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# **IBM Optim Performance** Manager for DB2 for Linux, **UNIX, and Windows**



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International Technical Support Organization

# IBM Optim Performance Manager for DB2 for Linux, UNIX, and Windows

December 2010

**Note:** Before using this information and the product it supports, read the information in "Notices" on page ix.

#### First Edition (December 2010)

This edition applies to Optim Performance Manager Extended Insight Edition Version 4.1.0.1.

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# Contents

Notices       ix         Trademarks       x
Preface       xi         The team who wrote this book       xi         Acknowledgement       xiii         Now you can become a published author, too!       xiii         Comments welcome       xiv         Stay connected to IBM Redbooks       xiv
Chapter 1. Optim Performance Manager overview.11.1 About Optim Performance Manager21.1.1 History.21.1.2 Features31.1.3 Components61.1.4 Packaging101.2 Architecture111.2.1 Optim Performance Manager architecture121.2.2 Optim Performance Manager Extended Insight architecture13
Chapter 2. Planning.152.1 Topology162.1.1 Optim Performance Manager Server162.1.2 Optim Performance Manager Extended Insight182.1.3 Monitored database202.1.4 Tivoli monitoring212.2 Prerequisites212.2.1 Optim Performance Manager Extended Insight232.2.2 Optim Performance Manager212.2.3 Integration with Tivoli252.3 Installation options.252.3.1 Common Optim Performance Manager installation parameters.262.3.2 Direct installation option292.3.3 Update option322.3.4 Migration option.332.4 Capacity planning342.4.1 Factors influencing capacity planning of Optim Performance Manager servers352.4.2 Hard disk requirement estimation38

2.4.3 CPU requirement estimation
2.4.4 Memory requirement estimation
2.5 Storage options
2.5.1 Table space type selection
2.5.2 Table space naming and usage
2.5.3 Table space location
2.5.4 Table space DDL
2.6 User authorization
2.6.1 User authorization for global tasks
2.6.2 User authorization for database-specific monitoring tasks 54
2.6.3 User authorization examples
2.7 Objects in the monitored database 57
Chapter 3. Installing and configuring Optim Performance Manager 59
3.1 Lab environment
3.2 Installing and running Optim Performance Manager
3.2.1 Installing Optim Performance Manager
3.2.2 Activating the Optim Performance Manager license
3.2.3 Activating the Optim Performance Manager Extended Insight license .
81
3.2.4 Installing DB2 Performance Expert Client
3.2.5 Starting and Stopping Optim Performance Manager
3.3 Configuring Optim Performance Manager
3.3.1 Configure user access
3.3.2 Adding or importing database connections
3.3.3 Configuring the database for monitoring
3.3.4 Monitoring profiles for inflight performance, reporting and Workload
manager
3.3.5 Monitoring profile for Extended Insight
3.4 Installing and Configuring Extended Insight Client
3.4.1 Installing Optim Performance Manager Extended Insight client 130
3.4.2 Configuring Optim Performance Manager Extended Insight Client 132
Chapter 4. Getting to know Optim Performance Manager
4.1 Health summary
4.1.1 Health summary page 149
4.1.2 Overview dashboard 151
4.1.3 Current application connections
4.1.4 Current table spaces
4.2 Alerts
4.2.1 Alert list
4.2.2 Alert configuration
4.2.3 Alert notification

4.3 Inflight dashboards	168
4.3.1 Workload dashboard	169
4.3.2 System dashboard	169
4.3.3 Buffer pool and I/O dashboard	170
4.3.4 Memory dashboard	171
4.3.5 Locking dashboard	173
4.3.6 Logging dashboard	174
4.3.7 Active SQL dashboard	175
4.3.8 Utilities dashboard.	177
4.4 Extended Insight dashboard	178
4.4.1 Extended Insight dashboard overview panel	179
4.4.2 Extended Insight dashboard details panel	182
4.4.3 Workload cluster groups and Workload clusters	187
4.4.4 pureQuery Runtime integration	192
4.5 Reports	193
4.5.1 Database Configuration report	194
4.5.2 Database Manager Configuration report.	195
4.5.3 Database Connection report	195
4.5.4 Disk Space Consumption report	197
4.5.5 Dynamic SQL Statement report	199
4.5.6 Workload Manager Configuration And Metrics report	201
4.6 Performance Expert client	202
	~~-
Chapter 5. Monitoring I/O utilization	205
Chapter 5. Monitoring I/O utilization	205
Chapter 5. Monitoring I/O utilization	205 206 206
Chapter 5. Monitoring I/O utilization5.1 Symptoms of high I/O utilization5.2 Monitoring high I/O through various alerts5.3 Resolving high I/O problem to improve performance	205 206 206 213
Chapter 5. Monitoring I/O utilization5.1 Symptoms of high I/O utilization5.2 Monitoring high I/O through various alerts5.3 Resolving high I/O problem to improve performance5.4 Preventing high I/O	205 206 206 213 216
Chapter 5. Monitoring I/O utilization	205 206 206 213 216 217
Chapter 5. Monitoring I/O utilization         5.1 Symptoms of high I/O utilization         5.2 Monitoring high I/O through various alerts         5.3 Resolving high I/O problem to improve performance         5.4 Preventing high I/O         Chapter 6. Monitoring CPU and memory usage         6.1 Monitoring CPU utilization	205 206 213 216 217 218
<ul> <li>Chapter 5. Monitoring I/O utilization</li> <li>5.1 Symptoms of high I/O utilization</li> <li>5.2 Monitoring high I/O through various alerts</li> <li>5.3 Resolving high I/O problem to improve performance</li> <li>5.4 Preventing high I/O</li> <li>Chapter 6. Monitoring CPU and memory usage</li> <li>6.1 Monitoring CPU utilization</li> <li>6.1.1 Monitoring utility execution</li> </ul>	205 206 213 216 217 218 223
<ul> <li>Chapter 5. Monitoring I/O utilization</li> <li>5.1 Symptoms of high I/O utilization</li> <li>5.2 Monitoring high I/O through various alerts</li> <li>5.3 Resolving high I/O problem to improve performance</li> <li>5.4 Preventing high I/O</li> <li>Chapter 6. Monitoring CPU and memory usage</li> <li>6.1 Monitoring CPU utilization</li> <li>6.1.1 Monitoring utility execution</li> <li>6.1.2 Monitoring statement execution</li> </ul>	205 206 213 216 217 218 223 224
<ul> <li>Chapter 5. Monitoring I/O utilization</li> <li>5.1 Symptoms of high I/O utilization</li> <li>5.2 Monitoring high I/O through various alerts</li> <li>5.3 Resolving high I/O problem to improve performance</li> <li>5.4 Preventing high I/O</li> <li>Chapter 6. Monitoring CPU and memory usage</li> <li>6.1 Monitoring CPU utilization</li> <li>6.1.1 Monitoring utility execution</li> <li>6.1.2 Monitoring statement execution</li> <li>6.2 Monitoring buffer pool behavior.</li> </ul>	205 206 213 216 217 218 223 224 234
<ul> <li>Chapter 5. Monitoring I/O utilization</li> <li>5.1 Symptoms of high I/O utilization</li> <li>5.2 Monitoring high I/O through various alerts</li> <li>5.3 Resolving high I/O problem to improve performance</li> <li>5.4 Preventing high I/O</li> <li>Chapter 6. Monitoring CPU and memory usage</li> <li>6.1 Monitoring CPU utilization</li> <li>6.1.1 Monitoring utility execution</li> <li>6.1.2 Monitoring statement execution</li> <li>6.2 Monitoring buffer pool behavior.</li> <li>6.3 Monitoring memory usage.</li> </ul>	205 206 213 216 217 218 223 224 234 236
<ul> <li>Chapter 5. Monitoring I/O utilization</li> <li>5.1 Symptoms of high I/O utilization</li> <li>5.2 Monitoring high I/O through various alerts</li> <li>5.3 Resolving high I/O problem to improve performance</li> <li>5.4 Preventing high I/O</li> <li>Chapter 6. Monitoring CPU and memory usage</li> <li>6.1 Monitoring CPU utilization</li> <li>6.1.1 Monitoring utility execution</li> <li>6.1.2 Monitoring statement execution</li> <li>6.2 Monitoring buffer pool behavior.</li> <li>6.3 Monitoring memory usage</li> <li>6.1 Monitoring memory usage</li> </ul>	205 206 213 216 217 218 223 224 234 236 236
<ul> <li>Chapter 5. Monitoring I/O utilization</li> <li>5.1 Symptoms of high I/O utilization</li> <li>5.2 Monitoring high I/O through various alerts</li> <li>5.3 Resolving high I/O problem to improve performance</li> <li>5.4 Preventing high I/O</li> <li>Chapter 6. Monitoring CPU and memory usage</li> <li>6.1 Monitoring CPU utilization</li> <li>6.1.1 Monitoring utility execution</li> <li>6.1.2 Monitoring statement execution</li> <li>6.2 Monitoring buffer pool behavior.</li> <li>6.3 Monitoring DB2 instance memory usage</li> <li>6.3.2 Monitoring database memory usage</li> </ul>	205 206 213 216 217 218 223 224 234 236 236 238
Chapter 5. Monitoring I/O utilization         5.1 Symptoms of high I/O utilization         5.2 Monitoring high I/O through various alerts         5.3 Resolving high I/O problem to improve performance         5.4 Preventing high I/O         Chapter 6. Monitoring CPU and memory usage         6.1 Monitoring CPU utilization         6.1.1 Monitoring Utility execution         6.1.2 Monitoring statement execution         6.2 Monitoring buffer pool behavior.         6.3 Monitoring DB2 instance memory usage         6.3.1 Monitoring database memory usage         6.3.3 Monitoring application memory usage	205 206 213 216 217 218 223 224 234 236 236 238 242
<ul> <li>Chapter 5. Monitoring I/O utilization</li> <li>5.1 Symptoms of high I/O utilization</li> <li>5.2 Monitoring high I/O through various alerts</li> <li>5.3 Resolving high I/O problem to improve performance</li> <li>5.4 Preventing high I/O</li> <li>Chapter 6. Monitoring CPU and memory usage</li> <li>6.1 Monitoring CPU utilization</li> <li>6.1.1 Monitoring utility execution</li> <li>6.1.2 Monitoring statement execution</li> <li>6.2 Monitoring buffer pool behavior.</li> <li>6.3 Monitoring DB2 instance memory usage</li> <li>6.3.1 Monitoring database memory usage</li> <li>6.3.3 Monitoring application memory usage</li> <li>6.3.4 Detecting a too small memory area</li> </ul>	205 206 213 216 217 218 223 224 234 236 236 238 242 243
<ul> <li>Chapter 5. Monitoring I/O utilization</li> <li>5.1 Symptoms of high I/O utilization</li> <li>5.2 Monitoring high I/O through various alerts</li> <li>5.3 Resolving high I/O problem to improve performance</li> <li>5.4 Preventing high I/O</li> <li>Chapter 6. Monitoring CPU and memory usage</li> <li>6.1 Monitoring CPU utilization</li> <li>6.1.1 Monitoring utility execution</li> <li>6.1.2 Monitoring statement execution</li> <li>6.3 Monitoring memory usage</li> <li>6.3.1 Monitoring DB2 instance memory usage</li> <li>6.3.2 Monitoring database memory usage</li> <li>6.3.3 Monitoring application memory usage</li> <li>6.3.4 Detecting a too small memory area</li> <li>6.3.5 Checking configuration changes using reports</li> </ul>	205 206 213 216 217 218 223 224 234 236 236 238 242 243 247
Chapter 5. Monitoring I/O utilization         5.1 Symptoms of high I/O utilization         5.2 Monitoring high I/O through various alerts         5.3 Resolving high I/O problem to improve performance         5.4 Preventing high I/O         Chapter 6. Monitoring CPU and memory usage         6.1 Monitoring CPU utilization         6.1.1 Monitoring utility execution         6.1.2 Monitoring statement execution         6.2 Monitoring buffer pool behavior.         6.3 Monitoring memory usage         6.3.1 Monitoring DB2 instance memory usage         6.3.2 Monitoring application memory usage         6.3.3 Monitoring application memory usage         6.3.4 Detecting a too small memory area         6.3.5 Checking configuration changes using reports	205 206 213 216 217 218 223 224 236 236 238 242 243 247
Chapter 5. Monitoring I/O utilization         5.1 Symptoms of high I/O utilization         5.2 Monitoring high I/O through various alerts         5.3 Resolving high I/O problem to improve performance         5.4 Preventing high I/O         Chapter 6. Monitoring CPU and memory usage         6.1 Monitoring CPU utilization         6.1.1 Monitoring Utility execution         6.1.2 Monitoring statement execution         6.2 Monitoring buffer pool behavior.         6.3 Monitoring DB2 instance memory usage         6.3.1 Monitoring database memory usage         6.3.3 Monitoring application memory usage         6.3.4 Detecting a too small memory area         6.3.5 Checking configuration changes using reports	205 206 213 216 217 218 223 224 236 236 238 242 243 247 251
Chapter 5. Monitoring I/O utilization         5.1 Symptoms of high I/O utilization         5.2 Monitoring high I/O through various alerts         5.3 Resolving high I/O problem to improve performance         5.4 Preventing high I/O         Chapter 6. Monitoring CPU and memory usage         6.1 Monitoring CPU utilization         6.1.1 Monitoring UU utilization         6.1.2 Monitoring statement execution         6.2 Monitoring buffer pool behavior.         6.3 Monitoring memory usage         6.3.1 Monitoring DB2 instance memory usage         6.3.2 Monitoring database memory usage         6.3.3 Monitoring application memory usage         6.3.4 Detecting a too small memory area         6.3.5 Checking configuration changes using reports         Chapter 7. Analyzing locking problems         7.1 Troubleshooting deadlock alerts	205 206 213 216 217 218 223 224 234 236 236 238 242 243 247 251 252

7.2 Troubleshooting bad response times	264
<ul> <li>Chapter 8. Extended Insight analysis</li> <li>8.1 Application running slowly caused by index issue</li> <li>8.1.1 Observing a performance issue</li> <li>8.1.2 Figuring out the cause and tuning</li> <li>8.2 Diving into the application layer.</li> <li>8.2.1 Extended Insight analysis approach</li> <li>8.2.2 WebSphere scenario description - Great Outdoors Comp</li> <li>8.2.3 Understanding workload clusters</li> </ul>	
<ul> <li>Chapter 9. Troubleshooting failing transactions alert</li> <li>9.1 Identify failed statements using Extended Insight dashboard .</li> <li>9.2 Identify failed statements using Performance Expert Client</li> </ul>	
<ul> <li>Chapter 10. Integration with Tivoli monitoring components</li> <li>10.1 How does Optim Performance Manager integrate with Tivoli'</li> <li>10.2 Implementing Optim Performance Manager integration with 326</li> </ul>	
<ul> <li>10.2.1 Pre-requisites to Optim Performance Manager-ITCAM i</li> <li>10.2.2 Enabling the integration</li> <li>10.3 Usage scenario</li> <li>10.3.1 Initial analysis in Tivoli Enterprise Portal</li> <li>10.3.2 Optim Performance Manager inside TEP</li> <li>10.3.3 More launch-in-context from Optim Performance Manager</li> </ul>	ntegration327 
Chapter 11. Workload Manager configuration tool 11.1 Setting up concurrency method 11.1.1 Configuring Optim Performance Manager to collect WLI 375	
<ul> <li>11.1.2 Workload Manager template configuration</li></ul>	

11.4.2 Deploying autonomic performance objective       41         11.4.3 Monitoring autonomic performance objective       41	5 6
Chapter 12. Monitoring SAP environments       42         12.1 Installing Optim Performance Manager Extended Edition       42         12.1.1 Embedding Optim Performance Manager Extended Insight into an existing DB2 client package       42         12.1.2 Validating Extended Insight Client configuration       42         12.2 Configuring Optim Performance Manager       42         12.2.1 Predefined system templates for SAP       42         12.2.2 Event monitor settings in Locking monitoring profile       42         12.2.3 DB2 monitor switch settings       43         12.2.4 Controlling event monitors by using watchdog procedures       43         12.2.5 Identifying objects in SAP database       43         12.3 Monitoring SAP workloads with Extended Insight       43	23 24 26 28 29 30 31 32
Appendix A. Managing the repository server and the repository database	Э
A.1 Tables in the repository database.       43         A.1.1 Global metadata tables.       43         A.1.2 Metadata and protocol tables for the monitored databases       43         A.1.2 Metadata and protocol tables for the monitored databases       43         A.1.3 Monitoring data tables for the monitored database       44         A.2 How the repository server works.       44         A.2.1 Extended Insight threads       44         A.2.2 Other threads       44         A.3 Data aggregation concepts.       45         A.3.1 Aggregating extended insight data       45         A.3.2 Aggregating inflight and workload manager data       45         A.4 Deleting data from the repository database       45         A.4.1 How the repository server deletes history data       45         A.4.2 Deleting history data using the delhistory script.       45         A.4.3 Deleting aggregated long-term history data manually       45         A.4.4 Deleting aggregated long-term history data manually       45	8891679002346891
A.5 Automatic functions and reorganization in the repository database       46         A.6 Backing up the repository database       46         A.7 Changing database configuration of the repository database       46         A.8 Enabling row compression for the repository database       46         A.9 Setting up HADR for the repository database       46         A.10 Using the configuration program peconfig       46	51 52 52 54 54
<ul> <li>A.11 Changing Java heap size parameters of the repository server</li></ul>	56 57 58 59

Appendix B. Optim Performance Manager footprint
B.1 Optim Performance Manager footprint on the monitored database 472
B.1.1 DB2 monitor switches
B.1.2 DB2 event monitors
B.1.3 Monitoring overhead considerations
B.2 Optim Performance Manager footprint on the monitored application 489
B.2.1 Footprint
Index
Related publications
Other publications
Online resources
Help from IBM

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# Preface

Optim<sup>™</sup> Performance Manager Extended Edition, a follow-on to DB2® Performance Expert, is one of the key product of the IBM® Optim Solution. Optim Performance Manager Extended Edition provides a comprehensive, proactive performance management approach. It helps organizations resolve emergent database problems before they impact the business.

This book describes the architecture and the components of Optim Performance Manager Extended Edition. We provide information for planning the deployment of Optim Performance Manager and detail steps for successful installation, activation, and configuration of Optim Performance Manager and the Extended Insight client.

Optim Performance Manager delivers new paradigm in terms of how it is used to monitor and manage database and database application performance issues. We describe individual product dashboards and reports and discuss, with various scenarios, how they can be used to identify, diagnose, prevent, and solve database performance problems.

## The team who wrote this book

This book was produced by a team of specialists from around the world working at the International Technical Support Organization, San Jose Center.

**Whei-Jen Chen** is a Project Leader at the International Technical Support Organization, San Jose Center. She has extensive experience in application development, database design and modeling, and DB2 system administration. Whei-Jen is an IBM Certified Solutions Expert in Database Administration and Application Development, and an IBM Certified IT Specialist.



**Ute Baumbach** has been a software developer at the IBM laboratory in Germany for 20 years, where she works in various software development projects and roles. Most of her projects were based on DB2. For seven years, she has worked as a member of the DB2 Performance Expert development team, now the Optim Performance Manager development team. In addition, Ute supports customers in setting up Optim Performance Manager and utilizing it to its best advantage in

DB2 data server environments. She is an IBM Certified Database Administrator

and a Certified Application Developer for DB2 for Linux®, UNIX®, and Windows®.



**Robert Borovsky** is an IT specialist at IBM Canada. For the last 10 years he has worked as a Technical Sales specialist covering IBM Information Management portfolio of products. His expertise is in the areas of database technology, data warehousing, database performance tuning and high availability. He holds an engineering degree from the Faculty of Electrical Engineering of the Technical University in Kosice,

Slovakia. He is located in Markham, Ontario in Canada.



**Sonali Kenge** is the Quality Assurance lead for IBM's pureQuery and Optim Performance Manager Extended Insight. Based at IBM Silicon Valley Lab, San Jose, she has over 12 years of experiences with DB2 and Informix® products and has held various roles in development, quality assurance, and product management. Her areas of expertise include application development life cycle and software testing. She

has a Bachelor of Physics and a Bachelor of Computer Science from Mumbai University in India.



**Marcia Miskimen** is an Advisory Software Engineer with the IBM Software Group and works from Minnesota. She has been with IBM for 21 years, most recently working on testing of Optim Performance Manager integration with Tivoli® software. She has worked with DB2 Performance Expert, and now Optim Performance Manager, since Version 1, and this is her fifth

Redbooks® publications. Over her many years in IT industry she has done COBOL/IMS development, mainframe system support, consulting, writing, pre-sales technical support, and testing, to name a few. She graduated from The Ohio State University with a bachelor's degree in business administration.



ILing Xu is an IBM software engineer with the BIM Software Group in China. She has been working on performance test, analysis, and tuning for Java software and DB2 for over three years. Before joining IBM, Ling was a Java developer for three years. Now she is leading a team working on IBM Optim Performance Manager and IBM Optim Query Tuner with a focus on performance tuning. Ling and her team also provide

assistance in customer enablement for Optim Performance Manager.

#### Acknowledgement

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Rafael Coss Jim Stephens Larry McWilliams Gary Walters Vikram Khatri Susan Althoff Sven Miller IBM Software Group, USA

Steve Rees IBM Toronto Laboratory, Canada

Jun Wong IBM Software Group, China

Steve Klopfer IBM Sales and Distribution, USA

Emma Jacobs International Technical Support Organization, San Jose Center

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# **Optim Performance Manager overview**

This chapter introduces Optim Performance Manager (OPM) product. We talk about the evolution of the product, formerly known as DB2 Performance Expert. We highlight features, components as well as packaging of the product. Architectural diagrams are provided to better illustrate functionality of individual Optim Performance Manager components.

## **1.1 About Optim Performance Manager**

Optim Performance Manager is a performance analysis and tuning tool for managing DB2 systems by using a web interface. Optim Performance Manager helps organizations resolve emergent database problems before they impact the business.

Optim Performance Manager is designed for those individuals responsible for the overall health and availability of their DB2 for Linux, UNIX, and Windows data servers, typically a database administrator (DBA) or an application owner. It watches over DB2 data servers by gathering performance metrics and determining if any key performance indicators are exceeding acceptable thresholds. By constantly monitoring the system, Optim Performance Manager can help detect potential performance problems before users are affected and service level agreements (SLA) are breached.

Optim Performance Manager utilizes a repository of historical performance metrics for problem prevention, trend analysis, customizable reporting and growth planning.

#### 1.1.1 History

Optim Performance Manager was formerly known as DB2 Performance Expert for Multiplatforms product. It was first released in 2002. This tool complimented DB2 database performance monitoring product for z/OS® platform, IBM Tivoli Omegamon XE for DB2 Performance Expert on z/OS.

DB2 Performance Expert for Multiplatforms Version 1 solution consisted of Performance Expert (PE) server and PE client components. PE server and its repository database were collocated with the monitored DB2 database. PE client was a Java<sup>™</sup> GUI client installed on the user's workstation, which displayed data collected by PE server.

DB2 Performance Expert for Multiplatform Version 2 was released in 2005. It introduced a new architecture of the product. PE server component was now designed to be installed on its own server. It would then remotely attach to monitored DB2 databases and collect database performance metrics. This architecture allowed a single PE server to manage multiple DB2 database servers. This version also delivered Performance Warehouse functionality, which aggregated collected database performance data into a separate set of tables in PE server's repository database, allowing for trend analysis and capacity planning of monitored database servers.

DB2 Performance Expert for Multiplatforms Version 3 was released in 2008. This version expanded the domain of the product, from just database server monitoring, to also include performance data of DB2 applications connected to DB2 servers using JDBC connectivity. This end-to-end database monitoring capability was delivered in the DB2 Performance Expert Extended Insight feature, which was an add-on feature of DB2 Performance Expert product.

Optim Performance Manager for DB2 for Linux, UNIX, and Windows 4.1 released in 2010, is a major step forward in the database monitoring capabilities that were previously provided in DB2 Performance Expert for Multiplatforms. It introduced a new web-based interface, which significantly simplifies the deployment of the product. Legacy PE client component is still available with this version, to allow for smoother migration of existing DB2 Performance Expert users.

Optim Performance Manager 4.1.0.1 became available in October 2010. It delivered new features and enhancements to Optim Performance Manager 4.1. It is available either as a fix pack for an existing copy of the 4.1 version of the product, or as a full installation. The content of the book is based on the version of the tool at the time of the writing of the book.

#### 1.1.2 Features

Optim Performance Manager provides a comprehensive and proactive performance management solution for database applications. This solution brings new paradigm for database performance management, which can be characterized as a top-down database performance management.

Top-down performance management approach begins at the top level component, which is the database application. From this level, Optim Performance Manager can drill down to database level for related database performance metrics.

Optim Performance Manager complements top-down approach with the bottom-up database performance approach. This is a reactive performance management approach, which is a traditional way of database performance management. It begins at the bottom level component, which is the database server level.

Features and functionality of the product can be grouped into three categories:

- Identifying and diagnosing performance problems
- Preventing performance problems
- Solving performance problems

#### Identifying and diagnosing performance problems

Optim Performance Manager offers the ability to monitor and analyze multiple DB2 instances (including single partition, multi partition, and pureScale<sup>™</sup> databases) running a wide variety of workloads, from a single control point. Predefined, customizable monitoring templates for online transaction processing (OLTP), business intelligence, SAP, and enterprise content management database systems allow users to rapidly and adequately deploy performance monitoring.

Optim Performance Manager extends database monitoring across the database client, the application server, and the network, giving DBAs immediate insight into where database workloads, transactions, and SQL requests are spending their time. It can monitor database end-to-end response time for Java,.Net, and DB2 Call Level Interface (CLI) database applications and provides predefined application views for WebSphere® Application Server, SAP, Cognos®, InfoSphere™ DataStage®, and InfoSphere Warehouse's SQL Warehousing Tool tasks. This feature allows users to:

► Improve availability of mission critical database applications.

Detect negative trends sooner including: eroding response times for database APIs; network congestion between the application and the database; or other key factors to sustaining defined service level agreements.

Manage applications to meet defined service level agreements.

DBAs can see the response time for single SQL requests or complete database transactions from the applications point of view. This holistic view of database application response times can help to create realistic performance indicators that more directly relate to the user's experience.

Reduce the time needed to isolate performance issues

Graphical displays allow to see where workloads, transactions, and SQL requests originate in the application, and how the time spent is spread across the database client, the application server, the database server, and the network between them. This brings transparency to the process of isolating performance issues in complex environments, which include application and database servers, spread across multiple physical or virtual servers.

Optim Performance Manager delivers a browser based dashboard approach to help users quickly identify potential problems. The new browser based interface includes performance overview displays with associated health indicators to quickly detect problems in the overall environment and within a specific database. Intelligent diagnostic dashboards provide relevant metrics that focus on a particular problem area and provide the details needed to determine the root cause including:

► Locking conflicts, deadlocks, and timeouts

- Long running or untuned SQL statements
- Sorting or prefetching issues
- Buffer pool, cache, and heap sizes
- Operating system memory or CPU shortages
- Partition skews or overloaded partitions
- Log performance issues

Optim Performance Manager can alert administrators by e-mail or page when events occur to find and fix problems before they affect the business. It can also generate SNMP traps, which can be configured to be sent to enterprise SNMP managers. Users can customize alerts and configuration options, such as type, severity, frequency, and back-outs as required.

#### Prevent performance problems

Workload management administration and management tooling is now available in Optim Performance Manager for customers that also own the DB2 workload management (WLM) feature. This new tooling provides the ability to define workloads, assign business priorities, and enable concurrency controls and aging to give resource priority to important queries that must meet service level objectives. After you setup WLM environment, you can use Optim Performance Manager to analyze live monitoring data to track resource consumption, system capacity, response times, performance issues, as well as historical data for trend analysis and growth planning.

Integration of Optim Performance Manager and DB2 Workload Manager feature delivers a proactive approach to database performance management. It allows for defining more predictable database server execution environment, by assigning resources (CPU, I/O, memory) according to the priorities of various workloads.

Optim Performance Manager provides predefined report templates that you can use to generate reports for trend detection, proactive monitoring, baselines, and more. Report templates include: disk space consumption, system configuration for the database and the database manager, dynamic SQL statements, WLM, and connections.

#### Solve performance problems

Integration of Optim Performance Manager with the IBM Optim family of products supports a user's efforts to quickly resolve problems.

Integration with Optim Query Tuner passes problematic SQL statements directly into a query tuning session so the query can be analyzed, tuned, and redeployed into production.

Integration with Optim pureQuery Runtime enables instant isolation of the SQL statement application source code and facilitates collaboration between the DBA and the developer to resolve the problem. Optim pureQuery Runtime also allows for optimizing the SQL without altering the application.

Integration with Tivoli Composite Application Manager (ITCAM) provides a consolidated view of the business transactions across the enterprise while providing the deep database diagnostics found in Optim Performance Manager to support efforts to resolve response time issues quickly. ITCAM provides a common model and consistent view of the performance of an application. From the transaction view within ITCAM, you can launch Optim Performance Manager in context. Additional integration facilitates the ability to view operating system statistics from Optim Performance Manager. This functionality is provided by Optim Performance Manager plug-in for Tivoli Enterprise Portal (TEP).

#### 1.1.3 Components

In this section we describe components of Optim Performance Manager product. We highlight most important characteristics of individual OPM components and how they contribute to OPM's ability to identify, diagnose, prevent, and solve database performance problems.

#### **Optim Performance Manager**

Optim Performance Manager provides system overview displays for quicker problem identification and detailed diagnostic displays for detailed problem analysis.

System overview displays with color-coded user interfaces are designed to quickly draw attention to problematic areas within the database. Once a problem has been identified, specific diagnostic dashboards provide focus on that area and present relevant details to provide a well-rounded analysis of the problem. Once the problem has been identified, integration to additional Optim products helps speed the resolution of the problem.

The Health Summary dashboard displays an overview of the performance data for your databases. You can use the Health Summary dashboard, for example, to identify which of your databases have critical issues that require your attention.

The Alerts dashboard displays a list of issues that require attention. Flexible alert notifications can be defined by type, severity, and database. You can also define alert notification parameters such as email addresses, SNMP trap generation, and alert frequency. You can view alerts by alert severity, host and port, or by custom groups.

Inflight dashboards provide recent and historical information about specific databases. Each dashboard provides information about a database that relates to a particular category of potential performance issues: Overview, Buffer Pool and I/O, Locking, Logging, Memory, Active SQL, System, Utilities, and Workload. For example, the Active SQL dashboard provides performance data for currently running queries. You can use the Active SQL dashboard to identify, tune, or terminate SQL queries that degrade the performance of your database.

Reporting feature described earlier in this chapter is also included in OPM.

#### **Optim Performance Manager Extended Insight**

Optim Performance Manager Extended Insight (OPM EI) complements OPM technology by monitoring database response time as seen by the application. This integrated monitoring system watches over both the database system and the end-user response times to help organizations achieve their SLA goals.

Extended Insight Dashboard displays end-to-end data about the entire database application system, which includes clients, application servers, data servers, and the network. Monitoring begins when you initiate a transaction, continues as that transaction is processed by each component, such as the client, network, and data server, and ends when the application finishes processing and produces the results.

OPM EI contains a client component, which is collocated with the database application. It intercepts DB2 database traffic from the application and sends performance data about this traffic to Optim Performance Manager. OPM EI supports Java, WebSphere Application Server, DB2 CLI, and .Net applications. It can also be used to monitor DB2 databases on z/OS systems. This functionality requires the use of OPM as well as OMEGAMON® XE for DB2 on z/OS V5.1 product.

**Note:** OPM EI collects and displays additional monitoring information for applications running in WebSphere Application Server. Application servers such as Weblogic or Tomcat, are treated by OPM EI as generic java applications.

With OPM EI you can proactively, quickly, and intuitively identify:

 Who has response time performance issues or causes them to others by identifying the specific set of transactions that make up the problem workload.

For example, Which end-user ID or applications issues those transactions?

 When did the response time performance occur by identifying the problem periods. For example monitor minutes, hours, days, weeks, or even years)

 What specific activities were involved in the response time performance problem by identifying the complete list of involved problem SQL statements.

For example, check the top N SQL statements by end to end response time or data server time.

► *Why* the response time problem occurred by identifying the exact problem layer that slows down the response time.

For example, detect whether the transactions are slowed down in the database, network, driver, application, or application server.)

#### **OPM plug-in for Tivoli Enterprise Portal**

Optim Performance Manager plug-in for Tivoli Enterprise Portal facilitates integration between OPM EI and IBM Tivoli Composite Application Manager for Application Diagnostics and ITCAM for Transactions in a Tivoli Enterprise Portal Console for end-to-end transaction monitoring. It allows OPM EI to be configured such that it sends database transaction information directly to ITCAM. This data is then being surfaced in the TEP console. This allows operators of the TEP console to be notified when database transactions are not performing well. It allows them to launch into OPM EI and OPM dashboards for further diagnostic and analysis.

OPM plug-in for TEP also delivers extended operating system performance data by launch-in-context capabilities. For instance, when you launched OPM or OPM El dashboards from TEP console, you can open the operating system monitoring details for a selected application client by launch-in-context into TEP workspace.

#### Workload manager configuration tool

Workload manager configuration tool provides workload management administration and management tooling for DB2 customers who have deployed DB2 Workload Management (WLM) feature. It enables proactive approach to database performance management by allocating resources to database workloads up front. This prevents workloads from monopolizing database resources, and creating database performance issues.

You can use this tool to:

- Define workloads
- Enable aging
- ► Assign business priorities to workloads to ensure service level agreements
- ► Monitor service classes, workloads, and work classes
- Obtain sophisticated usage statistics and definitions

- View real-time data and historical data
- Understand workload at a point in time
- Understand workload patterns and long-term development issues
- Derive effective service classes and thresholds
- ► Perform workload analysis for workload profiling and accounting
- Adjust the WLM configuration of a DB2 database continually so that your workloads meet their performance objectives

#### **Data Studio Health Monitor**

Data Studio Health Monitor is a web-based health and availability monitor for DB2 for Linux, UNIX and Windows databases. It replaces Data Studio Administration Console product and is now integrated into Optim Performance Manager.

Data Studio Health Monitor offers health alerts and basic monitoring capabilities including:

- Summary views across all monitored databases
- Monitoring for essential characteristics like database server status, storage utilization, recovery pending, backup pending, etc.
- HADR state monitoring
- Drill downs into alert details
- Views into active applications and utilities

#### **Performance Expert Client**

Performance Expert Client is the original client user interface of the DB2 Performance Expert product and is still available in the Optim Performance Manager product. Even though the majority of its functionality is now available in the new web browser interface of Optim Performance Manager, you can use Performance Expert client to perform a smoother migration from DB2 Performance Expert product to Optim Performance Manager.

You can also perform the following tasks by using DB2 Performance Expert Client:

- In addition to the features of the Workload Manager tool, you can look at Workload Manager data to monitor and report Workload Manager setup and activities over time.
- In addition to the features of the reporting feature, you can do long term performance analysis through Performance Warehouse.

- In addition to the features of the Optim Performance Manager plug-in for TEP, you can monitor and analyze operating system performance after installing the optional Common Information Model (CIM) server component.
- Real time database monitoring
- More detailed monitoring of partitioned DB2 databases

#### 1.1.4 Packaging

Optim Performance Manager product is available in two editions:

► Optim Performance Manager

This is the base version of the product that contains a useful set of base capabilities, including new Web-based user-interface, graphical dashboards, reporting capabilities, and Workload Manager tooling. It is licensed according to the type of monitored DB2 database:

- IBM Optim Performance Manager V4.1.0.1 for DB2 for Linux, UNIX, and Windows, Enterprise Edition
- IBM Optim Performance Manager V4.1.0.1 for DB2 for Linux, UNIX, and Windows, Workgroup Edition
- IBM Optim Performance Manager V4.1.0.1 for DB2 for Linux, UNIX, and Windows, Content Manager Edition
- Optim Performance Manager Extended Edition

Contains capabilities of the Optim Performance Manager product and extends them with Extended Insight and Tivoli integration.

Table 1-1 shows both Optim Performance Manager editions and lists their respective capabilities. Included in the table is also DB2 Performance Optimization Feature bundle (only available with DB2 Enterprise Server Edition) which contains Optim Performance Manager Extended Edition, as well as the activation of the DB2 Workload Manager feature. We also include DB2 9.7 Advanced Enterprise Edition, that contains Optim Performance Manager, as well as DB2 Workload Manager feature.

Feature	Optim Performance Manager	Optim Performance Manager Extended Insight	DB2 Performance Optimization Feature	DB2 9.7 Advanced Enterprise Server Edition
Alerts and Notifications	✓	✓	✓	✓

Table 1-1 Optim Performance Manager editions

Feature	Optim Performance Manager	Optim Performance Manager Extended Insight	DB2 Performance Optimization Feature	DB2 9.7 Advanced Enterprise Server Edition
Overview Health Summary	✓	✓	✓	✓
Diagnostic Dashboards	✓	✓	✓	✓
Reporting	$\checkmark$	$\checkmark$	✓	✓
Data Studio Health Monitor	<b>√</b>	✓	✓	✓
Workload Manager Tool	<b>√</b>	✓	✓	✓
Extended Insight		~	~	
Tivoli ITCAM integration		✓	✓	
DB2 Workload Manager Feature			✓	✓

**Note:** Optim Performance Manager Extended Edition is also included in following product offerings:

- ► InfoSphere Warehouse 9.7 Enterprise
- IBM Smart Analytics System

## **1.2 Architecture**

Optim Performance Manager can be deployed in two configuration options:

- Standalone It only captures monitoring information from DB2 data server.
- Extended Insight It offers monitoring of DB2 database, as well as database applications.

The following sections document architectural diagrams for both deployment options.

#### 1.2.1 Optim Performance Manager architecture

Figure 1-1shows the architecture of the base Optim Performance Manager product.



Figure 1-1 Optim Performance Manager architecture

Key components of Optim Performance Manager are:

Repository Server

It establishes connection to monitored DB2 database and mainly uses database snapshot commands and DB2 event monitors to collect database performance data. It stores this collected data in its repository database.

Console Server

It runs as an application in WebSphere Application Server environment and connects to Optim Performance Manager repository database. It also allows Optim Performance Manager users to use a Web interface to retrieve this data and configure the monitoring behavior of Optim Performance Manager.

Repository database

It is a DB2 Enterprise V9.5 database, which is included in the OPM product packaging. It stores database performance data collected by repository server from the monitored DB2 databases and database application data collected by OPM Extended Insight client.

#### 1.2.2 Optim Performance Manager Extended Insight architecture



Figure 1-2 illustrates the basic architecture of the Optim Performance Manager Extended Insight.

Figure 1-2 Optim Performance Manager Extended Insight architecture

Optim Performance Manager Extended Insight consists of following components:

► Optim Performance Manager Extended Insight client

It is collocated with the database application. It hooks into JDBC or CLI drivers, intercepts database traffic for the monitored DB2 database and collects response time data about transactions and SQL statements. This data is then periodically forwarded to the Extended Insight monitoring server, which stores it in the repository database.

Optim Performance Manager Extended Insight controller

It is embedded in the repository server of the Optim Performance Manager. The Extended Insight controller is a global controller that listens on a port for Extended Insight Clients accessing the controller. It also knows about all available Extended Insight monitoring servers. When an application that you monitor with Extended Insight client starts and connects to the monitored database, the Extended Insight client accesses the controller and asks for the Extended Insight monitor server port which is listening for the Extended Insight data from the monitored database. From that point on, the Extended Insight client sends the collected data to the Extended Insight monitor server for the monitored database over the communicated monitor server port.

You specify the port number of the controller when you activate Extended Insight on Optim Performance Manager and when you configure Extended Insight clients. On both systems the port number is saved in the pdq.properties file.

Optim Performance Manager Extended Insight monitoring server

It is embedded in the repository server of the Optim Performance Manager. There is one Extended Insight monitoring server available per monitored database for which Extended Insight monitoring is configured. Each monitoring server is listening on a dedicated port for response time data about transactions and SQL statements from Extended Insight clients. Extended Insight clients first access the Extended Insight controller to obtain the port number of the responsible Extended Insight monitoring server. After that Extended Insight clients send the collected response time data periodically to the Extended Insight monitoring server which receives the data and stores the data in the repository database.

By default the port number of each Extended Insight monitoring server is determined dynamically. If you prefer fixed port numbers, you can specify them when you configure Extended Insight monitoring from Optim Performance Manager web console.

► Optim Performance Manager Extended Insight metric collectors

It is embedded in the repository server of the Optim Performance Manager. There is one set of metric collectors available per monitored database for which Extended Insight monitoring is configured. The metric collectors collect additional information about the transactions and SQL statements directly from the monitored database, combine the collected data with the data which Extended Insight monitoring server receives from Extended Insight clients and store the data in the repository database. The metric collectors start unit of work or package cache event monitors (DB2 9.7 or above) or use the dynamic SQL snapshots (DB2 9.5 or lower) to collect additional information about the transactions and SQL statements. The additional information consists of time distributions for transaction and SQL statement executions on the database and complete statement text. By combining this data with data received from Extended Insight client you get an end-to-end response time distribution of transactions and SQL statements.

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# 2



This chapter contains important information for planning your deployment of Optim Performance Manager. We explore the component architecture in more detail and address some common questions about Optim Performance Manager:

- ► How can I best prepare for installation?
- What kind of system resources are required for the Optim Performance Manager server?
- How can Optim Performance Manager comply with my company's security requirements?
- What kind of footprint does Optim Performance Manager have on my production database?

# 2.1 Topology

In this section, we look at the Optim Performance Manager architecture and topology. Since this chapter is about planning, this section is intended to explore the components of Optim Performance Manager and what you need to think about as you proceed with your deployment tasks. The information in this section is a follow-on to the component architecture introduced in 1.2, "Architecture" on page 11.

The Optim Performance Manager Information Center has good descriptions of architecture and topology diagrams, see

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.perf
mgmt.installconfig.doc/architectures.html

When you think about a performance monitor in the simplest sense, you have a monitor, the monitored object, performance data, a place to store the data and a way to look at the data. Optim Performance Manager has these components, which we explore next.

#### 2.1.1 Optim Performance Manager Server

As described in 1.2.1, "Optim Performance Manager architecture" on page 12, there are three main components of what is called the "Optim Performance Manager server":

- Repository server
- Repository database
- Console server

Generally, when you see the term "Optim Performance Manager", "Optim Performance Manager server" or "OPM Server", it refers to the whole set of components, and if there is a reason to refer to a particular component, it will be called out separately.

**Important:** The repository server, console server, and repository database must all reside on the same machine.

#### **Repository server**

The repository server component is sometimes referred to as the "back end" or "back end server". It is the component that collects, stores, aggregates, and deletes the performance data according to your configured settings. The repository server could be considered like any application in your shop. It runs as a Java program, under ownership of the Optim Performance Manager DB2 instance user, and stores its data to the repository database.

When you start the repository server a Java process is started on the Optim Performance Manager machine. The Java process consists of a set of threads per monitored database responsible for collecting, storing, aggregating, and deleting performance data in the repository database. Appendix B, "Optim Performance Manager footprint" on page 471 describes the threads in detail.

To collect snapshot data from a monitored database, the repository server calls a stored procedure. The stored procedure periodically attaches to the DB2 instance of the monitored database, retrieves snapshot data using DB2 APIs, and detaches. Stored procedures are running in DB2 db2fmp processes. Therefore, a number of db2fmp processes are started on behalf of the repository server for collecting snapshot data from the monitored databases and storing it in the repository database. The number of db2fmp processes that are started depend on the number of databases the repository server monitors.

Altogether the repository server consists of one Java process, a number of db2fmp processes, and some other DB2 processes that are started when the repository server connects to the repository database, for example db2sysc.

#### **Repository database**

The repository database is the central storage for all performance metrics collected by Optim Performance Manager. As with any database, there are considerations for its placement, size, growth, and security. These considerations are described in several sections in this chapter.

In addition to the planning topics in this chapter, Appendix A, "Managing the repository server and the repository database" on page 437 constains information that can help you understand the layout of the repository database and give you hints to maintain the repository database, for example:

- Tables in the repository database
- Automatic runstats and reorganization
- Backing up the repository database
- Changing database configuration parameters
- Enabling row compression for the repository database

#### **Console server**

The Console server is the WebSphere application that presents the performance data to the end user. While Optim Performance Manager ships with an installable WebSphere Application Server, you could also use an existing WebSphere Application Server to host the software, if it meets the pre-requisites. The

considerations for deciding how to deploy in WebSphere are described in 2.3.1, "Common Optim Performance Manager installation parameters" on page 26.

#### 2.1.2 Optim Performance Manager Extended Insight

Extended Insight, unlike Optim Performance Manager server, is not a separate running component, but rather a feature with some hooks into other components. Review the architecture discussion in 1.2.2, "Optim Performance Manager Extended Insight architecture" on page 13. With Extended Insight, Optim Performance Manager now monitors not only the database itself, but the application database transactions which use that database. Therefore for planning purposes, deploying Extended Insight requires action at the monitored application client side, and on the Optim Performance Manager server.

- On Optim Performance Manager server, you activate the Extended Insight license and define the port number of the Extended Insight controller. Ensure that this port is open on firewalls which may exist in your shop between the application client machine and Optim Performancde Manager machine. The activation is described in to 3.2.3, "Activating the Optim Performance Manager Extended Insight license" on page 81.
- On Optim Performance Manager server you enable Extended Insight monitoring per monitored database that the client applications use. During enabling, you define configuration properties for the Extended Insight monitor server and the Extended Insight metric collectors per database. For example, you can define a fixed port number of the Extended Insight monitor server instead of letting the Extended Insight monitor server determine a port number dynamically. Defining a fixed port number is recommended if your shop has strict firewall rules between the application client machine and Optim Performance Manager machine and you have to open ports explicitly. Enabling Extended Insight monitoring is described in 3.3.3, "Configuring the database for monitoring" on page 98 and in more detail in 3.3.5, "Monitoring profile for Extended Insight" on page 119.
- On the application client side, you install Extended Insight Client and configure it. Configuration includes
  - Letting the DB2 .Net, CLI, or JDBC drivers that the application uses to connect to the monitored database know that the Extended Insight is available. The DB2 CLI or JDBC driver your application uses must be at a certain level to be able to communicate with the Extended Insight client in order to provide information about transactions. The CLI and JDBC driver prerequisites are described in 2.2.2, "Optim Performance Manager Extended Insight" on page 23.

 Specifying the port number of the Extended Insight controller so that the Extended Insight client can establish the communication and knows where to send collected data about transactions and statements.

Installation and configuration is described in 3.4, "Installing and Configuring Extended Insight Client" on page 129.

The most important concept in understanding the Extended Insight is how the performance data is collected on the application client side and transfered to Optim Performance Manager. When Optim Performance Manager monitors a DB2 database, it retrieves performance data from the database in an active *pull* method, using the standard DB2 functions such as snapshot or event monitors. When monitoring a client application, the data transfer is *pushed* to Optim Performance Manager. Let us describe this pushed data transfer in more detail:

- 1. Assume that Extended Insight is completly deployed as decribed above.
- 2. You now start the client application that connects to the monitored database using a DB2 CLI, .Net or JDBC driver. In the following we just call it DB2 driver.
  - a. The DB2 driver loads the Extended Insight client which runs in its own thread.
  - b. The Extended Insight client accesses the Extended Insight controller of Optim Performance Manager through the controller port and asks for the Extended Insight Monitor server port number for that database. Communication is established.
- 3. The client application starts a transaction by executing an SQL statement.
  - a. The DB2 driver provides information about the transaction and statement such as transaction start time, connection properties, or SQL statement text to the Extended Insight client.
  - b. Extended Insight client calculates a hash code for the SQL statement and keeps the provided data in memory.
- 4. The client application ends a transaction by executing a commit or rollback.
  - a. The DB2 driver provides information about the transaction such as transaction end time and the time breakdown. For example, how much time of the transaction was spent in the network or data server.
  - b. The Extended Insight client aggregates this information to the information already available in memory. An aggregating example is that it calculates the average response time for all transactions having the same connection properties such as user ID or application name.
- 5. The client application repeats steps 3.) and 4.)

- a. The Extended Insight client further aggregates the provided data in memory.
- b. If the client application is a WebSphere application then the Extended Insight client periodically checks the connection pool status and aggregates WebSphere connection pool information in memory as well.
- c. After each minute Extended Insight sends the aggregated data to the Extended Insight Monitor server through the monitor server port. Instead of sending the SQL statement text, it just sends calculated hash codes to keep the size of the sent data small.
- d. The Extended Insight monitor server reads the data and stores it in the repository database.
- e. The Extended Insight metric collectors within the repository server collect additional information about the transactions and statements from the database using the pull method. For each statement hash code the complete statement text is retrieved from the package cache either by using the dynamic SQL snapshot (DB2 9.5 or lower) or by using the package cache event monitor (DB2 9.7 and above).
- f. If your monitored database is at DB2 9.7 Fix Pack 1 or higher, the metric collectors collect transaction execution details and statement execution details on the database and combine it with the transaction and statement data received from Extended Insight client. For example, the Extended Insight client provides the information that the average time the transactions spent on the database is three seconds. Using the unit of work event monitor, the metric collectors provide further time breakdown information of the three seconds in time spent for locking, sorting, I/O, and other processing or waits.
- 6. The client application disconnects from the monitored database.

The Extended Insight client sends aggregated data a last time and stops processing.

#### 2.1.3 Monitored database

Typically, the monitored database resides on a remote machine. Optim Performance Manager does not require a separate program (agent) to be installed on the remote monitored database server, however, it does create some objects in the monitored database, depending on what monitoring options you choose. These objects are discussed in 2.7, "Objects in the monitored database" on page 57. Addditionally, Appendix B, "Optim Performance Manager footprint" on page 471 describes the created objects and their footprint in detail.
# 2.1.4 Tivoli monitoring

If you deploy Optim Performance Manager Extended Insight into an environment that also uses Tivoli Composite Application Manager for Transactions, some additional metrics are available through the Tivoli Enterprise Portal. Planning and pre-requisites for deploying into Tivoli environment are discussed in Chapter 10, "Integration with Tivoli monitoring components" on page 323.

# 2.2 Prerequisites

In this section, we document general prerequisites for installing and running Optim Performance Manager solution. Check the product document for the detailed information about software levels of individual components of Optim Performance Manager at the following website:

http://publib.boulder.ibm.com/infocenter/idm/docv3/index.jsp?topic=/com.ibm.dat atools.perfmgmt.installconfig.doc/pm\_install\_reqs.html

## 2.2.1 Optim Performance Manager

Following are the hardware and software requirements for the deployment of the Optim Performance Manager product.

#### Hardware and operating system

We recommend installing Optim Performance Manager in a separate physical or virtual server from the monitored DB2 database. This approach would prevent Optim Performance Manager to share CPU, memory, and disk resources with monitored database, thus allowing it to collect unbiased database performance data.

You can install Optim Performance Manager in the UNIX (AIX®, Solaris), Linux (RedHat, SuSE), and Windows environments. Size of the server in which it is installed would generally depend on:

- The number of monitored DB2 databases
- ► The number of partitions on your monitored DB2 databases
- The number of DB2 objects on your monitored DB2 databases
- The number of monitoring functions that are activated in Optim Performance Manager
- The volume of workload against monitored database (for instance, number of SQL statements per minute)

#### DB2 data server for Optim Performance Manager

Optim Performance Manager uses DB2 database as a repository for storing collected performance data as well as its own configuration information. If the server where Optim Performance Manager will be installed already contains a copy of DB2 server product, you can use it. Otherwise, the product ships with a restricted use license of DB2 Enterprise Server Edition Version 9.5.

Optim Performance Manager supports the following data servers for its repository database:

- ► IBM DB2 Enterprise Server Edition Version 9.1 for Linux, UNIX, and Windows
- ► IBM DB2 Enterprise Server Edition Version 9.5 for Linux, UNIX, and Windows
- ► IBM DB2 Enterprise Server Edition Version 9.7 for Linux, UNIX, and Windows

**Note:** The DB2 instance where the repository server runs may not run in Oracle compatibility mode. For more information on Oracle compatibility mode, please refer to DB2 documentation site:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ib m.db2.luw.apdv.porting.doc/doc/r0052867.html

**Note:** Optim Performance Manager requires DB2 Enterprise Server Edition product, because its repository database uses DB2 Enterprise Server Edition features such as table partitioning.

## WebSphere Application Server

Optim Performance Manager requires WebSphere Application Server to run the console server component. If the server where Optim Performance Manager is installed already has WebSphere Application Server 7.0.0.3 or later installed, it can use it. Otherwise, it installs a copy of WebSphere Application Server 7.0.0.5.

#### Monitored DB2 database

The following data servers are supported for the DB2 instances to be monitored by Optim Performance Manager. 64-bit DB2 instances are supported on each of these data servers. 32-bit DB2 instances are supported only on Linux on System  $x^{(m)}$  and Windows.

- ► IBM DB2 Enterprise Server Edition Version 9.1 for Linux, UNIX, and Windows
- ► IBM DB2 Enterprise Server Edition Version 9.5 for Linux, UNIX, and Windows
- ► IBM DB2 Enterprise Server Edition Version 9.7 for Linux, UNIX, and Windows
- ► IBM DB2 Enterprise Server Edition Version 9.8 for Linux, UNIX, and Windows
- IBM DB2 Workgroup Server Edition Version 9.1 for Linux, UNIX, and Windows

- IBM DB2 Workgroup Server Edition Version 9.5 for Linux, UNIX, and Windows
- IBM DB2 Workgroup Server Edition Version 9.7 for Linux, UNIX, and Windows
- ▶ IBM DB2 for z/OS Version 9.1
- ► IBM DB2 for z/OS Version 10.1

#### Web browsers

New web interface of Optim Performance Manager is supported in following web browsers:

- Mozilla Firefox Version 3.6 or later with Adobe® Flash Player 10.1.53.64 or later
- Microsoft® Internet Explorer Version 7.0 with Adobe Flash Player 9.0.124 or later
- Microsoft Internet Explorer Version 8.0 with Adobe Flash Player 9.0.124 or later

## 2.2.2 Optim Performance Manager Extended Insight

Optim Performance Manager Extended Insight enables end-to-end monitoring of DB2 database applications from following generic database client environments:

► CLI applications:

Require the use of DB2 Data Server Client Packages for Version 9.7 Fix Pack 2 or later.

► .Net applications:

Require the use of DB2 Data Server Client Packages for Version 9.7 Fix Pack 3.

► WebSphere Applications Server z/OS:

Use the following versions of WebSphere Application Server for z/OS:

- IBM WebSphere Application Server Version 6.1.0.31 or later
- IBM WebSphere Application Server Version 7.0.0.11 or later
- WebSphere Application Server:

Use the following versions of WebSphere Application Server for Linux, UNIX, and Windows:

 IBM WebSphere Application Server Version 6.1.0.27 or later with Patch PK98171

- IBM WebSphere Application Server Version 6.1.0.31 or later
- IBM WebSphere Application Server Version 7.0.0.5 or later with Patch PK98171
- IBM WebSphere Application Server Version 7.0.0.11 or later

**Note:** Application servers such as Weblogic or Tomcat are treated by Optim Performance Manager Extended Insight as generic Java applications.

JDBC and SQLJ applications

To have a complete set of extended insight monitoring data, use the following DB2 data server client versions:

- IBM Data Server Drivers for JDBC and SQLJ Version 9.7 Fix Pack 2 or later for Linux, UNIX, and Windows
- IBM Data Server Drivers for JDBC and SQLJ Version 9.5 Fix Pack 6 or later for Linux, UNIX, and Windows

**Note:** When using Optim Performance Manager Extended Insight for end-to-end monitoring, the level of collected and presented performance data differs according to the level of monitored DB2 database. For instance:

- For DB2 Version 9.1, use Fix Pack 6 s to obtain information about data server time.
- ► To be alerted for lock wait and lock wait timeout events, DB2 9.7 is required

You must have have DB2 Version 9.7 Fix Pack 1 or later to obtain layers for time that is spent in locking, sort, logging, queue time, and so on. Otherwise, you only have one layer that indicates DB2 data server time.

The following data server client versions are supported, but only a subset of extended insight monitoring data is collected. For example, if a transaction includes static and dynamic executions, you can monitor only dynamic executions.

- IBM Data Server Drivers for JDBC and SQLJ Version 9.7 for Linux, UNIX, and Windows
- IBM Data Server Drivers for JDBC and SQLJ Version 9.5 Fix Pack 5 for Linux, UNIX, and Windows

If you plan to monitor SAP, Cognos, InfoSphere Warehouse, or Information Server, use the following versions:

- SAP kernel Version 7.0 SR3 or later
- Cognos Version 8.4 Fix Pack 2 or later
- InfoSphere Warehouse Version 9.7 Fix Pack 1
- Information Server Version 8.5

# 2.2.3 Integration with Tivoli

If you plan to run Optim Performance Manager Extended Insight monitoring from your Tivoli Enterprise Portal (TEP) console, you must have following products installed:

- ► IBM Tivoli Monitoring (ITM) Version 6.2.2 Fix Pack 1 or later
- IBM Tivoli Composite Application Manager (ITCAM) for Transactions Version 7.2 or later
- ► ITCAM for Application Diagnostics Version 7.1 or later

If you use J2EE 1.4 application in your environment, use ITCAM for Application Diagnostics Version 7.1 Fix Pack 1 or later.

# 2.3 Installation options

The Optim Performance Manager Extended Edition product consists of the following components:

- Server component: Optim Performance Manager
- Client components:
  - Optim Performance Manager Extended Insight client
  - Optim Performance Manager Extended Insight plug-in for Tivoli Enterprise Portal
  - Performance Expert client

All components must be installed separately because, typically, these components are installed on separate systems.

The Optim Performance Manager Extended Insight client, Optim Performance Manager Extended Insight plug-in for Tivoli Enterprise Portal, and Performance Expert client installations do not require any license. To install version 4.1.0.1 of these components you have the following options:

- Install the version 4.1.0.1 available from the Optim Performance Manager Extended Edition 4.1.0.1 installation package.
- ► Install the version 4.1 Fix Pack 1 available from the fix pack download site:

#### http://www-01.ibm.com/support/docview.wss?rs=434&uid=swg27008647#opm-lib

If you have the version 4.1 already installed, update it to 4.1.0.1 by installing version 4.1.0.1 or Fix Pack 1 on the top of version 4.1.

Optim Performance Manager requires a license. To install version 4.1.0.1 of Optim Performance Manager you have the following options:

Direct installation option:

Install the version 4.1.0.1 available from the Optim Performance Manager Extended Edition 4.1.0.1 installation package. This package includes the license activation kit.

Use this option for a fresh installation. The installation installs Optim Performance Manager and sets up the DB2 repository database. It also sets up WebSphere Application Server and optionally installs it first if the product is not available yet. After installation, you configure Optim Performance Manager by adding databases and configure them for monitoring using the Optim Performance Manager web console.

► Update option:

Install version 4.1 available from the Optim Performance Manager Extended Edition 4.1 installation package. This package includes the license activation kit. Afterward, update it to 4.1.0.1 by installing Fix Pack 1 on the top of version 4.1.

Typically, you use this option if you already have installed and used version 4.1 and want to update it to the newest level.

► Migration option:

If you have Performance Expert V3.2 installed, you can migrate to Optim Performance Manager version 4.1.0.1 by installing version 4.1.0.1 from the Optim Performance Manager EE 4.1.0.1 installation package and continue use the repository database of Performance Expert for Optim Performance Manager.

You obtain the same set of functional features independent on the installation option you use. The version 4.1.0.1 of Optim Performance Manager offers new installation features. If you are new to Optim Performance Manager, we recommend using the direct installation option instead of using the update option. We describe the new installation features in 2.3.2, "Direct installation option" on page 29.

# 2.3.1 Common Optim Performance Manager installation parameters

In this section, we describe the parameters that you can set during Optim Performance Manager installation. These parameters are common to the direct installation, update, and migration options and they are important in planning your installation. You can choose between a typical installation and an advanced installation. If you choose typical installation then the default values are taken for some parameters.

#### **DB2 instance selection**

Optim Performance Manager requires a DB2 instance to host the repository database. During installation, you can specify which DB2 instance you want to use. If the DB2 instance does not yet exist then the Optim Performance Manager installation creates it.

#### **DB2 user specification**

The Optim Performance Manager installer uses the user that you specify to create the repository database in the selected DB2 instance. Later at Optim Performance Manager run time, this user is used by Optim Performance Manager to connect to the repository database to access the collected data. This user must have SYSADM authority on the DB2 instance. Learn more about user privileges in Optim Performance Manager in 2.6, "User authorization" on page 52.

# Repository database specification (Advanced installation only)

The repository database is the database of Optim Performance Manager to store the collected performance data. The Optim Performance Manager installer creates this database. You can use the advanced installation mode to specify the following settings for the repository database:

- Database name
- Database location
- ► Table space location for small SMS table spaces storing control and metadata

#### Table space type selection (Advanced installation only)

For each database that Optim Performance Manager monitors Optim Performance Manager creates a set of table spaces in the repository database. The table spaces are created when you configure a database for monitoring after Optim Performance Manager is installed. During installation you can specify which type of table spaces (SMS, DMS, or Automatic Storage) Optim Performance Manager should create. These table spaces can grow to multiple GBs in size. Refer to 2.4, "Capacity planning" on page 34 to learn how large these table spaces can get. 2.5, "Storage options" on page 49 gives you more details about these table spaces.

#### Working directory specification (Advanced installation only)

The Optim Performance Manager repository server uses the directory that you specify to write log and trace files during run time. In addition, this directory contains the property files that the Optim Performance Manager repository server uses.

#### Performance Expert client group specification

If you want to use Performance Expert client then all users that are part of this operating system group can logon from Performance Expert client to the Optim Performance Manager repository server. The operating system group must be available on the Optim Performance Manager machine. If you do not want to use Performance Expert client then it does not matter which group you specify.

# WebSphere Application Server selection

Optim Performance Manager requires a copy of WebSphere Application Server on the Optim Performance Manager machine to serve the Web User Interface (Optim Performance Manager web console). During installation, you specify whether you want to reuse an existing copy of WebSphere Application Server for Optim Performance Manager or you want to let the Optim Performance Manager installer install and set up WebSphere Application Server. The Optim Performance Manager installer list the existing copies of WebSphere Application Server that can be used for Optim Performance Manager. Only WebSphere Application Server copies that are at version 7.0.0.3 or higher and that have been installed as root (Linux, UNIX) are listed

#### **Parameter summary**

Table 2-1 summarizes the installation parameters and describes the defaults for the typical installation mode.

Parameter	Specify always	Specify in advanced mode	Default value for typical mode
DB2 instance	Yes	-	-
DB2 user	Yes	-	-
Repository database name	-	Yes	PERFDB or PERFDB[x] If PERFDB exists then x is replaced with a positive number
Repository database location	-	Yes	Default database path (DFTDBPATH) from database manager configuration

 Table 2-1
 Installation parameter summary

Parameter	Specify always	Specify in advanced mode	Default value for typical mode
Repository database small SMS table spaces location	-	Yes	Within database location directory
Table space type	-	Yes	SMS in version 4.1 DMS in version 4.1.0.1
Working directory			<ul> <li>Windows: <opm install<br="">dir&gt;\RepositoryServer\instanc es</opm></li> <li>Linux/UNIX: <home directory="" of<br="">DB2 instance owner&gt;/opm/v4</home></li> </ul>
WebSphere Application Server selection	Yes	-	-

# 2.3.2 Direct installation option

Use this option for a fresh installation of Optim Performance Manager version 4.1.0.1. This installation installs Optim Performance Manager and sets up the DB2 repository database and installs or sets up WebSphere Application Server.

Optim Performance Manager version 4.1.0.1 introduces new installation features. These new features broaden the environments in that the Optim Performance Manager can be installed, for example environments that use LDAP authentication. Additionally, these new features simplify the configuration and interaction with WebSphere Application Server compared to Optim Performance Manager 4.1

This section describes these features:

- Ability to specify the WebSphere Application Server profile name during installation that is to be used by Optim Performance Manager
- Ability to run the WebSphere Application Server profile that is used by Optim Performance Manager as the DB2 instance owner instead of root
- Ability to set up the authentication for the Optim Performance Manager Web console users through the repository database
- Ability to install Optim Performance Manager in environments that use LDAP authentication for DB2 users

#### WebSphere Application Server profile specification

You can specify the name of the WebSphere Application Server profile that Optim Performance Manager should use. If you selected to reuse an existing copy of WebSphere Application Server, the installer lists all available profiles that are either owned by the root user (Linux and UNIX), the SYSTEM user (Windows), or the owner of the DB2 instance. You can select one of the listed profile or specify a new one. If you specify a non-existing WebSphere Application Server profile name, the Optim Performance Manager installer creates it. Having the ability to specify the WebSphere Application Server profile name has the following advantages:

- You can use a dedicated WebSphere Application Server profile for Optim Performance Manager and, therefore, avoid interference with other WebSphere Application Server applications.
- You can share one WebSphere Application Server installation between multiple Optim Performance Manager installations on the same machine by specifying different profiles for each Optim Performance Manager installation.

A WebSphere Application Server profile defines the WebSphere Application Server runtime environment. Learn more about profiles:

http://publib.boulder.ibm.com/infocenter/wasinfo/v7r0/topic/com.ibm.websphere.n
d.doc/info/ae/ae/cpro\_overview.html

# Run WebSphere Application Server profile as DB2 instance owner

On Linux and UNIX, if you specify a new WebSphere Application Server profile, the Optim Performance Manager installer creates the profile under the DB2 instance owner of the instance used for Optim Performance Manager. You then can start the profile as the DB2 instance owner and it runs under the instance owner ID. This means that you can use the same user to run both WebSphere Application Server and Optim Performance Manager repository server.

On Windows, WebSphere Application Server is always running under the SYSTEM account.

# Optim Performance Manager console authentication through the repository database

By default, only authorized users can logon to the Optim Performance Manager Web console. During installation, the Optim Performance Manager installer sets the authentication method. The default authentication method is through the repository database. That means that users who can connect to the repository database can be authorized to use the Optim Performance Manager Web console. Right after the installation, only the user who was specified as the DB2 user during installation can logon to the Optim Performance Manager Web console.

You can authorize more users to logon to Optim Performance Manager Web console through the Console Security panel. You also can use the Console Security panel to change the Optim Performance Web console security to be no authentication required or to be authenticated through WebSphere Application Server. If the authentication is through the WebSphere Application Server, then authorizing the users to use the Optim Performance Manager Web console is performed through the WebSphere Application Server.

For more details refer to 2.6, "User authorization" that introduces you to the authorization and privilege concept of Optim Performance Manager.

#### LDAP authentication for DB2 users

During Optim Performance Manager 4.1.0.1 installation, you can specify a DB2 user for the repository database access and a group for the Performance Expert client logon that are authenticated through LDAP. The prerequisite is that the DB2 instance that you select for Optim Performance Manager must be created and configured to use LDAP-based authentication through the LDAP security plug-in or using transparent LDAP.

Take the following additional considerations if you want to use LDAP authentication:

- On Linux and UNIX, the WebSphere Application Server profile must run under the DB2 instance owner of the DB2 instance used for Optim Performance Manager. This is set up automatically when you specify a new WebSphere Application Server profile.
- On Windows, the user who starts the Optim Performance Manager installation (for example Administrator) and any user who uses the peconfig configuration tool must be defined in the LDAP directory.
- If you prefer to authenticate users to the Optim Performance Manager Web console through WebSphere Application Server instead of through the repository database, you must configure WebSphere Application Server to use LDAP through the WebSphere Application Server administrative console. For more information about how to do that, refer to:

http://publib.boulder.ibm.com/infocenter/wasinfo/v7r0/index.jsp?topic=/com. ibm.websphere.express.doc/info/exp/ae/tsec\_ldap.html

# 2.3.3 Update option

We recommend using this option only if you already have installed Optim Performance Manager version 4.1. To update Optim Performance Manager version 4.1 to version 4.1.0.1, apply Fix Pack 1 on the top of Optim Performance Manager 4.1 by selecting the same installation path. The fix pack installer does not change the existing WebSphere Application Server setup and the Optim Performance Manager console authentication. This means that none of the new installation features that we described in 2.3.2, "Direct installation option" on page 29 is applied during installation.

The following describes briefly how the Optim Performance Manager 4.1 installer sets up WebSphere Application Server and Optim Performance Manager console authentication:

- The WebSphere Application Server profile that the Optim Performance Manager uses is always AppServer1.
- On Linux and UNIX, the WebSphere Application Server profile is always set up to run as root. Therefore, you cannot use one ID to start both WebSphere Application Server and Optim Performance Manager. You must start the WebSphere Application Server as root and start the Optim Performance Manager repository server as the DB2 instance owner.
- The Optim Performance Manager Web console authentication is performed through WebSphere Application Server. After installation, the user that you specified as DB2 user during installation has access to the Optim Performance Manager Web console. You must add additional users who are allowed to logon to the Optim Performance Manager Web console using the WebSphere Application Server administrative console. Refer to the Optim Performance Manager Information Center about how to do that:

http://publib.boulder.ibm.com/infocenter/idm/docv3/index.jsp?topic=/com.ibm .datatools.perfmgmt.installconfig.doc/pm\_configure\_user\_access\_to\_opm.html **Tip:** If you have already had the Optim Performance Manager 4.1 installed and would like to update to version 4.1.0.1 as well as leverage the new installation features of Optim Performance Manager 4.1.0.1, use this procedure:

- Uninstall Optim Performance Manager 4.1. Do not reconfigure it so you can keep the repository database.
- Install Optim Performance Manager version 4.1.0.1. During installation, specify that you want to use an existing database and provide the name of your repository database.

This method allows you to keep the repository database with the configuration of the monitored databases and collected data. In the meantime, you can take the advantages of the new installation features including running the WebSphere Application Server profile as the DB2 instance owner, using LDAP authentication, and specifying a dedicated WebSphere Application Server profile.

## 2.3.4 Migration option

You can migrate an existing Performance Expert V3 installation to Optim Performance Manager version 4.1.0.1. Migration means the following:

- The performance database of Performance Expert is used for Optim Performance Manager and updated to the enhanced database schema of Optim Performance Manager.
- On Linux and UNIX, the working directory of Performance Expert Server is used by Optim Performance Manager. On Windows, the default location is used as working directory, see "Parameter summary" on page 28. The important property files are copied to the new location.

The migration is possible only if the same DB2 instance as for Performance Expert Server is used for Optim Performance Manager.

The migration is performed during the installation of Optim Performance Manager. You must select the advanced installation mode to get the option to migrate. The installer lists the DB2 instances that are used for Performance Expert. You can select from the list the DB2 instance to be migrated.

The result of the migration is the following:

 Optim Performance Manager version 4.1.0.1 is installed and it uses the same DB2 instance and database as Performance Expert.

- The monitored databases are configured as they have been configured for the Performance Expert and Optim Performance Manager continues monitoring them.
- You can continue performing configuration changes using peconfig or you can use the configuration wizard of Optim Performance Manager Web console for further configuration.
- Performance Expert Server is not uninstalled, but cannot be started anymore. The pestart script is renamed to avoid using the script accidentally.

Further considerations include these:

- In Performance Expert, you configure DB2 instances for monitoring whereas in Optim Performance Manager you configure databases for monitoring. In Performance Expert, any monitoring configuration such as collection intervals or retention times applies to all databases of the monitored DB2 instance. After migration, Optim Performance Manager continues to monitor all added databases of the monitored instance using the same configuration settings. If you change the configuration settings for one of the databases of the monitored instance using the configuration wizard of the Optim Performance Manager Web console, the changes are applied to all databases of the monitored instance.
- ► Performance Expert client must be updated to version 4.1.0.1 as well.
- If you have the Extended Insight Feature activated for Performance Expert, the license is no longer valid for Optim Performance Manager. Run the Extended Insight Activation Kit again to activate the license.

# 2.4 Capacity planning

In this section, we provide guidelines for a high-level estimation of hard disk, CPU, and memory required for the Optim Performance Manager server to help you plan for your Optim Performance Manager environment. The guideline is for the Optim Performance Manager V4.1 that monitors non-partitioned databases. For capacity planning when the partitioned databases are monitored or for more detailed calculation, contact IBM support.

This section uses Optim Performance Manager monitoring configuration terminology. We discuss monitoring configuration in 3.3, "Configuring Optim Performance Manager" on page 91.

# 2.4.1 Factors influencing capacity planning of Optim Performance Manager servers

The Opim Performance Manager Server resource (CPU, memory, disk, and network) consumed by Inflight monitoring data depends heavily upon five variables:

- > The Inflight monitoring profiles you intend to enable
- ► The Inflight sampling interval
- The retention time for Inflight data
- ► The schema of the monitored database server
- ► The workload being executed on the monitored database server

It is easy to see how the first three variables in the list above will contribute to the Opim Performance Manager Server resource consumption – the more monitoring profiles enabled, the more frequently the data is collected, and the greater the retention time of the monitoring data will all lead to an increase in Opim Performance Manager Server resource consumption to store and process the monitoring data.

For the last two variables, it is perhaps less obvious.

The schema of the monitored database server can have a large impact on disk space consumption if the "I/O and Disk Space" profile is enabled and:

- The "Collect table information" sub-option is selected and there are many tables in the monitored database server, or
- The "Collect table space information" sub-option is selected and there are many table spaces in the monitored database server, or
- The "Collect tablespace information with container information" sub-option is selected and there are many table space containers in the monitored database server.

For example, consider a database which contains 50,000 tables. If the "Collect table information" sub-option is selected for this database, then at each sampling interval, Opim Performance Manager will collect information on each of those 50,000 tables. If the default sampling interval of one minute, and Inflight retention period of 50 hours are used, then the Opim Performance Manager Server will hold 150 million (50,000 \* 50 \* 60) records to describe these tables. This is likely to consume a lot of Opim Performance Manager Server disk (and other) resource in order to process and store this information.

Similarly, consider a DB2 partitioned database system with 50 partitions, 20 table spaces on each partition, and five containers for each table space on each partition. If the "Collect tablespace information with container information"

sub-option is selected, this will result in monitoring information for 5000 table space containers being processed and collected by Opim Performance Manager – during each sampling interval. Consequently, the Opim Performance Manager Server will hold 15 million (5,000 \* 50 \*60) records to describe the table space containers.

The workload being executed on the monitored database can also impact the resource consumed by the Opim Performance Manager Server. For example, if the "Dynamic SQL" profile is enabled and the monitored database has a large package cache (DB2 database configuration parameter PCKCACHESZ). Consider a database with a package cache of 2GB, which on average holds 15,000 SQL statements. At each sampling interval, Opim Performance Manager will retrieve information about each of the SQL statements in the package cache (including the SQL statement text) and stores this in the repository database. If the default sampling interval of one minute, and Inflight retention period of 50 hours are used, then the Opim Performance Manager Server will store 45 million (15,000 \*50 \* 60) records to describe the SQL statements.

Another example would be if the "Locking" profile and "Collect lock wait information" sub-option are enabled, and the monitored database server encounters lots of lock wait situations, then collection of this monitoring data will consume Opim Performance Manager Server resource.

As can be seen from these examples, the amount of monitoring data processed and held in the Opim Performance Manager Server can be substantial.

The Opim Performance Manager Server resource consumed by the Extended Insight depends heavily upon the following factors:

- ► The Extended Insight monitoring profiles enabled.
- ► The retention times for aggregation levels 1, 2, 3 and 4.
- ► The number of unique SQL statements in the workload being monitored.
- The transaction rate at the database server.

For the first two items, the more EI monitoring profiles enabled, and the greater the retention period of the aggregated data, then the greater the Opim Performance Manager resource required to store and process the data.

When "Collect statement and transaction metrics on client" is enabled, then the number of unique SQL statements in the workload being monitored will have an impact on Opim Performance Manager Server resource consumed. Information about the SQL statements and transactions issued on the client or Application Server are collected at one minute intervals. All statements issued during this one minute interval are aggregated based on a hash code calculated from the SQL statement text. Therefore, if the workload contains many different SQL

statements more data will be aggregated than if the workload contains just a few different statements.

As an example, consider application A which uses literals, and application B which uses parameter markers. Both applications achieve exactly the same end-result, and both have Extended Insight monitoring enabled.

Table 2-2 and Table 2-3 lists the SQL statements run during a one-minute interval by the application A and B respectively.

SQL Statement	Number of times executed
INSERT INTO ORDERS (order_num, part, quantity, cost) VALUES (1,'widget A',3,5,60)	1
INSERT INTO ORDERS (order_num, part, quantity, cost) VALUES (2,'widget B',2,12.0)	1
INSERT INTO ORDERS (order_num, part, quantity, cost) VALUES (3,'widget C',7,2.21)	1
INSERT INTO ORDERS (order_num, part, quantity, cost) VALUES (4, widget A', 5, 8.60)	1
SELECT order_num, cost FROM ORDERS WHERE order_num=3	1
SELECT order_num, cost FROM ORDERS WHERE order_num=1	1

Table 2-2 Application A issues the following SQL during a one-minute interval

Table 2-3 Application B issues the following SQL during a one-minute interval

SQL Statement	Number of times executed
INSERT INTO ORDERS (order_num, part, quantity, cost) VALUES (?,?,?,?)	4
SELECT order_num, cost FROM ORDERS WHERE order_num=?	2

For application A, Opim Performance Manager will have six distinct records to process and store. For application B, Opim Performance Manager will have only two records to process and store. Therefore, the Opim Performance Manager resource required to monitor application A will be more than that required to monitor application B.

If we consider a more realistic example where application A issues 10,000 unique SQL statements per minute (because it does not use parameter markers), and each statement is executed just once. In this case, Opim Performance Manager will process 10,000 different statements each minute. If the default level 1 retention period of 24 hours is used, then Opim Performance Manager will requires resource to store and process 14.4 million records during that period.

Now let us consider the same application which issues 10,000 SQL statements per minute, but because it users parameter markers, only 500 of these statements are unique. Therefore, due to aggregation of the statements, Opim Performance Manager will only process 500 different statements each minute. If the default level 1 retention period of 24 hours is used, then Opim Performance Manager will requires resource to store and process 720,000 records during that period.

The primary cause for having many unique SQL statements in your workload would be when literal values are used instead of host variables and parameter markers. Best practice dictates that good coding should use host variables or parameter markers.

When "Collect transaction metrics on data server" El profile is enabled, the number of transactions (commits plus rollbacks) issued on the monitored database server will influence the resource consumed by Opim Performance Manager. If the Unit of Work event monitor is turned on, it will collect information on each transaction executed on the database server, and Opim Performance Manager will periodically read and process this information. Therefore, the greater the number of transactions occurring on the monitored database server, the greater the Opim Performance Manager resource required to process this data. For example, suppose a database is executing 500 transactions per second. Opim Performance Manager will then have to process and store 30,000 transactions every minute. If the default Extended Insight level 1 retention period of 24 hours is used, then Opim Performance Manager will store 43.2 million records to describe the transactions at 1 minute aggregation intervals.

# 2.4.2 Hard disk requirement estimation

In order to provide monitoring history, Optim Performance Manager keeps and maintains the collected data in the repository database that can be big if much monitoring data is collected and retained. Apart from the disk space used for DB2 and Optim Performance Manager installation, the monitoring data itself, along with the indexes, is the major disk space consumer of the repository server. The database log files also take some additional space. The installation and log files consume a relatively small and constant space, compared with the

repository database. To learn more about the installation consumption, refer the following link:

http://publib.boulder.ibm.com/infocenter/idm/docv3/index.jsp?topic=/com.ibm.dat atools.perfmgmt.installconfig.doc/pm\_install\_reqs.html

The majority of the monitoring data kept in the repository database are the Inflight monitoring data and the Extended Insight monitoring data. Therefore, for Hard Disk Capacity, this section focuses on the sizing of the Inflight monitoring data sizing and the Extended Insight monitoring data.

We provide algorithm and math formulas for estimating disk space consumption.

#### Disk space required by the Inflight monitoring data

The disk space consumption of Inflight monitoring data depends on many factors including the number of tables and buffer pools in the monitored database. To make the calculation simple and quick, here is an algorithm for high level estimation for the disk space consumed for *each* monitored database.

(0.3GB \* retention period for Inflight data)/sampling interval

where retention period for Inflight data is in *hour* and sampling interval is in *minute*.

You may set different sampling interval and retention period of Inflight data for the monitored databases. To calculate the total disk space consumption of Inflight monitoring on all monitored databases, apply the above algorithm to each monitored data server and then make a sum. The formula shown in Figure 2-1 on page 39 calculates the overall disk space consumption of Inflight monitoring on *all* databases and the result is in gigabytes.

$$HD_{inf}(GB) = \sum_{i=1}^{nab} 0.3 * \frac{1}{scamp_i} * retain_i$$

Figure 2-1 Overall disk space consumption of Inflight monitoring on all databases

The parameters in the formula are:

- ndb: The number of monitored database
- samp: The sampling interval for Inflight monitoring
- retain: Inflight data Retention Time (hour) for each monitored database

**Tips:** In the formula shown in Figure 2-1 on page 39, the number of the monitored databases is *ndb*. For each of the monitored database, which is represented as the i(th) database (i is from 1 to *ndb*), the corresponding sampling interval and retention period for that database is samp<sub>i</sub> and retain<sub>i</sub>. The values can be different from each databases. For each value of i, calculate the value of  $(0.3*samp_i)/retain_i$ . Then total the results to obtain the overall disk space consumption of Inflight monitoring on all databases.

This "sum" algorithm is also used in other formulas in this section.

#### Example 1

Suppose one customer wants to monitor five databases and the sampling interval and retention time of Inflight monitoring for each them are as shown in Table 2-4.

Monitored database name	Sampling interval in minute ( <i>samp</i> ) for this monitored database	Retention period in hour ( <i>retain</i> ) for this monitored database	Disk consumption (GB) of Inflight monitoring for this monitored database
DB1	1	50	0.3*50/1 = 15
DB2	5	240	0.3*240/5 = approx 15
DB3	3	168	0.3*168/3 = approx 17
DB4	15	300	0.3*300/15 = 6
DB5	10	300	0.3*300/10= 9

Table 2-4 Example: 5 databases to be monitored

As a result, the overall disk space consumption of Inflight monitoring for these five monitored databases is (15+15+17+6+9 = 62GB).

## Disk required by the Extended Insight monitoring data

The size of the Extended Insight client and Extended Insight server monitoring data depends mainly on the following factors:

Transaction rate (txt\_rate): This rate refers to the average number of executed transactions of the monitored application per minute during the retention of the aggregation level one.

- Unique SQL statement rate (uni\_sql): This rate is the average number of unique SQL statements executed per minute during the retention of aggregation level one.
- Retention time (retain\_ei\_a1, retain\_ei\_a2, retain\_ei\_a3, retain\_ei\_a4): Retention time refers to the retention time you set for each of the aggregation levels when the Extended Insight monitoring is configured.

Here we provide the estimation methods for using the default and non-default retention time for the aggregation levels.

#### Using the default retention time

If you take the default retention level values for aggregation 1, 2, 3, and 4 - one day, one month, three months, and two years, respectively, you can apply the formula shown in Figure 2-2 to calculate the disk space consumption for *each* monitored database. The result of this formula is gigabytes.

$$HD_{si\_sach\_db}(GB) = 7.5 * ei * \frac{uni\_sql}{1000} + 1 * txt * \frac{txt\_rate}{1000}$$



The parameters for this formula are:

- ei: Whether Extended Insight monitoring is enabled on a monitored database. If yes, ei=1; otherwise, ei=0
- uni\_sql: The average number of Unique SQL statements per minute executing on a monitored database
- txt: Whether "Collect transaction metrics on data server" is selected in monitoring configuration. If yes, txt=1; otherwise, txt=0. It is only applicable when the monitored database is DB2 v97fp1 or above.
- txt\_rate: Transaction rate per minute on a monitored database

The total disk space consumption of the Extended Insight monitoring for *all* databases is the sum of the disk space required of each monitored database. Figure 2-3 shows the formula. The result of this formula is gigabytes.

$$HD_{ei}(GB) = \sum_{i=1}^{nab} (7.5 * ei_i * \frac{uni\_sql_i}{1000} + 1 * txt_i * \frac{txt\_rate_i}{1000})$$

*Figure 2-3 Overall disk space consumption of Extended Insight monitoring for all databases* 

The parameters for this formula are:

▶ *ndb*: The number of monitored database.

- ei: Whether Extended Insight monitoring is enabled on a monitored database. If yes, ei=1; otherwise, ei=0
- uni\_sql: The average number of Unique SQL statements per minute executing on a monitored database
- txt: Whether "Collect transaction metrics on data server" is selected in monitoring configuration. If yes, txt=1; otherwise, txt=0. It is only applicable when the monitored database is DB2 v97fp1 or above.
- ► *txt\_rate*: Transaction rate per minute on a monitored database.

#### Example 2

Suppose one customer wants to monitor five databases and the monitoring profile is as shown in Table 2-5 on page 42.

Monitored database name	Whether Extended Insight monitoring is enabled ( <i>ei</i> )?	The average number of Unique SQL statements per minute ( <i>uni_sql</i> ) executing on a monitored database	Whether "Collect transaction metrics on data server" is selected in monitoring configuration ( <i>txt</i> )	Transaction rate per minute ( <i>txt_rate</i> ) on a monitored database	Disk space consumption (GB) of Extended Insight monitoring for this monitored database
DB1	1 (YES)	6,000	1 (YES)	4,500	49.5
DB2	1 (YES)	4,000	1 (YES)	10,000	40
DB3	1 (YES)	5,000	0(NO)	3,000	37.5
DB4	0 (NO)	15,000	0 (NO)	5,000	0
DB5	0(NO)	5,000	0(NO)	3,000	0

Table 2-5 Extended Insight monitoring profiles for the example monitored databases

As a result, the overall disk space consumption for Extended Insight monitoring for these 5 databases is (49.5+40+37.5=127GB).

#### Using non-default retention time

Considering that you may want to set different retention time for each aggregation level, here are the formulas to calculate the overall disk space consumption of the Extended Insight monitoring for *all* monitored databases by each aggregation level.

Use the formula shown in Figure 2-4 to calculate the overall disk space consumption of Extended Insight monitoring *aggregation level 1* for all monitored databases.

$$HD_{ei\_aeg\_1}(GB) = \left(60*\sum_{i=1}^{nab}(ei_i*\frac{uni\_sql_i}{1000}*retain\_ei\_al_i)+5*\sum_{i=1}^{nab}(txt_i*\frac{txt\_rate_i}{1000}*retain\_ei\_al_i)\right)/1024$$

Figure 2-4 Overall disk space consumption of Extended Insight monitoring aggregation level 1 for all databases

The parameters in the formula are:

- ► *ndb*: The number of monitored database.
- ei: Whether Extended Insight monitoring is enabled on a monitored database. If yes, ei=1; otherwise, ei=0.
- uni\_sql: The average number of Unique SQL statements per minute executing on a monitored database.
- retain\_ei\_a1: The retention time (hour) for aggregation level 1 of Extended Insight monitoring for a database.
- txt: Whether "Collect transaction metrics on data server" is selected in monitoring configuration. If yes, txt=1; otherwise, txt=0. It is only applicable when the monitored database is DB2 v97fp1 or above.
- ► *txt\_rate*: Transaction rate per minute on a monitored database.

The formula shown in Figure 2-5 is used for calculating the overall disk space consumption of Extended Insight monitoring *aggregation level 2* for all monitored databases.

$$HD_{si\_agg\_2}(GB) = \left(4 * \sum_{i=1}^{neb} (ei_i * \frac{uni\_sql_i}{1000} * retain\_ei\_a2_i) + 0.3 * \sum_{i=1}^{neb} (txt_i * \frac{txt\_rate_i}{1000} * retain\_ei\_a2_i)\right) / 1024 + 2 \cdot 1000 + 2 \cdot 1000$$

Figure 2-5 Overall disk space consumption of Extended Insight monitoring aggregation level 2 for all databases

The parameters in this formula are:

- uni\_sql: The average number of Unique SQL statements per minute executing on a monitored database.
- txt\_rate: Transaction rate per minute on a monitored database for which "Collect transaction metrics on data server" is selected.
- ► *ndb*: The number of monitored database.
- ei: Whether Extended Insight monitoring is enabled on a monitored database. If yes, ei=1; otherwise, ei=0.

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 retain\_ei\_a2: The retention time (hour) for aggregation level 2 of Extended Insight monitoring for a database.

Figure 2-6 on page 44 shows the formula used for calculating the overall disk space consumption of Extended Insight monitoring *aggregation level 3* for all monitored databases.

$$HD_{ei\_agg\_3}(GB) = \left(1*\sum_{i=1}^{ndb} (ei_i * \frac{uni\_sql_i}{1000} * retain\_ei\_a3_i) + 0.01*\sum_{i=1}^{ndb} (txt_i * \frac{txt\_rate_i}{1000} * retain\_ei\_a3_i)\right) / 1024$$

Figure 2-6 Overall disk space consumption of Extended Insight monitoring aggregation level 3 for all databases

The parameters for this formula are:

- uni\_sql: The average number of Unique SQL statements per minute executing on a monitored database.
- ► *txt\_rate*: Transaction rate per minute on a monitored database.
- ► *ndb*: The number of monitored database.
- ei: Whether Extended Insight monitoring is enabled on a monitored database. If yes, ei=1; otherwise, ei=0.
- retain\_ei\_a3: The retention time (hour) for aggregation level 3 of Extended Insight monitoring for a database.

Figure 2-7 shows the formula for calculating the overall disk space consumption of Extended Insight monitoring aggregation level 4 for all monitored databases.

$$HD_{ei\_agg\_4}(GB) = \left(0.05*\sum_{i=1}^{nab}(ei_i*\frac{uni\_sql_i}{1000}*retain\_ei\_a4_i) + 0.004*\sum_{i=1}^{nab}(txt_i*\frac{txt\_rate_i}{1000}*retain\_ei\_a4_i)\right)/1024$$

Figure 2-7 Overall disk space consumption of Extended Insight monitoring aggregation level 4 for all databases

The parameters in this formula are:

- uni\_sql: The average number of Unique SQL statements per minute executing on a monitored database.
- ► *txt\_rate*: Transaction rate per minute on a monitored database.
- ▶ *ndb*: The number of monitored database.
- ei: Whether Extended Insight monitoring is enabled on a monitored database. If yes, ei=1; otherwise, ei=0.
- retain\_ei\_a4: The retention time (hour) for aggregation level 4 of Extended Insight monitoring for a database.

The total disk space consumption of Extended Insight monitoring including all aggregation levels is the sum of the data size of four aggregation levels. Figure 2-8 shows the formula.

 $HD_{ei}(GB) = HD_{ei \ agg_{1}}(GB) + HD_{ei \ agg_{2}}(GB) + HD_{ei \ agg_{3}}(GB) + HD_{ei \ agg_{4}}(GB)$ 

*Figure 2-8 Overall disk space consumption of Extended Insight monitoring for all databases* 

To have the overall disk space consumption including both Inflight monitoring and Extended Insight monitoring, use the formula shown in Figure 2-9.

 $HD_{total}(GB) = HD_{inf}(GB) + HD_{ei}(GB)$ 

Figure 2-9 Disk space consumption for both Inflight and Extended Insight monitoring

# 2.4.3 CPU requirement estimation

The repository server retrieves data from monitored application and data server at regular intervals. Ideally, the overall CPU consumption should show regular peaks. However, the sampling to all monitored system is not synchronized, therefore, it also makes sense if you do not see the regular peaks when you have more than one database monitored. To make sure that the repository server works with acceptable performance, the available CPU should be greater than the peak values. In this document, the overall average of CPU consumption is also provided for a reference.

The overall CPU consumption mainly depends on the number of monitored data servers, number of database objects being monitored, transaction rate on each monitored database, and the number of console users. For any of these factors, the bigger it is, the higher the CPU consumption. The biggest contributors are transaction rate, number of monitored data servers, and number of console users. Table 2-6 shows a summary of required CPU based on these factors.

**Note:** CPU requirements in Table 2-6 are based on IBM pSeries® P5\_64-bit 1.9GHz processors. Appropriate conversion factors should be applied to convert the Opim Performance Manager Server CPU requirements to your intended deployment architecture.

Number of monitored data servers	Transaction rate on each monitored data server (K/minute)	Number of console users	Overall CPU when both Extended Insight client and Extended Insight server are disabled on all monitored database	Overall CPU when both Extended Insight client and Extended Insight server are enabled on all monitored database
10	1	5	2 CPU, above 2.0GHZ	3 CPU, above 2.0GHZ
20	2	10	2 CPU, above 2.0GHZ	6 CPU, above 2.0GHZ
30	5	15	6 CPU, above 2.0GHZ	8 CPU, above 2.0GHZ
30	20	15	8 CPU, above 2.0GHZ	12 CPU, above 2.0GHZ
30	40	20	10 CPU, above 2.0GHZ	16 CPU, above 2.0GHZ

Table 2-6 CPU requirements

### 2.4.4 Memory requirement estimation

To make sure that the Optim Performance Manager server runs with acceptable performance, adequate memory should be available for Optim Performance Manager console server (WebSphere Application Server), the repository server, and the repository database.

The memory capacity for an Optim Performance Manager system can be derived from the following formula:

OPM memory (GB) = Repository Server memory + Console Server memory + Repository DB memory + Operating System memory

We suggest to have 2GB RAM available for the operating system memory.

#### Memory required by the repository server

The memory consumed by the repository server depends on the number of monitored data servers and their transaction rate. The number of monitored applications on each data server also impacts the repository server memory consumption. To make a quick estimate, in this section, the capacity estimation involving Extended Insight is based on only one WebSphere application running for each data server. If you have more than one WebSphere Application severs for one database, contact IBM support for memory requirement estimation.

In general, the memory consumed by the repository server can be calculated by the sum of the following items:

- Basic consumption: approximately 200MB.
- Inflight monitoring for each monitored data server: 8MB.

Extended Insight monitoring for each monitored database: Increases by 5MB each time the transaction rate increases by 1000 transactions per minute.

Figure 2-10 shows a simple formula to estimate the memory consumption of the Optim Performance Manager repository server:

$$Mem\_rs = 200 + \sum_{i=0}^{ndb} 8 + 5 * EI_i * Tr_i$$



The parameters used in this formula are:

- ► *Mem\_rs* is the memory consumed by the repository server, in megabytes.
- ► *ndb* is the total number of monitored data servers.
- ei indicates whether the Extended Insight client or server monitoring is enabled on the data server. When either Extended Insight client or server is enabled, ei=1, otherwise, ei=0.
- Txt indicates whether "Collect transaction metrics on data server" is selected in monitoring configuration. If yes, txt=1; otherwise, txt=0. It is only applicable when the monitored database is DB2 97 Fix Pack 1or above.
- ► *Txt\_rate* is the transaction rate per minute on a monitored database.

To have an acceptable performance, additional memory is necessary to reduce the Java garbage collection overhead. The minimum requirement should be 1.5GB.

#### Example 3

This example demonstrates how you can use the formula shown in Figure 2-10 to estimate the memory required by Optim Performance Manager repository server. Table 2-7 shows the information for the five monitored database.

Monitored database name	Whether Extended Insight monitoring is enabled ( <i>ei</i> )	Whether "Collect transaction metrics on data server" is selected in monitoring configuration ( <i>txt</i> )	Transaction rate per minute ( <i>txt_rate</i> ) on a monitored database	Memory required by Optim Performance Manager Repository Server (MB)
DB1	1 (YES)	1 (YES)	25,000	133
DB2	1 (YES)	1 (YES)	20,000	108
DB3	1 (YES)	0(NO)	30,000	8

Table 2-7 Estimating the repository server memory requirement

Monitored database name	Whether Extended Insight monitoring is enabled ( <i>ei</i> )	Whether "Collect transaction metrics on data server" is selected in monitoring configuration ( <i>txt</i> )	Transaction rate per minute ( <i>txt_rate</i> ) on a monitored database	Memory required by Optim Performance Manager Repository Server (MB)
DB4	0 (NO)	0 (NO)	5,000	8
DB5	0(NO)	0(NO)	3,000	8

As a result, the total memory required by Optim Performance Manager repository server is 200+133+108+8+8 = approx 465MB.

#### Memory required by the Optim Performance Manager console

Memory consumed by the Optim Performance Manager console can simply refer to the free space in WebSphere Application Server Java heap that is dedicated to the Optim Performance Manager console. To allow an acceptable performance for the Optim Performance Manager, extra memory space is necessary to reduce the garbage collection overhead. Generally, the memory required by the Optim Performance Manager console is:

- If the number of concurrent console users is less or equal to 10, then 512M is required;
- If the number of concurrent console users is between 11 and 30, then 768M is required.
- If the number of concurrent console users is between 31 and 50, 1GB is required.

More than 50 concurrent console users are not recommended considering the acceptable performance.

#### Memory required by the repository database

Considering buffer pool consumption, the approximate memory required by a repository database is:

- If the number of monitored data servers is less or equal to 10, 3GB is required;
- If the number of monitored data servers is between 11 and 20, then 5GB is required;
- If the number of monitored data servers is between 21 and 30, then 7GB is required.

More than 30 data servers monitored by the same Optim Performance Manager instance is not tested in lab. If you need capacity for more than 30 data servers, contact IBM technical support for further analysis.

#### Example 4

This example is based on the scenario described in "Example 3" on page 47. Suppose that there are five database administrator to access the Optim Performance Manager console concurrently, the memory required will be:

- ► For the Optim Performance Manager console, 512MB of memory is required.
- ► For the repository database, 3GB of memory is required
- The total memory consumption of Optim Performance Manager would be (465MB + 512MB + 3GB = approx 4GB)

# 2.5 Storage options

For each database that Optim Performance Manager monitors, Optim Performance Manager creates two table spaces in the repository database, one for holding the short-term history data and one for holding the long-term history data. The table spaces are created when you configure a database for monitoring after the Optim Performance Manager is installed. During installation, in advanced installation mode, you can specify the type of table spaces (SMS, DMS, or automatic storage) the Optim Performance Manager should create. If you use the typical installation then the table space type defaults to DMS.

#### 2.5.1 Table space type selection

Each table space type has its characteristics. The following DB2 documentation provides a comparison:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.d b2.luw.admin.dbobj.doc/doc/c0055446.html

From a performance point of view, DMS and automatic storage table spaces are faster than SMS table spaces, especially for large tables. Because some tables in the Optim Performance Manager repository database can grow large, we recommend use DMS or automatic storage table spaces, considering performance.

Optim Performance Manager creates table spaces as *large* table space. If you consider the maximum table space size, the DMS and automatic storage table spaces allow higher maximum size than SMS stable spaces when the table spaces are created as large table space. For SMS table spaces the large option

is not available. See the table space size comparison in DB2 Information Center at:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.d b2.luw.admin.dbobj.doc/doc/c0052381.html

If the way to reclaim storage is important for you then SMS table spaces are the easiest to handle because the table space size shrinks whenever data is deleted from the table space. If the capacity planning results a disk space shortage, take the storage reclaiming behavior into account for your table space type decision. During Optim Performance Manager runtime it might happen that you run out of storage although Optim Performance Manager deletes collected data from the repository database regularly and automatically. Then you must delete data from the repository database manually in order to free disk space. Learn how DMS and Automatic Storage table spaces reclaim storage:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.d b2.luw.admin.dbobj.doc/doc/c0055392.html

# 2.5.2 Table space naming and usage

For each monitored instance, Optim Performance Manager creates the following table spaces to save the collected performance data:

- ► SHORTTERM <instance id>
- LONGTERM\_<instance\_id>

The variable *<instance\_id>* is a unique positive number that Optim Performance Manager assigns to each monitored database. The first database that you add for monitoring most likely receives the instance ID 1. For this database the table spaces SHORTTERM\_1 and LONGTERM\_1 are created.

All the collected performance data that can be displayed on the Optim Performance Manager Web console are saved in the SHORTTERM\_<instance\_id> table space. This table space can grow large. 2.4, "Capacity planning" on page 34 discusses the calculation of the required space for this table space. Retention times are set for the collected data and Optim Performance Manager deletes the data automatically when the retention time is reached.

The LONGTERM\_<instance\_id> table space stores the collected and aggregated data for Performance Expert client performance warehouse for long-term trend analysis and reporting. This data is not deleted automatically. Collecting this data is optional. It is collected only if you switch on the Performance Warehouse monitoring profile during the configuration of your monitored database. Since the data is stored in an aggregated format, the size of this table space is typically much smaller than the SHORTTERM <instance\_id> table space.

After you configured a database for monitoring, you can check the unique instance ID assigned to the database by Optim Performance Manager to learn which table spaces were created for the database. To check the ID, use the **peconfig -console** command from the RepositoryServer/bin directory of your Optim Performance Manager installation. Within peconfig, use the **list** command that returns information include the instance ID, for example:

```
Instance ID = 1
------
Enabled = Yes
Status = Inactive
CIM Object Manager enabled = No
Monitored Instance Alias = LOCALHOST_50000_PEDEMO
Node, Host, Port/Service name = NODE7507, LOCALHOST, 50000
Database, remote alias, local alias, EVM = PEDEMO, PEDEMO, PMDB3902, OFF
```

In this example, the Optim Performance Manager uses instance ID 1 for the configured database. This means that the table spaces for this database are named SHORTTERM\_1 and LONGTERM\_1.

#### 2.5.3 Table space location

If the DMS or SMS table space type is selected during installation, you specify the table space path during the configuration of a monitored database. Optim Performance Manager creates both table spaces in the specified path. You can either specify an explicit path or choose the default location. If you choose the default location then the table spaces are created under the database directory.

**Tip:** If you monitor multiple databases then we recommend that you specify an explicit path for each monitored database and ensure that the specified paths reside on multiple disks in order to avoid I/O bottlenecks.

If the Automatic Storage table space type is selected during installation, you specify the storage paths to be used during installation. When configuring a monitored database, Optim Performance Manager creates both table spaces using the automatic storage option. If you need to add storage paths later, you can use the ALTER DATABASE command.

#### 2.5.4 Table space DDL

In this section we show sample DDL statements for each table space type that Optim Performance Manager uses to create the table space. This helps you to understand which parameters Optim Performance Manager uses to create the table spaces: ► SMS:

CREATE REGULAR TABLESPACE SHORTTERM\_1 IN NODEGROUP PENG PAGESIZE 8K MANAGED BY SYSTEM USING ('SHORTTERM\_1 \$N') BUFFERPOOL DATA

► DMS:

CREATE LARGE TABLESPACE SHORTTERM\_1 IN NODEGROUP PENG PAGESIZE 8K MANAGED BY DATABASE USING ( FILE 'SHORTTERM\_1' 5000) BUFFERPOOL DATA AUTORESIZE YES

Automatic Storage:

CREATE LARGE TABLESPACE SHORTTERM\_1 IN NODEGROUP PENG PAGESIZE 8K MANAGED BY AUTOMATIC STORAGE INITIALSIZE 40M BUFFERPOOL DATA AUTORESIZE YES

# 2.6 User authorization

For user authorization, Optim Performance Manager uses privileges to control the following tasks:

Global tasks:

These tasks are checked at Optim Performance Manager and include:

- Logon to the Optim Performance Manager web console
- Administrative tasks
  - Changing global notification settings, for example, SMTP server settings
  - Accessing collected monitoring data if the monitored database is not accessible
  - Changing authentication method
  - Granting console privileges to users
- Configuration tasks
  - Adding databases for monitoring
- Database-specific monitoring tasks:

These tasks are checked at the monitored database and include:

- Collecting monitoring data
- Configuring monitoring
- Access to collected monitoring data
- Changing alert settings such as thresholds and notifications

# 2.6.1 User authorization for global tasks

Optim Performance Manager uses *console privileges* to control who can logon to the Optim Performance Manager web console and perform the administrative tasks. For the configuration tasks, additional privileges are required.

