



您的信息 您的智慧

2011 IBM 信息管理与业务分析论坛

# 优化:数据库管理的事半功倍之举

数据库性能健康和调优(OPM/OQT)

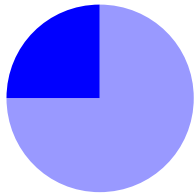
陈威

软件部 信息管理

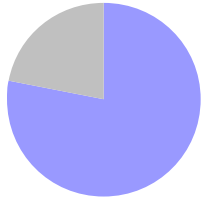




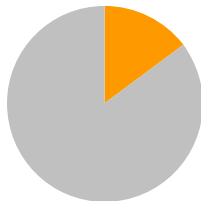
# 信息管理与数据管理的必要性



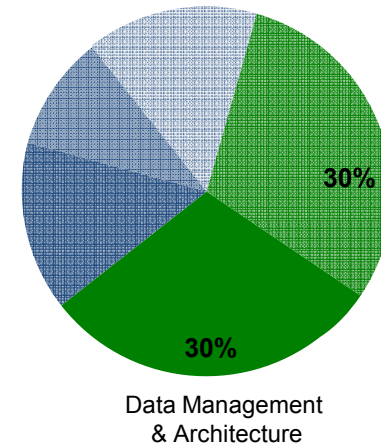
**75%** of CIO's believe they can strengthen their competitive advantage by better using and managing enterprise data.



**78%** of CIO's want to improve the way they use and manage their data.



...but **only 15%** believe that their data is currently comprehensively well managed.



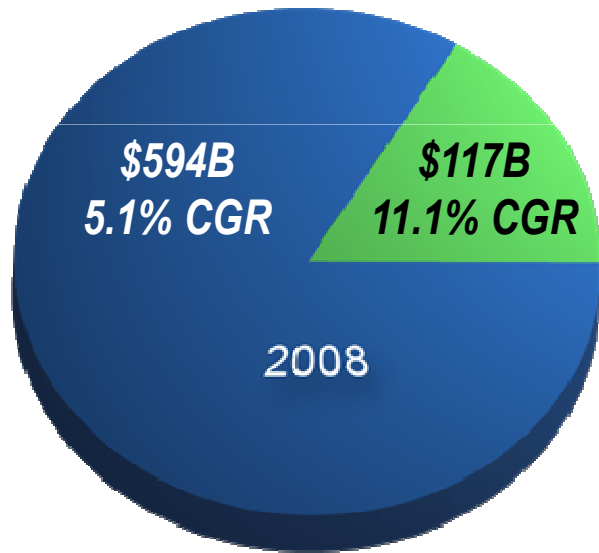
**60%** of all information management investment in the next 18 months is expected to be in data management, data architecture, data warehousing, and BI.