To logon to the web console, the user either needs the *Administrator*, *Operator*, or *Viewer* console privilege. A user with the Administrator privilege can execute the administrative tasks, users with Operator or Viewer privilege cannot. This is the only difference between these three privileges.

# Granting console privileges

The DB2 user that you specify during installation automatically receives the Administrator privilege, therefore, this user can logon to the web console right after installation. You can grant the console privileges to more users at any time after installation.

#### Authentication is controlled by repository database

If you use the direct installation option or migration option to install Optim Performance Manager V4.1.0.1I, the authentication is controlled by the repository database. To grant console privileges, as a user with Administrator privilege, use the *Console Security* panel to grant the Administrator, Operator, or Viewer privilege to DB2 users, DB2 groups, or DB2 roles. The user, group, or role that you specify must already have the CONNECT privilege to the repository database.

By granting the Administrator, Operator, or Viewer privilege to a user, group or role, Optim Performance manager grants execute rights to one of these user defined functions in the repository database:

- DSWEBSECURITY.CANVIEW
- ► DSWEBSECURITY.CANOPERATE
- ► DSWEBSECURITY.CANADMINISTER

Alternatively, you can grant the console privileges directly using the DB2 command GRANT EXECUTE, for example:

GRANT EXECUTE ON FUNCTION DSWEBSECURITY.CANVIEW TO USER <user id>

#### Authentication is controlled by WebSphere Application Server

If you use the update option for Optim Performance Manager V4.1.0.1 installation, the authentication is controlled by WebSphere Application Server because this is the only authentication method that is available in Optim Performance Manager V4.1. Use the WebSphere Administrative Console to grant console privileges to more users. Refer to the Optim Performance Manager Information Center about how to do that: http://publib.boulder.ibm.com/infocenter/idm/docv3/index.jsp?topic=/com.ibm.dat atools.perfmgmt.installconfig.doc/pm\_configure\_user\_access\_to\_opm.html

If you want to switch to the authentication controlled by the repository database, use the *Console Security* panel.

## Privileges required for configuration tasks

For the configuration tasks within the web console you need additionally DB2 privileges on the repository database. If you add a database for monitoring, Optim Performance Manager inserts entries for this database into the repository database tables with the IBMPDQ schema. To add a database for monitoring, you must authenticate to the repository database using a user who has SELECT and UPDATE privileges on tables within this schema. The DB2 user that you specify during installation has DBADM authority on the repository database. Either use this one or any other with the appropriate DB2 privileges on the repository database.

For the following tables, the SELECT and UPDATE privileges are required:

- ► IBMPDQ.MANAGED\_DATABASE
- ► IBMPDQ.MANAGED\_DATABASE\_PROPS
- ► IBMPDQ.PROFILE
- ► IBMPDQ.PROFILE\_PROPS

The following is an example GRANT statement to grant UPDATE privilege: GRANT UPDATE ON TABLE IBMPDQ.PROFILE TO USER <user id>

# 2.6.2 User authorization for database-specific monitoring tasks

Optim Performance Manager uses database privileges on the monitored database and database manager authorities to control the monitoring tasks. You define the users that execute monitoring tasks during configuration of a monitored database from the Optim Performance Manager web console. The first user you define is the *Optim Performance Manager collection user*. Optim Performance Manger uses this user to collect monitoring data from the monitored database. The monitoring data consists of snapshot and event monitor data. This user must have the following privileges and authorities on the monitored system:

- ► For DB2 Version 9.7:
  - DBADM
  - SECADM
  - SYSMON or SYSADM
- ► For DB2 Version 9.5 and earlier:
  - SYSADM

Further, you grant privileges to DB2 users, DB2 groups, or DB2 roles to authorize them to

Access collected monitoring data.

Grant the *canMonitor* privilege to accomplish this.

Change alert settings such as thresholds and notifications.

Grant the *canManageAlerts* privilege to accomplish this. The canManageAlerts privilege includes the canMonitor privilege.

The DB2 users, DB2 groups, or DB2 roles you grant a privilege to must already exist and have CONNECT privilege on the monitored database.

The Optim Performance Manager collection user automatically receives the canMonitor and canManageAlerts privilege.

By granting one of these privileges to a user, group, or role, Optim Performance Manager grants EXECUTE right to one of these user defined functions that Optim Performance Manager creates in the monitored database:

- ► OPM.CAN\_MONITOR
- ► OPM.CAN\_MANAGE\_ALERTS

The user defined functions do not do any operation, they are in the monitored database to check the EXECUTE right.

Alternatively, you can grant the privileges on the monitored database by using the DB2 command GRANT EXECUTE, for example:

GRANT EXECUTE ON FUNCTION OPM.CAN\_MONITOR TO USER <user id>

The canMonitor privilege is checked when you open a monitoring dashboard in the web console, select a database, and specify user credentials for this database. If the user you specify has EXECUTE right on the CAN\_MONITOR user defined function, the canMonitor privilege is confirmed and you are allowed to look at the monitoring data of this database. The canManageAlerts privilege is checked on the alert notification and configuration dashboards when you select a database and specify user credentials for this database.

To change the monitoring configuration you must specify the credentials of the Optim Performance Manager collection user. Otherwise, any changes to the configuration cannot be saved.

## 2.6.3 User authorization examples

In this section, we show two examples that illustrate the flow of privilege checking within Optim Performance Manager.

#### Example 1: Adding and configuring a database for monitoring

Follow the steps in Figure 2-11 on page 56 to see what authorizations are required to add a database and configure it for monitoring.



Figure 2-11 User authorization checking during configuration

# Example 2: Monitoring using dashboards and alerts

Follow the steps in Figure 2-12 on page 57 to see what authorizations are needed to look at monitoring data of a database and to change alert settings of a monitored database.


Figure 2-12 User authorization checking during monitoring

## 2.7 Objects in the monitored database

When monitoring is enabled for a database, Optim Performance Manager creates database objects in the monitored database including event monitors, event monitor tables, user-defined functions (UDFs), and stored procedures.

Depending on the monitoring data that you want to collect, Optim Performance Manager creates the following event monitors after the database is configured and enabled for monitoring:

- ► For Optim Performance Manager:
  - Lock event monitor (DB2 V9.7 or higher only)
  - Deadlock event monitor
  - Statistic event monitor (DB2 V9.5 or higher only)
- For Optim Performance Manager Extended Insight
  - Package cache event monitor (DB2 V9.7 or higher only)
  - Transaction event monitor (DB2 V9.7 or higher only)

These event monitors write the collected data into tables in the monitored database. Optim Performance Manager maintains these tables by deleting the data after Optim Performance Manager has read and saved it in the repository

database. The interval that Optim Performance Manager saves the monitor data is short, for example every minute. By default, the tables are created in the default table space that DB2 chooses. Often it is USERSPACE1. When configuring the database for monitoring using the Optim Performance Manager Web console, you can specify the table space that Optim Performance Manager should use to create the event monitor tables. We recommend that you specify a dedicated table space for the event monitors that Optim Performance Manager creates. Note that for a partitioned system, this table space should exist on all partitions that Optim Performance Manager monitors.

The following event monitors are created only if you use Performance Expert Client and start SQL or DB2 Workload Manager (WLM) activity traces:

- Statement event monitor
- Activity event monitor

These event monitors generate lots of data and, therefore, write the collected data into files on the monitored system instead of into tables. You specify the path for these files during configuration of a monitored database if you enable the performance warehouse monitoring profile. If the monitored database is partitioned, this path must be available on each partition. The instance owner and fenced user must have read and write rights to this path. Optim Performance Manager deletes the files after it reads and stores the contents to the repository database.

The UDFs and stored procedures that Optim Performance Manager creates are used for the following purposes and do not generate overhead on the monitored database

- ► Control canMonitor and canManageAlerts privileges.
- Control and read the event monitor files resulting from SQL or WLM activity traces.
- Watchdog for event monitors to ensure that event monitors are dropped on the monitored database in case Optim Performance Manager looses connection to the monitored database.

# Installing and configuring Optim Performance Manager

This chapter describes the steps necessary for a successful installation, activation, and configuration of Optim Performance Manager and the Extended Insight client.

# 3.1 Lab environment

In this section we describe the environment used for this Redbooks publication, shown in Figure 3-1. Other chapters and scenarios may reference these servers. The diagram here is a simplified, logical diagram, to give you an idea of which components are where, and how they interact.



Figure 3-1 Simplified logical view of book lab layout

While this section about our Lab environment describes the complete list of software used in the book, this chapter discusses installation and configuration of the Optim Performance Manager (OPM) server components only.

### **Optim Performance Manager Server**

This machine hosts the Optim Performance Manager server components:

- Optim Performance Manager repository server and its repository database
- Optim Performance Manager console server (WebSphere Application Server) that serves the web interface to the user

The details of this server are:

Machine	SD0D03A1
Operating system	AIX 6.1 TL6
CPU	4
RAM	6GB
Disk	500GB
Software installed	Optim Performance Manager 4.1.0.1
	WebSphere Application Server V7.0.0.5
	DB2 9.5 fp 6a
Instance	db2inst1
Port	50000
Database	PERFDB

Read about the installation and configuration of Optim Performance Manager Server components starting in section 3.2, "Installing and running Optim Performance Manager" on page 65.

### **Monitored DB2 server**

We demonstrate the Optim Performance Manager monitoring on both single and multi partitioned database.

### Single-partition database server

On this Linux server we set up two single-partition DB2 instances with several databases to be monitored by Optim Performance Manager. Installation of this DB2 server is not described in this book.

The system details are:

Machine Operating system CPU	SD0D03L3 Linux RHEL 5.5 2
RAM	- 8GB
Disk	200GB
Software installed	Optim Performance Manager 4.1.0.1 DB2 9.7 fp 2
Instance 1	db2ilin
Port	50001
Database	DTRADER
Instance 2	goinst
Port	50002
Database	GSDB

### Muiltipartition database server

Optim Performance Manager has robust capabilities for monitoring mutipartition database instances. The mutipartition database instance used for the scenarios

in this book, has four partitions defined across two machines. Machine1 hosts partition 0 and 1, and machine 2 has partitions 2 and 3. All four partitions can be considered data nodes.

Installation of these DB2 servers is not described in this book. The following are the system details:

Machine #1

Machine	SD0D03A2	
Operating system	AIX 6.1 TL6	
CPU	4	
RAM	6GB	
Disk	400GB	
Software installed	Optim Performance Manager 4.1.0.1	
	DB2 9.7 fp2	
Instance	db2iaix	
Port	50001	
Application databaseTPCH		

Machine #2

Machine	SD0D03A3
Operating system	AIX 6.1 TL6
CPU	4
RAM	6GB
Disk	400GB
Software installed	Optim Performance Manager 4.1.0.1
	DB2 9.7 fp2
Instance	db2iaix
Port	50001
Application database	PTPCH

### Monitored Extended Insight client

Optim Performace Manager V4.1.0.1 Extended Insight feature now supports monitoring applications that use the DB2 Call Level Interface (CLI). JDBC applications continue to be supported.

You can read about Installing and configuring the Extended Insight (EI) client software in section 3.4, "Installing and Configuring Extended Insight Client" on page 129.

**Note:** CLI support in Optim Performance Manager is for the DB2 Call Level Interface applications, not "Command Line Interface" which is sometimes also seen abbreviated as "CLI".

### WebSphere Application Server and JDBC applications

Optim Performance Manager Extended Insight feature supports monitoring WebSphere Application Server (WAS) applications that run JDBC transactions. Because WAS can be a complex environment by itself, we put this on its own server to separate it from any other EI client applications.

You can read about Installing and configuring the El client software in section 3.4, "Installing and Configuring Extended Insight Client" on page 129.

We describe the Tivoli ITCAM components configuration required on this server is in "Enable at ITCAM WebSphere agent side" on page 340.

The detail of this system are as follows:

Machine	SD0D03L2
Operating system	Linux RHEL5.5
CPU	2
RAM	8GB
Disk	200GB
Software installed	WebSphere Application Server 7.0.0.11
	DB2 Data Server Driver Package V9.7 fp2
	Optim Performance Manager El client 4.1.0.1
	IBM pureQuery runtime V2.25.76
	ITCAM Agent for WebSphere 7.1 fp1
	ITM OS monitoring agent 6.2.2 fp2
Applications	DayTrader
	GOCompany

### IBM Tivoli monitoring server

For the Tivoli monitoring scenarios, we have a very simple infrastructure defined, with the major IBM Tivoli monitoring components running on a single Windows server. This is not typical for production, but is perfectly suitable for our purposes in this book.

We have Tivoli Enterprise Monitoring Server (TEMS) and Tivoli Enterprise Portal Server (TEPS) running on one server, SD0D03W1. Also installed here are the IBM Tivoli Composite Application Manager (ITCAM) for Transactions' Transaction Collector and Transaction Reporter components, and the application support for the ITCAM for Application Diagnostics, and the Optim Performance Manager TEP workspace.

Description of the installation and configuration of the base Tivoli components is not covered in this book. We have installed the Tivoli components using mostly defaults and made very few configuration modifications. More information about the Tivoli integration is found in Chapter 10, "Integration with Tivoli monitoring components" on page 323.

The system details are:

Machine	SD0D03W1
Operating system	Windows Server 2008 Enterprise SP2 64-bit
CPU	2
RAM	8GB
Disk	100GB
Software installed	ITM 6.2.2 fp2 - TEMS, TEPS
	ITCAM for Transactions 7.2 fp2
	ITCAM for Application Diagnostics application support 7.1
	fp1
	Optim Performance Manager Extended Insight - Plug-in
	for Tivoli Enterprise Portal 4.1.0.1
	DB2 9.5 fp6a
Instance	DB2
Port	50000
Database	TEPS
	WAREHOUS

### **ITCAM for Application Diagnostics Managing Server**

The ITCAM for Application Diagnostics provides another user interface (UI) to view deep-dive information about WebSphere transactions. The UI is accessible from both the TEP and from a standalone browser. The Tivoli component that serves up the UI is called the ITCAM for AD Managing Server. We installed this component on a separate Windows server.

Description of the installation and configuration of the ITCAM for AD components is not covered in this book. We have installed the Tivoli components using mostly defaults and made very few configuration modifications.

More information about the Tivoli integration is found in Chapter 10, "Integration with Tivoli monitoring components" on page 323.

The system details are:

Machine	SD0D03W2
Operating system	Windows Server 2008 Enterprise SP2 64-bit
CPU	2
RAM	8GB
Disk	100GB
Software installed	ITCAM for Application Diagnostics Managing Server 7.1 fp1
	WebSphere Application Server 7.0.0.0

00
IGATE

## 3.2 Installing and running Optim Performance Manager

Optim Performance Manager (OPM) provides diversified installation options for user. We discuss these options in 2.3, "Installation options" on page 25 to help you decide the option that suit your environment the most.

Different from an installation guide, this section aims to give you an example about how you can set up Optim Performance Manager and does not cover every piece of details. We briefly describe the major steps of fresh installation of Optim Performance Manager V4.1.0.1 with the default option in most of the steps. For more details on installation, refer to the Information Center at:

# http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.perf mgmt.installconfig.doc/pm\_install\_modes.html

Before installing Optim Performance Manager, read the installation requirement described in the guide. We also discuss the installation prerequisite in 2.2, "Prerequisites" on page 21.

This section covers the installation of the following components:

- Installing Optim Performance Manager repository on AIX
- Activating Optim Performance Manager license on AIX.
- Activating Optim Performance Manager Extended Insight license on AIX
- Installing Performance Expert Client on Windows XP

### 3.2.1 Installing Optim Performance Manager

This section describes the major steps to install Optim Performance Manager on AIX. Before installing them, you should have DB2 available on the machine because a repository database will be created in DB2 during the installation. You can either create a DB2 instance during the installation or use an existing DB2 instance. The installation demonstrated in this section uses an existing DB2 instance.

A WebSphere Application Server profile is required to run Optim Performance Manager console server. You can set up a WebSphere Application Server profile either before or during Optim Performance Manager installation process. This section only covers setting up a new WebSphere Application Server profile during Optim Performance Manager installation. Refer to the installation guide for the process of other options.

The installation image of Optim Performance Manager for AIX consists of a WebSphere Application Server installer and Optim Performance Manager installer files:

WebSphere Application Server installer

WebSphere Application Installer is contained in a folder named "Was". During Optim Performance Manager installation process, if you choose to set up a new copy of WebSphere Application Server, the installer in this folder would be called automatically. If you choose to use an existing copy of WebSphere Application Server, this folder would not be used.

► Optim Performance Manager installer

Optim Performance Manager installer contains the following files or folders:

- iehs311aix64.jar
- OPM.server.v4.1.0.1.install-on-aix.bin
- DSWeb
- migration
- OPM\_sample\_install\_response\_file.rsp
- OPM.server.install.mode.trigger

To install Optim Performance Manager on AIX in GUI mode, complete the following steps:

1. Launching installation wizard (Figure 3-2):

Log on as root user and run

OPM.server.v4.1.0.1.install-on-aix.bin to launch the installation wizard. Choose language.



Figure 3-2 Launching installation wizard

2. Introduction:

The first introduction panel recommends you to quit all programs before continuing the installation. The second panel (Figure 3-3 on page 68) shows the supported minimum level list of AIX. Make sure your Operating System meets the requirement.



Figure 3-3 Supported AIX level

3. License Agreement (Figure 3-4 on page 69):

You can choose to install either the Try and Buy edition or a licensed edition. The Try and Buy edition is good for 60 days with the option to activate the license later. The license file, OPM.EnterpriseEdition.v4.1.0.1.opm\_lic, is in the Optim Performance Manager activation toolkit. You can place the license file anywhere on the machine where you run Optim Peroformance Manager installer, given that it can be read by the installation program. The default locate is in the same directory of Optim Performance Manager installer.

In this section, we demonstrate installing a licensed edition. We discuss details of the Optim Performance Manager avtivation toolkit and show how to apply license for Try and Buy edition using the activation toolkit in 3.2.2, "Activating the Optim Performance Manager license" on page 80.

We choose **Install a license edition** and specify the directory of the license file.



Figure 3-4 Choose an edition

- 4. License agreement: Read and accept the license agreement.
- 5. Response File (Figure 3-5 on page 70):

The installation program of Optim Performance Manager can create a response file for silent installation. The response file contains your input of each step during the installation process. If you choose to create a response file, the file will be created when the installation completes in the directory specified in this step. We choose **Install the production on this machine**.



Figure 3-5 Choose whether you want to create a response file

6. Installation directory (Figure 3-6 on page 71):

When choosing installation directory, you must make sure that there is enough space available for installation. We take the default AIX installation location /opt/IBM/0PM.

Additionally, the installer requires space in the /tmp directory during installation. The user (root on UNIX) who installs Optim Performace Manager must have read, write, and execute on /tmp or C:\temp.

Make sure that enough free space is available in /tmp as described in the System requirements:

http://www-01.ibm.com/support/docview.wss?rs=4014&uid=swg27019271

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<ul> <li>Introduction</li> <li>License Agreement</li> <li>Response File</li> <li>Choose Installation Directory</li> <li>Installation Type</li> <li>DB2 Instance Selection</li> <li>Connection Information</li> <li>Database Creation</li> <li>Table Space Option</li> <li>WebSphere Application Server</li> <li>Migration Option</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Product Startup</li> <li>Start Web Console</li> </ul>	Accept the default installation directory, or specify a different installation directory. Installation directory. /opt/IBM/OPM Browse Restore Default Directo	rγ
Cancel	Previous <u>N</u> e	ext

Figure 3-6 Installation directory

7. Installation Type (Figure 3-7 on page 72):

The options are Typical Installation and Advanced Installation. If you do not want to use the default repository database specifications including name, table space type, and location, choose **Advanced installation** to change them. The table space type to use is one of the planning task described in 2.5, "Storage options" on page 49. You must select the Advance installation to specify the table space type. The default type is DMS. We choose **Typical installation**.



Figure 3-7 Installation Type

8. DB2 Instance Selection (Figure 3-8 on page 73):

If you have a DB2 instance available for Optim Performance Manager, use the **Select an existing DB2 instance** option to specify the instance. To have the installer create a DB2 instance for you, choose **Create a new DB2 instance** and specify the instance user. In this process, we use an existing DB2 instance.

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			DB2 Instan	ce Selection
<ul> <li>Introduction</li> <li>License Agreement</li> <li>Response File</li> <li>Choose Installation Directory</li> <li>Installation Type</li> </ul>	Select the DB2 instance that IBM Op product on a DB2 instance that is in only one copy of the product on a D Select an existing DB2 instance:	tim Performance Manager will ru dependent from any monitored B2 Instance. db2inst1	un on. You must i DB2 instances. Y	nstall the 'ou can install
<ul> <li>DB2 Instance Selection</li> <li>Connection Information</li> <li>Database Creation</li> <li>Table Space Option</li> </ul>	DB2 version:	9.5.0.6		
WebSphere Application Server	DB2 installation directory.	/db2instance/IBM/db2/V9.5		
<ul> <li>Pre-Installation Summary</li> <li>Installing</li> </ul>	○ Create a new DB2 instance			
<ul> <li>Product Startup</li> <li>Start Web Console</li> </ul>	DB2 version:	9.5.0.6		
	DB2 installation directory.			
	Instance user:			
InstallAnywhere			Previous	Next

Figure 3-8 Select DB2 instance

9. Connection Information (Figure 3-9 on page 74):

Input a DB2 instance user name and a password. Optim Performance Manager uses this user name and password to create and access the repository database. This user must have the SYSADM authority on the DB2 instance. This user can run the WebSphere Application Server profile on which Optim Performance Manager console serverruns and it can log on to the Optim Performance Manager console.

Input a group name. The group can be any operating system group. Optim Performance Manager grants the appropriate privileges to this group so the users of this group can log on from Performance Expert Client to the Optim Performance Manager repository server. To learn more about this group, refer to "Performance Expert client group specification" on page 28. The repository database is created on the specified DB2 instance.

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	Connection Information
<ul> <li>Introduction</li> <li>License Agreement</li> <li>Response File</li> <li>Choose Installation Directory</li> <li>Installation Type</li> <li>DB2 Instance Selection</li> <li>Connection Information</li> <li>Database Creation</li> <li>Table Space Option</li> <li>WebSphere Application Server</li> <li>Migration Option</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Product Startup</li> <li>Start Web Console</li> </ul>	Specify the user account and group account that will have access to the repository database to work with the collected data. User name: db2inst1 Password: •••••••• Group account that will have access from DB2 Performance Expert Client Group name: db2iadm1
Cancel	Previous <u>N</u> ext

Figure 3-9 DB2 connection information

10.WebSphere Application Server (Figure 3-10 on page 75):

WebSphere Application Server is required for running Optim Performance Manager console server. Optim Performance Manager installer detects available WebSphere Application Server copies on the machine and list them in the *Use an existing copy of WebSphere Application Server* field for you to select the one to be used.

If you elect to create a new copy by choosing **Install a new copy of WebSphere Application Server**, which we recommend, Optim Performance Manager installer installs the WebSphere Application Server included in the Optim Performance Manager installation image.

To show how the Optim Performance Manager installer installs WebSphere Application Server, we choose **Install a new copy of WebSphere Application Server**" and input the installation directory. Refer to the disk space requirement described in the system requirements to make sure that there is enough space available in the specified directory:

http://www-01.ibm.com/support/docview.wss?rs=4014&uid=swg27019271

On AIX, by default, the new copy of WebSphere Application Server is set up in /opt/IBM/.

🐮 IBM Optim Performance Man	ager 📃 🗖	×
<ul> <li>IBM. Optim Performance Man</li> <li>Introduction</li> <li>License Agreement</li> <li>Response File</li> <li>Choose Installation</li> <li>Directory</li> <li>Installation Type</li> <li>DB2 Instance Selection</li> <li>Connection Information</li> <li>Database Creation</li> <li>Table Space Option</li> <li>WebSphere Application</li> <li>Server</li> <li>Migration Option</li> </ul>	A copy of WebSphere Application Server will be installed with this product. WebSphere Application Server will be used to host the Web interface.  Install a new copy of WebSphere Application Server Installation directory: //opt/IBM/WebSphere/AppServer Browse Use an existing copy of WebSphere Application Server Extended the copy of WebSphere Application Server	
<ul> <li>WebSphere Application Server</li> <li>Migration Option</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Product Startup</li> <li>Start Web Console</li> </ul>	Version: Directory: Status:	
InstallAnywhere	Previous Next	

Figure 3-10 WebSphere Application Server

11.WebSphere Application Server profile (Figure 3-11 on page 76):

A WebSphere Application Server profile defines the runtime environment. The profile includes all of the files that the server processes in the runtime environment and that you can change. To learn more about WebSphere Application Server profile, refer to the information center:

### http://publib.boulder.ibm.com/infocenter/wasinfo/v6r1/index.jsp?topic=/com. ibm.websphere.nd.multiplatform.doc/info/ae/ae/cpro\_overview.html

A WebSphere Application Server profile is required for running Optim Performance Manager console server. If you chose an existing WebSphere Application Server in last step and there are profiles on the server, in this step, you can either create a new profile or use an existing one. Optim Performance Manager installer detects available profiles on the specified WebSphere Application Server and list under the *Use an existing profile for WebSphere Application Server* field. If you chose to create a new copy of WebSphere Application Server in last step, you can only choose to create a new profile and specify a profile name. Since we chose to create a new WebSphere Application Server in last step, we choose **Create a new profile for WebSphere Application server** and take the default profile name.

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<ul> <li>Introduction</li> <li>License Agreement</li> <li>Response File</li> <li>Choose Installation Directory</li> <li>Installation Type</li> <li>DB2 Instance Selection</li> <li>Connection Information</li> <li>Database Creation</li> <li>Table Space Option</li> <li>WebSphere Application Server</li> <li>Migration Option</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Product Startup</li> <li>Start Web Console</li> </ul>	A WebSphere Application Server profile will be installed to manage the Web application for the product that you are installing.  Create a new profile for WebSphere Application Server Profile name: AppSrv01  Usg an existing profile for WebSphere Application Server Select one of the following existing profiles  Name: Location: Status:	10
InstallAnywhere	Previous	ext

Figure 3-11 WebSphere Application Server profile

12.WebSphere Application Server Global Security (Figure 3-12 on page 77):

In this panel, specify an administrative user to be used to log into the WebSphere Application Server Administrative Console of the profile (http://hostname:portnumber/ibm/console) if the global security of the profile is enabled.

🞕 IBM Optim Performance Man	ager 📃 🗖 🔀
	WebSphere Application Server Global Security
<ul> <li>Introduction</li> <li>License Agreement</li> <li>Response File</li> <li>Choose Installation Directory</li> <li>Installation Type</li> <li>DB2 Instance Selection</li> <li>Connection Information</li> <li>Database Creation</li> <li>Table Space Option</li> <li>WebSphere Application Server</li> <li>Migration Option</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Product Startup</li> <li>Start Web Console</li> </ul>	Specify the authentication information for the primary administrative user of the WebSphere Application Server profile that you are creating. This user ID is used internally, but you can use it to log in to the WebSphere Application Server Administrative Console. The user ID that you specify does not need to already exist. User Name: root Password: Confirm Password:
InstallAnywhere Cancel	<u>P</u> revious <u>N</u> ext

Figure 3-12 WebSphere Application Server profile administrative user

13. Pre-Installation Summary:

Thist panel shows a summary of your installation specifications for your review. Once proceed, a small window pops up informing that the time spend for installation depends on the machine capability.

14. Product Startup (Figure 3-13 on page 78):

When the wizard reaches to this step, the installation has already finished. On the first panel, select whether you want to start IBM Optim Performance Manager when the computer starts. To learn how to start Optim Performance Manger by using the command line, refer to 3.2.5, "Starting and Stopping Optim Performance Manager" on page 89.



Figure 3-13 Product Startup - option for starting the repository server

On the second panel of Product Startup (Figure 3-14 on page 79), choose whether to start IBM Optim Performance Manager and the associated WebSphere Application Server profile right now. If you select to start the product now, the repository server and the associated WebSphere Application Server profile will be started. If the associated WebSphere Application Server is running, it will be re-started.

🐮 IBM Optim Performance Man	iager 📃 🗖 🖸
	Product Startup
<ul> <li>Introduction</li> <li>License Agreement</li> <li>Response File</li> <li>Choose Installation Directory</li> <li>Installation Type</li> <li>DB2 Instance Selection</li> <li>Connection Information</li> <li>Database Creation</li> <li>Table Space Option</li> <li>WebSphere Application Server</li> <li>Migration Option</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Product Startup</li> <li>Start Web Console</li> </ul>	<ul> <li>IBM Optim Performance Manager was successfully installed in the following directory: /opt/IBM/OPM</li> <li>The log file is in the following directory: /var/adm/sw/opminstall.log</li> <li>Start IBM Optim Performance Manager and the associated copy of WebSphere Application Server. If the associated copy of WebSphere Application Server is running, it will be restarted.</li> <li>If you are reusing an existing WebSphere Application Server profile that is enabled for global security, and you select this checkbox, you might be prompted for the global security information during the configuration.</li> <li>If you are reusing an existing copy of WebSphere Application Server that is enabled for global security, and you do not select this checkbox, you will need to manually configure user access to IBM Optim Performance Manager.</li> </ul>
InstallAnywhere	Previous <u>N</u> ext

Figure 3-14 Product Startup - option for starting the products now

15.Start Web Console (Figure 3-15 on page 80):

If you chose to start Optim Performance Manager in last step and it is started successfully, you can select to open the Optim Performance Manager web console now or later. Take a note of the two URLs presented in the panel that are the Optim Performance Manger web console address. If the global security of the associated WebSphere Application Server profile is enabled, you can use either of the URLs. When you use the http URL, you will be automatically redirected to the https URL. If the global security is disabled, you will use the http URL.

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	Start Web Console
<ul> <li>Introduction</li> <li>License Agreement</li> <li>Response File <ul> <li>Choose Installation</li> <li>Directory</li> </ul> </li> <li>Installation Type</li> <li>DB2 Instance Selection</li> <li>Connection Information</li> <li>Database Creation</li> <li>Table Space Option</li> <li>WebSphere Application Server</li> <li>Migration Option</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Product Startup</li> <li>Start Web Console</li> </ul>	Neither WebSphere Application Server nor the repository server started successfully. You must start them manually before you can start the Web interface. You can open the Web Interface for IBM Optim Performance Manager from any workstation by entering the following Web address in a Web browser. You can add it as a bookmark for future use or forward it to other users of the Web Interface. <b>Open the Web Interface for IBM Optim Performance Manager</b> <ul> <li>https://9.12.5.104:9443/optimdatatools/console</li> <li>https://9.12.5.104:9080/optimdatatools/console</li> </ul> <li>Open the readme file</li> <li>Click Done to end the installation program.</li>
Cancel	Done

Figure 3-15 Start Web Console

The installation log is in /var/adm/sw/opminstall.log.

### 3.2.2 Activating the Optim Performance Manager license

IBM Optim Performance Manager is a licensed product. IBM provides you the 60-days no charge Try and Buy version to experience the product features and functions. The activation toolkit is for applying the license to the Try and Buy version to continue use the product after 60 days.

The Optim Performance Manager Extended Insight is a separated licensed option of Optim Performance Manager. The Extended Insight server component is installed together with the Optim Manager installation but not activated. To activate the Extended Insight, you can use the Extended Insight activation toolkit to apply the lances.

Optim Performance Manager activation toolkit contains the license of Optim Performance Manager. Having the license, user can apply it during installation or activate license for the Try and Buy edition. In this section, we discuss how to activate the Optim Performance Manager license using the activation toolkit on AIX.

The Optim Performance Manager activation toolkit for AIX contains the following files.

- OPM.server.v4.1.0.1.activate-on-aix.bin
- OPM.EnterpriseEdition.v4.1.0.1.opm\_lic

Use these steps to apply the license:

- 1. As root run OPM.server.v4.1.0.1.activate-on-aix.bin
- 2. Choose installation language.
- 3. Accept the license agreement.
- 4. Specify the Optim Performance Manager installation directory.

You may have several copies of Optim Performance Manager installed on the same machine. Choose the one to which you want to apply the license.

- 5. Review the pre-installation summary.
- 6. Click **Done** when the installation is finished.

# **3.2.3 Activating the Optim Performance Manager Extended Insight license**

The Extended Insight contains a server component and a client component. The server component is contained in Optim Performance Manager installation package and is installed with Optim Performance Manager in the in Optim Performance Manager installation directory. For example, on AIX, if you install Optim Performance Manager in /opt/IBM/0PM, you can see the /opt/IBM/0PM/pureQuery subdirectory which contains the major part of Extended Insight server. The property file of the Extended Insight Server named pdq.properties is located in <working directory>/<db2 instance>. pdq.properties is used in configuring the Extended Insight monitoring. <working directory> is the working directory of the repository server and <db2 instance> is the name of the DB2 instance on which the repository server runs.

**Tip:** On AIX, the default working directory of Optim Performance Manager repository server is <user home dir>/opm/v4, where <user home dir> is the home directory of the DB2 instance owner.

You can find out the working directory by running the following command:

grep <instance name> /var/db2pe/v3/db2pesrv.cfg | grep homedir

<instance name> is the name of the DB2 instance on which the repository
server runs. The result shows a parameter <instance name>.db2pe\_homedir
and its value. The value is <working directory>.

On Windows, the default working directory is <OPM install dir>\RepositoryServer

To use Extended Insight, you must activate the server by applying a license to the Extended Insight server using the Extended Insight activation toolkit.

The Extended Insight activation toolkit for AIX contains the following files:

activate\_EI.bin

Run this file to launch the installation wizard.

optim.pm.extendedinsight.pek\_4.1.0.1.jar

This jar file contains the license for activating the Extended Insight feature.

▶ parms\_Activate

This file contains parameters used by the toolkit. You do not need to do anything with this file.

sample\_activation.rsp

This is a response file that can be used to contain all user input during the installation process so that it can be used later for silent installation on other systems. Using this file is optional.

Use the following step to activate the Extended Insight license on AIX:

- 1. As root run activate\_EI.bin.
- 2. Choose installation language.
- 3. Select Activate the Extended Insight license and Configure Communication Properties.

If you select Configure Communication Properties in this step, you will be directed to step 6 after step 4 and 5. Otherwise, the activation process finishes at step 5.

4. Specify the Optim Performance Manager installation of which the Extended Insight is to be activated.

The installer detects and lists the valid copies of Optim Performance Manager installed on the system. Choose the copy to which you want to activate Extended Insight feature. If the copy is not in the list, click **Browse** to specify the installation directory.

- 5. Read and accept license agreement.
- 6. Configure communication properties. If you selected *Configure Communication Properties* in step 2, you will continue to this step for specifying the host name of Optim Performance Manager and a port number which would be used for communication between Optim Performance Manager and Extended Insight. The installer detects the valid host name of Optim Performance Manager and take it as default value.

The port number should be an unused on. The default port number is 60000. The value of pdq.cmx.controllerURL in <working directory>/<db2 instance>/

pdq.properties will be updated with the host name and port number you specify in this step:

pdq.cmx.controllerURL=<host name>:<port number>

<host name> is the host name you specified in this step and <port number> is the port number you specified.

You can check and update this property value accordingly later if necessary.

7. Specify the directory of optim.pm.extendedinsight.pek\_4.1.0.1.jar to finish the installation.

The installation of client component is described in 3.4, "Installing and Configuring Extended Insight Client" on page 129.

### 3.2.4 Installing DB2 Performance Expert Client

DB2 Performance Expert Client reads the data in the repository database and presents the monitoring information to users. The Optim Performance Manager users can either use the web console clients, the DB2 Performance Expert Client user, or both. Before starting installation, make sure that the prerequisite described in the following web address is met:

http://www-01.ibm.com/support/docview.wss?uid=swg27016380

This section describes the major steps for installing the Performance Expert Client on Windows XP. For all installation options, refer to 2.3, "Installation options" on page 25. The installation package of Performance Expert Client contains of the following files:

- bb2pe.client.v4.1.0.1.install-on-win32.exe
- ▶ iehs311win.jar
- ► README.txt

To install Performance Expert Client on Windows XP, log on with administrator authority and perform the following steps:

1. Run db2pe.client.v4.1.0.1.install-on-win32.exe to launch the installer. See Figure 3-16.



Figure 3-16 Installation introduction

The Introduction panel provides a simple installation instruction.

- 2. Software License Agreement: Read and accept the license agreement.
- 3. Client edition (Figure 3-17 on page 85): Choose the client edition you have purchased. The Performance Expert for Multiplatform edition supports DB2 for Linux, UNIX, and Windows as well as DB2 for z/OS.



Figure 3-17 Select client edition

4. Choose Install set (Figure 3-18 on page 86): We recommend the *Typical* installation for most of users. Choose **Custom** if you do not want to install "Help" for all supported language and prefer to select particular ones.



Figure 3-18 Choose install set

5. Installation folder (Figure 3-19 on page 87): Specify the installation directory. Make sure there is enough space available in the specified directory.

🖫 IBM DB2 Performance Expert Client v4		
<ul> <li>Introduction</li> <li>License Agreement</li> <li>Client Edition</li> <li>Choose Install Set</li> <li>Choose Install Folder</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Install Complete</li> </ul>	Accept the default installation directory, or specify a different installation directory. Installation directory: C:Program Files\IBM\IBM DB2 Performance Expert Client V Browse Restore Default Directory	
Cancel	Previous	

Figure 3-19 Choose install folder

6. Pre-Installation Summary (Figure 3-20 on page 88): Review the information.



Figure 3-20 Pre-installation summary

7. Install Complete (Figure 3-21 on page 89): Click **Done** when installation finishes.



Figure 3-21 Install complete

8. When installation is done, the "Getting Started" window pops up. Click open and then add connections to monitor. Alternatively, you can open this window from the start menu.

### 3.2.5 Starting and Stopping Optim Performance Manager

This section describes the procedures to start and stop the Optim Performance Manager on AIX including the Optim Performance Manager repository server and the Optim Performance Manager console.

Before starting Optim Performance Manager, the DB2 instance on which the Optim Performance Manager will run should be started.

To start (or stop) the repository server on AIX, finish the following steps:

- 1. Log on as the DB2 instance owner ID.
- 2. Go to directory: <OPM installation directory>/RepositloryServer/bin, where <OPM installation directory> is the installation directory of Optim Performance Manager. On AIX, the default path is /opt/IBM/OPM.

3. run ./pestart to start or run ./pestop to stop the repository server.

The starting, stopping, and running logs of the repository server is contained in <working directory>/<db2 instance>/db2pesrv.log. Typically, the monitoring status for each monitored data server is contained in the log.

To start (or stop) Optim Performance Manager console on AIX, start (or stop) the associated WebSphere Application Server profile where the Optim Performance Manager console runs. An alternative method is by performing the following steps:

- Log on as the DB2 instance owner ID or other ID with root authority, dependent on whether the WAS profile runs under DB2 instance owner or root user. If you have installed WAS together with OPM then the WAS profile runs under the DB2 instance owner.
- 2. Go to the <OPM installation directory>/bin directory.
- 3. run /WASstart.sh to start or /WASstop.sh to stop the console.

**Tip:** One of the new functional features of Optim Performance Manager V4.1.0.1 is the ability to run the WebSphere Application Server profile used by Optim Performance Manager as the DB2 instance owner instead of root on AIX or Linux.

On windows, the WebSphere Application Server profile is always running under the SYSTEM account.

The starting, stopping, and running logs of the Optim Performance Manager console is contained in the WebSphere Application Server profile log files under <WebSphere Application Server installation directory>/AppServer/ profiles/console is contained in the WebSphere Application Server installation directory

- startServer.log contains the log information about starting Optim Performance Manager console
- stopServer.log contains the log information about stopping Optim Performance Manager console
- SystemOut.log, SystemErr.log, native\_stdout.log, and native\_stderr.log contains the running logs.

Detailed-level log about Optim Performance Manager console access Repository Database is contained in <OPM installation directory>/logs/datatools.log, where <OPM installation directory> is the installation directory of Optim Performance Manager.

## 3.3 Configuring Optim Performance Manager

After installation you must configure Optim Performance Manager which comprises of the following steps:

1. Configuring user access

After installation the DB2 user that you specified during installation can logon to the Optim Performance Manager web console. If other users should have access then you have to give them the privileges. This is an optional step. It can also be done after the next two steps.

2. Adding or importing database connections

This step defines the databases that you want to monitor with Optim Performance Manager.

3. Configuring the database connections for monitoring

In this step you configure monitoring using monitoring profiles, define monitoring authorizations, and configure partition sets. Partition sets can be configured only for partitioned database.

**Note:** In the previous DB2 Performance Expert product you used the **peconfig** program to perform steps 2) and 3). Optim Performance Manager still supports the configuration via **peconfig** in addition or alternatively to the configuration via web console that we describe in this chapter. Refer to A.10, "Using the configuration program peconfig" on page 464 for more information about using **peconfig**.

You can login to the Optim Performance Manager console using the URL that is provided during installation. As an example:

### http://9.12.5.104:9080/optimdatatools/console

Enter authentication details to access Optim Performance Manager. See Figure 3-22 on page 92. Note that immediately after the installation, only the DB2 user that was provided during the installation can be used if you use the repository database authentication. For more details refer to 2.6, "User authorization" on page 52 that introduces you to the security and authentication concept of Optim Performance Manager.

Optim Performance Manager Log In
Repository used for authentication: PERFDB
User name: db2inst1
Password:
Log In
Licensed Materials - Property of IBM Corp. (C) IBM Corp. and its licensor(s) 2003,2010. IBM and the IBM logo are trademarks of IBM Corp. In the United States, other countries, or both.

Figure 3-22 Optim Performance Manager Login screen

Once you login you will be at the Optim Performance Manager Welcome screen (Figure 3-23).



Figure 3-23 Optim Performance Manager Welcome screen

### 3.3.1 Configure user access

One part of Optim Performance Manager configuration is to manage which users can authenticate to the Optim Performance Manager web console and what privileges they have once they are logged in.

Let us start by reviewing the security method for authenticating users of the web console. The privileges that are assigned to a user control the actions that a user can perform in the web console. We can do this by opening the Console Security tab under Task Manager on the web console (Figure 3-24 on page 93). You must have administrator privileges to use this page.
¢	Optim Performance Manager						
	🐞 Task Manager 🔹 🚯 Manage Database Connections 🔯 Welcome - My Optim Central						
	Health	Performance	Configuration	Setup			
	<ul> <li>Health Summary</li> <li>Alert List</li> <li>Current Application Connections</li> <li>Current Table Spaces</li> <li>Current Utilities</li> </ul>	<ul> <li>Inflight Dashboards</li> <li>Extended Insight Dashboard</li> <li>Reports</li> </ul>	<ul> <li>Workload Manager Configuration</li> <li>Purge Alerts Interval</li> <li>Health Alerts Configuration</li> <li>Alert Notification</li> <li>Performance Alert Configuration</li> </ul>	<ul> <li>ITCAM Data Collection</li> <li>Configuration Repository</li> <li>Console Security</li> <li>Manage Privileges</li> </ul>			
				<ul> <li>Services</li> <li>Logs</li> </ul>			

Figure 3-24 Task Manager - Console Security

After a fresh installation of Optim Performance Manager 4.1.0.1, the authentication method is set to **Repository database authentication** and you can manage user access from the same page (Figure 3-25 on page 94). The user, group, or role that you grant these privileges to must already be defined in the repository database and have the CONNECT privileges on the repository database. If you want to manage user authentication through WebSphere Application Server, select **Web container-managed authentication** and define the user access within WebSphere Application Server Administrative console. For more information about user authentication, refer to the Information Center at

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.perf
mgmt.installconfig.doc/pm\_configure\_user\_access\_to\_opm.html

**Tip:** If you want to configure user access for users authenticated through LDAP, we recommend to use *Repository database authentication*. This requires that the DB2 instance used for Optim Performance Manager is configured to use LDAP-based authentication through the LDAP security plug-in or using transparent LDAP. If you want to use *Web container-managed authentication* for LDAP users, you must configure WebSphere Application Server to use LDAP through the WebSphere Application Server administrative console. For more information about how to do that, refer to:

http://publib.boulder.ibm.com/infocenter/wasinfo/v7r0/index.jsp?topic=/com.i
bm.websphere.express.doc/info/exp/ae/tsec\_ldap.html

Select a security method for authentic	ating users of the web console. The privileges	; that are assigned to a user c				
) Repository database authentication						
User authentication is controlled by the repository database. All users that are allowed to connect to the repos						
③ Configure Repository Database						
<ul> <li>Web container-managed authentic</li> </ul>	) Web container-managed authentication					
User authentication is controlled by	y the web application server. Use the tools pro	ovided by your web application				
No user authentication						
No login is required to access the	web console. Tasks performed using the web o	console might require databas				
Apply						
You are connected to the repository d	atabase as user db2inst1. Click here to discon	inect.				
The table lists privileges for the repository database users, groups, or roles. Use the controls below to grant or re						
👍 Grant 💻 Revoke						
🐳 Grant 💻 Revoke						
💠 Grant 💻 Revoke	ID Type					
Grant Revoke ID DB2INST1	ID Type USER	Operator				
Grant Revoke ID DB2INST1 DB2INST1	ID Type USER USER	Operator Administrator				
Grant Revoke ID DB2INST1 DB2INST1 XU	ID Type USER USER USER USER	Operator Administrator Administrator				
Grant Revoke  ID  DB2INST1  DB2INST1  XU  WHEIJEN	ID Type USER USER USER USER USER USER USER	Operator Administrator Administrator Administrator Administrator				
Grant Revoke      ID  DB2INST1  DB2INST1  XU  WHEIJEN BAUMBACK	ID Type USER USER USER USER USER USER USER USER	Operator Administrator Administrator Administrator Administrator Administrator				
Grant Revoke      ID  DB2INST1  DB2INST1  XU  WHEIJEN BAUMBACK BOROVSKY	ID Type USER USER USER USER USER USER USER USER	Operator Administrator Administrator Administrator Administrator Administrator Administrator				
Grant Revoke      ID  DB2INST1  DB2INST1  XU  WHEIJEN BAUMBACK BOROVSKY  MISKIMEN	ID Type USER USER USER USER USER USER USER USER	Operator Administrator Administrator Administrator Administrator Administrator Administrator Administrator				
Grant Revoke      ID  DB2INST1  DB2INST1  XU  WHEIJEN BAUMBACK BOROVSKY  MISKIMEN KENGE	ID Type USER USER USER USER USER USER USER USER	Operator Administrator Administrator Administrator Administrator Administrator Administrator Administrator Administrator				
Grant Revoke      ID  DB2INST1  DB2INST1  XU  WHEIJEN BAUMBACK BOROVSKY  MISKIMEN  KENGE SONALL	ID Type USER USER USER USER USER USER USER USER	Operator Administrator Administrator Administrator Administrator Administrator Administrator Administrator Administrator Administrator				
Crant Revoke	ID Type USER USER USER USER USER USER USER USER	Operator Administrator Administrator Administrator Administrator Administrator Administrator Administrator Administrator Administrator Viewer				

Figure 3-25 Console Security Dashboard

To each user that requires access to the Optim Performance Manager web console, you can grant one of the following user roles:

- Viewer: The Viewer role is the default global privilege for every Optim Performance Manager web console user. A user who is assigned the Viewer role cannot change any global settings. Viewers cannot see the historical monitoring information of any monitored databases that are disconnected.
- Operator: The Operator role in Optim Performance Manager is exactly the same as the Viewer role.
- Administrator: The Administrator role is a global privilege that allows the user to perform any task in the Optim Performance Manager web console.
   Administrators can also view historical monitoring information of all disconnected databases.

For more details refer to Section 2.6, "User authorization" on page 52 that introduces you to the security and authentication concept of Optim Performance Manager.

## 3.3.2 Adding or importing database connections

You can add new database connections one by one, or you can import a set of database connections into the database repository.

#### Adding a database connection using the Connection Wizard

To add a database for monitoring you must have the database authorization and connection information.

Perform these steps to add a database connection:

- 1. Log on to Optim Performance Manager.
- 2. From the Optim Performance Manager window, click **Manage Database Connections**.
- 3. Click **Add** and you will be required to authenticated the Optim Performance Manager repository database (Figure 3-26). The user who connects to the repository database in order to add new connections must have certain privileges to the repository database. For more details about authorization, refer to 2.6, "User authorization" on page 52 that introduces you to the security and authentication concept of Optim Performance Manager.

Connect to the repository database PERFDB			
To perform privileged actions, you must log in to the repository database <b>PERFDB</b> (127.0.0.1:50000)			
User ID: * db2inst1			
Password: * ******			
$\checkmark$ Save this user ID and password			
Log In Cancel			

Figure 3-26 Authenticate the repository database

4. The database connection wizard opens up.

Enter Database connection name, Data server type, Database name, Host name, Port number, User ID and Password. Fields that do not have a red asterisk next to them are optional fields. See Figure 3-27 on page 96.

Add Database Connection	
	Learn more about database connections.
Database Connection	
Database connection name:	* reddb2 on AIX
Comment:	
Data server type:	* DB2 for Linux, UNIX, and Windows
Database name:	* reddb2
DB2 instance:	
DB2 CLP alias:	
Host name:	* 9.12.5.104
Port number:	* 50000
JDBC security:	* Clear text password V
Kerberos server principal:	
User ID:	* db2inst1
Password:	* *********
Additional JDBC properties:	Example: traceLevel=32;progressiveStreaming=1
JDBC URL:	jdbc:db2://9.12.5.104:50000/reddb2:retrieveMessagesFromServer
	onocureadyc-racyaecurrymechanian-5,
	Test Connection OK Cancel

Figure 3-27 Add Database Connection

5. Click **Test Connection** to ensure the authorization and connectivity of the database you want to monitor.

If authenticated and connected, you will receive a connection successful message.

Click **OK** to close the pop-up and return to the wizard that guides you through adding a database connection.

After you complete the steps in the wizard, the database connection is added as *Not configured* to the list of database connections under the Manage Database Connections dashboard.

#### Importing database connections

You can import database connection profiles using files. The two supported file formats are:

Comma-separated value text (CVS) file:

Optim Performance Manager comes with a sample CSV text file that contains the information about all the database connections. You can edit and use it to

import connections. The sample CSV is located in the samples subdirectory of installation directory:

<OPM\_Working\_Directory>/RepositoryServer/samples

 Configuration profiles that you can export from DB2 by using the Configuration Assistant menu in the Control Center or by using the db2cfexp command, for example:

db2cfexp <filename> MAINTAIN

Let us consider we have a CSV file named Import\_Databaseconnection.txt on our local machine which has the information about the database connections to be added. Perform the following steps to import the database connection profile using this CSV file:

- 1. Under Manage Database Connection tab, click Import.
- 2. An Import Connection wizard is opened (Figure 3-28). Browse for the location of your file and click **Next.**

Import Con	inections	
Step 1 of 3:	Specify a database connection configuration file	
Location of the d	latabase connection file:	4
• Local:	Import_Databaseconnection.txt Browse	
Server:		
	< Back Next → Finish	Cancel

Figure 3-28 Import Connections

- 3. The next step is how you want to handle a duplicate connection. For the purpose of this book, we say update the existing connection and click **Next**.
- 4. This display a preview of connections to be imported. See Figure 3-29 on page 98.

nport Connections					
3 of 3: Preview the c	onnections to im	port			
Database Connection Name	Data Server Type	Database Name	Host Name	Port Nur	Comment
testdb1	DB2LUW	DB2	fogcity.usca.ibm.c	50000	
testdb2	DB2LUW	DB2	fogcity.usca.ibm.c	50000	
testdb3	DB2LUW	DB2	fogcity.usca.ibm.c	50000	
testdb4	DB2LUW	DB2	fogcity.usca.ibm.c	50000	
testdb5	DB2LUW	DB2	fogcity.usca.ibm.c	50000	
testdb6	DB2LUW	DB2	fogcity.usca.ibm.c	50000	
			< B	ack Ne	xt > Finish

Figure 3-29 Preview the connections to import

5. Click **Finish** and an Import Summary is displayed.

Connection Name	Action	Result
testdb1	Add	Success
testdb2	Add	Success
testdb3	Add	Success
testdb4	Add	Success
testdb5	Add	Success
testdb6	Add	Success

Figure 3-30 Import Summary

After you complete the steps in the Import wizard, the database connections are added as *Not configured* to the list of database connections under the Manage Database Connections dashboard.

# 3.3.3 Configuring the database for monitoring

After you have added database connection to the Optim Performance Manager, the next step is to configure it for monitoring using the following procedure:

1. Log on to Optim Performance Manager.

- 2. From the Optim Performance Manager panel, click **Manage Database Connections**. You see a list of database connections that have been added with the Monitoring Status as *Not Configured*.
- 3. Select the database for which you want to configure monitoring and click **Configure Monitoring**. The Configure Monitoring wizard opens.
- 4. In the Configure Monitoring panel, enter the following information:
  - Physical database name:

This is automatically populated with the selected database name.

- Storage path for collected monitor data:

By default this is checked to use the default table space path. You can specify a different path. A new path can only be entered if the user selected SMS or DMS table space type during installation. For more details on Storage options refer to 2.5, "Storage options" on page 49 that introduces you to storage concept of Optim Performance Manager.

Optim Performance Manager collection user:

This is automatically populated with the same user that you specified when you added a database connection. You can change to a different user who has appropriate authorization on the database to be monitored. For more details on authorization, refer to 2.6, "User authorization" on page 52.

Password:

Enter the authentication password for the above user.

- Time zone:

This parameter refers to the time zones of the server on which the DB2 instance runs. Make sure that this is correct. Optim Performance Manager uses the time zone information to display collected performance data in the time zone of the monitored database. If the time zone is incorrect then wrong timestamps are displayed for collected performance data.

 Now select a starting point for your monitoring configuration profile that can be either new, use predefined template, or clone from another already configured database. Predefined templates are available for various monitored database systems, for example OLTP, BI or SAP systems. For more details on the various predefined templates, refer to the Information Center at this address:

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatoo
ls.perfmgmt.monitor.doc/sys\_templates\_monitor\_profiles.html

For the purpose of our book, we select **Use predefined template** and from the drop down we select **Development system**.

Activate monitoring: Ensure that you have this checkbox clicked if you
want to monitor this database immediately after configuration has finished.

Figure 3-31 on page 100 shows the Step 1 for configuring Monitoring settings.

K Configure Monitoring	E			
Step 1 of 5: Configure general monitoring settings				
Identify the database that you want point for your monitoring configurat	lentify the database that you want to monitor, specify where the monitoring data is stored, and select a starting sint for your monitoring configuration.			
Physical database name:	* REDDB2			
Storage path for collected monitor data:	* ☑ Use default storage path			
Optim Performance Manager collection user:	* db2inst1			
Password:	* *****			
Time zone:	* (GMT-5) Eastern Standard Time [America/N │ ▼ Show Matching			
Select a starting point for your mo on the next page.	Select a starting point for your monitoring configuration. You can modify defaults and inherited settings as needed on the next page.			
○ Create new				
Use predefined template	* Development system			
	Use to analyze the performance of new applications and their impact on the data server. No parameter values are captured for statements involved in a deadlock because these values are typically analyzed with a representative amount of data (for			
O Configure like	<select></select>			
Activate monitoring:	✓ Collect and process monitoring data			
	Previous Next > Finish Car	ncel		

Figure 3-31 Configure Monitoring Step-1

- 5. Click Next.
- 6. Because we select a predefined template in the previous step, Optim Performance Manager enable associated monitoring profiles - Figure 3-32 on page 101. Depending on what you selected, the system collects different types of data, such as inflight performance, reporting, or extended insight data. You can click the pencil icon a next to each profile to get an idea of the

default settings for each preconfigured monitoring profile and edit it if required. Additionally, Optim Performance Manager sets alert thresholds depending on the selected predefined template. For example, for a monitored OLTP system a buffer pool hit ratio over 90% is much more important than for a BI system. You can not edit the alert thresholds using the pencil icons, but you can edit them after configuration using the Performance Alert Configuration dashboard available from Task Manager.

🖹 Configure Monitoring	
Step 2 of 5: Configure monitoring profiles	
Define the type of monitoring data that is collected by enabling the corresponding monitoring profiles. If you selec Use predefined template or Configure like on the previous page, then the associated profiles are enabled.	ted
Selected configuration: Create new	
Monitoring settings	
Retention times and sampling intervals	
DB2 event monitor configuration	
Monitoring profiles	
Inflight performance, reporting, or Workload Manager	
These profiles collect performance statistics for the data server, which are shown in the inflight dashboards, Workload Manager, or in the reports.	in
✓ Basic	
🗹 Locking	
✓ Active SQL and Connections	
✓ I/O and Disk Space	
☑ Workload Manager	
✓ Dynamic SQL	
Extended Insight	
This profile is available only if the Extended Insight feature is installed. This profile collects end-to-end performance statistics for the data server, the network, and the applications. These statistics are shown on t Extended Insight Analysis dashboard.	he
Collect Extended Insight data	
DB2 Performance Expert Client	
These profiles apply only if you are using the previous Performance Expert Client application. These statistic are not displayed in the Optim Performance Manager dashboards, but are shown in the Performance Expert Client.	s
CIM OS Data	
Performance Warehouse	
< Previous Next > Finish Cance	•

Figure 3-32 Configure Monitoring step 2

Predefined templates are a great way to start with Optim Performance Manager. If you are not familiar with Optim Performance Manager, we suggest that you choose one of the predefined templates. Think of the predefined templates as a fast way of getting started. Once you are familiar with the settings, you can customize them later.

- Monitor Settings:
  - Retention times and sampling intervals:

Specify how long to keep performance data and how often to collect performance data. The selected predefined template will base these values. You can edit these values at a later time depending on your requirements.

The *Sampling rate in minutes* specifies the basic interval in that Optim Performance Manager collects snapshot data. In some monitoring profiles you can increase the basic interval to collect data less often.

The *Data retention in hours* applies to collected inflight performance, report and Workload Manager data. After the retention period is reached Optim Performance Data deletes the collected data automatically. Refer to A.4, "Deleting data from the repository database" on page 453 for detailed information about the automatic deletion.

The *Storage period* settings apply to collected Extended Insight data. Optim Performance Manager aggregates that data first before it deletes the data completely. Refer to A.3, "Data aggregation concepts" on page 450 about purpose and concept of the data aggregation.

• DB2 event monitor configuration

Specify the table space on the monitored database that Optim Performance Manager should use to create event monitor tables for event monitors. If you do not specify one, DB2 chooses the default table space.

**Note:** We recommend that you create a dedicated 32K table space for the event monitors. If your monitored database is a partitioned database then the table space must be created across all partitions that you monitor. The table space that you specify here is used for all event monitors that Optim Performance Manager creates unless you specify another table space for dedicated event monitors in the following monitoring profiles: Locking, Workload Manager, Extended Insight.

- Monitoring profiles for inflight performance, reports or Workload Manager:

These profiles collect performance statistics from the data server and present the data in the inflight dashboards, in Workload Manager, or in the

reports. You can edit any of these values from the default thresholds at any point.

- Basic: The Basic profile collects data from the database manager, database, and buffer pool snapshot.
- Locking: The Locking profile uses the Lock event monitor and Lock wait information settings that you can enable separately.
- Active SQL and Connections: The Active SQL and Connections profile collects data from the application snapshot.
- I/O and Disk Space: The I/O and Disk Space profile, by default, collects information for buffer pools. You can also specify to collect I/O information for tables and table spaces.
- Workload Manager: The Workload Manager profile collects data from the statistic event monitor for workload management statistics.
- Dynamic SQL: The Dynamic SQL profile collects data from the dynamic SQL snapshot.

For more details about the monitoring profiles, how to enable them, and sample screen captures of these profiles, refer to 3.3.4, "Monitoring profiles for inflight performance, reporting and Workload manager" on page 109.

- Monitoring profile for Extended Insight:

The Extended Insight profile collects statement and transaction metrics from the Extended Insight Clients and from the data server.

This option is available only if you have activated the Extended Insight feature on the Optim Performance Manager server. If the option is grayed out, check that your Extended Insight activation is completed and is successful. If Extended Insight is activated and it is still grayed out, restart the Optim Performance Manager repository server and the WebSphere Application Server associated with the Optim Performance Manager.

For more details about Extended Insight profile, refer to 3.3.5, "Monitoring profile for Extended Insight" on page 119.

- Monitoring profiles for DB2 Performance Expert Client:

These profiles apply only if you are using Performance Expert Client as client interface to Optim Performance Manager. These statistics are not displayed in the Optim Performance Manager dashboards, but are shown in the Performance Expert Client only.

 CIM OS Data: This is the Common Information Model Operating System Data profile that collects data from the CIMON server that is running on the monitored system and collecting data about the operating system.  Performance Warehouse: Specify where to store monitor data for Performance Warehouse and how you want the data aggregated for Performance Warehouse.

For more information about the various monitoring profiles, refer to the Information Center at

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.
perfmgmt.monitor.doc/sys\_templates\_monitor\_profiles.html

- 7. Once you are done with configuring monitoring profiles, click Next.
- 8. View Resulting DB2 Settings:

The switches and configuration settings that are displayed on this panel will be set for this database based on the monitoring profiles that you specified.

Monitor switches are settings that instruct DB2 to gather more specific information if a given switch is turned on. You can turn on several monitor switches to gather more data. DB2 provides two types of monitors: snapshot and event monitors. Optim Performance Manager creates event monitors in a monitored database depending on the configuration of the monitoring profile.

In Figure 3-33 on page 105, we see the list of snapshots collected that correspond to the monitoring profile configuration. All monitor switches are turned ON in order to collect the maximum information from the snapshots. Note that all listed event monitors are turned ON. Assuming that you have not set a dedicated table space in the monitoring profiles and have not set a PCTDEACTIVATE value in the monitoring profiles, Optim Performance Manager uses the following statements to create event monitors on the monitored DB2 9.7 database:

CREATE EVENT MONITOR <name> FOR LOCKING WRITE TO UNFORMATTED EVENT TABLE (PCTDEACTIVATE 100) MANUALSTART

CREATE EVENT MONITOR <name> FOR PACKAGE CACHE WHERE UPDATED\_SINCE\_BOUNDARY\_TIME WRITE TO UNFORMATTED EVENT TABLE MANUALSTART

CREATE EVENT MONITOR <name> FOR STATISTICS WRITE TO TABLE

If the unit of work event monitor would also be ON, this would result in the following statement:

CREATE EVENT MONITOR <name> FOR UNIT OF WORK WRITE TO UNFORMATTED EVENT TABLE (PCTDEACTIVATE 100) MANUALSTART

Warning icons indicate any configuration settings that might cause increased overhead. Review these settings and click **Next.** 

📉 Edit Monitoring Config	guration			
Step 3 of 5: View Resultin	ng DB2 Settings	I		
The following monitor switc profiles that you specified.	hes and configuration settir Warning icons indicate any	ngs will be set for this database configuration settings that migl	based on the monitoring ht cause increased overhea	d.
Monitor switches		Event monitors		
DFT_MON_BUFPOOL	ON	For package cache	ON	
DFT_MON_SORT	ON	For unit of work	OFF	
DFT_MON_LOCK	ON	For locks	ON	
DFT_MON_STATEMENT	ON	Deadlock events	ON	
DFT_MON_TABLE	ON	Lock wait threshold	ON	
DFT_MON_TIMESTAMP	ON	Lock timeout events	OFF	
DFT_MON_UOW	ON	Lock timeout	Unlimited	
		For WLM statistics	ON	
Snanshots collected				
DBM	VES	Others		
Database:	YES	Extended Insight monitor	ing ON	
Application	YES	CIM OS data	OFF	
Lock	YES		0.11	
Table space snapshot	YES	<u></u>	Impact on performance	
Container data	NO			
Buffer pool	YES			
Dynamic SQL	YES			
Table	YES 🛕			
			Copy to Clipboard Pi	rint
				_
		< Previous	Next > Finish Cano	:el

Figure 3-33 Configure Monitoring Step 3

9. Configure monitoring authorizations (Figure 3-34 on page 106):

When you configure a database for monitoring, you can assign different monitoring privileges for users, groups, or roles that require access to the monitored database. These privileges define the monitoring operations a user is allowed to do.

- The *CanMonitor* privilege allows this user to look at collected monitoring data of this database. It is checked when you open a dashboard. Select a database and specify user credentials for this database.
- The *Can Manage Alerts* privilege allows a user to change alert thresholds and notifications for this database. It is checked on the alert notification

and configuration dashboards when you select a database and specify user credentials for this database.

For more details on authorization, refer to 2.6, "User authorization" on page 52 that introduces you the security and authentication concept of Optim Performance Manager.

Configure Monitoring					
tep 4 of 5: Configure monitoring authorizations					
The Can Monitor privilege allow The Can Manage Alerts privile prune and delete alert instances Indicates that the authorizat Show: All	The <b>Can Monitor</b> privilege allows the viewing of all dialogs and data. The <b>Can Manage Alerts</b> privilege allows the control of alerts and their thresholds, which includes the ability to prune and delete alert instances. Indicates that the authorization ID is used by the Optim Performance Manager and cannot be edited or deleted.				
Authorization ID	ID Type	Privilege Name			
B2INST1	User	Can Monitor			
B2INST1	User	Can Manage Alerts			
<pre>     Previous     Next &gt;     Finish     Cancel     </pre>					

Figure 3-34 Configure Monitoring step 4

10.Configure partition sets:

This configuration is applicable for partitioned databases only. When you first configure a partitioned database for monitoring, this tab does not appear. When you save the configuration and then re-edit the Configure Monitoring option, the Optim Performance Manager server discovers that it is a partitioned database. Now, you can edit the configuration and add the partitions to monitor. You can also assign each partition a role if a partition has different monitoring requirements. The roles available in Optim Performance Manager are Catalog partition, Coordinator partition, Data partition, and ETL partition.

11.Configuration Summary (Figure 3-35 on page 107):

This panel shows a summary of the monitoring configuration that you specified for this database. The monitoring settings take effect when this monitoring configuration is saved. Complete the configuration by clicking **Finish**.

Configure Monitoring					
Step 5 of 5: Configuration Summary					
A summary of the monitoring configuration settings take effect when this monitoring	on that you specified for this database is shown below. The monitoring configuration is saved.				
Physical database name:	REDDB2				
Storage path for collected monitor data:	Use default storage path				
Configuration type:	System template Development system				
Activate monitoring:	YES				
Time zone:	(GMT-5) Eastern Standard Time [America/New_York]				
Monitoring profiles:	Inflight performance: Basic, Locking, Active SQL and Connections, I/O and Disk Space, Workload Manager, Dynamic SQL Extended Insight: Collect statement and transaction metrics on client				
Monitoring settings:	Data retention: 200 hours				
	Sampling rate: 1 minutes				
	(Pravious Navt) Finish Cancel				
	Cancel				

Figure 3-35 Configure Monitoring step 5

It takes a few minutes to complete the configuration. You may see a warning about watchdog procedures not being installed (Figure 3-36).



Figure 3-36 Configuration successful with warning

**Tip:** We recommend to activate the task scheduler because this is an easy way to ensure that the event monitors that Optim Performance Manager started are stopped in case of Optim Performance Manager failures. You can refer to the Information Center for more information about the watchdog procedures and how to install these at

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatool
s.perfmgmt.installconfig.doc/using\_watchdog\_procedures.html

After you have done a successful configuration, you can open several dashboards from the successful configuration message box (Figure 3-37).

You can also open various dashboards by clicking **Task Manager** in the Optim Performance Manager console window and then clicking the dashboards that you would like to see.

	_	
Step 5 of 5: Configuration A summary of the monitorin settings take effect when thi	1 Summary configuration that you specified for this database is shown below. monitoring configuration is saved.	The monitoring
Physical database name	REDDB2	
Storage path for collect data:	d monitor Use default storage path	
Configuration type:	System template Development system	
Activate monitoring:	YES	
Time zone:	(GMT-5) Eastern Standard Time [America/New_York]	
Monitoring profiles:	Inflight performance: Basic, Locking, Active SQL and and Disk Space, Workload Manager, Dynamic SQL Extended Insight: Collect statement and transaction (	Connections, I/O metrics on client
Monitoring settings:	Configuring Monitoring	
	This database connection is successfully configured for monitoring. You can open a dashboard by clicking one of the following buttons. You can access more dashboards from the Task Manager.	
	Health Summary Alerts Active SQL Close	

Figure 3-37 Successful configuration

# **3.3.4** Monitoring profiles for inflight performance, reporting and Workload manager

Monitoring profiles define the performance statistics that Optim Performance Manager should collect from the data server to be shown in the inflight dashboards, in the reports, or for Workload Manager configuration. In 3.3.3, "Configuring the database for monitoring" on page 98, we described shortly which monitoring profiles are available and how to enable and edit them. In this section, we describe the monitoring profiles in more detail and explain which dashboards or reports show the data of which profile. You might familiarize yourself with the dashboards and other features first before reading this section. The dashboards and features are described in Chapter 4, "Getting to know Optim Performance Manager" on page 147.

If a profile is not enabled, no performance data is collected for that profile. If you open a dashboard that would display data for a profile, but the profile is not enabled then you recive a message. Figure 3-38 shows the message that you receive if you open the Locking Dashboard, but the Locking monitoring profile is not enabled.

Perforn	nance Monitoring is Not Enabled								
	Inflight performance monitoring data is not being collected because its collection is not enabled. If Inflight monitoring data has previously been collected, you can still browse that data. Use the Manage Database Connections window to configure and enable data collection.								
• Show	v Details								
<ul> <li>Show Details</li> <li>On the Manage Database Connections window, select this database and click Configure Monitoring. On the monitoring profiles page, ensure that the Locking profile is selected.</li> </ul>									
	ок								

Figure 3-38 Performance Monitoring is not enabled for the selected profile

To enable the monitoring profile, click **Configure Monitoring** for the selected database on the Manage Database connections window and navigate to the **Configure Monitoring Profiles** step as shown in Figure 3-32 on page 101.

#### **Basic profile**

If this profile is enabled, Optim Performance Manager collects the basic monitoring information, such as statistics about database activity from the database and database manager snapshot and basic operating system load.

This profile also enables the collection of database and database manager configuration information. The collected data is displayed in various inflight dashboards such as Overview dashboard, Logging dashboard, Utilities dashboard or Workload dashbaord and in the database and database manager configuration reports reports.

## Locking profile

If the Locking profile enabled, on the Locking dashboard, you can see the performance monitoring data collected from the lock snapshot, application snapshot, and the lock and deadlock event monitors. To access the locking dashboard, from the Optim Performance Manager console, open **Task Manager**  $\rightarrow$  **Inflight Dashboards**  $\rightarrow$  **Locking**. Select the databases and authenticate it. Figure 3-39 on page 110 shows the Locking Dashboard.

Locking Dashboard: DPF o	on A2/A3 TPCH									
This dashboard shows the workload cluster groups that are in a locking situation. Click a workload cluster group to view loc										
Overview										
Activate Deactivate New	Edit Copy	Delete								
Database Workload	Maximum Wait	Maximum Block Time								
DPF on A2/A3 TPCH	15.576	15.576								

Figure 3-39 Locking Dashboard

If you enable lock wait information as shown in Figure 3-40, Optim Performance Manager uses snapshots to determine locking situations.



Figure 3-40 Locking Profile Details

On the Locking Dashboard (Figure 3-41 on page 112), Optim Performance Manager presents this information in the Max Wait Time and Max Block Time columns for your database workloads and in the list of Current Waiting Connections and Current Blocking Connections.

	u: sample				
his dashboard shows the n	workload cluster group	os that are in	a locking situation. Cli	ck a workload cluster group	to view locking
Activate Deactivate	e New Edit	. Copy	Delete		
Database	Workload	Maxii	num Wait Time	Maximum Block	Time
sample			36:03.69	9	36:03.699
Application Typ	pes		36:03.69	9	36:03.699
OTHER			36:03.69	9	36:03.699
DDt 🗍				0	0
Host names/IP	addresses		36:03.69	9	36:03.699
Client applicati	ion names		36:03.69	9	36:03.699
Client user IDs	S		9	36:03.699	
The grid shows application	ns that are waiting for	locked object	out on all these officers of the art of the little all the second by		
		locked object	ts for the selected work	doad cluster group. Choose	an application
Application Name	Application ID		ts for the selected work Wait Time	cload cluster group. Choose Connection Start	an application
Application Name	Application ID 127.0.0.1.3995.1	01110100	ts for the selected work Wait Time 36:03.699	doad cluster group. Choose Connection Start 11/10 11:01:3	an application Application 5 Lock Wait
Application Name	Application ID 127.0.0.1.3995.1	01110100	ts for the selected work Wait Time 36:03.699	doad cluster group. Choose Connection Start 11/10 11:01:3	an application Application 5 Lock Wait

Figure 3-41 Analyzing Locking Situation

For each of these connections you can click **Analyze** to obtain detailed information about the connection and the holding or waiting statement shown in Figure 3-42 on page 113.

Analyze Lo	cking Situations			×
Each comple entry and the	te set of entries in the tree includes an a e leaf entry are applications that are bloc	pplication that is holding a lock and the a king and waiting. Each leaf entry is an a	applications that are waiting because of pplication that is only waiting.	that lock. The entries between the main
= java	Details about the object that	the application is waiting for	Details about the application	n
📻 java	Table Name:	SYSEVENTS	Application Mode:	Exclusive Lock
	Table Schema Name:	SYSIBM	Application Name:	java
	Table Space Name:	SYSCATSPACE	Agent ID:	14147
	Lock Type:	х	Application ID:	9.12.5.104.63133.101102054209
	Lock Mode:	Exclusive Lock	Authentication ID:	DB2IAIX
	Lock Object Type:	Table Row Lock	Client User ID:	
	Lock Wait Time:	15.338 sec	Client Application Name:	IBM_OPM
	Sequence Number:	00008	Client Workstation Name:	sd0d03A1.itso.ibm.com
	Lock Mode Requested:	Next-key Share Lock	Application Status:	lock wait
	Lock Type Requested:	NS	Force Application	
	Details about the current act	ivity		
	EVENT_MON_STATE(T1.EVMONNAME)	= 1 AND T2.TYPE='STATISTICS'	Stop Current Statement Show A	I Text Tune
	Rows Written:	0		
	Statement Elapsed Time:	0.060 sec	Go to the Active SQL Dashboard	
	Statement Start Time:	11/02 01:42:09		
	Details about all activities			_
	Connection Request Completion	11/02 01:42:09	Rows Written:	0
	Timestamp:		Locks Held:	6
	User CPU Time:	5	Lock Waits:	3
	System CPU Time:	3	Time Application Waited on Locks:	33.070 sec
	Commits:	/	Time Waited on Locks per Second:	1.945 sec
	Rollbacks:	0	Average Wait Time per Lock:	11.023 sec
	Dynamic SQL Attempted:	24	Average Wait Time per Transaction:	4.134 sec
	Static SQL Attempted:	/	Deadlocks:	0
	Failed Operations:	2	Lock Escalations:	0
	Rows Read:	2	Lock Timeout Value:	-1
	Rows Selected:	4	Lock Timeouts:	0
				Close

Figure 3-42 Analyze a locking situation

If you enable one or more of the Lock Event monitor options in the monitoring profile, Optim Performance Manager starts the Lock event monitor for DB2 9.7 and higher; or the deadlock event monitor for DB2 prior to Version 9.7. See Figure 3-43 on page 114.

Locking	3
Specify the amount and type of lock information you want to collect.	
Lock event monitor	
Enable lock wait warning alert	
Lock wait threshold in microseconds: * 5000000	
Enable lock timeout alert	
Lock wait timeout in seconds: Unlimited	
Enable deadlock alert	
Use legacy deadlock event monitor	
Use custom table space: IBMDB2SAMPLEREL	
Maximum table space fill size in percent:	
Capture event details: Without statement history	
Lock wait information	
Collect lock wait information	
Special sampling rate in minutes:	
OK	

Figure 3-43 Locking monitoring profile

On the locking dashboard, Optim Performance Manager presents the collected events in the Deadlock, Timeout, and Lock Wait Alerts columns for your database workloads. Additionally, it lists all single events in the Locking Event tab (Figure 3-44 on page 115) with the ability to obtain the connection and statement details involved in the event by pressing the Analyze button.

Activate Deac	tivate New	Edit Copy	Delete				
Datab	ase Workload	Lock	Wait Alerts	Deadlocks	Timeouts		
* 🗁 sample			0	∎ 4	C		
Client use	r IDs		0	■ 4	C		
📄 db2pov	ver		0	2	(		
🔄 db2use	er1		0	■ 4	(		
🗋			0	■ 4	1		
Client app	lication names		0	■ 4	1		
🕨 🚞 Host nam	es/IP addresses		0	■ 4	l		
Applicatio	n Types		0	■ 4			
OTHER			0	■ 4	(		
ocking Event (4)	Current Waiting Co vait alerts, deadlocks	nnections (1)	Current Blocking C	onnections (1) doad cluster group. Choose ar	n event and click Anal		
lert Time			Alert Na	ime			
e Nov 09 12:27:39	CET 2010		Deadlock	in application			
ie Nov 09 12:27:23	CET 2010		Deadlock	in application			
ie Nov 09 12:22:17	CET 2010		Deadlock	in application			
e Nov 09 12:18:10	CET 2010		Deadlock	in application			

Figure 3-44 Analyze locking events

### Active SQL and Connections profile

If the Active SQL and Connections profile is enabled, on the Active SQL dashboard, you can see the performance monitoring data that is collected from the application snapshot. The Database Connection Report is also based on the application snapshot data collected from this profile.

To access the Active SQL dashboard, from the Optim Performance Manager Console open **Task Manager**  $\rightarrow$  **Inflight Dashboards**  $\rightarrow$  **Active SQL**. Select the database and authenticate it. Figure 3-45 shows the Active SQL Dashboard.

Act	ive SQL Dashboar	d: DPF on A2/A3 T	РСН												0 4
Lear	n about tuning SQL stateme	nts, stopping SQL statements,	and forcing applications.												
Sh	ow highest 5 💌 b	y Elapsed Time	Show Additional	Columns	Customize Colu	imns									
REEREE	Statement Text	Start Time Stamp	Stop Time Stamp	Elapsed Time	Costs	CPU Time	Sort Time	Sort Overflows	Rows Read	Rows Written	Logica	Read I/O	Physical Read I/O (pages)		
					(timerons)						(pages	)			
-	SELECT PARTITION_NUMBER	11/30 06:59:28	11/30 06:59:32	3.99	5 81	0.037	0.006	0	1,84	5	0	65			
	SELECT DBPARTITIONNUM,	4 12/02 16:03:36	12/02 16:03:37	1.01	5 5	0.001	0	0		D	0	0			
	SELECT DBPARTITIONNUM,	4 12/04 10:13:44	12/04 10:13:45	1.01	4 5	0.001	0	0		0	0	0			
	SELECT DBPARTITIONNUM,	A 12/02 10:41:35	12/02 10:41:36	1.01	4 5	0.001	0	0		0	0	0			
	SELECT DBPARTITIONNUM,	A 11/28 07:05:18	11/28 07:05:19	1.01	4 5	0.001	0	0		0	0	0			
-3	QL Statement Details														
St	atement				Row	Statistics					-	- Time			
					Row	s read:		1	1,845			Elaps	ed time:		3.995 sec
	SELECT	BOTTOM CLIM(NUMBED IN F	IN) HISTOCRAM TYPE SET		R	ws fetched:		3	7380			Sta	irt timestamp:		11/30 06:59:28
	D.TOP.WORK ACTION SET	ID.WORK CLASS ID.WORK	LOAD ID FROM	WICE_CDASS	R	Rows read for each fetched row: 0.25						Stop timestamp:			11/30 06:59:32
	ISTOGRAMBIN_OPMWNAR	J5 WHERE (1=?) OR PARTITIC	DN_NUMBER I		Row	s written:		0	)			CPU time:			0.037 sec
					=							Average CPU:			0 %
	Ide	ntify Workload Stop Curr	ent Statement Show	All Text	ne Appli	cation/Workload					_	Sort	time:		0.006 sec
C	oordinator partition/membe	r: 0			Ann	lication name:			iava			So	rts:		1
s	tatement type:	Dynai	mic statement		A	nolication status:			JOW waiting			So	rt overflows:		0
м	ost recently executed operation	tion: SQL (	Close		A	oplication ID:		-	9.12.5.104.47248.10	01130115927		Duffer	Deal Cashina		
C	osts (timerons):	81			A	ent ID		3	31,578			buile	Poor cacriing		
	Query cardinality estimates	: 7380			Ses	sion ID:		1	DB2IAIX			Total	read hit ratio:		100 %
P	ackage name:	SYSS	H200		Clie	nt user ID:			-			Logic	ai read 1/0:		65 pages
	Version:				Clie	nt workstation nar	ne:		-			Physi	cal reau 1/0:		o pages
	Consistency token:				Clie	nt application nam	ie:		-			Hit R	latio	Regular Data	1
	Section number:	1			Clie	nt operating syste	m:	,	AIX 64 bit			Data		100	
Ter	anastiona				Acco	ounting string:			-			Index			
	anaduuma				- Wor	kload ID:		1	1			XDA			
т	ransaction start timestamp	11/30	06:59:26							Force App	lication				
т	ransaction lock wait time	0 sec													
т	ransaction log space used	0 byte	15												

Figure 3-45 Active SQL Dashboard

### I/O and Disk Space profile

If the I/O and Disk Space Profile is enabled, on Inflight dashboards, the you can see the performance monitoring data that is collected from the database manager, database, and buffer pool snapshot. Other available options are the table space and table snapshots. The data collected here isalso used by The Disk Space Consumption report.

To access the Inflight dashboards and, from the Optim Performance Manager Console, open **Task Manager**  $\rightarrow$  **Inflight Dashboards**  $\rightarrow$  **I/O and Disk Space**. Select the database and authenticate it. Figure 3-46 on page 117 shows the Buffer Pool and I/O Dashboard.

But	Buffer Pool and I/O Dashboard: DPF on A2/A3 TPCH															
Buf	r Pools Table Space	s Tables														
s	w Lowest 5 💌	buffer pools by	Hit Ratio (%)	Show Cont	ained Objects		Change Co									
	Buffer Pool Name	Main Usage	Buffer Pool Size (pages)	Hit Ratio (%)	Logical Reads (/min)	Physical Reads (/min)	Physical Writes (/min)	Updates per Read	Avg Page Read Time	Avg Page Write Time	Prefetcher Hit Ratio (%)	Async Read Ratio (96	a) Async Writ			
-	Total		519,728	99.995	3,152.820	0.04	0.002	: 0	0.002	0.001			0			
	IBMDEFAULTBP	MIXED	315,872	99.995	3,146.841	0.04	G	0	0.002		-		0			
	BP32K	MIXED	164,000	100	5.879	0	0	0		-						
	OPM_SAMPLE_BP_1	MIXED	4,000	100	0.033	0	0.001	0.031		0.001	-					
	OPM_SAMPLE_BP_2	MIXED	4,000	100	0.067	0	0.001	0.016		0.001						
	BP32KTMP	UNKNOWN	31,600	-	- c	0	c			-						
⇒ De	tailed Information	for Total					1									
Gen	ral		Prefeto	thers			Utilization and I	Health								
	fee neel enmou	Tatal	Norm	has of 1/0 expression												
	rer poor name.	Total	Num	ber of prefetch requests	: 0 /min		Buffer Pool	Size	Buffer Poo	l Hit Ratio	Elle Logical P	age I/O				
			Pro	fotching Activity			600,000	Buffe	er Pool so-	Tot	al 3,000. A	MMAMA .	Index -			
			110	Activity	0.000		800,000 - Ch	Size	8	Ind.	lex-Non- = 2,000-		Temporary			
			•	so -	Prefetcher Hit		200,000 -			Ind	tex-	mm	Temporary			
			8.	40.	Asynchronou		0-1	5:26:40	0-	26:40 11/24 17:33:20 Ter	mporary 0-	06:26:40 11/24 17:33:20	Data -			
				· ·	s Read Ratio					•Dar	ta-jyon-		remporery			
				11/24 06:26:40 11/24 17:33	1:20		Logical vers	sus Physical I/O Activi	ity 🗐 📾 Read/Writ	e Activity	B Average	I/O Times	88			
								A	-11/0 600-		0.006.	1 .	-			
1/0	eaners						5,000 - ///	Phys	ical I/O .E 400-	B Rei	ad 1/O 2 0.004-	Λ -	s I/O read			
	about 110 shares and						E 1,000-		E 200- A A	A A A A A	ect Writes 🤴 0.002-	$\sim$	time			
	nper or 1/O cleaners: trade asynchronous I/O	write time:		3 0.001 sec			o		0.200	Dir	ect Reads		s I/O write			

Figure 3-46 Buffer Pool and I/O Dashboard

## Workload Manager profile

The Workload Manager profile enables the collection of configuration and statistics for Workload Manager workloads, service classes, and work classes. The collected data is displayed in Workload Manager Configuration and Metrics report. The "Workload Manager Configuration" also shows this information. To access Workload Manager Configuration, from the Optim Performance Manager Console, open **Task Manager**  $\rightarrow$  **Workload Manager Configuration**. For more details about Workload Manager, refer to Chapter 11, "Workload Manager configuration tool" on page 373.

Figure 3-47 and Figure 3-48 on page 118 are examples of Workload Manager Configuration and Metrics report. To create such a report, use **Task Manager**  $\rightarrow$  **Reports.** 

Workload Name	ID	Evalu Orde	r E	Enabled	Connection Attribute Type	Connection Attril Value	bute Service Super	class Name	Service Subclass Name	Databa Access	ase S	Partition for A Collection
SYSDEFAULTUSERWORKLOAD	1	1	٢	(	-	-	SYSDEFAULT	USERCLASS	SYSDEFAULTSUBCLASS	Y		С
SYSDEFAULTADMWORKLOAD	2	2	٢	(			SYSDEFAULT	USERCLASS	SYSDEFAULTSUBCLASS	Y		С
Norkload Statistics												
Workload Name		ID	Partition ID		Total Completed Workl	loads Max. C	Concurrent Workloads	Max. Co	ncurrent Workload Activities		Complet	ed Coordinato
Workload Name SYSDEFAULTUSERWORKLOAD	2	ID 1	Partition ID 0		Total Completed Workl 319	ioads Max. C 9	Concurrent Workloads	Max. Co 1	ncurrent Workload Activities		Complet 1684	ed Coordinato
Workload Name SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD	<u>!</u>	ID 1 1	Partition ID 0 1		Total Completed Workl 319 0	ioads Max. C 9 0	Concurrent Workloads	Max. Co 1 0	ncurrent Workload Activities		Complet 1684 0	ed Coordinato
Workload Name SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD	! ! !	ID 1 1	Partition ID 0 1 2		Total Completed Workl 319 0 0	ioads Max. C 9 0 0	Concurrent Workloads	Max. Co 1 0	ncurrent Workload Activities		Complet 1684 0 0	ed Coordinato
Workload Name SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD	<u> </u>	ID 1 1 1	Partition ID 0 1 2 3		Total Completed Workl 319 0 0 0	loads Max. C 9 0 0	Concurrent Workloads	Max. Co 1 0 0	ncurrent Workload Activities		Completi 1684 0 0 0	ed Coordinato
Workload Name SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD		ID 1 1 1 1 2	Partition ID 0 1 2 3 0		Total Completed Workl 319 0 0 0 0 0 0	0 ads Max. 0 9 0 0 0 0 0	Concurrent Workloads	Max. Co 1 0 0 0	ncurrent Workload Activities		Complete 1684 0 0 0 0 0	ed Coordinato
Workload Name SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD SYSDEFAULTADIWORKLOAD SYSDEFAULTADIWORKLOAD		ID 1 1 1 2 2	Partition ID 0 1 2 3 0 1		Total Completed Workl 319 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 ads Max 0 9 0 0 0 0 0 0	Concurrent Workloads	Max. Co 1 0 0 0 0 0	ncurrent Workload Activities		Complete 1684 0 0 0 0 0 0	ed Coordinato
Workload Name SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD SYSDEFAULTUSERWORKLOAD SYSDEFAULTADERWORKLOAD SYSDEFAULTADERWORKLOAD SYSDEFAULTADERWORKLOAD		ID 1 1 1 2 2 2 2	Partition ID 0 1 2 3 0 1 2 2		Total Completed Worki 319 0 0 0 0 0 0 0 0 0	toads         Max. C           9         0           0         0           0         0           0         0           0         0           0         0           0         0	Concurrent Workloads	Max. Co 1 0 0 0 0 0 0 0	ncurrent Workload Activities		Complete 1684 0 0 0 0 0 0 0 0	ed Coordinato

Figure 3-47 Workload Manager Configuration and Metrics report - Work class statistics

Service Superclass Definition	ons																
Service Superclass Name	ID	Enabled	Agent Priority	P	refetch riority	0	Outboun Correlate	d or	Partit Colle	ion for Activity Da	ita	Activity D Collect	ata to	C	ollect Aggre ata	pate Activity	/ Collect Data
SYSDEFAULTSYSTEMCLASS	1	Y	-32768	D	efault	-			С			N		N			Ν
SYSDEFAULTMAINTENANCECLASS	2	Y	-32768	D	efault	-	-		С			Ν		N			Ν
SYSDEFAULTUSERCLASS	3	Y	-32768	D	efault				С			N		N			Ν
Service Subclass Definition	s																
Service Superclass Name	Se	rvice Subc	lass Name	ID	Enabled	Ager Prior	nt rity	Prefetch Priority	0	utbound	Partition fo Collection	er Activity Da	ita	Activity I Collect	Data to	Collect Ag Data	gregate Activi
SYSDEFAULTSYSTEMCLASS	<u>SY</u>	SDEFAUL	<u>TSUBCLASS</u>	11	Y	-327	68	Default			С			N		N	
SYSDEFAULTMAINTENANCECLASS	<u>SY</u>	SDEFAULT	TSUBCLASS	12	Y	-327	68	Default			С			N		N	
SYSDEFAULTUSERCLASS	<u>SY</u>	SDEFAUL	TSUBCLASS	13	Y	-327	68	Default			С			N		N	
Service Subclass Statistics																	
Service Superclass Name	Se	wice Subcl	lass Name	Pa	rtition ID		Concurr	ent Activities		Failed Coordinator Activites	Compl Coordi Activitie	eted nator IS	Maximur of Coord Activities	m lifetim linator ; (ms)	e Reject Coord Activiti	ed inator es	Max. Estimat (timerons)
SYSDEFAULTMAINTENANCECLASS	SY	SDEFAUL	TSUBCLASS	0			4			1	1024		0		0		0

Figure 3-48 Workload Manager Configuration and Metrics report - Service class statistics

# **Dynamic SQL profile**

This profile is required for the Dynamic SQL statement report. This report identifies the SQL statements that consume the most resources in a given period of time. The report includes a graphical representation of the workload so that you can identify critical or problematic SQL statements. To create this report To create such a report, use **Task Manager**  $\rightarrow$  **Reports** from the Optim Performance Manager web console. Figure 3-49 on page 118 and Figure 3-50 show parts of a report displaying Top 5 SQL Statements by CPU Time.



Figure 3-49 Dynamic SQL Report - Top 5 SQL Statements by CPU Time.

Statement Identifier	<u>Statement Text</u>	Partition ID	Number of executions	Total elapsed time (sec)	Average elapsed time (sec)	<u>Number</u> of Logical Reads	Number of physical reads	<u>CPU</u> time (sec)	Total System CPU Time (sec)	Total User CPU Time (sec)	<u>Sorts</u>	Average rows read	Total rows read	Average rows read per selected row	<u>Average</u> rows written	<u>Total</u> rows written
564F1CF4081DE789	with c(ts) as (values current timestamp)select cac	0	519 k	12.076983	0.023270	178,190	0	4.533402	0.594186	3.939216	0	4,039	2,096,416	374	340	176,645
5951500A3980B1CC	select MEMBER, EXECUTABLE_ID, STMT_TYPE_ID, INSERT	0	526	15.497640	0.029463	0	0	2.074248	0.179207	1.895041	0	0	0	0	0	0
7876D627C4D2E878	DROP TABLE OPM .OPMUNARIJ52	0	524	422.914270	0.807088	102,927	0	1.126783	0.076132	1.050651	0	29	15,715		20	10,602
A6A1D4E20DEDB8E9	SELECT evmon.xmlreport FROM TABLE (EVMON_FORMAT_UE	0	495	6.906762	0.013953	15,968	0	1.021705	0.228021	0.793684	0	2	1,030	0	0	0
169E6F22F673C03B	SELECT DBPARTITIONNUM,MAX(CASE WHEN NAME='HOST_NAM	0	262	265.480034	1.013283	0	0	0.389332	0.077114	0.312218	262	0	0	0	0	0
169E6F22F673C03B	SELECT DBPARTITIONNUM,MAX(CASE WHEN NAME='HOST_NAM	2	262	263.083908	1.004137	0	0	0.336964	0.064802	0.272162	262	0	0		0	0
169E6F22F673C03B	SELECT DBPARTITIONNUM,MAX(CASE WHEN NAME='HOST_NAM	3	262	262.987637	1.003770	0	0	0.299586	0.062916	0.236670	262	0	0		0	0
169E6F22F673C03B	SELECT DBPARTITIONNUM,MAX(CASE WHEN NAME='HOST_NAM	1	262	262.999949	1.003817	0	0	0.285946	0.058939	0.227007	262	0	0		0	0
A6A1D4E20DEDB8E9	SELECT evmon.xmlreport FROM TABLE (EVMON_FORMAT_UE	2	495	0.464963	0.000939	15,947	0	0.163569	0.012806	0.150763	0	1	988		0	0

Figure 3-50 Dynamic SQL Report - Details of the SQL Statements

# 3.3.5 Monitoring profile for Extended Insight

The Extended Insight monitoring profile enables and configures the collection of transaction and statement response time data that is displayed on the Extended Insight dashboard. If Extended Insight is completely set up and configured, it collects data at two locations:

- It collects respone time data at the location of your application that initiates the transactions on the monitored database. This is performed by the Extended Insight client that must be installed and configured on the computer where the application runs on.
- It collects data from the monitored database itself to obtain details about transaction and statement execution on the database. This is performed by the Extended Insight server within Optim Performance Manager.

The Extended Insight dashboard displays a combination of the data collected from both locations. Review the architecture discussion in 1.2.2, "Optim Performance Manager Extended Insight architecture" on page 13 to have an overview about the parts involved in the data collection. Additionally, read 4.4, "Extended Insight dashboard" on page 178 to have an understanding of the data that the Extended Insight dashboard displays.

If you open the Extended Insight dashboard and this profile is not enabled for the selected database, you receive the message shown in Figure 3-51.



Figure 3-51 Extended Insight profile not enabled message

To enable the Extended Insight profile click **Configure Monitoring** for the selected database on the Manage Database connections window and navigate to the **Configure Monitoring Profiles** step as shown in Figure 3-52 on page 120. You can enable the Extended Insight profile only if the Extended Insight license is activated. See 3.2.3, "Activating the Optim Performance Manager Extended Insight license" on page 81 for how to activate the license.



Figure 3-52 Enabling Extended Insight profile

To edit the configuration properties, click the pencil icon. Figure 3-53 shows the Collect Extended Insight data configuration panel.

Collect Extended Insight da	ta		
Collection of monitorin	Usage of clie	ent field information	Integration with Tivoli Monitoring
Collect statement and tr	ansaction m	etrics on client	
Port number for the Extend client application that you o	led Insight configured:	<ul> <li>Dynamic</li> <li>Custom</li> </ul>	
Use logical database log	okup name:		
Package cache event moni You can override the defau	tor settings: It table space	that is used to moni	tor event data.
Use custom table space	SMALL		
Maximum table space	e fill size in p	ercent: 90 🔺	
Collect statement metri	cs on data se	erver	
✓ Collect transaction met	rics on data :	server	R
UOW event monitor setting You can override the defau	s: It table space	that is used to moni	tor event data.
Use custom table space	SMALL	<b>v</b>	
Maximum table space	ce fill size in p	ercent: 90	
			OK Cancel

Figure 3-53 Configuring Collect Extended Insight data

There are three main configurations involved here:

- Collection of monitoring data
- Usage of client field information
- Integration with Tivoli Monitoring

#### Collection of monitoring data

Monitoring data, statement and transaction metrics, can be collected on the Extended Insight client and the Extended Insight monitoring server.

In the Collection of monitoring data tab, you configure the following information:

Collect statement and transaction metrics on client

When enabling this task, you can view the end-to-end transaction response time data for this database and it's workloads on the Extended Insight dashboard. It includes, for example, maximum and average transaction response times, and the response time breakdown into client, network, and data server per workload.

The end-to-end response time data is delivered from the Extended Insight clients that must be installed and configured on the systems that run the applications initiating transactions and executing workload on the monitored database. The installation and configuration of Extended Insight Client is described in 3.4, "Installing and Configuring Extended Insight Client" on page 129.

Figure 3-54 is a sample screen for the data on the Extended Insight dashboard.

Exter	tended Insight Analysis Dashboard: DPF on A2/A3 TPCH 👔 🗄 DPF on A2/A3 TP										🚺 🁍 DPF on A2/A3 TP			
Workloa Open	Norkloads are listed in the grid. Click in the left column to show the chart for the workload. Use the second column to expand and collapse workload clusters in the grid. Double-click a row to view details. Click New to create Copen Details, Activate, Descrivate, New, Eds, Copy, Reset, Delete, View All Known Clients, Transaction Topology Exper										v details. Click New to create a workload cluster group. <u>Expand</u> <u>Collapse</u>			
Graph	Workloa d Cluster Group/ Workloa	Avera	Maximu m Inflight Elapsed Time	Maximu m End- to-End Respons e Time	Average Data Server	Average Network Time	Average Client Time	Warning (%)	Critical (%)	Transactions (/min)	Rows Read Rate	Rows Modified Rate	Rows Returned Rate	Statement Failure Rate (%)
े Sh	▼ reddb2	0.270	01:55.194	02:20.180	÷0.010	<b>0.394</b>	<b>♦</b> 0.101			4.753	34.559	0.327	10.401	0.001 🔺
🚵 Sh	► 🔶 Clie	0.270	01:55.194	02:20.180	<b>♦</b> 0.010	<b>♦</b> 0.394	<b>0.101</b>			4.753	34.559	0.327	10.401	0.001
🚵 Sh	► 🔶 field	0.270	01:55.194	02:20.180	÷0.010	\$0.394	<b>0.101</b>			4.753	34.559	0.327	10.401	0.001
े Sh	► 🗢 Clie	0.270	01:55.194	02:20.180	<b>0.010</b>	<b>0.394</b>	<b>0.101</b>			4.753	34.559	0.327	10.401	0.001 =
े Sh	► 🔶 clier	0.270	01:55.194	02:20.180	<b>\$0.010</b>	<b>0.394</b>	0.101			4.753	34.559	0.327	10.401	0.001
े Sh	► 🔶 Host	0.270	01:55.194	02:20.180	<b>0.010</b>	<b>0.394</b>	<b>0.101</b>			4.753	34.559	0.327	10.401	0.001
े Sh	► 🔶 clier	0.270	01:55.194	02:20.180	÷0.010	<b>0.394</b>	<b>0.101</b>			4.753	34.559	0.327	10.401	0.001
Rev of	> 4 Annel	0.070	01.00 104	00.00 100	A0.010	A0.204	A0.101			4 750	24.550	0.007	10.401	• • • •

Figure 3-54 Extended Insight overview

Double clicking one workload opens a new window that shows a graphical response time chart, the executed SQL statements, and information about clients who executed the workload. See Figure 3-55.



Figure 3-55 Extended Insight Details

Other settings under collect statement and transaction metrics on client are:

Collect Extended Insight data
Collection of monitorin Usage of client field information Integration with Tivoli Monitoring
✓ Collect statement and transaction metrics on client
Port number for the Extended Insight client application that you configured: Custom
Use logical database lookup name:
Package cache event monitor settings: You can override the default table space that is used to monitor event data.
Use custom table space: SMALL
Maximum table space fill size in percent: 90
✓ Collect statement metrics on data server
✓ Collect transaction metrics on data server
UOW event monitor settings: You can override the default table space that is used to monitor event data.
Use custom table space: SMALL
Maximum table space fill size in percent: 90
OK Cancel

Figure 3-56 Configuring Collect Extended Insight data

- Port number for the Extended Insight client application that you configured

On this port the Extended Insight monitoring server listens for end-to-end data from Extended Insight clients for this specific monitored database. By default it is determined dynamically. If you specify a port number, the port must be open.

- Use logical name

This is an optional field. A definition of a logical name is required only if the applications for that you set up Extended Insight use different IP address or database alias to connect to the monitored database as Optim Performance Manager. This can happen in the following cases:

- Your application use JCC type 2 to connect to the monitored database and have the monitored database cataloged in the local DB2 database catalog using a different database alias than Optim Performance Manager.
- Your application uses a DB2 connect gateway to connect to a z/OS DB2 database.

**Tip:** Extended Insight is also available for DB2 z/OS as part of IBM Tivoli Omegamon for Performance Expert for z/OS v5.1. We cover only Linux, UNIX, and Windows platforms.

- You use network address translation (NAT) in your company and a NAT is between the application and the monitored database, but not between Optim Performance Manager and the monitored database (or the other way round). In that case the application would use a different IP address than Optim Performance Manager to connect to the monitored database.
- You have multiple network adapters on the monitored data server. The application uses a different network adapter than Optim Performance Manager to connect to the monitored data server.

For all these cases, specifying a logical name ensures correct communication between Extended Insight client and Optim Performance Manager server in order to provide Extended Insight data for the monitored database.

If you specify a logical name, then you must specify it on Extended Insight client as well, either within your application in the connection URL or in the pdq.properties file.

To specify a logical name in the application in the connection URL, enrich the URL as follows:

dbc:db2://<host>:<port>/<dbname>:monitoredDataSourceName=<logical name>

To specify a logical name in pdq.properties, set the property as follows:

monitoredDataSourceName=<logical name>

- Use custom table space

This option is available only if the monitored database is on DB2 9.7 Fix Pack 1 or higher. Specify the table space on the monitored database that Optim Performance Manager should use to create event monitor tables for the package cache event monitors. If you do not specify one, Optim Performance Manager uses the one specified in the DB2 event monitor configuration settings. If that one is empty, then DB2 chooses the default tables space.

**Tip:** We recommend that you specify a dedicated 32K table space defined across all partitions for the event monitors instead of letting DB2 choosing the default table space.

Optim Performance Manager uses the statement text retrieved from the package cache to show the complete statement text on the Extended Insight dashboard. DB2 may flush statements from the package cache before Optim Performance Manager could collect them. In that case Optim Performance Manager will not show the complete statement text on the Extended Insight dashboard. To avoid this, Optim Performance Manager uses the package cache event monitor to collect statements.

Refer to the Information Center for more information on DB2 package cache at

http://publib.boulder.ibm.com/infocenter/db2luw/v9/topic/com.ibm.db2.udb .admin.doc/doc/r0000266.htm

Collect statement metrics on data server

This option is available only when the monitored database is DB2 9.7 Fix Pack 1 or higher. When it is enabled, the Statement Details area of Extended Insight dashboard gets an additional *Statement Server Execution Details* tab that displays time spent and execution data about the statements. Optim Performance Manager collects the data from the monitored database using the MON\_GET\_PKG\_CACHE\_STMT table function. See Figure 3-57 on page 125 for a sample.

Detail Area for SQL Statements						
General Information Statement Server Execution Details						
The tab displays data for each time that the statement ran on the	data server during the time interval: 11/01 18:00:00 and	11/03 14:15:00. In some cases, this o	data can comprise more statemer	t executions for th	e same statement than i	dicated on the tab that dis
March Darande Talandi Gardian			Chattananak Davis and Cast Dat	- 3-		
Most Recent Identification			Statement Row and Soft Dec	dlis		
Statement identifier:	0100000000000642600000000000000000000000	000000020020101101191421	Average rows read:			81,340
Package name:			Average rows returned:			1
Statement Type:	DML, Select (blockable)		Average rows modified:			0
Package Version:			Average Sort Processing Time			0 sec
Cache Insert time stamp:	11/01 19:14:21		Total sorts:			0
Last execution:	11/01 19:14:51		Number of Sort Overflows per	Partition/Member:		0
Involved partitions:	1		Post threshold sorts:			0
			Post threshold shared sorts:			0
Most Recent Compilation		_	Row Efficiency		Sort Efficiency	
Or seal tables the st	107					<u>^</u>
Compliation time:	10		Rows Read and Not Used			In Memory
Isolation level:	UR				Number of	
Estimated cost:	586		100 %	Returned or		Sort
				Modified		Overflows
Data Server Execution Time		-				
Number of executions:	2				4	
Average execution time:	0.041 sec		I/O Statistics			
Average CPU time:	0.017 sec					
Average activity time:	0.041 sec		Buffer Pool Hit Ratio:			97.650 %
Average workload manager queue time:	0 sec		Logical page I/O:			1,064
Average Routine Processing time:	0 sec		Physical page I/O:			25
Average Section Processing time:	0.037 sec		Pages written:			U

Figure 3-57 Statement Server Execution Details

Collect transaction metrics on data server

This option is available only when the monitoring database is DB2 9.7 Fix Pack 1 or higher. When it is enabled, you see details of the transactions from a data server execution perspective. Figure 3-58 illustrates more on the type of data seen when this is enabled. For example on the Extended Insight Overview dashboard, as seen in Figure 3-58, there are additional columns (in comparison to Extended Insight Client only setup).

Exten Workload	ded Insights Is are listed in t	nt Analysis he grid. Click i	s Dashboa in the left colur	nrd: AESA	MPLE on e chart for the	BB workload. Use	the second colu	umn to expand	and collapse (	vorkload cluste	rs in the grid. E	Oouble-click a	ESAMPLE on E	.8 • Disconn tails. Click New
Open	Details Activ	ate Dead	tivate Nei	w Edit			View All Kr	nown Clients	Transaction 1	opology			Expand	Collapse
Graph	Workload Cluster Group/Wo rkload	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time	Average Client Time	Warning (%)	Critical (%)	Transactio ns (/min)	Rows Read Rate	Rows Modified Rate	Rows Returned Rate	Statement Failure Rate (%)
🚵 Sh	▼	3.379	01:01.773	01:10.343	\$3.374	♦ 0.277	÷1.036			335.048	3,943.602	0.451	291.060	2.667
🚵 Sh	🕈 🔶 Client ι	3.379	01:01.773	01:10.343	\$3.374	♦ 0.277	1.036			335.048	3,943.602	0.451	291.060	2.667
🚵 Sh	+** с	5.173		9.847	\$5.173					313.543	6,277.348	0.605	211.674	
🚵 Sh	+*e:	2.406	0	2.656	<b>0.105</b>	1.905	<b>0.396</b>			0.074	2.889	12	0	0
🚵 Sh		1.961	0	2.078	÷0.016	1.564	<b>0.381</b>			0.074	1.259	6	0	0
🚵 Sh	+	1.456	0	12.341	<b>\$1.455</b>	÷0.551	<b>0.658</b>			158.988	455.084	0.267	166.470	12.500
🖮 Sh	**2	1.206	2.078	2.188	<b>0.341</b>	÷0.996	<b>0.387</b>			0.296	5.370	9	0	4.762

Figure 3-58 Extended Insight Analysis Dashboard

The response time distribution chart has all the layers from the *Average Data Server Time per Transaction* category. After selecting each layer, detailed data for this layer is displayed as a rainbow chart (Figure 3-59 on page 126).



Figure 3-59 Extended Insight Analysis Dashboard

In case of a partitioned database, there is a TopPartitions tab with Extended Insight server transaction metrics on a per partition basis.

Scope: Global			SQL Statements	Clients	Partitions/Members		
Graph Grid			Show highest	10 🛛 🕶	by Average Data Se	ver Time	1.
Selected layer: Average Data Server Time per Ti	ansaction 🔹	Fit Average	Partition/M	tember		Average Data Server	Time
120		V	Global				0.0
			Partition 2	100			0.2
80-	Λ.		Partition 1	)			0.2
9 40.			Partition 3	-			0.2
			Partition 0				0.0
0	14:46:40 11/16 15:00:00	11/16 15:13:20	Display this lie	st by the se	elected graph layer		Explore Partitio
		-	1000				
Partition 1 - Detail Area for Average D	ata Server Time per Tran	saction					
ata server time overall properties	A 535						
verage data server time per transaction:	0.273 Sec						
lumber of eventione-	96						
Number of executions:	96						
The Times							

Figure 3-60 Extended Insight Analysis Dashboard

Selecting **Average Data Server Time per Transaction** in the left tab, and selecting the partition on the right side, and then clicking on the explore partition in Figure 3-60, you see more detail data for that partition as shown in Figure 3-61 on page 127.



Figure 3-61 Extended Insight Dashboard - Explore partition

### Usage of client field information

This functionality allow Optim Performance Manager 4.1.0.1 to be configured to restrict the set of client information fields, or to mask portions of the client information fields, that are used collectively as a key to aggregate the statement and transaction statistics. Configuration of client information field masking can be changed during runtime. It can take some time (depending on monitored client application configuration) to consume changed configuration of masking fields. By default, the masking is disabled. You can enable it by checking **Usage of client field information**. See Figure 3-62 on page 128.

Collect Extended Insight da	ta	×
Collection of monitoring data	Usage of client field information	Integration with Tivoli Monitoring
You can mask portions of clier	nt field information or exclude client field	ds from aggregation.
✓ Use client field information	:	
Client user ID:	Masked	1 <b>to:</b> 1
Client workstation:	Excluded	
Client application name:	Masked 🛛 🔻 From position:	1 🔹 to: 1 🔹
Client accounting string:	Not masked   🔻	
		OK Cancel

Figure 3-62 Usage of client field information

Client information fields are explained in 4.4.3, "Workload cluster groups and Workload clusters" on page 187. The default value for each client information field is *not* masked. Possible values for each client info fields are:

Masked:

The client information fields configured as Masked are included into the set of aggregation keys but part of the field is masked. Figure 3-63 shows that the Client user IDs field is Masked from field 1 to field 2.

🚵 Sh	Client application names
🚵 Sh	▼ ♦ Client user IDs
🚵 Sh	♦ **lia
🚵 Sh	🔶 **er1
🚵 Sh	♦ **mes
🚵 Sh	♦ **mie
🚵 Sh	
🚵 Sh	♦ **t

Figure 3-63 Masking applied to the Client user ID field in Extended Insight dashboard

Excluded

The client information fields configured as Excluded are excluded from the aggregation keys set. There is no information about excluded client information field collected in Optim Performance Manager and user is unable to do any clustering based on it. The Optim Performance Manager Extended Insight dashboard shows a blank for the client information field that is excluded. Figure 3-64 on page 129 shows that the Client user IDs field is excluded from masking.


Figure 3-64 Excluding Client user ID field from masking

Not masked

The client information filed configured as *not* masked are included into the aggregation keys set. It behaves in the same way as in Optim Performance Manager 4.1. Figure 3-65 on page 129 shows that the Client user IDs field is *not* masked.

≧ Sh	▼
े Sh	Client application names
े Sh	Client user IDs
≧ Sh	🔶 julia
े Sh	🔶 james
े Sh	🔶 jamie
े Sh	🔷 we deadlock
🚵 Sh	🔶 guestuser
े Sh	🔶 db2user
≧ Sh	🔶 adminuser
े Sh	🔶 paul
≧ Sh	♦ mary

Figure 3-65 Masking not applied to Client User ID field

#### Integration with Tivoli Monitoring

For details about this setting, refer to Chapter 10, "Integration with Tivoli monitoring components" on page 323.

## 3.4 Installing and Configuring Extended Insight Client

To use Extended Insight monitoring with Optim Performance Manager, you must first activate Extended Insight on the Optim Performance Manager server using the activation tool as explained in 3.2.3, "Activating the Optim Performance Manager Extended Insight license" on page 81.

We can now go ahead with installing and configuring Extended Insight on the client computer that the applications run that you want to monitor with Extended Insight. Extended Insight client collects end-to-end response time information for database transactions that the applications initiate and execute on the monitored database and sends it to the Extended Insight monitoring server within Optim

Performance Manager. Since communication to the Extended Insight monitoring server is established during Extended Insight configuration, perform the configuration step after you have configured the database for monitoring and enabled the Extended Insight monitoring profile for in the Optim Performance Manager web console. Refer to 3.3.5, "Monitoring profile for Extended Insight" on page 119 for information how to do that.

#### 3.4.1 Installing Optim Performance Manager Extended Insight client

Extended Insight client provides an installation wizard and a configuration wizard to install and configure the product on your client computer. If you want to install and configure the product on a system that does not have a graphical user interface, you can do so by using the console mode. For more details on the installation using the console mode, refer to the Information Center at

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.perf
mgmt.ei.installconfig.doc/ei\_install\_wizard\_or\_console.html

The following are the steps we performed to install the Optim Performance Manager Extended Insight Client using the wizard on a Linux system:

- 1. From the directory of the Extended Insight installation image, launch the installation wizard by double click IBM\_OPMEI\_V4\_1\_0\_1\_Linux\_x86.bin.
- 2. The installation wizard displays the title screen. For the purpose of the book we select English and click **OK**.
- 3. Proceed through the Introduction panel and the Software License Agreement panel.
- 4. From the Choose Install Directory panel (Figure 3-66 on page 131), specify the installation path where you want to install the product and click **Next**. Use the default directory unless you need to install it somewhere else.

#### 7925ch03.fm

Nel	IBM Optim Performance Manager Extended Insight
	Choose Installation Directo
Introduction Software License Agreement Choose Installation Directory Pre-Installation Summary	Specify the directory in which to install or update IBM Optim Performance Manager Extended Insight. If you are updating an existing copy of the product, you must specify the installation directory of the existing copy.
▷ Installing	Directory:
▷ Installation Complete	/root//BM//BM_pureQuery
Install#ny#here	Previous

Figure 3-66 Choose Install Directory screen

5. Review the information on the Pre-Installation Summary screen, and click **Install**.

It will take a few minutes for the installation to complete. The Installing screen has an indicator at the bottom that shows the progress.

6. When installation is complete, you see a screen that indicates installation was successful. Select **Open the configuration tool** and click **Done** (Figure 3-67 on page 132). If you want to run the configuration wizard later, uncheck the checkbox and click **Done**.

Extended Insight is now installed on the client.



Figure 3-67 Installation complete

# 3.4.2 Configuring Optim Performance Manager Extended Insight Client

Once the Optim Performance Manager Extended Insight client is installed, you must configure it for each application that you want to monitor with Extented Insight. The configuration comprises the following:

- Ensures that the DB2 CLI or JDBC driver that the application uses to connect to the monitored database can load and access the Extended Insight client at application runtime.
  - During runtime, the DB2 CLI or JDBC driver calls Extended Insight client to provide data about transactions and statements, for example, start and end times.
  - Extended Insight client aggregates the provided transaction and statement data on a per minute basis.
  - If the application is a WebSphere application, the Extended Insight client checks periodically during runtime the connection pool state and collects connection pool information

- Establishes communication with the Extended Insight monitoring server for the monitored database within Optim Performance Manager.
  - During runtime Extended Insight client sends the aggregated transaction and statement data as well as connection pool information for WebSphere applications after each minute to the Extended Insight monitoring server.

If you ran the configuration program as part of the installation of Extended Insight client, the communication settings and your applications are already configured for extended insight monitoring. If you need more control over these configuration settings, or if you did not run the configuration tool, you must configure the Optim Performance Manager Extended Insight manually.

There are two approaches to configure the Extended Insight client:

- If you install the product by using the installation wizard, the installation wizard gives you the option to start the configuration tool automatically.
- You can run a command from the EI\_installation\_dir/configuration directory to start the configuration tool in the GUI mode:
  - UNIX: ./cfgtool.sh
  - Windows: cfgtool.bat

You can use ./cfgtool.sh -i console for Unix and ./cfgtool.bat -i console for Windows to run the configuration tool in console mode.

Here we demonstrate how to configure CLI, JDBC, and WebSphere applications for Optim Performance Manager Extended Insight monitoring using the installation wizard. We launched the configuration tool by selecting the Open the configuration tool at the end of installation.

Follow these steps to configure the database applications such as CLI, JDBC and WebSphere:

1. From the initial Configuration panel (Figure 3-68), select applications that you would like to configure at this point. For demonstration, we select all applications.



Figure 3-68 Configuration

- 2. In the Configuration Tool panel (Figure 3-69 on page 135), enter the host name or IP address of the Optim Performance Manager and the port number of the Extended Insight controller, that you already specified during activation of Extended Insight, see 3.2.3, "Activating the Optim Performance Manager Extended Insight license" on page 81. If you don't have the port number by hand then you can obtain it from the pdq.cmx.controllerURL parameter in the pdq.properties file which is located on the Optim Performance Manager machine at:
  - UNIX:

<OPM\_Working\_Directory>/opm/v4/<instancename>/pdq.properties

Windows:

<OPM\_Working\_Directory>\RepositoryServer\instances\<instancename>\pdq.properties

The controller port is used by the Extended Insight client to establish communication between the Extended Insight client and Optim Performance Manager. It is saved together with the host name or IP address of Optim Performance Manager in the pdq.properties file of Extended Insight client.



Figure 3-69 Configuration Tool wizard — Host name or IP address and port number

3. If you are configuring Extended Insight for CLI applications, in Configuration File panel (Figure 3-70 on page 136), you must identify the CLI driver that is being used by the application that you want to monitor. By specifying the correct CLI driver, you can identify which db2dsdriver.cfg file to configure. The configuration will not succeed if you do not configure the correct db2dsdriver.cfg file.

The configuration tool attempts to find the db2dsdriver.cfg files for you. If the configuration tool cannot find the one that you need to configure, you can enter the location for it. For more information about the contents and location of the db2dsdriver.cfg file, refer to the Information Center at

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/topic/com.ibm.swg.im.d bclient.config.doc/doc/c0054555.html



Figure 3-70 Configuration File panel

Once the db2dsdriver.cfg file is specified, The configuration tool modifies the db2dsdriver.cfg file and completes the CLI configuration. More information about what is changed and the contents of this configuration file before and after the configuration are well explained in the developerWorks® tutorial at

http://www.ibm.com/developerworks/data/tutorials/dm-1010optimextendedinsigh
t/index.html

The next step is configuring Extended Insight for WAS applications.

4. In this step you configure Extended Insight for WebSphere Application Server applications. You must provide credentials to connect to the WebSphere Application Server. This information is required to update the WebSphere JDBC provider so that the WebSphere applications can be monitored. The SOAP port is required, the other fields are required only if you have security turned on for your copy of WebSphere Application server. The SOAP port is generally the default port 8880. If you do not use the default ports, check the portdef.props file in your WebSphere Application Server profile for the port number. See Figure 3-71 on page 137.

#### 7925ch03.fm

<u>10</u>	Configuration Tool
	Configuration
	Specify the following information and credentials to connect to WebSphere Application Server. This information is needed to update the WebSphere JDBC provider so that WebSphere applications can be monitored. The SOAP port is required. The other fields are required only if security is turned on for your copy of WebSphere Application Server.
	SOAP port
	8880
	WebSphere Application Server user ID:
	wasadmin
	WebSphere Application Server password:
	WebCebare Application Concert CCI trust store programmit
	websphere Application server SSE trust store password.
	WebSphere Application Server SSL trust store file:
	/opt/IBM/WebSphere/AppServer/profiles/AppSrv01/etc/DummyClientTrustFile.jks
	Browse
InstallAnywhere	
Cancel	Previous <u>N</u> ext

Figure 3-71 WebSphere configuration

5. Specify the JDBC providers that correspond to the databases to collect extended insight data for (Figure 3-72 on page 138). The classpath for the JDBC provider will be updated so that Extended Insight can monitor your applications.



Figure 3-72 Select JDBC provider

6. This step is optional. If you want to verify that the database is properly configured for monitoring, the configuration tool can do that. Enter information for the database that you want to monitor. See Figure 3-73 on page 139.

For CLI applications, note that even though this information is requested at this point, it is not added into the db2dsdriver.cfg file. You have to manually add this information while setting up to run the workload. More information about what to add manually in the configuration file is well explained in Step 2 of *Run a workload to validate that data is being collected* in the developerWorks tutorial at

http://www.ibm.com/developerworks/data/tutorials/dm-1010optimextendedinsigh
t/index.html

#### 7925ch03.fm

<b>V</b> .	Configuration Tool	<b>-</b> ×
	Configura	tion
	Optional: Provide the following information about a database that is used by your application. This information is used by the tool to verify that the database is properly configured for monitoring in Optim Performance Manager.	
	${f V}$ Verify that the database is configured for monitoring	
	Database host name:	_
	9.12.5.104	
	Database port:	_
	50000	
	Database name:	_
	reddb2	
The second se		
InstallAnywhere		
Cancel	Previous Next	

Figure 3-73 Verify if the database is configured for Monitoring

If the database is not added for monitoring or the information that you added in this panel for verification is not correct, you will see an error as shown in Figure 3-74 on page 140.



Figure 3-74 Error while verifying if the database is correctly configured for monitoring

The error suggests to verify the following:

- Ensure that you have provided the correct database host name, database port, and database name of the database that you are monitoring.
- Ensure that the controller port number is not blocked.
- Ensure that your Optim Performance Manager server is up and running. On UNIX and Linux, you can use the pestatus command from the <0PM>/RepositoryServer/bin directory to check whether Optim Performance Manager is running. On Windows, check the Optim Performance Manager service using the Control panel.
- Ensure that database is configured for monitoring. You can check the Manage Database Connections Dashboard to see the monitoring status of this database (Figure 3-75).

	Name A	Data Server Type	Database Name	Host Name	Port Number	
re	eddb2	DB2 for Linux, UNIX, and Windows(9.7.2)	REDDB2	TREASUREISLAND.USCA.IBM.CC	50000	Configured - Enabled

Figure 3-75 Manage database connections - verify the monitoring status

- Ensure that you have enabled Extended Insight profile.
- 7. Review the information on the summary panel (Figure 3-76 on page 141).



Figure 3-76 Summary Screen for Configuration

Review the information before you continue with the configuration and Click **configure**. If you decide to change any information you can go back to the previous screens using the Previous button.

It will take a few minutes to configure. Once the configuration is complete you will see the Finish screen as shown in Figure 3-77 on page 142.

The Finish screen indicates that the tool has configured JDBC, CLI and WebSphere applications successfully.

<b>NE</b>	Configuration Tool	
	Fir	nish
	JDBC application configuration was successful. CLI application configuration was successful. WebSphere application configuration was successful. See the following log file for details: /tmp/PQ/ConfigTool/logs/ConfigTool_details.log Restart your copy of WebSphere Application Server to start using the new configuration settings.	Ą
InstallAnywhereCancel	Previous Done	

Figure 3-77 Finish Screen

8. If you are using WebSphere Application Server version 6, an additional configuration step is required. You must add a custom property enableEndToEndMonitoringFeature and set it to true in the WebSphere Application Server version 6.

Figure 3-78 on page 143 shows the WebSphere Application Server console.

Integrated Solutions Console Welcome						He	ilp   Logout
Minue: All tasks	Data sour	ces					
	Data sou	rces					? -
Welcome     Guided Activities							
	Datas	ources					_
± Servers	Use th applica	is page to edit the sett ation with connections fo	ings of a data source that is or accessing the database. I	s associated with your selected JDB0 Learn more about this task in a <u>qui</u>	ded activity. A guided a	ctivity provides a	list of task
Applications     ■     Applications     ■	steps a	and more general infor	mation about the topic.				
Resources	E Sco	pe: Cell=IBM-L3G9473	Node03Cell, Node=IBM-L3G	9473Node03, Server=server1			
Schedulers	s	cope specifies the leve	at which the resource defin	ition is visible. For detailed informa	tion on what scope is a	nd how it	
Object pool managers	w	orks, see the scope se	ttings help				
H JMS		Node=IBM-L3G9473N	ode03, Server=server1 💌				
IDBC Providers							
Data sources	Pre	terences					
Data sources (WebSphere Application Server V4)	Nev	v Delete Test co	Manage state				
Resource Adapters	R	B ++ +2					
Asynchronous beans				1			
Cache instances	Select	Name 🛟	JNDI name 🗘	Scope 🗘	Provider 🗘	Description 🗘	Category 🗘
Mail		Default Datasource	DefaultDatasource	Node=IBM-	Derby JDBC Provider	Datasource	
URL				L3G9473Node03,Server=server1		for the WebSphere	
H Resource Environment						Default	
E Security		600 X	idbs/localbost	Node=TRM-	DB2 Universal 1DBC	DB2 Universal	
Environment			1000,100011000	L3G9473Node03,Server=server1	Driver Provider	Driver Datasource	
		dzerodb	idbc/PDO	Node=IBM-	DB2 Universal JDBC	DB2 Universal	
Users and Groups				L3G9473Node03,Server=server1	Driver Provider	Driver	
Monitoring and Tuning     Monitoring     Addata     Addatata     Addatata     Addatata     Addatata     Addatata     Addatata     Addatata     Addatataa     Addatataaa     Addatataaa     Addataaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	Total			1		2 CLED OUTCO	
Troubleshooting	Total	· ·					
Service integration							
. UDDI							

Figure 3-78 WebSphere Application Server 6 console - Select the datasource

Click **Resources**  $\rightarrow$  **JDBC**  $\rightarrow$  **Data sources**. Select the datasource that you want to configure for this new property. In the datasource details panel (Figure 3-79 on page 143), select **Custom properties**.

Integrated Solutions Console Welcome		Help Logout
View: All tasks	Data sources	
	Data sources	2
- weicome		
H Guided Activities	Data sources > dzerodb	
Servers	Use this page to edit the settings of a data source that is associated with your selected JDBC pr	rovider. The data source object supplies your
Applications		
Resources	Configuration	
Schedulers Object pool managers JMS JMS JDBC UDBC Data sources Data sources CMSSphere Application Server V4) Resource Adapters Asynchronous beans Cache instances Mail UKL	Test connection  General Properties  Scop  cells:IBM-L3G9473Node03Cell:nodes:IBM-L3G9473Node03:servers:server1  Provider  DE2 Universal JDBC Driver Provider  Name damodo	Additional Properties     Connection pool properties     WebSphere Application     Server data source     properties     Custom properties     Related Items
Resource Environment	jdbc/PDQ	JAAS - J2C authentication
E Security	V Use this data source in container managed persistence (CMP)	data
Environment	E ose this data source in container managed persistence (core)	
System administration	Description	
	DB2 Universal Univer Datasource	
Monitoring and Tuning		
Troubleshooting		
Service integration		
E UDDI	Category	

Figure 3-79 WebSphere Application Server 6 console - Custom properties

In the References panel (Figure 3-81 on page 145), select **New** to create a new property.

rated Solutions Console Welcome					Helj
w: All tasks	Data sour	rces			
A come	Data sou	irces			
uidad Activitian					
alded Activities	Datas	sources > dzerodb > Custom pro	operties		
ervers	factor	is page to specify custom prope es that you configure. For exam	ple, most database vendors req	ation system (EIS) requires for the resource provide uire additional custom properties for data sources th	rs and reso hat access t
pplications	datal	ase.			
esources	🛛 🗆 🤟	ferences			
Schedulers Object pool managers JMS		v Delete			
JDBC	Select	Name 🗘	Value 🔿	Description 🔿	Required
JDBC Providers     Data sources		description		The description of this datasource.	false
= Data sources (WebSphere Application Server V4) Resource Adapters		traceLevel		The DB2 trace level for logging to the logWriter or trace file. Possible trace levels are:	<u>false</u>
Asynchronous beans				TRACE NONE = 0,TRACE CONNECTION CALLS = 1,TRACE STATEMENT CALLS =	
Cache instances				2,TRACE RESULT SET CALLS =	
Mail				16,TRACE CONNECTS = 32,TRACE DRDA FLOWS	
URL				= 64,TRACE RESULT SET META DATA =	
Resource Environment				256,TRACE DIAGNOSTICS = 512,TRACE SQLJ =	
ecurity				1024,TRACE ALL = -1, .	
nvironment		traceFile		The trace file to store the trace output. If you specify the trace file, the DB2 Jcc trace will be	false
ystem administration				logged in this trace tile. If this property is not specified and the WAS.database trace group is	
sers and Groups				enabled, then both WebSphere trace and DB2 trace will be logged into the WebSphere trace	
onitoring and Tuning				file.	

Figure 3-80 WebSphere Application Server 6 - Select New

Enter the name of the property as enableEndToEndMonitoringFeature, set the value to true, and click **Apply**. You have to restart the WebSphere Application Server for this new configuration to take affect.

Integrated Solutions Console Welcome	
View: All tasks	Data sources
Welcome	Data sources
Guided Activities	Data sources > dzerodb > Custom properties > New
E Servers	Use this page to specify custom properties that your enterprise information system (El
	factories that you configure. For example, most database vendors require additional c database.
E Resources	Configuration
<ul> <li>Schedulers</li> <li>Object pool managers</li> <li>JMS</li> <li>JDBC</li> <li>DBC Providers</li> <li>Data sources</li> <li>Data sources (WebSphere Application Server V4)</li> <li>Resource Adapters</li> <li>Asynchronous beans</li> <li>Cache instances</li> <li>Mail</li> <li>URL</li> <li>Resource Environment</li> </ul>	General Properties  * Scope  cells:IBM-L3G9473Node03Cell:nodes:IBM-L3G9473Node03:servers:server1  Required  * Name enableEndToEndMonitoringFeature Value true Description
Security     Environment     System administration     Users and Groups     Monitoring and Tuning     Troubleshooting     Service integration     UDDI	Type java.lang.String M Apply OK Reset Cancel

Figure 3-81 WebSphere Application Server 6 - New Custom property

Optim Performance Manager Extended Insight is now installed and configured. You can run the Extended Insight sample program against a monitored database to validate your configuration and see how the monitoring works. For information about how to run the sample program, refer to:

- For JDBC Application: See the readme file in the EI\_installation\_dir/samples directory.
- For CLI Application: See the tutorial, which has a sample application and steps to run the application at

http://www.ibm.com/developerworks/data/tutorials/dm-1010optimextendedinsigh
t/index.html

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# 4

# Getting to know Optim Performance Manager

Optim Performance Manager delivers new paradigm in terms of how it is used to monitor and manage database and database application performance issues. It enables:

- Top-down database performance management: An ability to start database performance management at the application level (top level) and trace its performance data as it traverses through database client and network to the database server.
- Proactive database performance management: An ability to integrate with DB2 Workload Management feature, which helps to prevent performance issues by creating a more predictable database server environment by assigning resources to various workloads according to their priorities.
- Bottom-up database performance management: The traditional way of database performance management, which starts at the database server level (bottom component)

It uses web interface and guided workflows to navigate user through the series of performance dashboards. Each dashboard surfaces collected metrics for a different database performance category, such as: memory, I/O, locking, SQL.

Optim Performance Manager provides predefined report templates that you can use to generate reports for trend detection, proactive monitoring, establishing baselines, and more.

New in Optim Performance Manager is the administrative and management tooling for DB2 workload management (WLM). This new tooling provides the ability to proactively administer, manage, and monitor the workload in context to their workload management settings.

Integration between Optim Performance Manager Extended Edition and Tivoli Composite Application Manager provides a consolidated view of the business transactions across the enterprise while providing comprehensive detail to help diagnose database-specific areas.

If you install the optional DB2 Performance Expert Client component, you can do a smoother migration from DB2 Performance Expert to Optim Performance Manager.

In this chapter we describe individual product dashboards and reports and discuss how they can be used to identify, diagnose, prevent, and solve database performance problems. The integration of Optim Performance Manager with the Tivoli Composite Application Manager as well as Workload Manager tool is described in separate chapters.

### 4.1 Health summary

This section describes several Optim Performance Manager dashboards, which give information about the overall health of the monitored database.

#### 4.1.1 Health summary page

You might start by viewing the Health Summary page (**Task Manager**  $\rightarrow$  **Health Summary**) to see an overview of the health of all monitored databases. From the Health Summary page (Figure 4-1), you can determine which databases have problems, and you can drill down for more details.



Figure 4-1 Health summary page

The Health Summary shows an overview of the severity and number of alerts for your data sources. The types of alerts that the Health Summary displays depends on the type of data source and the alerts that are configured for each data source.

Use the group pane (Figure 4-2) to select the data sources to view alert severity, host, and port from the default groups. If the custom group feature is available for your product, you can also create custom groups that are shared with all users of the web console.



Figure 4-2 Health summary page group pane

Use the column controls (Figure 4-3 on page 150) to control which columns to display in the grid, move columns around, filter and sort the data in the grid as needed. You can also click the column headings to sort the data in the grid according to any column value.



Figure 4-3 Health summary page column controls

Use the time control (Figure 4-4 on page 150) to set the time period for the health data that is displayed. You can view recent data that is refreshed at configurable intervals, or view historical data for a specific time period. For recent data, the refresh rate controls the rate at which the Health Summary page is updated. For historic data, specify the history timeframe in the timezone of your web browser. The alert data is collected at a rate that you can set individually for each monitored database.



Figure 4-4 Health summary page time control

Each column in the Health Summary represents an alert category contributed by a data source that shares the Health Summary interface. The alert icons (Figure 4-5 on page 151) in the grid reflect alert severity for each alert category and data source.



Figure 4-5 Alert categories and alert icons

Click an alert icon in the grid to see a list of all of the alerts of that specific category for that data source. You can then select a specific alert to troubleshoot.

To better understand or resolve the cause of an alert, open the appropriate dashboard by clicking **Open Dashboard**.

#### 4.1.2 Overview dashboard

After the initial review of the health of monitored data sources, you can drill down from the Health summary page into the overview dashboard for the selected data source. See Figure 4-6 on page 151.

DPF on A2/A3 TPCH	
dtrader on L3	Current Table Spaces
GOSALES	Overview Dashboard
GOSALES_NEW	Extended Insight Analysis Dashboard
reddb2 on AIX	
testdb2	Configure Alerts
testdb_aix_1	View Datasource Details

Figure 4-6 Overview dashboard invocation

Use the Overview dashboard (Figure 4-7 on page 152) to view the key performance indicators for multiple problems areas for a database, such as, workload, sorting, caching, locking, I/O and disk space.

Use the time slider and time controls to control the time period for the performance data that is shown on the dashboard.

Optim Performance	e Manager			borovsky   <u>Log.out</u>   <u>About</u>
🌞 Task Manager 🔹 🕒 Man	nage Database Connections 🛛 쉀 Welcom	- My Optim Central		<u>a</u>
Health Summary X Current A	Application Connections Overview	×		
Recent Carlor 10/27	/10 16:44 10/28 07:59 10/28 23:14	Learn about the time controls. O O I 4	11/0103:29 11/0118:44 11/0209:59 11	America/New_York 11/03/10 15:29 - 11/03/10 16:29 11/03/10 16:29 03 01:14 11/03/10 16:29 1 Hour 1 Hour
Overview Dashboard:	DPF on A2/A3 TPCH	Not en	ough performance data is available for the selected tin	DPF on A2/A3 TP      Disco
<b>■</b> Workload	_	<b>■</b> Sorting	_ Uccking	-
Transactions:	126.164 /min	Active sorts: 6	Currently waiting	E 0 % (4
Failing transactions:	■ 7.294 % 🚳	Sorts: 2.134 /min	applications:	
Open connections:	8	Sort overflows: 🗧 0.404 % 👌	Longest wait time:	7.024 sec
Active connections:	7	Post threshold sorts: 0 %	Average lock wait time per transaction:	0.020 sec
Rows read per fetched row:	18,980.561	Sort time per minute: 02:41.655 min	Lock alerts:	0
Maximum CPU time of running statements:	49:43.419 min	Average sort time: 01:15.766 min	Deadlocks:	0
Maximum elapsed time of	09:45:27.338	Average sorts per 0.017 transaction:	Timeouts:	0
Critical workloads:		Sort memory in use: 0 bytes	Escalations:	0
		<b>■</b> System	I/O and Disk Space	
Caching		CPU utilization: 25 %	Buffer pool hit ratio:	■ 48.442 % 🔤 🗰 💭
Catalog cache hit ratio:	96.813 %	Total virtual memory in use: 6.767 GB	Logical reads:	40,497.724 /min
Package cache hit ratio:	A /4.183 %	Virtual memory in use: 🛛 87.311 % 💳	Physical reads:	20,879.922 /min
Utilities	_	Swap memory in use: 14.497 % 💻	Physical writes:	10,319.444 /min
Active utilities:		Real memory in use: 🛛 99.676 %	Prefetcher hit ratio:	99.623 %
			Asynchronous read ratio:	■ 76.691 %
Logging		High Availability Disaster Recovery (HADR)	Page cleaner efficiency:	0.111 %
Log space used:	187.973 MB	HADR role:	Asynchronous write ratio	96.741 %
Log space used:	1.667 %	HADR state:	Average page read time:	0.022 sec
Log write rate:	14.489 KB/sec	HADR connection status:	Average page write time:	0.007 sec
Log to be read for recovery:	2.307 GB	HADR connection time:	Direct writes:	20.138 /min
Maximum indoubt	0	HADR log gap:	Direct reads:	363.431 /min
Ganaactions:		HADR missed heartbeats:		
N				
ne 💦			😜 Internet   P	rotected Mode: Off 🛛 🖓 👻 🔍 1075

Figure 4-7 Overview dashboard

You can see problem areas for a database quickly when you open the Overview dashboard. If a section heading displays a yellow warning icon or red critical icon, an alert threshold was crossed. The small graphs show where the alert thresholds are set. Figure 4-8 on page 153 shows the I/O and Disk Space section in the Overview dashboard.

■I/O and Disk Space	_
Buffer pool hit ratio:	59.785 %
Logical reads:	11,081.401 /min
Physical reads:	4,456.384 /min
Physical writes:	2,685.573 /min
Prefetcher hit ratio:	100 %
Asynchronous read ratio:	83.587 %
Page cleaner efficiency:	68.867 %
Asynchronous write ratio:	99.488 %
Average page read time:	0.010 sec
Average page write time:	0.004 sec
Direct writes:	19.707 /min
Direct reads:	4.879 /min

Figure 4-8 I/O and Disk Space section

You can obtain more information for each key performance indicator on the dashboard in the following ways:

Read about the value for the indicator

Read the hover help to determine what type of value is displayed for each key performance indicator. For example, the value might be the average, current, most recent, or maximum value for the time period that you selected with the time slider.

Figure 4-9 on page 153 shows a key performance indicator hover help.



Figure 4-9 Key performance indicator hover help

Drill down to a problem-oriented dashboard

Double-click a value for a performance indicator to drill down to the more detailed problem-oriented dashboards, where you can review statistics that are relevant to a specific problem.

If an alert is indicated but the average value for the time period that you selected does not exceed the threshold, then one or more data points exceeded the threshold. Click the alert icon to see when the alerts occurred. You can also use

the time slider and time controls to shorten the reporting interval to identify the data point that triggered the alert.

#### Identifying problems by using the small graphs

Many performance indicators have a small graph. You can use these graphs to determine how your system is behaving over time and identify bottlenecks or peaks. Performance indicators might have a bar graph or an area graph.

#### Bar graph

The blue horizontal bar indicates the average value during the reporting interval and across the partitions. For a partitioned database, the grey vertical bar indicates the maximum or minimum value that was reached during the reporting interval for any partition. The order of critical alert and warning alert markers depend on whether a high or low value indicates a problem for the type of metric.

Figure 4-10 on page 154 shows a small bar graph.

Figure 4-10 Bar graph

#### Area graph

The blue area indicates the changes in value during the reporting interval. For partitioned database, in most cases, indicates the change in the average value across the partitions. For partitioned database, the gray line indicates the highest value for any partition at specific times during the reporting interval.

Figure 4-11 on page 154 shows a small area graph.



Figure 4-11 Small area graph

You can interact with the small graphs in the following ways:

Move the cursor over a bar graph to see an enlarged view of the small graph. This enlarged view includes the threshold and metric values for the time period that you selected.

Figure 4-12 shows an enlarged small graph.

<b>Overview Das</b>	shboard: DI	PF on <i>I</i>	2/43	трсн	1			
Critical workloads:	-		Pac	kage cac	he hit rat	io: 70 80		E
▲Caching						<b>4</b>	▲ 74.183 %	H
Catalog cache hit ratio:	96.813 %		0	25	50 @ D	75 etail	Memory Dashboard	F
Package cache hit ratio:	▲ 74.183 %				in	use:	14.47/ /0	}

Figure 4-12 Enlarged small graph

Click a small graph to see a detailed graph window. In the detailed graph window, you can view details for the performance indicator and, where applicable, set values for warning and critical alerts. From a detailed graph window, you can also click on a link to open the dashboard for the performance indicator.

Figure 4-13 on page 155 shows a detailed view of a small graph.

Package Cache Hit Ratio	×
Graph	Memory Dashboard
80	
60	
<sup>జ</sup> 40	
20	
0 11/03 15:29:00 11/03 15:42:00 11/03 15:55:00 11/03 16:08:00 11/03 16:21:00	
Time	
Across all partitions	
📕 Average package cache hit ratio: 🔺 74.183 %	
Minimum package cache hit ratio: 🔺 72.842 %	
Warning value: 80 + % Critical value: 70 + %	
1	
	1
	OK Apply Cancel

Figure 4-13 Detailed view of a small graph

 Double-click a small graph to open the dashboard for the performance indicator.

#### Time slider and time controls

Use the time slider and time controls (Figure 4-14) to control the time period for the performance data that is displayed on the dashboard.

Recent		Learn about the time controls. O O I 1 America/New_York End 11/21/10 10:12 - 11/21/10 14:12	Time: 21/10	7
History	48 sec	11/01/10.15:44 11/03.20:59 11/06 62:16 11/08.06:33 11/10.11:50 11/12.17:05 11/14.22:22 11/17.03:38 11/19.08:55 11/21/10.14:12 4.Hit	ation: ours i	

Figure 4-14 Time slider and time controls

#### Time line

The time line (Figure 4-15 on page 156) is initially expanded to show the length of time that performance data has been collected. For example, if performance data has been collected for six weeks, then the leftmost time stamp is six weeks ago. If you use the zoom in and zoom out controls at the top of the time line, you can change the span of the time line. Changing the span can make the time slider easier to manipulate. However, changing the span of the time line does not change the data on the dashboard. Use the time slider control to control the data that is shown on the dashboard.



Figure 4-15 Time line

#### Time slider

This control shows the time interval for the data that is displayed on the dashboard. You can move this control to show different data on the dashboard. For example, you can slide the control to the left to show older data. You can control the amount of data that is shown on the dashboard by increasing or decreasing the time interval with the *Duration* control.

The time slider (<u>20 Hours</u>) control helps you isolate and analyze what was taking place on the database at a specific point in time. For example, by sliding the time slider, you can remove distracting data points that might not be related to the performance problem that you are investigating.

A dashboard shows performance data only if the position of the time slider on the time line contains at least two data points. Otherwise, you should increase the time interval for the time slider or move the time slider to another position. An inactive database can result in gaps in the collection of performance data.

#### Zoom and data point controls

Use the zoom controls ( ) to change how much of the time line is shown. For example, if the time line initially shows 60 days of data, you can zoom in so that the time line shows only 5 days of data. In this way, you can more easily manipulate the position of the time slider on the time line. Use the data point controls to move the time slider from one data point to the next. The blue lines at

the bottom of the time slider indicate the points where data was collected. You can move from one data point to the next data point or to the previous data point.

#### **Duration control**

Click the Duration control ( 20 Hours
) to control how much data is shown at one time on the dashboard. The duration is reflected in the time slider. For example, if the time slider indicates that two hours of data is shown on the dashboard, you can use this button to change the duration to one hour.

#### End Time control

Click End Time (Figure 4-16) to specify the end time for the time slider. For example, if you want to analyze performance data for a time period that ended at 10:00 a.m. the previous day, you can click this button and specify that day and time. The time slider will move to show you the requested time frame, and the data in the dashboard will reflect that time frame



Figure 4-16 End time control

#### **Clock button**

The Clock button ()) indicates the time that remains until the next refresh interval. Refresh interval is always 60 seconds. The content however is refreshed based on the sampling rate that was set when the database was configured for monitoring. You can click the Clock button to enable or disable the automatic refreshing of the data on the dashboard. Automatic refresh is useful for viewing the latest performance data.

#### **Recent button**

In Recent mode, the latest performance data is displayed and the time slider is at the right end of the time line. Click the Recent button (\_\_\_\_\_) to ensure that you are seeing the most recent data. Timeframe of the displayed performance data is based on the time zone of the monitored database.

#### History button

In History mode (), you can position the time slider to display the performance data for a previous time and date. The length of the time line indicates the amount of historical data that is available. If more data should be available, use the Zoom out button until you can see the whole time line. The retention period, which is set when the database was configured for monitoring, controls the amount of historical data that is available. Timeframe of the displayed performance data is based on the time zone of the monitored database.

#### 4.1.3 Current application connections

From the Health summary page you can continue to review the health of the monitored database by drilling down into current application connections page. This page displays the applications which are currently connected to a database, and indicates the status of the connection by idle time. The page also provides information about the connection, such as rows read and rows written.

Depending on the connection status you can choose to force the application. For example, to allow for system maintenance or to enhance system performance, you can force an application connection that has been idle for a long time.

For databases that have many connected applications, you can filter your view by criteria such as name, status, and idle time. You can select individual connection and click **View SQL details** to review the SQL statement that this connection is currently executing.

Figure 4-17 on page 158 shows a Current Application Connections view. The current application connections page has been integrated into Optim Performance Manager from Data Studio Health Monitor.

Optim	Performan	ce Manager									borovsky	<u>Log out</u>	About   🕜
🌞 Task Manag	er 🔹 🔥 M	lanage Databas	e Connections	💩 Welcome	- My Optim Cer	itral							8
Health Summan	Current	t Application	Connections	v) Overview									
ricalar Saminary	Curren	п Аррисации	connections	~ [] Overview									
The application of	connections that	t are listed are o	currently active	for the selected	l database. To in	nprove perform	ance, you can di	isconnect applic	cations.				
	on A2/A3 TP	▼ Disconnect	]										
Commentione	501		J										
Connections	1/04/2010 02-0	0.00.00											
Last updated: 1	1/04/2010 03:0	18:29 PM											
Force Applica	tion View SQ	L Details										\$ <b>\$</b>	ò 15 🗞
Agent ID	Name	Application ID	Authorization	Status	Dynamic State	Static Stateme	Failed Stateme	Locks	Client Product	Client ID	Idle Time	Rows Read	Rows Written
118	db2fw0	*N0.DB2.1	USER2	Unit of Wo	0	0	0	13	SQL09072	2660	177170	1125	168140
111	db2bp.exe	9.12.4.140	USER5	Unit of Wo	19	7	0	15	SQL09072	2232	137612	8709086801	300395437
117	db2lused	*N0.DB2.1	USER2	Unit of Wo	0	0	0	0	SQL09072	2660	177170	3	510
35110	OPMRepos	9.72.143.1	DB2IAIX	Unit of Wo	26	13	0	26	SQL09071	1892	0	71	23
110	db2bp.exe	9.12.4.140	USER3	Unit of Wo	75	30	6	0	SQL09072	3152	26894	1822986179	70108387
9695	db2bp.exe	9.12.4.140	DB2IAIX	Unit of Wo	78	30	6	0	SQL09072	2960	66624	1612401963	256299306
35116	java	9.12.5.104	DB2IAIX	Waiting for	24	7	2	4	SQL09056	23658706	0	0	0
31260	java	9.12.5.104	DB2IAIX	Unit of Wo	4317	2114	0	0	SQL09056	23658706	3	44562	9252
63299	OPMRepos	9.72.143.1	DB2IAIX	Unit of Wo	33360	22275	0	0	SQL09071	1892	3	436441	97434
108	db2bp.exe	9.12.4.140	USER2	Unit of Wo	60	18	6	0	SQL09072	2660	37257	1520546764	199462360
121	db2fw3	*N0.DB2.1	USER2	Unit of Wo	0	0	0	13	SQL09072	2660	177170	517	168300
120	db2fw2	*N0.DB2.1	USER2	Unit of Wo	0	0	0	13	SQL09072	2660	177170	668	168602
119	db2fw1	*N0.DB2.1	USER2	Unit of Wo	0	0	0	17	SQL09072	2660	177170	520	168401
112	db2bp.exe	9.12.4.140	USER4	Unit of Wo	179	30	7	0	SQL09072	1092	127805	380729517	149988638
111	db2bp.exe	9.12.4.140	USER5	Unit of Wo	0	0	0	15	SQL09072	2232	137611	9014851086	300426143
53 total iter	ns								15	<ul> <li>Items per per per per per per per per per per</li></ul>	page 🔣 📢	Page 1 🛛 🔻	of 4 🕨 🕅
									int 😜	ernet   Protected	Mode: Off		• @.107% •

Figure 4-17 Current Application Connections

#### 4.1.4 Current table spaces

To finalize the initial health check of the monitored database, you can drill down into Current Table Spaces page (Figure 4-18 on page 159) from the heath summary page. This page displays information about the current status of table spaces and table space containers for the selected database.

For databases that contain many table spaces you can filter your view by criteria such as name, state, and utilization.

The Current Table Spaces page has been integrated into Optim Performance Manager from Data Studio Health Monitor.

	Optim P	erformance M	lanager							borovsk	y   Log out	About   🕜
	isk Manager	🔹 🔥 Manaç	je Database Con	nections 🛛 🏠 We	lcome - My Optim	Central						<u>e</u> 11
Health	Summary	Current Ta	able Spaces	×								
Select	a data sour	ce to view table sp A2/A3 TP 🔻 I	Dace status and s	torage information.	Click View Conta	iner Information to	see details about th	ne containers used	by the selected ta	ble space.		
Last up	odated: 11/0	04/2010 04:01:00	PM									UN THE REAL
View	Container	Information									<u> </u>	
	ID	Name	Туре	Content type	State	Utilization	Free Size (KB)	Total Pages	Usable Pages	Used Pages	Free Pages	Total Size (KB)
	1	TEMPSPACE1	SMS	SYSTEMP	NORMAL			318	318	318	0	1272
	2	USERSPACE1	DMS	LARGE	NORMAL	8.62%	29824	8192	8160	704	7456	32768
	4	TABDATA	DMS	LARGE	NORMAL	99.94%	15360	934912	934896	934416	480	29917184
	5	TABINDEXES	DMS	LARGE	NORMAL	99.83%	1536	28672	28656	28608	48	917504
	6	TEMPSP32K	SMS	SYSTEMP	NORMAL			1	1	1	0	32
	7	TABSTAGE	DMS	LARGE	NORMAL	4.76%	30720	1024	1008	48	960	32768
	0	SYSCATSPACE	DMS	ANY	NORMAL	80.81%	31424	40960	40956	33100	7856	163840
	1	TEMPSPACE1	SMS	SYSTEMP	NORMAL			320	320	320	0	1280
	2	USERSPACE1	DMS	LARGE	NORMAL	4.69%	62336	16384	16352	768	15584	65536
	3	SYSTOOLSPACE	DMS	LARGE	NORMAL	1.90%	32128	8192	8188	156	8032	32768
	4	TABDATA	DMS	LARGE	NORMAL	99.94%	16384	934912	934896	934384	512	29917184
	5	TABINDEXES	DMS	LARGE	NORMAL	99.83%	1536	28672	28656	28608	48	917504
	6	TEMPSP32K	SMS	SYSTEMP	NORMAL			1	1	1	0	32
	7	TABSTAGE	DMS	LARGE	NORMAL	4.76%	30720	1024	1008	48	960	32768
	8	SMALL	DMS	LARGE	NORMAL	5.22%	402688	106496	106464	5568	100672	425984
28 t	otal items								15 V Iten	ns per page 🔣	Page 1	• of 2 🕨 🕅
Done									😔 Internet   Pro	otected Mode: Off	4	▼ € 107% ▼

Figure 4-18 Current Table Spaces

## 4.2 Alerts

To understand database performance, you monitor a set of key performance indicators for your connected DB2 data server databases. Potential areas for concern are identified by critical alerts (red squares) and warnings (yellow triangles) on the performance manager dashboards and windows.

The Health Summary and Alerts list provide an overview of alerts across all your monitored databases. The Health Summary shows active alerts by category. The

Alerts list also provides information about active alerts, but also provides information about all the alerts that occurred during the monitored period.

#### 4.2.1 Alert list

To display the Alert List page (Figure 4-19 on page 160), from the OPM console, click **Task Manager**  $\rightarrow$  **Alert List**.

Health Summ	ager 🔹 🚯 Manag	e Database Connections							
Health Summ	117		Welcome - I	My Optim Cent	ral				<u> </u>
	ary 🛛 Alert List	×							
Recent	60 minutes 💌	Configure Send Add	d Comment						1   1 4 1 1 1 1
Severity	Alert Type	Start Time	End	lime	Data Source	Category	Alert Group	Partition/Member	Last Alert Value
<b>A</b>	Catalog Cache Hi	11/05/2010 11:11:03 AM	11/05/2010 1	1:12:03 AM	GOSALES	I/O	Database	0	93.65 %
	Rows Read per F	11/05/2010 11:08:03 AM	11/05/2010 1	1:09:03 AM	GOSALES	Workload	Database	0	32.47
	Failing Transactions	11/05/2010 11:07:17 AM	11/05/2010 1	1:11:17 AM	testdb_aix_1	Workload	Database	0	17.0 %
<b>A</b>	Package Cache H	11/05/2010 11:06:47 AM	11/05/2010 1	1:12:47 AM	DPF on A2/A3 TPCH	I/O	Database	3	72.73 %
<b>A</b>	Package Cache H	11/05/2010 11:06:47 AM	11/05/2010 1	1:12:47 AM	DPF on A2/A3 TPCH	I/O	Database	2	72.73 %
<b>A</b>	Package Cache H	11/05/2010 11:06:47 AM	11/05/2010 1	1:12:47 AM	DPF on A2/A3 TPCH	I/O	Database	1	72.73 %
	Workload	11/05/2010 11:06:40 AM	11/05/2010 1	1:09:40 AM	testdb_aix_1	Workload	Database		
<b>A</b>	Catalog Cache Hi	11/05/2010 11:05:03 AM	11/05/2010 1	1:08:03 AM	GOSALES	I/O	Database	0	94.55 %
	Package Cache H	11/05/2010 11:04:03 AM			GOSALES	I/O	Database	0	72.0 %
<b>\</b>	Workload	11/05/2010 11:03:45 AM	11/05/2010 1	1:06:45 AM	GOSALES	Workload	Database		
Alert Det	ails	1		Data Thro	ughput		=	Actions	
Category		Workload		2,000 -	٨	Rows Re	Rows Read		Workload Dashboard
Severity		Critical		ي 1,600 -		■Rows W	ritten		1 5
Alert Nam	e	Rows Read per Fetched	Row	5 1,200 -					
Last Alert	Value	32.47		₩ 800-					
Data Serv	er Time Zone	America/New_York		400-					
Start Time	on the Data Server	Nov 5, 2010 11:08:03 /	АМ			-			
End lime o	on the Data Server	Nov 5, 2010 11:09:03 /	AM	11/05 11:05:	00 11/05 11:07:40 11/05 11	10:20			_
Connection	n Name	GOSALES		Down road	Time		<b>_</b>		-
Warning	nember	50		Kows read	per retched row				
Criticalus	aiue	10.0		30 -	Δ	Rows Report 1	ad		
				24- 9 18- 12- 6- 11/05 11:05:00	11/05 11:07:40 11/05 11: Time		neu		

Figure 4-19 Alert List

The types of alerts that the Alert List displays depends on the type of data source and the alerts that are configured for each data source.

Alerts are enabled with default threshold values, which are set when you configure a database for monitoring. The thresholds determine when an alert is triggered. The key performance indicators are checked periodically by using a default sampling rate. If a threshold is breached, then an alert is generated and an indicator appears on the Health Summary, the Alerts list, and the associated dashboard. You can customize the alert thresholds as needed for your environment.

If you want to share details about an alert with system administrators or other users, you can send the alert in an email or add comments to the alert.

► To send a link to an alert in an email, select the alert and click **Send**. The email contains a link to the alert in Health Summary.

**Note:** Email communication requires that the Email Service is configured with a valid SMTP host name and port.

 To add comments to an alert, select the alert and click Add Comment. Comments added to alerts are visible to all users.

To view detailed information about an alert, click the alert in the grid and view the details in the bottom of the page. To view additional details and suggestions for troubleshooting the alert, click **View details** (

🔅 Optin	m Performance	Manager			bo	provsky   <u>Log out</u>
👋 Task Man	ager 🔹 🚯 Man	age Database Connections	lcome - My Optim Central			
Health Summa	ary Alert Lis	Alert Details and Troubleshootin	ng	Ν		3
Recent	60 minutes -					<b>T</b> 🛛 🔛 🛷
		Alert Summary		Alert Description		
Severity	Alert Type	Severity	Critical	The number of rows that had	to be read before the target rows were found.	ist Alert Value
	Rows Read per F	Alert type	Rows Read per Fetched Row			-
	Failing Transaction	Time	11/05/2010 12:50:17 PM			
•	Workload	Data source	testdb_aix_1			
8	Rows Read per F					
	Catalog Cache Hi	Alert Details		Actions		
	Package Cache H.	Category	Workload	Navigate to	Workload Dashboard	1
	Rows Read per F	Severity	Critical			기
	Failing Transaction	Alert Name	Rows Read per Fetched Row	Data Throughput	= m	
	Failing Transaction	Last Alert Value	48.09	1,200	Rows Read	
	Package Cache H.	Data Server Time Zone	America/New_York		Rows Written	
136 total it	ems	Start Time on the Data Server	Nov 5, 2010 12:50:17 PM			e 🔣 📢 Page 🛛
Alert Details	Alert Description	End Time on the Data Server	Nov 5, 2010 12:51:17 PM			
Alert Details	s Prier Description	Connection Name	testdb_aix_1			
Alert Det	ails	Partition/Member	0			
Category		Warning value	5.0	11/05 12:47:00 11/05 12:49:40 11/	/05 12:52:20	Workload Dashboard
Severity		Critical value	10.0	Time		
Alert Name	e			Rows read per fetched rov	w == 0	
Last Alert	Value			50	Rows Read	
Data Serve	er Time Zone			40-	per Fetched	
Start Time	on the Data Server			b 30-	Row	
End Time o	on the Data Server			<u><u> </u></u>		
Connection	n Name			2		
Partition/I	Nember					
Warning vi	alue			11/05 12:47:00 11/05 12:49:40 11/	05 12:52:20	
Critical val	lue			Time		
						ล
		Comments				
						1.
			0.			

Figure 4-20 shows a sample alert detail panel.

Figure 4-20 Alert details panel

Optim Performance Manager alerts could be classified into:

Health alerts

Health alerts are triggered by the Data Studio Health Monitor component of Optim Performance Manager. They provide database health status information, such as, data server status, storage space state and utilization, HADR state. To configure health alerts, select **Task Manager**  $\rightarrow$  **Health Alerts Configuration**. Figure 4-21 on page 162 shows a sample Health Alerts Configuration panel.

(C) Optim Performance Man	ager			borovsky   <u>Loa out</u>
🌞 Task Manager 🔽 🚯 Manage Dat	tabase Connections 💧 💩	elcome - My Optim Central		
Health Summary × Alert List ×	Health Alerts Configuratio	n ×		
Select a database to view and edit the c	- onfigurable alert parameters.	To edit alerts, you must have	the Can Manage Alerts privil	ege on the database. An administrator can use the Manage Privileges page to add this privilege
✓     Image: DPF on A2/A3 TP       ✓     Monitor database health	afresh every 10 🔺 m	inutes Apply		
Edit				e
Alert Type	Enabled	Warning Threshold	Critical Threshold	Alert Description
Monitoring Status	yes	Configured - Disabled	Monitoring startup failed	Shows the performance monitoring status.
Database Availability	yes	ROLLFORWARD, QUIESCE	QUIESCED, UNREACHABLE	Shows the availability of the database.
Connections	no	100	150	The number of application connections to this database.
Table Space Utilization	yes	90	95	The percentage of table space storage used has exceeded an alert threshold.
Table Space Container Utilization	no	90	95	The percentage of table space container storage used has exceeded an alert threshold.
Table Space Container State	yes		INACCESSIBLE	The state of the table space container
Table Space State	yes		OFFLINE	At least one of the table spaces is offline.
Table Space Quiesced	yes	QUIESCED		At least one of the table spaces is in QUIESCED_EXCLUSIVE, QUIESCED_SHARE, or QUIESCED_UP
Table Space Backup Pending	yes		BACKUP PENDING	One or more table spaces is in a BACKUP_PENDING state.
Table Space Drop Pending	yes		DROP PENDING	One or more table spaces is in a DROP_PENDING state.
Incomplete Recovery	yes		RESTORE PENDING, ROLL	The database recovery failed or is incomplete. One or more of the table spaces is in a RESTORE
HADR Operational State	yes		Primary HADR Database	The High Availability Disaster Recovery (HADR) operational state of the database.
12 total items				All V Items per page C Page
				Sinternet   Protected Mode: Off

Figure 4-21 Health Alerts Configuration

Performance alerts

Performance alerts represent database key performance indicators from different categories such as memory, I/O, locking, logging, and SQL. Example of performance alerts are Rows read per fetched row, Package cache hit ratio, Currently waiting applications, and Sort overflows.

To configure performance alerts, select **Task Manager**  $\rightarrow$  **Performance Alert Configuration**. Figure 4-22 on page 163 shows a sample Performance Alert Configuration panel.

😲 Optim Pe	rformance M	lanager							borovsky   Log out   About   🧃
🌞 Task Manager	• 🚯 Manage	e Database (	Connections 1	💩 Welcome - M	ly Optim Central				
Performance Ale	t Configuration	×							
Select a database privilege to a user By Alert By	to view and edit 1 Database	the configura	able alert param	eters. To edit ale	erts, you must have th	e Can Manage Alerts priv	vilege on the	database. An adminis	trator can use the Manage Privileges page to add this
Select the type	of alert to config	jure.	6						
Alert Name		Enabled	Warning	Critical	Description				
Package Cac	e Hit Ratio	ON	< 80 %	< 70 %	Indicates if the pack	age cache is large enough	h. A high hit	ratio avoids reloading (	packages and sections from the system catalogs (stati
Select the data	bases and partiti	ons to apply	the alert change	es to.					
Na	me	Enabled	War	rning	Critical	Authenticated	Data	abase server type:	DB2_LUW
DPF on A	2/A3 TPCH	ON		80 %	70 %	Yes	Con	nection name:	DPF on A2/A3 TPCH
Coord	nator partition	ON		80 %	70 %		Hos	t name:	SD0D03A2
🗹 Data p	artition	ON		80 %	70 %		Port	<b>b</b> :	50001
ETL pa	rtition	ON		80 %	70 %		Tim	e zone:	GMT -04:00 America/New_York
Catalo	g partition	ON		80 %	70 %		Ver	sion:	09.07.0003
GOSALES		ON		80 %	70 %	Connect	Con	iments:	
GOSALES	NEW	ON		80 %	70 %	Connect			
🐹 dtrader o	n L3	ON		80 %	70 %	Connect			
🐹 testdb_ai	_1	ON		80 %	70 %	Connect			
									Apply

Figure 4-22 Performance Alert configuration panel

**Note:** For partitioned DB2 databases, you can set different thresholds to different partition roles (catalog, data, coordinator). This requires that you have assigned partition roles to individual database partitions when you have configured your database for monitoring.

#### 4.2.2 Alert configuration

From the Alert List, you can configure the alert settings for a specific alert category and data source by selecting the alert and clicking **Configure Alerts**. This configuration is only applicable for performance alerts.

Alert configuration panel allows you to configure alert settings in two ways:

By Alert

You can configure individual alert settings for one or more databases. You can modify, enable, or disable setting as well as warning and critical threshold levels for this particular alert.

Figure 4-23 on page 164 Alert configuration panel - By Alert

lert Name			Enabled Warning Critical Description									
lows Read per Fetch	ed Row	•	<u>ON</u>	> [	5		> [	10		The nur	nber of rows that ha	ad to be read before th
elect the databases a	and partitio	ins to	apply th	e aler	t chang	ges t	ю.					
Name	Enable	W	arning	Cr	itical	1	Authe	nticat	2	Data	base server type	DB2_LUW
DPF on A2/A3 TP	ON		5		1	0	Y	es		Conn	ection name:	DPF on A2/A3 TPCH
🖌 Coordinator p	ON		5		1	0				Host	name:	SD0D03A2
🖌 Data partition	ON		5		1	0				Port:		50001
ETL partition	ON		5		1	0				Time	zone:	GMT -04:00 America/New_York
🖌 Catalog partit	ON		5		1	0				Versi	on:	09.07.0003
GOSALES	ON		5		1	0	Con	nect		Comr	nents:	
GOSALES_NEW	ON		5		1	0	Con	nect	-			
🔀 dtrader on L3	ON		5		1	0	Con	nect				
🐹 testdb_aix_1	ON		5		1	0	Con	nect				
									_			

Figure 4-23 Alert configuration panel - By Alert

► By Database

You can configure settings for any alert for a particular database. Use **Copy Settings** to replicate alert definitions to other monitored databases.

Figure 4-24 on page 165 shows the Alert configuration panel - By Database.
	n to work wit	n.						Copy Settings			
Name Database 1	Type Datab Name	ase		Host	Name	Port	Comments	Authenticate d			
DPF on A2/, DB2_LUW	TPCH		S	D0D03/	A2	50001		Yes			
Coordina'											
🗎 Data part											
ETL partit											
Catalog p											
GOSALES DB2_LUW	GSDB		9.	12.4.1	70	50001		Connect			
GOSALES_N DB2_LUW	GSDB		S	DODO3I	L3	50002	new db on different instance	Connect			
dtrader on L DB2_LUW	DTRAD	ER	s	DODO3I	L3	50001	from marcia	Connect			
Alerc Name	ON	•••a	95	96	< C	90 %	The ratio between asynchronous and total buffer pool read	I/O A high ratio i			
Alart Nama	Enabled	Wa	roina		Critical	1	Description				
Buffer Pool Async Read Ratio	ON	<	95	%	<	90 %	The ratio between asynchronous and total buffer pool read	I/O. A high ratio i.			
	ON	1 . [			Buffer Pool Async Read Ratio ON < 95 % < 90 % The ratio between asynchronous and total buffer pool read I/O. A high ratio i						
Buffer Pool Async Write Ratio ON < 95 % < 90 % The ratio between asynchronous and total buffer pool write I/O. A high ratio i											
Buffer Pool Async Write Ratio Buffer Pool Hit Ratio		<	95 95	%	<	90 % 90 %	The ratio between asynchronous and total buffer pool write The percentage of data, index, and XML data pages that we	I/O. A high ratio i. are already in the			
Suffer Pool Async Write Ratio Buffer Pool Hit Ratio Catalog Cache Hit Ratio		< (	95 95 70	% % %	<	90 % 90 % 60 %	The ratio between asynchronous and total buffer pool write The percentage of data, index, and XML data pages that we Indicates how well the catalog cache is helping to avoid actu	I/O. A high ratio i. are already in the al accesses to th			
Suffer Pool Async Write Ratio Buffer Pool Hit Ratio Catalog Cache Hit Ratio Currently Waiting Applications		< <	95 95 70 5	% % % %	<	90 % 90 % 60 %	The ratio between asynchronous and total buffer pool write The percentage of data, index, and XML data pages that we Indicates how well the catalog cache is helping to avoid actu The percentage of database connections are waiting for a lo	I/O. A high ratio i. are already in the ual accesses to th ock.			
Sutter Pool Async Write Ratio Suffer Pool Hit Ratio Catalog Cache Hit Ratio Currently Waiting Applications Sailing Transactions		< <tr>                        &gt;           &gt;</tr>	95 95 70 5 3	% % % %	< < >	90 % 90 % 60 % 10 % 5 %	The ratio between asynchronous and total buffer pool write The percentage of data, index, and XML data pages that we Indicates how well the catalog cache is helping to avoid actu The percentage of database connections are waiting for a lo The percentage of transactions that were rolled back explicit	I/O. A high ratio i. are already in the. val accesses to th. ock. tly or implicitly by.			
Suffer Pool Async Write Ratio Suffer Pool Hit Ratio Catalog Cache Hit Ratio Currently Waiting Applications Failing Transactions			95 95 70 5 3 90	% % % % %	< < > >	90 % 90 % 60 % 10 % 95 %	The ratio between asynchronous and total buffer pool write The percentage of data, index, and XML data pages that we Indicates how well the catalog cache is helping to avoid actu The percentage of database connections are waiting for a lo The percentage of transactions that were rolled back explici The space that is currently used by the database on the sys	I/O. A high ratio i. are already in the ual accesses to th ock. tly or implicitly by. stem to store reco.			
Sutter Pool Async Write Ratio Suffer Pool Hit Ratio Catalog Cache Hit Ratio Currently Waiting Applications Failing Transactions Log Space Used Package Cache Hit Ratio Dack Threshold Sorts			95 95 70 5 3 90 80	% % % % % % %	<	90 % 90 % 60 % 10 % 5 % 95 % 70 %	The ratio between asynchronous and total buffer pool write The percentage of data, index, and XML data pages that we Indicates how well the catalog cache is helping to avoid actu The percentage of database connections are waiting for a lo The percentage of transactions that were rolled back explici The space that is currently used by the database on the sys Indicates if the package cache is large enough. A high hit re	I/O. A high ratio i. are already in the al accesses to th bck. tly or implicitly by. atio avoids reload atio avoids reload.			
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Figure 4-24 Alert configuration panel - By Database

Optim Performance Manager can automatically purge alerts which are no longer important. Select **Task Manager**  $\rightarrow$  **Purge Alert Configuration** to specify time interval after which alerts will be deleted.

Figure 4-25 on page 166 shows the purge alerts configuration panel.



Figure 4-25 Purge alerts configuration

# 4.2.3 Alert notification

After you have configured alerts for your databases, you can setup alert notifications for individual alerts per monitored database. This allows Optim Performance Manager to send alert notifications to different individuals based on their responsibility for a particular monitored database or an alert category within the monitored database.

You can define alert notification parameters such as email addresses, SNMP trap generation, and alert frequency. To configure alert notifications, click **Task Manager**  $\rightarrow$  **Alert Notification.** Figure 4-26 on page 167 shows the Alert notification panel.

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Alert List ×	Alert Notificat	tion ×								
Configure ale To add, edit,	Configure alert notifications for the alert types associated with the selected database. To add, edit, or delete alert notifications, you must have the Can Manage Alerts privilege on the database. An administrator can use the Manage Privileges page to add this privilege to a									
	0 ≟ DPF on A2/A3 TP ▼									
Configure Ema	il and SNMP serv	ices Ena	ble All Disable A	I Add	Edit Delete Copy			\$		
Alert Type	Severity	Enabled	Email Addresses		Reminder Interval	Notify On Close	Blackout Time	Notes		
Rows Read	▲ 🗉	Yes		Yes	15	No				
1 total items							10 V Items	per page 🔣 🕢 Page 1 🛛 v of		

Figure 4-26 Alert notification panel

Optim Performance Manager can use two alert notification methods:

- ► Email
- ► SNMP trap

To configure these notification methods, click **Configure Email and SNMP** services and provide details for each of the methods, including:

- Address and port number of the outbound SMTP mail server that will be used to send email notifications.
- SNMP Management server that will receive the SNMP traps.

After you have configured alert notification services you can proceed to add and configure individual alert notification details. From the Alert Notification panel click **Add**. Figure 4-27 on page 168 shows the panel to add new alert notification. On this panel you can specify:

- Alert severity type: Warning or Critical.
- Email address: Specify email addresses of the recipients of the alert notification.
- SNMP trap generation: Optim Performance Manager alerts can generate SNMP traps, which can be forwarded to SNMP manager.
- ► Blackout period: Time interval during which alert notification is disabled.

New Alert Notificatio	n	×
Alert type:	Database Availability	
Alert description:	Shows the availability of the database.	
Severity:	Warning or Critical 🛛 🔻	
	✓ Enabled	
Email addresses:	Add Edit Delete	
Reminder interval:	<ul> <li>Send SNMP notifications</li> <li>Repeat every 15  minutes</li> </ul>	
	<ul> <li>Do not repeat</li> <li>Send a notification when an alert is closed</li> </ul>	
Blackout time:	O Blackout time: (GMT -4:00)	
	Start time: 06 : 08 PM	
	End time: 06 : 08 PM	
	No blackout time	
Notes:		
	OK	ncel

Select the **Enabled** checkbox to activate the alert notification for the alert.

Figure 4-27 Adding new alert notification

# 4.3 Inflight dashboards

After initial review of the database health from the Health Summary page and the Overview dashboard, which were described in 4.1, "Health summary" on page 149, we can continue to drill down for more detailed database performance information. Optim Performance Manager delivers this information in a series of database performance dashboards, which are grouped under the Inflight dashboards category. They provide information about a database that relates to a particular category of potential performance issues including buffer pool and i/o, locking, logging, memory, active SQL, system, utilities, and workload.

This section gives an overview of individual Inflight dashboards. To navigate to Inflight dashboards, select **Task Manager**  $\rightarrow$  **Inflight dashboards**.

### 4.3.1 Workload dashboard

The Workload dashboard (Figure 4-28 on page 169) shows information about the workload on the database. It provides detailed information about the sort performance, throughput of transactions, SQL statements and rows, as well as information about database connections. You can use this dashboard to check the utilization of the database.

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Sorting	Architectur	e J		_ Throughput _
Learn about sorting.				Transaction Throughput E200 Row Throughput E200
Sort Activity	E Sorts Total Hash Joins	Sorts per Transaction	Com Sorts per Transaction	100 100 100 100 100 100 100 100
0	E Average Time per Sort Sort Time	0- 11/08 10:06:40 11/08 10:46:40		Statement Throughput EIOW Statement EIOW Statement Throughput EIOW Statement EIOW St
5ort Overflows	per Minute			Connections Database Manager Connection and Agent Information Maximum database manager connections: 200
Sort heap size:		13.773 MB		Maximum database manager coordinator agents: 200
Sort Heap Related Overflo	Total Sort Related Overflows Sort Overflows OLAP	Piped Sorts in Instance	EP@	Maximum concurrent adive agents: 0 Maximum concurrent coordinator agents: 61 Ratio of agents created vs. agents @D@ Database Hanager Connections @D@ 48.00 agents created vs. agents agents configured Configu
Post Threshold Sorts				11/08 10:06:40 11/08 10:46:40 from pool 11/08 10:46:40 from pool
Private sort heap threshold:		0 bytes		Database Connection Information
Shared sort heap threshold:		68.879 MB		
Post Threshold Sorts	-	Sort Memory	== A m	Plaximum configured database connections: 63 Database Connections 의미에 Database Connection Perguests 의미에 또

Figure 4-28 Workload dashboard

**Note:** For partitioned DB2 databases, Workload Dashboard provides ability to display data for configured partition sets using *Select partition set for analysis* drop down menu.

# 4.3.2 System dashboard

The System dashboard (Figure 4-29 on page 170) shows the system resources of the system on which the database is running. It provides information about the CPU and memory utilization. If you have launched Optim Performance Manager from Tivoli Enterprise Portal Console, you can click on Advanced System

Information link of the System dashboard, which will take you to Tivoli panels that provide more detailed system information.

(2) Optim Performance Mana	ger			borovsky   Log out   About   🕢						
🐞 Task Manager 🔻 🚯 Manage Data	abase Connections 🛛 🎰 Welcome -	- My Optim Central		à li						
Health Summary × Workload ×	System ×									
Recent History 26 sec 10/27/10 17:4 System Dashboard: DPF on	istory       26 sec       11/02/10 10:16 - 11/02/10 11:16       11/02/10 10:16 - 11/02/10 11:16       11/02/10 11:16									
Show 5 V Average CPU Utilization (%) V										
Host Name	Partition/Member	Average CPU Utilization (%)	Real Memory in Use (MB)	Virtual Memory in Use (MB)						
sd0d03A3.itso.ibm.com	2	18	6,386	6,585						
sdudu3A3.itso.ibm.com	3	18	6,386	6,383						
sd0d03A2.itso.ibm.com	1	13	6,196	6,331						
				· · · ·						
Detailed Information for 0				Advanced System Information						
CPU		Memory								
Number of CPUs:	8	System real r	nemory: 6.6	25 GB						
CPU Utilization	Em age CPU tition	Memory Us 8.583.669 5,722.046 2,861.023 0	age Em Used Real Memory Used Swap Memory Eree Real Memory							

Figure 4-29 System dashboard

**Note:** For partitioned DB2 databases system dashboard displays performance data for every partition.

# 4.3.3 Buffer pool and I/O dashboard

This dashboard (Figure 4-30 on page 171) shows database I/O at the buffer pool, table space, and table level. You can see the highest and lowest buffer pools by selecting the metric that you want to learn more about. You can find the buffer pools with low hit ratios and high activity and consider increasing their size to improve performance. You can also find table spaces and tables with low hit ratios and high activity and consider statements that access those tables that might need tuning.

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H	salth Summary	Buffer Pool and	1/0 ×											
B	uffer Pool and	l I/O Dashbo	oard: DPF (	on A2/A3 TP	СН						0	DPF on A2/A3	TP V Disconr	ect
	Buffer Pools Table	Spaces Tables												
	Show Lowest 5	v buffer poo	Is by Hit Ratio	(%)	▼ Sh	iow Contained Obje	cts					Char	ge Configuration	ī
	Buffer Pool Name	Main Usage	Buffer Pool Size (pages)	Hit Ratio (%)	Logical Reads (/min)	Physical Reads (/min)	Physical Writes (/min)	Updates per Read	Avg Page Read Time	Avg Page Write Time	Prefetcher Hit Ratio (%)	Async Read Ratio (%)	Async Write Ratio (%)	
	Total		511,72	18.226	126,569.216	5 103,500.621	848.360	0.007	0.005	0.156	100	99.997	0.051	*
	📫 ВРЗ2К	MIXED	164,00	14.188	120,612.824	4 103,500.621	0	0	0.005		100	99.997		
	IBMDEFAULTBP	MIXED	315,87	100	5,956.392	2 0	848.360	0.144		0.156			0.051	
	BP32KTMP	UNKNOWN	31,60		0	0 0	0							٢
	IBMSYSTEMBP32K	UNKNOWN	64			0 0	0							
•	Detailed Inform	ation for BP3	2K	tehora			Utilization :	and Health						
0	eneral		Preie	curiers.				ind Healdh						
	Buffer pool name:	BP32K	Nu	mber of I/O server	s: 3		Buffer P	ool Size		Buffer Pool	Hit Ratio	- 0		
	Page size:	32 KB	Nu	mber of prefetch	6,733.8	306 /min	180,000			18 -		<u>^</u>		
	Main usage:	MIXED	Ter	juesis:			- 120,000		Buffer Pool	12-	$\sim\sim\sim\sim$	Total		
	Buffer pool size:	164,000 page	PI PI	eretching Activit	y	<u>::</u>	60,000		0.20	8 6-		Temporary		
				80 -	Prefe	tcher Hit				0		Index-		
			*	40 -	Ratio	chronou	11/08	12:13:20 11/08 13:00:	00	11/08 12:13:20	11/08 12:50:00	Temporary		
					s Rea	ad Ratio								
				1/08 12:13:20 11/08 12:	50:00		Logical	Page I/O		Logical ver	sus Physical I/(	Activity 😳		
							120,000			120,000 -	~~~~~	Logical I/O		
							.⊑ so,ooo-		Temporary	. 🗧 80,000 -		Physical I/O		
<u>I</u> /	O Cleaners						40,000		Index - Non-	40,000 -				
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	Changed pages thre	shold:		80										
	Asynchronous V	Vrite Ratios					Read/W	rite Activity		Average I/	0 Times			
		_	^				120,000		Write I/O	0.004		Asynchronou		
	80-	Total Asyn	chronou				· E 80,000 ·		■Read I/O	8		s I/O read		
	× 40-	s Wri	te Ratio				40,000		Direct Write	s 0, 0.002-		time Asynchronou		
	0-	Asyn	chronou Wirite				0		□Direct Reads	s		s I/O write		h
	11/08 12:13:20 11/08 1	2:50:00					11/08	12:13:20 11/08 13:00:	00	11/08 12:13:	20 11/08 12:53:20	2		

Figure 4-30 Buffer Pool and I/O dashboard

Click an item in the grid to view details about that item in the Detailed Information area. Select a buffer pool and click **Show Contained Objects** to view the table spaces that use that buffer pool. Select a table space and click **Show Contained Objects** to view the table objects that the space contains.

**Note:** For partitioned DB2 databases buffer pool and I/O dashboard displays performance data which is aggregated over all partitions.

### 4.3.4 Memory dashboard

This dashboard (Figure 4-31 on page 172) shows the memory consumption of the selected database. It shows memory usage by instance, by database, and by application, and shows memory that is shared between applications.

(Contin Perform	nance Manage	er								bo	rovsky   <u>Log out</u>	About   🕜
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Health Summary 🛞 Wo	rkload 🛛 Sys	tem 🛛 Buffer Po	ol and I/O × Men	nory ×								
Recent History 46 sec	10/27/10 17:44	10/28 19:37 10/25	Learn 21:31 10/30 23:24	about the time	e controls.		15:05 11/04 0 t enough perform	nance dat	/05 08:52 11/06 10 a is available for the se	11/08 :45 11/07 11:3 elected time interv	America/New_York /10 12:33 - 11/08/10 13:33 9 11/08/10 13:33 al to calculate performan	End Time: 11/08/10 13:33 Duration: 1 Hour
Memory Dashboar	d: DPF on /	А2/АЗ ТРСН									DPF on A2/A3 TI	P • Disconnect
Scope: Database Global	cope: Database Global Memory v Partition set: All partitions v Partition: Global Show highest v Buffer Pools v											
Graph Grid			tition ID	B	uffer Pools							
Selected layer: Buffe	er Pools	▼ Fit User	Memory		📫 Glob	al			1.817 GB			
					0				1.817 GB			
200000000								3			1.817 GB	
160000000-								2			1.817 GB	
N								1				1.817 GB
··· 80000000-												
40000000-												
0	11/08 12:43:	20 11/08 12:53:	20 11/08 13:03:20	11/08 13	8:13:20 11/0	08 13:23:20	-	✓ Displa	v this list by the select	ted graph laver		Explore Partition
Health Overview for	Partition Glob	al										
Memory Area	Current Size and	Utilization			Hit Ratio (%)				Configuration Parameter Name	Configuration	Details	
										Value		
Database memory limit			2.463 GB						database_memory	645,552 pages		
Database heap - other			36.906 MB						dbheap	2,397 pages		
Database heap - log butter			1 MB		E 10 300 W	_	11		logbutsz	256 pages	Logging Dashboard	
Burrer pools			5 922 MB		A 79 144 %				ackracherz	1 522 03005	Buffer Pool and 1/0 Das	nooard
Catalog cache			608 KB		97,940 %				catalographe sz	300 pages		
Utility heap			240 KB						util heap sz	26,322 pages	Output Utilities Dashboard	
Lock list	0.227 %		26.625 MB	7					locklist	6,200 pages		
Shared sort heap	4.283 %	1	2.328 MB	2					sheapthres_shr	13,915 pages	Extended Insight Analys	is Dashboard
			-									

Figure 4-31 Memory dashboard

Select the Graph tab to display the statistics of the memory scope that you selected as a distribution chart. The layer (memory area) of the highest value is highlighted by default. Use the Selected layer menu to select a specific memory area to be highlighted both in the chart and in the bottom of the Health Overview table.

In a multi-partition environment, a table to the right of the Graph displays the partitions that have the highest values of the selected memory area. You can use the menu above this table to specify a memory area as well. To view the memory consumption of a specific partition or member, double click a partition, or select one of them and click **Explore Partition**.

The bottom Health Overview table shows the health status of a database. By using the Health Overview table, you can see how the memory areas are configured, the allocated size of the areas and how much of the allocated memory is in use, and check the efficiency of the memory area by examining at the hit ratio. By looking at this information, you can determine if a memory area is healthy or not, whether you want to increase the size of the memory area, and whether you can decrease the size to release some memory.

# 4.3.5 Locking dashboard

This dashboard (Figure 4-32) shows deadlocks, timeouts, and locking conflicts. You can use this dashboard to determine which workload applications, users, or servers have the most locking problems, and you can drill down to find the waiting or blocking connections and events.

	Optim Perfor	mance Ma	nager							borovsky   Log	iout   About   🕜
<b>8</b> 1	Task Manager 🔻	🔥 Manage Da	atabase Conne	ctions 💧 💩 Weld	come - My Optim Central						ê 🖬
Healt	th Summary 🐳 🕅	/orkload	System	Buffer Pool and	I/O Memory L	ocking	×				
Recei	nt 😱				Learn about the time	e controls.	11/03/10 1	9:19 - 11/03/10 20:19		America/N	lew_York End Time: 11/03/10 20:19
Histor	ry Refresh			39 10/29 21:34		24 11/0	02 03:19 11/03 05: Not e	15 11/04 07:10 11/05 09 enough performance data is av	ailable for the selected tir	1/07 11:55 11/08/10 13:51 me interval to calculate perf	orman 1 Hour
Loc	ocking Dashboard: DPF on A2/A3 TPCH										
This	his dashboard shows the workload cluster groups that are in a locking situation. Click a workload cluster group to view locking information for that group.										
Ove	verview										
A	Activate Deactivate New Edit Copy Delete Change Configuration										
	Database Wo	orkload	Maximum	Wait Time	Maximum Block Time	Lo	ck Wait Alerts	Deadlocks		Timeouts	
	DPF on A2/A3 TF	РСН		13.988	13.988		0	C			0
	Client applica	tion names		13.988	13.988		0	C			0
	🗋 clp myq11	.sql		0	0		0	Q			0
	🗋 dailysales			0	0		0	a			0
•	D			13.988	13.988		0	a			0
	clp myq10	.sql	0		0		0	0			0
	clp myq12	.sql	0		0		0	a			0
	] clp myq8.s	ql	0		0		0	0 0		1	
	Host names/I	P addresses		13.988	13.988		0	C	1		
	Client user ID	)s		13.988	13.988		0	a			0
	Application Ty	/pes		13.988	13.988		0	a			0
⇒ <u>L</u> o	ocking Informat	ion for N/F	)								
Loci	king Event (0) Curi	rent Waiting (	Connections (	(3) Current Bloc	king Connections (3)						
The	grid shows applicatio	ons that are wai	iting for locked	objects for the se	lected workload cluster group	. Choose a	an application and clic	k Analyze to view more inform	ation, force the applicatio	in, or stop the statement the	t the application is running.
java	a a a a a a a a a a a a a a a a a a a	9.12.5.104.4	2436.10110	watchine	4.857 11/03 20:	:17:47 Loc	ck Wait	DB2IAIX	-	sd0d03A1.itso.ibm.com	ІВМ ОРМ
OPN	4RepositoryServer6	9.72.143.12	4.57784.101		13.988 11/03 19:	:09:18 Loc	ck Wait	DB2IAIX -		fogcity	IBM_OPM
OPN	4RepositoryServer6	9.72.143.12	4.59598.101		0 11/03 19:	:32:34 Loc	ck Wait	DB2IAIX	-	fogcity	IBM_OPM
Ana	alyze										

Figure 4-32 Locking dashboard

To analyze a locking event:

- In the Overview grid, click the workload cluster group, workload cluster, or the database for which you want to view locking information.
- In the Locking Information grid, click the connection (waiting or blocking) or event that you want to analyze.
- Click Analyze.

Figure 4-33 on page 174 shows the Analyze Locking Situation panel. This panel displays the complete lock tree for waiting or blocking connection. Each complete set of entries in the tree includes an application that is holding a lock and the applications that are waiting because of that lock. The entries between the main entry and the leaf entry are applications that are blocking and waiting. Each leaf

entry is an application that is only waiting. In case of a deadlock event, waiting connections are also blocking connections. Deadlock analysis is described in detail in Chapter 7, "Analyzing locking problems" on page 251.

You can also use this panel to force an application, and stop or tune the statement that the application is running.

**Note:** Workload cluster groups and workload clusters are shared with the Extended Insight dashboard. For their description, refer to section 4.4, "Extended Insight dashboard" on page 178

java	Details about the lock	ed object	Details about the app	lication
CPMRepositoryServer6	Table Name:	SYSEVENTMONITORS	Application Mode:	Exclusive Lock
📻 java	Table Schema Name:	SYSIBM	Application Name:	java
OPMRepositoryServer6	Table Space Name:	SYSCATSPACE	Agent ID:	839
	Lock Type:	Х	Application ID:	9.12.5.104.42436.10110
	Lock Mode:	Exclusive Lock	Authentication ID:	DB2IAIX
	Lock Object Type:	Table Row Lock	Client User ID:	
	Lock Wait Time:	4.857 sec	Client Application Name:	IBM_OPM
	Sequence Number:	00008	Client Workstation Name:	sd0d03A1.itso.ibm.com
	Lock Mode Requested:	Next-key Share Lock	Application Status:	lock wait
	Lock Type Requested:	NS	Force Application	
	SELECT T1.EVMONNAME FR. T2.EVMONNAME AND EVENT	DM SYSCAT.EVENTMONITORS _MON_STATE(T1.EVMONNAM	S AS T1, SYSCAT.EVENTS AS T2 V E) = 1 AND T2.TYPE='STATISTIC	NHERE T1.EVMONNAME =
	SELECT TI. EVMONNAME FRI T2.EVMONNAME AND EVENT Rows Read: Rows Written: Statement Elapsed Time:	OM SYSCAT.EVENTMONITORS _MON_STATE(T1.EVMONNAM 9 0 0 0 sec	S AS T1, SYSCAT.EVENTS AS T2 V (E) = 1 AND T2.TYPE='STATISTIC Stop Current Statement ③ Go to the Active SOL Das	Stow All Text Tune
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Figure 4-33 Analyze locking situation panel

# 4.3.6 Logging dashboard

This dashboard (Figure 4-34 on page 175) shows the configuration and logging activity. You can use this dashboard to determine how recovery is impacted and whether tuning is needed for the log files or log buffer. High average log read/write times, which are in the Logging activity and I/O performance section of

Logging dashboard, can indicate whether disk configuration for the database log files can be responsible for the database performance degradation.

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🌞 Task Manager 💌 🍉 Manage Database Co	nnections 👌 Welcome - My	Optim Central			
Health Summary Vorkload System	Buffer Pool and I/O	Memory K Lock	king 🔹 Loggi	19 ×	
Logging Dashboard: DPF on A2/	АЗ ТРСН				👔 🏥 DPF on A2/A3 TP 🔻 Disconnect
Log Configuration Architectur	e 🕄		-	Log Buffer	
Log file size:	390.625 MB			Buffer size:	1 MB
Number of primary log files:	25			Commits before buffer is flushed:	1
Method used for logging:	CIRCULAR LOGGING	;		Number of Buffer Full Events	
Allowed number of secondary logs Log path: Mirroring log path: Log the creation and reorganization of indexes:	i that is used for logging, such as CIF RCHIVING TO VENDOR SYSTEM, o /db2data/db2iaix/NC  OFF	CULAR LOGGING, LOG r ARCHIVING via USER I DE0000/SQL00001/SQ	RETAIN, ARCHIVIN EXIT. QLOGDIR/	G 0. 40. 1003 20:000 11/03 19:50-10	
Log Space			_		
Block application when out of space:	No			Memory Dashboard	
Log Space Used 🖘 📾	Log Space Used			Long Running Unit of Recovery	_
228.882. Primary Logs 152.585. 76.294- 0- 100 - 1	2.400- 1.800- % 1.200- 0.60- 0.400- 1.1/02.10-00-11/02.20-00	<ul> <li>Total Amount of Active Log Space</li> </ul>	[	Log file limit for a unit of recovery: Log space limit for a unit of recovery: Crash Recovery	0 0 
				Last backup:	
Percentage of log space used			7	Run-at target for crash recovery log space:	520
Top member:	3.445 %			Partition/member with most logs to be read for potential	1
Bottom member:	2.149 %			Log to be read for potential crash recovery on that	388.382 MB
Maximum secondary log files in use			7	partition:	
Top member:	0			Log buffer read hit ratio:	
Bottom member:	0			Log to Be Read for Potential Crash Re 📰 🌚	
Indoubt Transaction Logging Activity and I/O Performance Average log amount per day:	4.317 GB		_	381.470. 2 190.752. 11/03 19:20:00 11/03 20:06:40	
Log Activity	Log I/O Times	E @ Average Log Read Time Average Log		Buffer Pool and I/O Dashboard	-

Figure 4-34 Logging dashboard

**Note:** For partitioned DB2 databases, Logging Dashboard provides ability to display data for configured partition sets using *Select partition set for analysis* drop down menu.

# 4.3.7 Active SQL dashboard

This dashboard (Figure 4-35 on page 176) shows SQL statements which were running at the time when Optim Performance Manager snapshot was taken. You can select an SQL statement from the list and look through the key performance indicators (KPIs) in the SQL Statement Details area to see if the statement impacts your system negatively. From this dashboard, you can stop queries and force applications if needed. You can tune these SQL statements with Optim Query Tuner, if it is available.

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*	Task Manager 💌	🚯 Manage Da	tabase Connections	💩 Welcome - My C	Optim Central							ê Li
Heal	ith Summary	Workload	System 🛞 Buffe	r Pool and I/O	Memory × Loc	king 🛛 Logging	Active SQL	×				
Ac	tive SQL Dash	board: DP	F on A2/A3 TP	СН						0	DPF on A2/A3	TP • Disconnect
Lear	rn about tuning SOL s	statements, stop	oing SOL statements, a	nd forcing application	15,							
						turin Others						
SI	iow nignest 5	• by Elaps	ed lime	Show Addition		istomize Columns						
	Statement Text	Start Time Star	np Stop Time Stamp	Elapsed Time	Costs (timerons)	CPU Time	Sort Time	Sort Overflows	Rows Read	Rows Written	Logical Read I/O (pages)	Physical Read I/O (pages)
	select o_year, su	11/03 17:55	:22 11/03 20:05:4	9 02:10:26.347	1,618,874	4 28:51.015	27:37.867		730,592,612	49,986,622	133,623,692	4,425,511
	select c_custkey,	11/03 18:05	:34 11/03 20:05:4	9 02:00:14.637	2,043,812	08:06.169	06:06.389		632,306,450	12,090,792	56,149,074	5,742,357
	select o_orderpri	11/03 18:59	:45	- 01:18:03.428	1,634,487	03:11.453	2.537		578,986,838	326,752	64,903,225	2,547,834
-	select ps_partkey	11/03 20:06	:29	- 11:19.946	374,619	32.541	3.684		83,549,280	5,417,935	2,386,431	31,161
	select n_name, s	11/03 20:06	:50	10:58.639	3,092,134	48.657	0		97,047,980	500,576	5,909,216	362,752
						10000						
⇒ <u>s</u>	QL Statement D	etails										
St	atement			_	Row Statistics			_	Time			-
_					Davis sands		83 540 380	N	Classed Name		11.10.046	
	select ps_partkey, su	im(ps_supplycos	t * ps_availqty) as val	ue from	Rows fetched:		0	13	Start timesta		11/03 20:06:29	
	tpcd.partsupp, tpcd.s	upplier, tpcd.nat	on where ps_suppkey	= s_suppkey	Rows read for	each fetched row:			Stop timestar	np: np:		
	and o_nadointey - n			, oup by pill	Rows written:		5,417,935		CPU time:		32.541 sec	
									Average CPU	:	0 %	
	Identify Workload	Stop Current	Statement Show	All Text Tune	Application/Worl	kload		_	Sort time:		3.684 sec	
C	Coordinator partition/	member:	0		Application name	a:	db2bp.exe		Sorts:		3	
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N	lost recently execute	d operation:	SQL Fetch		Application ID:	:	9.12.4.140.1879.1	01102175519	Ruffor Rool Coo	hina		
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_	Version:				Client workstatic	on name:			ingoloarroad i,		orfror pageo	
_	Consistency token:				Client application	n name:			Hit Ratio	Regular D	ata Tem	porary Data
-	Section number:		201		Client operating	system:	NT		Data	98.830	96.82	4
Tr	ansactions			_	Accounting string	9:			Index	75.336		
					WORKIDBU ID:				XDA			
Т	ransaction start time	stamp	11/03 20:06:29				F	orce Application				
T	ransaction lock wait	time	0 sec									
1	ransaction log space	used	u bytes									

Figure 4-35 Active SQL dashboard

**Note:** Data presented in this dashboard is based on application snapshot metrics. These snapshots are taken at intervals specified during the Optim Performance Manager configuration of the monitored database in the *Active SQL and Connections* profile, for instance, every 2 minutes. SQL statements which begin and end between the snapshots are therefore not captured in this dashboard.

### **Tuning SQL statements**

The process of tuning an SQL statement consists of first analyzing the statement, and then changing the SQL statement based on the results of the analysis.

Check the key performance indicators in the SQL Statement Details area for statements that you might want to tune. For example, a high value of sort time might indicate that an index is missing, and a high value of rows read per fetched row might also indicate that an index is missing. If one of these two values is high and the total execution time is unusually high, then tuning the statement is recommended. To tune the statement, start Optim Query Tuner product. and click **Tune** on the Active SQL dashboard. Optim Query Tuner can provide recommendations about indexes, materialized query tables (MQTs), or statistics to improve the execution of the SQL statement.

### **Stopping SQL statements**

Check the key performance indicators in the SQL Statement Details area for statements that you might want to stop. For example, check the values for CPU time, sort time, and physical reads. If they are very high, then other workloads might be impacted. In such cases, you might want to stop the statement. Some applications might be allowed to use a great amount of resources, so the decision to stop the statement also depends on the application that is executing the statement. Look at the Application/Workload section to see which application is executing the statement so that you can decide if the resource usage is unusual. If you decide that you want to release the resources to the system, you can stop the statement by clicking **Stop Current Statement**. This will roll back the current statement.

### **Forcing applications**

Similarly to stopping currently executing SQL statement, you can also use Active SQL dashboard to force an application by clicking **Force Application**. Forcing an application cancels the database connection that is being used by the application.

**Tip:** The impact of canceling a connection might be very big. Therefore, consider using the Stop Current Statement button instead to reduce the impact.

# 4.3.8 Utilities dashboard

This dashboard (Figure 4-36 on page 178) shows the status and progress of utilities such as RUNSTATS, LOAD, and BACKUP. You can get information about utilities that are in progress and that completed, and you can identify utilities that failed. You can use this information to determine if some utilities should run at different times to avoid high workloads.

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🐞 Task Manager 🔻 🕒 Manage Database Connectio	ns 💩 Welcome - My Optim Central		<u>a</u> 1						
Utilities × Current Utilities ×									
Recent History 34 sec 10/27/10 17:44 10/28 20:05	Learn about the time controls.	14 b 11/03/07/49 11/05/12/30 11/05/12/30 Not enough performance (data is available for the sel	America/New_York         End Time:           11/06/10 17:33 - 11/06/10 18:33         11/06/10           31 31/07 16:12 31/08/10 18:33         Duration:           Ceted time interval to calculate performan.         11/08/10 18:33						
Utilities Dashboard: DPF on A2/A3 TP	СН		👔 🏥 DPF on A2/A3 TP 🔻 Disconnect						
Summary									
Utility Overview	Time         System CPU Consum           RUNSTATS         50           16         50           16         50           16         10           11/08 17:33.20         11/08 18:18:18	Transactions           • System CPU Consumption         00 50 50 50 50 50 50 50 50 50 50 50 50 5	Rows Written ansactions						
ID Partition/Member Type	Description	Start Time End Time	Elapsed Priority Completion Invoker Time State						
40851 0 Runstats	TPCD.ORDERS	17:49:48:835 1 17:58:33.	08:44.335 0 Ended User						
Details for Utility 40851									
Phase Start Time	Utility Phase	Phase Type	Progress						

Figure 4-36 Utilities dashboard

# 4.4 Extended Insight dashboard

The Optim Performance Manager Extended Insight dashboard displays end-to-end data about the entire database application system, which includes clients, application servers, data servers, and the network. Monitoring begins when you initiate a transaction, continues as that transaction is processed by each component, such as the client, network, and data server, and ends when the application finishes processing and produces the results.

Figure 4-37 on page 179 illustrates software layers which are involved in the database transaction. Optim Performance Manager Extended Insight is able to identify how much time a database transaction spends in each layer (Application server, database driver, network, database server). For monitored databases that are at DB2 9.7 Fix Pak 1 or above, Optim Performance Manager Extended Insight can further break down the transaction response times at the database server layer, that is, average compilation time, sort processing, I/O processing, lock wait, and so on.

This can help database administrators to determine which software layer is responsible for the slow database transaction response time.



Figure 4-37 Extended Insight end-to-end monitoring

Extended Insight dashboard consists of two panels:

- Overview panel
- Details panel

# 4.4.1 Extended Insight dashboard overview panel

Figure 4-38 on page 180 shows a sample Extended Insight dashboard overview panel.

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Figure 4-38 Extended Insight dashboard overview panel

You can use the overview panel to view:

Statistics in the grid

The Extended Insight Analysis overview grid lists statistics for the workload cluster groups, workload clusters, and database that you are monitoring. Key statistics in the grid are:

- Average end-to-end response time
- Maximum end-to-end response time
- Average data server time
- Average network time
- Average client time

You can double-click a row in the grid to view response time details for a workload cluster group, a workload cluster, or the entire database.

Charts

You can view charts for a selected workload cluster group, workload cluster, or database by clicking the icon in the left column of the grid. Figure 4-39 on page 181 shows the chart for the selected workload cluster.

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🌞 Task Ma	anager 🔻 🔥 Manage Databas	se Connection	s 💩 Welco	ome - My Optir	n Central									d.	a 🖬
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🚵 Show	db2ats-task: opm_@cc2	0.448		1.181	<b>♦</b> 0.448		-			0.872	2.404	2	1.745		🔺
🚵 Show	db2ats-task: opm_@cc2	0.447		0.973	<b>♦</b> 0.447					0.872	2.191	2	1.745		
Show	db2ats-task: opm_@ccz	0.429		1.066	0.429					0.872	2.064	2	1.745		
Show	<b>*</b>	0.352		12.451	0.352					15.170	1,756.021	0.345	76.319		=
Hide	*ei01	0.120	1.040	9.800	♦ 0.101	0	÷0.020	D		219.029	4,174,468	1,472.534	214,909.353		0
Show	► ▼ Application Types	0.149	1.040	12.451		0	0.020	0 0		178.851	3.021.598	1.304.627	155.553.128		0
➡ <u>Charts</u>	for selected workload clu	ster group	)5												
0.160. 0.160. 0.120. 0.100. 0.060. 0.060. 0.060. 0.060. 0.060. 0.060. 0.060. 0.060.	12:05 20:05:00 12:05 20:23:30 Time	Avera to-Em Respc Time Maxin time of runnin transa	ige End- d onse num of ng action												
												Page size	e 4 💌 H	( - 1-1 of 1	$\mathbb{P}_{\mathbb{H}}$

Figure 4-39 Chart for the selected workload cluster

You can double click on the chart to obtain more detailed information about the transaction end-to-end response times for the selected workload cluster group, workload cluster, or the entire database. This detailed information also contains response time histogram, which groups transaction end-to-end response times into discrete ranges. Bar for each range of values represents the percentage of transactions, which completed within the particular range. Figure 4-40 on page 182 is an example of a detailed information displayed for the selected workload cluster chart.

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Workload group.	ds are listed in the grid. Cli	ick in the left	column to sho	w the chart for	0.000- to-End Response	.er
Open	Details Activate D	eactivate	New Ec	lit Copy	Maximum Expand Collapse	
Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum / End-to- End S Response 1	Average End-to-End Response Time     Average End-to-End Response Time     Average End-to-End Response Time	
े Sh	▼	0.144	1.040	10.513	Maximum time of running transaction . 1,348.229 208,854.143	0 🔺
े Sh	► 🗢 Client user IDs	0.144	1.040	10.513	Overall average response time per	0
े Sh	Client application r	0.144	1.040	10.513	Maximum response time:	0
🔤 Sh	🗢 db2ats-task: op	0.508		1.269	Maximum Time of running transactions + 1.040 sec 7 2 2	
े Sh	+ db2ats-task: op	0.482		1.127	Warning threshold: None  Chical threshold: None  D 2 2	
े Sh	db2ats-task: op	0.474		1.216	Alert History B 3 2 2	
े Sh	db2ats-task: op	0.470		1.181	BO	
े Sh	db2ats-task: op	0.460		0.973	5 40. 7 2 2	
Sh	♥ db2ats-task: op	0.439		1.066	0 7 2 2 12/05 19:20:00 12/05 19:33:20 12/05 19:46:40 12/05 20:00:00 12/05 20:13:20	-
Sh	•	0.388		10.513	8 0.355 87.233	
Hide	▼ei01	0.120	1.040	9.800	Warning Problem	•
⇒ <u>Char</u>	ts for selected work	doad clust	ter groups		Response Time HistTime 15 ms	-
ei01	Fit Ma	ximum Alert	History On	7 M X	24-	
0.160 0.140 0.120 0.100 0.080 0.080 0.040 0.020 0.12/0	5 19-20-00 12/05 19-43-20 12/ Time	/05 20:06:40	Averag to-End Respon Time Maximu time of running transac	e End- se m	ge       1	10
						<u> </u>

Figure 4-40 Detailed information for the selected workload cluster chart

# 4.4.2 Extended Insight dashboard details panel

Use the Extended Insight dashboard details view to locate the source of performance problems, determine how those problems affect different parts of the workload, and analyze the performance of individual SQL statements, clients, and partitions.

To view details panel, double click on the workload cluster group or workload cluster in the overview panel. Figure 4-41 shows an Extended Insight dashboard details panel.

#### Draft Document for Review January 13, 2011 8:13 pm

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Workload Manager Configuration	e Database Connections Y	ctended Insight Dashb	oard ×									
Recent History Refresh 11/01/10 19:00 11/03	22:42 11/06 02:25 11/0	Learn about the time co	11/12 12:35 1	1/14 16:18 11	<b>11/19/</b>	<b>10 12:14 - 11/19/10 13:14</b>	Ame 11/23 07:11 11/25/10	rica/New_York End Time: 11/19/10 13:14 • Duration: 10:56				
Aggregation level:1	Aggregation levels											
Extended Insight Analysis Dashboard: GOSALES_NEW												
Locate the source of performance problems, determine how those problems affect different parts of the workload, and analyze the performance of individual SQL statements, clients, and partitions.  Response Time Details: order entry												
Graph Grid		án la Fr	·	SQL Statements	Clients		~ 1					
0.02-		<u> </u>		Statement	io 🔹 o	Statement Executions	Average Data Server	Average End-to-End				
				INSERT INTO	GOSALESC	1	Time 0.002	Response Time				
0.016-				INSERT INTO	GOSALESC	1	0.005	0.728				
g 0.012-			×	INSERT INTO	GOSALESC	1	0.084	0.603				
0.008-		_ A	A -	INSERT INTO	GOGALESC	1	0.005	0.545				
0.004				INSERT INTO	COGALESC	1	0.005	0.545				
0.004				INSERT INTO	GOSALESC	1	0.006	0.539				
0	2:36:40 11/19 12:46:40 11/1	9 12:56:40 11/19 13:06	:40	Display this lis	by the selec	ted graph laver	0.006	0.531				
			in the second									
Detail Area for Average End-to-End	Response Time											
End-to-End Response Time												
Overall average response time per transaction:	0.014 sec											
Maximum response time:	1.707 sec											
Maximum Time of running transactions	0.657 sec											
Number of executions:	73,255							=				
Statements: Statement Failure Pate:	/3,255											
Statement railure Rate.	0 78											
Time Distribution (%)	Transaction Throughput	E Sta	tement Throughp	ut								
57.140 % Clent time Data server 28.570 % 14.290 %	600 600 000 11/19 12:16:40 11/19 12:56:40	Transaction throughput	00-00-00-00-00-00-00-00-00-00-00-00-00-	Statem throug	ent nput							
								•				

Figure 4-41 Extended Insight dashboard details panel

The details panel contains several tabs.

### Graph tab

The Graph tab shows response times for the components of the workload cluster group, workload cluster, or database for the time frame that is selected on the time slider. The graph shows time layers for each component, such as the data server, client, and network. Use the Selected layer list or click a layer in the graph to view details for that layer in the bottom pane of the dashboard. Figure 4-41 is an example of a details panel with the Graph tab for the selected layer of Average data server time per transaction. The details area of this panel displays more information relevant to the selected layer.

### SQL Statements tab

The SQL Statements tab lists the SQL statements that were run by the transactions of the workload cluster group, workload cluster, or database for the time frame that is selected on the time slider. Click a statement from the list to view details for that statement in the details area of the dashboard. Details area consists of two tabs:

General information tab

This tab shows the general SQL statement information such as statement text, end-to-end time spent metrics.

Figure 4-42 shows the details panel with the SQL statement general information.

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Extended Insight Dashboard × Overview ×	
Extended Insight Analysis Dashboard: GOSALES_NEW	
Back	
Locate the source of performance problems, determine how those problems affect different parts of the workload, and	analyze the performance of individual SQL statements, clients, and partitions.
Response Time Details: order entry	
Graph Grid	SQL Statements Clients
Selected layer: No layer selected 💌 🖄 🗓 Fit Average	Show highest 10 V by Average End-to-End Response Time
10 ····	Statement Text Statement Executions Average Data Server Average End-to-End
11/10 09:10:00 11/10 09:20:00 11/10 09:30:00 11/10 09:40:00 11/10 09:50:00 11/10 10:00:00 11/10 10:10:	nn ✓ Display this list by the selected graph laver
Detail Area for SQL Statements	
General Information Statement Server Execution Details	
Statement information	Statement Performance
SELECT CUST_CC_ID, CUST_CODE, CRDT_METHOD_CODE, CUST_CC_NUMBER, CUST_CC_SERV_CODE,	Average and to and alonged times 0.048 con
CUST_CC_EXP_DATE FROM GOSALESCT.CUST_CRDT_CARD WHERE CUST_CODE = ? FETCH FIRST 1 ROW	Average client time: 0.025 sec
ONLY	Average driver time: 0 sec
	Average network time: 0.007 sec
Show All Text Tune	Average data server time: 0.015 sec
Package pamer	Overall Time Distribution
Section number: 0	
Package Consistency token:	53.190 %
Package Version:	Driver time
Collection:	Petwork time
Java class Java Mathed Course Build Course Mathed Applicatio Matadata	14.890 %
package line version expressio Signature n Name File	
	Statement Outcome
	Failure rate (with penative SQL code):
	First SQL code:
Transfer Volume	
August between the second level in the second	
Average bytes transferred focally: U bytes	
Average bytes transiened remotely. 1.051 KB	

Figure 4-42 Details panel - SQL statement general information tab

Statement server execution details

This tab (Figure 4-43) shows the details of this SQL statement from a data server execution perspective. It displays information such as row and sort performance, I/O statistics, locking statistics, and data server execution times.

#### Draft Document for Review January 13, 2011 8:13 pm

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Estanded Incide Deckhaged					
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Back Locate the source of performance problems, determine he Response Time Details: order entry	ow those problems affect different parts of the workload, and a	alyze the performance of individual SQ	L statements, clients, and p	artitions.	
Graph Grid		SQL Statements Clients			
Selected layer: No layer selected 💌	🖄 🔢 Fit Average	Show highest 10 💌 by	Average End-to-End Respo	nse Time 🛛 🔻	
2 <sup>14</sup>		Statement Text St	tatement Executions A Ti	werage Data Server Average End-to me Response Time	-End
		SELECT CUST_CC_ID, CU	5,161	0.016	0.049
11/10 09:30:00 11/10 09:40:00 11/10 09:50:00	11/10 10:00:00 11/10 10:10:00 11/10 10:20:00	Display this list by the selected	graph layer		
General Information Statement Server Execution I	Details				
Most Recent Identification		Statement Row and Sort Details			
		Average rows read:	31,267	7.088	
Most Recent Compilation		Average rows returned:	1		
		Average rows modified:	0		
Data Server Execution Time		Average Sort Processing Time:	0 sec		
bdd berver Execution nine	_	Total sorts:	0		=
Number of executions:	5,245	Number of Sort Overflows per Partitio	on/Member: 0		
Average execution time:	0.016 sec	Post threshold sorts:	0		
Average CPU time:	0.005 sec	Post threshold shared sorts:	0		
Average activity time:	0.016 sec	Row Efficiency	Be Sort Efficie	ncy 💷	
Average workload manager queue time:	0 sec		and and	-	
Average Routine Processing time:	U SEC	Rom	d Not Used	= In Memory Sorts	
Average Section Processing time:	0.012 Sec	100 % Ro	ws	Number of	
Overall Time Distribution	0.300	Mo	turned or dified	Sort Overflows per	
Time WLM Queue	[	I/O Statistics			_
78.850 %		Buffer Pool Hit Ratio:	99.414	1 %	
processing		Logical page I/O:	1,007,	040	
		Physical page I/O:	5,901		-

Figure 4-43 Details panel - SQL statement data server execution statistics tab

**Note:** Statement server execution details are available for DB2 V9.7 Fixpak 1 or higher databases. It also requires that during the OPM configuration process of the monitored database you have selected to collect statement metrics on data server.

#### **Clients tab**

The Clients tab (Figure 4-44 on page 186) lists the clients that ran the transactions for the workload cluster group, workload cluster, or database for the time frame that is selected on the time slider. Click a client from the list to view the details for that client in the bottom pane of the dashboard.

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Back Locate the source of performance problems, determine ho Response Time Details: order entry	w those problems affect different parts of the workload, a	ind ana	lyze the performan	e of individu	ual S	QL statement	s, clients, and	partitions.				
Graph Grid			SQL Statements	Clients								
Selected layer: No layer selected 💌	🖄 🔢 Fit Maxim	um	Show highest	10 🛛	by	Average Re	sponse Time			•		
			Client Host	Name or IP		Transaction E	xecutions	Time of First Conr	ection	Average F	tesponse Time	
0.04-			Address				29.494	11/09	10:20:22			0.026
0		-					20,404	11/05	10.20.33			0.030
11/10 09:36:40 11/10 09:46:40 11/10 09:56:40	11/10 10:06:40 11/10 10:16:40 11/10 10:26:40		Display this ii	st by the sei	ected	graph layer						
Client Information		Cli	ient Performance									-
Host name or IP address:	9.12.4.169		Average client time				0.03	6 sec				
First connection start time:	11/09 10:20:33		Number of execution	ons:			29,4	84				
Last timestamp:	11/10/10		Response time war	nings:								
Operating system:	Linux		Response time pro	olems:								
Database driver name:	IBM DB2 JDBC Universal Driver Architecture	Overall Time Distribution (%)										
Database driver level:	3.59.81											
Connection properties:	maxStatements=0, currentPackagePath=null, curr	Client time Applicatio							ation			
Extended Insight client name:	IBM Optim pureQuery Runtime		77.440 %		III N	etwork time		time				
Extended Insight client level:	2.25.76				Data server		99.460 %-	-0.54 %	Conne	ction		
JRE vendor:	IBM Corporation			<u>∽10.120 %</u>	6 ti	ne			time	un		
JRE version:	2.4			- 12.440 %					■Databa	se		-
Runtime properties:	am.was.classpath.include.file.webservices=*ws-ha								-			=
WebSphere Application Server data source name:	jdbc/GoSalesApp											
WebSphere Application Server server name:	sd0d03l2Node01Cell#sd0d03l2Node01											
WebSphere Application Server version:	7.0.0.11											
WAS Connection Pool												
Connection pool size:	100											
Average connections in use:	33											
Maximum connection wait time:	0 sec											
Pool Usage												Ŧ

Figure 4-44 Details panel - Clients tab

### **Partitions/Members tab**

The Partitions/Members tab (Figure 4-45 on page 187) lists the partitions of a data server where transactions for the workload cluster group, workload cluster, or database were run during the time frame that is selected on the time slider. Click a partition from the list to view details for that partition in the bottom pane of the dashboard.

#### Draft Document for Review January 13, 2011 8:13 pm

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Workload Manager Configuration 🔹 🔥 Manage Database Connections 🐇 Extended Insight Dashboard 🛛 🗧	
Extended Insight Analysis Dashboard: DPF on A2/A3 TPCH	
Back Locate the source of performance problems, determine how those problems affect different parts of the workload, and an Response Time Details:	alyze the performance of individual SQL statements, clients, and partitions.
Scope: Global	SQL Statements Clients Partitions/Members
Graph Grid	Show highest 10 V by Average Data Server Time V
Selected layer: Average Data Server Time per Transaction 🔹 🖄 👔 Fit Average	Partition/Member Average Data Server Time
1.2	Global 0.154
1	Partition 0 0.132
0.8	Partition 3 0.064
0.8	Partition 2 0.064
g 0.6-	Partition 1 0.031
0.4	
0.2	
11/08 13:46:40 11/08 13:56:40 11/08 14:06:40 11/08 14:16:40 11/08 14:26:40 11/08 14:36:40	Display this list by the selected graph layer     Explore Partition
➡ Partition 0 - Detail Area for Average Data Server Time per Transaction	-
Data server time overall properties	
Average data server time per transaction: 0.150 sec	
Rows returned: 3,444	
Number of executions: 414	
FCM Time	
Overall average communication time per transaction: 0.012 sec	a
Time Distribution (%) E Rows Returned E Transaction Thro	oughput 🗉 Communication Time Distribution (% 🗐
320 -	
84.760 % 240. 12.230 % compile 460. 12.230	throughput     99.920 % 0.08 %     FOr receive     ime     FOr receive     ime
2.500 %	22226 Unite
FCM Communication Volume	
180,000-	

Figure 4-45 Details panel - Partitions/Members tab

# 4.4.3 Workload cluster groups and Workload clusters

It can be difficult to determine where and when performance problems and bottlenecks occurred. To isolate the source of performance problems, you can group and monitor transactions that come from specific components by using workload cluster groups.

Extended Insight monitoring is based on predefined or user defined workload cluster groups that contain workload clusters. The grouping of transactions into workload cluster groups is based on the connection attributes that are set for a connection to the monitored database. For example, in the predefined workload cluster group named *Client user IDs*, you get one workload cluster for each user ID that is set in the corresponding connection attribute. In each workload cluster of this group, all the transactions that originate from the same user ID are grouped together. The performance metrics are also aggregated within the group.

Connection attributes represent client information fields which are used at the DB2 server for determining the identity of the application or user currently using

the connection. For more detailed description of connection attributes, refer to section 8.2.3, "Understanding workload clusters" on page 291.

You can define values for the following connection attributes:

- Authorization ID
- Client user ID
- Client application name
- Client workstation
- Client accounting string
- IP address (DB2 Version 9.7 and higher)
- Application type

Connection attributes can be set either at the database server or at the application or application server level. For detail information on how to set these attributes refer to DB2 documentation site:

#### http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp

You can activate or deactivate a workload cluster group for monitoring at any time from Extended Insight dashboard by clicking **Activate** or **Deactivate**. When you activate a workload cluster group for monitoring, you can view detailed data for all transactions in the group and for each of the workload clusters in the group. Activation or deactivation process doesn't stop the collection of database performance data. It only impacts the aggregation of the data on the dashboard.

You can create workload cluster groups specific to your needs or use the predefined workload cluster groups that are already activated. OPM EI provides specific support for monitoring a set of common application frameworks:

- SAP: Monitoring response times per SAP end user, SAP transaction, SAP source module and SAP application server.
- Cognos: Monitoring response times per Cognos report, Cognos, report user, Cognos report package, and Cognos end user system and Cognos server
- DataStage: Monitoring response times per DataStage job, DataStage job user, DataStage project, and DataStage server
- ► InfoSphere Warehouse

To create new workload cluster group, click **New** on the Extended Insight dashboard.

Figure 4-46 on page 189 shows a Create new workload cluster group panel. In this example, let us assume that we want to create new workload cluster group called a\_user\_group, which will contain database application performance data from a client user ID a user. On screen shown in Figure 4-46 provide a name for the new workload cluster group name, and click **Next**.

New Workload Clu	uster Group	×
Step 1 of 3 You use a workload you determine whe	ad cluster group to group the incoming data server workload according to connection attributes. This ere performance problems and bottlenecks occurred.	grouping helps
Name: *	* a_user_group	
Description:		
Activate or deacti	tivate this workload cluster group for monitoring:	
<ul> <li>Activate</li> </ul>	e to process data and display this group on the monitoring dialogs	
O Deactiva	vate to stop data processing and hide this group from the monitoring dialogs	
	<back next=""></back>	Finish Cancel

Figure 4-46 Create new workload cluster group panel

Figure 4-47 on page 190 shows the New workload cluster group details panel. In this panel, select the connection attribute for this workload cluster group (Client User ID) and the filtering condition, which will only display data for the specific Client User ID (a user).

New Workload Cluster	r Group					Con	inection Attributes - GOSALES_NEW	×
Step 2 of 3 A workload cluster grou criteria to generate wo each connection attribu Click Refresh to genera	up can cover th rkload clusters ute to reduce th ate the workloa	e entire workload of a da for this group. You can so e workload that is covere d clusters.	tabase or only pa elect one more att d. Click Browse (.	onnection attributes ring. You can also u vailable filter values.	Se fro Con Filte	lect one or more items to use as filter criteria. The displayed items are tak m the specified sampling period. nection attribute: Client User ID r condition: loaded: 11	:en	
Connection Attributes	s and Filter Ci	iteria						
Type of workload cl	luster group:	Custom	sampling		Client User ID			
Cluster by Connection A	Attribute	Filter the Workload					e user	
Application type		Application type					c user	
Client Application Na	ime	Client Application	Na =	<b>v</b>			randy horman	
Client Accounting Str	ring	Client Accounting	String =	<b>v</b>		⊻	a user	
Host Name or IP Add	dress	Host Name or IP	Add =	v			buser	
Authentication ID		Authentication IE	=	<b>v</b>			g user	
Client Workstation		Client Workstatio	in =	v			h user	
✔ Client User ID		Client User ID	=	<b>v</b>			d user	
	cl. i						fuser	
Generated Workload Workload clusters: (	Clusters Transac	tions executed: N/P	Pefrech				anonymous	
			Kencan					
Reset Cluster Name								
Workload Applic Cluster Name type	ation Clier Appl Nam	t Client ication Accounting e String	Host Name of IP Address	Authentication ID	on Client Workstation			
					<back next=""></back>		OK Can	el

Figure 4-47 New workload cluster group details

Figure 4-48 on page 191 shows the new workload cluster group threshold settings panel. You can specify response time thresholds for the entire workload cluster group or for individual workload clusters. When the workload cluster group is activated for monitoring, you are informed if thresholds were violated. Click **Finish**.

ew Workload Cluster Gr	roup											
Step 3 of 3 You can specify response t luster group is activated f lusters on the Extended In	time thresholds for the entire or monitoring, you are infor nsight Dashboard do not app	e workload cluster group or med if thresholds were viol oly to other dashboards.	r for individual workload clu lated. The thresholds that y	sters. When the workload ou set for workload								
<ul> <li>Do not use default valu</li> <li>Use default thresholds</li> </ul>	ues. Specific thresholds can for all workload clusters(in a	be entered in the table belo addition,specify thresholds	ow. can be entered in the table	).								
Narning threshold:	5 ms 🛛 🔻											
Critical threshold:	7 ms	4 >										
Sampling period:         < 11/09 13:08:34 - 11/09 14:08:34 >           Workload Cluster Name         Average End-to-End Resonase         Maximum End-to-End Resonase         Warning Thresholds         Critical Thresholds												
a user	0.913	13.237	5 ms	7 ms								
Click in the threshold colu	mn to apply a specific value	to a workload cluster.										

Figure 4-48 New workload cluster group threshold settings

After the new workload cluster group is defined and activated, you can view its database performance metrics on the Extended Insight dashboard.

Figure 4-49 on page 192 shows the Extended Insight dashboard with the new workload cluster group.

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👋 Tas	ik Manager 💌 📴 Manage Data	base Con	nections	💩 We	lcome - I	My Optim	Central								ê 1
Extend	ed Insight Dashboard														
Recent History	20 sec 21/01/10 19:00 Aggregation level:1	11/02 1	2:06 1	1/03 05:1	3 11/0	Learn a	about the 11/04	time cont	rols.	33 11/06 01:40	11/0	6 18:47	11/07 10:53	America/New 11/09/10 13:14 - 11/09/10 11/08 04:00 11/08 21:07 11/09/10 14:14	_York End Time: 14:14 11/09/10 14:14 Duration: 1 Hour
Exte	nded Insight Analysis Da	ashboa	rd: G	OSALI	S_NE	w								👔 🟥 GOSAL	ES_NEW V Disconnec
Workloa	ads are listed in the grid. Click in the	e left colur	nn to sho	w the cha	rt for the	workload	d. Use the	second o	olumn to	expand and collap	se workl	oad cluste	rs in the grid. Do	puble-click a row to view details. Click New to crea	ate a workload cluster
Oper	group.           Open Details         Activate         Deactivate         New         Edit         Copy         Reset         Delete         View All Known Clients         Transaction Topology         Expand         Collapse														
Graph	Workload Cluster 1 Group/Workload Cluster	Avera ge End- to- End Respo nse	Max	Max	Avera ge Data Serve r Time	Avera ge Netwo rk Time	Avera ge Client Time	Warni ng (%)	Criti	Transactions (/min)	Rows Read Rate	Rows Modifi ed Rate	Rows Returned Rate	Statement Failure Rate (*	¥6)
🖮 Sh	. ▼	0.927	11.464	14.326	<del>\$</del> 0.022	<del>\$</del> 0.011	<b>0.894</b>			1,316.190			38,565.534		0
े Sh	. ▼■a_user_group	0.912	11.464	13.539	■0.022	■0.012	■0.878	1.394	97.264	131.069			3,733.724		0
🖄 Sh	a user	0.912	11.464	13.539	■0.022	■0.012	■0.878	1.394	97.264	131.069			3,733.724		0
🚵 Sh	. ►	0.927	11.464	14.326	<b>0.022</b>	<b>0.011</b>	<b>0.894</b>			1,316.190			38,565.534		0
🚵 Sh	. ▼⇔ Client user IDs	0.927	11.464	14.326	<b>0.022</b>	<b>0.011</b>	<b>0.894</b>			1,316.190			38,565.534		0
े Sh	. ♦ yong hua zeng	0.902	10.323	11.960	<b>0.022</b>	<b>0.010</b>	<b>\$0.870</b>			129.914			3,696.552		0
े Sh		0.907	10.325	13.540	<b>0.022</b>	<b>0.010</b>	<b>0.875</b>			129.759			3,692.034		0
	rts for selected workload c entry FitAverses	Alert Histo	Average to-End Respons Time Maximuu daximuu time of	7 BK s End- se m end e m	produ 14.00 12.00 10.00 0 0 0 0 0 0 0 0 10.00 0 0 0 0 0 0 0 0 0 0 0 0	ct v) wi 0	ng product view ) 11/09 13:4 Tir	Fit Av	rerace A	Average Average Average Maximur ed-to-e Maximur ed-to-e maximur ed-to-e Maximur time of	End- e n nd	Client 16.000 10.000 10.000 00 6.000 4.000 2.000 0 11/1	application nam	me: Fit Average Alert History On @ @ @ @ Average End- to-End Response Time • Maximum end-to-end response time • Maximum time of	F

Figure 4-49 Extended Insight dashboard with the new workload cluster group

# 4.4.4 pureQuery Runtime integration

An important step in tuning SQL is to determine the source of the SQL so it can be modified. This can be difficult, especially if the SQL was generated by a third party framework such as Hibernate or JPA. To help identify the source code, the Extended Insight dashboard can display the pureQuery metadata, such as Java class, package, application name, method name, and source line number, as shown in Figure 4-50 on page 193.

test	(Terres (sec.) 0.340
Graph Grid Selected System Statements Const.   Selected System Statements Const.   Selected System Statement Stat	1 Terres (sec.) 0.360
Scheidel Gyne: No lower statement =	6 Time (sec) 0.340
Balances Tool         Balances Tool         Balances         Average tool too find for point           2         DECLARI DB_0PO_SPCI:         DAILOR:         Average tool too find for point	• Times (sec.)
2 DECLAS DE JPOZ JUCE - CURSON - 4 6.316	0.345
DECLARE DE POQ, SPC7 CURSON K	
k OKCANI DL POC INC. CUISOR - 8 0.099	\$10.0
000LARE 08_F00_BF04_CLASOF 11 0.010	0.014
* DECLARE DR. JOD, 2007	0.014
S 4 SC(LAS 68_PO_SC) 8 8.004	0.008
060JAH 08,700JAHCS - 8 0.001	0.004
	ana a succession and
20/16 00:01:40 02/16 00:03:20 02/14 00:05:00 02/14 00:06:40 02/14 00:06:20 03/14 00:06:20 02/14 00:00 02/100 02/14 00:000:00 02/100 02/100 02/100:0000000	
NUNCORTINUES_DATE, KANDOUCT_CHER, KANDOUCT_CHER, KANDOUCT_CHER, KANDOUCT	0.8800
Average contistency 0.000 ap-	
Average relition's time 0.001 arc.	
AI Tune Average data server time: 0.000 sec	0 State
Package name / COSALES / Contract Cru Package name / COSALES / Contract Cru Statement Time Distribution (%) Em	
Section numbers 3 BClient true	802 I
Package Considency talent NP	
Package Version NP	
Collectorii Dilito	
Jara data Jara gatkaga Method Source Ine Bud varsian Source Net Application Methods File (133%)	
Wildshifegar. Ion-Ibn as ra. protecturize. 1066 (k/P In/P In/P In/P C/Iang/cpt. *	See L
W3HebRepart, Iom/Amilan. ImRemark(V, 108 3/P N/P myspp Criterior Dutioner Dutioner	
MSDdschupp4con/3m.ac.rgisdBath 233 JuP JuP JuP JuP Integrate Cutherspirate	1988 B

Figure 4-50 Integration of pureQuery Runtime metadata

This feature enables the database administrator and the developer to collaborate by quickly identifying the source SQL. This feature requires a license for the pureQuery Runtime product.

For more information about the pureQuery product, refer to *Using Integrated Data Management To Meet Service Level Objectives*, SG24-7769.

# 4.5 Reports

Optim Performance Manager provides predefined report types that you can use to generate reports to review and analyze your data in different ways. The following is a list of predefined reports:

- Database configuration report
- Database manager configuration report
- Database connection report
- Disk space consumption report
- Dynamic SQL statement report
- Workload manager configurations and metrics report

In this section we introduce and give examples of each report. From Optim Performance Manager web console, click **Task Manager**  $\rightarrow$  **Reports** to navigate to individual reports.

# 4.5.1 Database Configuration report

The Database Configuration report (Figure 4-51) shows an overview of the database configuration. If you use the DB2 Database Partitioning Feature (DPF), the report groups information by partition types so that you can compare the configuration of your coordinator, data, ETL, catalog, monitoring, or other partition types. This grouping of information by partition types requires that you have assigned roles (ETL, data, catalog, and so on) to database partitions during the Optim Performance Manager configuration process for your monitored DB2 DPF database.

You can generate additional reports to check whether all partitions of the same partition type have the same configuration, or to check which configuration parameters for a given partition or group of partitions changed over time.

The Database Configuration report contains information about capacity management, communications, logging and recovery, and database management. You can generate more detailed reports for a given partition role or partition member.

Ø	ບຮ Database Configuration Report			🏠 🔻 🛐 👻 🖃 🛲 👻 Page 🖛 Safety 🕶 Tools 🕶 🔞 🖛			
	Report Information>>						
	Report Description						
	The Database Configuration Parameters for the Pantition Roles Report shows an overview of the database configuration of your pantitions in a DPF environment. The information is grouped by the type of pantition, so that you can easily compare the configuration of your coordinator, data, ETL, catalog, monitoring, or other partition types. From here you can also generals further reports to check if all the partitions with the same partition type have the same configuration, or to check which configuration parameters for a partition or group of partitions were changed over time. The report contains information about capacity management, communications, logging, covery, and Database Management. You can drill down to see details about a specific partition reine or partition member.						
	Report Parameters						
	Connection:	DPF on A2/A3 TPCH					
	Database:	SD0D03A2:50001/TPCH					
	Time of data ( ( GMT-07:00 ) America/New_York):	Nov 10, 2010 1:57 PM					
1	Report Build:	Nov 10, 2010 1:58 PM					
Ľ							
F	Partitions on Database						
Т	compare the configuration of the partitions with the same role, dick the corresponding partition role.						
T	To check which configuration parameters have been changed in the selected report interval for a specific partition, click the partition number.						
	vole: You can change the assignment of partitions to a partition role by editing the monitoring configuration from the Manage Database Connections page.						
ļ	Partition Role Partitions						
	CATALOG	<u>0</u>					
L	DATA	1	2	3			
6	Capacity Management						
	or a detailed description of the DB C	Configuration parameters, see DB2 V9.7 Information C	enter				
Ir	Application Shared Memory		CATALOG (using partition 0)	DATA (using partition 1)			
ŀ	APPL MEMORY	Application memory (4 KB)	40.000	40.000			
ŀ	Database shared memory						
ŀ	CATALOGCACHE_SZ	Catalog cache size (4 KB)	300	300			
ŀ	DBHEAP	Database heap (4 KB)	2,397	2,397			
l	LOCKLIST	Maximum storage for lock list (4 KB)	6,200	6,200			
11 L L							

Figure 4-51 Database Configuration report

# 4.5.2 Database Manager Configuration report

The Database Manager Configuration report (Figure 4-52 on page 195) shows an overview of the current database manager configuration and which parameters have been changed in a given time frame to help you determine whether a problem might have been caused by configuration changes.

The Database Manager Configuration report contains details about system management, system monitoring parameters, instance administration, capacity management, and communications.

Optim Performance Manager V4.1								
Database Manager (DBM) Configuration Report								
Report Information >>								
Report Description								
The Datases Manager Configuration report shows an overview of the current database manager configuration and which parameters have been changed in a given time frame. You can use this information to determine whether a problem might have been caused by configuration changes. Under configuration changes. The report contains details about system management, system monitoring parameters, instance administration, capacity management, and communications.								
Report Parameters Connection: DPF on A2/A3 TPCH								
						Start Time ( ( GMT-07:00 ) America/New_York):	Nov 10, 2010 12:58 PM	
End Time ( ( GMT-07:00 ) America/New_York):	End Time ( (GMT-07:00 ) Nov 10, 2010 1:58 PM AmericaNew_York):							
Report Build:	Report Build: Nov 10, 2010 203 PM							
Report Configuration								
Tark Channes of Automatic Parameter Off  I unit for Detected Channes 25 (1000) (1000)								
Note: Selection and of the onlines above will relate the read								
True: Jefeuning ally on the Optionis adover min relocat use report.								
Instance Management								
For a detailed description of the DBM	Configuration parameters, see DB2 V9.7 Information	on Center						
"[A]" denotes "Can be Configured Auto	omatically by Database"							
"[S]" denotes "Can be Managed by Se	elf Tuning Memory Manager"							
System Management		Nov 10, 2010 1:57 PM						
FEDERATED	Federated database system support	No						
FEDERATED_ASYNC	Maximum asynchronous TQs per query	0						
CPUSPEED	CPU Speed	3.778755E-7						
DFT_ACCOUNT_STR	Default charge-back account	-						
JDK_PATH	Software developer	/db2instance/db2iaix/sqllib/java/jdk64						
TP_MON_NAME	Transaction processor monitor name							

Figure 4-52 Database Manager Configuration report

# 4.5.3 Database Connection report

Database Connection report shows an overview of the active database connections at a specific time. The report displays key performance indicators, such as lock wait times, physical and logical reads and writes, and other connection statistics to help you identify applications that are not performing well or applications that are causing problems in other database applications. For DB2 partitioned databases, this report displays the connection information for all partitions. You can click on individual partition in the Active connection section of the report to see the connection information for the selected partition.

You can navigate between snapshots in time to identify when problems occurred or to see the activity of the database application over time.

Figure 4-53 on page 196 shows the Active connections in a Database connection report.



Figure 4-53 Database connection report

By clicking on individual database connection you can drill down to see the details of the connection in a Database Connection Detail report (Figure 4-54 on page 197). It shows information about the selected connection, such as complete identification details, timing information, SQL activity, locks, cache, buffer pool, sorts, and agent-related activity.

eport Information>>					
entification					
Application information		User Identification		1	
Application handle	108	Authorization ID	USER2		
Application name	db2bp.exe	User Login ID	ADMINISTRATOR		
Application ID	9.12.4.140.1877.101102175519			_	
Application Status	Appl. has been decoupled from coord.				
Coordinating Node	0				
Client Information Fields					
Client user ID	-				
Client Workstation Name	-				
Client Application Name	-				
Client accounting string	-				
mes					
Connection request start timestamp	Nov 2, 2010 12:56 PM				
Connect request completion timestamp	Nov 2, 2010 12:56 PM				
User CPU time used by agent (sec)	2,904.521938				
System CPU time used by agent (sec)	451.651709				
Application idle time (sec)	555,468				
	0.000				

Figure 4-54 Database connection detail report

### 4.5.4 Disk Space Consumption report

The Disk Space Consumption report (Figure 4-55 on page 198) shows an overview of the current disk space usage by table space. You can analyze information about growth rates to plan for future disk space requirements or table space configuration changes.



Figure 4-55 Disk space consumption report

You can drill down to review the details of a given table space, such as containers and tables, container layout, and data skew, in the Disk Space Consumption Detail report (Figure 4-56 on page 199).

The Disk Space Consumption Detail report shows details about table space configuration, container details, ranges, table space layout, and active tables under a specific table space. The report includes information for the table space, such as general information about the table space, size of the table space, storage information, and the variation in size of the table space over time.



Figure 4-56 Disk Space Consumption Detail report

# 4.5.5 Dynamic SQL Statement report

The Dynamic SQL Statement report (Figure 4-57 on page 200) identifies the SQL statements that consume the most resource in a given period of time. The report includes a graphical representation of the workload over time so that you can easily identify critical or problematic SQL statements.



Figure 4-57 Dynamic SQL statement report

You can drill down to further analyze the activity and behavior of a given SQL statement in the Dynamic SQL Statement Detail report (Figure 4-58 on page 201).

The Dynamic SQL Statement Detail report shows an analysis of a specific SQL statement. The report includes detailed information, such as the complete statement text, general statement relation information, response time analysis, sort performance, I/O activity, and buffer pool activity.
Optim Performance	Manager V4.1					
Dynamic SQL Statements D	Detail Report					
Report Information						
SQL Statement						
SELECT P PRODUCT_NUMBER, P.BASE_PRODUCT_NUMBER, P.INTRODUCTION_DATE, P.DISCONTINUED_DATE, P.PRODUCT_TYPE_CODE, P.PRODUCT_COLOR_CODE, P.PRODUCT_SIZE_CODE, P.PRODUCT_BRAND_CODE, P.PRODUCTON_COST, P.GROSS_MARGIN, P.PRODUCT_MAGE, N.PRODUCT_DESCRIPTION FROM GOSALES PRODUCT_SPEAP.GOSALES PRODUCT_NOLVER AND GOSALES PRODUCT_TYPE AS R WHERE P.PRODUCT_NUMBER = N.PRODUCT_NUMBER AND P.PRODUCT_TYPE_CODE = R.PRODUCT_TYPE_CODE AND R.PRODUCT_TYPE_EN = ? AND N.PRODUCT_LANGUAGE = ?						
Tune						
Statement						
Database Name	GSDB					
Partition ID	0					
Number of executions	172,050					
Compilations	0					
Worst Preparation Time (sec)	0.000005					
Best Preparation Time (sec)	0.000005					
Response Time and Execution	ns					
550 Exec /min 500 Exec /min 450 Exec /min 350 Exec /min 300 Exec /min 250 Exec /min 150 Exec /min 150 Exec /min			eneraliyeyeneederiilayek	sec. 0.001700 sec. 0.001600 sec. 0.001500 sec. 0.001900 sec. 0.001900 sec. 0.001900 sec. 0.001900 sec. 0.001900 sec. 0.009900 sec. 0.009900 sec. 0.009900 sec. 0.009900 sec. 0.009500 sec. 0.009500		

Figure 4-58 Dynamic SQL statement detail report

#### 4.5.6 Workload Manager Configuration And Metrics report

This report provides an overview of your Workload Manager configuration and an overview of statistics related to your workload manager objects: service superclasses, service subclasses, workloads, and work classes. You can click the links in this report to view detailed statistics related to your workload manager objects. It also presents a summary of the statistics summed up for the service subclasses, workloads and workclasses.

Figure 4-59 on page 202 shows a WorkloaD Manager Configuration And Metrics report.

Optim Performance	e Manag	jer V4.1	-							-					
Workload Manager Repor	t		_	Statement Street			_		-						
Report Information>>															
Service Superclass Definitio	ns														
Service Superclass Name	ID Enabled	Agent Priority	Prefetch Priority	Outbou Correla	nd tor	Partition Collection	for Activity Dat	a i	Activity Data to Collect	Collec Data	t Aggregate Activi	ty Collect A Data	ggregate Request	Created	ι
SYSDEFAULTSYSTEMCLASS	1 Y	-32768	Default	-		С		I	4	Ν		Ν		Oct 21, 2010 PM	0 8:01 C F
SYSDEFAULTMAINTENANCECLASS	2 Y	-32768	Default	-		с		1	4	N		Ν		Oct 21, 2010 PM	08:01 C F
SYSDEFAULTUSERCLASS	3 Y	-32768	Default			С		I	4	N		N		Oct 21, 2010 PM	0 8:01 C F
Service Subclass Definitions	ervice Subclass Definitions														
Service Superclass Name	Service Subo	lass Name	ID Enabled	Agent Priority	Prefetch Priority	Outb Corre	ound Hator	Partition for A Collection	ctivity Data	Activity Data Collect	to Collect A Data	ggregate Activity	Collect Aggregate Data	Request Create	d
SYSDEFAULTSYSTEMCLASS	SYSDEFAUL	TSUBCLASS	11 Y	-32768	Default	-		С		Ν	N		N	Oct 21 PM	, 2010 8:01
SYSDEFAULTMAINTENANCECLASS	SYSDEFAUL	TSUBCLASS	12 Y	-32768	Default	-		С		Ν	N		N	Oct 21 PM	, 2010 8:01
SYSDEFAULTUSERCLASS	SYSDEFAUL	TSUBCLASS	13 Y	-32768	Default	-		С		Ν	N		Ν	Oct 21 PM	, 2010 8:01
Service Subclass Statistics															
Service Superclass Name	Service Subo	lass Name	Partition ID	Concu	rent Activities		Failed Coordinator Activites	Complete Coordinat Activities	d Maxim or of Coo Activiti	um lifetime ordinator es (ms)	Rejected Coordinator Activities	Max. Estimated (timerons)	I Cost Rows Returned	Temporary Tablespace Usage (KB)	Average Coordin: Activities
SYSDEFAULTMAINTENANCECLASS	SYSDEFAUL	TSUBCLASS	0	4			3	1090	0		0	0	0	0	0
SYSDEFAULTMAINTENANCECLASS	SYSDEFAUL	TSUBCLASS	1	2			0	4	0		0	0	0	0	0
SYSDEFAULTMAINTENANCECLASS	SYSDEFAUL	TSUBCLASS	2	2			0	4	0		0	0	0	0	0
SYSDEFAULTMAINTENANCECLASS	SYSDEFAUL	TSUBCLASS	3	2			0	4	0		0	0	0	0	0
SYSDEFAULTSYSTEMCLASS	SYSDEFAUL	TSUBCLASS	0	1			0	12	0		0	0	0	0	0
SYSDEFAULTSYSTEMCLASS	SYSDEFAUL	TSUBCLASS	1	0			0	0	0		0	0	0	0	0

Figure 4-59 WorkloaD Manager Configuration And Metrics report

## 4.6 Performance Expert client

Performance Expert client is an optional graphical user interface of Optim Performance Manager product. It originated with the DB2 Performance Expert product, and provided a client interface for it. It is a Java based application, which has to be installed on every user workstation that requires access to Optim Performance Manager product.

The new Optim Performance Manager web based client interface requires zero footprint on user's workstation. It contains majority of the functionality of the Performance Expert client.

If you have migrated to Optim Performance Manager from DB2 Performance Expert product, you may want to use Performance Expert client alongside with the new web interface for a smoother migration.

You can also perform the following tasks by using DB2 Performance Expert Client only:

- In addition to the features of the Workload Manager tool and the Workload Manager report, you can monitor activities for a specified time frame by starting Workload Manager activity traces.
- In addition to the features of the Reporting feature, you can do long-term performance analysis through Performance Warehouse.
- In addition to the features of the Optim Performance Manager plug-in for Tivoli Enterprise Portal, you can monitor and analyze operating system performance after installing the optional Common Information Model (CIM) server component.
- ► Real time database monitoring.
- More detailed monitoring of partitioned DB2 databases.
- User defined threshold sets.
- Trace the SQL statements of one or multiple connections for a specified timeframe by starting SQL Activity traces.
- Profile SQL PL stored procedures.

7925ch04.fm

# 5



This chapter discusses the use of Optim Performance Manager to better manage I/O performance. The basic steps involved include:

- Identify high I/O that affect your DB2 response time using alerts on the different dashboards of the Optim Performance Manager.
- Drill-down into problem detail and analyze the high I/O utilization on your monitored database.
- Resolve the high I/O causes and improve the performance of your applications by using expert advice.
- Prevent problems by monitoring historical trends for planning and building performance from the ground up.

### 5.1 Symptoms of high I/O utilization

Performance refers to the way that a system behaves in response to a particular application. It can be measured in terms of system response time and resource utilization. Performance is generally affected by:

- The resources that are available on your system.
- How well those resources are used and shared.

I/O performance can play an important part in the health of a database system. Possible reasons for high I/O could be any of the following:

- Too much activity on a single disk
- Small buffer pool
- No indexes
- Bad plans
- Poor SQL
- Hardware issues

It is important to isolate the scope of the high I/O activity. In this section, we discuss how to narrow down a high I/O activity seen on the operating system level down to the database object and the application consuming I/O.

### 5.2 Monitoring high I/O through various alerts

The environment that we are using here is two physical AIX machines with a partitioned database with four partitions.

You can see the I/O utilization of your database system using operating system commands such as iostat that reports central processing unit (CPU) statistics, asynchronous input and output (AIO), and input and output statistics for the entire system. The iostat command is used to monitor system I/O devices (physical and logical) that are loaded, by observing the time for which these devices are active. You can also see the I/O activity details for your monitoring database using the Buffer pool and I/O dashboard in the Optim Performance Manager. This dashboard lets you check buffer pools, tables paces, and tables performance. It helps identifying hot objects and moving them to dedicated buffer pools. It also lets you check the appropriate size of a buffer pool as well as check the disk space and container definition of table spaces.

We start by seeing the Health Summary dashboard on the Optim Performance Manager. From Figure 5-1 on page 207 we see critical alerts for memory usage, storage, workload, I/O, and locking.



Figure 5-1 Part of the Health Summary dashboard

Clicking the red I/O alert icon gives you an overview of alerts of the monitored databases. The alert list provides information about active I/O alerts and about all the I/O alerts that occurred during the monitored period.

Figure 5-2 shows some of the I/O alerts that have occurred for our monitored database DPF. Let us go through them:

- ► Buffer Pool Hit Ratio: This is an I/O alert.
- Buffer Pool Async Write Ratio: This is an I/O alert.
- ▶ Buffer Pool Async Read Ratio: This is an I/O alert.

I/O alerts for DP	D alerts for DPF on A2/A3 TPCH						
Select any alert to s	see more details at the bottom of the	screen. Learn more					
Open Full List	Configure Send Add Commo	ent	🔲   🗄 💠   🍓 🍇				
Severity	Alert Type	Start Time	End Time				
<u> </u>	Package Cache Hit Ratio	11/07/2010 12:00:41 AM	11/08/2010 07:25:07 AM				
	Buffer Pool Hit Ratio	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM				
	Buffer Pool Hit Ratio	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM				
	Buffer Pool Hit Ratio	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM				
	Buffer Pool Hit Ratio	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM				
	Buffer Pool Async Write Ratio	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM				
	Buffer Pool Async Write Ratio	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM				
	Buffer Pool Async Write Ratio	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM				
	Buffer Pool Async Write Ratio	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM				
<b>A</b>	Package Cache Hit Ratio	11/06/2010 11:58:41 PM	11/07/2010 12:14:42 AM				

Figure 5-2 I/O alerts for the A2/A3 TPCH database - from the Health Summary dashboard

In Figure 5-3 on page 208, "Rows Read per fetched row" is one of the Workload alerts that have occurred for our monitored database DPF during the same time frame as the I/O alert which is also of interest to us. This alert is from the Workload category, not from the I/O category. However, this does affect I/O so we talk about this alert here.

Workload alerts	for DPF on A2/A3 TPCH		
Select any alert to	see more details at the bo	ttom of the screen. Learn more	
Open Full List	Configure Send 4	dd Comment	🔹 🚓 115
	1		
Severity	Alert Type	Start lime	End lime
	Rows Read per Fetche	11/07/2010 12:00:41 AM	11/08/2010 07:25:07 AM
	Failing Transactions	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM
	Rows Read per Fetche	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM
<u> </u>	Failing Transactions	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM
	Failing Transactions	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM
	Failing Transactions	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM
	Rows Read per Fetche	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM
	Failing Transactions	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM
	Rows Read per Fetche	11/06/2010 11:58:41 PM	11/09/2010 12:07:34 PM

Figure 5-3 Workload alerts from the Health Summary dashboard

Before we drill down for more details, we take a look at the Overview Dashboard (Figure 5-4) to see if there are obvious hints about problems in I/O and Disk Space, System which includes CPU utilization and memory areas, Logging, Locking, and Sorting sections.

Overview Dashboard: DPF on A2	2/АЗ ТРСН							Disconnect
workload		N -	Sorting			_	Locking	_
Transactions:	31.228 /min	~	Active sorts:	1			Currently waiting applications:	0 %
Failing transactions:	■ 8.475 % 6		Sorts:	1.315 /mi	1		Longest wait time:	
Open connections:	15		Sort overflows:	0.%	5		Average lock wait time per transaction:	0 sec
Active connections:	4		Post threshold sorts:	0.%	5		Lock alerts:	0
Rows read per fetched row:	146,369.032		Sort time per minute:	01:11.517	min		Deadlocks:	0
Maximum CPU time of running statements:	0.001 sec		Average sort time:	54.400 se			Timeouts:	0
Naximum elapsed time of running statements:	0 sec		Average sorts per transaction:	0.042			Escalations:	0
Critical workloads:			Sort memory in use:	0 bytes			wI/O and Dick Seaso	
Cachina			a Suctors				and block apace	
Catalog carba bit ratio:	100 %	-	CPU utilization:	18.%	-	-	Butter pool nit ratio:	-1,263.21 W
Parkana cache bit ratio:			Total virtual memory in use:	6 327 GB			Logical reads:	5,284.8/1 /min
r detage edene na rotor			Visitual memory in unit	A 91 641 9			Physical reads:	72,043.004 /min
Utilities		-	virtual memory in use.	- 01.041 %	_		Physical writes:	90.664 /min
Active utilities:			Swap memory in use.	17.014 /8			Prefetcher hit ratio:	100 %
L			Real memory in use:	W 92:010 76	~		Asynchronous read ratio:	A 94.763 %
Logging		-	High Availability Disaster Recovery (HADR)			-	Page cleaner efficiency:	-1,263.20
Log space used:	87.348 MB		HADR role:				Asynchronous write ratio:	■ 88.829 % 🙀
Log space used:	0.775 %		HADR state:				Average page read time:	0.005 sec
Log write rate:	3.605 KB/sec		HADD connection status				Average page write time:	0.150 sec
Log to be read for recovery:	3.771 GB		inter connector states:				Direct writes:	22.534 /min
Maximum indoubt transactions:	0		HAUK connection time:				Direct reads:	149.957 /min
			HADR log gap:					
			HADR missed heartbeats:					

Figure 5-4 Overview Dashboard

From the Overview Dashboard, other than I/O, all the other sections look good. There are alerts for failing transactions. This is caused by failing statements in a workload that is indicated by a package cache alert. We discuss the workload and package cache alert in Chapter 6, "Monitoring CPU and memory usage" on page 217. Here we focus on the I/O alerts.

Figure 5-5 on page 209 shows the I/O and disk space information shown in the Overview Dashboard. The buffer pool hit ratio is negative, many physical reads is

high, and the asynchronous write ratio is 88.8%. Let us understand what each of these mean.

I/O and Disk Space	14 1		
Buffer pool hit ratio:	■ -1,263.21 😾		
Logical reads:	5,284.871 /min		
Physical reads:	72,043.884 /min		
Physical writes:	90.664 /min		
Prefetcher hit ratio:	100 %		
Asynchronous read ratio:	▲ 94.763 % <del></del>		
Page cleaner efficiency:	-1,263.20		
Asynchronous write ratio:	■ 88.829 % 🛃		
Average page read time:	0.005 sec		
Average page write time:	0.150 sec		
Direct writes:	22.534 /min		
Direct reads:	149.957 /min		

Figure 5-5 I/O and disk space information in the Overview Dashboard

Alerts are enabled with default threshold values which are set when you configure a database for monitoring. Thresholds determine when an alert is triggered. The key performance indicators are checked periodically by using a default sampling rate. If a threshold is reached, an alert is generated and an indicator appears on the Health Summary, the Alerts list, and the associated dashboard.

Now we look at the I/O alerts from the Health Summary dashboard for our database.

#### Buffer pool hit ratio

A good metric for buffer pool monitoring is the overall buffer pool hit ratio. We see from the Overview dashboard that the buffer pool hit ratio is -1,263% which is terrible. A low hit ratio indicates that some of the data that the application requested was not in the buffer pool. As a result, the data was read from the disk rather than from the buffer pool. Reading the data from the disk requires more time and resources.

In our case, we see the ratio is not only low but in negative. A negative hit ratio means that the prefetcher has brought pages into the buffer pool that are not subsequently referenced. The pages are not referenced because either the query stops before it reaches the end of the table space or DB2 must take the pages away to make room for newer ones before the query can access them. For our scenario, the second reason could be true because we see a workload alert for high Rows Read per fetched row. This alert means that DB2 is reading huge number of rows for every fetched row and, therefore, could be taking pages away

to make room for newer ones. All pages are read although they are not really needed and all do not fit in the buffer pool, therefore, must be freed. The same reason is true for negative page cleaner efficiency too which is discussed in "Buffer pool async write ratio" on page 212. Another reason could be a partitioned database system where the data is not balanced and is spanned across partitions which could lead to low hit ratio, but again that alone does not justify this terrible ratio.

We check the Buffer Pool and the I/O Dashboard for details about the I/O activities on the buffer pool, table spaces, and tables on our database. Figure 5-6 on page 210 shows the number of logical reads and the physical reads per minute for the buffer pool, BP32K, which is the buffer pool used by the application.

Buffer Pool and I/O Dashboard: DPF on A2/A3 TPCH								
Buffer Pools Table Spaces Tables								
Sł	Show     Lowest 5      ▼     buffer pools by     Hit Ratio (%)      ▼     Show Contained C							
Buffer Pool Name M		Main Usage	Buffer Pool Size (pages)	Hit Ratio (%)	Logical Reads (/min)	Physical Reads (/min)		
					n <mark>annan ann ann ann ann ann ann ann ann</mark>			
	Total		511,728	<b>-1,208.035</b>	7,622.931	99,710.603		
•	ВРЗ2К	MIXED	164,000	-1,432.282	6,507.328	99,710.586		

Figure 5-6 Part of the Buffer Pool and I/O Dashboard - Buffer Pools tab

We see that the physical reads are much higher than the logical reads that indicates that DB2 had to perform a lot of read access to data on disk. These high physical reads gives a good idea on the amount of physical versus logical reads taking place on the database, for tracking purposes, and establishing a baseline. This baseline can be useful to identify if an I/O bound system is a result of an increased number of physical reads. We can increase the buffer pool size and rerun our workload. If the physical reads have decreased and logical reads have increased, we know that buffer pool size is the cause of the I/O issue.

From the data so far we can make a note to try to increase the buffer pool size. However, increasing the buffer pool size may address only one of the causes of the high I/O issue. We continue analyzing for other reasons that could be causing our I/O issue.

We check the table spaces that use this buffer pool by selecting the Table Spaces tab (Figure 5-7). An alternative approach to come to this panel is from the Buffer Pool and I/O Dashboard, select the buffer pool, and click **Show Contained Objects**.

Buf	uffer bool and I/O Dashboard: DPF on A2/A3 TPCH							
Buffe	Suffer Pools Table Spaces Tables							
Sh	Show Lowest 5 🔻 table spaces by Hit Ratio (%) 🔹 in buffer pool: BP32K 💌 Show Contained Objects							
	Table Space Name	Main Usage	Buffer Pool Name	Hit Ratio (%)	Logical Reads (/min)	Physical Reads (/min)	Physical Writes (/min)	Updates per Read
•	Total			-1,20 990	7,626.259	99 1.690	0	
	TABDATA	MIXED	BP32K	-1,432.978	6,510.966	99,811.672	0	
	TABINDEXES	UNKNOWN	BP32K		0	0	0	

Figure 5-7 Part of the Buffer Pool and I/O Dashboard - Table Spaces tab

We see that there are two table spaces associated with this buffer pool namely, TABDATA and TABINDEXES. The low buffer pool hit ratio and the high physical reads are associated with the TABDATA table space. Note that the TABINDEXES table space has no activity.

To see the buffer pool activity details of the tables associated with the TABDATA table space, select the Tables tab (Figure 5-8) or selecting **TABDATA** and click **Show Contained Objects**.

luf	ffer Pool and I/O Dashboard: DPF on A2/A3 TPCH								
Suffe Sh	iffer Pools     Table Spaces     Tables       Show     Highest 5 <ul> <li>tables by</li> <li>Rows Accessed (/min)</li> <li>intable space:</li> <li>TABDATA</li> <li> </li> </ul> <li>Intable space:</li>								
	Table Name	Table Space Name	Schema	Rows Accessed (/min)	Rows Read (/min)	Rows Written (/min)	Pages in Object	Data Pages	Index Pages
⇒_	Total			373,165,796.983	373,165,456.569	340.414	3,751,534	3,722,505	4,12
Т	LINEITEM	TABDATA	TPCD	372,463,742.276	372,463,742.276	0	2,597,867	2,597,867	
	ORDERS	TABDATA	TPCD	701,536.397	701,536.397	0	557,672	557,672	
	CUSTOMER	TABDATA	TPCD	0	0	0	81,976	81,976	
	PARTSUPP	TABDATA	TPCD	0	0	0	385,693	385,693	
	PART	TABDATA	TPCD	0	0	0	91,935	91,935	

Figure 5-8 Part of Buffer Pool and I/O Dashboard - Tables tab

We see the top two tables on the list for the TABDATA table space are LINEITEM and ORDERS. These are two heavy activity tables where most of the I/O is being done within the database. These are generally referred to as "Hot Tables" too. There are few things to note here:

- Rows Accessed per minute
- Rows Read per minute
- Index Pages

The number of rows accessed per minute is the sum of rows read and rows written. Because we have no rows written, the number of rows accessed is the same as the rows read. It is important to note that the number of rows read is high for a period of two hours. (We selected the time slider to show the data for the past two hours.) There are no index pages which gives an indication that there is no index associated with the tables and that we could benefit from creating an index.

#### Buffer pool async write ratio

This is the ratio between the asynchronous writes and the total buffer pool write I/O. A high ratio indicates that the changed data in the buffer pools is written asynchronously by the I/O servers to the disk and that the applications are not waiting. A low value may indicate that you do not have enough I/O servers.

In Figure 5-5 on page 209, the *asynchronous write ratio* is about 89% which is a hint of high amount of I/O to the physical disk. This towards the higher side but is not too bad at this point.

The *Page cleaner efficiency* shows a negative percentage. Note that it is not showing us an alert because at the time of writing, Optim Performance Manager did not provide the possibility to specify alert thresholds for this metric. The negative page cleaner efficiency is resulted from the negative buffer pool hit ratio.

The buffer pool consists of pages that are either *in use*, meaning the pages are being updated or read, or *dirty*, meaning the pages have not yet been written to disk. Once the dirty pages are written to disk, they remain in the buffer pool, but their status changes to "clean for reuse" or "for continual use" by other database transactions. This is where the page cleaner (NUM\_IOCLEANERS) comes into play. The page cleaners write changed (dirty) pages from the buffer pool to disk. As a result, application transactions are faster because DB2 agents do not have to wait idle for I/O.

If your database usage is only for querying, it is safe to leave NUM\_IOCLEANERS set at its default of 1. If your application will be doing updates, inserts, and other action transactions, we recommend to set this value to at least the number of physical disks in the database. Due to the high number of physical reads in our example, the space must be freed in the buffer pool by the page cleaners in order to read the data in. This cannot be done efficiently by the page cleaners due to the high amount of physical reads and we could benefit from an index.

#### Buffer pool async read ratio

This is the ratio between the asynchronous reads and the total buffer pool read I/O. A high ratio indicates that the majority of data requested was read by prefetchers. Prefetching is the retrieval of data (one or more extent pages) from disk in anticipation of their use. This can significantly improve performance in SELECT statements by reducing the time waiting for I/O to complete. Setting the PREFETCHSIZE tells DB2 to place that number of pages in the buffer pool in anticipation of its use. The default is 32.

A low async read ratio may indicate that the prefetch size is too small. Figure 5-5 on page 209 shows the ratio is almost 95% which is really good for asynchronous read ratio. The high value in our example indicates that the majority of the data requested was read by prefetchers. When DB2 has to scan

many pages to find result sets, usually because indexes are missing or sub-optimally defined, DB2 uses asynchronous prefetch I/O. A high percentage of asynchronous I/O indicates that DB2 is doing a lot of scanning to find result sets. Scans occur when indexes are missing or are sub-optimally defined.

#### Rows read per fetched row

Though *Rows read per fetched row* is not an I/O alert, this alert does affect high or low I/O depending on its value. Let us look at the Workload section from the Overview Dashboard shown in Figure 5-9 on page 213.



Figure 5-9 Part of Overview Dashboard - Workload section

Rows read per fetched row is the number of rows that were read from the table for each row that was returned to the application. A high number indicates a table scan, which can be improved by indexing. In our scenario we see a terrible number for Rows read per fetched row which gives another clue that we can benefit from using an index on the high activity table.

## 5.3 Resolving high I/O problem to improve performance

From our analysis, we saw a few possible causes for the high I/O in our system: a small buffer pool and lack of indexes on the heavy activity tables. Here we demonstrate the performance effect on creating an index on the heavy access table.

You can see the running statements from the Active SQL dashboard. If Optim Query Tuner has been set up on the same machine where user runs the browser to access the Optim Performance Manager web console, users can perform SQL tuning in Optim Query Tuner. We discuss SQL query tuning in more detail in Chapter 8, "Extended Insight analysis" on page 271.

In our scenario, the Query Tuner recommended to create an index on the LINEITEM table. Indexes can be stored in a different table space from the table

data. When indexes and data are in same table spaces, both data and index pages use the same extent size and prefetch quantity. Creating indexes in a separate table space reduce the I/O traffic to the index table space. You can also create index table spaces on faster physical devices. In addition, you can assign the index table space to a different buffer pool, which might keep the index pages in the buffer longer because they do not compete with table data pages. In our example, we create the index in the TABINDEXES table space, the bp32k buffer pool using the following command:

CREATE UNIQUE INDEX tpcd.l\_okln ON tpcd.lineitem (l\_orderkey ASC, l\_linenumber ASC) PCTFREE 3 ; ALTER TABLE tpcd.lineitem ADD PRIMARY KEY (l\_orderkey, l\_linenumber);

After you create a new index, run the RUNSTATS utility to collect index statistics. These statistics allow the optimizer to determine whether using the index can improve access performance.

We then re-run our workload for about four hours and check the Health Summary dashboard on the Optim Performance Manager. The critical alerts for Storage, Workload, and I/O remains as shown in Figure 5-10.



Figure 5-10 Part of the Health Summary Dashboard

We click the red square alert icon to see the details of the I/O alert. Figure 5-11 on page 215 shows that the buffer pool hit ratio is still one of the top alerts in our partitioned database.

0					
By Alert By Database					
Select the database or par	tition to work wit	h.			
Name	Database Type	Databas e Name	Host Name	Port	Comments
DPF on A2/A3 TPCH	DB2_LUW	трсн	SD0D03A2	50001	
GOSALES	DB2_LUW	GSDB	9.12.4.170	50001	
GOSALES_NEW	DB2_LUW	GSDB	SD0D03L3	50002	new db on different instance
dtrader on L3	DB2_LUW	DTRADER	SD0D03L3	50001	
testdb_aix_1	DB2_LUW	TESTDB	9.12.5.104	50000	

Figure 5-11 I/O alerts for the DPF on A2/A3 TPCH database from the Health Summary dashboard

From the Overview Dashboard I/O and Disk Space section (Figure 5-12), we see improvements made by this added index:

- ► Buffer pool hit ration: From a negative number to 85.579%.
- Physical reads in comparison to the logical reads per minute:
  - Before index creation: 5K logical reads and about 72K physical reads per minute
  - After index creation: 180K logical reads and about 25K physical reads per minute

I/O and Disk Space	
Buffer pool hit ratio:	85.879 %
Logical reads:	180,066.851 /min
Physical reads:	25,427.877 /min
Physical writes:	0.99 /min
Prefetcher hit ratio:	99.999 %
Asynchronous read ratio:	97.194 %
Page cleaner efficiency:	0 %
Asynchronous write ratio:	100 %
Average page read time:	0.009 sec
Average page write time:	0.004 sec
Direct writes:	22.399 /min
Direct reads:	8.616 /min

Figure 5-12 Details about I/O and disk space from the Overview dashboard

## 5.4 Preventing high I/O

In a production environment, database performance tuning is a complicated task and should not be entered into for the reason of only gaining performance. First determine if there is a performance problem. If so, identify it and work from there. When designing a database, you should know what kind of performance you expect from it beforehand. Poor planning can affect performance by a factor of over 60% compared to good planning.

Within DB2, large amounts of disk I/O is a commonly seen attribute to poor performance. Minimizing the number of times DB2 has to retrieve data from disk increases performance. (Some disk I/O, such as logging, is unavoidable.) Consequently, DB2 uses buffer pools to improve performance. Increasing the buffer pool size is always the first attempt and usually shows significant impact, especially if you started a new database with the default parameters. Increase the buffer pool with caution and check the resulting performance because every database has a point when adding memory to the buffer pool does not show much effect any more. Tune the BUFFPAGE (buffer pool size) until you receive a good hit ratio. When you have got your hit ratio up, continue tuning other parameters such as PREFETCHSIZE, NUM\_IOCLEANERS, CHNGPGS\_THRESH, and NUM\_IOSERVERS until you get the expected results. (Use the Optim Performance Manager Dashboards and iostat to monitor I/O performance.)

Ensure that the tables are well maintained by running the REORGCHK\_TB\_STATS procedure and reorganize the table as needed. Although the optimizer decides whether to use an index to access table data, you must decide which indexes might improve performance and create these indexes. You must also run the RUNSTATS utility to collect new statistics about the indexes in the following circumstances:

- After you create an index
- After you change the prefetch size
- At regular intervals to keep the statistics current.

If your table has a lot of inserts but few updates, consider the APPEND option. It tells DB2 to write new records always to the end of the table and never to look for free space in between existing records (for example, space freed after deleting records). Use ALTER TABLE schema.tablename APPEND ON/OFF to enable or disable this option.

# 6

# Monitoring CPU and memory usage

In this chapter, we describe how you can use Optim Performance Manager to analyze a high CPU utilization on your monitored system. We show the dashboards and reports displaying CPU metrics and how you can use the CPU and related metrics to find the cause of a high CPU utilization. We also show how Performance Expert client can give additional insight on CPU utilization.

Another topic discussed is how to use Optim Performance Manager to monitor the memory that DB2 allocates and uses for the instance, databases, and applications. We describe the information you see on the memory dashboard and introduce the DB2 memory model in high level. This helps you to understand how DB2 uses memory in order to detect any memory bottlenecks easily. Additionally, we introduce briefly the use of the database manager configuration and database configuration reports because the configuration influences the memory allocation and usage.

# 6.1 Monitoring CPU utilization

High CPU utilization situations can slow down the response time of your database system. If the CPU utilization is higher than normal or close to 100%, you should investigate this situation and find the reason for that. Possible reasons, for example, can be

- Execution of long running or not well-tuned SQL statements
- Execution of DB2 utilities such as LOAD
- Memory problems such as under-sized DB2 memory areas or over-committed system memory

You can see the CPU utilization of your database system using operating system commands such as vmstat or the Optim Performance Manager dashboards.

In this scenario, we monitor a partitioned database with four partitions on two physical machines. We notice a higher-than-normal CPU utilization of 71% shown on the Health Summary dashboard (Figure 6-1). In addition, there are critical red alert indicators for Memory usage, I/O, and Sorting. These are good candidates for being responsible for the high CPU utilization.



Figure 6-1 Part of the Health Summary dashboard

We open the Overview dashboard of this database to have more information about the utilization of CPU, memory, I/O, and Sorting. First we look at the CPU utilization and system memory usage information on the System section as shown in Figure 6-2 on page 219. The System section shows the following information about CPU utilization:

- The current average CPU utilization over all partitions as percentage value. This is 71 %.
- The average CPU utilization over all partitions and over the displayed monitoring time frame as bar in the bar chart. For our example, we set six hours as monitoring time frame to be displayed on the dashboard.

The average maximum CPU utilization of the partitions over the displayed monitoring timeframe as vertical line in the bar chart. This indicates that we have higher CPU utilization on some partitions than others.

The memory usage is also high, the Real Memory is nearly all used, but Virtual Memory still has some room.

System	CHI San Contraction	
CPU utilization:	71 %	
Total virtual memory in use:	6.748 GB	Constant Street Constant Stree
Virtual memory in use:	▲ 87.072 %	
Swap memory in use:	17.708 %	
Real memory in use:	98.850 %	

Figure 6-2 System section of Overview dashboard

Click on the bar chart next to the CPU utilization value to see the CPU utilization over time for the displayed monitoring time frame. In Figure 6-3, we see a continuous higher CPU utilization one some partitions than on others. The CPU utilization differs over time with higher than normal peaks in the first third of the time frame and at the end.



Figure 6-3 CPU utilization overlay on Overview dashboard

The System Dashboard link at the right side of the CPU utilization graph takes you to the System dashboard where you can look at the CPU utilization of each partition. Since partition 0 and partition 1 are on the same machine, the CPU utilization is the same for both partitions, same for partition 2 and partition 3. Figure 6-4 on page 220 shows that the CPU utilization on partition 0 and 1 is higher over time as for partition 2 and 3 (Figure 6-5). The peaks that we have seen in Figure 6-3 are coming from partition 0 and 1.

System Dashboard: DPF	on A2/A3 TPCH								
Show     5     ▼     by     Average CPU Utilization (%)     ▼									
Host Name	Partition/Member A	Average CPU Utilization (%)							
sd0d03A3.itso.ibm.com	2	17							
sd0d03A3.itso.ibm.com	3	17							
sd0d03A2.itso.ibm.com	0	32							
sd0d03A2.itso.ibm.com	1	32							
CPU Number of CPUs:	8								
CPU Utilization	Em verage CPU ilization								

Figure 6-4 CPU utilisation on partition 0 and 1

	in the literation		with the database
Host Name	Partition/Member	Average CPU	Dtilization (%)
sd0d03A3.itso.ibm.com		2	
sd0d03A3.itso.ibm.com		3	
sd0d03A2.itso.ibm.com		0	
sd0d03A2.itso.ibm.com		1	
Detailed Information for 2			
Detailed Information for 2 U Number of CPUs:		8	
Detailed Information for 2 U Number of CPUs: CPU Utilization		8	

Figure 6-5 CPU utilization on partition 2 and 3

Let us go back to the Overview dashboard to see what hints we have for the high CPU utilization. The Workload section (Figure 6-6) shows, during the monitoring time frame, at least one statement took more than 17 minutes of the CPU time. The *Rows read per fetched row* number is high too. These provide us the clue that long running SQL statements are executed and because of the high rows read per fetched row ratio, the heavy queries could benefit from using an index.

In Figure 6-6, the red alert icon on the Caching section tells that the Package cache hit ratio is below the critical threshold. A low package cache hit ratio could indicate that a lot of time is spent in the SQL compiler that can lead to high CPU utilization. However, in this example, because we see more obvious reasons like the high CPU time of statements, the probability that the low package cache hit ratio is the primary reason for high CPU utilization is lower.

In the Utilities section in Figure 6-6, we see that four utilities were run in the monitoring time frame. This is also a good hint since utilities such as LOAD require high CPU time.

Workload	
Transactions:	38.024 /min
Failing transactions:	■ 13.167 %
Open connections:	9
Active connections:	3
Rows read per fetched row:	84,358.801
Maximum CPU time of running statements:	17:30.252 min
Maximum elapsed time of running statements:	02:42:31.161
Critical workloads:	
Caching	
Catalog cache hit ratio:	97.347 %
Package cache hit ratio:	■ 78.003 %
Utilities	
Active utilities:	4

Figure 6-6 Metric sections on Overview dashboard

The Sorting section (Figure 6-7 on page 222) shows that there are sort overflows within the displayed monitoring time frame. The sort overflows can be an indicator of undersized DB2 memory areas. A high sort number can be reduced by tuning heavy statements. Because we already have indicators that the executed statements could benefit from tuning, we do not worry about the sort overflows for now.

Sorting	Sector Sector and Sector	
Active sorts:	1	
Sorts:	1.605 /min	
Sort overflows:	1.866 %	6
Post threshold sorts:	0 %	5
Sort time per minute:	16.417 sec	
Average sort time:	10.230 sec	
Average sorts per transaction:	0.042	
Sort memory in use:	0 bytes	Construction of the second second

Figure 6-7 Sorting section on Overview dashboard

The I/O and Disk Space section (Figure 6-8) shows a very low buffer pool hit ratio. The reasons could be that either the buffer pools are too small or too many activities are on the buffer pool due to the execution of untuned statements. If an index is missing then probably a table scan took place that reads the entire table into the buffer pool. Both reasons can lead to the high CPU utilization.

I/O and Disk Space	
Buffer pool hit ratio:	<b>57.370 %</b>
Logical reads:	38,755.597 /min
Physical reads:	16,521.659 /min
Physical writes:	6,525.778 /min
Prefetcher hit ratio:	99.873 %
Asynchronous read ratio:	🔺 86.735 %
Page cleaner efficiency:	85.403 %
Asynchronous write ratio:	98.580 %
Average page read time:	0.013 sec
Average page write time:	0.007 sec
Direct writes:	7.959 /min
Direct reads:	48.795 /min

Figure 6-8 I/O section on Overview dashboard

To drill down further for the root cause of the high CPU utilization, we will check quickly what utilities were executed to find out whether they contribute to the high CPU utilization. After that, we look at the SQL statements that are running, then we check the buffer pool behavior.

### 6.1.1 Monitoring utility execution

The Utility dashboard in Figure 6-9 shows that in our 6 hours monitoring time frame, only the RUNSTATS utilities were executed on partition 0. From the Utility Overview graph you can see that these RUNSTATS jobs ran at the beginning of our monitoring interval. They add CPU consumption on partition 0 during the time frame of the first peak, but are not the main contributor to the CPU peaks that we see on System dashboard in Figure 6-4 on page 220 for partition 0 in the first third and at the end of the monitoring interval.

😫 Opti	😫 Optim Performance Manager baumback   Log out   About.   🥑										
🐞 Task Manager 🔻 🛛 🚯 Manage Database Connections ) 💩 Welcome - My Optim Central											
💩 Welcome	- My Opti B Man	age Database	Extended Insight Das	Memory	Reports	tem Ac	tive SQL	Utilities	x Overview	Health Summ	ary Buffer
Recent (	A fresh	10/27/10 18:3	5 - 10/28/10 00:35	Lea Antoinininininininininininininininininini	rn about the time co	ntrols.			10/28/22/24	10/29/02/18	
Utilities	Dashboard: DI	PF on A2/A3	ГРСН	103135 100	280/139 10201		19.07	28 18:54	10/28 22:54	10/29 02:10	0/29/06/02 10/29
Utility Ov	verview	Gen Utility T	ime	n Sv	stem CPU Consum	ption	=	Transacti	ons		Rows Written
2.500 2.400 2.400 1.600 1.200 0.40 0.40 0.40 0.40 0.40 0.40 0.40	10/27 11:46-40 Time		RUNS"	TATS	10/27 19:00:00 10/27 22:2 Time	Sy Cc Sy Cc at Pa ml	vstem CPU onsumption vstem CPU onsumption artition/Me ber 0	60- 50- 40- 20- 10- 0- 10/27 19:0	0:00 10/27 21:13:2 Time	0 10/27 23:26:40	Boon Boon Boon Boon Boon Boon Boon Boon
ID	Partition/Member	Туре	Description	Start Time		End Time		Elap	sed Time	Priority	Completion State
281	0	Runstats	OPM.OPMUNARIJ52	18:-	42:06.380 10/27/10	18	+41:54.464 10/	27/10	32,672	40	Ended
292	0	Runstats	TPCD.ORDERS	18:	47:39.425 10/27/10	10	:27:02.516 10/	27/10	39:23.091	40	Ended
435	0	Runstats	TPCD.ORDERS	19:	41:08.420 10/27/10	19	:59:11.219 10/	27/10	18:02.799	40	Ended

Figure 6-9 Utility dashboard

#### 6.1.2 Monitoring statement execution

Here we look at the running SQL statements using the Active SQL dashboard, the Dynamic SQL statement report, and Performance Expert Client.

The Active SQL dashboard shown in Figure 6-10 on page 225 let you display the top N statements by your favorite metric that run in the specified monitoring interval. In our example we display the top 10 statements by CPU time. The table on the dashboard lists these statements including execution metrics. If you click a statement then you see more execution details in the lower part of the dashboard including:

- The complete statement text.
- ► Launching to the statement in Query Tuner.
- Stopping the statement execution if the statement is still running.
- Force the connections.
- Identify the workload the statement belongs to in the Extended Insight dashboard by clicking the Identify Workload button.

At the time of the writing, clicking Identify Workload only opens the Extended Insight dashboard for the same database and monitoring time frame, but does not preselect any workload cluster group or workload cluster this statement belongs to.

	statements, and forcing applica											
Show highest 10 + by CPU Time	▼ Show Add	itional Columns	Customize Co	lumns								
Statement Text		Start Time Stamp	Stop Time Stamp	CPU Time	Elapsed Time	Sort Time	Sort Overflows	Rows Read	Rows Written	Logical Read I/O (pages)	Physical Read I/O (pages)	Costs (timeron
select nation, o_year, sum(amount) as sum_p	rofit from ( select n_name a	10/27 21:52:18		17:30.252	02:42:31.161	0	0	628,334,879	2,437,175	1,314,380,620	83,927,892	3.05
select c_count, count(*) as custdist from ( sele	ect c_custkey, count(o_orderk	10/27 21:52:26	10/28 00:15:30	12:57.478	02:23:04.170	24.009	1	246,800,649	123,052,340	3,005,257	619,547	2,28
select supp_nation, cust_nation, l_year, sum(vi	olume) as revenue from ( s	10/27 18:37:31	10/27 20:06:23	12:40.962	01:28:52.212	50:45.109	4	542,445,240	195,279,673	420,860,942	12,174,593	3,64
select o_year, sum(case when nation = 'BRAZII	L' then volume else 0 end) /	10/27 20:07:02	10/27 20:33:30	11:54.802	26:27.754	0	0	662,280,445	4,095,067	153,011,614	3,879	1,61
select   returnflag,   linestatus, sum(  quantity	) as sum otv. sum(I extend	10/27 21:52:36	10/27 23:06:08	09:21.276	01:13:32.390	08:58.267	0	592,822,687	0	118,169,905	61.113	1.26
select c count, count(*) as custdist from ( sele	et c custkey, count(o orderk	10/27 21:52:26	10/28 00:14:26	09:09.977	02:22:00.030	0	0	328,779,972	163.982.959	306.834.722	31,547,449	2.28
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select sum(I_extendedprice) / 7.0 as avg_year	ly from tpcd.lineitem, tpcd.p	10/27 21:52:30		05:21.651	02:42:19.790	11.407	4	1,117,993,074	/4/,/18	480,630,658	8,259,069	3,61
select o_orderpriority, count(*) as order_count	from tpcd.orders where o_or	10/27 18:42:43	10/27 19:58:11	04:11.840	01:15:28.086	5.419	3	611,314,300	6,786,709	275,966,015	23,405,941	4,4
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Figure 6-10 Active SQL dashboard

Let us take a closer look what we see on this dashboard. The listed statements shown in Figure 6-11 on page 225 are sorted by CPU time. The CPU time consists of user CPU and system CPU time. The first statement consumes most CPU and has not stopped yet at the end of the monitoring interval. Therefore, it contributes to the CPU peak we see at the end of the monitoring interval. The same is true for the other listed statements that have not finished yet.

Statement Text           select nation, o_year, sum(amount) as sum_profit from ( select n_name a           select c_count, count(*) as custdist from ( select c_custkey, count(o_orderk           select supp_nation, cust_nation, l_year, sum(volume) as revenue from ( s           select o_year, sum(case when nation = 'BRAZIL' then volume else 0 end) /				
<pre>select nation, o_year, sum(amount) as sum_profit from ( select n_name a select c_count, count(*) as custdist from ( select c_custkey, count(o_orderk select supp_nation, cust_nation, l_year, sum(volume) as revenue from ( s select o_year, sum(case when nation = 'BRAZIL' then volume else 0 end) /</pre>	Start Time Stamp	Stop Time Stamp	CPU Time	Elapsed Time
select c_count, count(*) as custdist from ( select c_custkey, count(o_orderk select supp_nation, cust_nation, l_year, sum(volume) as revenue from ( s select o_year, sum(case when nation = 'BRAZIL' then volume else 0 end) /	10/27 21:52:18		17:30.252	02:42:31.161
select supp_nation, cust_nation, l_year, sum(volume) as revenue from ( s select o_year, sum(case when nation = 'BRAZIL' then volume else 0 end) /	10/27 21:52:26	10/28 00:15:30	12:57.478	02:23:04.170
select <code>o_year</code> , <code>sum(case</code> when <code>nation = 'BRAZIL'</code> then <code>volume</code> <code>else</code> <code>0</code> <code>end) /</code>	10/27 18:37:31	10/27 20:06:23	12:40.962	01:28:52.212
	10/27 20:07:02	10/27 20:33:30	11:54.802	26:27.754
select l_returnflag, l_linestatus, sum(l_quantity) as sum_qty, sum(l_extend	10/27 21:52:36	10/27 23:06:08	09:21.276	01:13:32.390
select c_count, count(*) as custdist from ( select c_custkey, count(o_orderk	10/27 21:52:26	10/28 00:14:26	09:09.977	02:22:00.030
select l_orderkey, sum(l_extendedprice * (1 - l_discount)) as revenue, o_o	10/27 23:53:50		07:41.008	40:59.548
select n_name, sum(l_extendedprice * (1 - l_discount)) as revenue from t	10/27 21:52:42		05:40.210	02:42:07.741
select sum(l_extendedprice) / 7.0 as avg_yearly from tpcd.lineitem, tpcd.p	10/27 21:52:30		05:21.651	02:42:19.790
select <code>o_orderpriority</code> , <code>count(*)</code> as <code>order_count</code> from <code>tpcd.orders</code> where <code>o_or</code>	10/27 18:42:43	10/27 19:58:11	04:11.840	01:15:28.086

Figure 6-11 Statements on Active SQL dashboard

Looking closer at the execution metrics in Figure 6-12, we see that high sorting and high I/O activity took place. For some statements the sort time is still 0, especially for statements that have not finished yet at the end of our monitoring interval. The reason is that DB2 updates the sort information only if either the execution of subsections or the entire statement has finished. The reported Rows Written also results from the sorting activities.

**Tip:** If you want to verify that DB2 spills out sorts to disk and therefore report the Rows Written activity for SELECT statements then you can open the I/O dashboard and check the activity going on in temporary table spaces.

Sort Time	Sort Overflows	Rows Read	Rows Written	Logical Read I/O (pages)	Physical Read I/O (pages)	Costs (timerons)
0	0	628,334,879	2,437,175	1,314,380,620	83,927,892	3,054,546
24.009	1	246,800,649	123,052,340	3,005,257	619,547	2,287,035
50:45.109	4	542,445,240	195,279,673	420,860,942	12,174,593	3,649,700
0	0	662,280,445	4,095,067	153,011,614	3,879	1,619,449
08:58.267	0	592,822,687	0	118,169,905	61,113	1,266,801
0	0	328,779,972	163,982,959	306,834,722	31,547,449	2,287,035
0	0	409,737,281	246,589,540	118,448,393	3,521,417	6,673,096
0	0	651,163,295	20,708,350	560,248,090	77,652,320	3,092,141
11.407	4	1,117,993,074	747,718	480,630,658	8,259,069	3,663,675
5.419	3	611,314,300	6,786,709	275,966,015	23,405,941	4,469,009

Figure 6-12 Execution metrics on Active SQL dashboard

We run our workload using the DB2 command line processor for this example. Though the Extended Insight client does not support this type of workload, because the Extended Insight server monitoring is enabled for this monitored database, we can obtain the time spent per transaction information from the data server. We can use this information to verify our assumption about sorting and I/O contributing mostly to the high CPU utilization. Note that the Extended Insight dashboard reports how the execution time is spent, not how the CPU time is spent. However, because execution requires CPU, we can use this approach to verify our assumption.

On the Extended Insight dashboard, we open the Response Time Details for the whole database workload for our six hours monitoring interval and display the Data Server Time layer as shown in Figure 6-13. Most interested to us is the Time Distribution chart in the detail area of the dashboard. This shows that for all queries that run in this six hours interval, more than 65% of the execution time is spent for I/O and more than 32% of the execution time is spent for sorting. This confirms our assumption.

Extended Insight Analysis Dashboard:	DPF on A2/A3 TPCH
Back Locate the source of performance problems, determine ho Response Time Details: DPF on A2/A3 TPC	w those problems affect different parts of H
Scope: Global	
Graph Grid	
Selected layer: Average Data Server Time per Trans	action 🔹 🚵 🛄 Fit Maximum
Detail Area for Average Data Server Time Data server time overall properties Average data server time per transaction: Rows returned: Number of executions:	10/27 22:20:00 10/27 23:26:40 per Transaction 1.195 sec 20,020 2,105
Statements:	
CM Time Overall average communication time per transaction:	3.210 sec
Time Distribution (%)	Returned ==
0.09 % 32.480 % Routine user code 0.06 % Transaction end processing 0.02 % 0.06 %	Rows returned rate

Figure 6-13 Data Server Time layer on Extended Insight dashboard

We monitor a partitioned database with four partitions. In Optim Performance Manager version 4.1.0.1, the Active SQL dashboard shows the statements and execution details aggregated of all partitions only. There is no way to see how a statement execution performed on a single partition. We use Performance Expert Client to look the execution information for a single partitions. We want to compare the CPU utilization on partitions 0 and 1 with the utilization on partitions 2 and 3. Let us see whether Performance Expert gives us additional insight why the CPU utilization is higher on partition 0 and 1 than on 2 and 3.

Open Performance Expert Client, launch the Application Summary panel, and select All partitions view which shows all four partitions. In the time slider, we select the end timestamp of the monitoring interval because we know that the

CPU utilization was high at the end of the six hours interval. The Application Summary panel (Figure 6-14) shows the connected applications on the selected timestamp including the executing SQL statements.

Application Sur	nmary	and an a state of the second second								
w <u>T</u> ools <u>W</u> indow	Help	and an example of						Sector Color		
All partitions		Data: History		Oct 28, 2010	00:35:39	1	0/28/10 12:3	5:39 AM	Z	oom 🗨 🔍
All partitions		Refresh: Manual	4	*			0/27/10 4:44:20	) PM	10/29/	10 6:42:17 PM
atus   Auth ID	SQL Statement Te	ext	Partition	System CPU Ti	me Used by Agent (sec) User C	PU Time Used by	Total Sorts	Total Sort Time (sec)	Sort Overflows	SQL Stmt. Rows Read
g USER1	select I_orderkey,	sum(l_extendedprice	PART3		23,423105	0:17:51.408	11	0:05:39.716	2	148,279,224
g USER 1	select I_orderkey,	sum(I_extendedprice	PART2		25.174398	0:17:50.479	11	0:05:33.053	2	147,374,505
g USER 1	select l_orderkey,	sum(I_extendedprice	PART1		0:02:53.137	0:14:28.027	11	0:06:18.482	2	69,744,048
USER 1	select l_orderkey,	sum(l_extendedprice	PARTO		0:03:12.402	0:14:13.924	11	0:06:13.244	2	48,738,977
g USER2	select n_name, su	* m(l_extendedprice)	PART3		34.538905	0:16:22.269	11	0:18:24.037	8	160,630,125
g USER2	select n_name, su	m(l_extendedprice *	PART2		33.931918	0:16:39.883	11	0:18:00.807	8	164,111,517
USER2	select n_name, su	m(l_extendedprice *	PART1		0:04:02.095	0:16:21.817	11	0:32:27.533	8	164,646,512
USER2	select n_name, su	<pre>im(l_extendedprice *</pre>	PARTO		0:04:42.742	0:16:30.284	12	0:17:47.744	8	164,637,387
g USER5	select sum(l_exter	ndedprice) / 7.0 as av	PART3		0.519493	0:01:37.840	1	4.963000	1	305,225,023
g USER5	select sum(l_exter	ndedprice) / 7.0 as av	PART2		0.438971	0:01:37.539	1	6.206000	1	305,185,423
g USER5	select sum(l_exter	ndedprice) / 7.0 as av	PART1		0:02:05.359	0:01:22.993	1	0.099000	1	264,407,703
g USER5	select sum(l_exter	ndedprice) / 7.0 as av	PARTO		0:01:59.647	0:01:18.529	1	0.139000	1	247,468,450
g USER3	select nation, o_y	ear, sum(amount) as	PART3		14.791577	0:07:11.381	0	0.00000	0	175,266,204
USER3	select nation, o_y	ear, sum(amount) as	PART2		15.116549	0:07:11.327	0	0.00000	0	175,276,081
USER3	select nation, o_y	ear, sum(amount) as	PART1		0:02:51.413	0:05:55.217	0	0.00000	0	140,816,928
USER3	select nation, o_y	ear, sum(amount) as	PARTO		0:02:13.702	0:06:16.304	0	0.00000	0	140,045,258
USER4	select 100.00 * su	um(case when p_type	PART3		6.404520	0:03:47.559	4	1:07:59.119	2	6,927,375
USER4	select 100.00 * su	um(case when p_type	PART2		7.632134	0:03:45.195	4	1:06:41.820	2	6,931,599
USER4	select 100.00 * su	um(case when p_type	PART1		0:02:32.527	0:03:24.090	4	1:37:16.535	2	6,906,022
g USER4	select 100.00 * su	um(case when p type	PARTO		0:02:35.819	0:03:17.874	4	1:33:34.773	2	6,893,580

Figure 6-14 Application Summary in Performance Expert Client

The interesting information we obtain from Performance Expert Client is the user and system CPU time per statement by partition, see Figure 6-15 on page 228. The user CPU time per statement is nearly the same on all partitions, but the system CPU time used is much higher on partition 0 and 1 that is in line with what we have already seen on the System dashboard in Figure 6-4 on page 220.

SQL Statement Text	Partition	System CPU Time Used by Agent (sec)	User CPU Time Used by
select I_orderkey, sum(I_extendedprice	PART3	23.423105	0:17:51.408
select I_orderkey, sum(I_extendedprice	PART2	25.174398	0:17:50.479
select I_orderkey, sum(I_extendedprice	PART1	0:02:53.137	0:14:28.027
select I_orderkey, sum(I_extendedprice	PARTO	0:03:12.402	0:14:13.924
select n_name, sum(l_extendedprice *	PART3	34.538905	0:16:22.269
select n_name, sum(l_extendedprice *	PART2	33.931918	0:16:39.883
select n_name, sum(l_extendedprice *	PART1	0:04:02.095	0:16:21.817
select n_name, sum(l_extendedprice *	PARTO	0:04:42.742	0:16:30.284
select sum(l_extendedprice) / 7.0 as av	PART3	0.519493	0:01:37.840
select sum(l_extendedprice) / 7.0 as av	PART2	0.438971	0:01:37.539
select sum(l_extendedprice) / 7.0 as av	PART1	0:02:05.359	0:01:22.993
select sum(l_extendedprice) / 7.0 as av	PARTO	0:01:59.647	0:01:18.529
select nation, o_year, sum(amount) as	PART3	14.791577	0:07:11.381
select nation, o_year, sum(amount) as	PART2	15.116549	0:07:11.327
select nation, o_year, sum(amount) as	PART1	0:02:51.413	0:05:55.217
select nation, o_year, sum(amount) as	PARTO	0:02:13.702	0:06:16.304
select 100.00 * sum(case when p_type	PART3	6.404520	0:03:47.559
select 100.00 * sum(case when p_type	PART2	7.632134	0:03:45.195
select 100.00 * sum(case when p_type	PART1	0:02:32.527	0:03:24.090
select 100.00 * sum(case when p_type	PARTO	0:02:35.819	0:03:17.874

Figure 6-15 CPU time in Application Summary

Partition 0 is the coordinator partition. On this partition, DB2 combines the result sets from all partitions. Therefore, the subsection execution of the plan on this partition requires more CPU time than on other partitions. We confirm that by looking at the subsection details in Performance Expert Client. Figure 6-16 shows the subsection details of one query on partition 0 and Figure 6-17 shows the subsection details on the same query on partition 2.

Subsections				
Subsection Number	Rows Read	Rows Written	System CPU Time used by Subsection (sec)	User CPU Time used by Subsection (sec)
0	0	0	0.000053	0.00021
1	25	0	0.002992	0.00359
2	0	0	0.001571	0.00087
3	25,017,237	361,196	28.266892	0:02:45.84
5	1,064	0	0.001831	0.00164
4	115,026,932	367,710	0:01:45.399	0:03:30.27

Figure 6-16 Subsection details on partition 0

Subsections				
Subsection Number	Rows Read	Rows Written	System CPU Time used by Subsection (sec)	User CPU Time used by Subsection (sec)
1	0	0	0.000523	0.000465
2	3,795,192	3,683,559	2.721730	24.066228
3	18,520,953	45,623	3.652644	33.777163
4	125,058,360	81,315,258	7.536225	0:03:54.384

Figure 6-17 Subsection details on partition 2

The next step would be to launch Query Tuner from the Active SQL dashboard for each of the high CPU consuming statements to see the access plan and to obtain tuning recommendations. We do not show that in detail in this scenario because we cover this topic as well in 8.1, "Application running slowly caused by index issue" on page 272. To confirm our assumptions we show a portion of the access plan of one query here in Figure 6-18 which illustrates that table scans are performed on the database followed by sorts.



Figure 6-18 Part of the access plan showing table scans

Along with the access plan, Query Tuner recommends indexes as shown in Figure 6-19.

Custom and recommended in	ndexes				
6* 6* 6* 64 64					
Indexes by Table	Creator	Object Name	Columns	Estimated Disk Space	Custom
ORDERS					
Index	DB2OE	IDX 10 1028 1836 420	O_ORDERKEY(ASC) ,O_TO	753.860375 M	No
LINEITEM					
Index	DB2OE	IDX 10 1028 18363 10	L_ORDERKEY(ASC) ,L_QU	2210.1885 M	No
CUSTOMER					
Index	DB2OE	IDX 10 1028 1836 360	C_CUSTKEY(ASC) ,C_NAM	75.376 M	No
1					

Figure 6-19 Index recommendations from Query Tuner

#### Using the Dynamic SQL Statement report

In this section we show you how to use the Dynamic SQL report to analyze the SQL statements. This is another method to identify untuned queries. The

Dynamic SQL Statement report has the following characteristics compared to the Active SQL dashboard:

- It shows aggregated statement execution information, whereas the Active SQL dashboard reports each statement execution separately.
- It does not show statement start and end times like the Active SQL dashboard because the statement execution information are aggregated over executions.
- It considers all executed dynamic SQL statements, whereas the Active SQL dashboard considers only statements that were running when Optim Performance Manager took the snapshot on the monitored database which is ones per minute by default. Short running statements that start and finish between two snapshots are not collected and, therefore, not considered by the Active SQL dashboard. Hence this dashboard is helpful for business intelligent (BI) environments but less useful for OLTP environments.
- It shows statement execution information per partition whereas the Active SQL dashboard reports statement execution aggregated over all partitions only.
- You can export reports into Microsoft Power Point chart, Excel spreadsheet, and PDF formats.

To generate Dynamic SQL Statement report, select **Reports** from Task Manager and specify the input parameters, see Figure 6-20 on page 232. We choose six hours as the time interval and specify that we want to see the top 10 statements by CPU time.

Report type:	* Dynamic SQL Statement report
Description:	The Dynamic SQL Statement report identifies the SQL statements that consume the most resources in a given period of time. The report includes a graphical representation of the workload by day so that you can identify critical or problematic SQL statements. You can further analyze the activity and behavior of a given SQL statement in the Detailed SQL report.
Report duration (GMT-04:00):	* Show most recent activity of last 5: Mins .
	Show period of 6 Hours ▼     With start date of 10/27/2010 and Time 18:35 ▼
Sort by:	* CPU time
Number of statements:	* 10   •
Do not close the browser window	. Generating the report might take a few minutes.           Generate Report

Figure 6-20 Dynamic SQL Statement Report launch panel

The report first shows graphically the top 10 statements by CPU time per hour, see Figure 6-21.



Figure 6-21 Top 10 statements by CPU time per hour

Next, the aggregated execution details of the top 10 statements are shown. The statements are sorted by CPU time. As in Performance Expert Client, the report distinguishes between user and system CPU time and shows the information per single partition. Figure 6-22 shows the execution details for the top CPU statement.

Statement Text	Partition ID	Number of executions	<u>Total elapsed</u> <u>time (sec)</u>	Average elapsed time (sec)	Number of Logical Reads	Number of physical reads	▼ <u>CPU</u> time (sec)	<u>Total</u> <u>System</u> <u>CPU Time</u> (sec)	Total User CPU Time (sec)
select supp_nation, cust_nation, I_year, sum(volum	0	0	5,370.743362		993,400	2,040	539.764355	142.153539	397.610816
select supp_nation, cust_nation, I_year, sum(volum	1	0	5,370.730606		991,116	380	498.705839	108.668071	390.037768
select supp_nation, cust_nation, I_year, sum(volum	2	0	5,370.701343		990,809	322	409.286927	9.047416	400.239511
select supp_nation, cust_nation, I_year, sum(volum	3	0	5,370.731160		991,020	304	406.583160	9.011266	397.571894

Figure 6-22 Execution details in dynamic SQL statement report

**Hint:** In Figure 6-22, the number of executions for the displayed statement is 0. The reason is that this statement runs only ones in the six-hours reporting interval and has not finished yet at the end of the reporting interval. DB2 updates the execution metrics in the dynamic SQL statement cache while the statement is running, but DB2 does not update the number of executions before the statement has finished.

Within the report you can further drill down the statement to see how it behaves during the reporting interval. Click the link in front of the statement and the statement details opens in a new browser window. The statement details include the complete statement text, more execution details, and graphs. One graph shows, over the reporting interval, the number of executions per minute combined with the average execution time per minute. The other graph shows, over the reporting interval, the average user and system CPU time per execution. If a statement is executed very often, these graphs are helpful in understanding whether the execution time differ over time. In hour example, since most statements were run only ones during the reporting interval, this drill-down report does not give us new information.

**Hint:** In Performance Expert Client you obtain the Dynamic SQL Statements view in the Statistics Details panel. Performance Expert users often use this view to find the top statements. The Dynamic SQL Statement report uses the same source data as the Dynamic SQL Statements view in Performance Expert Client and is the replacement in the Optim Performance Manager web console.

# 6.2 Monitoring buffer pool behavior

In this high CPU utilization scenario we just do a quick check on the buffer pool behavior because we have seen on the Overview dashboard (shown in Figure 6-8 on page 223) that we have a low buffer pool hit ratio along with the high CPU utilization and the long running statements. For deeper buffer pool and I/O analysis, refer to Chapter 5, "Monitoring I/O utilization" on page 205.

The Overview dashboard shows you the buffer pool hit ratio across all buffer pools whereas the Buffer Pool and I/O dashboard shows you the buffer pool behavior for each single buffer pool. Figure 6-23 shows the Buffer Pool and I/O dashboard with the six hours monitoring interval that we used in our scenario. The BP32K and the IBMDEFAULTBP buffer pool both have low hit ratios that constitutes to the low overall hit ratio of 57.37%.

Recent			1	0/27/10 18:35 - 10/	Learn about 28/10 00:35	the time controls.
History	Refresh	10/27/10 16:44 1	8:03 19:03 20	103 21:03 22:	03 23:03 00:0	3 01:03 02:03
Buff	er Pool and	I/O Dashboar	d: DPF on A2	/АЗ ТРСН		
Buffe	r Pools Table	Spaces Tables				
Sho	Lowest 5	<b>•</b> buffer pools by	Hit Ratio (%)		Show Containe	d Objects
	Buffer Pool Nam	e Main Usage	Buffer Pool Size (pages)	Hit Ratio (%)	Logical Reads (/min)	Physical Reads (/min)
	Total		511,728	57.370	155,022.464	66,086,636
	врз2к	MIXED	164,000	55.124	110,082.472	49,400.671
	IBMDEFAULTBP	MIXED	315,872	62.871	44,939.992	16,685.965
	ВРЗ2КТМР	UNKNOWN	31,600		0	0
	IBMSYSTEMBP32K	UNKNOWN	64		0	0
	IBMSYSTEMBP16K	UNKNOWN	64		0	0

Figure 6-23 Hit ratios per buffer pool on Buffer Pool and I/O dashboard

Select the BP32K buffer pool and click **Show Contained Objects** to lists the table spaces that use the BP32K buffer pool. See Figure 6-24 on page 235. The TABDATA table space contains all the tables that our SQL queries use and the hit ratio is low with around 56%. The TABINDEXES table space is supposed to contain the indexes. No activity is done in the buffer pool for the TABINDEXES table space which is an indication of missing indexes.

Buffer Pool and I/O Dashboard: DPF on A2/A3 TPCH								
Buffer Pools Table Space Tables								
Show	Lowest 5 🗸 🔻	table spaces by	Hit Ratio (%)	▼] in	buffer pool: BP3	ol: BP32K 💌		
Ta	ble Space Name	Main Usage	Buffer Pool Name	Hit Ratio (%)	Logical Reads (/min)	Physical Reads (/min)		
То	tal			58.884	127,630.888	52,476.2		
AT 🧔	BDATA	MIXED	ВРЗ2К	56,404	86,627.430	37,766.2		
ТА	BINDEXES	UNKNOWN	BP32K		0			

Figure 6-24 Hit ratios per table spaces using the BP32K buffer pool

A detailed look at the hit ratio graph grid view confirms that only data reads are performed and no index reads at all, as shown in Figure 6-25.

Time	Total (%)	Index-Non- Temporary (%)	Index- Temporary (%)	Data-Non- Temporary (%)	Data- Temporary (%)	XDA-Non- Temporary (%)	XDA- Temporary (%)
10/27 23:28	57.383			57.383			
10/27 23:15	54.380			54.380	· · ·	·	
10/27 23:02	53.478			53.478			
10/27 22:49	59.866	· · <u></u>	· · · · · · · · · · · · · · · · · · ·	59.866	···· ···· <u></u>		
10/27 22:36	60.935			60.935			
10/27 22:23	51.690			51.690			
10/27 22:10	58.537			58.537			

Figure 6-25 Hit ratio separation for TABDATA table space

IBMDEFAULTBP buffer pool also had a low hit ratio of around 63%. We use same method to check quickly which table spaces use IBMDEFAULTBP buffer pool. Select **IBMDEFAULTBP** and click **Show Contained Objects** results in the list of table spaces shown in Figure 6-26 on page 236. The main contributor to the low hit ratio in IBMDEFAULTBP is the table space TEMPSPACE1 with around 61%. This table space is used for the sorting activity of the queries, which is high due to the missing indexes.

Show Lawe Table Spa Total Total SMALL	I able Space est 5 V	table spaces by	Hit Ratio (%) Buffer Pool Name	v in Hit Ratio (%)	Logical Reads	DEFAULTBP   Physical Reads
Table Spa Total TEMPSPAC	est 5 💌	table spaces by Main Usage	Hit Ratio (%) Buffer Pool Name	▼ ii Hit Ratio (%)	Logical Reads	Physical Reads
Table Spa Total TEMPSPAC SMALL	ice Name	Main Usage	Buffer Pool Name	Hit Ratio (%)	Logical Reads	Physical Reads
Total TEMPSPAC SMALL					(/min)	(/min)
SMALL		-		58.884	127,630.888	52,476.225
SMALL	E1 M	IIXED	IBMDEFAULTBP	61.386	38,019.709	14,680.76
	D	ATA	IBMDEFAULTBP	97.922	498.454	10.356
SYSTOOLS	PACE M	IIXED	IBMDEFAULTBP	99.133	68.769	0.596
SYSCATSP	ACE M	IIXED	IBMDEFAULTBP	99.245	2,415.730	18.236
SYSTOOLS	TMPSPACE M	IIXED	IBMDEFAULTBP	100	0.796	(

Figure 6-26 Hit ratios per table space using the IBMDEFAULTBP buffer pool

## 6.3 Monitoring memory usage

In this section we describe how you can use the Memory dashboard to monitor the memory that DB2 allocates and uses for the instance, databases, and applications. We describe the information you see on the memory dashboard and use that to introduce the DB2 memory model. This help you to understand how DB2 uses memory in order to detect any memory bottlenecks easily.

Since the database manager configuration and database configuration influence how the memory is used, we also describe using the *Database Manager Configuration report* and the *Database Configuration report* to check how your database manager and databases are configured and which parameters have been changed over time.

#### 6.3.1 Monitoring DB2 instance memory usage

DB2 uses the *INSTANCE\_MEMORY* parameter to limit the memory usage on each partition. This parameter is set to AUTOMATIC by default. The INSTANCE\_MEMORY database manager configuration parameter controls the maximum amount of memory that can be used by each DB2 logical partition, including all shared memory and private memory usage for the agents associated to that particular logical partition. DB2 considers that between 75% and 95% of the RAM can be used for all the database partitions within a physical node.

The partitioned database that we used in the CPU scenario has two partitions on each physical node. Each physical node has 8 GB of RAM. The instance memory limit for each partition on the physical node is around 2.7 GB (217263)
4K pages in the INSTANCE\_MEMORY parameter) which results to around 5.4 GB for both partitions. This is at the lower bound of the RAM that DB2 uses as memory limit in our scenario.

On the Memory dashboard you can look at these values by selecting the **Instance** scope, shown in Figure 6-27. The blue line in the graph represents the available RAM on the machine, whereas the red line shows the defined instance memory limit per partition.

Memo	ory Dash	board: DPF or	A2/A3 TPCH				and the second se
Scope:	Instance		Partition set: All	partitions		Partition: G	ilobal
Graph	Grid						
Select	ted layer:	FCM Buffers		Fit Used Memory			
900	0000000-						
800	00000000-						
700	00000000-						
600	00000000-						
원 <b>500</b>	00000000-						
à 400	0000000-				Instance Memory Lim	it : 2.729 GB 10/27 21:00:00	
300	00000000-				•		
100	00000000						
	0.						
		10/27 17:53:20	10/27 19:00:00	10/27 20:06:40	10/27 21:13:20	10/27 22:20:00	
Health	Overvie	w for Partition Gl	obal				
Memory	Area	Current Size	and Utilization		Configuration Parameter Name	Configuration Parameter Value	2
Instance	e memory lir	nit		2.729 GB	instance_memory	715,263	page
Audit buf	ffer			0 bytes	audit_buf_sz	0	page
Monitor h	heap			160 KB	mon_heap_sz	90	pages
<b>ECM</b> buff	ers	61.794 %		53.125 MB	fcm_num_buffers	4,096 b	uffers

Figure 6-27 Instance Memory usage and memory limit on memory dashboard

Click **Fit Used Memory** to remove the limit lines and adjust the scale of the graph to the memory that is really used. See Figure 6-28 on page 238.

Memory Dashl	board: DPF on A	А2/АЗ ТРСН			
Scope: Instance		Partition set: All p	partitions		Partition: Globa
Graph Grid					
Selected layer:	FCM Buffers		Fit Memory Limit		
	FCM Buffers				
200000000	🔜 Audit Buffer				
	📰 Monitor Heap				
160000000-	🧱 This Database - Data	abase Global Memory			
120000000-	📕 This Database - App	lication Global Memor			
80000000					
40000000-					
0					
1	0/27 17:53:20	10/27 19:00:00	10/27 20:06:40	10/27 21:13:20	10/27 22:20:00
Health Overview	for Partition Glob	al			
Memory Area	Current Size and	Utilization		Configuration Parameter Name	Configuration Parameter Value
Instance memory lim	it	Design (1999) and the product of the second seco	2.729 GB	instance_memory	715,263 page
Audit buffer			0 bytes	audit_buf_sz	0 page
Monitor heap			160 KB	mon_heap_sz	90 page
FCM buffers	61.794 %		53.125 MB	fcm_num_buffers	4,096 buffer

Figure 6-28 Actual Instance memory usage on memory dashboard

In the graph you see the memory areas that belong to the database manager shared memory are Audit Buffer, Monitor Heap, FCM Buffers. These memory areas are allocated when the instance is started. The graph also shows the database global memory and application memory of the database you selected on this dashboard. If your instance contains multiple databases and you want to know the entire amount of memory that DB2 allocated for this instance, you have to select the databases one by one on the memory dashboard and calculate the sum of the used memory manually.

The table beneath the graph only shows details for the memory areas belonging to database manager shared memory. For the details of the database global memory and application memory, change the scope by using the **Scope** drop down box.

## 6.3.2 Monitoring database memory usage

DB2 uses the *DATABASE\_MEMORY* parameter to limit the memory used for the database global memory allocations on each partition. This parameter is set to AUTOMATIC by default. The DATABASE\_MEMORY database configuration parameter represents the maximum amount of memory reserved for the database global memory allocations. On DB2 9.7, this value is equal to individual

memory pool allocations within the database global memory such as buffer pool, utility heap size with additional memory to accommodate for dynamic heap growth. DATABASE\_MEMORY should be less than INSTANCE\_MEMORY. Database global memory is allocated when the database is activated.

On the Memory dashboard you can look at this value by selecting the **Database Global Memory** scope as shown in Figure 6-29. The red line shows the defined database memory limit set in the DATABASE\_MEMORY parameter.

Memory Dashboard: DPF on A2/A3 TPCH						
Scope: Database (	lobal Memory	s Partition:				
Graph Grid						
Selected layer:	Database Heap - Other					
280000000		Database Memory Limit : 2.463 GB 11/02 14:56:00				
2400000000-		•				
200000000-						
හ <u></u> 1e0000000-						
120000000-						
80000000-						
40000000-						
0	11/02 14:53:20 11/02 14:55:	00 11/02 14:56:40 11/02 14:58:20 11/02 15				
Health Overview	for Partition 2					
Memory Area	Current Size and Utilization	Hit Ratio (%) Configuration Para				
Database memory lin	it 2.463	GB database_memory				

Figure 6-29 Database memory limit on memory dashboard

The colored part below the database memory limit show the database global memory that is used by the database over time. The memory limit is not reached yet. If there are memory shortages in one of the heaps or buffer pools, there is still room to increase size for the heaps or buffer pools.

Click **Fit Used Memory** to remove the limit line and to adjust the scale of the graph to the memory that is really used. See Figure 6-30 on page 240. Each color in the graph represents one memory area of the database global memory. The largest part of the memory is used by buffer pools, therefore, it is hard to see any other column in the graph. The other memory areas are rather small.

#### 7925ch06.fm

Memory Dashboard: DPF on A2/A3 TPCH							
Scope: Database G	Scope: Database Global Memory V Partition set: All partitions						
Graph Grid							
Selected layer:	Database Heap - Other	Fit Mem	ory Limit				
	🔝 Database Heap - Oth	er 🔺					
200000000-	📰 Database Heap - Log	Buffer					
	Buffer Pools						
160000000-	Seckage Cache						
120000000-	Catalog Cache						
<sup>60</sup> 80000000-							
40000000-							
11/02 1	15:00:00 11/	/02 15:16:40	11/02 15:33:	20 11/	02 15:50:00	11/02 1	
	ويتكبر ويسترعب فيتكافر						
Health Overview	for Partition 2						
Memory Area	Current Size and	Utilization		Hit Ratio (%)			
Database memory limi	it		2.463 GB				
Database heap - other	Construction of the second		36.781 MB				
Database heap - log bu	uffer	Construction of the second second	1 MB				
Buffer pools			1.817 GB	54.683 %	stretur - service 🗛		
Package cache			1.031 MB	39.436 %	• • • • •		
Catalog cache		Construction of the second second second	J 576 KB	97.950 %	• • •	لا	
Utility heap		www.accord.com.com.com.com.com	197 KB				
Lash Kat	0.622.04	any new printing the second second	26 625 MB	6			

*Figure 6-30 Memory areas in data base global memory* 

The table beneath the graph shows the details for each memory that consist of:

Current Size and Utilization:

The current size is the size of the memory area at the end of the monitoring interval. If you are looking at recent data then this is the most recent value from the database.

The utilization shows the utilization percentage of the memory area at the end of the monitoring interval. Because DB2 does not return the actual utilization value for every memory area, only a few memory areas' utilization can be calculated, for example the lock list. A high utilization is an indication that increasing the memory area could be helpful. For example, if the Lock list is used by 100% then DB2 changes row locks to table locks which can slow down concurrency.

► Hit Ratio (%):

This field shows the average hit ratio during the monitoring interval. The hit ratio tells the percentage the data is available in the memory areas when the data is needed. Only a few memory areas' hit ratio can be calculated and make sense to calculate. A low hit ratio is an indication that this memory area could be too small and the data is not in the memory area when needed.

Configuration Parameter Name:

This field shows the database manager configuration parameter or the database configuration parameter that can be configured to control the size of the memory area.

Configuration Parameter Value:

This is the value of the configuration parameter at the end of the monitoring interval. If you are looking at the recent data then this is the most recent value from the database.

Figure 6-30 on page 240 shows the current size, utilization, and hit ratio information which are only a portion of the whole memory dashboard. In Figure 6-31, we reorder the columns of the table to present the configuration parameter name and value.

Memory Area	Configuration Parameter Name	Configuration Parameter Value	Current Size and Utilization
Database memory limit	database_memory	645,552 pages	2.463 GB
Database heap - other	dbheap	2,397 pages	36.562 ME
Database heap - log buffer	logbufsz	256 pages	1 MB
Buffer pools			1.817 GB
Package cache	pckcachesz	100 pages	1 MB
Catalog cache	catalogcache_sz	300 pages	320 КВ
Utility heap	util_heap_sz	26,322 pages	64 KB
Lock list	locklist	6,200 pages	0.429 % 26.625 ME
Shared sort heap	sheapthres_shr	13,915 pages	24.607 % 🗾 13.375 ME

Figure 6-31 Memory area details

For a partitioned system you can list the top partitions by the size of a memory area, view the memory area details for a single partition, and display the memory usage graph for a single partition. On the right side of the memory dashboard you find the top partition listing and partition selection. As an example we list the top partitions by package cache size shown in Figure 6-32 on page 242.

Sh	ow highest 5 🛛 🔹 by Package Cache	
	Partition ID	Package Cache
	Global	985.370 KB
	0	1.239 MB
	1	915.349 KB
	2	913.860 KB
	3	843.906 KB
V C	isplay this list by the selected graph layer	Explore Partition

Figure 6-32 Top partitions by package cache size

The highest package cache size exists on partition 0. The reason for that is probably because partition 0 is the coordinator partitions and any query execution starts from there. Selecting a partition displays the memory area details such as size, hit ratio, and so on in the lower table on the dashboard. Clicking the Explore Partition button displays the memory usage graph for the selected partition. By default, The Global values displayed on the memory dashboard show the average values of all partitions.

# 6.3.3 Monitoring application memory usage

Memory used for the applications consist of application global memory and application private and shared memory.

DB2 uses the *APPL\_MEMORY* database configuration parameter to control the maximum amount of application memory that is allocated by DB2 database agents to service application requests. This parameter is set to AUTOMATIC by default.

You can look at application global memory usage by selecting the **Application Global Memory** scope and you can look at application private and shared memory by selecting the **Application Private/Shared Memory** scope. The usage and navigation is the same as for the Instance and Database Global Memory scope therefore we do not go into more detail here. Just one screenshot showing the application global memory usage in Figure 6-33 on page 243 that shows nicely the different memory areas using different colors.

	Application	Global Memory 🛛 🔹 🖡	Partition set: All parti	tions		
Graph	Grid					
Selec	ted layer:	Application Heap	Fit Memory Limit			
Catalogue Southering		Application Heap				
120	00000	Statistics Heap				
100	00000-	Statement Heap				
80	00000-					
Ĕ	00000-					
۵۵ 40	000000-					
20	00000-					
	0		And a second			
	0 11/02 15:	00:00 11/02	2 15:16:40 1	1/02 15:33:20	11/02 15:50:00	11/02 16:06:
Health	0 11/02 15: Overview	00:00 11/02 for Partition 0	2 15:16:40 1	1/02 15:33:20	11/02 15:50:00	11/02 16:06:
Health Memory	0 11/02 15: Overview Area	00:00 11/02 for Partition 0 Configuration Parameter Name	2 15:16:40 1 Configuration Parameter Value	1/02 15:33:20 Current Size and L	11/02 15:50:00	11/02 16:06:4
Health Memory Applicati	0 11/02 15: Overview Area	00:00 11/02 for Partition 0 Configuration Parameter Name appl_memory	Configuration Parameter Value 40,000 pages	1/02 15:33:20 Current Size and L	11/02 15:50:00 Jtilization 156.250 MB	11/02 16:06:
Health Memory Applicati	0 11/02 15: Overview Area on memory lir on heap	00:00 11/02 for Partition 0 Configuration Parameter Name appl_memory applheapsz	2 15:16:40 1 Configuration Parameter Value 40,000 pages 128 pages	1/02 15:33:20 Current Size and L	11/02 15:50:00 Jtilization 156.250 MB	11/02 16:06:4
Health Memory Applicati Applicati Statistics	Overview Area on memory lir on heap s heap	00:00 11/02 for Partition 0 Configuration Parameter Name appl_memory applheapsz stat_heap_sz	Configuration Parameter Value 40,000 pages 128 pages 4,384 pages	1/02 15:33:20 Current Size and t	11/02 15:50:00 Jtilization  156.250 MB  3 MB  2.625 MB	11/02 16:06:4

Figure 6-33 Application global memory areas

# 6.3.4 Detecting a too small memory area

The memory dashboard helps to detect if a memory area is too small. Monitoring the size of the memory areas over time is especially important if the self tuning memory manager (STMM) is turned off for the monitored database.

In the following example STMM is turned off on the partitioned database.

In Figure 6-34 on page 244, the Overview dashboard shows a low Package cache hit ratio of 39% while heavy statements are running, indicated by these metrics Rows read per fetched row, Maximum CPU time of running statements, and Maximum elapsed time of running statements.

Overview Dashboard: DP	F on A2/A3 TPCH
Workload	
Transactions:	86.284 /min
Failing transactions:	9.709 %
Open connections:	8
Active connections:	9
Rows read per fetched row:	27,502.765
Maximum CPU time of running statements:	29:41.376 min
Maximum elapsed time of running statements:	02:29:43.948
Critical workloads:	
Caching	
Catalog cache hit ratio:	97.950 %
Package cache hit ratio:	■ 39.436 %

Figure 6-34 Part of Overview dashboard showing package cache hit ratio

Clicking on the bar chart next to Package cache hit ratio opens the graph shown in Figure 6-35 on page 245. This graph confirms that the package cache hit ratio is low over time. It also shows that there are differences among the partitions, the minimum hit ratio that occurs on one partition is lower than the average hit ratio over all partitions.

Package Cache Hit Ratio	
Graph Grid Partition Details	Memory Dashboard
70 60 50 40 30 20 10	
0 11/02 14:58:00 11/02 15:18:00 11/02 15:38:00 11/02 15:58:00 11/02 16:18:00 Time Across all partitions	
📕 Average package cache hit ratio: 📕 39.436 %	
🚪 Minimum package cache hit ratio: 🧧 35.243 %	
Warning value: 80 🔹 % Critical value: 70 🔹 %	
	K Apply Cancel

Figure 6-35 Package cache hit ratio graph.

To list the top partitions by package cache size, click **Memory Dashboard** from the graph and select the scope for Database Global Memory on the dashboard. Figure 6-32 on page 242 shows that the package cache size for partition 0 is around 1.2 MB and is around 900 KB for the other partitions. Select the coordinator partition 0 for he details as shown in Figure 6-36. The partition 0 has an average package cache hit ratio of 35% which is the lowest hit ratio of all partitions because partition 0 is the coordinator partition.

Memory Area	Configuration Parameter Name	Configuration Parameter Value	Hit	Ratio (%)		
Database memory limit	database_memory	645,552 pages				
Database heap - other	dbheap	2,397 pages				
Database heap - log buffer	logbufsz	256 pages				
Buffer pools				63.005 %		7
Package cache	pckcachesz	100 pages		35.243 %	• • • • • • • •	
Catalog cache	catalogcache_sz	300 pages		97.681 %		Ø
Utility heap	util_heap_sz	26,322 pages				
Lock list	locklist	6,200 pages				
Shared sort heap	sheapthres_shr	13,915 pages				

Figure 6-36 Package cache details of partition 0

Figure 6-37 shows the package cache hit ratio for partition 2 with 52%. The ratio is higher than on partition 0, but the number is not good.

Health Overview for	Partition 2				
Memory Area	Configuration Parameter Name	Configuration Parameter Value	Hit Ratio (%)		
Database memory limit	database_memory	645,552 pages			
Database heap - other	dbheap	2,397 pages			
Database heap - log buffer	logbufsz	256 pages			
Buffer pools			52.622 %		2
Package cache	pckcachesz	100 pages	52.909 %		2
Catalog cache	catalogcache_sz	300 pages	99.348 %	• • • • •	Ø
Utility heap	util_heap_sz	26,322 pages			
Lock list	locklist	6,200 pages			
Shared sort heap	sheapthres_shr	13,915 pages			

Figure 6-37 Package cache details on partition 2

The database configuration parameter PCKCACHESZ shows only 100 pages, which is a very small size. We increase the size using the following command on a command line on the monitored system while our workload is still running:

db2 update db cfg using pckcachsz 1533

Some minutes later we check the actual sizes of the package cache on the Memory dashboard. On partition 0, the actual size increased by around 4 MB to 5 MB as shown in Figure 6-38.

Sh	Show highest 5 ▼ by Package Cache ▼				
	Partition ID	Package Cache			
	Global	2.206 MB			
⇒	0	5.037 MB			
	1	1.262 MB			
	3	1.262 MB			
	2	1.262 MB			

Figure 6-38 Package cache size after increasing pckcachesz

Looking at the memory details for each partition confirms that the package cache hit ratio is much higher now on all partitions. It is about 72% on average on partition 0 as shown in Figure 6-39 on page 247. It still shows an alert, because the critical alert threshold is 70% and, at some timestamps during the monitoring interval the hit ratio was below 70%. Increasing the package cache size further would improve the hit ratio further.

Memory Area	Configuration Parameter Name	Configuration Parameter Value	Hit	Ratio (%)	
Database memory limit	database_memory	645,552 pages			
Database heap - other	dbheap	2,397 pages			
Database heap - log buffer	logbufsz	256 pages			
Buffer pools				40.422 %	
Package cache	pckcachesz	1,533 pages		72.067 %	
Catalog cache	catalogcache_sz	300 pages		97.036 %	
Utility heap	util_heap_sz	26,322 pages			
Lock list	locklist	6,200 pages			
Shared sort heap	sheapthres_shr	13,915 pages			

Figure 6-39 Details on partition 0 after increasing pckcachesz

# 6.3.5 Checking configuration changes using reports

The database manager configuration and database configuration influence how the memory is used. In this section we describe how to use the *Database Manager Configuration report* and the *Database Configuration report* to check how your database manager and databases are configured and which parameters have changed over time.

To launch either Database Manager Configuration report or Database Configuration report, from **Task Manager**  $\rightarrow$  **Reports**. On the reports launch page select the type of report and the reporting interval. A new browser window opens that displays the report. Both reports have similarities and offer you the ability to track changes that DB2 does when the memory related parameters were set to AUTOMATIC. By default, the tracking of changes to automatic parameters is off and you see only the changes that you did manually to the non-automatic parameters.

### Using the Database Manager Configuration report

In Figure 6-40 on page 248 we show a partial report, which includes all parameters important for capacity management. Some of the parameters are displayed on the memory dashboard for the Instance scope. No changes were manually applied to the database manager configuration during the reporting interval of one day, therefore, you only see configuration parameters from one timestamp.

Agents		Nov 3, 2010 12:10 AM
MAX_CONNECTIONS	[A] Maximum number of client connections	-1
MAX_COORDAGENTS	[A] Maximum number of coordinating agents	200
MAXCAGENTS	Maximum number of concurrent agents	0
MAXAGENTS	Maximum number of agents	0
NUM_POOLAGENTS	[A] Agent pool size	100
NUM_INITAGENTS	Initial number of agents in pool	0
AGENTPRI	Priority of agents	-1
MAXTOTFILOP	Maximum total of files open	0
Agent private memory		
AGENT_STACK_SZ	Agent stack size	1,024
PRIV_MEM_THRESH	Private memory threshold configuration parameter	0
QUERY_HEAP_SZ	Query heap size	1,000
SHEAPTHRES	Sort heap threshold	0
Agent/application commun	ication memory	
RQRIOBLK	Client I/O block size	32,767
ASLHEAPSZ	Application support layer heap size	15
Database application remo Fenced processes	te interface (DARI) /	
KEEPFENCED	Keep fenced process	Yes
NUM_INIFENCED	Initial number of fenced processes	0
FENCED_POOL	[A] Maximum number of fenced processes	-1
Database manager instance	a second and a second	
MON_HEAP_SZ	90	
AUDIT_BUF_SZ	Audit buffer size	0
DIR_CACHE	Directory cache support	Yes
JAVA_HEAP_SZ	Maximum Java interpreter heap size	2,048
INSTANCE_MEMORY	[A] Instance memory	715,263

Figure 6-40 Capacity Management section from database manager report

## Using the Database Configuration report

The Database Configuration report services two purposes:

 For a partitioned system, the report let you compare the database configuration of multiple partitions and highlights the differences.

Figure 6-41 on page 249 shows a sample report with a few parameters on partition 0 and 1.

 For a single partition, the report shows and highlights the changes performed manually or automatically by DB2 during the reporting interval.

In the example shown in Figure 6-42 on page 250 we see the manual change of the Package cache size that we did to improve the package cache hit ratio. Although STMM is turned off, we specify that we want to track changes of automatic parameters in order to see this manual change.

Partitions on Database					
To compare the configuration of To check which configuration pa	the partitions with the same role, click the correspo rameters have been changed in the selected repor	nding partition role. t interval for a specific partition, click the partition number			
Note: You can change the assig	nment of partitions to a partition role by editing the r	nonitoring configuration from the Manage Database Con	nections page.		
Partition Role	Partitions				
CATALOG	<u>0</u>				
DATA	1	2			
Application Shared Memor	DB Configuration parameters, see <u>DB2 v9.7 Inform</u> ry	CATALOG (using partition 0)	DATA (u		
Application Shared Memor		CATALOG (using partition 0)	DATA (U		
APPL_MEMORY	Application memory (4 KB)	40,000	40,000		
Database shared memory					
CATALOGCACHE_SZ	Catalog cache size (4 KB)	300	300		
DBHEAP	Database heap (4 KB)	2,397	2,397		
LOCKLIST	Maximum storage for lock list (4 KB)	6,200	6,200		
PCKCACHESZ	Package cache size (4 KB)	1,533	1,533		
UTIL_HEAP_SZ	Utility heap size (4 KB)	26,322	26,322		

Figure 6-41 Comparison of parameters on partition 0 and partition 1

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Report Configuration			
Track Changes of Automatic F Note: Selecting any of the opti	Parameter: On V Limit for Detected Changes	: 25 V (2 found)	
Capacity Management			
For a detailed description of th	e DB Configuration parameters, see <u>DB2 V9.7 Info</u>	rmation Center	
"[A]" denotes "Can be Configu "[S]" denotes "Can be Manage	ured Automatically by Database" ad by Self Tuning Memory Manager" y	Nov 2, 2010 7:38 DM	Nov 2 2010 6:56 DM
Application shared memor		40.000	10 000
APPL_MEMORY	[A] Application memory size (4 KB)	40,000	40,000
Database shared memory			
CATALOGCACHE_SZ	Catalog cache size (4 KB)	300	300
DBHEAP	[A] Database heap (4 KB)	2,397	2,397
LOCKLIST	[S] Maximum storage for lock list (4 KB)	6,200	6,200
PCKCACHESZ	[S] Package cache size (4 KB)	1,533	100
UTIL_HEAP_SZ	Utility heap size (4 KB)	26,322	26,322
SELF_TUNING_MEM	Self-tuning memory	Off	Off
DB_MEM_THRESH	Database memory threshold	655,360	655,360
DATABASE_MEMORY	[S] Database shared memory size (4 KB)	645,552	645,552

Figure 6-42 Parameter changes on partition 0





Optim Performance Manager is good in identifying locking problems as the cause of a performance slowdown. Using either Inflight dashboards or Extended Insight dashboard or a combination of both let you easily find locking problems and the involved statements or applications.

This chapter provides two scenarios in that we identify and analyze locking problems:

- In the first scenario the system shows many deadlock alerts and we use the Locking dashboard to identify the cause of the deadlocks.
- In the second scenario we assume that the alerting for deadlock, lock, and timeout events is disabled in order to avoid the overhead of the lock event monitor on the monitored database. We show how you can identify locking problems easily even if the alerting is disabled.

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# 7.1 Troubleshooting deadlock alerts

Assume that you are notified about a high number of deadlock alerts. The ways of notification include the following:

- You have configured e-mail notification and receive e-mails about deadlock alerts.
- You have configured notification through SNMP and see the Optim Performance Manager alerts in other products interfacing with SNMP.
- ► You are called by users who complain about bad response times and SQL errors indicating deadlocks or timeouts.
- You do your usual health check and see locking alerts on the Health Summary dashboard.

Open the Health Summary dashboard to verify the notifications. For the database SAMPLE you see a red critical alert indicator for the Locking category and the number of critical alerts is very high, shown in Figure 7-1.



Figure 7-1 Health Summary showing alert indicators for databases

Click on the red alert indicator icon in the Locking category for the SAMPLE database. An overlay window opens listing all alerts that occurred during the selected monitoring time frame as shown in Figure 7-2 on page 253.

Open Full List	Configure	Send	Add Com	nment				\$	+0	10
Severity	Ale	ert Type	Constanting Providence	- Series and -	atart Time			Er	nd Time	
	Application	n Deadlock	11	/09/2010 1	11:47:12 AM		11/09/2	2010 11	:47:12 AM	4
	Application	n Deadlock	11	/09/2010 1	11:46:56 AM		11/09/2	2010 11	.:46:56 AM	4
	Application	n Deadlock	11	/09/2010 1	11:46:45 AM		11/09/2	2010 11	.:46:45 AM	4
	Application	n Deadlock	11	/09/2010 1	11:46:39 AM		11/09/2	2010 11	.:46:39 AM	4
	Application	n Deadlock	11	/09/2010 1	11:46:17 AM		11/09/2	2010 11	.:46:17 AM	4
	Application	n Deadlock	11	/09/2010 1	11:46:06 AM		11/09/2	2010 11	:46:06 AM	4
	Application	n Deadlock	11	/09/2010 1	11:45:22 AM		11/09/2	2010 11	:45:22 AM	v <b>1</b>
	Application	n Deadlock	11	/09/2010 1	11:44:55 AM		11/09/2	2010 11	:44:55 Af	M
	Application	n Deadlock	11	/09/2010 1	11:43:50 AM		11/09/2	2010 11	:43:50 AM	M
	Application	n Deadlock	11	/09/2010 1	11:42:34 AM		11/09/2	2010 11	:42:34 AM	4
	Application	n Deadlock	11	/09/2010 1	11:42:23 AM		11/09/2	2010 11	:42:23 AM	M
	Application	n Deadlock	11	/09/2010 1	11:42:12 AM		11/09/2	2010 11	142:12 AM	4
	Application	n Deadlock	11	/09/2010 1	11:42:01 AM		11/09/2	2010 11	:42:01 AM	M
	Application	n Deadlock	11	/09/2010 1	11:41:45 AM		11/09/2	2010 11	:41:45 AM	A
	Application	n Deadlock	11	/09/2010 1	11:41:34 AM		11/09/2	2010 11	:41:34 AM	1
41 total item	5			15	Items per p	page [		Page 🛛	1   🔻 0	f 3 💽
lert Details	Actions Alert	t Descriptic	n							

Figure 7-2 Deadlock alerts for SAMPLE database

You can analyze each single alert from here by selecting the Alert Details tab. Alternatively, you can open the Locking dashboard for further investigation. The Locking dashboard opens by clicking the link in the Actions tab. The Locking dashboard not just list all occurred deadlock events, it groups the deadlocks and other locking problems by connection attributes, for example, client application name or client user that causes the problems. The grouping by connection attributes is based on the client information fields that you can set in your application for each connection. Grouping by connection attributes results in so called workload clusters, each containing multiple connections with the same connection attribute values. This helps to distinguish applications having real locking problems from others.

In our example we see in Figure 7-3 on page 254 that we have workload clusters for the client users db2user1 and db2power and workload clusters for the client applications db2user1 and db2power. The client users db2user1 and db2power use the client applications named db2user1 and db2power which result in multiple database connections per client application and per client user. Both client applications get deadlocks which means that both users are impacted, db2power

user with 28 deadlocks in the monitoring interval is a little bit more impacted than db2user1 with 23 deadlocks. Clicking the db2power user shows in the lower table all deadlock events in that the db2power participates.

Locking Dashboard: sam	ple					
This dashboard shows the workload clu	ister groups that are	in a locking si	tuation. Click a workload cluster o	proup to view locking informa		
Overview						
Activate Deactivate New.	Edit Copy	Delete				
Database Workload	Maximum	Wait Time	Maximum Block Time	Deadlocks		
T 🗁 sample		2.014	6.466			
🕈 🚞 Client user IDs		2.014	6.466	28		
db2user1		0.964	0	23		
db2power		2.014	6.466	28		
··· 🗋		2.014	6.466	<b>2</b> 8		
Client application names		2.014	6.466	28		
db2user1		0.964	0	<b>2</b> 3		
db2power	ver		6.466	28		
		2.014	6.466	 28		
				-		
Locking Information for d	2power					
Locking Event (28) Current Waiti	ng Connections (5)	Current Bloc	king Connections (2)			
The grid shows lock wait alerts, deadl	ocks, and timeouts f	or the selected	workload cluster group. Choose	an event and click Analyze to		
Alert Time		Ale	rt Name			
Tue Nov 09 11:43:50 CET 2010		Dea	Deadlock in application			
Tue Nov 09 11:42:34 CET 2010		Dea	Deadlock in application			
Tue Nov 09 11:42:23 CET 2010		Dea	Deadlock in application			
Tue Nov 09 11:42:12 CET 2010	Tue Nov 09 11:42:12 CET 2010					
Tue Nov 09 11:42:01 CET 2010			Deadlock in application			
Tue Nov 09 11:42:01 CET 2010			Deadlock in application			
Tue Nov 09 11:42:01 CET 2010 Tue Nov 09 11:41:45 CET 2010		Dea	dlock in application			
Tue Nov 09 11:42:01 CET 2010 Tue Nov 09 11:41:45 CET 2010 Tue Nov 09 11:41:34 CET 2010		Dear	dlock in application dlock in application			
Tue Nov 09 11:42:01 CET 2010 Tue Nov 09 11:41:45 CET 2010 Tue Nov 09 11:41:34 CET 2010 Tue Nov 09 11:41:28 CET 2010		Dea Dea Dea	dlock in application dlock in application dlock in application			

Figure 7-3 Locking dashboard showing deadlock events

Select one deadlock event in the lower table and click **Analyze** to get the deadlock details. An overlay window opens that shows the details about the involved participants and the executed SQL statements. The amount of details provided vary dependent on the detail level with that the lock or deadlock event monitor runs on the monitored database. You select the level of detail during configure monitoring.

In our example, every deadlock event shows similar details. We noticed that the DB2 table that participates most in the deadlocks is DB2USER1.0PM\_SAMPLE\_TABLE.

In most deadlocks, one participating connection holds a TABLE lock instead of single ROW locks. We illustrate this in Figure 7-4 which shows the details of the participating connections in the deadlock and in Figure 7-5 on page 256 which shows the SQL statements the participating connections execute.

verview Participants	Statements Lock		
Show/highlight difference	Statement 🖌	Locks 🗹 Ap	plication 🗹 Table
Property Name	Participant 1	Pa	articipant 2 - Victim
Participant ID	1,494	1,-	493
Agent ID	8,524	8,	534
Application ID	127.0.0.1.4928.10	109103554 12	7.0.0.1.4940.10110910360
Application Name	db2user1_2	db	2power_2
Authorization ID	DB2USER1	DE	32POWER
Agent PID	10,224	9,3	264
Coordinator Agent PID	10,224	9,	264
Client User ID	db2user1	db	2power
Client Workstation	VMWareDB2	VN	1WareDB2
Client Application	db2user1	db	2power
Client Accounting String	·		
Application Status	UOW Executing	UC	DW Executing
Application Activity	No action	No	action
Workload ID	4		
Workload Name	DB2USER1_WL	DE	32POWER_WL
Service Subclass ID	18 17		,
Service Subclass Name	DS_LOW_CONC_SU	BCLASS DS	MED_CONC_SUBCLASS
Current Statement Operation	Execute	Fe	itch
Lock Timeout Value (sec)	0	0	
Lock Wait Value (sec)	0	0	
Lock Escalation	yes	no	)
Past Activities Wrapped	no	no	)
Lock Name	7.0004e+24	7.	00040004e+24
Lock Object Type	TABLE	RC	w
Lock Attributes	3,000	0	
Lock Mode Requested	x	NS	3
Lock Mode	IS	X	
Locks Held	1	1	
Lock Hold Count	0	0	
Lock Status	Converting	W	aiting

Figure 7-4 Deadlock participant details

			in and a second			
Activity ID	P	articipa	nt 1 - Ov	wner	Particip	ant 2 - Victim
1	UP	DATE DI	B2USER 1	LOPM_SAMPLE	1.000	
4					SELECT *	FROM DB2USER1.OPM_
1					CALL SYS	PROC.ADMIN_CMD('EXP.
			10.000			
Statement text				LOCK Details		
UPDATE DB2USER1 OPM	SAMPLE TA		-	General		
SALARY = 1.1 * SALARY V	VHERE SALA	RY < 3	0000	Lock Name		070004000000000
				Lock Object Ty	pe	TABLE
				Lock Attributes		00003000
Stop Current Statement	Show At	Text	Tune	Lock Mode Req	uested	x
Stop current Statement	Show At	TOXU	lung	Lock mode		IS
Parameter marker values				Locks Held		1
Data	Desition	Valu	acat	Lock hold count	t	0
Vata Type	POSIDOII	an in V diu	ESEL	Lock Status		Converting
				Release flags		4000000
				Table Schomp		OPM_SAMPLE_TABLE
				Table Schema		OPM SAMPLE TS 1
				Data partition i	d d	0FM_3AMFEL_13_1
				Data partition i		
Daticipant ID:	1404					
Activity ID:	1494					
HOW ID:	127					
Package Name:	SYSSH20	1				
Package Schema:	NULLID					
Package Version ID:						
Consistency Token:	SYSLVL01					
Section Number:	1					
REOPT Bind Option:	none					
Incremental Bind:	no					
Effective Isolation Level:	CS					
Effective Query Degree:	0					
Statement is Unicode:	no					

Figure 7-5 Deadlock statement details

From the TABLE locks that we see in each of the deadlocks we suspect that lock escalations occurred.

We confirm this suspicion in the next steps using other dashboards but first we want to explain what additional information you can gain from the Locking dashboard. Each deadlock causes lock wait times for the involved connections before the victim connection is rolled back. The columns *Maximum Wait Time* and *Maximum Block Time* show the maximum wait or block time of all the

connections belonging to the selected workload cluster by the end timestamp of the monitoring interval. In the example in Figure 7-6, we select the db2power client user and select the **Current Waiting Connections** tab in the lower table. All connections of client user db2power are listed together with wait time. The highest wait time is 2.014 seconds. This information helps us to find the connection that is most affected by the wait time. Especially in lock wait situations that do not result in a deadlock, this is important in order to concentrate on troubleshooting the connections waiting longest.

Locking Dash	board: sampl	e				
This dashboard show	s the workload clust	er groups that are	e in a locking sit	uation. Click a workloa	d cluster grou	up to view locking information
Overview						
Activate Dea	ctivate New	Edit Copy	Delete			
Datab	ase Workload	Maximum	Wait Time	Maximum Block Tir	ne	Deadlocks
Sample			2.014		6.466	
T 🗁 Client us	er IDs		2.014		6.466	28
📄 db2u	ser1		0.964		0	23
📫 🗋 db2p	ower		2.014		6.466	28
D		2110112201239999999999999999999999999999	2.014		6.466	28
🕈 🚞 Client ap	oplication names		2.014		6.466	28
🗋 db2u	ser1		0.964		0	<b>2</b> 3
db2p	ower		2.014		6.466	<b>2</b> 8
🖄			2.014		6.466	<b>2</b> 8
Locking Infor	mation for db2	power				
Locking Event (28)	Current Waiting	Connections (5	) Current Bloc	king Connections (2)		
The grid shows appl	ications that are wait	ing for locked ob	jects for the sel	ected workload cluster	group. Choos	e an application and click An
Application Name	Application ID	Wait Time C	onnection Start	Application Stat	us	Client User ID
db2power_0	127.0.0.1.4937	1.926	11/09 11:3	5:00 Lock Wait		db2power
db2power_1	127.0.0.1.4939	1.760	11/09 11:3	5:02 Lock Wait		db2power
db2power_2	127.0.0.1.4940	1.903	11/09 11:3	5:02 Lock Wait		db2power
db2power_3	127.0.0.1.4941	2.014	11/09 11:3	5:03 Lock Wait		db2power
db2power_4	127.0.0.1.4942	1.839	11/09 11:3	5:04 Lock Wait		db2power

Figure 7-6 Waiting connections of user ID db2power

Selecting one connection and clicking **Analyze** gives you the details of the lock wait situation in that this connection is involved, including the complete tree of connections that wait and block each other. The details and the lock wait tree are calculated based on data collected at the last timestamp within the selecting monitoring interval on this dashboard. For a lock wait situation, the first connection listed in the tree is the top blocking connection. If the lock wait situation still exists, forcing this connection or canceling the running statement would resolve the locking situation to a great extent if not completely. In case of

deadlocks as we have here, DB2 resolves the situation by rolling back a connection. In a deadlock situation you do not have one top blocking connection but have a group of connections blocking each other as a circle. Therefore, it is not possible to show a tree. Optim Performance Manager illustrates this circle by showing all connections involved in the deadlock in a tree and placing links next to the top connection and next to the leaf connection. Selecting these links will show the same connections again either as holding or waiting. This way you recognize that this lock tree illustrates a circle of wait situation.

The Analyze Locking Situations panel in Figure 7-7 shows the lock tree after pressing the Analyze button. You see the *Show Waiting* and *Show Holding* links. We press **Show Waiting** and **Show Holding** which results in the lock tree as shown in Figure 7-8 on page 259. You recognize the never ending circle.

Each complete set of entries in the tr entries between the main entry and waiting.	ree includes an application that is ho the leaf entry are applications that a	Iding a lock and the applications that are waiting and waiting. Each leaf entry is an a
db2power_2 <u>Show Holding</u>	Details about the object	that the application is waiting for
db2power_0	Table Name:	OPM_SAMPLE_TABLE
🐻 db2power_3 Show Waiting	Table Schema Name:	DB2USER1
	Table Space Name:	OPM_SAMPLE_TS_1
	Lock Type:	х
	Lock Mode:	Exclusive Lock
	Lock Object Type:	Table Row Lock
	Lock Wait Time:	1.926 sec
	Sequence Number:	00156
	Lock Mode Requested:	Update Lock
	Lock Type Requested:	IX

Figure 7-7 Initial deadlock tree

Analyze Locking Situations		
Each complete set of entries in the entries between the main entry and waiting.	tree includes an application that is ho I the leaf entry are applications that a	lding a lock and the applications that are waiting re blocking and waiting. Each leaf entry is an ap
db2power_2 <u>Show Holding</u>	Details about the object	that the application is waiting for
ab2power_0	Table Name:	OPM_SAMPLE_TABLE
🔂 db2power_3	Table Schema Name:	DB2USER1
adb2user1_0	Table Space Name:	OPM_SAMPLE_TS_1
db2power 1	Lock Type:	Х
	Lock Mode:	Exclusive Lock
dubzpower_4	Lock Object Type:	Table Row Lock
db2power_2	Lock Wait Time:	1.926 sec
db2power_0	Sequence Number:	00156
db2power_3	Lock Mode Requested:	Update Lock
db2user1 0	Lock Type Requested:	IX
= db2power_1		
db2power_2	Details about the curren	t activity
🔂 db2power_4		c uccorreg
	UPDATE DB2USER1.OPM_SAMP	LE_TABLE SET SALARY = 2.5 * SALARY WHERE

Figure 7-8 Expanded deadlock tree

# 7.1.1 Identifying lock escalations as the cause of the deadlocks

The Analyze Locking Situations panel displays details for each involved connection and we use that to verify that the connections have lock escalations. Lock escalation is the process of replacing row locks with table locks in order to reduce the number of locks in the list. Figure 7-9 on page 260 shows the connection details of the db2power\_2 application. In the *Details for all activities* section, you see that this connection has already had 16 lock escalations.

Analyze Locking Situa	ations				
Each complete set of ent entries between the mai	tries in the tree includes an appli n entry and the leaf entry are ap	ication that is holding a lock a oplications that are blocking a	and the applications that are waitin and waiting. Each leaf entry is an a	ng because of that lock. The application that is only waiting.	
db2power_2 Show H	Details about the locke	ed object	Details about the appl	ication	
📆 db2power_0	Table Name:	OPM SAMPLE TABLE	Application Mode:	Exclusive Lock	
db2power_3	Table Schema Name:	DB2USER1	Application Name:	db2power 2	
db2user1_0	Table Space Name:	OPM SAMPLE TS 1	Agent ID:	8534	
	Lock Type:	x	Application ID:	127.0.0.1.4940.1011091	
db2power_1	Lock Mode:	Exclusive Lock	Authentication ID:	DB2POWER	
db2power_2	Lock Object Type:	Table Row Lock	Client User ID:	db2power	
db2power_4	Lock Wait Time:	1.903 sec	Client Application Name:	db2power	
	Sequence Number:	00204	Client Workstation Name:	VMWareDB2	
	Lock Mode Requested:	No Lock	Application Status:	lock wait	
	Lock Type Requested:	U	Force Application		
	Details about the curre	ent activity	Torce Appreciation		
	Rows Read: Rows Written: Statement Elapsed Time:	27921 27889 0 sec	Stop Current Statement Show All Text Tune Stop Correct SQL Dashboard		
	Statement Start Time:	11/09 11:43:04			
	Details about all activities			-TO PT	
	Connection Request	11/09 11:35:02	Rows Written:	1226179	
	Completion Timestamp:	0007	Locks Held:	27911	
	User CPU Time:	8906	Lock Waits:	145	
	System CPU Time:	1/9/	Time Application Waited on	05:20.305 min	
	Rollbacks:	1	Locks: Time Waited on Locks per	0.664 sec	
	Dynamic SOL Attempted:	3534	Second:		
	Static SQL Attempted:	181	Average Wait Time per	2.209 sec	
	Failed Operations:	23	Lock:	1 570 200	
	Rows Read:	5474054	Transaction:	1.570 Sec	
	Rows Selected:	1407469	Deadlocks:	22	
			Lock Escalations:	16	
			Lock Timeout Value:	-1	
			Lock Timeouts:	0	
L		636363636323232333333333333333333333333			
				Close	

Figure 7-9 Application details and lock escalations for db2power\_2

The Overview dashboard displays the total number of lock escalations for the database in the displayed monitoring time, which is 10 minutes for our example. Figure 7-10 on page 261 shows the Locking section of the Overview dashboard with 43 lock escalations.

Locking	
Currently waiting applications:	🔺 46.154 % 🔂
Longest wait time:	7.860 sec
Average lock wait time per transaction:	0.392 sec
Lock alerts:	28
Deadlocks:	58
Timeouts:	0
Escalations:	43

Figure 7-10 Lock escalations on the Overview dashboard

Further, we use the Memory dashboard, part of that shown in Figure 7-11 on page 262, to check the size and the utilization of the Lock list memory area. The Lock list memory area contains the locks held by all applications concurrently connected to the database. We select the **Lock List** layer from the drop down box above the graph and Optim Performance Manager highlights the lock list memory area in the graph and in the details table. From the graph you see that quite a high amount of memory used by the database is allocated for the lock list and from the details you see the utilization of the lock list at the end of the monitoring interval is 43,659%. Lock escalations occur either if the lock list memory area as defined in the MAXLOCKS database configuration parameter. Around 43% for the lock list memory is a high number but does not indicate an out of space problem.

Memory Dashboard: sample								
Scope: Database Global Memory								
Graph Grid								
Selected laver: Lock I								
		ng dina Ng ng ti						
8000000-								
7000000-								
5000000-								
4000000-								
a 3000000-								
2000000-								
1000000-								
11/09 11:35:00	11/09 11:36:40	1						
Health Overview								
Memory Area	Current Size and Utilization							
Database memory limit	142.438 MB	Regional C						
Database heap - other	14.562 MB							
Database heap - log buffer	1 MB							
Buffer pools 36.875 MB								
Package cache	1.312 MB							
Catalog cache	896 KB							
Utility heap	128 KB							
Lock list	43.659 % 16.562 MB	Ø						
Shared sort heap	2.560 % 512 KB	⊘						

Figure 7-11 Lock list on Memory dashboard

By opening the graph for the lock list utilization in Figure 7-12 on page 263, we check the lock list utilization over the complete monitoring interval and not just at the end. Since we have an even utilization over the monitoring interval of around 43%, we confirm that we do not have an out of space problem as the cause for the lock escalations.



Figure 7-12 Current lock list utilization chart

Next, we check the MAXLOCKS parameter. In general, the lock escalations and the resulting concurrency problems such has deadlocks can be avoided by tuning the LOCKLIST and MAXLOCKS database configuration parameters if SELF\_TUNING\_MEM is set to OFF as in our example. The command **db2 get db cfg for sample** returns the following result for the parameters responsible for this situation:

Self tuning memory	(SELF_TUNING_MEM) = OFF
Max storage for lock list (4KB)	(LOCKLIST) = 4096
Percent. of lock lists per application	(MAXLOCKS) = 22

From the Memory dashboard we have confirmed that the lock list memory area is big enough for the moment. However, MAXLOCKS is set to 22% only that means when the number of locks held by any one connection reaches this percentage of the total lock list size, lock escalation will occur for the locks held by that connection.

As a summary, the tuning action for this troubleshooting scenario is to increase the MAXLOCKS configuration parameter in order to avoid the lock escalations and the high number of deadlocks. If still too many lock escalations occur, increase LOCKLIST. The DB2 documentation provides guidelines about how to calculate adequate sizes for these parameters based on the number of connections to the database. See this link:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.d b2.luw.admin.config.doc/doc/r0000267.html

Alternatively, you can set STMM to ON to let DB2 adapt the LOCKLIST parameter dynamically.

# 7.2 Troubleshooting bad response times

Assume that you receive complains from the users of your applications about bad response times. You have the lock event monitor disabled on the monitored database thus you do not receive alert notification about lock wait, deadlock, or lock timeout events. In this situation, you can login to the Optim Performance Manager web console and open the Extended Insight dashboard to verify the response time degradation.

In Figure 7-13 on page 265, the Extended Insight dashboard shows an Average End-to-End Response Time of 9.5 secondes for the JCC applications workload cluster. This is indeed much longer than the expected and normal average response times of less than two seconds. In the graph you see the warning and critical threshold lines. For the JCC applications we specified a transaction response of two seconds as warning threshold and a transaction response time of four seconds as critical threshold. On the dashboard we display a monitoring interval of 30 minutes. During this monitoring interval, around 14% of all transactions breached the warning threshold and about 85% breached the critical threshold.

Exten	ded II	nsight /	Analysis Da	ashboard	l: sampl	e	workload Us	a the second	column to a	bac baca
Open [	Details	Activate.	Deactivat	e New	Edit	Copy	eset Dele	te View Al	l Known Clie	nts Trai
Graph	Workle Cluster Group/ ad Clus	oad r /Worklo ster	Average End-to-End Response Time	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time	Average Client Time	Warning (%)	Critical (%)
🚵 Sh	🕶 🗖 sam	ple	7.803	10.953	11.937	6.624	<b>0.002</b>	<b>\$1.436</b>	0.629	70.021
े Sh	<b>▼</b> 🗖 A	pplication	7.803	10.953	11.937	<b>\$6.624</b>	<b>0.002</b>	<b>\$1.436</b>	11.530	70.440
Hide	-	ວວເ	9.500	10.953	11.937	8.062	<b>0.002</b>	\$1.436	14.066	85.934
🕍 Sh		OTHER	0.088		1.312	<b>\$0.088</b>				
🕍 Sh	► 🔶 C	lient appli	7.803	10.953	11.937	<b>\$6.624</b>	<del>\$</del> 0.002	<b>\$1.436</b>		
🚵 Sh	►♦H	ost name:	7.803	10.953	11.937	<b>\$6.624</b>	<b>0.002</b>	<b>\$1.436</b>		
🚵 Sh	▼ <del>♦</del> C	lient user	7.803	10.953	11.937	<b>\$6.624</b>	<b>0.002</b>	<b>\$1.436</b>		
े Sh	•	•	7.803	10.953	11.937	<b>\$6.624</b>	<b>0.002</b>	<b>\$1.436</b>		
<u>Chart</u> <u>JCC</u> 12.000-	s for s	selected	workload ( Fit Average )	Alert History						
10.000 - 8.000 - 9 6.000 - 4.000 - 2.000 - 0 - 11/1	0 11:10:00	11/10 11:	23:20 11/10 11:	■ A to R m m m m re tiu - M M 36:40	verage End- -End esponse ime aximum nd-to-end esponse me aximum me of					

Figure 7-13 Extended Insight dashboard showing high response times for JCC

If you press the Details icon on the chart then an overlay panel opens showing you more details including the response time histogram, see Figure 7-14. This helps to understand the response time distribution among all transactions from that the average response time is calculated.



Figure 7-14 Response time histogram for JCC applications

In addition to the high response time values and the warning and critical percentages, you can determine from the Extended Insight dashboard where

most of the response time was spent: On the data server, network, or on the client that runs the application. In our example an average of around eight seconds of each transaction is spent on the data server that identifies the cause of the bad response times residing from the data server. See column Average Data Server Time column in Figure 7-13 on page 265

Now we drill down to the details of the JCC applications to analyze why the data server response time is so high. On the Extended Insight dashboard, select the JCC workload cluster and double click. The Extended Insight details dashboard displays the colored response time distribution chart showing graphically in which time layers the time was spent, see Figure 7-15. In our example most of the time is spent for lock waits (the highlighted rose layer). Select the Average lock wait time layer to get more information about this time layer below the distribution chart. The Locking Problem chart shows a high number of *deadlocks*.



Figure 7-15 Response time distribution chart and lock wait time details for JCC application

Next to the response time distribution graph, the SQL statements are listed that the JCC applications execute during the monitoring interval. The top statements are UPDATE statements. We select the first one to get execution details. The statement execution details consist of two parts. One part shows the end-to-end execution details, including overall time distribution among data server, network, application, and the return code of the statement. The important information of this part is shown in Figure 7-16. We have a failure rate of 43% of this statement. The first SQL code is -911, which is the SQL code the victim application receives in case of a deadlock. Considering the high number of deadlocks we have seen in the Locking Problem chart in Figure 7-16, we assume that most failed statement executions receive SQL code -911.

SQL Statements Clients					
Show highest 10 V by	Average End-to-End Respo	nse Time			
Statement Text	Statement Executions	Average End-to-End Response Time			
UPDATE WE_3FZKGFY1UDEA	. 390	8.123			
UPDATE WE_3FZKGFY1UDEA	. 392	7.994			
	12	3.664			
Display this list by the selected	oraph laver				
	and the second				
Statement Performance					
Number of Executions:		390			
Average end-to-end elapsed time	1	8.123 sec			
Average client time:		0 sec			
Average driver time:		0 sec			
Average network time:		0.001 sec			
Average data server time:		8.122 sec			
Overall Time Distribution	<b></b>				
99,990 %0.01 %	IClient time IDriver time Network time IData server time				
Statement Outcome					
Failure rate (with negative SQL co	ode):	43 %			
First SQL code:		-911			

Figure 7-16 General statement execution information

The other part of statement execution details shows the data server execution details of the selected statement. This information is only available if the monitored database runs on DB2 V9.7 Fix Pack 1 or higher. This time the Overall Time Distribution chart in Figure 7-17 on page 268 shows the distribution of the

statement execution time on the data server. It confirms that the statement spends most time for lock waits. Additionally, we see the reason for the high number of deadlocks. The statement uses isolation level repeatable read (RR).

Cache Insert time stamp:       11/10 11:10:11         Last execution:       11/10 11:39:32         Involved partitions:       1         Average toother compilation       1         State Server Execution Time       1         Number of executions:       421         Average execution time:       8.084 sec         Average execution time:       0.045 sec         Average execution time:       0.045 sec         Average execution time:       0.045 sec         Average execution time:       0.688 sec         Average activity time:       0 sec         Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Time         92.150 %       Pranasction         Logd isk wait time:       0 sec         Average log disk wait time:       0 sec         Average log disk wait time:       0 sec         Overall average lock wait time per transaction:       0 sec         Logd isk waits:       0         Overall average lock wait time:       0 sec         Lock waits:       364         Lock waits:       0 sec         Lock kast:       364         Lock kast:       364	eneral Information Statement Server Execution Details	
Last execution: 11/10 11:39:32 Involved partitions: 1  Aost Recent Compilation Compilation time: 1 Isolation level: RR Estimated cost: 0  Data Server Execution Time Number of executions: 421 Average execution time: 8.084 sec Average cPU time: 0 sec Average activity time: 0 sec Average workload manager queue time: 0 sec Average workload manager queue time: 0 sec Average Routine Processing time: 0 sec Average Section Void Time  Transaction Logging Statistics Average log disk wait time: 0 sec Log disk waits: 0  Overall average lock wait time per transaction: 8.084 sec Average global lock wait time: 0 sec Lock waits: 364 Lock exelations: 0  Deadlocks: 182	Cache Insert time stamp:	11/10 11:10:11
Involved partitions: 1  Australia and a second seco	Last execution:	11/10 11:39:32
Most Recent Compilation Compilation time: Isolation level: RR Estimated cost: Outat Server Execution Time Number of executions: Average execution time: Average execution time: Average execution time: Average cPU time: Substantiation Average Routine Processing time: Substantiation Substantia	Involved partitions:	1
Most Recent Compilation          Compilation time:       1         Isolation level:       RR         Estimated cost:       0         Data Server Execution Time       421         Average execution time:       8.084 sec         Average execution time:       0 sec         Average Average CPU time:       0 sec         Average activity time:       0 sec         Average Section Processing time:       0 sec         Average Section Vait Time:       0 sec         Deverall Time Distribution       Transaction         Lock Wait       Deveral         Sector       Sec         Average log disk wait time:       0 sec         Lock Inger Sector       0         Sector       Sec         Average log buffer wait time:       0 sec         Locking Statistics       0         Overall average lock wait time per transaction:       0 sec         Lo		
Compilation time:       1         Isolation level:       RR         Estimated cost:       0         Optimization contraction contracti	Most Recent Compilation	a the second second
Isolation level: RR Estimated cost: 0 Data Server Execution Time Number of executions: 421 Average execution time: 8.084 sec Average CPU time: 0 sec Average activity time: 8.084 sec Average activity time: 0 sec Average Routine Processing time: 0 sec Average Section Processing time: 0 sec Average Section Processing time: 0 sec Average Section Wait Time: 0 sec Overall Time Distribution Image Induction Image Induction Image Induction Sec Image Induction Image Induction Image Induction Image Induction Sec Image Induction Image Inductina Image Induction Image	Compilation time:	1
Estimated cost: 0  Data Server Execution Time  Number of executions: 421 Average execution time: 8.084 sec Average CPU time: 0 sec Average activity time: 0 sec Average morkload manager queue time: 0 sec Average Routine Processing time: 0 sec Average Section Processing time: 0 sec  Average Section Wait Time: 0 sec  Overall Time Distribution  Summary Statistics  Transaction Logging Statistics  Average log disk wait time: 0 sec  Average log disk wait time: 0 sec  Log disk waits: 0  Overall average lock wait time per transaction: 8.084 sec  Average global lock wait time: 0 sec  Lock waits: 364 Lock secalations: 0  Deadlocks: 182	Isolation level:	RR
Data Server Execution Time       421         Number of executions:       421         Average execution time:       8.084 sec         Average CPU time:       0 sec         Average activity time:       8.084 sec         Average activity time:       0.688 sec         Average workload manager queue time:       0.688 sec         Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Em         1       Cock Wait         1       Time         21:50 %       Cock Wait         1       Time         1       Transaction         Logging Time       0 sec         Average log disk wait time:       0 sec         Average log disk wait time:       0 sec         Lock waits:       0         2       Sec         Average log buffer wait time:       0 sec         Lock waits:       0         2       Sec         Average lobal lock wait time per transaction:       8.084 sec         Average global lock wait time:       0 sec         Lock waits:       364         Lock escalations:       0         Deadlocks: <td>Estimated cost:</td> <td>0</td>	Estimated cost:	0
Number of executions:       421         Average execution time:       8.084 sec         Average CPU time:       0 sec         Average activity time:       8.084 sec         Average workload manager queue time:       0.688 sec         Average Routine Processing time:       0 sec         Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Image: Construct time         92.150 %       Routine time         92.150 %       Routine time         0 sec       Overall Time Distribution         Image: Construct time:       0 sec         Average log disk wait time:       0 sec         Average log disk wait time:       0 sec         Log disk waits:       0         Overall average lock wait time per transaction:       8.084 sec         Average global lock wait time:       0 sec         Lock waits:       364         Lock waits:       0         Lock waits:       0         Lock scalations:       0         Deadlocks:       182	Data Server Execution Time	
Average execution time:       8.084 sec         Average CPU time:       0 sec         Average activity time:       8.084 sec         Average activity time:       0.688 sec         Average Routine Processing time:       0 sec         Average Section Processing time:       0 sec         Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Ime         Image: Section Logging Statistics       Ime         Transaction Logging Statistics       0 sec         Average log disk wait time:       0 sec         Average log disk wait time:       0 sec         Log disk waits:       0         Coverall average lock wait time per transaction:       8.084 sec         Average global lock wait time:       0 sec         Lock waits:       364         Lock waits:       0         Lock waits:       0         Lock waits:       0         Lock secalations:       0         Imeouts:       0         Deadlocks:       182	Number of executions:	421
Average CPU time:       0 sec         Average activity time:       8.084 sec         Average workload manager queue time:       0.688 sec         Average Routine Processing time:       0 sec         Average Section Processing time:       0 sec         Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Image: Constraint of the sec         \$21.50 %       Image: Constraint of the sec         \$21.50 %       Image: Constraint of the sec         Transaction Logging Statistics       Image: Constraint of the sec         Average log disk wait time:       0 sec         Average log buffer wait time:       0 sec         Log disk waits:       0         Coking Statistics       0         Coke waits:       364         Lock waits:       0         Lock waits:       0         Lock waits:       0         Lock escalations:       0	Average execution time:	8.084 sec
Average activity time:       8.084 sec         Average workload manager queue time:       0.688 sec         Average Routine Processing time:       0 sec         Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Employed and the sec         Image: Section Wait Time:       0 sec         Overall Time Distribution       Employed and the sec         Section Wait Time:       D sec         Section Wait Time:       D sec         Section Uogging Statistics       Transaction         Log disk wait time:       0 sec         Average log buffer wait time per transaction:       8.084 sec         Lock waits:       0 sec         Lock secalations:       0 sec         Lock secalations:       0         Timeouts:       0         Deadlocks:       182	Average CPU time:	0 sec
Average workload manager queue time:       0.688 sec         Average Routine Processing time:       0 sec         Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Image: Control of the sec	Average activity time:	8.084 sec
Average Routine Processing time:       0 sec         Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Image: Constraint of the sec of t	Average workload manager queue time:	0.688 sec
Average Section Processing time:       0 sec         Average Section Wait Time:       0 sec         Overall Time Distribution       Image: Constraint of the section o	Average Routine Processing time:	0 sec
Average Section Wait Time:       0 sec         Overall Time Distribution       Image: Section Wait Time         92.150 %       Routine time         92.150 %       Routine time         Ucock Wait       Time         Transaction       Logging Time         Average log disk wait time:       0 sec         Average log disk wait time:       0 sec         Log disk waits:       0         Cocking Statistics       0         Average log buffer wait time:       0 sec         Log disk waits:       0         Lockwaits:       0 sec         Lock waits:       0 sec         Lock waits:       0 sec         Lock waits:       0 sec         Lock escalations:       0         Timeouts:       0         Deadlocks:       182	Average Section Processing time:	0 sec
Overall Time Distribution       Image: Constraint of the second sec	Average Section Wait Time:	0 sec
Transaction Logging Statistics         Average log disk wait time:       0 sec         Average log buffer wait time:       0 sec         Log disk waits:       0         Cocking Statistics       0         Locking Statistics       0         Overall average lock wait time per transaction:       8.084 sec         Average global lock wait time:       0 sec         Lock waits:       364         Lock escalations:       0         Timeouts:       0         Deadlocks:       182	92.150 %	
Average log disk wait time:     0 sec       Average log buffer wait time:     0 sec       Log disk waits:     0       Locking Statistics     0       Overall average lock wait time per transaction:     8.084 sec       Average global lock wait time:     0 sec       Lock waits:     364       Lock escalations:     0       Timeouts:     0       Deadlocks:     182	Transaction Logging Statistics	
Average log buffer wait time:     0 sec       Log disk waits:     0       Locking Statistics     0       Overall average lock wait time per transaction:     8.084 sec       Average global lock wait time:     0 sec       Lock waits:     364       Lock escalations:     0       Timeouts:     0       Deadlocks:     182	Average log disk wait time:	0 sec
Log disk waits:     0       Locking Statistics     8.084 sec       Overall average lock wait time per transaction:     8.084 sec       Average global lock wait time:     0 sec       Lock escalations:     364       Lock escalations:     0       Timeouts:     0       Deadlocks:     182	Average log buffer wait time:	0 sec
Locking Statistics Overall average lock wait time per transaction: Average global lock wait time: Lock waits: Lock escalations: O Timeouts: O Deadlocks: 182	Log disk waits:	0
Overall average lock wait time per transaction:     8.084 sec       Average global lock wait time:     0 sec       Lock waits:     364       Lock escalations:     0       Timeouts:     0       Deadlocks:     182	Locking Statistics	
Average global lock wait time:         0 sec           Lock waits:         364           Lock escalations:         0           Timeouts:         0           Deadlocks:         182	Overall average lock wait time per transaction:	8.084 sec
Lock waits:         364           Lock escalations:         0           Timeouts:         0           Deadlocks:         182	Average global lock wait time:	0 sec
Lock escalations:         0           Timeouts:         0           Deadlocks:         182	Lock waits:	364
Timeouts:         0           Deadlocks:         182	Lock escalations:	0
Deadlocks: 182	Timeouts:	0
	Deadlocks:	182

Figure 7-17 Data server statement execution information

The RR isolation level locks all the rows that an application references during a transaction. Every referenced row is locked, not just the rows that are retrieved. For example, if you scan 10 000 rows and apply predicates to them, locks are held on all 10 000 rows, even if, say, only 10 rows qualify. Because RR can acquire a considerable number of locks, this number might exceed limits

specified by the LOCKLIST and MAXLOCKS database configuration parameters. To avoid lock escalation, the optimizer might elect to acquire a single table-level lock for an index scan, if it appears that lock escalation is likely. If you do not want table-level locking, use the read stability isolation level.

Let us shortly verify that we have no lock escalations but table locks. According to the statement execution information on the data server in Figure 7-17 on page 268, no lock escalation takes place. To verify the usage of table locks, we open the Locking dashboard that represents the deadlocks as locking situations. Remember that Deadlock alerts are disabled, therefore, we can not check the event details for table locks. We select one of the connections involved in the deadlocks and press **Analyze**. This opens the panel shown in Figure 7-18. The Lock Object Type field shows *Table Lock*.

Analyze Locking Situation Each complete set of entries i entry and the leaf entry are a	s in the tree includes an application t applications that are blocking and v	that is holding a lock and the applications that a vaiting. Each leaf entry is an application that is v	
db2jcc_application	Details about the object	that the application is waiting for	
db2jcc_application	Table Name:	WE_3FZKGFY1UDEADLOCK_1	
db2jcc_application	Table Schema Name:	BMB	
	Table Space Name:	IBMDB2SAMPLEREL	
	Lock Type:	S	
	Lock Mode:	Share Lock	
	Lock Object Type:	Table Lock	
	Lock Wait Time:	9.751 sec	
	Sequence Number:	00451	
	Lock Mode Requested:	Share with Intention Exclusive Lock	
	Lock Type Requested:	U	
	Details about the curren	It activity .OCK_1 set text=? where id=?	

Figure 7-18 Lock details

To solve the high number of deadlocks in this example, use a lower isolation level for the statement executions.

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# 8



Optim Performance Manager Extended Insight extends the performance monitoring capability from data server to the whole system. It enables users to monitor their production system end- to-end, including application client, application server, network, and data server.

Though the symptom of a performance issue often appears first in an application, the cause could be in anywhere of the entire system. For example, a user may feel that his application runs very slowly and the possible causes could be a bad application algorithm, an overloaded application server, bad network condition, or bad data server performance. From Extended Insight dashboard, you can see which application runs into a problem and drill down on the Extended Insight dashboard from panel to panel for details. Each panel provides the performance details of certain tier - application client, application server, network, or data server, for you to figure out the root causes. With the root causes on hand, you can then perform proper performance tuning including using the advice provided by Optim Query Tuner.

This chapter provides scenarios about using Optim Performance Manager Extended Insight toinvestigatethe cause of performance issues on the monitored system. Some scenarios involve tuning the performance issue using Optim Query Tuner and fixing the performance issue by applying the advice from Optim Query Tuner. We also explore using Extended Insight with WebSphere applications and dive deepr into workload clusters.

# 8.1 Application running slowly caused by index issue

IBM Optim Query Tuner (OQT) V2.2 Fix Pack 2 or later release is integrated well with Optim Performance Manager. When you use the Optim Performance Manager to identify the poor performed queries, you can pass the queries to Optim Query Tuner and run tuning advisor for tuning suggestions. The suggestions could include different optimization options for the data server, such as running statistics, creating indexes, and changing queries.

In this section, we describe how to use the Optim Performance Manager Extended Insight Analysis dashboards to analyze a poor performed application to identify the slow running query as well as how to obtain optimization advice from Optim Query Tuner.

The installation of Optim Query Tuner for DB2 for Linux, UNIX, and Windows affects two locations, a DB2 database server and a client system. To leverage Optim Query Tuner with Optim Performance Manger, on the monitored database, you must run an installation program to activate the product license and enable the Index Advisor stored procedure. On the client system where you run the browser to access Optim Performance Manager console, you must install the Optim Query Tuner client.

Once the Optim Query Tuner is set up, you can perform SQL statement tuning using Optim Query Tuner form the system where you access the Optim Performance Manager web console. Before tuning the SQL statements, you have to launch Optim Query Tuner first and make sure the data bridge is enabled (the icon shown in Figure 8-1 is selected).

le It	3M Qu	iery Tunin	g - Quer	y Tuner	Work	flow As:
Eile	<u>E</u> dit	<u>N</u> avigate	Se <u>a</u> rch	Project	<u>R</u> un	<u>W</u> indov
	} • (	a 🗉 🌔	0	👌 Task N	avigato	or – ]
	(A) ·	Tack Launch	or (		oioch1	louaru d

Figure 8-1 Click this button to enable data bridge

To learn more about Optim Query Tuner, refer to the Information Center by the following link:

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.qryt
une.installconfig.doc/topics/installconfig.html

# 8.1.1 Observing a performance issue

The Optim Performance Manager console Extended Insight Analysis Dashboard displays the application end-to-end response time and the breakdown details in
both tabular and chart formats. The *end-to-end response time* means the overall response time of a transaction that includes the elapse time on application client, application server, network, and data server. It measures the time period between the application starts a database transaction on behalf of the users' request and ends the transaction by a commit or rollback. The time the application used to display the data on any user interface is not counted. For measuring the entire time used, use IBM Tivoli Composite Application Manager (ITCAM). We discussed the monitoring with ITCAM in Chapter 10, "Integration with Tivoli monitoring components" on page 323.

#### Setting thresholds for applications

On a monitored database, the applications are usually for various business functions and the response time requirements are different. By default, on the Extended Insight Analysis Dashboard, all the applications are in the same workload cluster group. You can categorize the applications by business characteristics and group them into workload cluster groups. A workload cluster group can have one or many applications, each of them is a workload cluster. Each workload cluster group can have a global response time threshold set or each workload cluster in the group can have an individual response time threshold set

A response time threshold consists of warning threshold and critical threshold. During the specified time duration, once the maximum response time of an application in the workload cluster group exceeds the warning threshold, a warning marked as a yellow triangle appears on the Extended Insight Analysis Dashboard. When the maximum response time exceeds the critical threshold, a critical alert marked as a red square appears.

In this scenario, we use the procedure described in 4.4, "Extended Insight dashboard" on page 178 to create a workload cluster group named Checking Order Status. The workload cluster group contains one application orderstatus. We defined four seconds for the warning threshold and seven seconds as the critical threshold for this workload cluster group as shown in Figure 8-2.



Figure 8-2 Set response time threshold for the workload cluster group

#### Monitoring the work cluster group

We started the orderstatus application and let it run for a while. Initially, this application runs with acceptable performance as shown in Figure 8-3. The

maximum end-to-end response time is below warning threshold (the status marked with green diamond). The Warning (%) and Critical (%) show 0 for the one hour we were monitoring.

Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Respons e Time	Maximu m Inflight Elapsed Time	Maximu m End- to-End Respons e Time	Average Data Server Time	Average Network Time	Average Client Time	War ning (%)	Critic al (%)	Transa ctions (/min)
≧ Sh	▼⇔irww51	0.881	6:18.725	7:08.483	<b>0.856</b>	<b>♦0.012</b>	<b>0.012</b>			271.705
े Sh	Client application name	0.881	6:18.725	7:08.483	<b>0.856</b>	<b>0.012</b>	<b>0.012</b>			271.705
🖄 Sh	Checking Order Status	2.468	3.326	3.960	♦2.462	♦0.004	<b>♦</b> 0.002	0	0	65.656
े Sh	🔶 orderstatus	2.468	3.326	3.960	<b>♦</b> 2.462	<b>0.004</b>	<b>♦</b> 0.002	0	0	65.656

Figure 8-3 Workload cluster group runs without performance issue

Later, we observe that the application performance slow down in the last one hour of the monitor time frame. 64% of the transactions of the Checking Order Status workload cluster group runs with response time beyond the critical threshold. See Figure 8-4. Note that you can configure the Optim Performance Manager to send alert messages by e-mail.

Graph	Workload Cluster Group/Workload Cluster	Averag e End- to-End Respon se Time	Maximu m Inflight Elapsed Time	Maximu m End- to-End Respon se Time	Average Data Server Time	Averag e Networ k Time	Averag e Client	Warnin g (%)	Critical (%)
े Sh	▼	32.149	26:29.251	27:08.483	♦32.129	<b>0.010</b>	<b>0.011</b>		
े Sh	Client application names	32.149	26:29.251	27:08.483	♦32.129	<b>0.010</b>	<b>0.011</b>		
े Sh	Checking Order Status	01:43.757	11:55.326	12:26.960	01:43.757	0	<b>0.002</b>	0	64
े Sh	orderstatus	01:43.757	11:55.326	12:26.960	01:43.757	0	<del>\$</del> 0.002	0	64

Figure 8-4 Workload cluster group runs into a response issue

# 8.1.2 Figuring out the cause and tuning

To find out why 60% of transactions runs beyond the response time threshold, we click **Checking Order Status** workload cluster group shown in Figure 8-3 to open the detail page.

Figure 8-5 on page 275 shows the distribution of end-to-end response time. This chart shows how the response time varies in a specified period of time for each tier, application client, application server, network, and data server. The end-to-end response time growth can be caused by performance degradation of several tiers. The response time distribution chart clearly show the trend and distribution of each tier allowing you to identify the tiers with problem. From this graph, you also can tell the turn-point that the response time started growing up.

With the time the performance changed narrowed down, you can check if there is anything changed on the system during that time frame that might cause the respond time increased.



Figure 8-5 Response time distribution chart

In Figure 8-5, we see that the end-to-end response time started to increase at 16:53 and climbed up quickly in about 30 minutes to a high level. To learn what is the tier that contributes the most to the end-to-end response time, we click the tier in light blue at the bottom. The label in the Selected layer field shows that it is the *Average Data Server time per Transaction*. The long elapse time of data server led to the reported performance issue.

Next step is to check which SQL statements take the time. On the Extended Insight Analysis dashboard, click **Open Details**. On the right of the Extended Insight detail page, we choose to show the top 10 SQL statements which take longest "Average Data Server Time" as shown in Figure 8-6 on page 275. In this scenario, we have one SQL statement that takes a much longer elapse time on data server than the others.

SQL Statements Clients		
Show highest 10 ▼ by Average D	ata Server Time	
Statement Text	Statement Executions	Average Data Server Time
SELECT OL_I_ID, OL_SUPPLY_W_ID, OL	45	01:20.358
SELECT O_ID, O_OL_CNT, O_CARRIER_ID	45	0.012
SELECT C_FIRST, C_MIDDLE, C_LAST, C	45	0.010
SELECT COUNT(*) FROM CUSTOMER WH	62	0.008
SELECT C_FIRST, C_ID FROM CUSTOMER	62	0
Display this list by the selected graph layer		

Figure 8-6 Top SQL statements which longest average data server time

Click the SQL statement in the Statement Text field and the Statement Performance chart shows. This chart tells how the execution time of this SQL statement is spent. The Overall Time Distribution pie chart shown in Figure 8-7 confirms that almost 100% of the end-to-end response time of our SQL is spent on the data server. We can proceed to tune this SQL on the data server.

Statement Performance		
Number of Executions:		45
Average end-to-end elapsed ti	me:	01:20.355 min
Average client time:		0.001 sec
Average driver time:		0 sec
Average network time:		0 sec
Average data server time:		01:20.358 min
<b>Overall Time Distribution</b>		
100 %	Client time Driver time Network time Data server time	

Figure 8-7 Response time distribution of an SQL statement

On the left side of the pie-chart shown in Figure 8-7, there is a text field showing the whole SQL statement. Because we have launched the Optim Query Tuner enabled the data bridge, we click **Tune** (Figure 8-8 on page 276) to pass this SQL to Optim Query Tune for tuning.

Statement information	
SELECT OL_I_ID, OL_SUPPLY_W_ID, OL_QUANTITY, OL_AMOUNT, OL_DELIVERY_D FROM ORDERLINE WHERE OL_O_ID = ? AND OL_D_ID = ? AND OL_W_ID = ?	
Show All Text	•

Figure 8-8 SQL statement

Figure 8-9 on page 277 shows the tuning panel of the Optim Query Tuner with our SQL statement to be tuned.

Tem Que	BM Query Tuning - Query Tuner Workflow Assistant - IBM Optim Query Tuner Client									
ile <u>E</u> dit <u>N</u>	e Edit Navigate Segrch Project Run Window Help									
13 - 🖫	3 • 🖫 △ ] 🎯 ] 🖄 TaskNewlystor • ] 🗛 • ] ⋊ • ] ⋊ • 3 · 5 · 5 · 5 · 5 · 5 · 5 · 5 · 5 · 5 ·									
🖉 😰 Tas	C TaskLaunder 🕞 *QProject1/Query Group 1/Query 1 🛛									
	d @Query Tuner Workflow Assistant Run All Single-Query Advisors And Analysis Tools									
🔐 🕫 🛛	Specify EXPLAIN options and runtime environment options for the query. Click Run All Advisors and Tools to run all advisors, format the query, and generate an access plan graph.									
	🔒 Run All Advisors and Analysis Tools	EXPLAIN options and runtime environment options								
aptn	Generate Summary Report	Schema: DB2INST2 Current optimization profile:								
4. Invoke 3. Manage 2. Ca	(2, Workload	Current isolation level: SYSIEM", "SYSIEM", "								

Figure 8-9 SQL statement passed into Optim Query Tuner and ready for tuning

Click **Select What to Run** (Figure 8-9 on page 277), the Select Query-Tuning Activities panel shows (Figure 8-10). You can select multiple tuning activities and run them together or you can run one activity at a time. In this scenario, we select all the tuning activities.

Select Query-Tuning Activities	×
Query Format and Annotation	
Access Plan Graph	
Collect Actual Execution Values	
Note: This option is for SELECT statements; It might increase the cost of running the query.	
Statistics Advisor	
Vuery Advisor	
C Access Path Advisor	
Index Advisor	
Summary Report	
Select All Clear All	
OK Cancel	

Figure 8-10 Select Query-Tuning Activities

At the end, Optim Query Tuner returns an index advice about creating indexes, as shown in Figure 8-11 on page 278.

E	🏷 Ta	sk Launcher 👘 *QTProject1/Query Group 1/Que	ery	1 23					
	4 (	Query Tuner Workflow Assistant		Review Single-Query Advisor Recommendations					
	g	🕞 Query and Workload 🛷		This page shows the recomm	endations from the	advisors that you ran. To	o see the details of a recommendation, right-clic	k it and select Vi	
L	Staf	→ Query 1		ह जि हो 🕃 😨					
	÷.	Analysis Result 1							
L	Ð	Analysis Result 2							
L	tur	🕰 Single Query 📌							
L	Cap	👫 Open Single-Query Recommendations		Recommendations Academic Develop 2					
L	Ň	🗑 Open Formatted Query							
L	e	🔊 Open Access Plan Graph							
L	mag	🖓 Open Textual Access Plan		Advisor	Number	Priority	Description		
L	M.	🕞 Open Summary Report		Index Advisor	4	🕒 LOW	Index recommendations found.		
L	m	🛒 Compare Access Plan Graphs							
L	ke	1 Workload	1	▶ <u> </u>					
	ž	C WOINDED	1						

Figure 8-11 Optim Query Tuner advises to create index

We click the index advice to open the details panel, as show in Figure 8-12. As told by Optim Query Tuner, creating the advised index would improve the performance of this SQL by approximately 99%. Optim Query Tuner also gives an estimation on the disk space consumption of this new index.

R	leview Single-Query Advisor Recommendations							
Tł	nis page shows the recommendations from the advisors that you ran. To see the details of a recommendation, right-click it and select View Details. 👔 🔞 🚅 民   🛒							
P	Recommendations - Analysis Resu	lt 2 Index Advisor	Details 🛛				_	
F	Recommendation 3: Index recommendations found. Recommended indexes are listed below. You can view and modify the DDL for creating the indexes and then run the DDL. You can also test the recommended indexes and indexes that you suggest.							
	Estimated performance improve Disk space required (DASD space	ement: 99. ce): 379.	98 % 96 MB					
	Custom and recommended indexes							
	Indexes by Table	Creator	Object Name	Columns	Estimated Disk Space	Custom		
	ORDERLINE     Index	DB2OE	IDX011180948070000	OL_O_ID(ASC) ,OL_D_ID(ASC) ,OL_W_ID(ASC) ,OL	379.961937 M	No		

Figure 8-12 Index Advisor Details

We take this advice and create the advised index on our data server. Then we return to the Extended Insight panel. After several minutes, the average end-to-end response time drops below the warning threshold.

For the detail steps about turning SQL statement, refer to Information Center at

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.qryt
une.sngqry.doc/topics/tsupertask\_true.html

# 8.2 Diving into the application layer

We already know that Optim Performance Manager can monitor the DB2 database at a deep level. What about the application side? The database may be performing well, but the application is still having slow response times. If you use a monitor that only looks at the application, you may not get the full picture of the slowdown, just like if you only look at a database monitor, you may not determine where the problem is... only where it *is not*.

### 8.2.1 Extended Insight analysis approach

Figure 8-13 depicts how the different Optim Performance Manager components can help monitor across the transaction landscape. We can suggest a general approach for how to examine the different layers using Extended Insight.



Figure 8-13 Investigating the transaction landscape with Extended Insight

A typical flow of problem analysis in Optim Performance Manager Extended insight is to look at the following metrics:

- 1. Check the overview page for alerts or outliers.
- 2. Check layers that contribute most to the response time.
- 3. Check the details about the top layer's top statement or top client.
- 4. Check for top statements in spending time within top layers or check top clients that execute the workload

Armed with information you learn by examining the layer metrics, you can more readily narrow down a performance issue to a specific statement or client.

## 8.2.2 WebSphere scenario description - Great Outdoors Company

In Chapter 4, "Getting to know Optim Performance Manager" on page 147, we learned about the kinds of metrics Optim Performance Manager Extended insight provides. Let us take a look at the case of a WebSphere application that uses DB2 database.

Extended insight can monitor WebSphere applications that use JDBC transactions with standard data source definitions. From the Extended insight perspective, WebSphere DB2 transactions can be considered as a special case of JDBC transactions.

Optim Performance Manager has awareness of WebSphere application server and will collect additional metrics related to the connection pool for the data source. Such metrics are crucial in telling the bigger story of enterprise application performance.

**FAQ:** Can Optim Performance Manager Extended insight monitor application transactions running on some other kind of application server that is not WebSphere?

In general, the answer is yes, if the application uses standard JDBC transactions. The application would be configured like any other JDBC application, not like a WebSphere application, and you would collect standard JDBC metrics. There are some additional metrics that Optim Performance Manager Extended insight collects specific to WebSphere.

We are using the shopping web site for the fictitious Great Outdoors Company. In our lab environment, the shopping application, GOSales, runs under the WebSphere Application Server that is on the SD0D03L2 server. Our book environment is described in 3.1, "Lab environment" on page 60.

Suppose we receive a call from the help center saying some customers have complained they cannot complete their purchases because the web site is too

slow. You are a DBA, what can you tell them about the web site being slow? We show an example of using Optim Performance Manager Extended Insight to provide analysis to the application and server support staff to help investigate the slowdown.

#### **Extended Insight Dashboard**

First, we open the Extended Insight dashboard, as in Figure 8-14 on page 281. What can we observe about the application?

We notice a few alerts have occurred. Some problem icons are shown for the Client layer, and the Data Server layer has a couple of warnings. (This scenario is not really about alerts, therefore, we do not discuss them further.)

The average end-to-end response time is 144 ms. We are familiar with this application, so we know that is higher than normal.

Let us drill down to the overall metrics for the entire database, so double-click on the GOSALES line.

Recent History Exter Workloa	cent       Image: Control of Control									d Time: /29/10 :39 ration: Hour I • Disconnect New to create a				
workloa Open	d cluster group. Details Activate Deactivat	e New	Edit		et Delete	View All Kno	own Clients	Transaction T	opology			E	kpand <u>Co</u>	llapse
Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time	Average Client Time	Warning (%)	Critical (%)	Transac	Rows Read	Rows Modified Rate	Rows Returned Rate	Statement Failure Rate (%)
🖮 Sh	▼	0.144	3.109	4.803	▲0.023	<del>\$</del> 0.007	0.115	14.277	26.045	409.962			23,164.528	0
े Sh	Client application names	0.144	3.109	4.803	▲0.023	<b>0.007</b>	0.115	14.277	26.045	409.962			23,164.528	0
े Sh	Client workstations	0.144	3.109	4.803	<b>0.023</b>	<b>0.007</b>	<b>0.115</b>			409.962			23,164.528	0
े Sh	Client user IDs	0.144	3.109	4.803	▲0.023	<del>\$</del> 0.007	0.115	14.277	26.045	409.962			23,164.528	0
े Sh	Authentication IDs	0.144	3.109	4.803	<b>0.023</b>	\$0.007	<b>0.115</b>			409.962			23,164.528	0
े Sh	► ♦ Host names/IP addresses	0.144	3.109	4.803	<b>\$</b> 0.023	<b>\$</b> 0.007	<b>\$</b> 0.115			409.962			23,164.528	0

Figure 8-14 Extended Insight Dashboard for GOSales application

### **Extended Insight Analysis Detail Dashboard - Statements**

When you first open the Extended Insight details dashboard, the main response time graph is shown, as in Figure 8-15 on page 282, with the maximum value plotted in red. We observe a steadily increasing maximum, rather than an occasional peak or a steady max. To get a better look at the average values, click **Fit Average**, which will hide the maximum line.



Figure 8-15 Extended Insight Response Time Details chart - with maximum

Figure 8-16 on page 283 shows the entire dashboard. Notice the response time chart is easier to read now without the red maximum plot line. Some charts are labeled in the figure so we can refer to them easily. What can we quickly observe from the information on this page?

- Steadily increasing overall average end-to-end response time (chart A).
- Steadily decreasing transaction throughput (chart B).
- The pie chart (chart C) shows the majority of time is spent in client (application) side:
  - Client time = 79.3%
  - Data server time = 15.8%
  - Network time = 4.8%
- We notice the statement failure rate is 0%, out of a total 23,798 statements executed in the hour. This is good to know, and we can rule out some kind of problem with failing statements.

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#### Draft Document for Review January 13, 2011 8:13 pm

Manage Database Connections * ITCAM Data Collection * Extended Insight Dashboard *	
Recent         Learn about the time controls.         O O I           Image: Second Secon	A → America/New_York     find Time:     10/29/10 20:39 - 10/29/10 21:39     10/29 10 21:39     10/29 00:38 10/29 22:03 10/30/10 19:29     10/29 00:48 10/29 22:03 10/30/10 19:29
Extended Insight Analysis Dashboard: GOSALES	
Back     Locate the source of performance problems, determine how those problems affect different parts of the worklos     Response Time Details: Client user IDs	d, and analyze the performance of individual SQL statements, clients, and partitions.
Graph Grid	SQL Statements Clients
Selected layer: Average End-to-End Response Time 🔹 🔯 🚺 Fit Maximum	Show highest 10 V Average Data Server Time V
	Statement Text Statement Executions Average Data Server Time
0.3 (A)	SELECT COH.CUST_ORDER_N 1,032 0.098
0.24-	SELECT CUST_CODE, CUST_FI 3,112 0.089
0.18-	SELECT CUST_CODE, CUST_FI 1,038 0.083
0.12	DELETE FROM GOSALESCT.CU 1 0.047
0.06	INSERT INTO GOSALESCT.CUS 1 0.014
	INSERT INTO GOSALESCT.CUS 1 0.013
10/29 20:40:00 10/29 20:53:20 10/29 21:06:40 10/29 21:20:00 10/29 21:33:20	✓ Display this list by the selected graph layer
Detail Area for Average End-to-End Response Time	
End-to-End Response Time	
Overall average response time per transaction: 0.144 sec	
Maximum response time: 4.803 sec	
Maximum Time of running transactions 3.109 sec	
Number of executions: 21,728	-
Statements: 23,798	
Statement Failure Rate: 0 %	
C         Client time         B         Transaction Throughput         Statem           75.310 %         C         Client time         0	ent Throughput
Transferring data from sd0d03a1.itso.ibm.com	

Figure 8-16 Extended Insight details for GOSales transactions

In the SQL Statements section, we see, by default, the 10 statements with the longest average data server time. The top three slowest statements are SELECTs with an average data server time in the 80-90 milliseconds range. We remember the warning alert on data server time, so we make a mental note of these statements, and may come back to look at them later. However, we still do not think these are major contributors to slow response, because we know the total data server time is only 15% of the total, and the actual data server time on the graph (it is the bottom-most area in medium blue) is flat.

Looking at just this information, we could form a hypothesis that the slowdown is not in the database. Though we think we can pass this issue off to the application support team, we do some quick diagnosis that might help the application support staff.

#### **Extended Insight Analysis Dashboard - Clients**

Optim Performance Manager shows a decrease in the transaction throughput and increase in response times. The database metrics appear to be otherwise satisfactory. Therefore, the problem may lie in the transaction landscape somewhere before the transaction arrives at DB2, which in this scenario means the WebSphere server. We look next at what kind of client metrics Optim Performance Manager can provide.

Click the **Clients** tab on the Extended insight dashboard, see Figure 8-17 on page 284. We again see the average response time over the selected hour is 144 ms. That is not so good for this application.

7	SQ	L Statements Clients			
	S	how highest 10 🔹	by Average Response T	ime	•
		Client Host Name or IP Address	Transaction Executions	Time of First Connection	Average Response Time
	9.12.4.169		21,728	10/29 18:28:48	0.144

Figure 8-17 Extended Insight client tab

Select the client of interest (we only have one) to view more detail about it. See Figure 8-18 on page 285. The pie charts under the Client Performance section indicate the overall cumulative transaction distribution for the selected client, then a further breakdown within the client time. In this example in Figure 8-18 on page 285, we see 79.4% is spent in client time (the Overall Time Distribution pie chart). The Client Time Distribution pie chart on the right shows the further breakdown of client time into 70.8% spent in the application, a very large 28.7% of the time spent in waiting on the WebSphere connection pool, and a miniscule time less than 1% spent in the (JDBC) driver itself. Now we are suspicious of such a high percentage of connection pool waits.

lient Information			
lient Information		Client Performance	
Host name or IP address:	9.12.4.169	Average client time:	0.144 sec
First connection start time:	10/29 18:28:48	Number of executions:	21,728
Last timestamp:	10/29/10	Response time warnings:	14.277 %
Operating system:	Linux	Response time problems:	26.045 %
Database driver name:	IBM DB2 JDBC Universal Driver Architecture	Overall Time Distribution (%)	Client Time Distribution (%)
Database driver level:	3.59.81		
Connection properties:	maxStatements=0, currentPackagePath=null,	Client time	70.880 %
Extended Insight client name:	IBM Optim pureQuery Runtime	79.410 % Network time	time
Extended Insight client level:	2.25.76	Data server	-0.40 % pool wait
JRE vendor:	IBM Corporation	15.990 % time	time
JRE version:	2.4	4.600 %	□ 28.720 % ■Database
Runtime properties:	am.was.classpath.include.file.webservices=*w		÷
WebSphere Application Server data source name:	jdbc/GoSalesApp		
WebSphere Application Server server name:	sd0d03l2Node01Cell#sd0d03l2Node01		
WebSphere Application Server version:	7.0.0.11		
AS Connection Pool			
Connection pool size:	4		
Average connections in use:	1		
Maximum connection wait time:	0.180 sec		
Pool Usage 📰			
Configured maximum pool size			
Z 1 0 10/29 20:40:00 10/29 21:16:40 Connections			

Figure 8-18 Extended Insight client details - WebSphere client

**Reminder:** The Extended Insight metrics shown on these screens are all calculated within the scope of the duration selected on the time slider. The default is one hour. However, you can expand or contract that interval, or move back in history to view something from another day. Information about using the time slider is described in "Time slider and time controls" on page 155.

The *WAS Connection Pool* section on the lower left shows the configured connection pool size for this client is 4. That seems way too small for the GOSales application, and we should discuss this with the WebSphere administrator. The maximum wait time is shown to be 180ms. If we take another look at the Extended insight details, see Figure 8-19, this time we have selected the WebSphere Connection Wait Time layer in the response time chart. The Average wait time is shown to be 46ms, still pretty long.



Figure 8-19 Extended Insight details for WebSphere Connection Wait Time

We notice the highlighted section of the graph, however, does not show that the connection pool wait time is getting any longer over the hour, it is the application time that is increasing. We need to investigate this, it is either some problem dealing with the waits, or perhaps some secondary problem with the application itself. This all still points to a potential problem in the client side, because ideally we should not have any waiting for connections at all, and again the data server time is flat.

#### Investigating increase in application time

Let us look at the application layer more. We know the data server time is not increasing, but the time spent in the GOSales application is getting longer all the time. The pie chart in Figure 8-18 on page 285 showed over 70% of the client time was spent in the application.

Staying on the same screen, we return to the SQL Statements tab. You can change the Response Time chart view by selecting different layers from the drop down list, for example Figure 8-20 on page 287.



Figure 8-20 Extended Insight Response Time chart - list of layers

You can select or de-select different layers to highlight or hide them on the chart. In this case, we select the **Average Data Server Time per Transaction** layer on the response time chart to view some additional metrics, see Figure 8-21.

As before, we know the transaction throughput is decreasing but now we can see another chart showing Rows Returned is increasing. If the queries are returning more and more rows to the application, the application has to process more rows and thus take more time. DB2 seems to be handling the query well enough, but the application is not.

Extended Insight Analysis Da	shboard: GOSALES						
Back     Locate the source of performance problems,     Response Time Details: GOSALES	determine how those problems affect	different parts of the workloa	d, and analyze the perfi	ormance of indivi	dual SQL statements, clients, an	d partitions.	
Graph Grid			SQL Statement	lients			
Selected layer: Average Data Server T	ime per Transaction 💌	🖄 🚹 Fit Maximum	Show highest 10	by A	verage Data Server Time	•	
0.32-			Statement Tex	ct	Statement Executions	Average Data Server Time	
0.24-			SELECT COH.CU	JST_ORDER_NU	1,032		0.098
0.16-			SELECT CUST_C	ODE, CUST_FI	3,112		0.089
0.08-			SELECT CUST_C	ODE, CUST_FI	1,038		0.083
0-10/29 20:40:00 10/29 20:53:20	10/29 21:05:40 10/29 21:20:0	0 10/29 21:33:20	Display this list by	v the selected ara	aph laver		
				·			_
Detail Area for Average Data Se	erver Time per Transaction						-
Data server time overall properties							
Average data server time per transaction:	0.023 sec						
Rows returned:	1,227,720						_
Number of executions:	21,728						-
Statements:	23,798						
FCM Time							
Overall average communication time per tra	insaction:						
Time Distribution (%)	Rows Returned	Transac	tion Throughput	=	Statement Throughput	=	
Overall average compile processin	18,000 - E 12,000 - 6,000 -	Rows returned rate	$\sim$ '	Transaction throughput	- <u>ie</u> 200-	Statement throughput	

Figure 8-21 Extended Insight - Rows Returned

In fact, we examined our lab workload and discovered that it was doing repeated task of buying a product, then checking the order history. The order history transaction simply queries all the orders for that customer, returning them to the application for display on the page. If the same customer keeps buying more and more, of course the order history will grow. We recommend to the application owner that they should consider improving the order history transaction to include a time or volume range, so we are not retrieving so many rows from the database - for example, only retrieve orders from the last week, or only the last 10 orders.

We now have a lot more information to provide to the application support team not only can we tell them the problem is not in DB2, we can tell them precisely which application server is showing a small connection pool size (4), which data source may be misconfigured (jdbc/GoSalesApp), and what version of WebSphere is running on the server (7.0.0.11). In addition, we have discovered a potential application design improvement in the order history processing.

#### What happened next?

For this example, in our lab we changed the connection pool size from 4 to 10, started some workload again, and we saw the connection pool wait time disappear. Notice the pie chart in Figure 8-22 on page 288, and the large connection wait time wedge is gone.



Figure 8-22 Extended Insight - after increasing connection pool size (1)

Figure 8-23 on page 289 is a picture of the lower section of same screen, where we see the new connection pool size is 10, and the line chart shows plenty of capacity. The average end-to-end response time is now about 23ms, compared to 144ms before.

The application has not yet been modified to improve order history processing.

Extended Insight Analys	sis Dashhoa	rd GOSALES NE	W	-							
Back     Locate the source of performance pr     Response Time Details: Clic	roblems, determinent user IDs	ne how those problems affe	ct different parts of the worklo	ad, a	nd analyze tł	e performan	ice of	individual SQL stateme	nts, clients, and partitions		
Graph Grid				s	QL Statemer	ts Clients	1				
Selected layer: No layer select	ed 💌		🖄 🚺 Fit Maximum		Show highes	10 🗸	by	Average Response	ime		
0.03-					Client He	st Name or I	IP 1	Fransaction Executions	Time of First Connection	Average Res	ponse Time
0.02- 0.01-		$\sim$	$\sim$		9.12.4.16	9		10,448	11/22 17:28:45		0.023
0					Z Display this	list by the s	alact	ad araph lawar			
11/22 17:26:40 11/22 1	//30/00 11/22 1	/:33:20 11/22 17:36:40 11	/22 17:40:00 11/22 17:43:20		_ Display thi	list by the s	electi	su graph layer			
WAS Connection Pool											1
Connection pool size:		10									
Average connections in use:		3									
Maximum connection wait time:		0.120 sec									
Pool Usage	<b>EB</b>										
	Configured										
a a	maximum										
	Currently										
0-11/22 17:26:40 11/22 17:40:00	used										-
	Connections										

Figure 8-23 Extended Insight - after increasing connection pool size (2)

### Working with multiple WebSphere clients

In our book lab, we only have one WebSphere server. If you run multiple application servers or clusters, you would see each of them on the Clients tab. They would be sorted and sortable by different metrics.

You must install and configure the Extended insight client software on each WebSphere Application Server you want to monitor.

Figure 8-24 on page 290 is an example of some metrics from an environment that has two WebSphere V7 application servers in a cluster, and a third WebSphere V6 server running standalone. All three servers run the same application against the same DB2 database. The application uses a single data source. This is just an example of what the client list would look like. This screenshot is not from our book lab environment.

Extended Insight Analysis Dashboar	rd: gsdb on moninst1 97										
Back Locate the source of performance problems, determine how those problems affect different parts of the workload, and analyze the performance of individual SQL statements, clients, and partitions. Response Time Details: Client workstations											
Graph Grid		SQL Statements Clients									
Selected layer: No layer selected •	🖄 🚺 Fit Maximum	Show highest 10 💌 by Average Response Time									
2		Client Host Name or IP Transaction Executions Time of First Average Respon Address Connection	se Time								
1.6		192.168.1.11 647 11/21 16:53:46	1.094								
0 1.2- 9 0.8-		192.168.1.20 440 11/21 16:54:19	0.986								
0.4-		➡ 192.168.1.61 5,101 11/21 15:14:53	0.342								
11/21 15:06:40 11/21 15:40:00	11/21 16:13:20 11/21 16:46:40	Display this list by the selected graph layer									
Operating system:	Linux	Response time problems:									
Database driver name:	IBM DB2 JDBC Universal Driver Architecture	Overall Time Distribution (%)									
Database driver level:	3.61.65										
Connection properties:	maxStatements=0, currentPackagePath=null,	Client time Application									
Extended Insight client name:	IBM Optim pureQuery Runtime	Network time time									
Extended Insight client level:	2.25.73	Data server 98.810 %- 1.190 % pool wait	=								
JRE vendor:	IBM Corporation	22.090 % time									
JRE version:	2.3	4.950 %									
Runtime properties:	am.was.classpath.include.file.webservices=*w	•									
WebSphere Application Server data source name:	jdbc/GoSalesApp										
WebSphere Application Server server name:	was6appNode01Cell#was6appNode01										
WebSphere Application Server version:	6.1.0.31										
			•								

Figure 8-24 Extended Insight with multiple WebSphere clients

At the bottom of the client details section, there is a *Client Comparison* button. It is only enabled if there is more than one client. If you click it, you get a popup window with some information about all the clients, as in Figure 8-25 on page 290. The columns of the grid are sortable, which can be especially useful when you have a large number of clients. The view provides some key metrics to compare at a glance, across the different clients.

Client Compar	Client Comparison												
Client Host Name or IP Address	Time of First Connection	Last TimeStamp	Network Time	Client Time	Currently Used Connections	Connect ion Pool Size ▲	Maximum Connectio n Wait Time	JRE Version	Operating System	Database Driver Level			
192.168.1.20	11/21 16:54:19	11/21/10	24.765	06:06.996	4	5	0.180	2.4	Linux	3.61.58			
192.168.1.11	11/21 16:53:46	11/21/10	28.227	10:19.895	5	5	0.183	2.4	Linux	3.61.58			
192.168.1.61	11/21 15:14:53	11/21/10	01:26.185	21:11.123	1	10	0	2.3	Linux	3.61.65			

Figure 8-25 Extended Insight Client Comparison

## 8.2.3 Understanding workload clusters

In section 4.4.3, "Workload cluster groups and Workload clusters" on page 187, we introduced concepts about workload clusters. We explore that topic some more here, with specific focus on WebSphere applications.

Workload cluster groups, and their associated workload clusters, provide a way for you to look at your database and application transaction monitoring metrics from different perspectives. By using the JDBC connection properties on the connections you have configured for monitoring with Optim Performance Manager Extended Insight, you can increase the dimensions by which you can observe the performance data. We explore this now, in the context of the examples used in this section, which are specific to WebSphere. The general concepts apply to all connection types supported by Optim Performance Manager Extended insight, however, the specifics may vary slightly for the non-WebSphere JDBC and the CLI connections.

#### What are connection properties?

When you create a JDBC connection to DB2 database, the connection has certain attributes associated with it, such as the database name, the authentication ID, and the connection's origin server. You can, optionally, specify more attributes by using client information properties, which DB2 and monitors such as Optim Performance Manager, can detect and use for other purposes. For example, DB2 Workload Manager can use connection attributes to define custom workload definitions. Optim Performance Manager uses these connection attributes as dimensions for workload clusters, which are used in the Extended Insight and Locking dashboards.

### What are client information properties?

The IBM Data Server Driver for JDBC and SQLJ version 4.0 supports JDBC 4.0 client information properties, which you can use to provide extra information about the client to the server. This information can be used for accounting, workload management, or debugging. Extended client information is sent to the database server when the application performs an action that accesses the server, such as executing SQL.

You can read more about the client information properties in the DB2 Information Center. Search for "client information", there are many references, this link is one example:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/topic/com.ibm.db2.luw.apdv .java.doc/doc/t0052428.html

### Why are connection properties interesting or useful?

When you are looking at performance data, it is important to be able to narrow down, or rule out, problem areas. Suppose you observe a downward trend in some application performance metric; if you can say with confidence the issue is related to a specific part of the application, or even a specific SQL statement, this is much more useful than just saying the application is getting worse, and only then getting out your performance analysis toolkit to begin investigation.

Optim Performance Manager Extended Insight can do the "slicing and dicing" of the performance metrics, across all the available connection property dimensions to give you the information you need to isolate the problem.

We'll use two applications to highlight this point. In our book environment, we have two WebSphere test applications, DayTrader and GOSales.

Let us look at DayTrader first.

### DayTrader scenario

The DayTrader application does not use client information properties, while GOSales makes extensive use of them. Another difference, as shown in Figure 8-26, which is a clip from the WebSphere administrative console view of JDBC resources, is that the DayTrader application that has two data sources, NoTxTradeDataSource and TradeDataSource, while GOSales has a single data source, GoSalesApp. Both DayTrader data sources point to the same database.

Nev	v Delete Test conr	ection Manage state				
D	6 # \$					
Select	Name 🛟	JNDI name 🗘	Scope 🗘	Provider 🗘	Description 🗘	Category 🗘
You	an administer the follow	ving resources:				
	Default Datasource	DefaultDatasource	Node=sd0d03l2Node01,Server=server1	Derby JDBC Provider	Datasource for the WebSphere Default Application	
	GoSalesApp	jdbc/GoSalesApp	Cell=sd0d03l2Node01Cell	DB2 Universal JDBC Driver Provider	DB2 Universal Driver Datasource	
	<u>NoTxTradeDataSource</u>	jdbc/NoTxTradeDataSource	Node=sd0d03l2Node01	DB2 Universal JDBC Driver Provider Only (XA)	minVer null - maxVer null - DB2 Universal Driver Datasource	
	<u>TradeDataSource</u>	jdbc/TradeDataSource	Node=sd0d03l2Node01	DB2 Universal JDBC Driver Provider Only (XA)	minVer null - maxVer null - DB2 Universal Driver Datasource	
Total	4					

Figure 8-26 WebSphere data sources for GOSales and DayTrader

From Extended Insight perspective, each data source is treated as a single client, therefore, they will appear as separate entities on the Clients dashboard.

Let us say, for argument, that both DayTrader data sources use the same authentication ID. Each will have identical connection properties, and because DayTrader does not use client information properties, all the metrics will end up grouped together in the Extended Insight dashboard. You would see something similar to Figure 8-27. While you can see different cluster groups, they all have only one cluster, and all the metrics are identical.

Extended Insight Analysis Dashboard: dtrader on L3												
Workload a workloa	ds are listed in the grid. Click in the left o ad cluster group.	olumn to sho	w the chart fo	or the workloa	ad. Use the s	econd column						
Open	Details Activate Deactivate	New Ed	lit Copy.	Reset	Delete	/iew All Known						
Graph	Workload Cluster Group/Workload Cluster	Aver age End- to-	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time						
े Sh	▼	0.002	0	0.599	<b>♦</b> 0.001	♦0.001						
े Sh	▼	0.002	0	0.599	<del>\$</del> 0.001	♦0.001						
े Sh	♦ 9.12.4.169	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
े Sh	Application Types	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
े Sh	♦ WAS	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
े Sh	Authentication IDs	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
े Sh	🔶 wasapp	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
े Sh	Client user IDs	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
🖮 Sh	<b>*</b>	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
े Sh	Client workstations	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
े Sh	sd0d03l2	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
🚵 Sh	• $\diamond$ Client application names	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						
े Sh	🔶 daytrader2-ee5	0.002	0	0.599	<b>0.001</b>	<b>0.001</b>						

Figure 8-27 Extended Insight dashboard - DayTrader, single cluster

There is nothing inherently wrong with this grouping, but you would not be able to distinguish statement metrics *per data source*, because all the connection attributes are identical. Yes, you could see difference in client metrics, on the Extended insight client details page because each data source is shown as separate client, but you could not narrow down to statements per data source.

Let us explore that a bit - we drill down on any cluster (remember, it does not matter which one, they are all the same) and we see some SQL statements are executed, as in Figure 8-28.

Extended Insight Analysis Dashboard: dtrader on L3											
Back Locate the source of performance problems, determine how those problems affect different parts of the workload, and analyze the performance of individual SQL statements, clients, and partitions.  Response Time Details: 9.12.4.169											
Graph Gha Selected layer: Average End-to-End Response Time	Show highest 10 V A	verage Data Server Time									
0.004-	Statement Text	Statement Executions	Average Data Server Time								
0.003-	SELECT t0.HOLDINGID, t0.ACC	3,810	0.008								
	SELECT t0.SYMBOL, t0.CHANG	43	0.001								
ğ 0.002-	SELECT SEQSCHEMA AS SEQUE	1	0.001								
0.001-	DELETE FROM holdingejb WHE	295	0								
0	INSERT INTO orderejb (ORDE	714	0								
11/22 12:00:00 11/22 12:13:20 11/22 12:26:40 11/22 12:40:00 11/22 12:53:20	Display this list by the selected g	aph layer									

Figure 8-28 Extended Insight Response time details for DayTrader, single cluster

We have no way to know which statements are from which data source.

Open the **Clients** tab, as in Figure 8-29. Now we see the two clients, one has only four transactions, the other one nearly 50,000.



Figure 8-29 Extended Insight Clients tab for DayTrader, single cluster

Select the client with only four transactions, and view the client details on the lower part of the screen, as shown in Figure 8-30 on page 295. Now we can see the client metrics and know the data source with four transactions is the NoTxTradeDataSource. But we still do not know which statements it ran.

0.004			Client Host Name or IP Address	Transaction Executions	Time of First Connection	Average Response Time
0.002-			9.12.4.169	4	11/22 12:45:19	0.012 *
			0 10 / 100	40 121	11/00 10:45:10	0.002
11/22 12:00:00 11/22 12:13:20 11/22	12:26:40 11/22 12:40:00	11/22 12:53 20	Display this list by the sele	cted graph layer		
Runtime properties:	am.was.classpath.include.file.we	abse vices=*				
WebSphere Application Server data source name:	jdbc/NoTxTradeDataSource 🥌					
WebSphere Application Server server name:	sd0d03l2Node01Cell#sd0d03l2Ne	lode01				
WebSphere Application Server version:	7.0.0.11					
WAS Connection Pool						
Connection pool size:	2					
Average connections in use:	1					
Maximum connection wait time:	0 sec					
Pool Usage 🗉 🖩						=
1 000						-
Configured						
maximum						
Z 0.60-						
0used						•
The second se						

Figure 8-30 Extended Insight Client detail for NoTxTradeDataSource

How can you improve this state, if the application itself cannot change to use client information properties within its code?

One option is to use a different authentication ID for each data source, thus introducing a new dimension that Optim Performance Manager can group on. This is viable but does require work by your security team to add a new user ID, and there could be implications to the application if it depends on the authentication ID to qualify a table schema, for example.

Another option is to use the WebSphere capability to set default values for one or more of the four client information properties. This would require assistance from the WebSphere administrator, or who ever has privileges to change the application data source properties.

You may have noticed in Figure 8-27 on page 293 that the cluster value for the Client User IDs workload cluster group was blank. This is because neither WebSphere nor the DayTrader application set any value for that property. Suppose we keep the same authentication ID for both data sources, but we add a unique value for the clientUser property in WebSphere's data source definition. Here we set the clientUser property for NoTxTradeDataSource to notxuser in Figure 8-31. (This picture is from the WebSphere administration console.)

Cell=sd0d03l2Node01Cell, Profile=AppSrv01										
Data sources			? _							
Data sources > NoTxTradeDataSource > Custom properties										
Use this page to specify custom properties that your enterprise information system (EIS) requires for the resource providers and resource factories that you configure. For example, most database vendors require additional custom properties for data sources that access the database.										
Preferences     ■										
New Delete										
Select Name 🗘	Value 🗘	Description 🗘	Required 🗘							
You can administer the following resources:	and the second second	allanta a success all allantations and a success								
clientUser	notxuser	Specifies the current client user name for the connection. This information is for client accounting purposes. Unlike the JDBC connection user name, this value can change during a connection. For a DB2 UDB for Linux, UNIX and Windows server, the maximum length is 255 bytes.	false							

*Figure 8-31 Set default clientUser value for NoTxTradeDataSource* 

For the TradeDataSource data source we set it to itsoUser, see Figure 8-32.

Cell=sd0d03l2Node01Cell, Profile=AppSrv01										
Data sources			? =							
Data sources > TradeDataSource > Custom properties Use this page to specify custom properties that your enterprise information system (EIS) requires for the resource providers and resource factories that you configure. For example, most database vendors require additional custom properties for data sources that access the database.										
New Delete										
Select Name 🗘	Value 🗘	Description 🗘	Required 🗘							
You can administer the following resources:	~~~	value is not valu.	den ante de la company							
slientUser	itsoUser	Specifies the current client user name for the connection. This information is for client accounting purposes. Unlike the JDBC connection user name, this value can change during a connection. For a DB2 UDB for Linux, UNIX and Windows server, the maximum length is 255 bytes.	false							

*Figure 8-32 Set default clientUser value for TradeDataSource* 

**Note:** You can access this WebSphere administrative console page in one of two ways:

- ▶ Resources  $\rightarrow$  JDBC  $\rightarrow$  Data sources  $\rightarrow$  data\_source
- ► Resources → JDBC → JDBC providers → JDBC\_provider → Data sources → data\_source

These data source changes are picked up at next WebSphere start. When a new connection is established, it will have the appropriate clientUser property value associated with it. Now our two data sources have uniqueness between them, manifested in the connection properties, which are monitored and collected by the Optim Performance Manager Extended Insight client.

We run some more workload through the DayTrader application, let us see how this changes the view of data on the Extended Insight dashboard. Observe in Figure 8-33 on page 297, now we see two workload clusters under Client User IDs workload cluster group - one for itsouser and one for notxuser. The properties now reflect the different data source from the application. We know this because we set the value in WebSphere, so when the application acquires a connection, it will always be set with the corresponding value on the client information property.

Exter	ided Insight Analysis D	ashboard	: dtrade	er on L3								1	dtrader on L	.3 • Disconnect
Workloa workloa	Workloads are listed in the grid. Click in the left column to show the chart for the workload. Use the second column to expand and collapse workload clusters in the grid. Double-click a row to view details. Click New to create a workload cluster group.													
Open	Details Activate Deactivat	te New	Edit	Copy Re	set Delete	View All Kr	nown Clients	Transaction Topology					Expand	Collapse
Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time	Average Client Time	Warning (%)	Critical (%)	Transacti ons (/min)	Rows Read Rate	Rows Modified Rate	Rows Returned Rate	Statement Failure Rate (%)
े Sh	▼	0.002	0	1.463	♦0.001	<b>0.001</b>	0			3,799.875			4,231.938	0
😂 Sh	Client user IDs	0.002	0	1.463	<del>\$</del> 0.001	<b>0.001</b>	0			3,799.875			4,231.938	0
🖮 Sh	notxuser	0.022	0	0.078	<b>0.002</b>	<b>0.002</b>	<b>0.019</b>		-1	4	) -		9	0
े Sh	itsouser	0.002	0	1.463	<b>0.001</b>	<b>0.001</b>	0		\	3,799.625			4,231.375	0
🚵 Sh	<ul> <li>Application Types</li> </ul>	0.002	0	1.463	<b>0.001</b>	<b>0.001</b>	0			3,799.875			4,231.938	0
े Sh	♦ WAS	0.002	0	1.463	<b>0.001</b>	<b>0.001</b>	0			3,799.875			4,231.938	0
🚵 Sh	▼ ◆ Authentication IDs	0.002	0	1.463	<b>0.001</b>	<b>0.001</b>	0			3,799.875			4,231.938	0
े Sh	wasapp	0.002	0	1.463	<b>0.001</b>	<b>0.001</b>	0			3,799.875			4,231.938	•
🚵 Sh	Host names/IP addresses	0.002	0	1.463	<b>0.001</b>	<b>0.001</b>	0			3,799.875			4,231.938	0
🖮 Sh	9.12.4.169	0.002	0	1.463	<b>0.001</b>	<b>0.001</b>	0			3,799.875			4,231.938	0
🚵 Sh	<ul> <li>Client workstations</li> </ul>	0.002	0	1.463	<b>0.001</b>	<b>0.001</b>	0			3,799.875			4,231.938	0

Figure 8-33 Extended Insight dashboard - DayTrader, two clusters for Client User IDs

How is this helpful to us? Let us drill down on the Client User IDs workload cluster group first, by double-clicking on the row. We see the same kind of statement information we saw before as in Figure 8-28 on page 294 where we cannot discern which statements came from which data source. The *Clients* tab still show both data sources as separate clients. The summary information is useful for the bigger picture, but now we can drill down on each individual workload cluster - the client user ID values in this case - to see more detail.

Back on the Extended Insight overview screen, double-click the notxuser workload cluster, to view its details, as seen in Figure 8-34 on page 298. Now we can see exactly which statements were executed under that data source. There are only three statements for this data source, which is used only for keeping track of some sequence counters for the application, and the statements are not executed very often. (Note also we switched the graph to a bar chart, to make the single data point easier to see.)

Extended Insight Analysis Dashbo	ard: dtrader on I	.3			
Back Locate the source of performance problems, determ Response Time Details: notxuser	nine how those problems af	fect different parts of the workloa	d, and analyze the performance of individual SQL statem	ents, clients, and partitions.	
Graph Grid			SQL Statements Clients		
Selected layer: Average End-to-End Response	Time 🔹	🖄 🔟 Fit Maximum	Show highest 10 V Average Data Ser	ver Time	<b>  •</b>
0.02-		I	Statement Text	Statement Executions	Average Data Server Time
0.016			SELECT SEQSCHEMA AS SEQUENCE_SCHEMA, SEQN	A 1	0.005
입 0.012-			UPDATE KEYGENEJB SET KEYVAL = ? WHERE KEYNA	4 4	0
0.008-			SELECT KEYVAL FROM KEYGENEJB WHERE KEYNAME	= 4	0
0.004-					
0					
12/01 13:06:40 12/01 13:20:00 12	/01 13:33:20 12/01 13	46:40 12/01 14:00:00	Display this list by the selected graph layer		
Detail Area for Average End-to-End	Response Time				
End-to-End Response Time					
Overall average response time per transaction:	0.022 sec				=
Maximum Time of running transactions	0.076 sec				
Number of executions:	4				
Statements:	9				
Statement Failure Rate:	0 %				

Figure 8-34 Extended Insight details for notxuser Workload Cluster

If we look at the *Clients* tab for this cluster, what do you think we will see? We can see only one client now, because we have filtered the view to look at only metrics for that single data source - shown in Figure 8-35.

EACCINE INSIGNE AND SIS DUSIDOU							
Back Locate the source of performance problems, determine	e how those problems affect different parts of the worklo	d.an	nd analyze the p	performance	of individual SOL statemer	nts, clients, and partitions,	
Response Time Details: notxuser		-,	,,				
Graph Grid		S	QL Statements	Clients			
Selected layer: No layer selected 💌	🖄 🚺 Fit Average		Show highest	10 🔻	by Average Response 1	îme	· ·
0.08-			Client Host Address	Name or IP	Transaction Executions	Time of First Connection	Average Response Ti
0.06-			9.12.4.169		5	12/01 13:45:54	
g 0.04-	/	- I					
0.02-		-					
12/01 13:06:40 12/01 13:20:00 12/01	13:33:20 12/01 13:46:40 12 01 14:00:00	~	Display this lis	st by the sele	cted graph layer		
WebSphere Application Server data source name:	jdbc/NoTxTradeDataSource						
WebSphere Application Server server name:	sd0d03l2Node01Cell#sd0d03l2Node01						
WebSphere Application Server version:	7.0.0.11						

Figure 8-35 Extended Insight client detail for notxuser

#### Summary for DayTrader scenario

In this scenario, we have shown how you can set a default client information property in WebSphere data source, and have that value carried through the connection and all transactions that occur with that data source. Optim Performance Manager Extended Insight stores that information as another dimension by which you can view the metrics in the Extended Insight dashboards.

For DayTrader scenario, even though the application does not use client information properties, we were still able to control how the workload clusters were grouped. No application changes were required.

In the example just discussed, we only showed using one of the client information properties. You can use any or all of the four properties to add more dimensions to Extended Insight.

### **Great Outdoors Company scenario**

As we mentioned in "Why are connection properties interesting or useful?" on page 292, we have two different sample applications in our environment. The Great Outdoors Company's GOSales application makes extensive use of client information properties within the application. Let us take a look at that application next.

For the GOSales data sources defined in WebSphere, no default client information properties are set. Remember also the GOSales application uses only one data source.

When we run some workload for GOSales application, the Extended Insight dashboard shows a lot of workload clusters, because the application sets and changes the connection properties frequently. See for example in Figure 8-36 on page 300. Observe there are several workload clusters under each workload cluster group. We are using the default workload cluster groups - we have not yet created our own. If we look at workload cluster group Client application names, for example, we see three clusters:

- ► customer log in
- ► product viewing
- ▶ order entry

Exten	ded Insight Analysi	s Dashbo	ard: GO	SALES_N	EW							0	E GOSALES	NEW V Disconnect
Workload workload	Is are listed in the grid. Click I cluster group.	in the left colu	umn to show t	he chart for th	ie workload. U	Jse the second	i column to ex	pand and c	ollapse workl	oad clusters in th	e grid. Double-	click a row to	view details.	Click New to create a
Open	Details Activate Dead	tivate Ne	ew Edit			lete View A	All Known Clier	nts Trans	saction Topol	ogy			Expand	Collapse
Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time	Average Client Time	Warning (%)	Critical (%)	Transactions (/min)	Rows Read Rate	Rows Modified Rate	Rows Returned Rate	Statement Failure Rate (%)
🚵 Sh	▼	0.018	0.511	0.602	<b>0.013</b>	<del>\</del> 0.002	<del>\</del> 0.003			202.583	108,998.200	34.559	4,089.300	0
े Sh	Client application nar	0.018	0.511	0.602	<b>0.013</b>	<b>0.002</b>	<b>0.003</b>			202.583	108,998.200	34.559	4,089.300	0
🚵 Sh	customer log in	0.091	0.059	0.602	<b>0.085</b>	<b>0.006</b>	<b>0.001</b>			24.450	52,103.333	0	24.450	0
🚵 Sh	product viewing	0.014	0.511	0.566	\$0.003	\$0.003	<b>0.008</b>			55.933	29,788.867	145.770	3,979.283	0
े Sh	order entry	0.004	0.001	0.522	<b>\$</b> 0.003	<b>0.001</b>	<b>0.001</b>			122.200	27,106	1.299	85.567	0
े Sh	▼ ♦ Client user IDs	0.018	0.511	0.602	\$0.013	<b>0.002</b>	<b>0.003</b>			202.583	108,998.200	34.559	4,089.300	0 =
े Sh	application	0.075	0.059	0.579	<b>0.070</b>	<b>0.005</b>	<b>0.001</b>			12.267	26,051.667	0	12.267	0
🚵 Sh	🔶 e user	0.014	0.005	0.602	<b>0.009</b>	<b>0.002</b>	<b>0.003</b>			67.667	43,850.883	34.034	1,601.500	0
े Sh	🔶 c user	0.014	0.511	0.588	<b>0.010</b>	<b>0.002</b>	<b>0.003</b>			66.417	39,095.650	39.964	1,373.567	0
🚵 Sh	♦ d user	0.013	0	0.566	<b>0.009</b>	<b>0.002</b>	<b>0.003</b>			64.784			1,266.039	0
े Sh	anonymous	0.004	0	0.022	<b>0.002</b>	<b>0.001</b>	<b>0.001</b>			70			1,550	0
🚵 Sh	Client workstations	0.018	0.511	0.602	<b>\$</b> 0.013	<b>0.002</b>	<b>0.003</b>			202.583	108,998.200	34.559	4,089.300	0
≧ Sh	◆log in	0.075	0.059	0.579	\$0.070	\$0.005	<b>0.001</b>			12.267	26,051.667	0	12.267	0
200	A													

Figure 8-36 Extended Insight dashboard - GOSales with multiple workload clusters

For this grouping, we look at the Transactions per Minute column, to see which cluster has the most activity. The order entry cluster shows the highest transaction rate of the three clusters. If we were investigating some alerts, we might want to focus on the heavy-hitter cluster first - order entry in this case. Or, we might want to focus on just the cluster with longest end-to-end transaction time - in our example this is the customer log in cluster. That is the strong point of Extended Insight - you *can* view the metrics in many different ways.

As with the DayTrader scenario, when you drill down into any workload cluster, you see the metrics associated only with that cluster. So, if we want to see what statements were executed for the order entry cluster, we just double-click on it to view the details. In Figure 8-37, it looks like there are a lot of INSERT statements (no big surprise for an order entry transaction).



Figure 8-37 Extended Insight details for GOSales order entry workload cluster

To see the full text of the SQL statement, click **Show All Text**. In Figure 8-38 on page 301, we see the statement has a literal in the text, as well as some parameter markers. We might want to talk to developers about that too, knowing that another parameter marker might be needed. We could also launch the Optim Query Tuner from here, but we do not go into that with this scenario. You can see an example of the Optim Performance Manager-Optim Query Tuner integration in 8.1, "Application running slowly caused by index issue" on page 272.



Figure 8-38 GOSales order entry - show all text

#### Statement Server Execution Details tab

While not directly related to this scenario, it is a good time to mention the additional metrics you can collect with Extended Insight. Up to now, we have been concerned with metrics collected on the Extended Insight client side - in this case WebSphere application server. If your DB2 data server runs at least version 9.7 Fix Pack 1, you can also collect metrics about statements and transactions at the data server side. This is configurable in the Extended Insight section of the Configure Monitoring dialogs, see Chapter 3, "Installing and configuring Optim Performance Manager" on page 59. We do not go into detail about it here but let us take a quick look.

in Figure 8-39 on page 302, we selected the **Statement Server Execution Details** tab, to see some more metrics. The data here is only available if you have configured its collection, otherwise, the fields will be empty.

Seneral Information Statement Server Exec	cution Details				
he tab displays data for each time that the state ame statement than indicated on the tab that dis	ement ran on the data server during the time interval: 12/ splays the client metrics.	01 15:40:00 and 12/01 16:43:00. In	some cases, this c	ata can comprise more statement	executions for the
Most Recent Identification	-	Statement Row and Sort Deta	ails		
Statement identifier:	01000000000000ef6105000000000000000	Average rows read:		0	
Package name:		Average rows returned:		0	
Statement Type:	DML, Insert/Update/Delete	Average rows modified:		1	
Package Version:		Average Sort Processing Time:		0 sec	
Cache Insert time stamp:	12/01 16:21:12	Total sorts:		0	
Last execution:	12/01 16:21:12	Number of Sort Overflows per l	Partition/Member:	0	
Involved partitions:	1	Post threshold sorts:		0	
		Post threshold shared sorts:		0	
Most Recent Compilation	-	Row Efficiency	=	Sort Efficiency	=
Compilation time:	4		Rows Read		In Memory
Isolation level:	-> ur		and Not Used		Sorts
Estimated cost:	23	100 %-	Rows		Number of
			Modified		Overflows
Data Server Execution Time	-				per 🔔
Number of executions:	1				
Average execution time:	0.075 sec	I/O Statistics			
Average CPU time:	0 sec	Deffer Deal tilt Detfer		27.500.0/	
Average activity time:	0.075 sec	Burrer Pool Hit Ratio:		37.500 %	
Average workload manager queue time:	0 sec	Logical page I/O:		8	
Average Routine Processing time:	0 sec	Physical page I/O:		5	
Average Section Processing time:	0 sec	Pages written:		U	
Average Section Wait Time:	0 sec	Logical Page I/O Distributi	on 💷	Physical Page I/O Distribution	on 💷
Querall Time Distribution			<u> </u>		<u> </u>

Figure 8-39 Extended Insight - GOSales Statement Server Execution Details

A single INSERT statement, in this case, may not show anything especially interesting, but you can still see the type of information that would be collected if you enable the server-side statement metrics. One metric many people find useful is the isolation level, in this case it uses UR (uncommitted read). The server-side statement metrics are collected using package cache monitor functions, and only if your monitored DB2 is version 9.7 Fix Pack 1 or higher.

Even more metrics can be collected if you also enable the server-side transaction metrics. We did not enable it for this example. The server-side transaction

metrics are collected using the DB2 Unit of Work event monitor, and only if your monitored DB2 is version 9.7 Fix Pack 1 or higher.

To enable or disable the server-side collections, see the Configuration dialog for Extended Insight, as shown in Figure 8-40 on page 303.

Collection of monitorin	Usage of clie	ent field information	Integration with Tivoli Monitoring
Collect statement and t	ransaction n	netrics on client	
Currently known clients:		View	
Port number for the Extend	ded Insight	O Dynamic	
client application that you t	conngureu.	Ocustom * 55	5002
Use logical database log	okup name:		
Package cache event moni	tor settings:		
You can override the defau	It table space	that is used to monit	or event data.
You can override the defau	It table space GOSALES	e that is used to monit	or event data.
You can override the defau Use custom table space Maximum table space	It table space GOSALES the fill size in p	e that is used to monit	or event data.
You can override the defau	ilt table space GOSALES ce fill size in p cs on data s rics on data	erver	or event data.
You can override the defau Use custom table space Maximum table space Collect statement metri Collect transaction metri UOW event monitor setting You can override the defau	<pre>it do datago it table space ce fill size in p cs on data s rics on data s: ult table space</pre>	erver server ethat is used to monit	or event data.
You can override the defau Use custom table space Maximum table space Collect statement metric Collect transaction metric UOW event monitor setting You can override the defau Use custom table space	It table space GOSALES ce fill size in p cs on data s rics on data is: it table space GOSALES	erver ethat is used to monit erc_TS V erver server ethat is used to monit SCT_TS V ethat is used to monit	or event data.

Figure 8-40 Extended Insight configuration

#### **Customizing Workload Cluster Groups**

In the GOSales scenario, we saw how the metrics for the three client application names were grouped as separate workload clusters, within the Workload Cluster Group for Client application names. What if we wanted to see metrics for order entry and product viewing grouped together, and only isolate the customer log in metrics as a separate cluster. Is this possible?

Yes, you can create your own workload cluster groups using a variety of grouping and filtering. Let us create a group with that example, and add another dimension as well, only include metrics from client users "c user" and "e user".

In section 4.4.3, "Workload cluster groups and Workload clusters" on page 187, we showed how to create a new workload cluster group. In this section we show

this again but with different focus on the clustering and filtering aspects, rather than the thresholds.

On the Extended Insight overview dashboard, click **New...** to open the Workload Cluster Group dialog. We name the new group Test group, see Figure 8-41 on page 304.

w Workload Clu	ster Group	
the state of the second second	I. Bartinet	
Step 1 of 3		
You use a workl	oad cluster group to group the incoming data server workload according to connection attributes. This grouping	
helps you deterr	nine where performance problems and bottlenecks occurred.	
Name:	* Test group	
Description:	a test group	
Description.		
Activate or dea	ctivate this workload cluster group for monitoring:	
	ive to process data and display this group on the monitoring dialogs	
O beac	wate to step data processing and nide this group norm the monitoring dialogs	
	<back next=""> Finish Ci</back>	anc

Figure 8-41 Create new Workload Cluster Group - step 1

We want to cluster on the Client application name attribute, so we select that checkbox. But we also want to exclude some values, so we also select the Filter checkbox. See Figure 8-42 on page 305.

v Workload Cluster Group	Extende	d Insight Dash	hoard						×
Step 2 of 3 A workload cluster group can cover criteria to generate workload cluster for each connection attribute to redu Click Refresh to generate the worklo	the entire v s for this g ce the wor ad clusters	vorkload of a data roup. You can sel kload that is cove s.	abase ( ect one red. C	or only pa e more at lick Brows	nt of it. Spe tributes for se () to v	ecify c cluste iew th	onnection attrib ring. You can a e available filter	utes and filter Iso use a filter r values.	•
Connection Attributes and Filter	Criteria								
Type of workload cluster group	Custom	ı	•	Samplin	g period:	Cur	rent time s 🛛 🔻		
Cluster by Connection Attribute	Filte	er the Workload				_			
Application type		Application type		=					
Client Application Name	<b>v</b>	Client Application I	Na	=	▼			•	
Client Accounting String		Client Accounting §	String	=					
Host Name or IP Address		Host Name or IP A	dd	=					
Authentication ID		Authentication ID		=					
Client Workstation		Client Workstation	1	=					
Client User ID		Client User ID		=					
enerated Workload Clusters Vorkload clusters: 0 Transa Reset Cluster Name	ictions ex	ecuted: N/P	[	Refresh					
Workload Application Clie Cluster Name type App Nam	nt lication 1e	Client Accounting String	Host I IP Ad	Name or Idress	Authentic n ID	atio	Client Workstation	Client User ID	
									•
							<back next=""></back>	Finish Ca	ancel

Figure 8-42 Create new Workload Cluster Group - step 2- before filtering

Click the button marked "..." to open the filter dialog. As shown in Figure 8-43 on page 306, un-check the customer log in attribute since we do not want to see it in our cluster group.

Select one or more items to use as filter criteria. The displayed items are taken from the specified sampling period.	d f
Connection attribute: Client Application Name	
Filter condition:	-
Client Application Name	
	ſ
✓ order entry	ľ
	ł
	-
	-
	l
	0
OK Cancel	

Figure 8-43 New Workload Cluster Group - filter selection

Click **OK** to accept the filter list. Now back on the main dialog, see in Figure 8-44, the filter is displayed, showing the client application name will only be shown for the application names in the list.

Connection Attributes and Filter Cr	iteria		
Type of workload cluster group:	Custom   🔻	Sampling period	Current time s
Cluster by Connection Attribute	Filter the Workload		
Application type	Application type	=	
Client Application Name	Client Application Na	IN 🗸 🔻	product viewing,
Client Accounting String	Client Accounting String	=   •	product viewing,order entry
Host Name or IP Address	Host Name or IP Add	=	
Authentication ID	Authentication ID	=   •	
Client Workstation	Client Workstation	=	

Figure 8-44 New Workload Cluster Group - cluster and filter on Client Application Name

We also want to create an additional filter for only metrics for two users. This is an important point about workload cluster groups - you can *cluster* and/or you can *filter*. For this case we only want to filter.

Select **Filter** for client User ID, but leave the "cluster by" checkbox unchecked. Click the filter button ("...") and select only the desired users (Figure 8-45), then click **OK**.

duce kload	the workload that is covered. I clusters.	E more attributes for clostering. For can also use a filter Click Browse () to view the available filter values.
r Cr	iteria	Connection Attributes - GOSALES_NEW
ıp:	Custom 🗸 🗸	Select one or more items to use as filter criteria. The displayed items are taken from the specified sampling period.
	Application type	Connection attribute: Client User ID
	Client Application Na	Titer condition: Item loaded: 3
	Client Accounting String	
	Host Name or IP Add	Client User ID
	Authentication ID	application
	Client Workstation	C user
	✓ Client User ID	V e user

Figure 8-45 New Workload Cluster Group - filter on Client User ID

Now back on the Step2 page of the Workload Cluster Group dialog, click **Refresh** to view the list of clusters you would see for this set of cluster/filter options. In Figure 8-46 on page 308, now we see the results of the combination of clustering and filtering. We did not choose to *cluster* on the client user ID attribute, so we do not get a separate row for that dimension. The metrics shown for the new Workload Cluster Group, however, will include only transactions from the two client user IDs we selected as the filter. In this case, we have two clusters.

A workload cluster group criteria to generate worklo for each connection attribu Click Refresh to generate	can cover the e bad clusters for ute to reduce th the workload c	entire workload this group. You ne workload tha lusters.	of a database u can select on t is covered. (	or only part of e more attribu Click Browse (	it. Spec tes for c ) to vie	cify conne clustering ew the av	ection attrib . You can a railable filte	butes and filter also use a filter er values.
Connection Attributes a	nd Filter Crite	eria						_
Type of workload clust	ter group:	Custom	•	Sampling pe	riod:	Current	time s 🛛 🔻	
Cluster by Connection Attr	ibute	Filter the Wo	rkload					
Application type		Applicatio	n type	=	-			
Client Application Name		🖌 Client App	lication Na	IN	V P	roduct vie	wing, c	
Client Accounting String		Client Acc	ounting String	=	-			
Host Name or IP Addres	is	Host Nam	e or IP Add	=	•			
Authentication ID		Authentica	ation ID	=				
Client Workstation		Client Wo	rkstation	=	-			
Client User ID		Client Use	TD.				er	
			10	IN	▼ c	user,e us		
Generated Workload Clu Workload clusters: 2 Reset Cluster Name Workload Cluster Name	USTERS Transactio Application type	Client Application Name	179.241 Client Accounting String	IN Refresh Host Name or IP Address	Authe on ID	nticati (	Client Workstatio	n Client User ID
Generated Workload Clu Workload clusters: 2 Reset Cluster Name Workload Cluster Name	Application type	Client Application Name product viewing	179.241 Client Accounting String	IN Refresh Host Name or IP Address *	Authe on ID	nticati (	Client Workstatio	n Client User ID *
Generated Workload Clu Workload clusters: 2 Reset Cluster Name Workload Cluster Name product viewing order entry	Application type	Client Application Name product viewing order entry	179.241 Client Accounting String * *	IN Refresh Host Name or IP Address * *	Authe on ID *	nticati (	Client Workstatio	Client User ID * *

Figure 8-46 New Workload Cluster Group - clustered and filtered

We will not set any alert thresholds at this time, so click **Finish** to save the new workload cluster group.

If we had chosen also to cluster, as well as filter, on the client user ID attribute, we would end up with four clusters - one for each combination of attributes. An example of this is shown in Figure 8-47 on page 309.
ew Workload Cluster Grou	p had vile	ixtended Insia	ht Dachboar	ન ્રો					
	d cite - c-it								•
Type of workload cluster group: Custom									
Cluster by Connection Attril	bute	Filter the Wo	orkload			Current and	3   •		
Application type		Applicatio	n type	=	<b>•</b>				
Client Application Name		Client App	plication Na	IN	•	product viewing,			
Client Accounting String		Client Acc	ounting String	=	•				
Host Name or IP Address	5	Host Nam	e or IP Add	=					
Authentication ID		Authentic	ation ID	=	•				
Client Workstation		Client Wo	orkstation	=	•				
Client User ID		Client Use	er ID	IN	•	c user,e user			
Generated Workload Clu Workload clusters: 4	sters Transactio	ons executed:	179.102	Refresh					
Workload Cluster Name	Application type	Client Application Name	Client Accounting String	Host Name or IP Address	Auth on I	D Client	tation	Client User ID	
product viewing, e user	*	product viewing	*	*	*	*		e user	
product viewing, c user	*	product viewing	*	*	*	*		c user	
order entry, c user	*	order entry	*	*	*	*		c user	
order entry, e user	*	order entry	*	*	*	*		e user	

Figure 8-47 New Workload Cluster Group - clustered and filtered on both attributes

You might want to experiment with clustering and filtering with your own data, it is quite interesting and easy to see metrics in different combinations.

**Important:** The workload cluster groups and clusters operate on data that is already collected. You could look at current or history data, decide you want to view some other dimensions, create a new cluster group and view it. You can create, modify, delete, or just disable different workload cluster groups at will. However, it is best to leave the default groups alone. There is no cost to creating new ones.

Now that we saved the new workload cluster group, how does it appear on the Extended Insight dashboard? See Figure 8-48 on page 310.

Exten	Extended Insight Analysis Dashboard: GOSALES_NEW									
Workload workload	Workloads are listed in the grid. Click in the left column to show the chart for the workload. Use the second column to expand and collar workload cluster group. Open Details Activate Deactivate New Edit Copy Reset Delete View All Known Clients Transact									
Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time	Average Client Time	W		
े Sh	▼	0.018	0.129	0.646	<del>\</del> 0.015	<b>♦</b> 0.001	<del>\</del> 0.002			
े Sh	Client application names	0.018	0.129	0.646	\$0.015	<b>0.001</b>	<b>0.002</b>			
े Sh	Client user IDs	0.018	0.129	0.646	<b>0.015</b>	<b>0.001</b>	<b>0.002</b>			
े Sh	Client workstations	0.018	0.129	0.646	<b>0.015</b>	<b>0.001</b>	<b>0.002</b>			
े Sh	Authentication IDs	0.018	0.129	0.646	<b>0.015</b>	<b>0.001</b>	<b>0.002</b>			
🖮 Sh	▼	0.007	0.015	0.554	<b>0.003</b>	<b>0.001</b>	\$0.003			
े Sh	product viewing	0.013	0.015	0.554	<b>0.003</b>	<b>0.002</b>	\$0.008			
े Sh	🔶 order entry	0.004	0	0.491	<b>0.003</b>	<b>0.001</b>	0			

Figure 8-48 Extended Insight dashboard with new Test group

We notice that the Test group cluster group shows the two applications we wanted, but we do not have any indication that it is also filtered on user ID. Can we improve this? *Yes.* When you create or modify a workload cluster, you can also change the default name. Let us do that now. Select Test group, and click **Edit...** to open the Workload Cluster Group dialog for that group.

Click **Next**> to go to Step2 page. Click **Refresh** to cause the lower sample section to populate with data. If you have active workload running, you will see the current values displayed here. You can also switch to different time span by using the *Sampling period* drop down list. See Figure 8-49 on page 311. Click on the cell for the cluster name, and it will move into edit mode. Type any value you want for the cluster name. Here we added some text to indicate a filter. Each individual cluster can have its own custom name, or you can keep the default.

Click **Finish** to save these changes and return to the Extended Insight dashboard.

dit Workload Cluster Group Test grou	ıp	n have						
Step 2 of 3 A workload cluster group can cover the entire workload of a database or only part of it. Specify connection attributes and filter criteria to generate workload clusters for this group. You can select one more attributes for clustering. You can also use a filter for each connection attribute to reduce the workload that is covered. Click Browse () to view the available filter values. Click Refresh to generate the workload clusters.								
Connection Attributes and Filter Cri	teria							
Type of workload cluster group:	Custom		•	Sampling p	period:	Current time	es 🔻	
Cluster by Connection Attribute	Filter	the Worklo	ad		_			
Application type	A;	pplication typ	pe	=				
✔ Client Application Name	√ c	lient Applica	tion Na	IN	•	product viewing	,	
Client Accounting String		lient Account	ting String	=	•			
Host Name or IP Address	н	ost Name or	IP Add	=	•			_
Authentication ID	A	uthentication	ID	=	<b>.</b>			=
Client Workstation		lient Workst	ation	=	•			
Client User ID	V C	lient User ID	•	IN		c user,e user		
Generated Workload Clusters Workload clusters: 2 Transactions executed: 178.579 Refresh Reset Cluster Name								
workload cluster name		on type	Applicati on Name	Accounti ng String	Name IP Addro	or cation ID	Workstat ion	User ID
product viewing - for Users C and E only		*	product	*	*	*	*	*
order entry - just user c and e	*	order entry	*	*	*	*	*	
						<back< td=""><td>Next&gt;</td><td>Finish Cano</td></back<>	Next>	Finish Cano

Figure 8-49 Modify Workload Cluster names

Now the Extended Insight overview dashboard looks like the example in Figure 8-50 on page 312, clearly identifying the two clusters as having a filter. Here we changed the individual cluster names, but we could have changed the Workload Cluster Group name as well.

Extended Insight Analys	sis Dashboard	: GOSALES_NEW
-------------------------	---------------	---------------

Workloads are listed in the grid. Click in the left column to show the chart for the workload. Use the second column to expar workload cluster group.

Open	Details Activate Deactivate New I	Edit	py Res	et Delete	View All	Known Clier	nts
Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Respons e Time	Maximu m Inflight Elapsed Time	Maximu m End- to-End Respons e Time	Average 	Average 	A1
े Sh	▼	0.072	50.961	52.569	<del>\$</del> 0.069	<del>\</del> 0.001	
े Sh	► ♦ Client user IDs	0.072	50.961	52.569	<b>0.069</b>	<b>0.001</b>	
े Sh	Client application names	0.072	50.961	52.569	<b>0.069</b>	<b>0.001</b>	
े Sh	Client workstations	0.072	50.961	52.569	<b>0.069</b>	<b>0.001</b>	
े Sh	► ◆ Authentication IDs	0.072	50.961	52.569	<b>0.069</b>	<b>0.001</b>	
े Sh	▼ ♦ Test group	0.008	0	0.503	<b>0.004</b>	<b>0.001</b>	
े Sh	product viewing - for Users C and E only	0.013	0	0.503	<del>\$</del> 0.003	<del>\$</del> 0.002	
े Sh	order entry - just user c and e	0.005	0	0.491	<b>0.004</b>	<b>0.001</b>	

Figure 8-50 Extended Insight dashboard with new Test group custom cluster names

**Recommendation:** There are no visual indicators that a filter is in effect, therefore we recommend using custom names if you use filtering without clustering, so that you don't forget about the filter later.

Now we have a custom group that we can monitor easily, and we have added some additional filtering to further narrow down its contents. If you have applications that use client information attributes, you will find the capabilities of Workload Cluster Groups quite powerful.

#### Summary for GOSales scenario

In the scenario for the GOSales application, we have seen how Optim Performance Manager Extended Insight uses the connection properties to allow different views of the application transaction metrics. If your application developers can add such properties to the getConnnection requests, you will have greater insight into application behavior.

We also learned about customizing Workload Cluster Groups to create the best views for your shop.

# 9

# Troubleshooting failing transactions alert

If you receive an alert about a high percentage of failing transactions then you want to know which transactions failed and why. In this chapter we show you how to troubleshoot this alert in Optim Performance Manager.

To calculate the percentage of failing transactions Optim Performance Manager uses the number of rollbacks and commits occurred in the database. Each rollback is counted as a failed transaction, each commit is counted as a successful transaction.

Optim Performance Manager considers both internal rollbacks and explicit rollbacks.

An internal rollback occurs when any of the following cannot complete successfully:

- ► A reorganization.
- ► An import.
- ► A bind or precompile.
- An application ends as a result of a deadlock situation or a lock timeout situation.

 An application ends without executing an explicit commit or rollback statement (on Windows).

An explicit rollback is a ROLLBACK statement executed by an application. A well-designed application issues a ROLLBACK statement after an SQL statement execution failed.

In Optim Performance Manager you can perform the following tasks to troubleshoot failing transaction alerts:

- Identify failed statements.
- ► Check for deadlocks or lock timeouts and analyze them.
- > Determine connections with a high number of failed statements or rollbacks.
- Check utility executions.

If you use Extended Insight, you can easily drill down to the failed statements that cause a transaction to fail, but even if you do not use Extended Insight, Optim Performance provides features that let you identify failed statements.

In the following sections we show you the following tasks in more detail:

- ► Identify failed statements using the Extended Insight dashboard.
- Determine connections with a high number of failed statements or rollbacks using Performance Expert Client. In addition, we use SQL and activity tracing capabilities provided by Performance Expert Client to find failed statements. You can use this combination of tasks if you do not have Extended insight.

## 9.1 Identify failed statements using Extended Insight dashboard

Let us start with failing transaction alerts that you receive from Optim Performance Manager for one of your monitored databases. In the Health Summary dashboard, list the alerts by clicking the red alert icon in the Workload category. An overlay opens which show all alerts belonging to the Workload category that occurred in the displayed monitoring period. In this example we choose a monitoring period of three hours. A number of failing transaction alerts occurred as shown in Figure 9-1 on page 315. The selected alert shows a failing transaction percentage of 9%.

1			
pen Full List	Configure Send	Add Comment	J   🗒 💞   🍪 🎼 🕻
Severity	Alert Type	Start Time	End Time
	Failing Transactions	11/11/2010 04:37:12 AM	11/11/2010 05:09:12 AM
	Failing Transactions	11/11/2010 04:36:12 AM	11/11/2010 04:37:38 AM
8	Failing Transactions	11/11/2010 04:35:12 AM	11/11/2010 04:36:41 AM
	Failing Transactions	11/11/2010 04:34:12 AM	11/11/2010 04:35:52 AM
	Failing Transactions	11/11/2010 04:33:12 AM	11/11/2010 04:35:02 AM
	Failing Transactions	11/11/2010 04:32:12 AM	11/11/2010 04:34:11 AM
	Failing Transactions	11/11/2010 04:31:12 AM	11/11/2010 04:32:28 AM
	Failing Transactions	11/11/2010 04:30:12 AM	11/11/2010 04:31:37 AM
	Failing Transactions	11/11/2010 04:29:12 AM	11/11/2010 04:30:41 AM
	Failing Transactions	11/11/2010 04:28:12 AM	11/11/2010 04:29:51 AM
3 total items	;	10 🛛 Items per pag	e 🔣 📢 Page 🔟 🔻 of 6 🕟
			Contraction of the second seco
ert Details	Actions Alert Descrip	tion	
ert Details	Actions Alert Descrip	tion	
ert Details	Actions Alert Descrip	tion Failing Transactio	ns E@
ert Details Alert Detail Category	Actions Alert Descrip S Workload	Failing Transactio	ns E@
ert Details Alert Detail Category Severity	Actions Alert Descrip S Workload Critical	Failing Transactio	ns EM Transactions Failing
ert Details Alert Detail Category Severity Alert Name	Actions Alert Descrip S Workload Critical Failing Transi	actions	ns Eim Transactions Failing Transactions
ert Details Alert Detail Category Severity Alert Name Last Alert Va	Actions Alert Descrip S Workload Critical Failing Transi Jue 9.0 %	sections	ns Em Transactions Failing Transactions
Alert Details Alert Detail Category Severity Alert Name Last Alert Val Data Server T Zone	Actions Alert Descrip S Workload Critical Failing Transi Jue 9.0 % Finne America/New	Actions	ns Em Transactions Failing Transactions
Alert Details Alert Detail Category Severity Alert Name Last Alert Val Data Server Start Time on Data Server	Actions Alert Descrip S Workload Critical Failing Transz lue 9.0 % fime America/New the Nov 10, 2010 10:32:12 PM	tion Failing Transactio 60- 50- 40- 20- 20- 10- 1/10 22:30:00	ns Eim Transactions Failing Transactions
Alert Details Alert Detail Category Severity Alert Name Last Alert Val Data Server 1 Zone Start Time on Data Server End Time on t Server	Actions Alert Descrip S Workload Critical Failing Transi Jue 9.0 % Fime America/New the Nov 10, 2010 10:32:12 PM the Data Nov 10, 2010 10:34:11 PM	York	ns Em Transactions Failing Transactions

Figure 9-1 Failing transaction alerts on Health Summary

Open the Overview dashboard to do a quick check about whether, during the monitoring period, deadlocks or lock timeouts occurred or whether utilities

executed that could have failed. In our example the Overview dashboard does not show any deadlocks, lock timeouts, or utility executions. Therefore, most likely the failing transaction are caused by failed statement executions.

Before we continue to identify the failed statements, let us point out one interesting thing we notice on the Overview dashboard shown in Figure 9-2 on page 316. The number of failing transactions is only 0.826%, however, it shows a red alert icon although the critical threshold is set to 5%.

Overview Dashboard: GC	SALES_NEW
<b>■</b> Workload	
Transactions:	490.168 /min
Failing transactions:	■ 0.836 %
Open connections:	34
Active connections:	2
Rows read per fetched row:	313.907
Maximum CPU time of running statements:	0.003 sec
Maximum elapsed time of running statements:	6.932 sec
Critical workloads:	Application Types (12.255 sec)
Caching	
Catalog cache hit ratio:	99.854 %
Package cache hit ratio:	99.918 %
Utilities	
Active utilities:	

Figure 9-2 Failing transactions percentage on Overview dashboard

The explanation of this low failing transaction rate marked with a critical alert icon is as follows. Optim Performance Manager displays the average percentage of failing transactions during the monitoring period. Our monitoring period for this example is three hours. During this period, there are times where the percentage of failing transactions is higher than the critical threshold and there are times where the percentage is lower. This results in an average value of only 0.826%, but the alert is marked as red since there were critical alerts occurred during the monitoring period. Opening the failing transactions graph confirms that as shown in Figure 9-3 on page 317.

Failing Transactions	
Graph       Grid         12       12         14       12         10       8         4       2         11/10       11/10 <th>Workload Dashboard</th>	Workload Dashboard
	OK Apply Cancel

Figure 9-3 Failing transactions graph on Overview dashboard

If you click on the red icon next to the failing transactions percentage value on the Overview dashboard in Figure 9-2 on page 316, an overlay opens showing the last alert that occurred in the monitoring period. See Figure 9-4.



Figure 9-4 Alert details opened from Overview dashboard

Now, open the Extended Insight dashboard to identify the failed statements for the same monitoring period, a part of the dashboard is shown in Figure 9-5. Extended Insight dashboard displays the failed statement rate in percentage (%) for all workload clusters and workload cluster groups of applications that use Extended Insight client. For applications that do not use Extended Insight client, no statement failure rate can be calculated. Therefore, the average statement failure rate can be lower than the failing transactions rate.

Workload Cluster Group/Workload Cluster	Average End-to-End Response	Statement Failure Rate 1 ▼ (%)
GOSALES_NEW	0.434	0.043
Application Types	0.434	0.043
♥ ♦ Client user IDs	0.434	0.043
anonymous	0.675	5
🔶 e user	0.478	0
♦ c user	0.472	0
🔶 a user	0.433	0
🔶 h user	0.433	0
🔷 yong hua zeng	0.425	0
🔶 g user	0.423	0
🔶 f user	0.421	0

Figure 9-5 Part of Extended Insight dashboard

We see that user anonymous generates a statement failure rate of 5%. Drill down to the executed statements of this user by double clicking. We use the drop down boxes to list the top statements by *Failed Statement Executions (%)* as shown in Figure 9-6 on page 319. The statement that failed with 100% is a DELETE statement. It was executed 40 times in the monitoring period. The negative SQL code of the first execution is -4228. We assume that all 40 executions failed with the same SQL code. You can verify that by shortening the monitoring period on the Extended Insight dashboard.

Show highest 10	by Failed St	atement Executions (%)	
Statement Text	State	ment Executions	Failed Statement Executions (%)
DELETE FROM GOSALESCT	r.cu	40	10
SELECT P.PRODUCT_NUM	BER	240	
select cust_order_number	fro	40	
SELECT P.PRODUCT_NUM	BER	80	
SELECT P.PRODUCT_NUM	BER	80	
SELECT CUST_COUNTRY_	co	40	
SELECT CUST_CC_ID, CUS	ST	40	
lumber of Executions:		40	
lumber of Executions: werage end-to-end elapsed ti	me:	40 0 se	C
lumber of Executions: werage end-to-end elapsed ti Average client time:	me:	40 0 se 0 se	ic ic
lumber of Executions: average end-to-end elapsed ti Average client time: Average driver time:	me:	40 0 se 0 se 0 se	ic c c
lumber of Executions: verage end-to-end elapsed ti Average client time: Average driver time: Average network time:	me:	40 0 se 0 se 0 se 0 se 0 se	ic ic ic ic
umber of Executions: verage end-to-end elapsed ti Average client time: Average driver time: Average network time: Average data server time:	me:	40 0 se 0 se 0 se 0 se 0 se	ic ic ic ic ic
umber of Executions: verage end-to-end elapsed ti Average client time: Average driver time: Average network time: Average data server time: Dverall Time Distribution	me:	40 0 se 0 se 0 se 0 se 0 se	
umber of Executions: verage end-to-end elapsed ti Average client time: Average driver time: Average network time: Average data server time: Overall Time Distribution	me: Client time Driver time	40 0 se 0 se 0 se 0 se 0 se e	
umber of Executions: verage end-to-end elapsed ti Average client time: Average driver time: Average network time: Average data server time: Dverall Time Distribution	me: Client time Driver tim Network ti Data serve time	40 0 se 0 se 0 se 0 se 0 se e me e r	
umber of Executions: verage end-to-end elapsed ti Average client time: Average driver time: Average network time: Average data server time: Dverall Time Distribution	me: Client time Driver tim Network ti Data servi time	40 0 se 0 se 0 se 0 se 0 se e e e e e e e e e e e e e e e e e e	
Iumber of Executions: average end-to-end elapsed ti Average client time: Average driver time: Average network time: Average data server time: Overall Time Distribution atement Outcome ailure rate (with negative SOU	me: Client time Driver tim Network ti Data servi time	40 0 se 0 se 0 se 0 se 0 se e me er	ка ка ка ка ка ка ка ка ка ка ка ка ка к

Figure 9-6 Failed statements

## 9.2 Identify failed statements using Performance Expert Client

Assume that you receive failing transactions alerts similar to what we described in the previous 9.1, "Identify failed statements using Extended Insight dashboard" on page 315, however, you do not have Extended Insight set up for this database. Using the Overview dashboard you have excluded deadlocks, lock timeouts, or utility executions as the primary reason for the failing transactions. What now? First, look at the connections to determine the number of failed statements, rollbacks, deadlocks, and lock timeout. In the Optim Performance Manager web console, two features are available to look at connections:

- Current application connections dashboard to monitor connections connected now
- ► Connection report to monitor connections connected at a specified timestamp

Both features list the connections including execution metrics in tabular format. At the time of book writing, they do not provide the ability to customize the displayed execution metrics in the table. Therefore, we can not use these features to list the connections with the most failed statements, rollbacks, deadlocks, or lock timeouts in a single view.

Performance Expert Client provides us this ability. We open the *Application Summary* window and customize the displayed columns to obtain the top connections for the number of failed statements and rollbacks. See the top connections in Figure 9-7. From the list we see that the first connection executes a lot of failed statements whereas the next four connections seem to be involved in repeated deadlock situations.

Database Name	Application Name	Application Status R	ollbacks 📑 Faile	d Operations Deadlo	cks Detected	Application ID
SAMPLE	db2jcc_application	UOW waiting	2,406	4,812	.0.	127.0.0.1.2806.10111116313
SAMPLE	db2jcc_application	lock wait	252	207	207	127.0.0.1.2913.10111116335
SAMPLE	db2jcc_application	UOW waiting	252	0	0	127.0.0.1.2911.10111116335
SAMPLE	db2jcc_application	lock wait	250	207	207	127.0.0.1.2909.10111116335
SAMPLE	db2jcc_application	UOW waiting	250	0	0	127.0.0.1.2907.10111116334
SAMPLE	db2wlmd	connect comple	0	0	0	*LOCAL.DB2.101111155149
SAMPLE	db2jcc_application	UOW waiting	0	1	0	127.0.0.1.2591.10111116260

Figure 9-7 Application Summary in Performance Expert Client

If the first connection is still connected and refreshing of the Application Summary display shows that the number of failed operations and rollbacks increase, then you can use tracing features in Performance Expert client to trace the entire SQL activity of this connection. If Application Summary displays historical data and the connection is already closed, then you are done at this point. There is no way to get the failed statements this connection tried to execute.

For the connections involved in deadlock situations, it is possible for historical data to detect the statements involved in the deadlocks by looking at deadlock event details. You can do this from Performance Expert client or from the Optim Performance Manager web console.

Let us go back to the SQL and activity tracing features that Performance Expert client provide. You can start activity or SQL traces for the complete database workload or filtered. Prerequisite to use them is that the *Performance Warehouse* 

monitoring profile is enabled. When you start a trace for a specified time frame, the statement event monitor (For SQL Activity Traces) or activity event monitor (For WLM activity traces) is created on the monitored database. It is dropped when the specified time frame is over. Perform a trace only for a few minutes since these event monitors create higher overhead on the monitored database than others. The collected trace data is displayed in a browser window that opens after the tracing time frame is over.

For example, you can start an SQL trace for the first connection in Figure 9-7 on page 320 by right clicking and selecting the option to create a SQL activity summary report. Specify the time frame to run, for example one minute, and wait for the report to come up. This report showed us that all statements of this connection failed with SQL code -206.

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# 10

# Integration with Tivoli monitoring components

In this chapter, we explore the integration of Optim Performance Manager with several Tivoli monitoring products. We describe installation, configuration, usage, and troubleshooting for Optim Performance Manager specifics only. Discussion of implementing Tivoli monitoring in your enterprise is beyond the scope of this book.

### **10.1 How does Optim Performance Manager integrate with Tivoli?**

Optim Performance Manager Extended Edition integrates the deep database performance insight of Optim with the broad enterprise-wide insights provided by IBM Tivoli monitoring products. This powerful combination extends transaction response-time monitoring from the database to the complete end-to-end transaction path.

Database application environments can be complex, often including several middleware components through which transactions can flow, including Web servers, application servers, message servers, transaction servers, and database servers.

The IBM Tivoli Composite Application Manager (ITCAM) for Transactions product can keep a watch over the entire end-to-end transaction path that touches many of these components. When ITCAM for Transactions detects a transaction execution problem, it can isolate the problem to individual components in the end-to-end transaction path. It can then provide a launch point for deep-dive investigation into the components. For any transaction problems in the DB2 database component, ITCAM for Transactions can launch the Extended Insight dashboard in Optim Performance Manager Extended Edition in the context of the problematic database transactions. This capability enables you to use the deep database insights provided by Optim to further isolate the problem and drive it swiftly to resolution. Furthermore, Tivoli monitoring provides deeper, more extensive operating system, network, and storage information that you can access from within the system dashboard of Optim Performance Manager.

In Figure 10-1 on page 325, we show the components involved in the integration between Optim Performance Manager and ITCAM. Notice that WebSphere Application Server is part of the integration - this is because we depend on the ITCAM WebSphere monitoring agent for the integration. The integration of performance metrics between Optim Performance Manager and ITCAM is only possible for WebSphere JDBC applications.



Figure 10-1 Optim Performance Manager-ITCAM integration monitoring architecture

### Packaging and licensing

The capability of integrating with ITCAM is part of the Optim Performance Manager Extended Insight feature. However, purchasing Optim Performance Manager Extended Insight does not entitle you to any Tivoli software. The pre-requisite Tivoli products must be purchased and implemented separately.

### Installation

When you activate the Extended Insight on your Optim Performance Manager server, you have also enabled the Optim Performance Manager server for the ITCAM integration. There are no additional installation steps on the Optim Performance Manager server side.

On the Tivoli side, you must install the Optim Performance Manager Plug-in for TEP onto the machine where your Tivoli Enterprise Portal Server (TEPS) runs. The Optim Performance Manager workspace and links are added to the TEPS to extend the ITCAM Transaction Collector views, allowing for the launch of Optim Performance Manager inside the Tivoli Enterprise Portal (TEP).

### **10.2 Implementing Optim Performance Manager** integration with Tivoli ITCAM

The integration between Optim Performance Manager and ITCAM is dependent on multiple software components being in working order. You should proceed step by step when implementing the components - it will make your life much easier than trying to set up everything at once and then try to find the mistake if things are not working properly. We recommend the sequence in 10.2.1, "Pre-requisites to Optim Performance Manager-ITCAM integration" on page 327 for implementing the integration between Optim Performance Manager and ITCAM.

**Reminder:** Optim Performance Manager-ITCAM integration can only be used for applications running in WebSphere and using JDBC transactions with the IBM JDBC driver.

### Summary of the integration steps

The Optim Performance Manager-ITCAM integration procedure includes seven steps of two major tasks:

- Verify the pre-requisites products:
  - a. Base Optim Performance Manager is working.
  - b. Optim Performance Manager Extended Insight is working.
  - c. Tivoli Monitoring (ITM) is working.
  - d. Tivoli ITCAM components are working.

We provide the details about how to verify if these products are working in 10.2.1, "Pre-requisites to Optim Performance Manager-ITCAM integration".

► Enable the integration:

The enabling details are provided in the following sections:

- e. Enable the Optim Performance Manager Data Collector on Optim Performance Manager: See "Enable in Optim Performance Manager" on page 332.
- f. Enable the Optim Performance Manager on ITCAM WebSphere agent: See "Enable at ITCAM WebSphere agent side" on page 340.
- g. Install the Optim Performance Manager TEP plug-in on the TEPS: See "Install the Optim Performance Manager TEP workspace" on page 343.

#### Roles required to perform the setup tasks

You should understand the types of activities required to fully deploy the Optim Performance Manager-ITCAM solution. Consult with your enterprise support staff before deploying the solutions, many of the tasks also require root level access. Listed below are some of the roles that could be required for a full implementation, we discuss more in later sections:

- Optim Performance Manager administrator: To configure ITCAM collection in Optim Performance Manager.
- WebSphere administrator: In case that you want or have to adjust any settings for Optim Performance Manager Extended Insight.
- ITCAM for Transactions administrator: To provide ITCAM host and port information to Optim Performance Manager administrator.
- ITCAM for WebSphere administrator: To modify an ITCAM properties file to enable Optim Performance Manager integration.
- ► TEPS administrator: To install the Optim Performance Manager plug-in.

### **10.2.1 Pre-requisites to Optim Performance Manager-ITCAM** integration

Before you try to integrate the Optim Performance Manager and ITCAM, you should have a working environment for both Optim Performance Manager and ITCAM. The numbered steps here correspond to the "Summary of the integration steps" on page 326.

1. Install and configure the base Optim Performance Manager components.

*Why*: Establish the base product is functioning properly in your environment.

This step is already described earlier in this book.

- a. See 3.2, "Installing and running Optim Performance Manager" on page 65 for information about installation.
- b. See 3.3, "Configuring Optim Performance Manager" on page 91 for information about configuration.
- c. *Verify*: You can verify that some data is being collected by Optim Performance Manager, by viewing one of the inflight dashboards, such as Workload dashboard, as shown in Figure 10-2. If the screen is empty, then you should investigate why Optim Performance Manager data is not being shown.

Workload Dashboard	GOSALES	NEW				
Sorting	Architecture	2		_	Throughput	
Learn about sorting. Sort Activity	E 2 m Sorts Total Hash Joins	Sorts per Transaction	ERM Sorts per Transaction		Transaction Throughput 1.800 1.200 0. 1/13 13:13:20 11/13 13:56:40	Transactions Failing Transactions
0-11/13 13:13:20 11/13 13:56:40		0.11/13 13:13:20 11/13 13:53:20			Statement Throughput	∷>⊞ Writing DML
Sort Times 1.600 0.600 0.400 0.400 0.400 11/13 13:13:20 11/13 13:56:40	E Average Time per Sort Sort Time per Minute				E 1,200- 600- 11/13 13:13:20 11/13 13:36:40 Connections	Reading DML DDL XQUERY

Figure 10-2 Optim Performance Manager - Workload dashboard

2. Activate, install, and configure the Extended Insight components on your Optim Performance Manager server and your WebSphere Application Server.

*Why*: Establish the Extended Insight communication is working properly.

- a. See 3.2.2, "Activating the Optim Performance Manager license" on page 80 for information on Extended Insight activation.
- b. See 3.4, "Installing and Configuring Extended Insight Client" on page 129 for information on installation and configuration of the Extended Insight client software.
- c. See 3.4, "Installing and Configuring Extended Insight Client" on page 129 for information on enabling and configuring Extended Insight monitoring for your database.
- d. See 3.4, "Installing and Configuring Extended Insight Client" on page 129 for WebSphere Application Server version customization details.
- e. *Verify*: After running your WebSphere application for some time, you should see data on the Extended Insight dashboard, as in Figure 10-3. It is not important in this example what the data is, only that there is something there. You may have to wait several minutes before all the data is properly flowing and presented on the screen the first time. If the screen is still empty after 15 minutes, you should investigate before proceeding.

Exten	Extended Insight Analysis Dashboard: GOSALES_NEW											
Workload workload	Workloads are listed in the grid. Click in the left column to show the chart for the workload. Use the second column to expand ar workload cluster group.											
Open	Details Activate Deactivate	New	Edit C	opy Rese	et Delete	View All Kno	wn Clients	Tra				
Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Maximum Average End-to- Data End Server Response Time		Average Client Time					
े Sh	GOSALES_NEW	0.105	1.443	4.228	<b>0.02</b> 3	<b>0.007</b>	÷0.075					
🖮 Sh	Client application names	0.105	1.443	4.228	<b>0.023</b>	<b>0.007</b>	<b>0.075</b>					
े Sh	► ♦ Client user IDs	0.105	1.443	4.228	<b>0.023</b>	<b>0.007</b>	<b>0.075</b>					
🖮 Sh	Client workstations	0.105	1.443	4.228	<b>0.023</b>	<b>0.007</b>	<b>0.075</b>					
🖮 Sh	Application Types	0.105	1.443	4.228	<b>0.023</b>	<b>0.007</b>	<b>0.075</b>					
े Sh	► ◆ Authentication IDs	0.105	1.443	4.228	<b>0.023</b>	<b>0.007</b>	<b>0.075</b>					

Figure 10-3 Active Extended Insight dashboard

3. Install and configure your IBM Tivoli Monitoring (ITM) infrastructure.

Optim Performance Manager assumes a working ITM environment exists, and does not provide how-to information. Implementing Tivoli monitoring is not a trivial task, so we strongly recommend that you work with your IBM Tivoli technical representatives to ensure that you have the proper monitoring design for your shop. A working Tivoli monitoring environment is a pre-requisite for the integration with Optim Performance Manager.

The Information Center for Tivoli Monitoring has extensive documentation about implementation:

http://publib.boulder.ibm.com/infocenter/tivihelp/v15r1/topic/com.ibm.itm.d
oc\_6.2.2fp2/welcome.htm

In-depth discussion of Tivoli implementation is beyond the scope of this book.

In the lab environment for this book, we use the ITM OS Agents for our AIX and Linux servers. We also have a simple configuration with most of the components (TEMS and TEPS) on one machine. This is not a typical enterprise production topology, but works fine for the needs of the book. Types of monitoring topologies are discussed at length in the Tivoli monitoring documentation.

a. *Verify*: In Figure 10-4, we show an example TEP OS workspace for our lab Linux DB2 server, SD0D03L3. Seeing this information indicates that the Tivoli infrastructure is operational.



Figure 10-4 TEP OS Agent workspace

4. Install and configure ITCAM for Transactions and ITCAM for Application Diagnostics base products.

Optim Performance Manager assumes a working ITCAM environment exists, and does not provide how-to information in its documentation. Implementing ITCAM is not a trivial task, so we strongly recommend that you work with your IBM Tivoli technical representatives to ensure you have the proper monitoring design for your shop. A working Tivoli ITCAM monitoring environment is a pre-requisite for the integration with Optim Performance Manager.

The Information Center for Tivoli Composite Application Monitoring has extensive documentation about implementation:

http://publib.boulder.ibm.com/infocenter/tivihelp/v24r1/topic/com.ibm.itcam fad.doc\_7101/ic-homepage.html

In-depth discussion of Tivoli implementation is beyond the scope of this book.

In the lab environment for this book, we use a single Transaction Collector and Transaction Reporter, which are also installed on the same machine as the TEMS and TEPS. This may not be typical enterprise production topology, but works fine for the needs of the book. ITCAM topologies are discussed at length in the ITCAM documentation.

a. *Verify*: Figure 10-5 on page 331 shows the TEP workspace for ITCAM Transaction Aggregate Topology view for the JDBC transactions. This is the typical view of an enterprise application transaction flow. Remember, we have not yet integrated Optim Performance Manager into this picture.

**Note:** You must specifically enable TTAPI for JDBC in order to see the JDBC node as shown in Figure 10-5. By default, an ITCAM Agent for WebSphere Applications Data Collector will not monitor JDBC transactions when it is set to MOD Level 1 by the Managing Server. If you need JDBC tracking on MOD L1, you must enable it. ITCAM configuration is beyond the scope of this book, for more information on enabling the TTAPI for JDBC transactions see

http://publib.boulder.ibm.com/infocenter/tivihelp/v24r1/topic/com.ibm. itcamt.doc\_7.2.0.2/tt/dita/cam\_ad/enable\_disable\_jdbcl1.html



Figure 10-5 TEP ITCAM Transaction Aggregate Topology view

*Checkpoint*: At this point if you have established a functioning Optim Performance Manager with Extended Insight, and a working Tivoli monitoring infrastructure with ITM and ITCAM, as described in steps 1-4 above, you are ready to enable the integration of Optim Performance Manager with Tivoli.

### 10.2.2 Enabling the integration

The enabling items could be performed in any order, however, we recommend the order described here - it will be easier to verify your progress at each step. If we continue the step numbering from the previous section, the steps for enabling the integration are as follows:

- 5. Enable the Optim Performance Manager Data Collector on Optim Performance Manager.
- 6. Enable the Optim Performance Manager on ITCAM WebSphere agent.
- 7. Install the Optim Performance Manager TEP plug-in on the TEPS.

### Who perform this task

The person with role of Optim Performance Manager Administrator can perform this task, but will need some specific information from the ITCAM administrator. Someone with privileges for, and knowledge of, the TEP is also required to perform the verify step.

### **Enable in Optim Performance Manager**

This step is to enable Optim Performance Manager data collector. In this step, you tell Optim Performance Manager where to send the Extended Insight data, defining the location of the ITCAM for Transactions Transaction Collector, and how often to send the data.

There are two methods to enable the Optim Performance Manager data collector:

- Using Optim Performance Manager configuration dialog: This method is only available in Optim Performance Manager V4.1.0.1,
- Using the ITCAM Data Collection dialog of Optim performance Manager: This method is available in both Optim Performance Manager V4.1 and V4.1.0.1.

### *Configure data collection using Optim Performance Manager configuration dialog*

Perform these steps to configure data collection:

- 1. On the Optim Performance Manager Manage Database Connections page, Select **Configure Monitoring...** for the database you want to configure, and go to Step 2 of the configuration dialog.
- 2. Select **Collect Extended Insight data** to modify the existing Extended Insight configuration (remember we have assumed here, and recommend, that your Extended Insight is already working), see Figure 10-6.

Edit Monitoring Configuration	
Step 2 of 5: Configure monitoring profiles	
Define the type of monitoring data that is collected by enabling the corresponding monitoring profiles. If you select Use predefined template or Configure like on the previous page, then the associated profiles are enabled.	ted
Selected configuration: Use existing configuration	
Monitoring settings	
Retention times and sampling intervals	
DB2 event monitor configuration	
Monitoring profiles	
Inflight performance, reporting, or Workload Manager	
These profiles collect performance statistics for the data server, which are shown in the inflight dashboards, Workload Manager, or in the reports.	in
✓ Basic	
🗹 Locking	
✓ Active SQL and Connections	
☑ I/O and Disk Space	
🗌 Workload Manager 🖉	
☑ Dynamic SQL	
Extended Insight	
This profile is available only if the Extended Insight feature is installed. This profile collects end-to-end performance statistics for the data server, the network, and the applications. These statistics are shown on t Extended Insight Analysis dashboard.	:he
✓ Collect Extended Insight data	
DB2 Performance Expert Client	
These profiles apply only if you are using the previous Performance Expert Client application. These statistic are not displayed in the Optim Performance Manager dashboards, but are shown in the Performance Expert Client.	s
CIM OS Data	
Performance Warehouse	
	_
< Previous Next > Finish Cance	1

Figure 10-6 Extended Insight configuration

3. On the Extended Insight configuration page, select the **Integration with Tivoli Monitoring** tab as shown in Figure 10-7 on page 334.

Collect Extended Insight da	ta	×
Collection of monitoring data	Usage of client field information	Integration with Tivoli Monitoring
You can configure Optim Perfo Transactions. ITCAM for Trans end application transaction pat and resolve database transact	rmance Manager to send database actions can then integrate databas th, and enable the use of Optim Per ion problems within the Tivoli Enter	transaction information to ITCAM for e transactions into the complete end-to- rformance Manager to isolate, diagnose, rprise Portal console.
Send database transaction	data to ITCAM for Transactions	
Transaction Collector:	lone v New	
Host name: *		
Port number: *		
Interval time (min): *		
If client statement and transac Transaction workspaces for th and data server time. If client includes only the data server t	Test Connection to Collect tion metrics are collected, the tran e DB2 node includes: driver time, o statement and transaction metrics ime.	saction time that displays in the Tivoli connection pool wait time, network time, are not collected, the transaction time
		OK Cancel

Figure 10-7 Optim Performance Manager-ITCAM configuration page - initial view

- 4. Select **Send database transaction data to ITCAM for Transactions**, which will enable the "Transaction Collector" field on the screen.
  - a. The "Transaction Collector" drop down list will show any collectors that already exist. You can reuse an existing one, or you can define a new one. In this example we are adding a new collector.
  - b. Click New, to enable the other fields.
  - c. Enter the host name (or IP address) and port number of your ITCAM for Transactions transaction collector machine. You must have or obtain this from your Tivoli administrator. The default port for the transaction collector component is 5455, so Optim Performance Manager pre-fills that field. If your shop uses a different port, you will have to enter that value here. The host name is not required to be fully qualified name, but it must be reachable in the DNS.

In this example, we use our lab environment transaction collector host SD0D03W1 and the default port, 5455.

d. The "Interval time" value tells Optim Performance Manager how often to retrieve, aggregate and send data to ITCAM. Optim Performance Manager uses the data collected by the Extended Insight client and stored in the Optim Performance Manager repository database tables as the source of data it sends to ITCAM. The Optim Performance Manager transaction data collector process will wake up at the frequency you specify here, and

aggregate the Extended Insight data that has arrived over the last interval, then send it to ITCAM. Optim Performance Manager uses the data source connection attributes to identify the workload groups - similar to what you see on the Extended Insight dashboards in the workload cluster groups.

The default interval is five minutes, however in our ITSO lab environment, we found using eight minute interval provided the better results with our small test workload.

**Note:** The 5-minute default interval in Optim Performance Manager corresponds to the default ITCAM for Transactions aggregation interval. You may need to coordinate the intervals between Optim Performance Manager and ITCAM for Transactions. For more information on ITCAM for Transactions configuration, see

http://publib.boulder.ibm.com/infocenter/tivihelp/v24r1/topic/com.ibm. itcamt.doc\_7.2.0.2/tt/dita/reference/kto\_tools\_datacoll\_coll.html

See Figure 10-8 on page 335 for the final definition of the new collector we added.

Collect Extended Insight da	ita 🔀						
Collection of monitoring data	Usage of client field information Integration with Tivoli Monitoring						
You can configure Optim Performance Manager to send database transaction information to ITCAM for Transactions. ITCAM for Transactions can then integrate database transactions into the complete end-to- end application transaction path, and enable the use of Optim Performance Manager to isolate, diagnose, and resolve database transaction problems within the Tivoli Enterprise Portal console.							
✓ Send database transaction	data to ITCAM for Transactions						
Transaction Collector:	None Vew						
Host name: * s	d0d03w1						
Port number: * 5	455						
Interval time (min): * 8							
If client statement and transa Transaction workspaces for th and data server time. If client includes only the data server	Test Connection to Collector ction metrics are collected, the transaction time that displays in the Tivoli te DB2 node includes: driver time, connection pool wait time, network time, statement and transaction metrics are not collected, the transaction time time.						
	OK Cancel						

Figure 10-8 Add a new Optim Performance Manager transaction data collector

e. You can use the "Test Connection to Collector" button to perform a simple ping to the host and port you specified. See Figure 10-9 for an example of a successful ping.



Figure 10-9 Successful test to ITCAM Transaction Collector

**Note:** Currently, this only pings to the host and port and verifies it is listening - it does not confirm it is indeed an ITCAM Transaction Collector listening. You should verify the ITCAM host and port data with your Tivoli administrator to be positive of these values.

- f. Click **OK** to accept the new collector and dismiss the Extended Insight configuration window.
- g. Click **Finish** to save the configuration.

**IMPORTANT:** The collector you added is not saved until you save the entire configuration.

*Checkpoint*: Now you have added a collector. If your WebSphere workload is still running and your collector is configured correctly, Optim Performance Manager will start to send the Extended Insight data to ITCAM. You should wait for at least two cycles of the interval period before checking for data on the TEP Transaction Reporter workspace.

- 5. When Optim Performance Manager data is successfully transferred to the ITCAM Transaction Collector, a new transaction node type will appear in the Transaction Reporter workspaces in TEP. The node is named DB2\_LUW, and has additional strings after it, describing the connection attributes. The connection attributes are discussed later in this chapter when we look at an integration scenario, see 10.3, "Usage scenario" on page 351.
- 6. *Verify*: As shown in Figure 10-10 on page 337, some DB2\_LUW nodes are present but there are no arrows connecting the JDBC node to them. This is called "stitching", which is missing here. There are a few more steps required to have full integration with ITCAM. However, if you see this much, it means you are on the right track.



Figure 10-10 TEP Transaction Reporter workspace with unstitched JDBC and DB2 LUW nodes

This is the end of the configuration steps required on the Optim Performance Manager server side.

### *Configure using the ITCAM Data Collection dialog of Optim Performance Manager (alternate)*

The ITCAM Data Collection is another dialog where you can add, update, and remove data collectors, and this dialog was the only option in Optim Performance Manager V4.1. While the new option of configuring the ITCAM data collection during the Optim Performance Manager Extended Insight configuration was added with Optim Performance Manager V4.1 Fix Pack 1, the ITCAM Data Collection dialog was retained for several reasons:

Ability to modify existing collectors.

The Optim Performance Manager configuration dialog only allows adding a new collector and/or associating your database connection with an existing collector. If you want to make any changes to the collector parameters, you must use the dialog described here.

Ability to configure multiple databases at one time.

Suppose you have 25 database connections you want to configure for Optim Performance Manager-ITCAM integration. The new method would require you to edit each connection's configuration separately and enable the data collection. If you use the ITCAM Data Collection dialog, you can enable them all at one time.

- The ITCAM Data Collection dialog is a view grouped by the data collector itself, rather than the connection-level view. This makes it easier to manage if you have many databases or many ITCAM Transaction collectors.
- The ITCAM Data Collection dialog also now provides a status check, which is described later in this section.

We describe here using the alternate method to configure another database to use the same collector we defined before.

- 1. Click the Task Manager from the Overview dashboard.
- 2. Select ITCAM Data Collection under the Setup heading, see Figure 10-11.

📴 Optim Performance Manager: Exten 🔶	Optim Performance Hanager: Exten								
Optim Performance Manager									
🍓 Task Manager 💌 🚺 Manage Databas	🎇 Task Manager 🔻 🐚 Manage Database Connections 💁 Welcome - My Optim Central								
Health	Performance	Configuration	Setup						
Health Summary	Inflight Dashboards	Workload Manager Configuration	ITCAM Data Collection						
Alert List	Extended Insight Dashboard	Purge Alerts Interval	Configuration Repository						
Current Application Connections	Reports	Health Alerts Configuration	Console Security						
Ourrent Table Spaces		Alert Notification	Manage Privileges						
Ourrent Utilities		Performance Alert Configuration	Services						
			Output Logs						

Figure 10-11 Task Manager menu - ITCAM Data Collection

3. On the ITCAM Data Collection screen (Figure 10-12 on page 338), we see the one data collector we added for SD0D03W1.

Doptim Performance Mana	ger: ITCAM 🔶								
Optim Performance Manager									
🌞 Task Manager 🔻 🛛 🚯 Manage Database Connections 🗋 🎰 Welcome - My Optim Central									
Manage Database Connec	tions 😪 ITCAM Data	Collection × Extended In:	sight Dashboard						
ITCAM Data Collect	tion								
The ITCAM Transaction Colle to-end application transaction and resolve any database tra	ctors that Optim Perfo n path. If you install th insaction problems wit	rmance Manager sends database e Optim Performance Manager Pl hin the Tivoli Enterprise Portal. Le	transaction information to are listed below. I ugin for TEP on the Tivoli Enterprise Portal Se earn how to install the Tivoli Enterprise Portal						
Status 😽	~ ~								
Host Name	Port Number	Collection Interval (min)	Monitored Connections						
sd0d03w1	5455	8	1 🧑 <u>View details</u>						

Figure 10-12 ITCAM Data Collection

In this example, we want to use this same collector for another database -DTRADER. Open the Extended Insight configuration for DTRADER database and enable monitoring there, but we will use the alternate method this time.

- 4. Select the collector, and click **Update**.
- 5. You could change any of the collector parameters here, and these changes would apply to any database using that collector. In this case, we are only adding another database. Select the **Monitored connections** drop down list, and choose the DTRADER database connection, as shown in Figure 10-13.

Update ITCAM Transactio	n Collector Configuration
Host name: *	sd0d03w1
Port number: *	5455
Interval time (min): *	8
Monitored connections: *	2 of 4
The Monitored connections li which the Extended Insight of However, if you enable metr and masking of the client fie enabled connections for the collection are not included in list.	<ul> <li>All</li> <li>✓ dtrader on L3</li> <li>✓ GOSALES_NEW</li> <li>GOSALES</li> <li>testdb_aix_1</li> <li>Test Availability</li> </ul>
	OK Cancel

Figure 10-13 Update existing ITCAM collector

- 6. Click **OK** to save your changes.
- 7. On the ITCAM Data Collection screen, now you can see there are 2 databases associated with the one collector. Figure 10-14 shows the View Details window, indicating both the GSDB and DTRADER are configured.

Optim Performance Manager: ITCAM									
Optim Performance Manager									
🌞 Task Manager 🔻 😼 Manage Database Connections 🔯 Welcome - My Optim Central									
🔥 Manage Database Connections 💉 🛛 ITCAM Data Collection 🛛 🗙 Extended Insight Dashboard 🛶									
ITCAM Data Collect	tio	n							
The ITCAM Transaction Collecto- to-end application transaction and resolve any database tra	ctor i pa insa	rs tha ath. If action	you install the problems with	mance Manager so Optim Performan in the Tivoli Enter	ends datapase ice Manager Pli prise Portal. Le	trans ugin f arn f	for TEP on the Tive	n to are listed ben bli Enterprise Port Tivoli Enterprise P	al Serv
Host Name	Po	ort Nu	mber	Collection Interva	al (min)	Mon	itored Connection	5	_
sd0d03w1	54	155		8	2		View details		
	м	onito	ored Connecti	on Details					×
		Trai	Connection Na	im Host Name	Port Numb	er	Database Name	Version	
		4	dtrader on L3	SD0D03L3	50001		DTRADER	09.07.0002	
		42	GOSALES_NEW	SD0D03L3	50002		GSDB	09.07.0002	
						_			1.

Figure 10-14 Updated ITCAM collector with two monitored connections

If your shop uses multiple ITCAM transaction collectors, you should collaborate with your ITCAM administrator to understand the appropriate transaction collector to specify. A database connection monitored by Optim Performance Manager can be associated with one and only one ITCAM transaction collector.

### Enable at ITCAM WebSphere agent side

You must also enable a property in the ITCAM for Application Diagnostics WebSphere agent property file. You may see references to the Tivoli product code for this agent as "yn".

### Who perform this task

The property file must be modified by someone with privileges to modify the file an ITCAM administrator for example. It may vary at your shop. Generally the file is owned by root user, so you should plan accordingly.

### Enabling procedure

If IBM Optim Performance Manager is installed, you can enable TTAPI integration between ITCAM for Application Diagnostics, Transaction Tracking, and Optim Performance Manager. Optim Performance Manager provides detailed information about DB2 JDBC calls. If integration is enabled, you can "drill down" from transactions displayed in Transaction Tracking workspaces to the Optim Performance Manager console and dashboard to view deep database diagnostics information and detailed SQL statement performance data.

The Information Center for ITCAM for Transactions has a good description of how to enable this integration.

http://publib.boulder.ibm.com/infocenter/tivihelp/v24r1/topic/com.ibm.itcamt.do
c 7.2.0.2/tt/dita/cam ad/enabling optim integration.html

To customize ITCAM to handle the incoming DB2\_LUW data from Optim Performance Manager, perform these steps:

1. Modify the property file

To enable Optim Performance Manager integration, modify DCHOME/runtime/platform.node.server/custom/toolkit custom.properties

Set the following property in this file:

com.ibm.tivoli.itcam.dc.ttapi.jdbc.opm.enabled=true

If any monitored J2EE application changes the JDBC connection client attributes during an active session, also set the following property:

com.ibm.tivoli.itcam.dc.ttapi.jdbc.opm.clientinfo.reset=true

Example 10-1 shows a snippet from the property file in our book lab environment. The file name in this server is:

/opt/IBM/ITM/lx8266/yn/wasdc/7.1.0.1.2/runtime/was70.sd0d03l2Node01.server1
/custom/toolkit\_custom.properties

Example 10-1 ITCAM toolkit\_custom.properties file

### add this property to enable clientinfo changing in app com.ibm.tivoli.itcam.dc.ttapi.jdbc.opm.clientinfo.reset=true

2. Restart your WebSphere application server instance.

3. *Verify*: Run your WebSphere workload again, as in the verify step described in step 5 on page 339, and again after waiting several intervals, you should see arrows stitching the JDBC and DB2\_LUW nodes together. An example is shown in Figure 10-15 on page 342.



Figure 10-15 TEP Transaction Reporter workspace with stitched JDBC and DB2\_LUW nodes

At this point of the configuration, you have the end-to-end transaction flow visible in TEP, but you do not yet have capability to drill down into Optim Performance Manager from the transaction in TEP. There is one more installation piece that is required to fully enable the ITCAM integration, and is covered in section "Install the Optim Performance Manager TEP workspace" on page 343.

To verify whether the TEP workspace is configured yet (maybe your administrator already installed the workspace), you can right-click one of the DB2\_LUW transaction objects in TEP, select the **Link To...** menu item, then check if there is "Database Diagnostics" menu item listed. In the picture shown in Figure 10-16 on page 343, there is no such link so we know the Optim Performance Manager TEP plug-in is not yet installed.

/GOCompan jsp	iy/Proc	JDBC:jdbc sd0d03l3	/GoSales/	Арр:		
		52ms - 40ms		Zoom to Selected		
				Take Action	•	
	Ø	Link Wizard		Link To	→	
/GOCompar	Ø	Transaction Detail		Launch		
	Ø	Transaction Instances		Split vertically		
	Ø	Historical Transaction Instances		Split horizontally		
L			×	Remove		
GOCompany	/Excep	tion.	۵	Print Preview		
sp			8	Print		
		(	<u> <u></u></u>	Properties		

Figure 10-16 Optim Performance Manager TEP workspace not available yet

*Checkpoint*: If you have the correct stitching visible in the TEP workspace, then you are on the right track. If stitching does not appear from JDBC to DB2\_LUW nodes after some waiting, then you should begin investigation. This may require assistance from ITCAM administrators who know how the Transaction Collector and Reporter are configured.

### Install the Optim Performance Manager TEP workspace

Use the Optim Performance Manager plug-in for TEP installation wizard to create a workspace and several dynamic links in IBM Tivoli Monitoring (ITM) under Transaction Reporter application support. This workspace is required to integrate Optim Performance Manager in your TEP Console.

### Who performs this task

You need someone who has root or administrator privileges to the Tivoli Enterprise Portal Server (TEPS) machine. The TEPS must be restarted after the install process.

### Installation procedure

The Optim Performance Manager TEP plug-in installer program is on a separate CD, or is a separate package you download with Optim Performance Manager Extended Edition. You can read more detail at the Information Center page:

```
http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.perf
mgmt.tep.installconfig.doc/tep_install.html
```

Install Optim Performance Manager application support into TEP workspace, using a GUI:

1. On the TEPS server, launch the installer.

In our lab environment, the TEPS machine runs on Windows server SD0D03W1, and the installer program is install.bat.

2. When prompted, confirm the directory where the IBM Tivoli Monitoring (ITM) is installed. In our case, it is the C:\IBM\ITM directory. See Example 10-2. The install script (.BAT or .sh) will automatically stop and start the TEPS server as needed, so be aware that this will restart TEPS.

Example 10-2 Optim Performance Manager TEP Plug-In installation dialog - start

```
Specify the directory in which to install TEP plug-in.
    Default installation directory: C:\ibm\ITM
Enter an absolute path, or press Enter to accept the default:
The TEP plug-in is installing.
The TEP Server service is stopping.
The TEP Server service was stopped.
```

3. After the TEPS is stopped, the install script launches the GUI install, as shown in Figure 10-17. Click **Next** to continue.



Figure 10-17 Optim Performance Manager TEP Plug-in installer GUI

4. Confirm the ITM installation path, and the installer location, as shown in Figure 10-18 on page 345, and click **Next**.
| Installer  |                |
|--|----------------|
| Enter your Tivoli Monitoring installation directory          |                |
| C:\ibm\ITM   |                |
|  | Browse         |
| Enter the location where your installable media is located   |                |
| C:\Downloads\OPMTEPPlugin\unzipped\Optim Performance Manager | Plugin for TEP |
|  | Browse         |
|  |                |
|  |                |
|  |                |
|  |                |
|  |                |
|  |                |
|  |                |
|  |                |
| istallShield   |                |
| < Dools  | Norts          |

Figure 10-18 TEP Plug-in installer - confirm paths

5. On this screen you only have one choice, TEPS, and it must be selected, see Figure 10-19 on page 346. Click **Next** to continue.

😫 Installer 📃 🗖	X
Select which Tivoli Monitoring components you would like to add application support to	
V Tivoli Enterprise Portal Server (TEPS)	
InstallShield	_
< Back Next > Cancel	

Figure 10-19 TEP Plug-in installer - select TEPS

6. On this screen, check the box for TEPS and click **Next**, as shown in Figure 10-20

🖞 Installer			
Please select which applications you would like to add su	pport for.		
Optim Performance Manager Plugin For TEP	or using Ontim Borfo	rmanaa Managar ta	diagnood tran
Provides a workspace within Thom Enterprise Portan	or using Oplim Peno	rmance wanager u	) ulagnose trar
•			▶
InstallShield			
	< Back	Next >	Cancel

Figure 10-20 TEP Plug-in installer -select application support for Optim Performance Manager

7. Confirm your choices one more time, and click **Next** to initiate the install, as shown in Figure 10-21 on page 348.

🔮 Installer 📃 🗖	x
The following installation actions will be performed	
<ul> <li>Perform initial TEPS configuration</li> <li>Add TEPS support for Optim Performance Manager Plugin For TEP Version 04.01.00.01</li> <li>Perform final TEPS configuration</li> </ul>	
InstallShield	
< Back Next > Cancel	

Figure 10-21 TEP Plug-in installer - confirm choices

8. You can watch the progress screen, and when install is complete, there is a message, as shown in Figure 10-22 on page 349. The install was successful. Click **Finish** to return back to the install.bat program.

업 Installer			
Please wait while application support is added			
Installation completed successfully _Installation details			
Performing initial TEPS configuration Adding TEPS support for Optim Performance Ma Performing final TEPS configuration - can ta Installation completed successfully	nager Plugin For 7 se up to 20 minute	TEP Version O4 es, please wai	4.01.00.01 .t
The log file for this installation is locate "C:\Users\ADMINI~l\AppData\Local\Tem	1 at p\2\ITM_AppSupport	t_Install.log"	,
InstallShield			
	< Back	Next >	Finish

Figure 10-22 TEP Plug-in installer - successful completion

9. The original installer script will restart the TEPS process, as we see in the bold text of Example 10-3. Press any key to dismiss the console window.

Example 10-3 Optim Performance Manager TEP Plug-In installation dialog - finish

```
Specify the directory in which to install TEP plug-in.
Default installation directory: C:\ibm\ITM
Enter an absolute path, or press Enter to accept the default:
The TEP plug-in is installing.
The TEP Server service is stopping.
The TEP Server service was stopped.
The TEP Server service is starting.
The TEP Server service was started.
The TEP plug-in was installed.
Press any key to continue . . .
```

10. *Verify*: Now your Optim Performance Manager workspace has been installed and the TEPS restarted. You can verify the workspace by checking the same link as in Figure 10-16 on page 343, but this time there should be a "Database Diagnostics" choice on the menu, as shown in Figure 10-23 on page 350.



Figure 10-23 Optim Performance Manager TEP workspace is present - Database Diagnostics

## *Silent install Optim Performance Manager application support into TEP workspace, (alternate)*

If you do not have a GUI available on your TEPS machine, or if you prefer not to use a GUI, you can install the Optim Performance Manager TEP Plug-in using a silent install. A sample response file is included in the install image, which you can update and pass to the install script.

We do not show an example here, but the process is described in the Optim Performance Manager Information Center:

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.perf
mgmt.tep.installconfig.doc/tep\_install.html

## *Verify Optim Performance Manager product presence on TEPS (optional)*

Your TEPS administrator might want to know the two-character product code for Optim Performance Manager, that is "O9" (the letter O, not zero.) The TEPS administrator could verify the Optim Performance Manager application support by using the Tivoli command **kincinfo** (Windows) or **cinfo** (UNIX).

For example, we can see the Optim Performance Manager information in the output as shown in Example 10-4.

Example 10-4 TEPS - kincinfo command output

C:\Users\Administrator>kincinfo -t o9

\*\*\*\*\*\*\*\*\*\* Tuesday, November 16, 2010 4:15:19 PM \*\*\*\*\*\*\*\*\*\*\*

User	:	Administrator	Group	:	NA				
Host	Name :	SDODO3W1	Installer	:	Ver:	06220	2000		
Cand	leHome :	C:\ibm\ITM							
Inst	allitm :	C:\ibm\ITM\Install	ITM						
****	******	*****	***********	***	*****	*****	****		
P	roduct I	nventory							
PC	APPLICAT	ION SUPPORT DESC				PLAT	APP VER	BUILD	INSTALL DATE
09	TEPS Sup	port for Optim Perf	ormance Manage	er	P1	WINNT	04.01.00.01	200705161329	NOVALUE
09	TEPB Sup	port for Optim Perf	ormance Manage	er	P1	WINNT	04.01.00.01	200705161329	NOVALUE

### 10.3 Usage scenario

In the earlier sections of this chapter, we showed some isolated screenshots of Optim Performance Manager and TEP screens in varying states of integration. We explore a simple scenario in this section.

Suppose that a system operator is looking at the TEP console and notices some slow transactions in the GOSales application. Can they quickly narrow down the problem area and open a ticket to the right group?

#### 10.3.1 Initial analysis in Tivoli Enterprise Portal

Start this scenario by looking at the top-level view in the Tivoli Enterprise Portal (TEP). In Figure 10-24 on page 352, we observe a situation has been raised about slow transactions for the GOSales application. There are many ways to use the TEP to investigate problems, and this book is intended to focus on Optim Performance Manager, so we just dive right to the relevant areas of TEP for this scenario.

The person using the TEP might be a general system operator, or it could be anyone who has privileges to use the software.

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🖻 💾 Windows Systems										
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🗉 🔯 Summarization and Pruning Agent										
- 🔯 Transaction Collector		4								
🗐 🎒 Transaction Reporter										
- Applications		1								
- Components										
- Servers										

Figure 10-24 TEP showing slow transaction situation for GOSales

We know that for the GOSales application, we can use the Transaction Reporter workspaces in TEP. These belong to the ITCAM for Transactions product, which is what Optim Performance Manager integrates with.

#### **Using Transaction Reporter workspaces**

Navigate to the **Transaction Reporter**  $\rightarrow$  **Transactions** workspace on the TEP navigator, on the left side of the screen. See Figure 10-25 on page 353.



Figure 10-25 TEP Transaction Reporter Transactions workspace

The TEP screen is made up of different views. For example, if we zoom in on the workspace above, in Figure 10-26, we show just the Lowest Availability view from the top-right part of the screen. It shows 100% of the DB2\_LUW transactions for "business reports" and "admin user" are slow (yellow).



Figure 10-26 TEP Transactions workspace, Lowest Availability view

**Note:** For information on understanding the Transaction Reporter workspaces, consult the User's Guide section in the Information Center for ITCAM for Transactions:

http://publib.boulder.ibm.com/infocenter/tivihelp/v24r1/topic/com.ibm.itcamt .doc\_7.2.0.2/tt/dita/concept/kto\_ws\_oview.html

In the lower-left area of the screen, shown in Figure 10-27, is the Transactions table view, which we have sorted by the *Total Time* column. Clearly the first row belongs to DB2\_LUW and is by far the slowest transaction. The next slowest is the /G0Company/Admin.jsp, which sounds like it might be related to someone named "admin user" who is doing these slow business reports we saw above.

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Ø	/GOCompany/Admin.jsp		6,9	383	
Ø	DB2_LUW:(SD0D03L3:50002 GSDB) (business reports,logged in,9.12.4.169,cust research,		8	384	
Ø	/GOCompany/Login.jsp		3	321	
Ø	JDBC:jdbc/GoSalesApp:sd0d03l3		1	294	
Ø	DB2_LUW:(SD0D03L3:50002 GSDB) (customer log in,logged in,9.12.4.169,c user,WSRdbMa		1	113	
Ø	DB2_LUW:(SD0D03L3:50002 GSDB) (customer log in,logged in,9.12.4.169,e user,WSRdbMa		1	107	
Ø	DB2_LUW:(SD0D03L3:50002 GSDB) (customer log in,log in,9.12.4.169,application,WSRdbM			92	
Ø	/GOCompany/Cart.jsp			28	
Ø	/GOCompany/Catalog.jsp			26	
Ø	/GOCompany/Order.jsp			22	
Ø	DB2_LUW:(SD0D03L3:50002 GSDB) (order entry,logged in,9.12.4.169,e user,WSRdbManag			7	
Ø	DB2_LUW:(SD0D03L3:50002 GSDB) (product viewing,logged in,9.12.4.169,e user,WSRdbMa			7	
Ø	/GOCompany/Product.jsp			6	
Ø	DB2_LUW:(SD0D03L3:50002 GSDB) (order entry,logged in,9.12.4.169,c user,WSRdbManage			6	-
	4				•

Figure 10-27 TEP Transactions workspace, Transactions view

The JSP data does not come from Optim Performance Manager - it comes from the ITCAM WebSphere agent. Notice there are several JSPs listed, as well as a JDBC transaction, for our GOSalesApp data source. What else can the TEP show us about these transactions?

Select the small link icon on the JDBC transaction row, and choose the **Transaction Topology** menu item. This displays a different workspace, as shown in Figure 10-28 on page 356. The ITCAM for Transactions workspaces can show the transaction data in several formats - such as the graphical flow layout (topology view) we see in this diagram, or in table views and other charts. In this topology diagram, we see an aggregated view of all the JSPs that reference the JDBC data source, and all the DB2\_LUW transactions on the other side of those JSPs.



Figure 10-28 Transaction Aggregate Topology workspace

Notice the arrow pointing from the JDBC node to the top-most DB2\_LUW node shows a number 56,096 ms. This corresponds to the "total time" value you can see in the table view below the topology view, and indicates the time collected by Optim Performance Manager Extended Insight, which was later sent to the Transaction Collector. (See "Configure data collection using Optim Performance Manager configuration dialog" on page 332, where we set up that communication.)

At this point of the analysis, using ITCAM, we hypothesize that the slowdown of the transactions is occurring on the data server side, and that the slowest transaction appears to be something with an admin business report.

#### Connection attributes and "stitching"

How did the transactions get the information about "business reports" and "admin user"? These are parts of the connection attributes, which we discussed in 8.2.3, "Understanding workload clusters" on page 291, and are central to the integration of Optim Performance Manager and ITCAM.

The Tivoli ITCAM for Application Diagnostics WebSphere agent collects performance metrics about transactions and sends those metrics to the ITCAM for Transactions Transaction Collector. Optim Performance Manager Extended Insight also collects performance metrics about the same DB2 JDBC transactions, and sends them to the ITCAM for Transactions Transaction Collector.

It is the job of the ITCAM Transaction Reporter component to figure out how to tie those metrics together to form the transaction flow across the different components. This process is called "stitching". The stitching is made by using the connection attributes, which we discussed in 8.2.3, "Understanding workload clusters" on page 291.

#### 10.3.2 Optim Performance Manager inside TEP

The power of the ITCAM family of products is being able to look at high-level and/or aggregate views, but then to drill down to the domain expert for analysis of specific areas, such as WebSphere or DB2. What the Optim Performance Manager integration provides now is just that ability, using Optim Performance Manager as the domain expert on DB2 performance.

Of course you could just open a new browser and look at Optim Performance Manager, but you lose the context of the particular transaction topology you were just looking at in TEP. Let us see how to launch to Optim Performance Manager in context for those bad business reports transactions.

Right click on the row in the table view (or on the DB2\_LUW node in the topology view) to bring up the context menu, as in Figure 10-29 on page 358. Select **Link to...**, then **Database Diagnostics**. (You could also use the link icon at the left of the table row, to bring up the link menu.)

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	ø	Transaction Inter	action by Transacti	on Rate	Ø	Link Anchor		
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	B	Transaction Top	ology		$\mathbf{F}$	Launch		
	Ø	Transaction Insta	inces			Split vertically		
•	Ø	Database Diagn	ostics			Split horizontally		
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Name			<ul> <li>Total Time</li> </ul>	Percent Slo	<u> 우</u> 년수	Properties	Т	lime Devia
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Figure 10-29 Link menu for DB2\_LUW node

Selecting **Database Diagnostics** opens a new workspace in TEP. The primary view is a browser, and it is pointed to the Optim Performance Manager server associated with the DB2 database you clicked from in TEP.

**Note:** Your default browser must have Flash player installed. If it is not detected, you will get a prompt to install it.

You will be prompted to log in to Optim Performance Manager, if this is the first launch of your session. Enter your credentials just like in standalone Optim Performance Manager, as shown in Figure 10-30 on page 359.

7925ch10.fm

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/GOCompany/Login.jsp		
/GOCompany/Order.jsp		
/GOCompany/Setup.isp		
B2_LUW:(SD0D03L3:50002 GSDB		
BB2_LUW:(SD0D03L3:50002 GSDB		
DB2_LUW:(SD0D03L3:50002 GSDB		
DB2_LOW:(SD0D03L3:50002 GSDB		

Figure 10-30 TEP Optim Performance Manager Workspace- Log in

After you log in, the information about the transaction you clicked on in TEP is carried through to the Extended Insight dashboard. A special ad-hoc custom workload cluster is created, filtered on just the connection properties for that particular transaction. The launching of Optim Performance Manager from TEP is referred to as "launch in context", because the browser is automatically positioned to the Extended Insight details dashboard for the specific transaction you selected in TEP. It knows the context because of the connection attributes.

For example, we know from the TEP the connection attributes are for Client Application name "business reports" and Client user ID "admin user", along with some other attributes. See Figure 10-31 on page 360. You do not have to create special workload clusters with these attributes - Optim Performance Manager will do this on the fly, when it launches from TEP.



Figure 10-31 Optim Performance Manager Extended Insight details for in-context transaction

We changed the graph to a bar chart view, Figure 10-32 on page 361, because these transactions do not run very often so the line chart is not continuos. It is easier to see this data in a bar chart. Also we set the view to show only the average values, and exclude the maximum line.



Figure 10-32 Extended Insight - statements for "business reports" and "admin user"

In the SQL Statements table, there are only three statements executed over the last hour, for this set of connection attributes (remember we launched here from TEP, for a specific transaction.) One of those statements shows an average data server time of nearly 59 seconds. The other two statements are much faster.

Select the bad statement, to view some details about it, as in Figure 10-33 on page 361. This view does not tell us a lot we did not already see previously, so let us click on the **Statement Server Execution Details** tab.



Figure 10-33 Extended Insight - General Information tab for slow statement

Statement details such as those shown in Figure 10-34, are collected only when the Extended Insight configuration has enabled the "Collect statement metrics on data server". This configuration option is described in 3.3, "Configuring Optim Performance Manager" on page 91. If you do not have this enabled, you may still see some of these metrics on the **Active SQL** dashboard, which you can read about in 4.3.7, "Active SQL dashboard" on page 175.

The metrics Average rows read and Average rows returned show a over 76 million rows read for one selected row, which is very bad. This statement is an excellent candidate for tuning.

tion	Locate the source of performance problems, deter Response Time Details: Drill down for	rmine how those problems affect different parts of the r (SD0D03L3:50002 GSDB) (business	the wo	orkload, and analyze the per orts,logged in,9.12.4	formance of individ 169,admin use	ual SQL state e <b>r,WSRdb</b>	ments, clien Managec
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Figure 10-34 Extended Insight - Statement Server Execution Details tab for slow statement

We are quite sure now that this statement is the likely cause of the GOSales slowdown, but let us look at a one more screen.

Using the typical Extended Insight analysis process, take a look at the Clients tab, just to be thorough. In Figure 10-35 on page 363, the pie chart shows that 99.9% of the overall transaction time takes place in the data server. This is consistent with our previous analysis.

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start time:	12/02 09:45:33	Number of	executions:		28		
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Figure 10-35 Extended Insight - Clients tab

What have we learned so far? The TEP console showed GOSales application with slow transactions. The ITCAM showed admin.jsp and one DB2 transaction for business reports accounted for the bulk of the slowness. Then in Optim Performance Manager, one statement looks like the main contributor. At this point, the operator could open a ticket with this information, routed to the application DBA. The DBA could also use Optim Performance Manager, either inside TEP or stand-alone, to investigate that statement. For example the DBA could launch to the Optim Query Tuner.

This analysis was done completely within the scope of the Extended Insight dashboards. Of course there are many more metrics available on other Optim Performance Manager dashboards that might help in the analysis as well.

#### 10.3.3 More launch-in-context from Optim Performance Manager

We already saw how Optim Performance Manager is launched from TEP in context of the transaction.

Another area of integration between Optim Performance Manager and Tivoli monitoring is the ability to launch to the TEP workspace in the context of the data server or the client WebSphere Application Server. This integration requires that you are monitoring the data server or WebSphere server with the Tivoli monitoring OS Agent.

## Launching to TEP workspaces from Optim Performance Manager

When you are looking at the Clients tab as in Figure 10-36, notice the link under the clients list, "Advanced System Information". If you are using Optim Performance Manager stand-alone browser, the link only displays an information popup. If you are using Optim Performance Manager inside TEP, however, there is TEP awareness, so the link is "hot" and it launches back to the TEP system workspace for the client you have selected. In our example, our WebSphere server is on 9.12.4.169, or SD0D03L2.

	SQL	Statements	Clients			
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						d System Information
		Ac	cess detaile	ed system information	n for the client by usin	g Tivoli Enterprise Monitoring

Figure 10-36 Extended Insight - Advanced System Information

Click the **Advanced System Information** link. A message appears, as in Figure 10-37 on page 365, reminding you that you are going back to TEP, and that certain conditions must exist for the link to work. You can check the box to hide the message in future.

	Message	8	×	y Average Rest	oonse Time	
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Figure 10-37 Optim Performance Manager launches to TEP, warning message

Click **OK** to continue back to TEP. You now change from the Optim Performance Manager workspace to the system workspace for the Optim Performance Manager client you selected, the WebSphere server in our example, see Figure 10-38 on page 366. In our example, the slow transactions were found to be slow on the data server side. If we had found the slowdown was on the client side, we might find it useful to use the domain expert for the operating system the Tivoli monitoring agent in this case - to see if there were any system issues on that client.



Figure 10-38 TEP workspace for WebSphere server SD0D03L2

Optim Performance Manager can also launch to the system workspace for the data server. Again, our example showed a slow statement, but suppose we suspected an overall system slowdown instead. We mentioned earlier the Optim Performance Manager inflight dashboards are available, so let us open the System Dashboard : on the Optim Performance Manager view, select **Task Manager**  $\rightarrow$  **Inflight Dashboards**  $\rightarrow$  **System**. The resulting dashboard is shown in Figure 10-39 on page 367.

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/GOCompany/Product.isp	20-			3,722.040 -	Memory	
/GOCompany/Setup.jsp	12/02 18:33:20 12/02	19:10:00		12/02 18:33:20 12/0	02 19:26:40 Mamony	
DB2_LUW:(SD0D03L3:50002 GSDB					Memory	
DB2_LUW:(SD0D03L3:50002 GSDB						
Ø DP2 1100//20000212:50002.02DP	1					

Figure 10-39 Optim Performance Manager - System dashboard inside TEP workspace

We do not see any unusual values here, however, we could still launch back to TEP's workspace for the data server. This dashboard has the same *Advanced System Information* link as we saw on the Extended Insight Clients page, and it works the same way.

Click the **Advanced System Information** link, and click **OK** on the popup message, then you see a screen similar to Figure 10-40 on page 368.



Figure 10-40 TEP workspace for DB2 server SD0D03L3

We do not see any evidence that system issues are at the root of our transaction slowdown, just as expected.

#### Some differences from stand-alone browser

When viewing Optim Performance Manager inside the TEP browser, there are a few differences from how it looks in a standalone browser. Some of the Task Manager menu options are not available, such as reports or connection management. You can view all the Inflight dashboards, however, as well as the alerts and health summary pages. You can also look at the ITCAM configuration. A sample Task Manager menu is shown in Figure 10-41 on page 369.



Figure 10-41 Optim Performance Manager Task Manager menu - inside TEP browser

Optim Performance Manager also has a way to quickly launch back to the ITCAM workspace. When you first come into Optim Performance Manager from TEP, you land on the Extended Insight DETAILS page for a specific transaction. If you want to look at other workload clusters, for example you must navigate back to the Extended Insight overview page. Click the **Back** link as shown in Figure 10-42.



Figure 10-42 Extended Insight Details - navigate back to overview

On the Extended Insight overview page, there is a Transaction Topology button, see Figure 10-43 on page 370. This button is only functional when you are using Optim Performance Manager inside the TEP workspace. Otherwise, it just puts up an informational popup.

Exten	ded Insight Analysis	Dashboa	ard: GO	SALES_N	IEW					=∰ GOSALI	ES_I
Workload Click Nev Open	ds are listed in the grid. Click in v to create a workload cluster o Details Activate Deacti	the left colu group. vate Ne	mn to show ti w Edit	he chart for t	he workload	Use the sec	ond column to w All Known C	expand and	collapse wor nsaction Top	kload cluster	s in
Graph	Workload Cluster Group/Workload Cluster	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time	Average Client Time	Warning (%)	Critical (%)	Transacti ons (/min)	Re
🖄 Sh	▼ <pre></pre>	0.164	53.992	01:03.264	<del>\$</del> 0.161	<b>♦</b> 0.001	<b>0.002</b>			206.459	
े Sh	► 🔷 Client user IDs	0.164	53.992	01:03.264	<b>0.161</b>	<b>0.001</b>	<b>0.002</b>			206.459	
≧ Sh	Client application name	0.164	53.992	01:03.264	<b>0.161</b>	<b>0.001</b>	<b>0.002</b>			206.459	
े Sh	Client workstations	0.164	53.992	01:03.264	<b>0.161</b>	<b>0.001</b>	<b>0.002</b>			206.459	
े Sh	► ◆ Authentication IDs	0.164	53.992	01:03.264	<b>♦0.161</b>	÷0.001	<b>0.002</b>			206.459	

Figure 10-43 Extended Insight - Transaction Topology button

When you click the button, you will launch back to the ITCAM Transaction Reporter Transaction Topology workspace as shown in Figure 10-44 on page 371.



Figure 10-44 Transaction Aggregate Topology workspace

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# 11

# Workload Manager configuration tool

The Workload Manager configuration tool is a graphical user interface that you can use to configure and monitor DB2 Workload Manager V9.5 or higher. It is automatically installed with Optim Performance Manager. The Workload Manager configuration tool offers two solutions to set up DB2 Workload Manager in order to control and manage database workload:

Concurrency method

Concurrency solution provides following capabilities:

- Implement business priorities by applying concurrency controls.
- Dedicate shares of system resources to database work.
- Manage the database activities of applications, users, groups, and more.
- Prioritize work by categories and by estimated costs.
- Control and stabilize response times.
- Implement policies for disruptive work that over-consumes resources.
- Refine policies by limiting diverse classes of work.
- Analyze live monitoring data to report resource consumption, estimate system capacity, track adherence to response times, troubleshoot performance issues, and validate controls.

Priority aging method

Priority aging solution provides following capabilities:

- Downgrade the priority of work as required automatically.
- Set the initial priority of work by cost or category.
- Adjust the cost limits of expensive activities.
- Customize the runtime limits of database work.

In this chapter we document setup and deployment of a concurrency method using the Workload Manager (WLM) configuration tool.

### 11.1 Setting up concurrency method

The concurrency method manages resources for the database server by enforcing concurrency limits on certain types of work. The concurrency method runs urgent work without concurrency limits or restraints. The concurrency method allocates most of the concurrency tickets to ordinary work, and a lesser number of concurrency tickets to batch jobs to limit the impact on more urgent work. When the database server is busy, the concurrency method queues batch jobs so that they must wait for an opportunity run.

The concurrency method also provides control of service superclasses, response time objectives and monitoring, and support for workload management thresholds.

## **11.1.1 Configuring Optim Performance Manager to collect WLM statistics**

Before you can use the monitoring graphs and reports of Workload Manager, you need to configure Optim Performance Manager to monitor the WLM statistics.

On the Optim Performance Manager web console, click **Manage Database Connection**, select the database for which you want to collect Workload Manager metrics and click **Configure Monitoring**. See Figure 11-1 on page 375.

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🌞 Task Manager 💌 🕓	🔓 Task Manager 🔹 🚯 Manage Database Connections 🕼 Welcome - My Optim Central									
Workload Manager Configurat	tion 💦 🕓 Manage (	Database Connections ×								
<ul> <li>Show all database</li> </ul>	These database conne	ctions are shared by all the components and us	sers. Updating or deleti	ng a database connection migl	nt impact other users.					
connections	The database PERFDB (127.0.0.1:50000) is in use as the repository for database connection definitions.									
<ul> <li>Filter database</li> </ul>	You are connected to the repository database as user borovsky. Click here to disconnect.									
connections by	.earn more about authorizations.									
Custom Groups	🛃 Add 🛃 Edit.	🚛 Delete 🛛 Test Connection 🕼 Re	fresh	Export All	gure Monitoring	ure Monitoring				
+ / 1	Name 🔺	Data Server Type	Database Name	Host Name	Click to configure performance monitor	ng for the selected connection.				
	DPF on A2/A3 TPCH	DB2 for Linux, UNIX, and Windows(9.7.2)	трсн	SD0D03A2	50001	Configured - Enabled				
	dtrader on L3	DB2 for Linux, UNIX, and Windows(9.7.2)	DTRADER	SD0D03L3	50001	Configured - Enabled				
	GOSALES	DB2 for Linux, UNIX, and Windows(9.7.2)	GSDB	9.12.4.170	50001	Configured - Disabled				
	GOSALES_NEW	DB2 for Linux, UNIX, and Windows(9.7.2)	GSDB	SD0D03L3	50002	Configured - Enabled				
	reddb2 on AIX	DB2 for Linux, UNIX, and Windows(9.5.6)	REDDB2	9.12.5.104	50000	Not configured				
	testdb2	DB2 for Linux, UNIX, and Windows(9.5.6)	TESTDB2	9.12.5.104	50000	Not configured				
	testdb_aix_1	DB2 for Linux, UNIX, and Windows(9.5.6)	TESTDB	9.12.5.104	50000	Configured - Enabled				

Figure 11-1 Configuring WLM monitoring for selected database

Step through the configure monitoring wizard and enable collection of WLM monitoring information as shown in Figure 11-2.

Define Use pre	the type of monitoring data that is collected by enabling the corresponding monitoring profiles. If you se defined template or Configure like on the tevious page, then the associated profiles are enabled.	ecte
Selec	ted configuration: Use existing configuration	
Monit	pring settings	
	Retention times and sampling intervals	
	DB2 event monitor configuration	
Monit	oring profiles	
T ii	hese profiles collect performance statistics for the data server, which are shown in the inflight dashboard Workload Manager, or in the reports.	ls,
	Basic	
	Locking	
	Active SQL and Connections	
	V I/O and Dish C	
	Workload Manager	
	V Dynamic Sq.	
E T F t	xtended Insight his profile is available only if the Extended Insight feature is installed. This profile collects end-to-end erformance statistics for the data server, the network, and the applications. These statistics are shown o ne Extended Insight Analysis dashboard.	n
	🔄 Collect Extended Insight data 🖉	

Figure 11-2 Collecting the WLM monitoring information

#### 11.1.2 Workload Manager template configuration

After enabling the collection of WLM monitoring information for the selected database, you can proceed to Workload Manager configuration by performing the following steps:

1. From the Optim Performance Manager web console, click **Task Manager** and select **Workload Manager Configuration**. See Figure 11-3 on page 377.

(2) Optim Performance Manager	Optim Performance Manager borovsky							
🌞 Task Manager 💌 🕒 Manage Databas	e Connections 🛛 🏠 Welcome - My Opt	im Central						<u></u>
Health	Performance	Configur	ation		Setup			
Health Summary     Alert List     Current Application Connections	<ul> <li>Inflight Dashboards</li> <li>Extended Insight Dashboard</li> <li>Reports</li> </ul>	<ul><li>Worl</li><li>Purg</li><li>Heal</li></ul>	kload Manager Config e Alerts Interval th Alerts Configuration	Workload M	<ul> <li>ITCAM Data Collection</li> <li>anager Configuration on Repositi</li> <li>Console Security</li> </ul>	n to <b>ry</b>		
Current Table Spaces     Current Utilities		<ul> <li>Alert Notification</li> <li>Performance Alert Configure</li> </ul>		uration	<ul> <li>Manage Privileges</li> <li>Services</li> <li>Logs</li> </ul>		Unconfigure Monitoring Number Monitoring Status	
dtrader on L3	DB2 for Linux, UNIX, and Window	s(9.7.2)	DTRADER	SD0D03L3		50001		Configured - Enabled
GOSALES	DB2 for Linux, UNIX, and Window	s(9.7.2)	GSDB	9.12.4.170	)	50001		Configured - Disabled

Figure 11-3 Invoking Workload Manager Configuration

 Select the database that you want to configure and click Connect to connect to the database. This will take you to the WLM configuration wizard (Figure 11-4 on page 377).

🔹 Opt	tim Performance	e Manager		borovsky   <u>Log out</u>   <u>About</u>   🕢
🌞 Task Ma	anager 💌 🔒 Man	age Database Connections 🛛 💩 Welcome - My Optim Central		2 L
🔥 Manage D	Database Connections	Workload Manager Configuration		
0 4	DPF on A2/A3 TP	Disconnect		
Step 1 of 5	: Review information	about the origin of your current workload management configuration.		
Current d	atabaco connection			
Host: SI	2000342			
Port number	er: 50001			
Database r	name: TPCH			
Database	version: DB2 v9.7.0.	3		
Current v	vorkload manageme	ant configuration		
The curren	t workload manageme	nt configuration has been reverse engineered from the database that you cor	nnected to, and is ready for you to use.	
Property	Comparison			
	Туре	Name	Property	Database Value
•	Database	TPCH		
►	Workload	SYSDEFAULTUSERWORKLOAD		
Þ	Workload	SYSDEFAULTADMWORKLOAD		
Þ	SuperClass	SYSDEFAULTSYSTEMCLASS		
Þ	SuperClass	SYSDEFAULTMAINTENANCECLASS		
Þ	SuperClass	SYSDEFAULTUSERCLASS		
Þ	🖂 Histogram	SYSDEFAULTHISTOGRAM		
				< Back Next > Finish Cancel

Figure 11-4 WLM configuration wizard - Step1

In this page the wizard shows you the existing WLM configuration in the database that you are connected to. If this is initial WLM configuration, there are no user defined WLM objects and you see only the default workloads and service classes.

3. On Step 2 (Figure 11-5), the wizard provides a choice of two WLM configurations: concurrency method or priority aging method. The default is the concurrency method. For our example, we accept this default.

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🗱 Task Manager 🔹 🚯 Manage Database Connections 💩 Welcome - My Optim Central	ê 🖌
Manage Database Connections 🐑 Workload Manager Configuration 🛛 🗙	
DPF on A2/A3 TP      Disconnect	
Step 2 of 5: Review or change the current configuration method.	
The current configuration is based on the concurrency method. You can change to the priority aging method. However, it is not recommended that you change the configuration method frequently because Workload Manager drops the current configuration and creates a new configuration when you change the method.	
Concurrency method (recommended)	
The concurrency method manages resources for the database server by enforcing concurrency limits on certain types of work. The concurrency method runs urgent work without concurrency limits or restraints. The concurrency method allocates most of the concurrency tickets to ordinary work, and a lesser number of concurrency tickets to bath jobs to limit the impact on more urgent work. When the database server is busy, the concurrency method queues batch jobs so that they must wait for an opportunity run.	
The concurrency method also provides control of service superclasses, response time objectives and monitoring, and support for workload management thresholds.	
Priority aging method	
Priority aging provides a simple solution that lowers the priority of database activities from high to medium to low over time. Priority aging moves the activities that consume excessive processor time to the next lower priority. For example, priority aging moves activities from medium priority to low priority when they do not finish running within the specified time limit for medium priority.	
Change to priority aging method	
	✓ Back Next > Finish Cancel

Figure 11-5 WLM configuration wizard - Step 2

4. WLM configuration wizard constructs a template WLM configuration, which contains a service super class, several subclasses, and related WLM infrastructure. Step 3 of the wizard (Figure 11-6 on page 379) displays the current WLM database configuration as well as the new template WLM configuration. It also highlights the differences between these two configurations.

**Note:** No changes are made to the database until you choose to deploy this template WLM configuration.

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Manage	Database	e Connections 🛞	Workload Manager Configuration ×					
n la	DPF on A	A2/A3 TP 🔻 E	visconnect					
0 1-0								
Step 3 of	5: Revie	ew and evaluate i	nformation about errors, warnings, and incompatibilities.					
No errors,	, warning:	ıs, or incompatibili	ties were found during the reverse engineering process.	8				
Propert	v Compa	arison						
Show	only diffe	erences						
	-	Туре	Name	Property	Database Value	New Value	Differences	
Ŧ		Database	трсн	. ,			()	-
				Database name	TPCH	TPCH	()	
Þ		Workload	SYSDEFAULTUSERWORKLOAD				(==)	
Þ		Workload	SYSDEFAULTADMWORKLOAD				(==)	
Þ		SuperClass	SYSDEFAULTSYSTEMCLASS				(==)	
Þ		SuperClass	SYSDEFAULTMAINTENANCECLASS				()	
Þ		SuperClass	SYSDEFAULTUSERCLASS				()	
۳	- 🗖 🤅	SuperClass	DS_AUTO_MGMT_SUPER				(!-)	
				Name	N/P	DS_AUTO_MGMT_SUPER	(→)	
				Enable service class	N/P	true	(→)	=
				Agent priority	N/P	-32768	(→)	
				Prefetch priority	N/P	DEFAULT	(→)	
				Buffer pool priority	N/P	DEFAULT	(→)	
				Request metrics collection	N/P	NONE	(→)	
•	- (a)	WorkActionSet	DS_AUTOMGMTSU_1290056235209_WORK_ACTION_SI	E			(→)	
•		Threshold	DS_AUTOMGMTSU_1290056235209_PRI_CONC_DB_TH				(→)	
•		SubClass	DS_HIGH_PRI_SUBCLASS				(→)	
•		SubClass	DS_MED_CONC_SUBCLASS				(→)	
		SubClass	DS_LOW_CONC_SUBCLASS				(→)	
		SubClass	US_LOAD_SUBCLASS				(→)	
•			T DS ALLOMGNUSU 1290056235200 WORK CLASS SE					

Figure 11-6 WLM configuration - Step 3

5. Step 4 of the wizard (Figure 11-7 on page 379) shows a few key points about your WLM configuration. It calls attention to issues such as disabling access to the database for some of your workloads.



Figure 11-7 WLM configuration - Step 4

6. The final step of the wizard (Figure 11-8 on page 380) shows a summary of the state of your WLM configuration. It also checks for several common setup problems that will prevent WLM monitoring from working. If the wizard detects any such problems, it will tell you what is wrong and offer help on how to correct it.

Click Finish to complete the wizard.



Figure 11-8 WLM configuration - Step 5

7. Workload Manager tool takes you to the main configuration and monitoring panel (Figure 11-9 on page 381), where you can further customize your WLM configuration as well as deploy it to the database.
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( Ontim Performance Manager	horovsky   Log out   About   @
Task Manage Database Connections	
Workload Manager Configuration *	h Swimmed Sur State Burth Ham bring
DFF on A2/A3 TP V Disconnect	Preview and Kun SQL Save Draft More Actions
Service Superclasses Workloa Costs and Concurrency Thresholds Performance Objectives	Display the SQL code and apply it to the database
Create top-level runtime environments called service superclasses for the activities that are routed from your workloads. superclasses. Then, enable enforcement of concurrency limits for those service superclasses that you want to limit.	Adjust the distribution of resources among service superclasses by adjusting the concurrency limits of the service
Concurrency for Service Superclasses	Service Superclass Definition
Total number of concurrent coordinator activities: 80	Name: DS_AUTO_MGMT_SUPER
Add Toplate	Comments:
Service Superclass Enforce Concurrency Concurrency Limit	Workloads
Name	A list of the workloads that route activities to the selected service superclass. An empty list indicates that you have not associated workloads with this service superclass. You can associate workloads with a service superclass on
	the Workloads page.
	SYSDEFAULTUSERWORKLOAD
DS_AUTO_MGNT_SUPER	
DS_AUTO_MGMT_SUPER: default service superclass. Activities that do not run in your service superclasses run in	
Graphs, Tables, and Reports	
Concurrency and CPU Usage Share of System Resources	-
	100 Select the metrics and the objects
10-	200 Select the ments and the objects:
	✓ CPU Usage (%)
8 -	- 80 V Database
	DS_AUTO_MGMT_SUPER
6	- 60 Legend:

Figure 11-9 WLM configuration and monitoring panel

8. To deploy WLM configuration to the database, click **Preview and Run SQL**. This will generate and display the DDL necessary to deploy the WLM configuration to the database. See Figure 11-10 on page 382. You can choose to let the WLM tool to run it for you, or copy and paste the generated DDL to inspect it and run it yourself.

20 50	Apply Configuration	
Ce 10	When you run the SQL, you apply the changes that are displayed in this dialog to the database. If you want to run the SQL on a different computer, you can copy the SQL from the window and paste it into an editor. SET WORKLOAD TO SYSDEFAULTADMWORKLOAD; CREATE SERVICE CLASS "DS_AUTO_MGMT_SUPER" DISABLE; CREATE SERVICE CLASS "DS_HIGH_PRI_SUBCLASS" UNDER "DS_AUTO_MGMT_SUPER" COLLECT AGGREGATE ACTIVITY DATA EXTENDED DISABLE; CREATE SERVICE CLASS "DS_MED_CONC_SUBCLASS" UNDER "DS_AUTO_MGMT_SUPER" COLLECT AGGREGATE ACTIVITY DATA EXTENDED DISABLE; CREATE SERVICE CLASS "DS_LOW_CONC_SUBCLASS" UNDER "DS_AUTO_MGMT_SUPER" COLLECT AGGREGATE ACTIVITY DATA EXTENDED DISABLE; CREATE SERVICE CLASS "DS_LOAD_SUBCLASS" UNDER "DS_AUTO_MGMT_SUPER" COLLECT AGGREGATE ACTIVITY DATA EXTENDED DISABLE; CREATE SERVICE CLASS "DS_LOAD_SUBCLASS" UNDER "DS_AUTO_MGMT_SUPER" COLLECT AGGREGATE ACTIVITY DATA EXTENDED DISABLE; CREATE SERVICE CLASS "DS_LOAD_SUBCLASS" UNDER "DS_AUTO_MGMT_SUPER" COLLECT AGGREGATE ACTIVITY DATA EXTENDED DISABLE; CREATE WORK CLASS SET "DS_AUTOMGMTSU_1290056235209_WORK_CLASS_SET" ( WORK CLASS "DS_LOW_COST_DML_WC" WORK TYPE DML FOR TIMERONCOST FROM 0.0 TO 100000.0 POSITION AT 1, WORK CLASS "DS_HIGH_COST_DML_WC" WORK TYPE DML FOR TIMERONCOST FROM 100000.0 TO UNBOUNDED POSITION AT 2, WORK CLASS "DS_DDL_WC" WORK TYPE DDL POSITION AT 3, WORK CLASS "DS_LOAD_WC" WORK TYPE LOAD POSITION AT 4, WORK CLASS "DS_OTHER_WC" WORK TYPE ALL POSITION AT 5); CREATE THRESHOLD "DS_AUTOMGMTSU_1290056235209_PRI_CONC_DB_TH" FOR SERVICE CLASS "DS_AUTO_MGMT_SUPER" ACTIVITIES ENFORCEMENT DATABASE DISABLE WHEN CONCURRENTDBCOORDACTIVITIES NO AND QUEUEDACTIVITIES UNBOUNDED CONTINUE; CREATE THRESHOLD "DS_AUTOMGMTSU_HIGHPRI_1290056235210_EST_COST_TH" FOR SERVICE CLASS "DS_HIGH_PRI_SUBCLASS" UNDER "DS_AUTO_MGMT_SUPER" ACTIVITIES ENFORCEMENT DATABASE DISABLE WHEN ESTIMATEDSQLCOST > 1000000 CONTINUE;	±1
n	Run SQL Close	

Figure 11-10 Deploy WLM configuration to the database

**Note:** This initial configuration is intentionally structured for monitoring only. That is, all of the thresholds are disabled and all of the service classes are configured to use the default agent priority. Deploying it will not impact the performance of your database. Rather it will begin categorizing and monitoring work.

# 11.1.3 Workload Manager objects in concurrency solution

When you configure a concurrency solution, you work with the following set of WLM database objects. Workload Manager provides default objects in the template configuration, and you can also create your own objects.

#### Service superclasses

A service superclass is a top-level runtime environment that you create to represent a business entity. You can distribute the total concurrency of the database among the runtime environments by defining a concurrency limit for each service superclass. DS\_AUTO\_MGMT\_SUPER is the name of the default service superclass.

#### Workloads

A workload is a category that you create to identify database activities by connection attributes that represent groups of users, important applications, IP addresses, and more. SYSDEFAULTUSERWORKLOAD is the name of the default workload.

#### Service subclasses

A service subclass is a second-level runtime environment that you create in a service superclass. You can distribute the concurrency of the service superclass among the service subclasses of the service superclass. The system automatically creates the following default service subclasses in every service superclass: DS\_HIGH\_PRI\_SUBCLASS, DS\_MED\_CONC\_SUBCLASS, DS\_LOW\_CONC\_SUBCLASS, and DS\_LOAD\_SUBCLASS.

### Thresholds

A threshold is an additional control that you can apply to the work that runs in the service subclasses. You can configure thresholds that enforce time limits, limit the number of rows read and returned, and control temporary table space usage. You can configure thresholds to stop database activities from running if they exceed a threshold limit, and to monitor database activities that exceed a threshold limit.

# 11.2 Customizing concurrency method

After deployment of WLM template configuration, you can use the Workload Manager configuration tool to further customize WLM objects - service superclasses, workloads, service subclasses, and thresholds.

# 11.2.1 Customizing service superclasses

On the Service Superclasses page of Workload Manager configuration tool, you create the top-level runtime environments that can represent applications, lines of business, departments, divisions, and other important business entities.

When you add or modify a service superclass, you work with the following objects and attributes:

Default service superclass

The system creates the default service superclass (DS\_AUTO\_MGMT\_SUPER) and the default service subclasses in it. Initially, the default workload (SYSDEFAULTUSERWORKLOAD) routes activities to the default service superclass.

Initially, the activities of the default workload run in the default service subclasses according to the concurrency or priority setting of the default workload.

► Total number of concurrent coordinator activities

The total number of concurrent coordinator activities is the total concurrency limit of the database. This total is a system-defined, read-only number that you can adjust by adding service superclasses and adjusting the concurrency limits of the service superclasses. By adding service superclasses and adjusting the concurrency limit of each service superclass, you divide the total concurrency limit among all the service superclasses, including the default service superclass. When you adjust the concurrency limits of the service superclasses, the system automatically adjusts the total concurrency of the database to be equal to the total of the concurrency limits of all the service superclasses.

► Enable enforcement of a concurrency limit

Initially, concurrency limits of service superclasses are disabled. You can enable enforcement of concurrency limits for individual service superclasses.

To do baseline monitoring before you configure Workload Manager, you can run the default configuration with the concurrency limits of all service superclasses disabled. When you are ready to monitor the effects of applying concurrency limits to your service superclasses and service subclasses, enable the concurrency limits of service superclasses as necessary.

► Workloads

A list of the workloads that route activities to the selected service superclass. You can associate workloads with a service superclass on the Workloads page.

In our example we set the concurrency limit of the DS\_AUTO\_MGMT\_SUPER service superclass to 20, and leave the enforcement of concurrency disabled, as shown in Figure 11-11 on page 385.

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🗱 Task Manager 🔻 🚯 Manage Database Connections 🔕 Welcome - My Optim Central			<u>a</u>			
Manage Database Connections Workload Manager Configuration						
DPF on A2/A3 TP V Disconnect		Preview an	d Run SQL Save Draft More Actions 🔹			
Service Superclasses Workloads Costs and Concurren Thresholds Performance Objectiv						
Create top-level runtime environments called service superclasses for the activities that are routed from your workloads. superclasses. Then, enable enforcement of concurrency limits for those service superclasses that you want to limit.	Adjust the distribution of resources amo	ong service superclasses by adjusting t	the concurrency limits of the service			
Concurrency for Service Superclasses	Service Superclass Definition					
Total number of concurrent coordinator activities: 20	Name: DS_AUTO_MGMT_SU	PER				
+ Add T Delete	Comments:					
Bervic Superclass Enforce Concurrency Limit Name DS_AUTO_MONT_SUPER 20 *	Workloads A list of the workloads that route ac not associated workloads with this s the Workloads page.	tivities to the selected service supercla ervice superclass. You can associate w	ass. An empty list indicates that you have workloads with a service superclass on			
	SYSDEFAULTUSERWORKLOAD					
DS_AUTO_MGMT_SUPER						
Graphs, Tables, and Reports	•					
Read about the service superclass metrics that you can use to do the following: 📴 > Evaluate the concurrency limit > Project the system capacity G > Assess the division of resource	of a service superclass 🕞		•			
Concurrency and CPU Usage Share of System Resources						
Graphs for Service Superclasses						
160 -	- 100	Select the metrics and the objects:				
140 -		CPU Usage (%)				
	80	✔ Database	✓ High water mark (HWM)			
120 -		DS_AUTO_MGMT_SUPER	Concurrency limit			

Figure 11-11 Service superclasses page

# 11.2.2 Customizing workloads

On the Workloads page of Workload Manager configuration tool, you can group similar sources of database activities into categories called workloads. Workloads represent who or what is connecting to the database and submitting requests.

When you add or modify a workload, you work with the following objects and attributes:

Default workload

When the database is created during the installation, the installation also creates the default workload (SYSDEFAULTUSERWORKLOAD). When database connections do not match the connection attributes of your workloads, the system assigns the connections to the default workload. You cannot delete the default workload.

The concurrency of the activities that are assigned to the default workload is determined by the estimated SQL cost of the activities. The activities that are assigned to the default workload initially run in the default service superclass

(DS\_AUT0\_MGMT\_SUPER). You can run the activities in one of your service superclasses by changing the related service superclass of the default workload.

► Workload evaluation

The database server assigns a request to the first workload in the workload evaluation table that has the same connection attributes as the request. For example, the database server selects a matching workload in the second row of the table over a matching workload in the third row.

The workload evaluation table displays all the workloads in the current evaluation order. When you create a new workload, the workload is automatically positioned after all the user-defined workloads in the table, but before the default workload, which is always in the last position. You can change the evaluation order of your workloads by changing the value in the Evaluation position field or by moving the workload up or down in the table.

► Related service superclass

You specify a top-level runtime environment for the activities of a workload by selecting the related service superclass. By default, the activities that are assigned to a new workload run in the default service superclass (DS\_AUT0\_MGMT\_SUPER) until you change the related service superclass of the workload.

► Enable database access

The system can assign activities to a workload only when the database access to the workload is enabled.

► Connection attributes

When you create a workload, you define the connection attributes of the workload to identify the activities that are assigned to the workload. For a new workload, you must define at least one value for one connection attribute. Otherwise, the system cannot assign activities to the workload.

You can define values for the following connection attributes:

- Application name

The name of the application that the data server recognizes and that is running on the client.

User ID

The authorization ID of the user who connects to the database. This ID is set in the SYSTEM\_USER special register.

Session user ID

The authorization ID of the current session of the application. This ID is set in the SESSION\_USER special register.

- Group ID

The groups to which the current session user belongs.

- Role ID

The roles that are granted to the current session user.

- Client user ID

The client user ID from the client information in the CURRENT CLIENT\_USERID (or CLIENT USERID) special register.

- Client application name

The application name from the client information in the CURRENT CLIENT\_APPLNAME (or CLIENT APPLNAME) special register.

Client workstation

The workstation name from the client information in the CURRENT CLIENT\_WRKSTNNAME (or CLIENT WRKSTNNAME) special register.

- Client accounting string

The accounting string from the client information in the CURRENT CLIENT\_ACCTNG (or CLIENT\_ACCTNG) special register.

- IP address (DB2 Version 9.7 and higher)

The address that the client uses to communicate with the database server. TCP/IP is the only supported protocol for the address. The address must be an IP Version 4 address, an IP Version 6 address, or a secure domain name.

► Concurrency/priority

To specify how concurrency or priority is determined for the activities of a workload, select an option that corresponds to one of the following types of work:

Urgent work

Specify the DS\_HIGH\_PRI\_SUBCLASS option for urgent work. Use this option sparingly for high-priority work and rush jobs that start to run immediately, run to completion at the high priority, and never wait in a queue. The activities of high-priority workloads run without a concurrency limit.

- Ordinary work

Specify the DS\_MED\_CONC\_SUBCLASS option for everyday work and queries. The system distributes a majority of the concurrency tickets to the DS\_MED\_CONC\_SUBCLASS service subclass.

- Batch jobs

Specify the DS\_LOW\_CONC\_SUBCLASS option for work that takes a long time to run, work that can disrupt urgent work, and work that can acceptably wait in a queue. The system distributes fewer concurrency tickets to the DS\_LOW\_CONC\_SUBCLASS service subclass than it does to the DS\_MED\_CONC\_SUBCLASS service subclass.

- Jobs with variable SQL cost

Specify the *Estimated SQL cost* option for the cost of activities to determine the concurrency limit at which they run. When the concurrency of activities is determined by cost, the activities are routed to the default service superclass or to your service superclasses. Depending on the costs of the activities, the activities run in the DS\_MED\_CONC\_SUBCLASS, the DS\_LOW\_CONC\_SUBCLASS, or a performance objective subclass. Any LOAD type activities of the workloads that determine concurrency by cost automatically run in the DS\_LOAD\_SUBCLASS.

- Jobs with performance objectives

Performance objectives will be discussed later in this chapter.

For help with defining the connection attributes of a workload, you can open the View Current Activities report (Figure 11-12 on page 389) from the Workloads page and see the values that are currently in use.

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reate workloads to identify, categorize, and manage different sources of database requests. For each workload, specify connection attributes that represent who or what is connecting to the database and submitting requests. A best practice is to create one workload for each source of work that you want to manage.										
Workload Evaluatio	m				Workload Definition					
Requests are assigned	I to the first w	orkload with connection attrib	ute values that match	the request.	Specifies the top-level ru	ntime environment	, evaluation position, cor	nection attributes, and	d concurrency basis.	
Add T Delete	🛧 Up 🚽	Down			Name:	SYSDEFAULT	JSERWORKLOAD			1
N			C		Related service superclas		GMT SUPER			-
SYSDEFAULTUSER WOR	RKLOAD	connection Attributes	Estimated SOL cost		Commenter					
		and the set for a second second		da a da	Comments:					
Always last in the list.	Initally bases	concurrency on costs and is a	assigned to your work issociated with the def	ault service	Evaluation position:	1				
superclass.					<ul> <li>Enable database acce</li> </ul>	55				
					The second se					
Graphs, Tables, and I	Reports									
Concurrency and Tim	e in the Queu	e (%) Workload Histograms	Response Times	View Current Act	tivities					
View Current Activitie	es									
Use the connection att	tribute values	of the current activities to he	p you define the conn	ection attributes of	your workloads.					
Workload Name	User ID	Session User ID	Application Name	Client Workstatio	on Client Accounting Str	Client User ID	Client Application Na	Role ID	Group ID	IP Address
SYSDEFAULTADMWOF	DB2IAIX	DB2IAIX	db2jcc_application	9.49.180.143			DS_WLM_CONFIG	SYSROLE_AUTH_DBAI	DASADM1, DB2IADM1	9.12.5.104
SYSDEFAULTUSERWO	DB2IAIX	DB2IAIX	db2jcc_application	9.49.180.143			DS_WLM_CONFIG	SYSROLE_AUTH_DBAI	DASADM1, DB2IADM1	9.12.5.104
SYSDEFAULTADMWOF	DB2IAIX	DB2IAIX	db2jcc_application	9.65.113.48			DS_WLM_CONFIG	SYSROLE_AUTH_DBAI	DASADM1, DB2IADM1	9.12.5.104
SYSDEFAULTUSERWO	DB2IAIX	DB2IAIX	db2jcc_application					SYSROLE_AUTH_DBAI	DASADM1, DB2IADM1	
SYSDEFAULTUSERWO	USER1	USER 1	db2bp.exe				CLP myq1.sql	SYSROLE_AUTH_DBAI	DB2IADM1, STAFF	9.12.4.140
SYSDEFAULTUSERWO	USER1	USER1	db2bp.exe			USER1	CLP WLM08.DML	SYSROLE_AUTH_DBAI	DB2IADM1, STAFF	9.49.180.143
SYSDEFAULTUSERWO	USER 1	USER 1	db2bp.exe					SYSROLE_AUTH_DBAI	DB2IADM1, STAFF	
SYSDEFAULTUSERWO	USER2	USER2	db2bp.exe				DailySales	SYSROLE_AUTH_DBAI	DB2IADM1, STAFF	9.12.4.140
SYSDEFAULTUSERWO	USER2	USER2	db2bp.exe			USER2	CLP WLM08user2.DM	SYSROLE_AUTH_DBAI	DB2IADM1, STAFF	9.49.180.143
SYSDEFAULTUSERWO	USER2	USER2	db2bp.exe					SYSROLE_AUTH_DBAI	DB2IADM1, STAFF	

Figure 11-12 View current activities report

In our example, based on the current activities report, we create two additional workloads, USER1\_WL and USER2\_WL. They are based on the value of the User ID connection attribute, such that USER1\_WL will contain database work from USER1 and USER2\_WL will contain database work from USER2.

To add a workload, go to the Workloads page click **+Add** and specify the name of the workload. See Figure 11-13.

cy/Priority	Kelated service superclass: *	L
Add a \	Workload	Π
Spe	ecify the name of the workload.	
Nar	me: * USER1_WL	_
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-		
	OK Cancel	

Figure 11-13 Add workload panel

In the connection attributes section of the Workloads page, select the User ID as a connection attribute and click **Add**, as shown in Figure 11-14.

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Service Superclasses Workloads Costs and	ervice Superclasses   Workloads   Costs and Concurren   Threshol   Performance Objectives								
Create workloads to identify, categorize, and manage create one workload for each source of work that yo	ge different sources of database requests. For each w ou want to manage.	orkload, specify connection attributes that represent who or what is connecting to the database and submitting requests. A best practice is to							
Workload Evaluation		Workload Definition							
Requests are assigned to the first workload with	connection attribute values that match the request.	Specifies the top-level runtime environment, evaluation position, connection attributes, and concurrency basis.							
🛧 Add 🧊 Delete 🕼 Up 🕹 Down		Name: USER1_WL							
Name Connection At	tributes Concurrency/Priority	Related service superclass: * DS_AUTO_MGMT_SUPER V							
USER1_WL	Estimated SQL cost	Comments:							
SYSDEFAULTUSERWORKLOAD	Estimated SQL cost	Evaluation position:							
		✓ Enable database access							
		Connection Attributes							
		You must specify at least one connection attribute value for the workload. Use commas to separate multiple values of a connection attribute with OK. The values of one connection attribute are automatically connected to the values of a different connection attribute by ANO.							
		Application name:							
		Additional connection attributes: User ID + Add							
SYSDEFAULTUSERWORKLOAD: default workload Always last in the list. Initally bases concurrency superclass.	for requests not assigned to your workloads. on costs and is associated with the default service	Specify how the activities of this workload are processed.     Add a field for the selected connection attribute.       Concurrency/priority:     Estimated SQL cost: determines concurrency							

Figure 11-14 Add connection attribute

Specify the value of the User ID attribute, USER1 in our example, as well as the Concurrency/Priority selection. We use **Estimated SQL cost: determines concurrency** value, which means that workloads will be routed into service subclasses based on the SQL cost value of individual statements. See Figure 11-15 on page 391. To apply changes press **Enter** key.

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Create workloads to identify, categorize, and manage different source create one workload for each source of work that you want to manage	es of database requests. For each v e.	rkload, specify connection attributes that represent who or what is connecting to the database and submitting requests. A best practice is to
Workload Evaluation		Workload Definition
Requests are assigned to the first workload with connection attribut	te values that match the request.	Specifies the top-level runtime environment, evaluation position, connection attributes, and concurrency basis.
🕂 Add 🛐 Delete 🍙 Up 🖶 Down		Name: USER1_WL
Name Connection Attributes	Concurrency/Priority	Related service superclass: * DS_AUTO_MGMT_SUPER
USER1_WL	Estimated SQL cost	Comments:
SYSDEFAULTUSERWORKLOAD	Estimated SQL cost	Evaluation position:
		☑ Enable database access
		Connection Attributes
		You must specify at least one connection attribute value for the workload. Use commas to separate multiple values of a connection attribute with OR. The values of one connection attribute are automatically connected to the values of a different connection attribute by AND.
		Application name:
		User ID: USER1
		Additional connection attributes: IP address 🗾 🕂 Add
SYSDEFAULTUSERWORKLOAD: default workload for requests not a Always last in the list. Initally bases concurrency on costs and is as superclass.	ssigned to your workloads. sociated with the default service	Specify how the activities of this workload are processed. Concurrency/priority: Estimated SQL cost: determines concurrency   •

Figure 11-15 Specify the value of the connection attribute

Similarly, add USER2\_WL, and specify USER2 as a value of the User ID connection attribute, as shown in Figure 11-16 on page 391.

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Create workloads to identify, categorize, and manage different sources of database requests. For each wo create one workload for each source of work that you want to manage.	rkload, specify connection attributes that represent who or what is connecting to the database and submitting requests. A best practice is to
Workload Evaluation	Workload Definition
Requests are assigned to the first workload with connection attribute values that match the request.	Specifies the top-level runtime environment, evaluation position, connection attributes, and concurrency basis.
🕂 Add 📑 Delete 🏠 Up 🕹 Down	Name: USER2_WL
Name Connection Attributes Concurrency/Priority	Related service superclass: * DS_AUTO_MGMT_SUPER
USER1_WL systemUser=USER1 Estimated SQL cost	Comments:
USER2_WL systemUser=USER2 Estimated SQL cost	Evaluation position:
SYSDEFAULTUSERWORKLOAD Estimated SQL cost	Enable database access
	Connection Attributes
	You must specify at least one connection attribute value for the workload. Use commas to separate multiple values of a connection attribute with OA. The values of one connection attribute are automatically connected to the values of a different connection attribute by ANC.
	User ID: USER2
	Additional connection attributes: Application name V Add
SYSDEFAULTUSERWORKLOAD: default workload for requests not assigned to your workloads. Arways last in the list. Initially bases concurrency on costs and is associated with the default service superclass.	Specify how the activities of this workload are processed. Concurrency/priority: Estimated SQL cost: determines concurrency

*Figure 11-16 Workloads page with custom defined workloads* 

# 11.2.3 Customizing service subclasses - costs and concurrency

On the Costs and Concurrency page of Workload Manager configuration tool, you can create service subclasses, which are the second-level runtime environments that you create to distribute the concurrency of your service superclasses.

The system creates the default service subclasses in every service superclass. The system also creates special service subclasses for the activities that run according to target response times.

Figure 11-17 on page 393 shows examples of a how the system routes activities to the service subclasses where they run depending on the priority of the workload, the concurrency of the workload, or the activity type, such as LOAD activities.





When you add or modify a service subclass, you work with the following objects and attributes:

Default service subclasses

The system automatically creates the following default service subclasses in every service superclass. The concurrency limit of a service superclass is distributed among the medium concurrency default service subclass (DS\_MED\_CONC\_SUBCLASS), the low concurrency default service subclass (DS\_LOW\_CONC\_SUBCLASS), the default service subclass for load activities (DS\_LOAD\_SUBCLASS), and any service subclasses that you create. You cannot delete the default service subclasses.

For each service superclass, the set of default service subclasses consists of the following:

#### – DS\_HIGH\_PRI\_SUBCLASS

Only the activities of the high-priority workloads run in this service subclass. The system routes high-priority activities directly from the workload to this service subclass. The system does not apply a concurrency limit to the activities that run in this service subclass. The agent priority of this service subclass is set to the default value.

– DS\_MED\_CONC\_SUBCLASS

The system routes ordinary work, which includes most of the database activities, directly from the workload to this service subclass, where it runs. For the activities of workloads that base concurrency on the estimated SQL cost, the system routes only the low-cost activities to this service subclass, where they run. The system applies a medium concurrency limit and the default agent priority value to this service subclass.

- DS\_LOW\_CONC\_SUBCLASS

This service subclass limits the impact of long-running activities, disruptive activities, and batch jobs. The system routes batch jobs and low-priority work directly to this service subclass, where the activities run. For the activities of workloads that base concurrency on the estimated SQL cost, the system routes only the high-cost activities to this service subclass, where they run. The system applies a low concurrency limit and the default agent priority value to this service subclass.

– DS\_LOAD\_SUBCLASS

All the LOAD activities from the workloads that process activities by the estimated SQL cost automatically run in this service subclass. The system applies a low concurrency limit and the default agent priority value to this service subclass.

Service subclasses for performance objectives

When you specify a performance objective for the activities of a workload, you create an additional, unique service subclass in which the activities run. We will discuss this later in the chapter

• Limits for the service subclasses of a service superclass

The table of service subclasses displays the concurrency and priority limits that apply to the activities that run in each service subclass of the selected service superclass. When you add a new service subclass, the system automatically redistributes the concurrency of the parent service superclass among the child service subclasses.

- Minimum and maximum cost in timerons

When the concurrency of the activities that run in the service subclass is determined by the estimated SQL cost, you can define the maximum and minimum costs in timerons.

Agent Priority

The Agent Priority property helps to determine the priority at which activities run. The agent priority value specifies the priority of all the agents that work in the service subclass relative to the priority of all the other DB2 agents. UNIX and Linux values range from -20 to 20, where a negative value denotes a higher relative priority than a positive value. Windows values range from -6 to 6, where a negative value denotes a lower relative priority than a positive value.

- Prefetch priority

The Prefetch Priority property controls the priority with which the agents in the service superclass submit prefetch requests. Prefetchers empty the priority queues in order from high to low. The default value for a service superclass is the medium prefetch queue.

**Note:** A service subclass inherits the prefetch priority from the parent service superclass when the parent value is set to the default value, which is MEDIUM. Select the high prefetch queue infrequently to allow requests with a lower priority to be submitted.

Buffer pool priority

The Buffer Pool Priority property influences the proportion of pages in the buffer pool that can be occupied by activities in the service subclass, which can improve the throughput and performance of activities in that service subclass.

Concurrency limit

The system maintains the concurrency limits of the child service subclasses to equal the concurrency limit of the parent service superclass. You can adjust the concurrency limits of the child service subclasses within the concurrency limit of the parent service superclass. To adjust the amount of concurrency that is allocated to the child service subclasses, you must adjust the concurrency limit of the parent service superclass.

Performance objective

We discuss performance objectives later in this chapter.

In our example, we change the maximum SQL cost limit for the DS\_MED\_CONC\_SUBCLASS to 10000 as well as increase its agent priority value to -10. We apply concurrency limit of 14 for this service subclass.

DS\_LOW\_CONC\_SUBCLASS will receive workload with the SQL cost higher then 10000. We apply concurrency limit of 4 for this service subclass. See Figure 11-18.

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Service Superclasses   Workloads   Costs and Concurrency   Thresholds   Performance Objectives   xr any of your service superclasses, you can create second-level runtime environments called service subclasses and divide the resources of the service superclass among the service subclasses.										
Limits for the Service Subclas	ses of a Service	Superclass								
To redistribute resources among the	he service subclass	es, adjust the lim	its an	d the Agent Priority.						
Select the service superclass:	DS_AUTO_MGMT_S	UPER		•						
To apply concurrency limits, enable	s the enforcement o	of concurrency lin	nits fo	or each service subclass th	nat you want to limit.					
🕂 Add 🔟 Delete										
Service Subclass	Minimum Cost	Maximum Cost	- 1	Agent Priority	Prefetch Priority	Buffer Pool Priority	Enforcement Type	E	Enforcement Details	Enforce
DS_HIGH_PRI_SUBCLASS	Not applicable	Not applicable	_	Default 🔻	Default 🔻	Default 🗸 🔻	High priority	Ur	Inlimited	Not applicable
DS_MED_CONC_SUBCLASS	0	10000	÷	-10 🔻	Default 🔻	Default	Fixed	▼ 1.	14	
DS_LOW_CONC_SUBCLASS	10000	Unbounded		Default 🔻	Default 🔻	Default 🔻	Fixed	• 4	+ 🔁	
DS_LOAD_SUBCLASS	Not applicable	Not applicable		Default 🔻	Default 🗸 🔻	Default 🔻	Fixed	<b>▼</b> 2	2	
Learn about the default convice ou	belaeses D				Loor	a about autonomic porform	ance objectives. D			
	JCidsbes. C*		_			about autonomic person	ance objectives. Le			
Processing Priority of DDL Ac	tivities									
Prioritize the processing of DDL ac	tivities separately.									
Priority of DDL activities: Ordin	ary work									

Figure 11-18 Costs and concurrency page

# 11.2.4 Customizing thresholds

On the Thresholds page of Workload Manager configuration tool, you can apply controls to your service subclasses in addition to the concurrency and priority controls.

When you configure a threshold for a service subclass, you work with the following objects and attributes:

► Threshold limit

The threshold limit is the enforcement point at which any actions that you enable begin to occur. You can enable either or both of the following actions:

- Stop activities that exceed the limit

When the threshold limit is reached, this action stops any additional activities from running and affecting the system.

- Monitor activities that exceed the limit

When the threshold limit is reached, this action monitors the statistics of any additional activities.

► Enable threshold

The system enforces threshold limits and applies the stop and monitor actions only when a threshold is enabled.

Threshold types

In addition to the system-defined threshold that enforces concurrency, Workload Manager supports the following threshold types for service subclasses:

Activity total time (ACTIVITYTOTALTIME)

This threshold specifies the maximum amount of time that the data server can spend processing an activity. The threshold is enforced on the coordinator and nested activities of the database. The total time that is measured by the threshold includes the time that is spent in a queue.

Estimated SQL cost (ESTIMATEDSQLCOST)

This threshold specifies the maximum estimated cost in timerons for DML activities that are issued at the coordinator partition. This threshold is enforced on the database.

CPU time (CPUTIME)

(DB2 V9.7.x only) This threshold specifies the maximum amount of combined user and system processor time that an activity can use on a particular database partition while the activity is running. This threshold is enforced on a database partition. This threshold tracks DML and CALL activities.

SQL rows returned (SQLROWSRETURNED)

This threshold specifies the maximum number of rows that the database server can return to the client. This threshold is enforced on the database.

SQL rows read (SQLROWSREAD)

(DB2 9.7.x only) This threshold specifies the maximum number of rows that a DML activity can read on a database partition, and is enforced on the database partition. This threshold controls the maximum number of rows that are read during query evaluation.

SQL temp space (SQLTEMPSPACE)

This threshold specifies the maximum amount of system temporary table space that a DML activity can consume at any database partition. This threshold is enforced on the database partition.

For our example we accept default settings of thresholds as shown in Figure 11-19.

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Service Superclasses   Workloads   Costs and Concurren	cy Thresholds Performance Objectives						
In addition to the concurrency limits, you can define different	threshold limits for the activities that run in a service subcla	ss.					
Service Subclasses Each row in the table represents a service superclass and additional thresholds.	service subclass combination for which you can define	Thresholds of the Service Subclass Enable any thresholds that you want to enforce.					
Service Superclass	Service Subclass	Service subclass: US_HIGH_PKI_SUBCLASS					
DS_AUTO_MGMT_SUPER	DS_HIGH_PRI_SUBCLASS						
DS_AUTO_MGMT_SUPER	DS_MED_CONC_SUBCLASS	Threshold type: Activity total time					
DS_AUTO_MGMT_SUPER	DS_LOW_CONC_SUBCLASS	Detects and controls rogue activities that might run for too long.					
DS_AUTO_MGMT_SUPER	DS_LOAD_SUBCLASS	Time limit (minutes): 60					
		Monitor the activities that exceed the limit					
		Stop the activities that exceed the limit					
		Enable threshold					
		Threshold type: Estimated SQL cost					
		Detects and controls DML activities with an estimated cost that is above the limit you specify.					
		Estimated SQL cost limit (timerons): 1000000					
		Monitor the activities that exceed the limit					
		Stop the activities that exceed the limit					
		Enable threshold					
		Threshold type: CPU time					
		Detects and controls the activities that use excessive processor resources.					
		CPU time limit (seconds): 300					
		Monitor the activities that exceed the limit					
		Stop the activities that exceed the limit					
		Foxble threshold					
Learn about the default service subclasses.							

Figure 11-19 Thresholds page

# 11.2.5 Deploying customized WLM configuration

After having completed the customization of WLM objects in Workload Manager configuration tool, you can deploy these changes into database by clicking **Preview and Run SQL**. You can review the list of DDL statements, which modify WLM objects based on the previous customization. See Figure 11-20 on page 399. Click **Run SQL** to deploy these changes to database.



Figure 11-20 Deploy WLM configuration changes

# 11.3 Analyzing the monitoring statistics of a concurrency solution

When you create a configuration by using the concurrency method, you can plot graphs of the Workload Manager monitoring statistics. You can also see tables of the graph data and reports that help you analyze the performance of your service superclasses and service subclasses.

# 11.3.1 Analyzing the monitoring statistics of service superclasses

From the Graphs, Tables, and Reports area of the Service Superclasses page of Workload Manager configuration tool, you can plot graphs and review tables of the related monitoring metrics. You can use this information to:

- Project the system capacity
- Evaluate the concurrency limit of a service superclass

You can also see the Share of System Resources report and review the resource usage of each service superclass.

## Project the system capacity

You can use the concurrency high water marks of the database and the CPU usage percentage to project the system capacity.

The concurrency high water marks of the database are plotted over time so that each point represents the high water mark for a specific collection interval. The CPU use percentage is the CPU usage of the system.

To plot concurrency high water marks and CPU usage graphs, follow these steps:

- 1. From the Graphs, Tables, and Reports area of the Service superclasses page, select the **Concurrency and CPU Usage** tab.
- 2. Define the time period that you want to evaluate.
- 3. Select Database.
- 4. Plot the concurrency high water marks of the database by selecting **High** water mark.
- 5. Plot the system CPU usage percent by selecting CPU usage.
- 6. Compare the two graphs.

Figure 11-21 on page 401 shows the concurrency high water mark and CPU usage graphs our scenario. Highest concurrency high water mark has a value of 29 and the associated CPU usage value is 25%. It could be reasonably predicted, that the system could handle a workload with the concurrency high water mark of up to 100.



Figure 11-21 Concurrency high water mark and CPU usage graph

#### Evaluate the concurrency limit of a service superclass

You can use the concurrency high water marks and the concurrency limit metrics to evaluate whether the concurrency limit of a service superclass is appropriate.

The concurrency high water marks are plotted over time so that each point represents the high water mark for a specific collection interval. The concurrency limit specifies the maximum number of concurrent coordinator activities that the service superclass can run.

To plot concurrency high water marks and CPU usage graphs, follow these steps:

- 1. From the Graphs, Tables, and Reports area of the Service Superclasses page, select the **Concurrency and CPU Usage** tab.
- 2. Define the time period that you want to evaluate.
- 3. Select the check box next to the service superclass that you want to analyze.
- 4. Plot the concurrency high water marks by selecting High water mark.
- 5. Plot the concurrency limit by selecting Concurrency limit.
- 6. Compare the two graphs.

Figure 11-22 shows the concurrency high water mark and concurrency limit graphs for our example. Concurrency limit is set to 20 and concurrency high water mark averages at around 18.

The concurrency limit is appropriate if the concurrency high water mark graph is close to the concurrency limit graph throughout the specified time period.

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Service Superclasses Workleads Costs and Concurrency   Thresholds   Performance Objectives									
Graphs, Tables, and Reports									
Concurrency and CPU Usage. Share of System Resources	-								
10/30/10 13/30	GMT -05:00 End Time: 11/19 12:17 - 11/19 13:12 11/19/10 13:19 Duration: 1 Hour   •								
Graphs for Service Superclasses									
20 DS_AUTO_MGMT_SUPER: HWN 11/19/10 13:14 17 CPU Usage (%)	objects:								
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Timestamps									
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Figure 11-22 Concurrency high water mark and concurrency limit graph

# **11.3.2** Analyzing the monitoring statistics of service subclasses

From the Graphs, Tables, and Reports area of the Costs and Concurrency page of Workload Manager configuration tool, you can plot graphs of the monitoring metrics, create and review histograms, and see the response time statistics of your service subclasses.

This information could be used to:

- Evaluate the distribution of concurrency among service subclasses
- Stabilize the response times of a service subclass

# Evaluating the distribution of concurrency among service subclasses

You can use the concurrency high water mark, the concurrency limit, and the time in the queue metrics to analyze and improve the distribution of concurrency.

Normally, you distribute the concurrency limit of a service superclass among the service subclass that runs ordinary work, the service subclass that runs batch jobs, and any additional service subclasses that you create for the service superclass. You expect that batch jobs often wait in the queue and that ordinary work starts to run immediately and spends little or no time in the queue.

You can find any service subclasses that are not using all the concurrency that is distributed to them. When you learn which service subclasses are under-utilizing the concurrency allotment, you can go to the Costs and Concurrency page and change the concurrency limits of those service subclasses.

To plot concurrency high water mark, concurrency limit and time in queue graph for selected service subclasses, follow these steps:

- 1. From the Graphs, Tables, and Reports area of the Costs and Concurrency page of Workload Manager configuration tool, select the **Concurrency and Time in the Queue Percentage** tab.
- 2. Define the time period that you want to observe.
- 3. Select the check box next to the service subclass that you want to analyze.
- 4. Plot a graph of the concurrency high water marks by selecting **High water mark check**.
- 5. Plot a graph of the concurrency limit by selecting **Concurrency limit**.
- 6. Compare the graph of the high water marks to the graph of the concurrency limit over the specified time period.

Figure 11-23 on page 404 shows the concurrency and time in queue graph for service subclass from our example. High water mark for DS\_MED\_CONC\_SUBCLASS never reaches concurrency limit. However, DS\_LOW\_CONC\_SUBCLASS high water mark is constantly above the concurrency limit for this service subclass.



Figure 11-23 Concurrency and time in queue graph for selected service subclass

This concurrency overrun in case of DS\_LOW\_CONC\_SUBCLASS is due to the fact, that concurrency limits have not been enforced for this subclass. To enforce these limits, go to the Cost and concurrency page and in the service subclass grid, click **Enforce** for the DS\_LOW\_CONC\_SUBCLASS service subclass. Then click **Preview** and **Run SQL** to apply this change to the database. See Figure 11-24 on page 405.

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#### Draft Document for Review January 13, 2011 8:13 pm

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Figure 11-24 Concurrency limit enforcement for the selected service subclass

After enforcing concurrency limits on your service subclasses, continue to monitor them from the Cost and concurrency page.

If the concurrency high water mark of a service subclass rarely or never reaches the concurrency limit, you can go to the Costs and Concurrency page and reduce the concurrency limit.

If a service subclass frequently reaches the concurrency limit, determine whether only a few activities are queued or a pervasive concurrency issue exists, and make the required adjustments. Plot a graph of the percentage of time the activities of the service subclass spend in the queue over the specified time period by selecting **Time in the queue**.

If the activities of the service subclass spend an excessive amount of time in the queue, go to the Costs and Concurrency page and reduce the concurrency limit of the service subclass.

#### Stabilizing the response time of a service subclass

You can use the activity total time and the activity queue time histograms of the Cost and concurrency page to evaluate and stabilize erratic response times that result from low concurrency limits.

When erratic response times result from low concurrency limits, you can increase the concurrency limits of your service subclasses to improve the response times of the activities that run in the service subclasses.

To verify, that the response times are erratic, go to the Graphs, Tables, and Reports area of the Costs and Concurrency page, select the **Service Subclass Histograms** tab. Review the activity total time histogram of the service subclasses. Wide variation among the response times might be an indication of erratic response times.

Activity total time histogram for service subclass, collects and distributes total activity lifetime data into discrete ranges called *bins*. For each bin it displays the number of activities which completed within the defined range.

Figure 11-25 on page 407 shows a DS\_MED\_CONC\_SUBCLASS activity total time histogram.

7925ch11.fm



Figure 11-25 DS\_MED\_CONC\_SUBCLASS activity total time histogram

In our example, the activity total time histogram for DS\_MED\_CONC\_SUBCLASS shows that most activities (144) completed within the range of 1309ms to 1997ms.

To verify that you can stabilize the response times by increasing the concurrency limit of the service subclass, review the activity queue time histogram of the service subclass.

Look for a large number of nonzero values as evidence that the concurrency limit is too low. If the concurrency limit is too low, go to the Costs and Concurrency page and increase the limit.

Figure 11-26 shows a comparison of activity queue time histograms for the DS\_MED\_CONC\_SUBCLASS and DS\_LOW\_CONC\_SUBCLASS service subclasses. The DS\_MED\_CONC\_SUBCLASS histogram shows that all activities of this service subclass spent 0 to 1ms in queue, which means that this service subclass has no activity queueing. The DS\_LOW\_CONC\_SUBCLASS histogram shows that there were activities in this service subclass that spent various amount of time in queue. However, overall number of queued activities in DS\_LOW\_CONC\_SUBCLASS does not represent a substantial number, so there is no need to change concurrency limit for this service subclass.



Figure 11-26 Activity queue time histogram

# 11.3.3 Analyzing the monitoring statistics of workloads

From the Graphs, Tables and Reports section of Workloads page you can analyze monitoring statistics of workloads. It is very similar to analyzing monitoring statistics of service subclasses. Collected data however is based on workloads rather than service subclasses. You can use the *Concurrency and Time in queue* percentage tab to plot the graph of workload occurrences high water marks for the defined workloads as well as time queue percentage for each workload.

Figure 11-27 on page 409 shows a Workloads Concurrency and Time in queue percentage graph.



Figure 11-27 Workloads Concurrency and Time in queue percentage graph

Use the *Workload histograms* tab to plot activity total time and activity queue time histograms for defined workloads. Figure 11-28 on page 410 shows a Workloads activity total time histogram.



Figure 11-28 Workloads activity total time histogram

# 11.4 Autonomic performance objectives for workloads

You can configure Optim Performance Manager to continually adjust the concurrency settings of service subclasses so that your workloads meet their performance objectives.

When you specify a performance objective for the activities of a workload, you create an additional unique service subclass in which the activities run.

A performance objective is defined by a target response time and the percentage of activities that must adhere to the target response time for the performance objective to be met. If you enable autonomic performance objectives, Optim Performance Manager will continually adjust the concurrency limit of the workloads associated with the service subclass to ensure that activities meet the performance objective.

You can create a performance objective when you create a new workload, or you can change a fixed service subclass or a discretionary service subclass to a performance objective.

# 11.4.1 Configuring autonomic performance objectives for workloads

Before you begin to configure autonomic performance objectives for workloads, go to the Service Superclasses page and ensure that the concurrency limit for the service superclass is set to an appropriate value. If the concurrency limit is too low, the autonomic performance objective service might overly restrict the concurrency of discretionary subclasses of the service superclass. Therefore, a low concurrency limit can degrade the performance of activities that run in discretionary service subclasses. If the concurrency limit is too high, activities that run in a subclass of the service superclass can use more system resources than you want.

In our example we have created PRICE\_LOOKUP\_WL workload, which contains workload activities based on the value of Client Application Name set to PRICE\_LOOKUP.

### Performance objective workload

To create a performance objective for this workload, go to the Workloads page and select the workload from the Workload Evaluation list. In the Concurrency/priority field, select **New performance objective**, as shown in Figure 11-29.

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Figure 11-29 Create performance objective workload

On the Add a Service Subclass panel (Figure 11-30) define the new performance objective by specifying:

- Name of the service subclass, which will execute performance objective workload
- Target time in milliseconds
- Percent adherence

If you specify a value in the *Maximum estimated SQL cost* field, the service subclass of the performance objective is inserted into the cost hierarchy for workloads that are configured to determine concurrency by estimated SQL cost.

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Figure 11-30 Performance objective service subclass settings

Deploy these configuration changes to database by clicking **Preview and Run SQL**.

# Performance objective service subclass

A side effect of specifying a performance objective in the workloads tab is the creation of a new service subclass where PRICE\_LOOKUP\_WL activities will run. In the costs and concurrency tab, you can see the new service subclass as shown in Figure 11-31 on page 413.

#### Draft Document for Review January 13, 2011 8:13 pm

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o redistribute resources	among the se	ervice subclas:	ses, adjust the limits	and the Agent Prior	rity.				
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Figure 11-31 New performance objective service subclass

On the Costs and Concurrency page, you can also specify an upper bound for the concurrency of the service subclass that corresponds with your performance objective. The system prevents the maximum concurrency of the service subclass from exceeding the value that you specify as the upper bound.

#### **Discretionary service subclass**

Performance objectives are enforced by taking resources away from some service subclasses. You indicate which service subclasses are available for this purpose by marking them as discretionary. There must be at least one service subclass marked as discretionary before you can enforce a performance objective.

In this example, the existing service subclass DS\_MED\_CONC\_SUBCLASS is designated as a discretionary service subclass. See Figure 11-32 on page 414.

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	Select the service supercla	ss: DS_AUT	O_MGMT_SUPER									
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	Learn about the default service subclasses. 🕩											

Figure 11-32 Discretionary service subclass definition

After you defined performance objective infrastructure, use the Response Times report in the Graphs, Tables, and Reports section of the Costs and Concurrency page to monitor the activities in the service subclass to verify that the expected activities are running and to determine an appropriate target response time. Then, if necessary, change the target response time setting of the performance objective on the Costs and Concurrency page.

Figure 11-33 on page 415 shows a performance objective service subclass response times report. In this example, 80% of the activities completed in less than 20 ms. So a reasonable goal might be 18 ms, this is 10% better than the observed performance when there are no concurrency limits on the discretionary subclasses.

#### Draft Document for Review January 13, 2011 8:13 pm

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Service Superclasses	Workloads URALQUCARD QICARD.BUDI QICARD.BUDI QICARD.BUDI Costs and Concur	Threshold	ds Performance O	bjectives
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65	0.009802	0.0015	77	25.07
70	0.012258	0.0025	67	34.3
75	0.014885	0.004	70	43.94
80	0.01972	0.0065	68	53.31
85	0.025985	0.01	90	65.7
90	0.034882	0.0155	76	76.17
95	0.063906	0.024	56	83.88
100	0.305	0.0365	51	90.91
		0.056	23	94.08
		0.0855	25	97.52
		0.1305	7	98.48
		0.1995	7	99.45
		0.305	4	100
	List Data		List Data	

Figure 11-33 Performance objective service subclass response times

# 11.4.2 Deploying autonomic performance objective

To enforce the performance objective for the service subclass, go to the Cost and Concurrency page and select **Enforce**.

On the Performance Objectives page (Figure 11-34), ensure that autonomic performance objectives are enabled. When autonomic performance objectives are enabled, the concurrency settings of all service subclasses with enforced performance objectives are continually adjusted.

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▲	Tue Nov 23 14/24/11 DS_AUTO_MGMT_SU USER3_SSC 18000.0 80.0 Not available The autonomic performance objective service is initializing. Initialization can take up to one hour.										

Figure 11-34 Performance objective page

Click **Preview and Run SQL** to deploy your configuration. If you are prompted to save the performance objective or to enable autonomic performance objectives, click **Yes**.

# 11.4.3 Monitoring autonomic performance objective

When you enable autonomic performance objectives for the first time for a workload, the autonomic performance objective service initializes by collecting monitoring data. Initialization can take more than an hour.

After the autonomic performance objective service initializes, Optim Performance Manager continually adjusts the concurrency settings of the service subclass to meet the performance objective of the workload. You can monitor these adjustments on the Graphs, Tables and Reports section of the Costs and Concurrency page.

Figure 11-35 shows how Optim Performance Manager automatically increased concurrency limit for performance objective service subclass. This adjustment also increased the Percent adherence value for this service subclass.


Figure 11-35 Concurrency and Time in queue graph for the performance objective service subclass

You can also use this tab to show the impact that the automatic increase or decrease of the concurrency limit for the performance objective service subclass has on discretionary service subclasses. Figure 11-36 on page 418 shows an example of this behavior.



Figure 11-36 Concurrency limits changes for performance objective and discretionary service subclasses

The Response Times tab (Figure 11-37 on page 419) of the Costs and Concurrency page shows cumulative percentage number of service subclass activities that completed within the specified value for target time setting as well as cumulative percentage number of activities that completed outside target time setting.

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iead about the service subclass metrics that you can use to do the following: 🕒 🔹 Frauluste the distribution of concurrency among service subclasses 🕒						
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Percentage of Activities     60     65     70     75	Activity Total Time in Seconds 0.583124 0.781307 1.002675 1.391009	Seconds 0.0005 0.0015 0.0025 0.0035 0.0035	Count 0 0 0 0 0	Eumulative Percentage 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
Percentage of Activities           0         60           60         65           70         70           80         80	Activity Total Time in Seconds 0.583124 0.781307 1.002675 1.391809 1.983962	Seconds           0.0005           0.0015           0.0025           0.0035           0.0035	Count 0 0 0 0 0 0 0 0	Cumulative Percentage 0 0 0 0 0 0		
Percentage of Activities           60           63           70           75           80           80	Activity Total Time in Seconds 0.583124 0.781307 1.002675 1.391809 1.983962 3.205148	Seconds           0.0005           0.0015           0.0025           0.0025           0.0035           0.0035           0.005	Count 0 0 0 0 0 0 0 0 0 0	Cumulative Percentage 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
Percentage of Activities           60           65           70           75           80           90	Activity Total Time in Seconds           0.583124           0.781307           1.002675           1.391009           1.983962           3.205148           5.559463	Seconds           0.0005         0.0015           0.0025         0.0035           0.0035         0.005           0.0075         0.011	Count 0 0 0 0 0 0 0 0 14	- Cumulative Percentage 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
Percentage of Activities           60           65           70           80           80           95           95	Activity Total Time in Seconds           0.583124           0.781307           1.002675           1.391809           1.983962           9.203149           5.559463           10.398445	Seconds           0.0005           0.0015           0.0025           0.0025           0.0025           0.0025           0.005           0.0075           0.011           0.016	Count 0 0 0 0 0 0 14 104	Cumulative Percentage 0 0 0 0 0 0 0 0 0.30 5.41		
Percentage of Activities           60           61           70           75           80           83           90           95           100	Activity Total Time in Seconds           0.583124           0.781307           1.002675           1.391609           9.99562           3.205148           5.559463           10.398445           8.1762497	Seconds           0.0005           0.0015           0.0025           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.011           0.016           0.0235	Count 0 0 0 0 0 0 0 14 104 200	Cumulative Percentage           0           0           0           0           0           0           0           0           0           0           0           0           0.39           5.41           11.68		
Percentage of Activities           60           70           75           80           85           90           95           100	Activity Total Time in Seconds           0.583124           0.781307           1.002675           1.391009           1.983962           3.203148           5.559463           10.398445           81.762497	Seconds           0.0005           0.0035           0.0035           0.0035           0.0035           0.003           0.003           0.0014           0.011           0.014           0.0235           0.0235	Count 0 0 0 0 0 0 14 184 230 245	Cumulative Percentage           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           11.68           19.97		
Percentage of Activities                € 60             € 65                 70                 80                 80                 95                 910	Activity Total Time in Seconds           0.589324           0.781307           1.002675           1.3983962           3.203348           5.559463           10.782497	Seconds           0.0005           0.0015           0.0025           0.0025           0.0025           0.005           0.005           0.0075           0.011           0.016           0.0235           0.024           0.034           0.049	Count 0 0 0 0 0 0 14 14 14 230 245 215	Camulative Percentage           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0.38           5.41           11.68           18.37           24.24		
Percentage of Activities           60           61           62           70           75           80           83           90           95           100	Activity Total Time in Seconds           0.583124           0.781307           1.002675           1.391809           3.983962           3.208149           5.559463           10.39445           81.762497	Seconds           0.0005           0.0015           0.0025           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.005           0.0235           0.024           0.049           0.0715	Count 0 0 0 0 0 0 0 14 14 194 230 245 215 225	Cumulative Percentage           0           0           0           0           0           0           0           0           0           0           0           0           0.38           5.41           11.68           18.97           24.24           30.41		

Figure 11-37 Response Times tab for performance objective service subclass

On the Performance Objectives page you can monitor the changes in the percent adherence value for the performance objective service subclass. This information closely corresponds to Concurrency and Time in queue graph from the Costs and Concurrency page.

Figure 11-38 on page 420 shows the Performance result tab of the Performance Objectives page.

Service Superclasses   Workloads	Service Superclasses   Workloads   Costs and Concurrency   Thresholds   Performance Objectives						
rou can enable autonomic performance objectives to continually adjust the concurrency settings of your service subclasses so that they meet their performance objectives.							
his behavior is currently enabled.							
Diskle standard biothing							
visible acconomic performance objectives							
GMT-07:00 End Time: 10/14 16:40 - 10/14 17:40 - Ind/14/10							
10/13/10					1 Ho 17:40		
10:10					17:49 Duration:		
Status Performance Results DL	DL results		1	1			
Time	Service Superclass	Service Subclass	Target Response Time	Target Adherence	Weighted Adherence Trend		
Thu Oct 14 17:39:29 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.47372289599411		
Thu Oct 14 17:38:33 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.47372289599411		
Thu Oct 14 17:37:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.47372289599411		
Thu Oct 14 17:36:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.47372289599411		
Thu Oct 14 17:35:29 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.6615194564546		
Thu Oct 14 17:34:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.6615194564546		
Thu Oct 14 17:33:29 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.6615194564546		
Thu Oct 14 17:32:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.6615194564546		
Thu Oct 14 17:31:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.6615194564546		
Thu Oct 14 17:30:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	91.6615194564546		
Thu Oct 14 17:29:31 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.64788732394366		
Thu Oct 14 17:28:32 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.64788732394366		
Thu Oct 14 17:27:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.64788732394366		
Thu Oct 14 17:26:29 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.64788732394366		
Thu Oct 14 17:25:32 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.64788732394366		
Thu Oct 14 16:53:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.12587412587412		
Thu Oct 14 16:52:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.12587412587412		
Thu Oct 14 16:51:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.12587412587412		
Thu Oct 14 16:50:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.12587412587412		
Thu Oct 14 16:49:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.12587412587412		
Thu Oct 14 16:48:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.12587412587412		
Thu Oct 14 16:47:30 GMT-0700 2010	DS_AUTO_MGMT_SUPER	PERF_OBJ_SUB	5000.0	80.0	74.12587412587412		

Figure 11-38 Performance results tab

The DDL tab (Figure 11-39 on page 420) of the Performance objective page displays the DDL statements that the autonomic performance objective service issues to enforce the performance objectives.

Service Superclasses Workloads Costs and Concurrency Thresholds Performance Objectives						
You can enable autonomic performance objectives to continually adjust the concurrency settings of your service subclasses so that they meet their performance objectives.						
This behavior is currently enabled.						
Disable autonomic performance objectives						
	GMT -07:00 End Time: 10/14 16:26 - 10/14 17:26   10/14/70					
10/13/10 16:16	10/4/10 17:26 Unration:					
	1 Hour IV					
Status Performance Re	suits DDL results					
Time	DDL					
	ALTER THRESHOLD *DS_AUTOMGMTSU_LOW_1285112450203_DRI_CONC_D8_TH* WHEN CONCURRENTD&COORDACTIVITIES > 5 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA NONE CONTINUE;					
Thu Oct 14 17:26:29 GMT-0700 2010	ALTER THRESHOLD "DS_AUTOMGMTSU_PERFOBJSUB_1283300274881_PRI_CONC_DB_TH" WHEN CONCURRENTDBCOORDACTIVITIES > 7 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA NONE CONTINUE;					
	ALTER THRESHOLD "DS_AUTOMGMTSU_MED_1285112450202_PRI_CONC_0B_TH" WHEN CONCURRENTDBCOORDACTIVITIES > 7 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA NONE CONTINUE					
Thu Oct 14 16:51:30 GMT-0700 2010	ALTER THRESHOLD 'DS_AUTOMGMTSU_PERFORJSUB_1285300274881_PRI_CONC_D&_TH" WHEN CONCURRENTDBCOORDACTIVITIES > 6 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA NONE CONTINUE;					
	ALTER THRESHOLD "DS_AUTOMGMTSU_MED_1285112450202_PRI_CONC_DB_TH" WHEN CONCURRENTDBCOORDACTIVITIES > 8 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA HONE CONTINUE;					
Thu Oct 14 16:47:30 GMT-0700 2010	ALTER THRESHOLD "DS_AUTOMGMTSU_PERFOBJSUB_1285300274881_PRI_CONC_D6_TH" WHEN CONCURRENTDBCOORDACTIVITIES > 5 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA NONE CONTINUE;					
	ALTER THRESHOLD *DS_AUTOMGMTSU_LOW_1285112450203_BRI_CONC_D8_TH* WHEN CONCURRENTD&COORDACTIVITIES > 6 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA NONE CONTINUE;					
Thu Oct 14 16:42:30 GMT-0700 2010	ALTER THRESHOLD "DS_AUTOMGMTSU_PERFOBJSUB_1285300274881_PRI_CONC_DB_TH" WHEN CONCURRENTDBCOORDACTIVITIES > 4 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA NONE CONTINUE;					
	ALTER THRESHOLD *DS_AUTOMGMTSU_MED_1285112450202_PRI_CONC_DB_TH" WHEN CONCURRENTDBCOORDACTIVITIES > 9 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA HONE CONTINUE;					
Thu Oct 14 16:33:30 GMT-0700 2010	ALTER THRESHOLD 'DS_AUTOMGMTSU_PERFOBJSUB_1285300274881_PRI_CONC_D6_TH" WHEN CONCURRENTDBCOORDACTIVITIES > 3 AND QUEUEDACTIVITIES UNBOUNDED COLLECT ACTIVITY DATA NONE CONTINUE;					

Figure 11-39 Performance objective DDL tab

Use the Status tab (Figure 11-40) of the Performance objective page to find out whether:

- ► autonomic performance objective service is running.
- Optim Performance Manager cannot adjust services subclasses to meet the performance objective of a workload

Servi	e Superclasses	Vorkloads Costs and (	Concurrency Th	nresholds P	erformance	Objectives		
You car	You can enable autonomic performance objectives to continually adjust the concurrency settings of your service subclasses so that they meet their performance objectives.							
This bel	This behavior is currently enabled.							
Disable	autonomic perfor	nance objectives						
10/13/ 16:16	0/13/10 10/14 19:15 - 10/14 20:15 10/14 19:15 - 10/14 20:15 10/14/10 10/14/10 20:16 10/14/10 20:16 10/14/10 20:16 10/14/10 20:16 10/14/10 20:16 10/14 19:15 10/14 19:15 10							
Status	Performance R	sults DDL results						
Alert	Time	Service Superclass	Service Subclass	Target Response Time	Target Adherence	Weighted Adheren Trend	Status	
	Thu Oct 14 20:0	:16 DS_AUTO_MGMT_SU	I PERF_OBJ_SUB	1000.0	80.0	73.482916879143	The autonomic performance objective service has allocated the maximum allowed resources to the service subclass and the performance objective still cannot be met.	

Figure 11-40 Performance objective status tab

7925ch11.fm

7925ch12.fm

# 12

# Monitoring SAP environments

IBM works together with SAP closely to optimize Optim Performance Manager for monitoring an SAP environment. The optimizations that are implemented in Optim Performance Manager Extended Edition V4.1.0.1 include installation enhancements for Extended Insight client, lock monitor event detail levels, special DB2 monitor switch handling, watchdog for event monitors, and predefined system templates.

In this chapter we describe how to install and configure Optim Performance Manager Extended Edition to monitor an SAP environment. Within these steps we describe the implemented optimizations briefly including the benefit of them and give further configuration hints that result from the close work with SAP.

We also show you how to monitor response times and time spent details of transactions and SQL statements per SAP user, SAP source module or SAP transactions using Optim Performance Manager Extended Insight.

# 12.1 Installing Optim Performance Manager Extended Edition

Installing Optim Manager Extended Edition consists of the following:

- Installing and activating Optim Performance Manager
- Installing and configuring Optim Performance Manager Extended Insight client

To plan the installation of Optim Performance Manager, see Chapter 2, "Planning" on page 15. To install and activate Optim Performance Manager, use 3.2.1, "Installing Optim Performance Manager" on page 65 and 3.2.4, "Installing DB2 Performance Expert Client" on page 83.

SAP environments use CLI to access their DB2 databases. The path you need to choose to install and configure Optim Performance Manager Extended Insight depends on the setup of your SAP environment:

- In your SAP environment, if DB2 client packages are located on a central file share and copied to the SAP system during startup of the SAP application server, you can embed a configured Optim Performance Manager Extended Insight client into a DB2 client package. This way you ensure that Optim Performance Manager Extended Insight client is copied together with the DB2 client package to the SAP system. No additional configuration is required after the copy step. The embedded installation is described in 12.1.1, "Embedding Optim Performance Manager Extended Insight into an existing DB2 client package".
- In your SAP environment, if DB2 client packages are fix installed on the SAP system and not copied, then install Optim Performance Manager Extended Insight client and configure it for CLI as described in 3.4, "Installing and Configuring Extended Insight Client" on page 129.

# 12.1.1 Embedding Optim Performance Manager Extended Insight into an existing DB2 client package

The embedded installation of Optim Performance Manager Extended Insight uses a response file to embed and configure the product silently in a subdirectory under the DB2 Client Package installation path. When copying the DB2 Client Package to the SAP system during SAP application server startup, Extended Insight client is copied with it.

To embed Optim Performance Manager Extended Insight into an existing DB2 client package, perform these steps:

 Update the properties shown in Example 12-1 in the opmei\_sample\_response.rsp file with the appropriate values of your environment, and save the file. The value for DB2DSDRIVER\_CONSROLLER\_URL is the same as the value for the pdq.cmx.controllerURL property in pdq.properties file of Optim Performance Manager which is set when activating Optim Performance Manager for Extended Insight.

Example 12-1 Update properties

#Has the license been accepted
LICENSE ACCEPTED=TRUE

#CLI driver installation root directory CLI DRIVER ROOT=C:/temp/IBM/ibm cli driver/clidriver

#flag for embedding Optim Performance Manager Extended Insight at the given CLI installation root directory EMBEDDED INSTALL=TRUE

#CMX controller url
DB2DSDRIVER\_CONTROLLER\_URL=localhost:60000

#location of the db2dsdriver.cfg file
DB2\_DSDRIVER\_CFG=C:/temp/IBM/ibm\_cli\_driver/clidriver/cfg/db2dsdriver.cfg

**Note:** If you use a DB2 client package of DB2 V9.7 Fix Pack 3 or higher, specifying the DB2\_DSDRIVER\_CFG property is optional on Linux and UNIX. If the property value is blank, the installer uses the default location of the db2dsdriver.cfg file. For all other platforms and DB2 client package versions, specifying a value for DB2\_DSDRIVER\_CFG is mandatory.

 From the directory of the Extended Insight installation image, run the following command with *<platform>* replaced with your platform, for example AIX:

IBM\_OPMEI\_V4\_1\_0\_1\_<platform>.bin -i silent -f path\_to\_response\_file

3. When the installation finished, verify that it was successful by reading the installation log files in the following directory:

db2\_client\_package\_installation\_dir/opmei/logs

During the embedded installation, the value for the connectionSupervisorLibrary property in the db2dsdriver.cfg file is updated with the location of the pqcmx library. For DB2 Client Package V9.7.3 and later, the connectionSupervisorLibrary property is updated with a relative path to the pqcmx library so that the path remains valid even if the DB2 client package is copied to another location.

#### 12.1.2 Validating Extended Insight Client configuration

If your DB2 client package is at DB2 9.7 Fix Pack 2 or higher, you can validate your Extended Insight client configuration for your SAP environment to ensure that Extended Insight data can be collected by Optim Performance Manager.

If you use the embedded install, then use this validation step for troubleshooting purposes if Optim Performance Manager does not collect Extended Insight data. Do the validation after the DB2 client packages were copied to the SAP system during startup of the SAP application server.

If you installed and configured Extended Insight client without the embedded install, we recommend to always perform the validation after you finished installation and configuration.

Call the validation routine using the following command:

#### db2cli validate -database mydb:mydbserver:50000

where *mydb*, *myserver* and *50000* are the database name, host name, and port number of your monitored database.

Run this command as the SAP user. The SAP user has the name as <ssid>adm, where <ssid> is the SAP system ID.

Before running the db2c1i command on Linux or UNIX, you might have to adapt environment variables. Try the command first and if it fails, set the DB2\_CLI\_DRIVER\_INSTALL\_PATH variable to the path of the DB2 client package and include the lib directory of the DB2 client package in the LIBPATH variable. Example 12-2 shows an example of commands for an SAP system.

Example 12-2 Set environment variables

export DB2\_CLI\_DRIVER\_INSTALL\_PATH=/sapmnt/OLT/global/db6/AIX\_64/db6\_clidriver/

#### export

LIBPATH=/sapmnt/OLT/global/db6/AIX\_64/db6\_clidriver/lib:/usr/sap/OLT/SYS/exe/uc/rs6000\_64:/db2/db2olt/sqllib/lib64

cd /sapmnt/OLT/global/db6/AIX\_64/db6\_clidriver/bin

./db2cli validate -database OLT:db6lpar4:5912

Example 12-3 shows a sample output of the db2cli command. Look for messages prefixed with PQCMX. If you receive successfully connected messages, the Extended Insight client is correctly configured.

#### Example 12-3 Output of validation

```
IBM DATABASE 2 Interactive CLI Sample Program
(C) COPYRIGHT International Business Machines Corp. 1993,1996
All Rights Reserved
Licensed Materials - Property of IBM
US Government Users Restricted Rights - Use, duplication or
disclosure restricted by GSA ADP Schedule Contract with IBM Corp.
Header
:-----
[ CLI Driver Version : 09.07.0000 ]
[Informational Tokens : "DB2 v9.7.0.2", "s100514", IP23082", "Fixpack 2"]
[ CLI Driver Type : IBM DB2 Application Runtime Client
]-----
Warning: The schema validation operation completed successfully.
The following data source name was not found in the db2cli.ini
file: "".
db2dsdriver.cfg Validation:
_____
[ DB2DSDRIVER CFG PATH env var : unset ]
[ db2dsdriver.cfg Path : /db2/db2olt/sqllib/cfg/db2dsdriver.cfg ]
_____
[ Keywords used by CLI for Database : OLT ]
Keyword Value
_____
connectionSupervisorLibrary /opm data/OPMEI07011/pureQuery/lib64/pqcmx
connectionSupervisorProperties
controllerURL=10.17.202.179:35055.dataSourceLookupInterval=1
_____
CSC Information Section:
-----
Monitored Database Name: OLT
Monitored Database Server: db61par4
Monitored Database Port: 5912
Platform Specific CSC Library Name:
/opm data/OPMEI07011/pureQuery/lib64/libpqcmx.a
CSC library load: success
CSC initialization: success, 2.1
CSC Name: PQCMX
CSC Version: '9.7.0.2' 's100514' 'IP23082' '2'
PQCMX is attempting to connect to a controller server using the controllerURL
property fixed address: 10.17.202.179:35055.
PQCMX successfully connected to a controller server using the controllerURL
property fixed address: 10.17.202.179:35055 with a negotiated level: 2.
```

PQCMX datasource 1:db6lpar4:5912:0LT will use properties resolved after connecting to the controller server. Resolved properties version: 1. Resolved properties: monitorEnabled: 1, monitorServer: 10.17.202.179, monitorPort: 33366, monitorLevel: 1, monitorCollectionInterval: 60. PQCMX monitoring for client datasource 1:db6lpar4:5912:0LT is enabled. PQCMX datasource 1:db6lpar4:5912:0LT is attempting to connect to monitor server 10.17.202.179:33366. PQCMX datasource 1:db6lpar4:5912:0LT is successfully connected to monitor server 10.17.202.179:33366. Monitoring status: on End CSC Information Section

The validation completed.

### 12.2 Configuring Optim Performance Manager

Configuring Optim Performance Manager includes adding a monitored SAP database and specifying the monitoring configuration by either selecting a predefined system template or enabling monitoring profiles manually. As a result of the monitoring configuration, monitor switches and event monitors are turned on on the SAP database. Many of the SAP optimizations are implemented in the configuration part of Optim Performance Manager to ensure that

- The monitoring overhead on the SAP database does not impact the SAP system much.
- The monitoring settings that Optim Performance Manager changes on the SAP database do not change SAP required monitoring settings.
- The objects that Optim Performance Manager creates on the SAP database can easily be recognized.
- The event monitors are dropped even if Optim Performance Manger fails unexpectedly.

We describe the SAP specific configuration optimizations and hints in this section.

#### 12.2.1 Predefined system templates for SAP

We recommend that you select one of the predefined SAP system templates when you configure the database for monitoring. The settings of the system templates result from the close work with SAP to optimize Optim Performance Manager for SAP environments. They ensure that monitoring overhead does not impact the SAP system much, but at the same time ensure that still valuable monitoring data is collected.

The predefined system templates are the following:

- ► SAP Business Information Warehouse production with low overhead
- SAP Business Information Warehouse production with all details
- SAP Enterprise Resource Planning production with low overhead
- ► SAP Enterprise Resource Planning production with all details

Those two *low overhead* templates set the same monitoring configurations, but differ in the predefined thresholds of the alerts. The same is true for two *with all details* templates.

All system templates include the following characteristics:

- The basic sampling interval is set to 5 minutes.
- ► The Basic, Locking, and I/O and Disk Space monitoring profiles are enabled.
  - Within the I/O and Disk Space monitoring profile, buffer pool, table spaces, and table data are collected, but no table space container data.
  - Within the Locking monitoring profile, deadlock events without history are enabled.
- The Active SQL and Connections, Workload Manager, CIM OS, and Performance Warehouse monitoring profiles are disabled
- ► The Extended Insight monitoring profile is enabled
  - Within the Extended Insight profile, only the collection on the client is enabled.

The with all details system templates have these additional characteristics:

- Within the Locking monitoring profile, lock wait information is collected with a sampling interval of 15 minutes.
- ► The Dynamic SQL profile is enabled with a sampling rate of 15 minutes.
- Within the Extended Insight monitoring profile, the collection of server metrics is enabled.

#### 12.2.2 Event monitor settings in Locking monitoring profile

For a database running SAP workload, SAP recommends to set the detail level of lock event monitor data collected to WITHOUT\_HIST. The database should not be configured to collect more details on lock events.

Therefore, during configuration, if Optim Performance Manager detects the database is a SAP database, it disallows the configuration of the lock event monitor details level in the Locking profile.

When you enable lock events in the Locking profile, Optim Performance Manager sets the corresponding database configuration parameter to the WITHOUT\_HIST value. This is true for all lock events such as deadlock events, lock timeout events, or lock wait events. The WITHOUT\_HIST setting minimizes the overhead that is created when the lock events are generated.

If you want to enable lock wait events, you can set a lock wait threshold in microseconds. In general, the suggested default value for a lock wait threshold is 5 000 000 microseconds, which is five seconds. If you want to set a value lower than the suggested default value, set the lock wait threshold to be 100,000 microseconds (100 milliseconds) or greater for an SAP environment. If you set a value that is lower than 100,000 microseconds, a very large number of lock wait alerts will be generated which can result in a certain overhead on the monitored database.

#### 12.2.3 DB2 monitor switch settings

SAP requires that the snapshot switches be turned on for a DB2 database regardless of whether the database is monitored by Optim Performance Manager.

In general, Optim Performance Manager is designed to turn on DB2 monitor switches during configuration of a database based on the enabled monitoring profiles and to turn them off if you disable monitoring or unconfigure a database for monitoring. However, as a result of this requirement, none of the DB2 monitor switches are turned off by Optim Performance Manager during disabling or unconfiguring of an SAP database.

#### 12.2.4 Controlling event monitors by using watchdog procedures

Depending on the enabled monitoring profiles, event monitors are created on the monitored SAP database. The watchdog procedures are used to drop event monitors if Optim Performance Manager is not reading and pruning the generated event monitor data on the SAP database due to a network disruption or similar system problem.

The watchdog procedures are stored procedures that Optim Performance Manager creates during configuration on an SAP database and configures to run automatically on an SAP database by registering them in the administrative task scheduler of DB2 that is available for DB2 V9.5 Fix Pack 2 or higher. If Optim Performance Manager becomes unavailable, the watchdog procedures drop the event monitors and further data is not collected. When Optim Performance Manager becomes available again, the event monitors are re-created.

Activate the administrative task scheduler in DB2 for an SAP database before you configure it for monitoring using the following description from the DB2 Information Center:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.d b2.luw.admin.gui.doc/doc/c0054380.html

Table 12-1 shows the monitoring profiles that create event monitors based on the settings in the profile, the corresponding event monitors, and watchdog stored procedures. *OPMID* identifies your Optim Performance Manager installation.

Monitoring profile	Event monitor	Watchdog procedure name
Extended Insight	Package Cache event monitor	OPM_ <i>OPMID</i> _PKGC_EVMON_WATCHDOG
Extended Insight - Server metrics	UOW event monitor	OPM_ <i>OPMID</i> _UOW_EVMON_WATCHDOG
Workload Manager	Statistic event monitor	OPM_ <i>OPMID</i> _WLMS_EVMON_WATCHDOG
Locking	Deadlock event monitor	OPM_ <i>OPMID</i> _DLCK_EVMON_WATCHDOG
Locking	Lock event monitor	OPM_ <i>OPMID</i> _NLCK_EVMON_WATCHDOG

Table 12-1Event monitors and corresponding watchdog procedures per monitoringprofile

#### 12.2.5 Identifying objects in SAP database

SAP demands that any objects created by third party products in a database that is running an SAP workload must be clearly identifiable. Therefore, Optim Performance Manager creates objects in its own schema and has defined naming conventions for the event monitors.

► Objects in the Optim Performance Manager schema:

The objects are created in schema named OPM. You can easily identify the objects in your monitored database that are created by Optim Performance Manager, such as the table of event monitors.

Naming conventions for event monitors:

Optim Performance Manager creates event monitors in a monitored database depending on the configuration of the monitoring profile. The event monitors are not associated with specific schemas. Therefore, Optim Performance

Manager uses specific names to identify the event monitors. The names of the event monitors that are created by Optim Performance Manager in the monitored databases all start with *OPM*.

## 12.3 Monitoring SAP workloads with Extended Insight

Extended Insight has predefined workload cluster groups to monitor SAP workloads, such as *SAP users* or *SAP transactions*. Using these groups helps you to pinpoint any problem and the source of the problem easily. For example, if a long running SAP Business Warehouse query slows down response time of other queries, you can find out which SAP user initiated the query, to which SAP transaction it belongs, or which SAP source modules it is using. In addition, you can find out the SQL text of this query and how this query is performing in the database.

The Extended Insight dashboard in Figure 12-1 on page 432 shows a high average end-to-end response time for user torsten.

Exten	Extended Insight Analysis Dashboard: X97								
Workload group.	Workloads are listed in the grid. Click in the left column to show the chart for the workload. Use the second column to expand and colla group.								
Open	Details Activate Deactiv	vate New	npy Reset	Delete	ew All Known Cli	ents Transac			
Graph	Workload Cluster Group/Workload 1 V Cluster	Average End-to-End Response Time (sec)	Maximum Inflight Elapsed Time (sec)	Maximum End-to-End Response Time (sec)	Average Data Server	Average Network Time (sec)	Average Client Time (sec)		
🕍 Sh	▼◆X97	3.987	19:20.846	14:45.339	◆3.071	♦0.287	<b>◆1.733</b>		
🚵 Sh	▼◆ SAP users	5.178	19:20.846	14:45.339	♦3.945	<b>0</b> .287	<b>\$</b> 1.733		
🖄 Sh	🔷 torsten	23.047	19:20.846	14:45.339	\$20.896	<b>0.280</b>	<b>\$1.872</b>		
े Sh	🔶 sapsys	0.651	01:26.108	14:45.339	<b>0.010</b>	<b>0.089</b>	<b>♦</b> 0.815		
े Sh	🔶 karl	9.879	23.904	35.230	<b>~</b> 6.038	<b>♦</b> 0.494	\$3.347		
े Sh	🔶 andrea	6.208	06:33.349	02:53.529	<b>0.737</b>	<b>\$1.212</b>	<b>\$</b> 4.259		
े Sh	<b></b>	0.421	01:00.454	01:27.910	<b>0.038</b>	<b>0.017</b>	\$5.459		
े Sh	► ♦ SAP transactions	5.178	19:20.846	14:45.339	♦3.945	<b>0.287</b>	<b>\$1.733</b>		
े Sh	►	5.178	19:20.846	14:45.339	♦3.945	<b>0</b> .287	<b>\$1.733</b>		
≧ Sh	► ♦ Host names/IP address	3.987	19:20.846	14:45.339	♦3.071	<b>0</b> .287	<b>\$1.733</b>		
🚵 Sh	► 🔶 Client user IDs	3.987	19:20.846	14:45.339	♦3.071	<b>0</b> .287	<b>∲</b> 1.733		
े Sh	►	3.987	19:20.846	14:45.339	<b>\$</b> 3.071	<b>0</b> .287	<b>\$1.733</b>		
े Sh	Application Types	3.987	19:20.846	14:45.339	♦3.071	<b>0.287</b>	<b>\$</b> 1.733		

Figure 12-1 Extended Insight dashboard showing response times of SAP users

Let us see from Figure 12-2 on page 433 what SAP source modules are used for running the workload of these users. The workload spent much time in source

module SAPLRR15 because the average end-to-end response time for this source module is the highest.

group.									
Open D	etails Activate	Deactivate	New Edit	Copy	Reset	View /	All Known Clie	ents Trans	action Topolo
Graph	Workload Cluster	Group/Worklo	ad Cluster 1	Average End-to- End Response	Maximum Inflight Elapsed Time	Maximum End-to- End Response	Average Data Server Time	Average Network Time (sec)	Average Client Time (sec)
🖄 Sh	* 🗢 X97			3.987	19:20.846	14:45.339	♦3.071	<b>0.287</b>	<b>\$1.73</b>
🖮 Sh	► 🔷 SAP users			5.178	19:20.846	14:45.339	<b>∲</b> 3.945	\$0.287	<b>\$1.73</b>
🚵 Sh	▼ ♦ SAP source m	odules		5.178	19:20.846	14:45.339	\$3.945	<b>0.287</b>	<b>\$1.73</b>
े Sh	♦ SAPLSOMS			15.545	41.621	52.140	<b>0.029</b>	<b>\$1.419</b>	<b>\$14.09</b>
े Sh	*SAPLSCSM_DOWNTIME			25.243	01:26.108	01:30.618	<b>0.040</b>	<b>@</b> 0.728	24.475
🚵 Sh	♦ SAPLSALA			15.913	0	31.612	<b>\$0.018</b>	<b>0.131</b>	<b>\$15.76</b>
🖮 Sh	♦ SAPLRRI5			01:38.038	19:20.846	14:45.339	<b>♦01:35.806</b>	<b>0.278</b>	<b>\$1.95</b>
🚵 Sh	♦ SAPLBTCH			21.655	02:37.264	02:53.529	<b>\$6.641</b>	\$3.264	<b>\$11.75</b>
🖮 Sh	♦ RSDSSPTI			8.695	13.906	26.375	<b>0.011</b>	\$0.625	<b>\$8.06</b>
🚵 Sh	CL_RSTT_DB_TRACE=======CP			P 8.326	01:06.574	01:08.954	<b> 0.456</b>	<b>\$1.277</b>	<b>\$6.59</b>
🚵 Sh	CL_RSDR_AT_QUERY_HANDLER=====CP			7.267	0	7.267	<b>0.325</b>	<b>0.582</b>	÷6.359
🖮 Sh	CL_GUI_ALV_GRID========CP			7.756	0	11.934	\$0.020	\$0.267	<b><b><b><b></b></b></b></b>
🚵 Sh	CL_DB6_TREE_NAVIGATOR======CP			16.966	10.837	30.802	<b>\$1.935</b>	<b></b>	<b> </b>
🚵 Sh	►	servers		5.178	19:20.846	14:45.339	\$3.945	\$0.287	<b>\$1.73</b>
🚵 Sh	► 🔶 Host names/IP	addresses		3.987	19:20.846	14:45.339	\$3.071	<b>0.287</b>	<b>\$1.73</b> 3

Figure 12-2 Extended Insight dashboard showing response times of SAP users

Let us drill down to user torsten by double clicking to see what SQL statements he is initiating in the SAP system. In Figure 12-3, we see that the top query the SAP user torsten is executing spends on average 11 minutes in the data server.

SQL Statements	Clients	Par	titions/Members	Contraction of the	And the second second second
Show highest	100 🛛 🔻	Ьу	Average End-to	-End Res	ponse Time (sec)
Statement T	ext		Statement Execu	tions	Average Data Server Time (sec)
SELECT "DU".	"/B49/S_BA	<b></b>		7	11:10.39
SELECT "DU".	"/B49/S_BA			6	09:18.45
✓ Display this list	by the sel	ected	l graph layer		
atement Performar	nce			in the second second	
umber of Executions				7	
verage end-to-end e	lapsed tim	ie:	11:10.403 min		
Average client time	i		0.007 sec		
Average driver time	91		0.004 sec		
Average network tir	me:		0.004 sec		
Average data serve	r time:			11:10	.391 min
)verall Time Distri	ibution				
00 %	-0.01 % 0.01 % 0 %	■ Clie ■ Dri <sup>.</sup> ■ Net ■ Dat tim	ent time ver time work time ta server e		

Figure 12-3 SQL statements of SAP user torsten

Figure 12-4 on page 435 shows the statement text.

Statement
<pre>SELECT "DU"."/B49/S_BASE_UOM" AS "S025" ,"DU"."/B49/S_STAT_CURR" AS "S026" ,"DT"."SID_0CALMONTH" AS "S017" , SUM ( "F"."/B49/S_CRMEM_CST" ) AS "Z034" , SUM ( "F"."/B49/S_CRMEM_QTY" ) AS "Z042" , SUM ( "F"."/B49/S_CRMEM_VAL" ) AS "Z048" , SUM ( "F"."/b49/S_INCORDCST" ) AS "Z045" , SUM ( "F"."/b49/S_INCORDQTY" ) AS "Z046" , SUM ( "F"."/B49/S_INCOD_QTY" ) AS "Z040" , SUM ( "F"."/B49/S_INVCD_CST" ) AS "Z043" , SUM ( "F"."/B49/S_INVCD_QTY" ) AS "Z049" , SUM ( "F"."/B49/S_OPORDVALS" ) AS "Z038" , SUM ( "F"."/B49/S_CRNSQTY" ) AS "Z043" , SUM ( "F"."/B49/S_OPORDVALS" ) AS "Z036" , SUM ( "F"."/B49/S_CRNSQTY" ) AS "Z039" , SUM ( "F"."/B49/S_RTNSCST" ) AS "Z036" , SUM ( "F"."/B49/S_RTNSQTY" ) AS "Z039" , SUM ( "F"."/B49/S_RTNSVAL" ) AS "Z036" , SUM ( "F"."/B49/S_RTNS_ITEM" ) AS "Z047" , COUNT_BIG(* ) AS "Z024" FROM '/BIC/ZZBENCH1" "F" JOIN '/BIC/DZBENCH1P" "DP" ON "F" . "KEY_ZBENCH1P" = "DP" ."DIMID" JOIN '/BIC/DZBENCH11" "DI ON "F" ."KEY_ZBENCH19" DP" ON "F" ." "VEY_ZBENCH19" = "D1" ."DIMID" JOIN '/BIC/DZBENCH11" = "D1" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON "F" ."KEY_ZBENCH11" = "D1" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON "F" ."KEY_ZBENCH11" = "D1" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON "F" ."KEY_ZBENCH11" = D1" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON "F" ."KEY_ZBENCH11" = D1" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON "F" ."KEY_ZBENCH13" = D3" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON "F" ."KEY_ZBENCH13" = D3" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON "F" ."KEY_ZBENCH13" = D3" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON 'F" ."KEY_ZBENCH13" = D1" ."DIMID" JOIN '/BIC/DZBENCH11" "D1" ON 'F" ."KEY_ZBENCH13" = D1" ."DIMID" JOIN '/BIC/DZBENCH11" = D1</pre>

Figure 12-4 SQL statement text of long running SAP BW query

SAP applications use comments in the SQL statements that help for analysis and debugging purposes. You can identify the comments by looking for the double hyphen (--) at the end of the SQL statement. The SQL query in Figure 12-4 on page 435 includes several comments. Here is a general description of the comments that SAP applications use:

- OPTLEVEL: The optimization level which was set for DB2 Optimizer. The optimization level influences the SQL access plan.
- QUERY\_DEGREE: This comment indicates the level of intra-partition parallelism which was used for execution of the query.
- LOCATION: This comment indicates the location in the SAP code, that is, method name or report name, and the code line which executed the given SQL query.
- SYSTEM: This comment indicates the SID of the SAP system where the SQL statement was executed.
- BW\_QUERY: The comment is used by SAP Business Information Warehouse application after the code change implemented in the SAP Note 1379260. It has the following elements:

- BW\_QUERY(InfoProvider /QueryName), where the InfoProvider element can be an InfoCube, a MultiProvider, or a DSO against which the query runs.
- QueryName is the name of the query.

To analyze this query further, using the Extended Insight dashboard you can check the execution details on the data server or launch Optim Query Tuner to obtain the access plan and tuning recommendations. Looking at the execution details on the data server shows that the query is reading a lot of rows, but does not return many. This is shown in Figure 12-5.

Average rows read: Average rows returned:		870,442 120			
Average rows modified:		0			
Average Sort Processing Time	:	0 sec			
Total sorts:		7	7		
Number of Sort Overflows per	Partition/Member:	0	0		
Post threshold sorts:		0			
Post threshold shared sorts:		0			
Row Efficiency		Sort Efficiency	=		
99.990 %0.01 %	Rows Read and Not Used Rows Returned or Modified	100 %-	In Memory Sorts Number of Sort Overflows		

Figure 12-5 SQL exection metrics on data server



# Managing the repository server and the repository database

This appendix contains useful information that helps you to manage Optim Performance Manager, especially, the repository server and the repository database, during run time.

The information we provide in this chapter consists of architectural concepts and troubleshooting tips and hints to maintain and administer the repository database.

### A.1 Tables in the repository database

In this section, we introduce tables in the repository database. You learn

- which tables reside in which table space
- which tables store data for which monitoring profile
- which tables can get large
- which tables store collected monitoring data and which tables store metadata or configuration data

**Note:** This section does not explain the complete set of tables but focuses on important ones that contain collected monitoring data, meta data or configuration data.

#### A.1.1 Global metadata tables

The global metadata tables exist only once in the repository database. They reside in the CONTROL table space. Table A-1 list a few global metadata tables.

Table name	Schema	Description
CONNECTION_PROFILE	DB2PM	Defines the databases configured for monitoring.
DATABASES	DB2PM	Defines the databases to monitor. You can see the mapping between instance ID and monitored database by using the D_I_INSTANCE_ID and D_DBNAME columns.
INSTANCES	DB2PM	Defines the instances of the databases to monitor.
MT_COLUMN	DB2PM	<ul> <li>Defines all columns of tables that are created if a new database is configured for monitoring. You can use this table to learn about the meaning of columns in tables.</li> <li>Important columns:</li> <li>MC_COLUMN_NAME: Column name</li> <li>MC_TABLE_NAME: Table the column belongs to</li> <li>MC_DESCRIPTION: Description for each column.</li> </ul>

Table A-1 Global metadata tables

Table name	Schema	Description
MT_TABLE	DB2PM	Defines all tables that are created if a new database is configured for monitoring. You can use this table to learn about the purpose of a table Important columns: MT_TABLE_NAME: Table name MT_SCHEMA: Schema name MT_DESCRIPTION: Description for each table.
PE_SETUP	DB2PM	Defines the Optim Performance Manager level for each monitored database. A monitored database is identified using the instance ID (column ID). If you install a new version or fix pack of Optim Performance Manager, the database layout of the repository database might change, for example, new tables or new columns must be added. The migration of the database to the new layout is performed during installation. This table records the completed or uncompleted migration per instance ID by the Optim Performance Manager level per instance ID (column VERSION). At each startup of the repository server, it is checked whether the migration to the new layout is still outstanding for one or more instance IDs. If so, then the migration is performed during startup.
VERSION	DB2PM	Stores global system information such as the Optim Performance Manager version or the DB2 version.
MANAGED_DATABASE	IBMPDQ	Defines the databases that you add on the "Manage database connections" panel.
MANAGED_DATABASE_P ROPS	IBMPDQ	Defines properties of the databases that you add on Manager database connections panel.

#### A.1.2 Metadata and protocol tables for the monitored databases

These metadata tables and protocol tables store database-specific information and there are a set of these tables each monitored database. The schema is DB2PM\_<instance\_id>. The metadata tables contain configuration and setup details and reside in the CONTROL table space. The protocol tables record the timestamps about the collected history data and the time frames of alerts. They reside in the SHORTTERM\_<instance\_id> table space.

Table A-2 Metadata and protocol tables

Table Name	Table space	Description
DB_PARTIONS	CONTROL	Contains partition information of the monitored database.
HISTORY_DATA	CONTROL	Contains the specification by which the data is collected and in which intervals. This table is changed if you change the collection intervals in the monitoring profiles using the "Configure Monitoring" wizard.
INSTANCE_INFO	CONTROL	Contains version information about the DB2 instance of the monitored database.
PARAMETER	CONTROL	Contains detailed information about configured monitoring profiles and other configurations. Any changes to the PARAMETER table are effective immediately using triggers. The PARAMETER table is changed if you change monitoring profiles using the "Configure Monitoring" wizard. For troubleshooting purposes, you might be asked by support to change settings in the PARAMETER table.
PARTITION_ROLES	CONTROL	Contains the predefined and user-defined partition roles.
PARTITION_SETS	CONTROL	Contains partition set definitions.
PARTITION_TO_ROLES	CONTROL	Assigns roles to partitions.
PARTITION_TO_SETS	CONTROL	Assigns partitions to partition sets.
PE_THRESHOLDDEF	CONTROL	Contains the alert threshold definitions.
SMTPDESTINATION	CONTROL	Contains e-mail notification destinations.
SMTPNOTIFICATION	CONTROL	Contains e-mail notification settings
HISTORY_TOC	SHORTTERM_ <instance_id></instance_id>	Contains timestamps of collected history data.
E2E_HISTORY_TOC	SHORTTERM_ <instance_id></instance_id>	Contains timestamps of collected and aggregated Extended Insight data.
PE_EXCPLOG	SHORTTERM_ <instance_id></instance_id>	Contains the occurred performance alerts.
PE_EXCPLOGDETAIL	SHORTTERM_ <instance_id></instance_id>	Contains details about the occurred performance alerts.

#### A.1.3 Monitoring data tables for the monitored database

In this section, we describe the tables that store the collected data by each monitoring profile. A few tables are used by multiple monitoring profiles. For example, some tables of the Basic monitoring profile are also used for the I/O and Disk Space monitoring profile. For simplicity we list each table once only.

#### **Basic monitoring profile**

Table A-3 list the tables that belong to the Basic monitoring profile. These tables have the schema DB2PM\_<instance\_id> and reside in the SHORTTERM\_<instance\_id> table space.

Table name	Description
DB2	Contains instance information from the DBM snapshot.
DBASE	Contains database activity information from the Database snapshot.
DBCFG	Contains database configuration data.
DBMCFG	Contains database manager configuration data.
DB_STORAGE_GROUP	Contains storage group information from the Database snapshot.
DETAIL_LOG	Contains detail log information from the Database snapshot.
FCM	Contains FCM information from the DBM snapshot.
FCM_NODE	Contains FCM node information from the DBM snapshot.
HADR	Contains HADR information from the Database snapshot.
MEMSTATPOOL	Contains memory pool information from the Database and DBM snapshot.
OS_DATA_DB2	Contains memory and CPU utilization information about the monitored system retrieved by using the DB2 ENV_SYS_RESOURCE administrative procedure.
PROGRESS	Contains utility progress information from the DBM snapshot.
ROLLFORWARD	Contains rollforward information from the Database snapshot.
UTILITY_INFO	Contains utility information from the DBM snapshot.

 Table A-3
 Tables for Basic monitoring profile

#### Locking monitoring profile

Table A-4 on page 442 lists the tables that belong to the Locking monitoring profile. These tables have the schema DB2PM\_<instance\_id> and reside in the SHORTTERM\_<instance\_id> table space.

Table name	Description
APPLINLOCKCONF	Contains application locking conflict data from the Application and Lock snapshot. If you disable the collection of Lock wait information in the Locking profile then the Lock snapshot is not taken and this table is not filled.
LOCKEDRES	Contains resource locking conflict data from the Lock snapshot. If you disable the collection of Lock wait information in the Locking profile then the Lock snapshot is not taken and this table is not filled.
EVMON_*	All tables with prefix EVMON_ contain data collected from the Lock event monitor of DB2 9.7 or higher. The tables are filled if you enabled the lock wait, lock timeout or deadlock alert in the Locking monitoring profile and if such alerts occurred.
EV_*	All tables with prefix EV_ contain data collected from the Deadlock event monitor of DB2 9.1 or DB2 9.5. These tables are filled if you enabled deadlock alerts in the Locking monitoring profile and if such alerts occurred.

Table A-4 Tables for Locking monitoring profile

#### Active SQL and Connection monitoring profile

Table A-5 lists the tables that belong to the Active SQL and Connection monitoring profile. These tables have the schema DB2PM\_<instance\_id> and reside in the SHORTTERM\_<instance\_id> table space.

Table A-5 Tables for Active SQL and Connection monitoring profile

Table name	Description
APPL	Contains connection information from the Application snapshot. This table can get very large dependent on the number connections you have in the monitored database. If you run into disk space shortages then it might help to increase the collection interval of this monitoring profile.
STATEMENT	Contains statement information from the Application snapshot.
SUBSECTION	Contains statement subsection information from the Application snapshot.

#### I/O and Disk Space monitoring profile

Table A-6 lists the tables that belong to the I/O and Disk Space monitoring profile. These tables have the schema DB2PM\_<instance\_id> and reside in the SHORTTERM\_<instance\_id> table space.

 Table A-6
 Tables for I/O and Disk Space monitoring profile

Table name	Description
BUFFERPOOL	Contains buffer pool activity data from the Bufferpool snapshot.

Table name	Description
LCONTAINERS	Contains table space container information from the table space snapshot. This table can get very large dependent on the number of table space containers you have in the monitored database. If you run into disk space shortages then it might help to change the collection settings of this monitoring profile. You can for example disable the collection of container information, but continue to collect other table space information like table space activity data.
NODEIFBP	Contains buffer pool node information from the Bufferpool snapshot
NODEIFTBSP	Contains table space node information from the Tablespace snapshot. This table can get very large dependent on the number of table spaces you have in the monitored database. If you run into disk space shortages then it might help to change the collection settings of this monitoring profile. You can for example disable the collection of table space information.
TABLE	Contains table activity information from the Table snapshot. This table can get very large dependent on the number of tables you have in the monitored database. If you run into disk space shortages then it might help to change the collection settings of this monitoring profile. You can for example disable the collection of table information.
TABLEREORG	Contains table reorganization information from the Table snapshot.
TABLESPACE	Contains table space activity information from the Tablespace snapshot. This table can get very large dependent on the number of table spaces you have in the monitored database. If you run into disk space shortages then it might help to change the collection settings of this monitoring profile. You can for example disable the collection of table space information.
TBSPQUIESCER	Contains table space quiesce information from the Tablespace snapshot.
TBSPRANGES	Contains table space range information from the Tablespace snapshot

#### Workload Manager monitoring profile

Table A-7 lists the tables that belong to the Workload Manager monitoring profile. These table have the schema DB2PM\_<instance\_id> and reside in the SHORTTERM\_<instance\_id> table space.

Table name	Description
WORK*	All tables with prefix WORK contain configuration information about defined Workload Manager objects such as WORKLOADS, WORKCLASSES, WORKACTIONS, and so on.
SERVICECLASSES	Contains configuration information about defined service classes.

 Table A-7
 Tables for Workload Manager monitoring profile

Table name	Description
THRESHOLDS	Contains configuration information about defined thresholds.
HISTOGRAMBIN	Contains histogram information collected from the Statistic event monitor.
SCSTATS	Contains service class statistics collected from the Statistic event monitor.
WCSTATS	Contains work class statistics collected from the Statistic event monitor.
WLSTATS	Contains workload statistics collected from the Statistic event monitor.

#### **Dynamic SQL monitoring profile**

Table A-8 lists the tables that belong to the Dynamic SQL monitoring profile. These table have the schema DB2PM\_<instance\_id> and reside in the SHORTTERM\_<instance\_id> table space.

 Table A-8
 Tables for Dynamic SQL monitoring profile

Table name	Description
DYNSQL	Contains SQL data from the Dynamic SQL snapshot. This table can get very large dependent on the number of Dynamic SQL statements in the package cache. If you have run into disk space shortages then it might help to change the collection settings of the Dynamic SQL monitoring profile.

#### Extended Insight monitoring profile

Table A-9 lists the tables that belongs to the Dynamic SQL monitoring profile. These tables have the schema DB2PM\_<instance\_id> and reside in the SHORTTERM\_<instance\_id> table space.

Table name	Description
E2E_STATEMENT_ EXECUTIONS_x	Partitioned fact table containing statement execution information from Extended Insight client. The x represents the aggregation level 1,2,3, or 4.
E2E_STATEMENT_SRV_ EXECUTIONS_x	Partitioned fact table containing statement execution information collected from the package event monitor on DB2 9.7 Fix Pack 1 or higher. The x represents the aggregation level 1,2,3, or 4.
E2E_TRANSACTION_ EXECUTIONS_x	Partitioned fact table containing transaction execution information collected from Extended Insight client and from the unit of work event monitor on DB2 9.7 Fix Pack 1 or higher. The x represents the aggregation level 1,2,3, or 4.

Table A-9 Tables for Extended Insight monitoring profile

Table name	Description
E2E_TRANSACTION_ EXECUTIONS_M_x	Partitioned fact table containing transaction execution information on partitions or members collected from the unit of work event monitor on DB2 9.7 Fix Pack 1 or higher. The x represents the aggregation level 1,2,3, or 4.
E2E_CLIENT_ RUNTIMES_x	Partitioned fact table containing client runtime information from Extended Insight client. The x represents the aggregation level 1,2,3, or 4.
E2E_HISTOGRAMBIN_x	Partitioned fact table containing transaction execution histogram information. The x represents the aggregation level 1,2,3,or 4
E2E_*	All other tables starting with E2E_ are dimension tables to the fact tables containing statement text, user ids, applications, and so on.

#### CIM OS data monitoring profile

Table A-10 lists the tables that belong to the CIM OS data monitoring profile. These tables have the schema DB2PM\_<instance\_id> and reside in the SHORTTERM\_<instance\_id> table space. Data collected by this monitoring profile is displayed on Performance Expert Client only. To collect this data you must setup a CIMON server on the monitored system that Optim Performance Manager accesses to get the data.

Table name	Description
CPU	Contains CPU information.
CPUSTATISTICS	Contains CPU statistic information.
DISK	Contains information about disk drives.
DISKSTATISTICS	Contains statistical information about disk drives.
FILESYSTEM	Contains information about file systems.
OSCFG	Contains operating system information.
OSSTATISTICS	Contains operating system information.
PROCESSES	Contains processes information.

Table A-10 Tables for CIM OS data monitoring profile

#### Performance Warehouse monitoring profile

Table A-11 on page 446 lists the tables that belong the Performance Warehouse monitoring profile. These table have the schema PWH\_<instance\_id> and reside in the LONGTERM\_<instance\_id> table space.

Table name	Description
EVM_*	Contains statement or activity information collected from the statement or activity event monitor if you start SQL or Workload Manager activity traces from Performance Expert Client.
*	All tables that have the same table name in schema PWH_ <instance_id> as a table in schema DB2PM_<instance_id> contain the same information, but the data is aggregated. See chapter A.3.2, "Aggregating inflight and workload manager data" on page 452 for information on data aggregation for long-term history.</instance_id></instance_id>

Table A-11 Tables for Performance Warehouse monitoring profile

### A.2 How the repository server works

In Figure 1-1 on page 12 we introduced the architecture of Optim Performance Manager. Optim Performance Manager consists of a console server and a repository server component. The repository server collects monitoring data from the monitored database and stores it in the repository database. The repository server starts up if you call the **pestart** command or on Windows use the **Start the Repository Server** entry from the program start menu. The repository server logs the startup in the db2pesrv.log file and writes it to the console if you used the pestart command.

Let us use the log messages to explain how the repository server works. The repository server is a java process which starts for each monitored database a set of threads. The number of threads in this set depend on the enabled monitoring profiles for a monitored database. Each thread has it's own purpose. The set of threads that the repository server java process starts for one monitored database is called a monitoring instance. Therefore each monitored database has it's assigned instance ID which is used at several places like in the table schema name and in the table space names belonging to one monitored database, for example schema DB2PM\_<instance\_id> or table space <SHORTTERM\_<instance\_id>. The repository server writes global log messages and log messages for each monitored database to the log file. Example 12-4 shows one global log message and all log messages for one monitored database with instance ID 1 that has all monitoring profiles enabled except CIM OS Data.

Example 12-4 Startup log messages for one monitored database

[17:34:29.687][0]The Extended Insight controller server is started on port 7777. [17:34:38.984]Starting the monitoring for [1] ... [17:34:54.125]The monitoring of [1] is started. [Node: NODE7507, Host: BL3AED4M, Port: 50000, OS: WINDOWS, DB2: DB2 v9.7.100.177]

```
[17:34:54.203][1]Initializing ...
[17:34:54.203][1]Databases [PEDEM0]
[17:34:54.203][1]Working directory = C:\Program
Files\IBM\OPM\RepositoryServer\instances\DB2\NODE7507
[17:34:54.203][1]Trace file
                                   = C:\Program
Files\IBM\OPM\RepositoryServer\instances\DB2\NODE7507\db2pesrv.trc
[17:34:54.203] [1] Stored procedures trace file = C:\Program
Files\IBM\OPM\RepositoryServer\instances\DB2\NODE7507\fpesnap.trc
[17:34:54.203][1]CIM Trace file = C:\Program
Files\IBM\OPM\RepositoryServer\instances\DB2\NODE7507\fpecim.trc
[17:34:54.437]Status of [1]: initializing.
[17:35:01.359][1]Extended Insight data aggregator started.
[17:35:02.968] [1] Extended Insight data loader started.
[17:35:09.75 ][1]Extended Insight data merger started.
[17:35:10.14 ][1]Extended Insight started.
[17:35:10.171][1]The Extended Insight monitor server is started on port 2232.
[17:35:11.89 ][1]Performance warehouse server started.
[17:35:12.625] [1] Threshold alert processor started.
[17:35:12.765][1]Performance warehouse data loader started.
[17:35:13.078][1]Data cleaner started.
[17:35:13.718] [1] Snapshot data collector started.
[17:35:32.64 ][1]Workload management statistic collector started.
[17:35:32.64 ][1]Workload management definition collector started.
[17:35:32.64 ] [1] Operating system data collector started.
[17:35:33.39 ][1]Deadlock event alert processor started.
[17:35:37.703][1]Extended Insight statement text collector started.
[17:35:38.093] [1] Extended Insight transaction metric collector started.
[17:35:38.546][1]Extended Insight statement metric collector started.
[17:35:39.343]Status of [1]: alive (2/4).
```

The number in brackets, in our example [0] or [1] tell you the instance ID. Instance ID [0] means that it is a global message and not belonging to a specific database.

The first messages you see for instance ID 1 gives you the info which database is associated with instance ID 1 and which trace files are used to write trace messages. The remaining messages tell you which threads are started to monitor the database. We describe the threads in the following.

#### A.2.1 Extended Insight threads

Before describing the Extended Insight threads, we give a few sentences about the architecture of Extended Insight within the repository server. Extended Insight consists of a global controller and a monitor server for each monitored database for that the Extended Insight monitoring profile is enabled. The controller listens on a port that you specify when you activate Extended Insight on Optim Performance Manager. The port is saved in the pdq.properties file. When you configure an Extended Insight client, you specify this port as well and it is saved in the pdq.properties file on the Extended Insight client machine. In this way, the communication between Extended Insight client and the repository server is established. When an application that you monitor with Extended Insight client starts and connects to the monitored database, the Extended Insight client accesses the controller and asks for the Extended Insight monitor server port number that is listening for the Extended Insight data for that monitored database. From that point on, the Extended Insight client sends the collected data to the monitor server for that database over the communicated monitor server port.

In our example, we see messages telling that the controller and the monitor server for database with instance ID 1 is started and which port numbers are used:

[0] The Extended Insight controller server is started on port 7777 [1] The Extended Insight monitor server is started on port 2232.

The port number of the monitor server is determined dynamically unless you set it explicitly in the Extended Insight monitoring profile.

The Extended Insight threads include:

- Data aggregator: This thread aggregates Extended Insight data into the next aggregation level. For details, see A.3.1, "Aggregating extended insight data" on page 450.
- Data loader: Stores collected Extended Insight data in the appropriate tables in the repository database.
- Data merger: Combines received data from Extended Insight client with collected unit of work event monitor data from the monitored database in order to insert the data from both sources into a single table.
- Statement text collector: Extended Insight client does not send the complete statement text of the SQL statements the applications execute to the monitor server. It sends a unique hash code. This thread retrieves SQL statements from the dynamic SQL statement cache of the monitored database either through the dynamic SQL snapshot or the package cache event monitor dependent on the DB2 version of the monitored database. It then calculates a hash code for them and stores them in the appropriate table. Through mapping the hash codes, the SQL statements that the applications execute are identified.
- Transaction metric collector: This thread collects unit or work event monitor data from the monitored database for DB2 9.7 Fix Pack 1 or higher.

 Statement metric collector: This thread collects data server statement execution details for static and dynamic statements using the package cache listing table function MON\_GET\_PKG\_CACHE\_STMT on the monitored database for DB2 9.7 Fix Pack 1 or higher.

#### A.2.2 Other threads

Other threads in the repository database include:

- Performance Warehouse server: This thread is only started if you enabled the Performance Warehouse monitoring profile. It allows scheduling Performance Warehouse processes and running SQL or Workload Manager activity traces from Performance Expert Client.
- Performance Warehouse data loader: This thread is only started if you enabled the Performance Warehouse monitoring profile. It aggregates data from the history tables into the long-term history tables. For more details see A.3.2, "Aggregating inflight and workload manager data" on page 452
- Threshold alert processor: This thread checks in fixed intervals whether threshold alerts occurred or ended
- Data cleaner: This thread deletes history data after the retention time is reached. For more details see A.4.1, "How the repository server deletes history data" on page 454
- Snapshot<sup>TM</sup> data collector: This thread is started whenever an inflight monitoring profile is enabled. It collects snapshot data from the monitored database in specified intervals. To collect the data, it executes a stored procedure. This stored procedure attaches to the DB2 instance of the monitored database, retrieves the snapshot using the DB2 snapshot API, detaches and stores the retrieved snapshot data in the appropriate tables. Stored procedures execute in the db2fmp processes started by DB2. Therefore, you see on the Optim Performance Manager machine multiple db2fmp processes running and consuming memory and CPU. The amount of memory and CPU they consume per collection depend on the amount of retrieved monitoring data.
- Workload Management statistic collector: This thread is started if the Workload Manager monitoring profile is enabled. It collects statistic event monitor data from the monitored database.
- Workload Management definition collector: This thread is started if the Workload Manager monitoring profile is enabled. It collects Workload Manager objects definition data from the catalog tables in the monitored database.
- Operating System data collector: This thread is started if the Basic monitoring profile is enabled. In the specified collection interval, it collects CPU and

memory consumption data from the monitored database using the DB2 ENV\_SYS\_RESOURCES administrative procedure.

 Deadlock event alert processor: This thread is started if the lock or deadlock event monitor is enabled in the Locking profile. It collects lock or deadlock event monitor data from the monitored database.

## A.3 Data aggregation concepts

The repository server of Optim Performance Manager aggregates collected history data over time in order to provide a long-term history of data that can be used for trend and capacity purposes. This history data does not consume much space in the repository database. At time of writing this book, the inflight history data and extended insight history data have different aggregation concepts:

- Extended insight history data: Optim Performance Manager aggregates the data using four aggregation levels to achieve this goal: The older the data, the more it is aggregated.
- Inflight and workload manager history data: Optim Performance Manager uses the legacy Performance Warehouse functionality available from the legacy Performance Expert Client to aggregate data.

The report data in Optim Performance Manager is not aggregated at the time of writing this book. The reports that you can create from the Optim Performance Manager web console are based on the detailed history data that is deleted automatically after the retention period is reached. To achieve that you can create reports on data collected over a longer period of time than the retention period of the detailed history data you can configure a monitored database twice. One configuration collects performance data in short intervals with a retention time of a few days. The second configuration collects performance data in long intervals with a retention time of a few weeks or month. The second configuration is used for reports. The following technote describes how you can configure a monitored database in Optim Performance Manager twice to use the reports for trend and capacity purposes:

http://www-01.ibm.com/support/docview.wss?uid=swg21429964

#### A.3.1 Aggregating extended insight data

Optim Performance Manager uses four aggregation levels to aggregate and store extended insight data. Each aggregation level has a storage period. Optim Performance Manager deletes the data from an aggregation level automatically after the storage period is over. The storage period for aggregation level 1 is the shortest and for aggregation level 4 the longest.

Every minute Optim Performance Manager receives extended insight data from the Extended Insight clients and stores it in aggregation level 1. The extended insight data it receives contains transaction response time data that the Extended Insight client has aggregated already within one minute. Aggregation means that average and maximum response times, including the time breakdown and SQL statements for transactions with the same connection attributes, are calculated. After 15 minutes of collection, Optim Performance Manager reads the data from aggregation level 1 and aggregates it into aggregation level 2. After one hour of collection, Optim Performance Manager reads the data of aggregation level 2 and aggregates it into aggregation level 3. The aggregation to level 4 happens first after one day of collection. Figure A-1 on page 451 shows the aggregation concept.



Figure A-1 Extended Insight data aggregation

Until the storage period for aggregation level 1 is reached, data for all four aggregation levels exist in parallel. If the data becomes older than the storage period of aggregation level 1, it only exists in aggregation level 2 to 4, if the data becomes older than the storage period of aggregation level 2, it only exists in aggregation level 3 and 4; and so on.

Optim Performance Manager stores the data in the partitioned tables. One partitioned table exists for each aggregation level. The aggregation level is appended to the table name. For example the transaction execution information is stored in the following tables:

- E2E\_TRANSACTION\_EXECUTIONS\_1 Contains transaction execution information for aggregation level 1.
- E2E\_TRANSACTION\_EXECUTIONS\_2 Contains transaction execution information for aggregation level 2.

- E2E\_TRANSACTION\_EXECUTIONS\_3 Contains transaction execution information for aggregation level 3.
- E2E\_TRANSACTION\_EXECUTIONS\_4 Contains transaction execution information for aggregation level 4.

To display the extended insight data on Extended Insight Dashboard, Optim Performance Manager chooses the optimal aggregation level. For example, if you select a monitoring time frame of a few hours in history and the end of storage period of aggregation level 1 is within these hours, then the data from aggregation 2 is displayed for the whole monitoring timeframe. Another example is that if you select a long monitoring time frame and the data of aggregation level 2 is available for the whole monitoring time frame but would result in too many data points to be displayed on the Extended Insight dashboard, then Optim Performance Manager uses data from aggregation level 3 to display.

#### A.3.2 Aggregating inflight and workload manager data

Optim Performance Manager aggregates inflight history data only if you enable the Performance Warehouse monitoring profile during monitoring configuration of a database. A screenshot of the Performance Warehouse profile is shown in Figure A-2. The Aggregation period in minutes specifies how many data entries are aggregated. The default setting of 60 minutes means that all data that Optim Performance Manager collected within 60 minutes is aggregated to one data entry. The Aggregation run interval in hours specifies how often the aggregation step takes places. The default setting of two hours means that every two hours, the collected data of the last two hours is read and aggregated according to the aggregation period setting.



Figure A-2 Performance Warehouse monitoring profile
**Note:** The event monitor paths that you specify in the Performance Warehouse profile have nothing to do with the aggregation. From Performance Expert Client, you can run SQL or activity traces based on event monitors. These trace functions belong to Performance Warehouse but the collected data is not involved in any aggregation.

Optim Performance Manager stores the aggregated data in tables in schema PWH\_<instance\_id>. The table name is the same as for the non-aggregated data, only the schema is different. For example, the inflight data about the database activity is saved in DB2PM\_<instance\_id>.DBASE and the aggregated data is saved in PWH\_<instance\_id>.DBASE.

Aggregation is only performed for the inflight data that is used in the Performance Warehouse analysis functions, such as trend analysis, reporting, queries, or rules-of-thumb. You can use Performance Warehouse analysis functions from Performance Expert Client only.

The following data is aggregated:

- Inflight data about database, buffer pool, table space, and table activity
- Database manager and database configuration data
- DB2 Workload Manager data
- Optional operating system data if CIM OS Data monitoring profile is enabled

The following data is not aggregated:

- Inflight data about connections, locks and dynamic SQL
- Inflight data about table space disk usage and containers

### A.4 Deleting data from the repository database

Optim Performance Manager's repository server deletes the collected data that resides in the SHORTTERM\_<instance\_id> table space automatically once the specified retention period is reached. The SHORTTERM\_<instance\_id> table space stores all the data that you can monitor from the Optim Performance Manager web console. In this chapter, we refer to this data as *history data*. You can set the retention period using configuration wizard opened from the Manage Database Connection panel. In A.4.1, "How the repository server deletes history data", we provide the algorithm that the Optim Performance Manager repository server uses to delete the data.

If disk space for the history data is a concern, you can manage disk space consumption by adapting the monitoring profiles using the Configure Monitoring wizard. You can

- ► shorten the retention time.
- increase the collection intervals.
- disable monitoring profiles completely or partially.

2.4, "Capacity planning" on page 34 provides the formulas that you can use to calculate your disk space consumption in advance. A.1, "Tables in the repository database" on page 438 provides which tables are affected if you increase the collection intervals of monitoring profiles or disable monitoring profiles. For example, if you have already collected data for a while, then you know which tables are the biggest. Based on that, you could adapt the appropriate collection settings.

If you have to delete data from the history data immediately, for example, you receive the disk full error messages in the db2pesrv.log file, you can use the delhistory script that comes with Optim Performance Manager. A.4.2, "Deleting history data using the delhistory script" describes how to use this script. The delhistory script does not delete extended insight data. To delete extended insight data manually, we provide a few hints in A.4.3, "Deleting extended insight data manually" on page 458

If you collect long-term history data by having the Performance Warehouse monitoring profile enabled, you have to maintain the data manually. The long-term history data is saved in the LONGTERM\_<instance\_id> table space. The size of the LONGTERM\_<instance\_id> table space is usually much smaller than of the SHORTTERM\_<instance\_id> table space because Optim Performance Manager stores aggregated data in the long-term history. It is useful to keep this data for a long time (for example, months or even years) for trend analysis or capacity planning purposes. Refer to A.4.4, "Deleting aggregated long-term history data manually" on page 459 for maintaining the long-term history data manually.

### A.4.1 How the repository server deletes history data

When configuring a database for monitoring, you can specify the retention time and storage period of the collected data as shown in Figure A-3 on page 455. The data retention time is used for history data that you can display on the Inflight Dashboards, the Workload Manager configuration, or in the Reports. The storage period is used for data that you can display on the Extended Insight Dashboard.

When the retention or storage period is reached, The repository server of Optim Performance Manager deletes the data automatically.

Retention times and sampling intervals				
Specify how long to keep performance data and how often to collect performance data.				
Database information co	ollection settings			
Database information includes information and performance statistics about the data server, caches, buffers and other objects.				
Data retention in hours:	200			
Sampling rate in minutes:	1			
Workload information re	etention settings			
Workload information includes performance statistics about transactions and SQL statements. The aggregation levels control the amount of stored data. You can specify how long to keep data at each aggregation level.				
Aggregation level	Storage period			
1: 1 minute	1 month			
2: 15 minutes	2 months			
3: 1 hour	3 months			
4: 1 day 2 years 🔍				
	OK Cancel			

Figure A-3 Retention times and storage period settings

### Deleting inflight, workload manager, and report history data

The inflight and report history data is stored in the tables with schema DB2PM\_<instance\_id> and reside in the table space SH0RTTERM\_<instance\_id>. All tables containing monitoring data in schema DB2PM\_<instance\_id> that do not begin with prefix E2E belong to this category. Optim Performance Manager uses the following approach to delete the history inflight, workload manager, and report data:

- Every half an hour the repository server checks for data that should be deleted. The first check takes place after the repository server run for half an hour.
- The retention time is calculated between the newest data and the oldest data in a table containing monitoring performance data for a monitored database. If a database is currently not monitored, no new data is coming in. In this case the history data is not deleted. This avoids having an empty history if a database is not monitored for a while.
- If the repository server runs once a while only, then the data volume that exceeds the retention period and should be deleted can be high. If the repository server would try to delete all the to-be-deleted data at once, it can lead to log full problems in the repository database. To avoid log full problems,

the repository server deletes, at one time, only the amount of data that was collected in a time frame which is twice of the cleanup interval. The cleanup interval is 30 minutes (see first bullet). This means that the repository server deletes every half hour data of a one-hour interval. It can take a while for the repository server to catch up with the data deletion if it does not run constantly.

### **Deleting Extended Insight history data**

Extended Insight history data is stored in partitioned fact tables in schema DB2PM\_<instance\_id> and reside in table space SHORTTERM\_<instance\_id>. The table names begin with prefix E2E. Optim Performance Manager uses the following approach to delete the Extended Insight history data:

- Every half an hour Optim Performance Manager repository server checks for data that should be deleted. The first check takes place after the repository server run for half an hour.
- The storage period is calculated between the newest data and the data of the oldest partition in a partitioned table storing extended insight data for a monitored database. If a database is currently not monitored then no new data is coming in. In this case the history data is not deleted. This avoids having an empty history if a database is not monitored for a while. The time frame.
- Each partition contains data of a fixed range. Only if the complete range of a partition exceeds the storage period the partition is detached and dropped. The partition ranges for the four aggregation levels are the following:
  - Aggregation Level 1: 2 hours
  - Aggregation Level 2: 12 hours
  - Aggregation Level 3: 168 hours
  - Aggregation Level 4: 720 hours

### A.4.2 Deleting history data using the delhistory script

You can use the delhistory script to delete history data that you can display on the Optim Performance Manager web console on the Inflight Dashboards, Workload Manager configuration or in the Reports.

**Note:** The delhistory script does not delete history data that you can monitor from the Extended Insight dashboard.

The delhistory script is available in the Repository/bin directory of the Optim Performance Manager installation. On Windows, it is named delhistory.bat and

on Linux and UNIX, it is named delhistory.sh. Run the delhistory script without any parameters to show the syntax. See Example A-1 for Windows.

Example A-1 delhistory syntax

```
C:\Program Files\IBM\OPM\RepositoryServer\bin>delhistory
Usage: delhistory nodename hours [dbname]
Description:
Delete all rows from history tables in the specified monitored instance, which
are older than the specified number of hours.
Parameter 'nodename' specifies the nodename of the remote monitored instance as
defined in OPM Server (displayed by 'peconfig').
Optional parameter: 'dbname' is the name of the OPM database, default is
'PERFDB
'Examples:
    delhistory NODE9194 24 : deletes all rows older than 1 day
    delhistory NODE9194 0 : deletes all rows
Attention: Run this script only when the server does not currently collect
history for this monitored instance.
```

The script exports the remaining data that should not be deleted into the temporary directory, for example /tmp on Linux and UNIX, and imports it back using the REPLACE option. Using the **EXPORT** and **IMPORT** commands, the data deletion is not logged and therefore avoids that you run into log full problems during data deletion.

**Tip:** Before you run the delhistory script check the available free space in the temporary directory and increase it if necessary.

If your table spaces are SMS table spaces, the free disk space is given back immediately to the operating system after deleting the data. But if your table spaces are DMS or Automatic Storage table spaces, the disk space is released back to the operating system only if the table space high water mark is lowered as well.

Refer to DB2 Information Center for more information about the high water mark:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.d b2.luw.admin.dbobj.doc/doc/c0055399.html

Refer to DB2 Information Center for more information about how the storage is released back to the operating system:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.d b2.luw.admin.dbobj.doc/doc/c0055392.html

### A.4.3 Deleting extended insight data manually

Extended Insight history data is stored in partitioned fact tables in schema DB2PM\_<instance\_id> and reside in table space SH0RTTERM\_<instance\_id>. The table names begin with prefix E2E. If you must delete data immediately because of disk spaces shortages and you cannot wait until Optim Performance Manager deletes the data automatically, use the following approach:

- Use the db21ook command to determine the DDL and the partition names of the following partitioned tables, where <x> refers to the aggregation level:
  - E2E\_STATEMENT\_EXECUTIONS\_<x>
  - E2E\_STATEMENT\_SRV\_EXECUTIONS\_<x>
  - E2E TRANSACTION EXECUTIONS <x>
  - E2E TRANSACTION EXECUTIONS M <x>

Example A-2 is an example for a DDL returned by the **db21ook** command. The columns names are replaced by dots since they are not important here.

Example A-2 Extended Inisght history data table DDL

```
CREATE TABLE "DB2PM 7 "."E2E STATEMENT SRV EXECUTIONS 3" (....)
VALUE COMPRESSION
PARTITION BY RANGE ("COLLECTION TIMESTAMP")
(PART "PARTO" STARTING(MINVALUE) ENDING('1970-01-01-00.00.00.000000')
EXCLUSIVE IN "SHORTTERM 7", PART "1282348800000"
STARTING('2010-08-21-00.00.00.000000') ENDING('2010-08-28-00.00.00.000000')
EXCLUSIVE IN "SHORTTERM 7", PART "1282953600000"
STARTING('2010-08-28-00.00.00.000000') ENDING('2010-09-04-00.00.00.000000')
EXCLUSIVE IN "SHORTTERM 7", PART "1283558400000"
STARTING('2010-09-04-00.00.00.000000') ENDING('2010-09-11-00.00.00.000000')
EXCLUSIVE IN "SHORTTERM 7", PART "1284163200000"
STARTING('2010-09-11-00.00.0000000') ENDING('2010-09-18-00.00.0000000')
EXCLUSIVE IN "SHORTTERM 7", PART "1284768000000"
STARTING('2010-09-18-00.00.00.000000') ENDING('2010-09-25-00.00.00.000000')
EXCLUSIVE IN "SHORTTERM 7", PART "1287187200000"
STARTING('2010-10-16-00.00.00.000000') ENDING('2010-10-23-00.00.00.000000')
EXCLUSIVE IN "SHORTTERM 7");
```

 Detach a partition by altering the tables and then drop the table created from the detach step. Start with the oldest partition in a table.

This is an example for detaching and dropping a partition from the DDL listed in Example A-2:

```
ALTER TABLE DB2PM_7.E2E_STATEMENT_SRV_EXECUTIONS_3 DETACH PART
"1282348800000" INTO junk;
DROP TABLE junk;
```

### A.4.4 Deleting aggregated long-term history data manually

Here we provide a script for you to delete the aggregated long-term history data. Long-term history data is stored if the Performance Warehouse monitoring profile is enabled. The data is stored in tables in schema PWH\_<instance\_id>. The tables reside in the LONGTERM\_<instance\_id> table space. The script shown in Example A-3 contains a set of DELETE statements that delete data older than a specified timestamp from the long-term history tables.

```
Example A-3 Long-term data deletion script
```

```
#! /usr/bin/ksh
*******
# call the script as DB2 instance owner
# Syntax:
# -d PE database name (required)
# -i instance ID (required)
# -t deletion timestamp in format yyyy-mm-dd (required)
errtrap() {
       es=$?
       echo "ERROR line $1: Command exited with status $es."
       exit $es
trap 'errtrap $LINENO' ERR
cleanup() {
       exit 256
       }
trap cleanup INT TERM
SYNTAX ()
cat << EOF
Svntax
-d PE database name (required)
-i instance ID (required)
-t deletion timestamp in format yyyy-mm-dd (required)
EOF
while getopts ":od:i:t:" opt; do
      case $opt in
          d ) PEDBNAME=$OPTARG
           if [ -z "$PEDBNAME" ]; then
          SYNTAX
          exit -1
          fi;;
           i ) PEINSTID=$OPTARG
          if [ -z "$PEINSTID" ]; then
          SYNTAX
           exit -1
          fi;;
          t) PEDATE=$OPTARG
           if [ -z "$PEDATE" ]; then
          SYNTAX
           exit -1
          fi;;
          o ) set -o xtrace;;
           /? ) SYNTAX
          exit -1
```

```
esac
done
## connect the PE server database
tran - FRR
(db2 -o- CONNECT TO $PEDBNAME)
PECONNECTED=$?
trap 'errtrap $LINENO' ERR
if (( $PECONNECTED!=0 )); then
    print "Failed to connect to the database return code="$PECONNECTED
    exit $PECONNECTED
    fi
## delete from the PWH tables
(db2 -t -n "DELETE from PWH $PEINSTID.DBASE where INTERVAL TO
             < '$PEDATE-00.00.000000';")
(db2 -t -n "DELETE from PWH $PEINSTID.BUFFERPOOL where INTERVAL TO
             < '$PEDATE-00.00.000000';")
(db2 -t -n "DELETE from PWH $PEINSTID.TABLE where INTERVAL TO
             < '$PEDATE-00.00.000000';")
(db2 -t -n "DELETE from PWH $PEINSTID.TABLESPACE where INTERVAL TO
            < '$PEDATE-00.00.000000';")
(db2 -t -n "DELETE from PWH $PEINSTID.DBCFG where INTERVAL TO
             < '$PEDATE-00.00.000000';")
(db2 -t -n "DELETE from PWH $PEINSTID.DBMCFG where INTERVAL TO
            < '$PEDATE-00.00.000000';")
## delete data from PWH OS tables. They only contain data if CIM is enabled
#(db2 -t -n "DELETE from PWH $PEINSTID.OSCFG where INTERVAL TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH $PEINSTID.CPU where INTERVAL TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH $PEINSTID.DISK where INTERVAL TO
             < '$PEDATE-00.00.00.000000';")
#(db2 -t -n "DELETE from PWH_$PEINSTID.OSSTATISTICS where INTERVAL_TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH $PEINSTID.CPUSTATISTICS where INTERVAL TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH $PEINSTID.DISKSTATISTICS where INTERVAL TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH $PEINSTID.FILESYSTEM where INTERVAL TO
             < '$PEDATE-00.00.000000';")
#
## delete data from PWH WLM tables. They only contain data if DB2 V9.5
## is monitored
#(db2 -t -n "DELETE from PWH $PEINSTID.SCSTATS where INTERVAL TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH_$PEINSTID.WCSTATS where INTERVAL_TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH $PEINSTID.WLSTATS where INTERVAL TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH $PEINSTID.HISTOGRAMBIN where INTERVAL TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH_$PEINSTID.SERVICECLASSES where INTERVAL_TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH_$PEINSTID.THRESHOLDS where INTERVAL_TO
             < '$PEDATE-00.00.00.000000';")
#(db2 -t -n "DELETE from PWH_$PEINSTID.WORKACTIONS where INTERVAL_TO
             < '$PEDATE-00.00.000000';")
#(db2 -t -n "DELETE from PWH $PEINSTID.WORKACTIONSETS where INTERVAL TO
             < '$PEDATE-00.00.00.000000';")
#(db2 -t -n "DELETE from PWH_$PEINSTID.WORKCLASSES where INTERVAL_TO
             < '$PEDATE-00.00.000000';")
```

## A.5 Automatic runstats and reorganization in the repository database

The Optim Performance Manager installer creates the repository database and enables automatic table maintenance in the database configuration. For DB2 9.7, this action results to the configuration parameter settings for the repository database as shown in Figure A-4.

Automatic maintenance Automatic database backup Automatic table maintenance Automatic runstats Automatic statement statistics Automatic statistics profiling Automatic profile updates Automatic reorganization	(AUTO_MAINT) (AUTO_DB_BACKUP) (AUTO_TBL_MAINT) (AUTO_RUNSTATS) (AUTO_STMT_STATS) (AUTO_STATS_PROF) (AUTO_PROF_UPD) (AUTO_REORG)		ON OFF ON ON OFF OFF ON
--	--	--	---

Figure A-4 Automatic maintenance settings

Automatic table maintenance includes automatic reorganization and automatic statistic collection. The automatic statistic collection is an online activity, but the automatic reorganization is an offline activity. This means that you must define an offline maintenance window to let the reorganization activity take place. You can specify an offline maintenance window using the Configure Automatic Maintenance wizard from DB2 Control Center.

For online activities, a default maintenance window is already set. You can change it using the Configure Automatic Maintenance wizard.

**Note:** Optim Performance Manager requires that the automatic maintenance is enabled for the repository database. If you disable the automatic maintenance manually in the database configuration, then Optim Performance Manager enables it again.

### A.6 Backing up the repository database

Whether you implement a backup strategy for the repository database depends on the importance of the collected data. Here are a few considerations that may help to decide how often you back up the repository database:

- As a minimum backup, initially, back up the repository database after you configured your monitored databases. This action prevents you from loosing any configurations you have done. Additionally, back up the repository database whenever you have performed major changes to the configuration.
- If you collect performance data mainly for troubleshooting purposes, and have set retention times of a few days only, then the minimum backup concept might be suitable for you.
- If you collect long-term data or have set long retention times for trend and capacity planning purposes then backup that repository database regularly in order to not loose the long-term data.

# A.7 Changing database configuration of the repository database

To benefit from the DB2 autonomic features, Optim Performance Manager creates the repository database with self tuning memory set to on. In addition, all database configuration parameters that are set to AUTOMATIC by default are not changed by Optim Performance Manager.

For some non-automatic configuration parameters, Optim Performance Manager requires initial settings and changes the configuration parameters after creating the repository database. Examples of changed parameters are:

- ► AUTO\_MAINT
- ► AUTO\_RUNSTATS
- AUTO\_REORG
- ► AUTO\_TBL\_MAINT
- ► CATALOGCACHE\_SZ
- ► CHNGPGS\_THRESH

- ► LOGFILSIZ
- ► LOGBUFSZ
- LOGPRIMARY
- LOGSECOND
- SOFTMAX
- ► UTIL\_HEAP\_SZ
- ► LOCKTIMEOUT

In general, you can adapt database configuration parameters of the repository database if your environment requires that. Optim Performance Manager checks whether the parameters that require initial settings are changed. If numeric parameters are changed to lower values or string parameters are set to a different value, Optim Performance Manager changes them back to the setting it requires. If the numeric parameters are changed to higher values than required, Optim Performance Manager does not touch them. Optim Performance Manager does this check during the following operations:

- > You start the **peconfig** configuration tool.
- You configure a database for monitoring in the web console or change an existing configuration.
- ► You enable or disable monitoring of a database in the web console.

If you have to change configuration parameters, it is most likely that you have to increase parameters that affect logging such has L0GFILSIZ, L0GPRIMARY, or L0GSECOND. The amount of log records depend on the amount of monitoring data that is inserted and deleted from the repository database for all monitored database. If the repository database runs out of log space then you receive the SQL0964N error message in the db2pesrv.log file. If you get this error repeatedly then increase the following configuration parameters:

- ► LOGFILSIZ
- ► LOGPRIMARY
- ► LOGSECOND

Make sure that you have enough space available in the path used for the log files. Check the Path to log files in the database configuration which path is used. We recommend that you separate log files into a separate path that does not include table spaces of the repository database in order to avoid I/O bottlenecks. You can change the log path by setting the NEWLOGPATH configuration parameter.

By default, the repository database is set up for circular logging. If you prefer another log method, you can change the database configuration appropriately.

## A.8 Enabling row compression for the repository database

Currently, Optim Performance Manager stores the data in an uncompressed format. You can enable row compression for the repository database to save disk space. The following technote describes how to do that:

http://www-01.ibm.com/support/docview.wss?uid=swg21442681

**Tip:** Take a look at this technote even if you don't want to enable row compression. This technote lists which tables of the repository database store data for which monitoring profiles.

### A.9 Setting up HADR for the repository database

If you want to set up high availability disaster recovery (HADR) for the repository database then you get step-by-step guidance from the following technote:

http://www-01.ibm.com/support/docview.wss?uid=swg21442697

### A.10 Using the configuration program peconfig

The **peconfig** program was part of DB2 Performance Expert and is still supported by Optim Performance Manager. Using peconfig you can perform the following configuration tasks in an interactive mode or in a silent mode:

- Add remote DB2 instances for monitoring.
- Remove local and remote DB2 instances from monitoring.
- Enable, disable, or change monitoring for DB2 instances.
- Add databases for monitoring.
- Remove databases from monitoring.
- Enable or disable deadlock event monitoring.
- List added DB2 instances and databases.
- Restart monitoring for single monitored DB2 instances.

To use peconfig in an interactive mode, you can run it as command line program or graphical user interface program. From the RepositoryServer/bin directory, call **peconfig** to start the graphical user interface or call **peconfig -console** to start it as command line program. If you have installed Optim Performance Manager on Windows, then the program start menu has the following entries to start peconfig in graphical or console mode:

- Connection configuration
- Connection configuration (Command line)

peconfig still follows the approach of DB2 Performance Expert architecture where you added DB2 instances for monitoring and not single databases as in Optim Performance Manger. The advantage of this configuration method is that after you register a DB2 instance for monitoring, you can add all its cataloged databases for monitoring in one step. However, all databases of a DB2 instance that you add by using the peconfig program have the same default monitoring values such as retention times and collection intervals. You can change the monitoring settings later using the Configure Monitoring wizard from the Optim Performance Manager web console. The changes for one database apply to all other monitored database of the DB2 instance that are added using peconfig. Depending on your monitoring requirements, this can be considered as a disadvantage.

To get a list of commands that you can use in the peconfig command line prgram, refer to the Information Center at

http://publib.boulder.ibm.com/infocenter/idm/docv3/topic/com.ibm.datatools.perf
mgmt.installconfig.doc/reference\_configuration.html

You can also perform the configuration using peconfig in silent mode. This is a way to configure multiple DB2 instances and databases for monitoring in unattended batch mode. To perform a silent configuration, follow these steps:

► Prepare a response file.

A sample response file, peresp.txt, can be found in the bin subdirectory of the installation directory. This file contains detail information about performing a configuration in silent mode, including instructions, syntax, a template, and examples. For the purpose of this book, we have the Optim performance Manager installed on an AIX machine and the path to the response file is /opt/IBM/0PM/RepositoryServer/bin.

Execute the silent configuration.

Run the following command from the bin subdirectory of the installation directory:

peconfig -silent /opt/IBM/OPM/RepositoryServer/bin/peresp.txt

where peresp.txt represents the name of your response file. Performing
silent configuration will create the log file pesilent.trc in
<working\_dir>/<InstName>, where InstName represents the name of the DB2
instance on which the Optim Performance Manager Server runs.

Additionally to the interactive and silent mode peconfig provides external commands that you can use in scripts or batch files to automate configuration changes. Using external commands you can perform the following tasks:

- ► Enable or disable monitoring for DB2 instances.
- Change passwords to be used to access monitored DB2 instances.
- Add databases for monitoring.
- Remove databases from monitoring.
- Enable or disable deadlock event monitoring.
- List added DB2 instances and databases.
- Crypt passwords in silent configuration files.
- ► Restart monitoring for single monitored DB2 instances.

The external commands are described in the DB2 Performance Expert Information Center using the following link:

http://publib.boulder.ibm.com/infocenter/idm/v2r1/index.jsp

# A.11 Changing Java heap size parameters of the repository server

The Java heap size parameters specify the minimum amount of memory that the repository server allocates at start up and the maximum amount of memory that the repository server uses at run time.

By default, the minimum value for the JVM heap size parameter is 128 MB; the maximum value is 1024 MB on UNIX and Linux and 768 MB on Windows.

Increasing or decreasing the values depend on these conditions:

- You might have to increase the minimum value if many applications and processes run on the same system, on which repository server is installed. This ensures that the repository server process can allocate a specific amount of memory to run without out-of-memory errors.
- You might have to decrease the minimum value if the workload is small, for example, if you use Performance Expert only for a test system.
- You might have to increase the maximum value if you have many monitored DB2 instances with many partitions or database objects, such as LCONTAINERS, or if many monitoring functions are active. This ensures that the repository server can allocate enough memory to run without out-of-memory errors.
- You might have to decrease the maximum value if you experience that a lower value is sufficient.

The db2pesrv.log file indicates if you have to change the Java heap size parameters. A sample error message for this situation is the following:

There is insufficient memory to process all statement metrics data from this database. Optim Performance Manager shuts down monitoring for this database.

User response: Increase maximum Java heap size parameter and restart the Optim Performance Manager Repository Server.

In our book test environment, we resolve this error message by increasing the minimum value of the JVM heap size parameter to ensure that the heap size required for the repository server is allocated right after startup.

If you must increase or decrease minimum or the maximum value of the JVM heap size parameter, complete the following steps. The steps are for a Linux or UNIX environment, and can be applied to Windows accordingly:

- 1. Stop repository server with the **pestop** command.
- 2. Log on as root.
- 3. Change to the directory *<install dir server*>/RepositoryServer/bin, where *<install dir server*> is the installation directory of Optim Performance Manager.
- 4. Open the script pestart and search for this line:

-Xms128m -Xmx1024m

This means that the Java parameter for minimum heap size is set to 128 megabytes, and that the Java parameter for maximum heap size is set to 1024 megabytes.

- 5. Edit the line by changing the value of the parameter to -Xms128m or -Xmx1024m accordingly.
- 6. Log on as the DB2 instance owner.
- 7. Start repository server again with **pestart** command.

### A.12 Determining collection interval bottlenecks

Optim Performance Manager collects monitoring data in intervals. A collection step includes retrieving the monitoring data from the monitored database and inserting it into the repository database. Depending on the amount of monitoring data retrieved from the monitored database and the memory and CPU resources of the Optim Performance Manager machine the interval might be too short to complete the collection step. The collection steps are executed in sequence, one does not start before the previous completed. If the interval is too short to complete the collection step then collection steps are queued which results in a

permanently busy Optim Performance Manager machine and in unsteady collected monitoring data.

The db2pesrv.log file indicates too short collection intervals by posting appropriated messages.

### A.12.1 Determining inflight and report data collection bottlenecks

If the collection interval of inflight and report data is too short to complete the collection step, you find messages similar to the following in the db2pesrv.log file or on the pestart console:

[20:08:10.42 ][5]Snapshot time[s][137] exceeds iteration time. Tip: Increase snapshot interval.

[5] indicates that this message belongs to monitored database with instance ID 5 and [137] indicates that the collection step took 137 seconds.

If you see such messages for the same monitored database often, increase collection intervals using the following approach:

- Determine to which database this message belongs. Call peconfig -list from the <install dir>/RepositoryServer/bin directory and look up the monitored database having the instance ID as posted in the message, in our example instance ID 5.
- 2. In the Optim Performance Manager web console, go to the Manager Database Connection panel, open the Configure Monitoring wizard for this database and move to step 2 in this wizard.
- 3. Either increase the base collection interval or increase the collection interval of single monitoring profiles.
  - To increase the base collection interval, open the *Retention times and sampling intervals* dialog from step 2 of the Configure Monitoring wizard and increase the sampling rate in minutes. Because changing the base sampling rate overrides all custom sampling rates, we recommend to choose this method if you have not customized sampling rates of the single monitoring profiles before.
  - To increase sampling rates of single monitoring profiles, edit the following monitoring profiles and specify a higher sampling rate:
    - Locking Snapshot data per single lock and per connection
    - Active SQL and Connection Snapshot data per connection
    - Dynamic SQL Snapshot data per statement in the package cache

The sampling rate must be a multiplier of the base sampling rate. You do not have to increase the sampling rate for all of these monitoring profiles at once. For example, increase the sampling rate of one monitoring profile and after a period of a few intervals, check whether you still receive this message. If so, then increase another one. Unfortunately, the message does not tell you for which monitoring profile you receive this message, therefore, you have to try out to determine the one that you have to increase the value. All of them are candidates for a high amount of monitoring data. We recommend that you start with the one where you typically expect the highest amount of monitoring data.

4. If the monitored database is a partitioned database, reducing the number of monitored partitions also helps to avoid collection bottlenecks. You can reduce the number of monitored partitions by defining partition sets. A partition set contains the partitions for that you want to collect monitoring data. Partition sets can be defined in step 5 of the Configure Monitoring wizard.

### A.12.2 Determining Extended Insight data collection bottlenecks

If you collect Extended Insight data for a monitored database of DB2 9.7 Fix Pack 1 or higher and within the Extended Insight monitoring profile, you have the collection of transaction metrics on data server enabled, the unit of work event monitor is created on the monitored database. Optim Performance Manager uses a fixed interval to read and flush data from the unformatted event monitor table. See Appendix B, "Optim Performance Manager footprint" on page 471 to learn more about how Optim Performance Manager uses this event monitor. If it takes too long to read and flush the data from the event monitor table and transfer it to the Optim Performance Manager machine, you might see an error message similar to the following in the db2pesrv.log file.

[10:28:26.617] [7] Error: The monitored data could not be processed within [180000] milliseconds by Monitor [opmuow1].

Explanation: Possible reason is that the workload is too high for the monitored DB Server and/or network to deliver the monitoring data to the OPM Server in sufficient time for it to be processed.

User response: If the problem persists, increase the network and/or DB Server capacity.

[7] indicates that this message belongs to monitored database with instance ID 7. To check which monitored database is associated with the instance ID posted in this message, call **peconfig -list** from the <install

dir>/RepositoryServer/bin directory and look up the monitored database having this instance ID.

If you receive this message repeatedly, we recommend to analyze further in order to improve the performance of reading and flushing data from the event monitor table. Some hints to improve performance are:

- If you monitor a partitioned database, then the amount of unit of work events that Optim Performance Manager has to read and flush correspond to the number of partitions that you monitor. You can reduce the number of monitored partitions by defining partition sets. A partition set contains the partitions for that you want to collect monitoring data. Partition sets can be defined in step 5 of the Configure Monitoring wizard.
- To avoid that the operations on the event monitor table impacts the workload on your monitored database as well as to avoid that the workload on your monitored database impacts reading data from the event monitor table, we recommend that you assign a dedicated table space and buffer pool for the event monitors that Optim Performance Manager creates. You can specify the table space to use in the Configure Monitoring wizard.
- We recommend that you use DB2 9.7 Fix Pack 2 or higher for the monitored database. Fix pack 2 includes a fix that reduces the CPU consumption of the unit of work event monitor.
- Monitor CPU and memory consumption over time on the Optim Performance Manager machine to check whether Optim Performance Manager has enough resources to retrieve and store monitoring data fast enough.

# Β

## **Optim Performance Manager footprint**

To collect the performance information from the monitored DB2 databases, Optim Performance Manager must take snapshots and run event monitors. Depending on the monitoring profile, Optim Performance Manager may introduce overhead on the monitored database and monitored application. In this appendix, we describe what Optim Performance Manager does on your monitored database and the monitored application. We highlight the monitors that might have overhead for your attention.

# **B.1 Optim Performance Manager footprint on the monitored database**

Optim Performance Manager retrieves information from monitored database by two means: calling snapshot and reading from the DB2 event monitors. When you configure the monitoring profile for a monitored database, the DB2 monitor switches and DB2 event monitors are turned on or turned off.

Figure B-1 on page 473 shows the step 2 of the configuring monitoring profile. When you enable a monitoring profile in this step, the corresponding DB2 monitor switches or DB2 event monitors are turned on on the monitored database to allow Optim Performance Manager to get snapshots or read event monitors to provide the monitoring information you require. When you disable a monitoring profile, the corresponding DB2 monitor switches or DB2 event monitors are turned off on the monitored database.

Chan 2 of C. Configure monitories and line	
Sten 7 of 5° Continuing monitoring profiles	
Use predefined template or Configure like on the previous page, then the associated profiles are enabled.	1
Selected configuration: Use existing configuration	
Monitoring settings	
Retention times and sampling intervals	
DB2 event monitor configuration	
Monitoring profiles	
Inflight performance, reporting, or Workload Manager	
These profiles collect performance statistics for the data server, which are shown in the inflight dashboards, in Workload Manager, or in the reports.	
✓ Basic	
✓ Locking	
✓ Active SQL and Connections	
✓ I/O and Disk Space	
🗹 Workload Manager 🖉	
🗹 Dynamic SQL	
Extended Insight	
This profile is available only if the Extended Insight feature is installed. This profile collects end-to-end performance statistics for the data server, the network, and the applications. These statistics are shown on the Extended Insight Analysis dashboard.	;
✓ Collect Extended Insight data	
DP2 Reviewance Except Client	
These profiles apply only if you are using the previous Performance Expert Client application. These statistics	
are not displayed in the Optim Performance Manager dashboards, but are shown in the Performance Expert Client.	
🗹 CIM OS Data	
Performance Warehouse	
< Previous Next > Finish Cancel	1

Figure B-1 Configuring monitoring profile

Turning on DB2 monitor switches or enabling DB2 event monitors on monitored database may cause some performance overhead. In step 3 of configuring monitoring profile (Figure B-2 on page 474), Optim Performance Manager uses a small yellow triangle to highlight the DB2 snapshots and event monitors that may cause unwanted performance overhead on the monitored database.

Edit Monitoring Confi	guration		
Step 3 of 5: View Result	ing DB2 Settings		
The following monitor switc	hes and configuration sett	ings will be set for this database	e based on the monitoring
profiles that you specified.	Warning icons indicate any	y configuration settings that mig	ght cause increased overhead.
Monitor switches		Event monitors	
DFT_MON_BUFPOOL	ON	For package cache	ON
DFT_MON_SORT	ON	For unit of work	ON 🛕
DFT_MON_LOCK	ON	For locks	ON
DFT_MON_STATEMENT	ON	Deadlock events	ON
DFT_MON_TABLE	ON	Lock wait threshold	ON
DFT_MON_TIMESTAMP	ON	Lock timeout events	ON
DFT_MON_UOW	ON	Lock timeout	Unlimited
		For WLM statistics	ON
Construction and the stand			
Snapsnots collected	1/50	Others	
DBM	YES	Others	-1 ON
Database:	YES	Extended Insight monitor	
Application		CIM US data	ON (Changed)
LOCK	YES A	A	Impact on performance
Container data	YES A	200	1 inpact on performance
Buffer pool	VES		
Dynamic SOL	VES		
Table	YES A		
	120 22		
			Copy to Clipboard Print
		< Previous	Next > Finish Cancel

Figure B-2 DB2 settings

When you move the mouse over the yellow triangle, a message pops up to indicate the possible overhead. Figure B-3 on page 474 shows the pop-up message when we move the mouse over the yellow triangle of Table.



Figure B-3 Hint about monitoring overhead

Table B-1 on page 475 lists the monitoring profiles and their corresponding monitor switches, snapshots, and event monitors that will be turned on or created

when a monitoring profile is enabled. When the monitoring profile is disabled, the corresponding DB2 event monitor will be dropped.

Enabled monitoring profile	Enabled secondary monitoring profile	DB2 monitor switches to be turned on	DB2 snapshots collected	DB2 event monitor to be created
Basic	N/A	DFT_MON_SORT, DFT_MON_TIMESTAMP	DBM, Database	N/A
Lock	Lock waiting alert	N/A	N/A	Lock event monitor for lock wait
Lock	Lock timeout alert	N/A	N/A	Lock event monitor for lock timeout
Lock	Deadlock alert	N/A	N/A	Lock event monitor for deadlock, or deadlock event monitor for DB2 9.1 or DB2 9.5
Lock	Collect lock wait information	DFT_MON_LOCK, DFT_MON_STMT, DFT_MON_TIMESTAMP	Application, Lock	N/A
Active SQL and Connections	N/A	DFT_MON_SORT, DFT_MON_STMT, DFT_MON_TIMESTAMP, DFT_MON_UOW	Application	N/A
I/O and Disk Space	Collect table information	DFT_MON_BUFPOOL, DFT_MON_TABLE, DFT_MON_TIMESTAMP	DBM, Database, Buffer pool, Table	N/A
I/O and Disk Space	Collect table space information without container information	DFT_MON_BUFPOOL, DFT_MON_TIMESTAMP	DBM, Database, Table space snapshot without Container data, Buffer pool	N/A
I/O and Disk Space	Collect table space information with container information	DFT_MON_BUFPOOL, DFT_MON_TIMESTAMP	DBM, Database, Table space snapshot with Container data, Buffer pool	N/A
Workload Manager	N/A	N/A	N/A	Statistic event monitor
Dynamic SQL	N/A	DFT_MON_STMT, DFT_MON_TIMESTAMP	Dynamic SQL	N/A
Collect Extended Insight Data	Collect statement and transaction metrics on client	DFT_MON_STMT (DB2 9.1 or DB2 9.5)	N/A	Package cache event monitor (DB2 9.7 or higher)

Table B-1 Monitoring profiles, monitoring switches, snapshots, and event monitors

Enabled monitoring profile	Enabled secondary monitoring profile	DB2 monitor switches to be turned on	DB2 snapshots collected	DB2 event monitor to be created
Collect Extended Insight Data	Collect statement and transaction metrics on client and Collect statement metrics on data server	N/A	N/A	Package cache event monitor
Collect Extended Insight Data	Collect transaction metrics on data server	N/A	N/A	Unit of work event monitor

Table B-2 shows the relationship between monitoring profiles and dashboards. When a monitoring profile is enabled, the related monitoring data will be presented on corresponding dashboards.

 Table B-2
 Monitoring profile verses dashboard

Dashboard	Monitor	Monitoring profile						
	Basic	Locking	Active SQL and Connections	I/O and Disk Space	Workload Manager	Dynamic SQL	Extended Insight	
Overview	Y	Y	Υ				Υ	
Active SQL			Υ					
BPIO	Y			Y				
Locking		Y						
Logging	Y							
Memory	Y		Υ					
System	Y							
Utilities	Y							
Workload	Y							
Extended Insight								
Report			Y	Y	Y	Υ		
Workload Manager configuration					Y			

### **B.1.1 DB2 monitor switches**

Optim Performance Manager turns on or off the DB2 monitor switches by updating the database manager configuration parameters with the following commands:

db2 update dbm cfg using *switch\_name* on db2 update dbm cfg using *switch\_name* off

However, if the monitored system is an SAP system, the monitor switches are not turned off when the monitoring profile on Optim Performance Manager is disabled. To learn more about monitoring SAP with Optim Performance Manager, see Chapter 12, "Monitoring SAP environments" on page 423.

Table B-3 shows the information retrieved by Optim Performance Manager (DBM) when each DB2 monitor switch is turned on respectively.

Table B-3	Information retrieved by	Optim F	Performance	Manager when	DB2 Monitor	Switch is turned on
-----------	--------------------------	---------	-------------	--------------	-------------	---------------------

Monitor switch	Database manager configuration parameter	Information Optim Performance Manager obtains
BUFFERPOOL	DFT_MON_BUFPOOL	Number of reads and writes, time taken
SORT	DFT_MON_SORT	Number of heaps used, sort performance
LOCK	DFT_MON_LOCK	Lock wait times, deadlocks
STATEMENT	DFT_MON_STMT	Start/stop time, statement identification
TABLE	DFT_MON_TABLE	Measure of activity (rows read/written)
TIMESTAMP	DFT_MON_TIMESTAMP	Timestamps
UOW	DFT_MON_UOW	Start/end times, completion status

For DB2 for Linux, UNIX, and Windows Version 9.1, 9.5, and 9.7, by default, all the switches listed in Table B-3 are turned off, except DFT\_MON\_TIMESTAMP, which is turned on.

To learn more about these switches, refer to the relative topics in DB2 Information Center:

▶ DB2 9.1:

http://publib.boulder.ibm.com/infocenter/db2luw/v9/index.jsp?topic=/com.ibm .db2.udb.admin.doc/doc/c0005719.html

▶ DB2 9.5:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r5/index.jsp?topic=/com.i
bm.db2.luw.admin.mon.doc/doc/c0005719.html

### ▶ DB2 9.7:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.i
bm.db2.luw.admin.mon.doc/doc/c0005719.html

### B.1.2 DB2 event monitors

Optim Performance Manager creates the event monitor tables under the schema OPM on each monitored database.

### Package cache event monitor

The package cache event monitor is supported on DB2 9.7 Fix Pack 1 or above. Package cache event monitor captures data related to statement entries that have been flushed from the database package cache. It provides the history of the contents of the package cache that which can help with SQL query performance analysis and problem determination issues. To learn more about package cache event monitor, refer to DB2 Information Center at:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/topic/com.ibm.db2.luw.admi
n.mon.doc/doc/c0056443.html

If the monitoring profile results in package cache event monitor created, Optim Performance Manager creates one package cache event monitor on the monitored database. The package cache event monitor is named as 0PMP followed by a hash code that uniquely identifies the Optim Performance Manager server which created the event monitor. For example, a package cache event monitor may be named as 0PMPAZ1AKZ. When a record is flushed from the DB2 package cache, the package cache event monitor writes data into an unformatted event table which is created in schema 0PM. The event table has the same name as the event monitor. Once every minute, the Optim Performance Manager Server reads the contents of the unformatted event table, processes the records, and then prunes the table by deleting the processed rows. This table is re-created only when the configuration profile is changed.

The package cache event monitor will be most active when the monitored database server has a low package cache hit ratio - meaning that SQL statements are regularly being flushed out of the package cache.

The DB2 package cache event monitor was designed to collect information about SQL statements with minimal impact to the database. However, there are guidelines you can follow to minimize this impact still further:

Create a dedicated 32K table space (across all partitions) and a dedicated buffer pool, and specify that the package cache event table is to be created in the newly created table space when configuring El monitoring profile, as shown in Figure B-4 on page 479. The table space should use 32K pages because the package cache event table contains a BLOB column and a 32K page table spaces will allow the BLOB data to be stored inline (in most cases). Inlined large object data allows the BLOB to flow through the buffer pool and thus improves efficiency. In addition, you can specify the table space as auto-resize or specify a maximum percent, which is 90% by default.

Collect Extended Insight data
Collection of monitorin Usage of client field information Integration with Tivoli Monitoring
✓ Collect statement and transaction metrics on client
Currently known clients: View
Port number for the Extended Insight Opynamic
Custom * 6666
Use logical database lookup name:
Package cache event monitor settings:
Tou can override the derault table space that is used to monitor event data.
Maximum table space fill size in percent: 90
✓ Collect statement metrics on data server
✓ Collect transaction metrics on data server
UOW event monitor settings: You can override the default table space that is used to monitor event data.
✓ Use custom table space: IRWWDATA1 ▼
✓ Maximum table space fill size in percent: 90
OK Cancel

Figure B-4 Use custom table space for the package cache event table

- To account for peak periods, size the buffer pool to hold approximately two to three minutes worth of package cache event monitor data. The average size one-minute size of the package cache event monitor data can be calculated by estimating the transaction size in one minute, which is dependent on how much workload is running and monitored. This will allow Optim Performance Manager to read the monitor data from the buffer pool and thus reduce disk I/O.
- If at all possible, locate the package cache monitor table space on a set of dedicated disks.

### Unit of work event monitor

The unit of work (UOW) event monitor is supported on DB2 9.7 Fix Pack 1 and above. However, to improve efficiency of this monitor, we strongly recommend

installing DB2 9.7 Fix Pack 2. The unit of work event monitor records an event whenever a unit of work is completed, that is, whenever there is a commit or a rollback within the database. The recorded event is inserted, as a record, into the corresponding UOW unformatted event table. This historical information about individual units of work is useful for chargeback purposes (charging by CPU usage) and for monitoring compliance with response time service level objectives. To learn more about unit of work event monitor, refer to DB2 Information Center at:

## http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/topic/com.ibm.db2.luw.admi n.mon.doc/doc/c0055273.html

If the monitoring profile results in creating unit of work event monitor, Optim Performance Manager creates two unit of work event monitors on each monitored database. One unformatted event table is created for each unit of work event monitor to store information. Each unit of work event monitor is named with prefix followed by a hash code that uniquely identifies the Optim Performance Manager server that creates the event monitor. If the monitored database is a non-HADR database, the prefix is 0PMU. If the monitored database is an HADR database, the prefix is 0PM0. Since there are always two unit of work event monitors created, the event monitor name ends with "1" or "2" respectively. For example, on a non-HADR monitored database, the event monitors name could be 0PMU@AZ1AKZ1 and 0PMU@AZ1AKZ2.

The two event monitors do not work concurrently, instead, one is always active, whilst the other is dormant. The active monitor is collecting information about units of work executed and inserting this information (one record per UOW) into the corresponding unformatted event table. After 30 seconds, the monitors switch and the dormant monitor becomes active, whilst the active monitor becomes dormant. At this point the unformatted event table of the dormant monitor is read by Optim Performance Monitor, the data processed, and the event monitor is then re-created. When 30 seconds has elapsed, the monitors switch once again and the process is repeated. The event monitor is dropped and then re-created because this is more efficient than using the SQL DELETE statements to prune the data - primarily because DELETEs will be logged by the database server.

On non-HADR database and HADR database, the unformatted event tables are pruned using different approaches:

- Non-HADR database: The event monitors and the event tables are re-created.
- HADR database: The event monitor is pruned by deleting records in the event tables but not being re-created. In the case of HADR with read-on-standby, all the methods for effective pruning (dropping table and let event monitor recreate it) will cause the active standby to be placed on the replay-only

window, which will terminate all application connections. Therefore, if Optim Performance Manager detects that the monitored database is set up for HADR, it prunes the unformatted event table by reading and deleting the data from the event tables instead of recreating them.

On a partitioned system, the amount of data retrieved from the UOW event monitor will depend upon on the number of partitions touched by each transaction. If a transaction touches many partitions, then information related to that transaction will be placed into the UOW event table on each partition. Consequently there could be significantly more data for Optim Performance Manager to process.

The DB2 unit of work event monitor was designed to collect transaction information with minimal impact to the database. However, there are guidelines you can follow to minimize this impact still further:

Create a dedicated 32K table space (across all partitions) and a dedicated buffer pool, and specify that the UOW event tables are to be created in the newly created table space when configuring Extended Insight monitoring profile, as shown in Figure B-5 on page 482. The table space should use 32K pages because the UOW event table contains a BLOB column and a 32K page table spaces will allow the BLOB data to be stored inline (in most cases). Inlined large object data allows the BLOB to flow through the buffer pool and thus improves efficiency. In addition, you can specify the table space as auto-resize or specify a maximum percent, which is 90% by default.

Collect Extended Insight data	
Collection of monitorin Usage	of client field information Integration with Tivoli Monitoring
Collect statement and transacti	on metrics on client
Currently known clients:	View
Port number for the Extended Insig	ht 🔿 Dynamic
cient application that you configure	• Custom * 6666
Use logical database lookup nam	ne:
Package cache event monitor settin You can override the default table s	igs: ;pace that is used to monitor event data.
✓ Use custom table space: IRW	WDATA1 V
✓ Maximum table space fill size	e in percent: 90
✓ Collect statement metrics on data	ata server
Collect transaction metrics on c	lata server
UOW event monitor settings: You can override the default table s	pace that is used to monitor event data.
✓ Use custom table space: IRW	WDATA1 V
✓ Maximum table space fill size	e in percent: 90
	OK Cancel

Figure B-5 Use custom table space for UOW event tables

- Size the buffer pool to hold approximately two to three minutes worth of UOW event monitor data - to account for peak periods. This will allow Optim Performance Manager to read the monitor data from the buffer pool and thus reduce disk I/O.
- ► If at all possible, locate the UOW table space on a set of dedicated disks.
- A record is inserted into the UOW event table for each completed UOW and each of these inserts are logged by the database manager. Therefore, enabling the UOW event monitor will cause additional logging on the monitored database server. The amount of additional logging incurred is dependant upon the mix of read and write transactions within the workload being monitored. We recommended that you monitor logging activity on the monitored database server to ensure the additional logging does not become a bottleneck, and if so, tune logging related parameters accordingly.

### Deadlock event monitor and lock event monitor

The deadlock event monitor, also called legacy deadlock event monitor, is supported on DB2 9.1 and 9.5. Since DB2 9.7, the lock event monitor, also called new lock monitor, is supported. When you monitor DB2 9.7 or above on Optim

Performance Manager, you can choose to use legacy deadlock or to use new lock event monitor when configuring monitoring profile, as shown in Figure B-6 on page 483.

Locking	×
Specify the amount and type of lock information you want to collect.	
Lock event monitor	
Enable lock wait warning alert	
Lock wait threshold in microseconds: 5000000	
Enable lock timeout alert	
Lock wait timeout in seconds: Unlimited	
Enable deadlock alert	
☑ Use legacy deadlock event monitor	
☑ Use custom table space: IRWWDATA1 I	
Maximum table space fill size in percent: 90	
Capture event details: Statement history with values	
Lock wait information	
Collect lock wait information	
Special sampling rate in minutes:	
OK Can	cel

Figure B-6 Choose to use legacy deadlock event monitor

The deadlock event monitor collects information about the applications involved in the deadlock and the locks in contention and places the data in the deadlock event tables. When creating a deadlock event monitor, you can specify the following event monitor types:

DEADLOCK WITH DETAILS event monitor:

This event monitor collects the comprehensive information regarding the involved applications, including the identification of participating statements (and statement text) and a list of locks being held. Generally, the event monitor would cause some overhead on the database, dependent on how many statements are involved in deadlocks.

► DEADLOCKS WITH DETAILS HISTORY event monitor:

This event monitor collects all information reported in a DEADLOCKS WITH DETAILS event monitor, along with the statement history for the current unit of work of each application owing a lock participating in a deadlock scenario for the database partition where that lock is held. Usually the event monitor would cause some minor overhead on the database.

► DEADLOCK WITH DETAILS HISTORY VALUES event monitor:

This event monitor collects all information reported in a deadlock with details and history, along with the values provided for any parameter markers at the time of execution of a statement. This event monitor collects the most deadlock information among the three deadlock even monitors. Therefore, in general, the DEADLOCK WITH DETAILS HISTORY VALUES event monitor causes higher overhead on the database than the other two types of event monitor.

To learn more about dead lock event monitor, refer to DB2 Information Center at:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r5/topic/com.ibm.db2.luw.admi
n.perf.doc/doc/t0055033.html

Lock event monitor collects lock timeout, lock wait, and deadlock information to help identify and resolve locking problems. To learn more about lock event monitor, refer to DB2 Information Center at:

## http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/topic/com.ibm.db2.luw.admi n.mon.doc/doc/t0055093.html

If the monitoring profile results in deadlock event monitor or lock event monitor created, Optim Performance Manager creates deadlock or lock event monitors on the monitored database.

### Deadlock event monitor

If the monitored database is DB2 9.1 or 9.5, Optim Performance Manager creates one deadlock event monitor and some event tables in schema 0PM per each monitored database. The number of event tables created depends on the detail level you configure.

- For deadlock with details event monitoring, event tables are created for DEADLOCK, DLCONN, DLLOCK, and CONNHEADER,
- For deadlocks with details history event monitoring, event tables are created for STMTHIST.
- For deadlock with details history values event monitoring, event tables are created for STMTVALS.

The deadlock event monitor is named with prefix 0PMD followed by a hash code that uniquely identifies the Optim Performance Manager server that creates the event monitor. The table name consists of the data group name (DEADLOCK, DLCONN, DLLOCK, CONNHEADER, MTMTHIST, or STMTVALS) followed by the event monitor name. Here is an example of creating a deadlock event monitor when deadlock event monitor is enabled with details, history, and values:

CREATE EVENT MONITOR OPMDAZ1AKZ FOR DEADLOCKS WITH DETAILS HISTORY VALUES WRITE TO TABLE

DEADLOCK (TABLE OPM.DEADLOCK\_OPMDAZ1AKZ),

DLCONN (TABLE OPM.DLCONN\_OPMD7AZ1AKZ), DLLOCK (TABLE OPM.DLLOCK\_OPMD7AZ1AKZ), CONNHEADER (TABLE OPM.CONNHEADER\_OPMDAZ1AKZ), STMTHIST (TABLE OPM.STMTHIST\_OPMDAZ1AKZ), STMTVALS( TABLE OPM.STMTVALS OPMDAZ1AKZ) BUFFERSIZE 64

Optim Performance Manager reads and deletes data from these event tables in every 30 seconds.

#### Lock event monitor

If the monitored database is DB2 9.7 or above, Optim Performance Manager creates two lock event monitors per monitored database and one unformatted event table for each lock event monitor. Each lock event monitors is named with prefix followed by a hash code that uniquely identifies the Optim Performance Manager server that creates the event monitor. If the monitored database is a non-HADR database, the prefix is 0PMN. If the monitored database is an HADR database, the prefix is 0PML. Since there are always two lock event monitors created, the event monitor name ends with "1" or "2" respectively. For example, on a non-HADR monitored database, the event monitored database, the event monitored database, the event monitored database is name could be 0PMN@AZ1AKZ1 and 0PML@AZ1AKZ2.

Similar to the unit of work event monitors, the two lock event monitors also work switchingly and iteratively. Optim Performance Manager prunes the lock event tables iteratively in an interval of 30 seconds. Suppose that at the beginning of one iteration, the first event monitor (event monitor A) is active, collecting data, and the second event monitor (event monitor B) is waiting. Then event monitor A is deactivated and Optim Performance Manager reads data from its unformatted event table (UET\_A); at the same time, event monitor B is activated to collect data. After Optim Performance Manager obtains the data from UET\_A, UET\_A is pruned. Then this iteration ends up. In the next iteration, event monitor A and event monitor B switches.

On non-HADR database and HADR database, the unformatted event tables are pruned in different way: on a non-HADR database, the event monitors and the event tables are re-created, while for a HADR database, the event monitor is pruned by deleting records in the event tables but not being re-created.

Lock event monitor can collect information of lock wait, lock timeout, and deadlock, depending on your monitoring profile and wether the following DB2 configuration parameters are enabled:

- MON\_LOCKWAIT: when this parameter is on, lock wait events at the database level is collected for the lock event monitor.
- MON\_LOCKTIMEOUT: when this parameter is on, lock timeout events at the database level is collected for the lock event monitor.

 MON\_DEADLOCK: when this parameter is on, deadlock events at the database level is collected for the lock event monitor.

There are guidelines you can follow to minimize this impact further:

Create a dedicated 32K table space (across all partitions) and a dedicated buffer pool, and specify that the legacy deadlock event table or lock event table is to be created in the newly created table space when configuring locking monitoring profile, as Figure B-7 on page 486 shows. The table space should use 32K pages because the event tables contain BLOB and CLOB columns and a 32K page table spaces will allow the BLOB and CLOB data to be stored inline (in most cases). Inlined large object data allows the BLOB and CLOB to flow through the buffer pool and thus improves efficiency. In addition, you can specify the table space as auto-resize or specify a maximum percent, which is 90% by default.

Locking	$\mathbf{X}$
Specify the amount and type of lock information you want to collect.	
Lock event monitor	
Enable lock wait warning alert	
Lock wait threshold in microseconds: 5000000	
Enable lock timeout alert	
Lock wait timeout in seconds: Unlimited	
✓ Enable deadlock alert	
Use legacy deadlock event monitor	
✓ Use custom table space: IRWWDATA1 ▼	
✔ Maximum table space fill size in percent: 90 🔷	
Capture event details: Statement history with values   🔻	
Lock wait information	
Collect lock wait information	
Special sampling rate in minutes: 1	
OK Cance	1

Figure B-7 Use custom table space for lock event monitor or legacy deadlock event monitor

- Size the buffer pool to hold approximately two to three minutes worth of lock event monitor data or legacy deadlock event monitor data - to account for peak periods. This will allow Optim Performance Manager to read the monitor data from the buffer pool and thus reduce disk I/O.
- ► If at all possible, locate the table space on a set of dedicated disks.

### Statistic event monitor

The statistic event monitor is supported on DB2 95 and above. This monitor serves as a low-overhead alternative to capturing detailed activity information by collecting aggregate data (for example, the number of activities completed and average execution time). The aggregate data includes histograms for a number of activity measurements including lifetime, queue time, execution time, and estimated cost. You can use histograms to understand the distribution of values, identify outliers, and compute additional statistics such as averages and standard deviations. The histograms can help you understand the variation in lifetime that users experience. The average life time alone does not reflect what a user experiences if there is a high degree of variability. To learn more about WLM event monitor, refer to the DB2 Information Center at:

http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/topic/com.ibm.db2.luw.admi
n.wlm.doc/doc/c0052603.html

If the monitoring profile results in statistic event monitor created, Optim Performance Manager creates one statistic event monitor on each monitored database. The event monitor is named as 0PMW followed by a hash code that uniquely identifies the Optim Performance Manager server that creates the event monitor. Six event tables are created on the monitored database. The name of the tables is started with CONTROL\_, HISTOGRAMBIN\_, QSTATS\_, SCSTATS\_, WCSTATS\_, WLSTATS\_, respectively, and is followed by the event monitor name. For example, a statistic event monitor could be named as"0PMWAZ1AKZ, and the tables could be CONTROL\_0PMWAZ1AKZ, HISTOGRAMBIN\_0PMWAZ1AKZ, QSTATS\_0PMWAZ1AKZ, SCSTATS\_0PMWAZ1AKZ, WCSTATS\_0PMWAZ1AKZ, WLSTATS\_0PMWAZ1AKZ. Optim Performance Manager reads and deletes data from the event tables iteratively and the interval is defined when configuring monitoring profile, as shown in Figure B-8.



Figure B-8 Workload Manager data collection interval

Keep in mind that DB2 only supports one active statistic event monitor. This means that if you have already started a statistic event monitor on the monitored database, Optim Performance Manager cannot start another one to obtain other statistic information for you. Attempting to start more than one will result an error message in the db2pesrv.log file indicating that there is already one active

statistic event monitor and Optim Performance Manager failed to start another one. Therefore, make sure that no statistic event monitor is running before you start Optim Performance Manager with the Workload Manager profile enabled.

### **B.1.3 Monitoring overhead considerations**

When you configure monitoring profile, if you enable a monitoring profile, on the monitored database, the corresponding monitor switches will be turned on, the corresponding event monitors will be created, and the corresponding snapshots will be called. On the contrary, if you disable a monitoring profile, on the monitored database, the corresponding monitor switches will be turned off, the corresponding event monitors will be dropped, and the corresponding snapshots will not be called.

For enabled Inflight monitoring profiles, Optim Performance Manager takes snapshots or reads from DB2 event monitors periodically and you can specify the sampling rate. Generally, the bigger the sampling rate is, the less monitoring overhead is made to the monitored database.

For enabled Extended Insight monitoring profiles, Optim Performance Manager Extended Insight reads from DB2 event monitors in fixed frequency and you can not change it. The package cache event table is read by Optim Performance Manager once every minute. Each of the two UOW unformatted event tables is read by Optim Performance Manager once every minute. When the Optim Performance Manager repository server is stopped successfully by running pestop, the event monitors created by Optim Performance Manager would be dropped.

Enabling Dynamic SQL profile (or any other monitoring profile which takes Dynamic SQL snapshots) may cause unwanted overhead on the monitored database when the package cache is large - because each snapshot retrieves all the data from the package cache at the time of the snapshot. If you wish to collect Dynamic SQL data and the monitored database package cache is large, it will be necessary to increase the sampling interval for Dynamic SQL collection.

Consider the following potential monitoring overhead on the monitored database server:

- Collecting application snapshots: collecting SQL data can cause unwanted overhead on your monitored database if you have a large number of concurrent applications (more than 1000).
- Collecting lock snapshots: collecting lock snapshots can cause unwanted overhead on your database if you have a large number of locks on the database.
- Collecting table space snapshots: collecting table space data can cause unwanted overhead on your monitored database if you have a large number of table spaces or table space containers (more than 1000). You can avoid this overhead by configuring the I/O profile so that it does not collect table space data or does not collect table space container data.
- Collecting table snapshots: collecting table data can cause unwanted overhead on your monitored database if you have a large number of tables (more than 1000). You can avoid this overhead by configuring the I/O profile so that it doesn't collect data.
- Enabling event monitors for unit of work: collecting extended server insight data can cause unwanted overhead on your monitored database if you have a very large number of transactions running on your system (more than 20000 per minute).

## **B.2 Optim Performance Manager footprint on the monitored application**

Optim Performance Manager collects client-side information regarding the statements and transactions executed by an application if the "Collect statement and transaction metrics on client" profile is enabled when configuring Extended Insight monitoring.

Optim Performance Manager has hooks into the JDBC drivers, as well as the DB2 CLI driver which allow it to collect this client side information. These hooks record information about the statements and transactions executing on that client into an in-memory table. Every second, the information within this table is hashed and aggregated in order to reduce its memory footprint. For example, every second a hash code is calculated based on the SQL statement text, and the hash code is then used to aggregate this new data with data already in the table. If the newly calculated hash code already exists in the table, the record is updated, if the hash code does not exist, a new record is inserted. Note that in order to reduce memory consumption, the SQL statement text is not kept, only the hash code. For transactions, a unique transaction ID is used for aggregation, rather than calculation of a hash code based on SQL statement.

Once every minute, this in-memory data is sent to the Optim Performance Manager Server where it is processed and inserted into the repository server database. The in-memory hash table is then cleared as soon as the data is sent to the Optim Performance Manager server (it does not wait for confirmation of receipt from the server) and processing starts again. When the data arrives at the Optim Performance Manager server, Optim Performance Manager attempts to match the hash code for the SQL statements with a hash code the server computed from either a dynamic SQL snapshot, or a package cache event monitor. When a match is found, the record can be inserted into the Optim Performance Manager repository. This matching of client and server side information allows Optim Performance Manager to correlate client and server side metrics for individual statements – which in turn provides the full end-to-end view of execution metrics for each statement executed. A similar process occurs for transactions, except these are matched on transaction ID.

#### **B.2.1 Footprint**

Client side CPU and memory are consumed as Optim Performance Manager Extended Insight client component records information about the transactions and SQL statements executed by the application, performs the aggregation and sends this information to the Optim Performance Manager server. In most cases, the additional CPU and memory required to perform this processing will not be noticeable. However, the following points should be noted:

- Applications which issue a large number of unique SQL statements during a 1-minute interval are likely to generate more work for Optim Performance Manager Extended Insight client component. Since many of the statements are unique, it will not be possible to group the statements together in the in-memory table, and consequently the table will grow, as will the memory required to monitor the application. This may be the case if the application uses literals instead of parameter markers. Using literals will cause many of the SQL statements to be unique and best practice dictates that applications should use parameter markers wherever possible.
- The higher the rate at which transactions and SQL statements are executed, the more resources Optim Performance Manager Extended Insight client component will consume. Therefore, OLTP type applications are likely to create more work for Optim Performance Manager to deal with than traditional BI type workloads - simply because an OLTP application will execute far more statements and transaction per minute than a BI application.

Much of Optim Performance Manager Extended Insight client processing is done asynchronously. This greatly reduces the potential impact client side monitoring will have on elapsed time of the transactions and SQL statements - and therefore, reduce the impact client side monitoring has on application throughput.

## Index

#### Α

access plan 229 actions tab 253 active I/O alerts 207 active pull method 19 active SQL and connections monitoring profile 429 active SQL dashboard report 231 activity event monitor 58, 321 activity queue time histogram 406 Activity total time 397 activity total time 406 activity total time histogram 406 activity trace 58, 321 activity type 392 activitytotaltime 397 ad-hoc custom workload cluster 359 administrative console 31 administrative task scheduler 431 administrator privileges 92 agent priority 382 agent priority property 395 aggregated statement 231 aggregation key 128 alert 149 alert category 150 alert data 150 alert details tab 253 alert frequency 166 alert icon 315 alert notification 6, 166 alert severity 6 alert threshold 152 appl table 442 appl\_memory parameter 242 application connections 158 application global memory 242 application name 192 application private and shared memory 242 application server 7, 288, 324 application server instance 341 application snapshot 110, 176 area graph 154 async read ratio 212

asynchronous input 206 asynchronous write 212 asynchronous write ratio 209 authentication 99 authentication method 30, 52, 93 automatic reorganization 461 automatic statistic collection 461 automatic storage table space 50 automatic table maintenance 461 autonomic performance objective 416 average CPU utilization 218 average maximum CPU 219

### В

bar graph 154 baseline monitoring 384 basic monitoring information 109 basic monitoring profile tables db\_storage\_group 441 db2 441 dbase 441 dbcfg 441 dbmcfg 441 detail\_log 441 fcm 441 fcm node 441 hadr 441 memstatpool 441 os data db2 441 progress 441 rollforward 441 utility\_info 441 blocking connection 173 buffer pool 170, 206, 222, 234, 429 buffer pool async read ratio 207 buffer pool async write ratio 207 buffer pool hit ratio 207-209, 222 buffer pool priority property 395 buffer pool size 210, 216 buffer pool snapshot 103, 116 buffpage 216 business intelligence 4 business intelligent 231

#### С

cache 5 caching 151 Call Level Interface 4 canManage alert privilege 105 canManageAlerts privilege 55 CanMonitor privilege 105 canMonitor privilege 55 capacity management 194-195, 247 capacity planning 2, 34 chargeback 480 child service subclass 395 chngpgs\_thresh 216 CIM OS data monitoring profile tables CPU 445 cpustatistics 445 disk 445 diskstatistics 445 filesystem 445 oscfg 445 osstatistics 445 processes 445 CIM OS monitoring profile 429 cinfo 350 CLI application 135 CLI driver 135 CLIENT ACCTNG special register 387 client application 253 client applname special register 387 client information field 128, 253 client userid special register 387 client wrkstnname special register 387 client\_acctng special register 387 client\_applname special register 387 client\_userid special register 387 client\_wrkstnname special register 387 column control 150 comma-separated value text 96 commit 19, 480 common information model 203 communication setting 133 concurrency 400 concurrency control 5, 373 concurrency limit 375, 382, 384, 395, 403 concurrent coordinator activity 384 configuration dialog 332 configuration parameter 241 connect gateway 123 connect privilege 55

connection attribute 187, 253, 336, 383, 386 connection pool 280 connection pool status 20 connection propriety 359 connections 224, 257 console mode 130 console privileges 52-53 administrator 53 operator 53 viewer 53 console server 16 content management 4 coordinator partition 245 CPU consumption 223 CPU metrics 217 CPU time 397 CPU utilization 217-219, 221, 234, 441 CPUTIME 397 critical alert 159 critical icon 152 critical threshold 264, 273 CSV file 97 current average CPU utilization 218 custom group feature 149

#### D

dashboard 4, 218 data cleaner 449 data server 7 data server execution times 184 data source 149, 280, 288, 293 Data Studio health monitor 9 database activity 109 database configuration parameter 241 database configuration parameter pckcachesz 246 database configuration parameters auto\_maint 462 auto\_reorg 462 auto\_runstats 462 auto\_tbl\_maint 462 catalogcache\_sz 462 chngpgs\_thresh 462 locktimeout 463 logbufsz 463 logfilsiz 463 logprimary 463 logsecond 463 softmax 463

util\_heap\_sz 463 database configuration report 193 database connection 95 database connection profile 96 database connection report 193 database connections dashboard 96 database diagnostics 358 database directory 51 database global memory 238 database manager configuration 195, 247 database manager configuration parameters dft mon bufpool 477 dft\_mon\_lock 477 dft\_mon\_sort 477 dft mon stmt 477 dft\_mon\_table 477 dft\_mon\_timestamp 477 dft\_mon\_uow 477 database manager configuration report 193 database partitions 163 database performance metrics 2 database privilege 54 database server 2.324 database snapshot 441 database\_memory database configuration parameter 238 DB2 performance expert client 9 DB2 performance expert for multiplatform 2 DB2 privileges dbadm 54 secadm 54 sysadm 54 sysmon 54 DB2 workload management (wlm) 8 db2\_cli\_driver\_install\_path variable 426 db2 dsdriver cfg property 425 db2dsdriver\_consroller\_url 425 DBM snapshot 441 deadlock 4, 173, 251, 258, 267, 314-315, 319, 484-485 deadlock alerts 252 deadlock event 429-430 deadlock event alert processor 450 deadlock event monitor 57, 110, 113, 431, 450 deadlock with details event monitoring 484 deadlock with details history values event monitorina 484 deadlocks with details history event monitoring 484 default location 51

default service subclass 383 default service superclass 383 default workload 383, 385 dftdbpath 28 diagnose xi, 148 diagnostic dashboard 6 direct installation option 26 dirty page 212 discretionary service subclass 413 disk resources 21 disk space 151 disk space consumption report 193 disk space requirements 197 DML activity 397 DMS table space 99 dormant monitor 480 drop down list 334 ds\_auto\_mgmt\_super 386 ds\_auto\_mgmt\_super superclass 382 ds high pri subclass 387.394 ds\_load\_subclass 388, 393-394 ds\_low\_conc\_subclass 388, 393-394 ds low conc subclass service subclass 388 ds\_med\_conc\_subclass 387-388, 393-394 ds\_med\_conc\_subclass service subclass 388 duration control 157 dynamic 233 dynamic SQL snapshot 490 dynamic SQL statement 5, 231 dynamic SQL Statement report 231 dynamic SQL statement report 118, 193 dynsgl table 444

#### Ε

end-to-end response time 272 end-to-end transaction monitoring 8 estimated cost 487 estimated SQL cost 397 event monitor 57, 104, 428, 431, 472 event monitor tables 57 event table 478 event tables connheader 484 deadlock 484 dloch 484 stmthist 484

stmtvals 484 execution time 487 Extended Insight dashboard 7, 318 extended insight data 100 Extended Insight threads data aggregator 448 data loader 448 data merger 448 statement metric collector 449 statement text collector 448 transaction metric collector 448 extent page 212

#### F

failing transactions rate 318 failure rate 267, 318 fenced user 58

#### G

garbage collection overhead 47 global controller 447 global metadata table 438 global metadata tables db2pm.connection\_profile 438 db2pm.databases 438 db2pm.instances 438 db2pm.managed\_database 439 db2pm.managed\_database\_props 439 db2pm.mt\_column 438 db2pm.mt\_table 439 db2pm.pe\_setup 439 db2pm.version 439 global notification 52 global privilege 94 growth planning 2 growth rate 197

#### Η

hash code 19, 448, 489 health indicator 4 health monitor 158 Health Summary dashboard 315 heap size 5 high water mark 400 histogram 406 histograms 487 historical data 150 historical performance metric 2 history data 450 History mode 157 hit ratio 172 how-to information 329

#### I

I/O and disk space monitoring profile tables bufferpool 442 Icontainers 443 nodeifbp 443 nodeiftbsp 443 table 443 tablereorg 443 tablespace 443 tbspquiescer 443 tbspranges 443 identify xi, 148 idle time 158 index scan 269 Inflight dashboard 168 inflight performance 100 Inlined large object 479, 486 in-memory table 489 installation image 425 installer location 344 instance 27 instance administration 195 instance owner 58 instance owner ID 30 instance\_memory database manager configuration parameter 236 instance\_memory parameter 236 interactive mode 464 internal rollback 313 intra-partition parallelism 435 iostat 206 isolation level 268 ITCAM for Transactions administrator 327 ITCAM for WebSphere administrator 327

#### J

JCC applications 264 JDBC transactions 280

#### Κ

key performance indicator 151, 153, 209

kincinfo 350

#### L

large table space 49 launch-in-context capability 8 LDAP authentication 29, 33 LDAP directory 31 legacy deadlock event monitor 482 libpath variable 426 list command 51 load activities 392 Lock 103 lock escalation 259, 262, 269 lock event monitor 57, 103, 431, 482 lock list 261 lock list memory 261 lock monitor event level 423 lock snapshot 110 lock timeout 314-315, 319-320, 485 lock timeout event 430 lock tree 173 Lock wait 103 lock wait 484 lock wait event 430 lock wait time 256 locking 151, 206 locking alerts 252 locking conflicts 173 locking dashboard 110, 251 locking monitoring profile tables applinlockconf 442 lockedres 442 locking profile 430 locking statistics 184 locklist 263 log buffer 174 log file 174 log read/write time 174 logging 24 logging activity 174, 482 logging and recovery 194 logical reads 210 lowest availability view 353

#### Μ

materialized query table 177 maxlocks configuration parameter 263 maxlocks database configuration parameter 261 memory consumption 171 memory dashboard 241 memory usage 206 memory utilization 169 message server 324 metadata 192 metadata table 439 method name 192, 435 migration 33 migration option 26 mon\_deadlock 486 mon\_get\_pkg\_cache\_stmt table function 125 mon\_locktimeout 485 mon\_lockwait 485 monitor switch 104, 423, 428, 472 monitor switches bufferpool 477 lock 477 sort 477 statement 477 table 477 timestamp 477 uow 477 monitored database 34, 149, 321 monitoring authorization 91 monitoring compliance 480 monitoring configuration 428 monitoring interval 223, 225-226, 241, 257 monitoring overhead 428 monitoring period 315 monitoring profile 35, 91, 101, 429, 431, 478 monitoring setting 428 monitoring time frame 222 multi partition 4 multiple database connection 253

#### Ν

naming conventions 431 network address translation 124 network congestion 4 new lock monitor 482 notification method 167 num\_iocleaners 212, 216 num\_ioservers 216

#### 0

OLTP environment 231 online transaction processing 4

Operating System data collector 449 operating system group 28 operating system load 109 operator role 94 opmei\_sample\_response.rsp file 425 Optim Performance Manager 2 architecture 12 component 6 configuration 11 edition 10 feature 3 history 2 identifying and diagnosing performance problem 4 performance problem prevention 5 plug-in for Tivoli Enterprise Portal 8 solve performance problem 5 Optim Performance Manager administrator 327 Optim Performance Manager Extended Insight architecture 13 optimization level 435 optimizations 423 overflows 222 overhead 321

#### Ρ

Package 244 package cache 20, 36, 125, 478 Package cache event monitor 478 package cache Event monitor 490 package cache event monitor 57, 124, 431, 478 package cache event table 478 package cache hit ratio 162, 221, 246 page cleaner efficiency 212 parameter marker 37 partition 440 partition role 163 partition roles catalog partition 106 coordinator partition 106 data partition 106 ETL partition 106 partition set 91, 469 Partition skew 5 partitioned database 91 partitioned databases 34 pdq.cmx.controllerURL 83 pdg.cmx.controllerURL parameter 134

pdg.properties file 124, 425 peconfig 465 peconfig configuration tool 31 pencil icon 100 Performance alert 162 performance database 16 performance indicator 4 performance overview 4 performance warehouse 2 performance warehouse data loader 449 performance warehouse monitoring profile 58, 429 Performance Warehouse server 449 physical read 210 physical reads 208 port number 83 pgcmx library 425 precompile 313 predefined system template 423 predefined template 99-100 prefetch 209 prefetch priority property 395 prefetchsize 212, 216 priority 392 priority aging 374 private memory 236 problem prevention 2 problematic SQL statement 199 product code 340 profile name 30 property file 81 protocol table 439 pull method 20 pureScale database 4 purge alerts configuration 165

#### Q

queue time 24, 487

#### R

read stability isolation level 269 recent mode 157 Redbooks Web site Contact us xiv refresh interval 157 refresh rate 150 reorganization 313 repeatable read 268 repository database 27, 36, 53, 57, 95

repository database authentication 91 repository server 16, 30 resource consumption 5 resource utilization 206 response file 69, 424, 465 response time 4, 218, 423, 480 response time analysis 200 response time detail 226 response time distribution 126 response time histogram 181, 265 response time threshold 273 retention period 35, 157, 453 retention time 35, 102 rollback 19, 314, 480 rollbacks 320 row lock 255 rows read 158 rows written 158 runtime 127 runtime environment 30, 382, 386

#### S

sampling interval 35, 102 sampling rate 468 schema 431 security method 92 self tuning memory manager 243 self\_tuning\_mem 263 server status 162 service class 9, 117, 377 service level agreement 2 service level objectives 480 service subclass 201, 383, 403 service subclass histogram 406 service super class 378 service superclass 201, 375, 382-383, 385, 403 ds\_high\_pri\_subclass 383 ds load subclass 383 ds\_med\_conc\_subclass\_383 service superlcass ds low conc subclass 383 session\_user special register 386 shared memory 236 silent configuration 465 silent mode 464-465 single partition 4 SMS 99 SMS table space 27, 50

snapshot 104 snapshot data 17 snapshot data collector 449 SNMP Management server 167 SNMP manager 5 SNMP trap 5 SNMP trap generation 166 SOAP port 136 sort overflow 162, 222 sort performance 184 sorting 151 source module 423 SQL code 318 SQL cost 385, 395 SQL rows read 397 SQL rows returned 397 SQL temp space 397 sqlrowsread 397 sqlrowsreturned 397 SQLTEMPSPACE 397 statement event monitor 58, 321 statement hash code 20 statement metrics 103 statement table 442 statistic event monitor 57, 431 statistics 109 statistics details 233 storage 206 storage path 99 storage space state 162 stored procedure 57, 430 subclass 378, 383 subsection table 442 sysadm authority 27 sysdefaultuserworkload 385 sysdefaultuserworkload workload 383 system 397 system capacity 5, 373, 399 system maintenance 158 system monitoring parameters 195 system overview display 6 system response time 206 system template 428 system\_user special register 386

#### Т

table data 429 table lock 255

table scans 229 table snapshot 116 table space 159, 234-235, 429 table space configuration 197 table space container 159, 429 table space layout 198 table space path 99 table 206 table-level lock 269 task scheduler 108 temporary table space 383 TEPS administrator 327 threshold 101, 153, 209, 383 Threshold alert processor 449 threshold definition 440 threshold limit 396 throughput 169 time control 150–151 time slider 151, 156 timestamp 320 topology 355 transaction 4 transaction alert 315 transaction collector 334 transaction event monitor 57 transaction metrics 103, 469 transaction rate 46 transaction response time 121, 264 transaction response time data 451 transaction response-time monitoring 324 transaction server 324 transaction statistics 127 transaction throughput 283 trend analysis 2

#### U

unattended batch mode 465 unformatted event table 485 Unit of work event monitor 479 unit of work event monitor 303 unit or work event monitor 448 UOW event monitor 431 UOW unformatted event table 480 update option 26 update privilege 54 urgent work 387 user-defined function 53, 57 Utility dashboard 223

#### Draft Document for Review January 13, 2011 8:13 pm

utility executions 316, 319 utility progress information 441

#### V

version information 440 viewer role 94 virtual memory 219 virtual server 21 vmstat 218

#### W

warning icon 152 warning threshold 264, 273 warnings 159 watchdog for event monitor 423 watchdog procedures 107-108, 430 watchdog stored procedure 431 web console 92, 233, 320, 375 web interface 23 Web servers 324 WebSphere administrator 327 without\_hist 429 WLM configuration wizard 377 WLM object 377 work class 8, 117, 201 workclass 201 working directory 29 workload 151, 206-207, 226, 377, 383 workload category 315 workload cluster 173, 180, 224, 253, 257, 264, 291, 318 workload cluster group 173, 180, 182-183, 224, 273, 318 workload management 5 workload management definition collector 449 workload management statistic collector 449 workload management thresholds 375 workload manager configurations and metrics report 193 workload manager monitoring profile 429 workload manager monitoring profile tables histogrambin 444 scstats 444 serviceclasses 443 thresholds 444 wcstats 444 wlstats 444 workload manager tool 8

workload manager workloads 117 workload pattern 9 workloads 4 workspace 325, 363

#### Ζ

zoom control 156



## **Related publications**

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

## **Other publications**

These publications are also relevant as further information sources:

- ► Database Monitoring Guide and Reference, SC27-2458
- ► Troubleshooting and Tuning Database Performance, SC27-2461

## **Online resources**

These Web sites are also relevant as further information sources:

► Integrated Data Management Information Center

http://publib.boulder.ibm.com/infocenter/idm/v2r2/topic/com.ibm.dstu
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► IBM Tivoli Monitoring (latest ver)

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