# 越来越多的契机来源于商业的优化

商业业务数据的优化比  
商业流程的自动化的发展  
快**2倍**

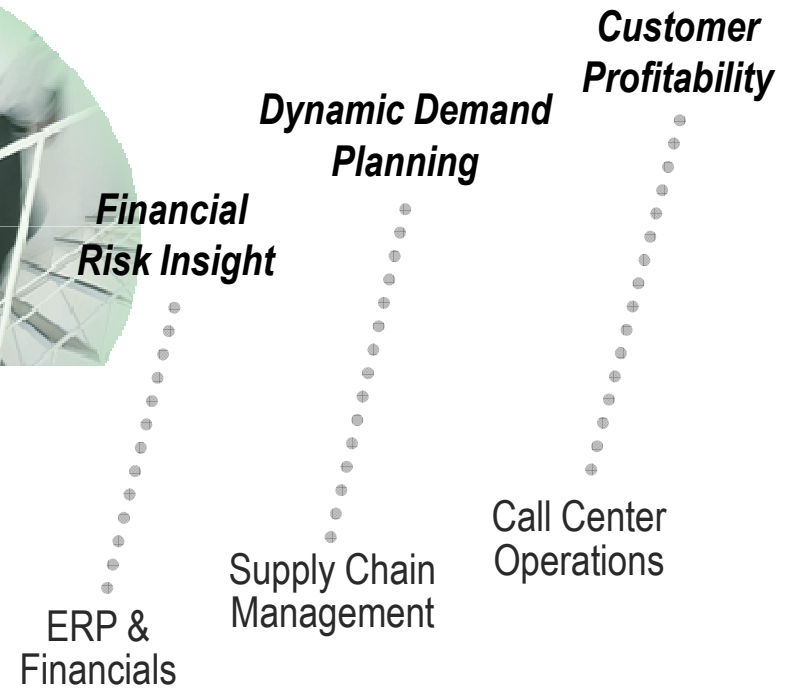


业务  
优化  
信息议程

业务  
自动化  
应用议程



## 竞争的优势



Includes Hardware, Software and Services. Does not include Networking, Printer, or Standalone Printer or PC Markets. CGRs 2006 – 2011. Opportunity estimates based on analysis done by the IBM Market Intelligence Department. IBM Market Intelligence data is provided for illustrative purposes and is not intended to be a guarantee of market opportunity.

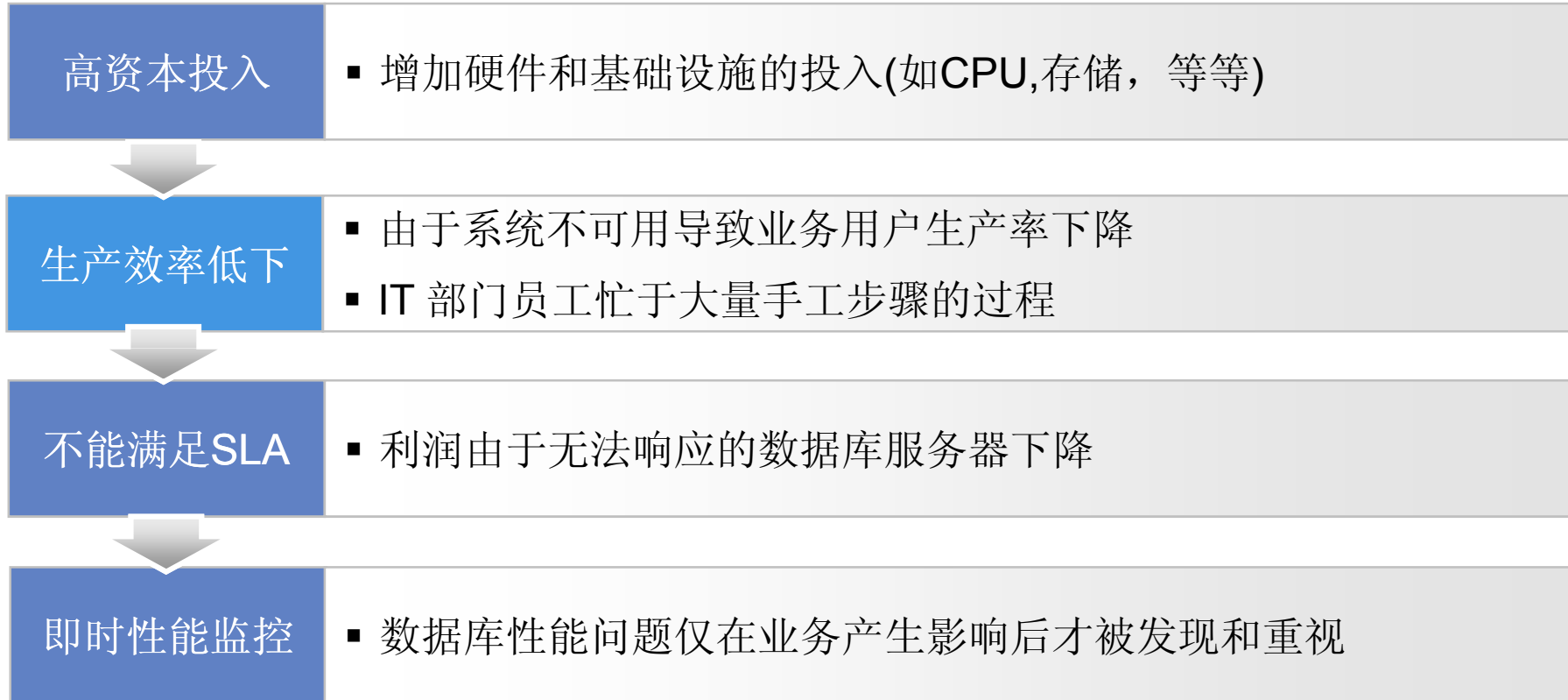
您的**信息** 您的**智慧** 2011 IBM 信息管理与业务分析论坛

更快更高效的处理，更能节省成本





## IBM 研究证实的性能低下的系统造成的影响

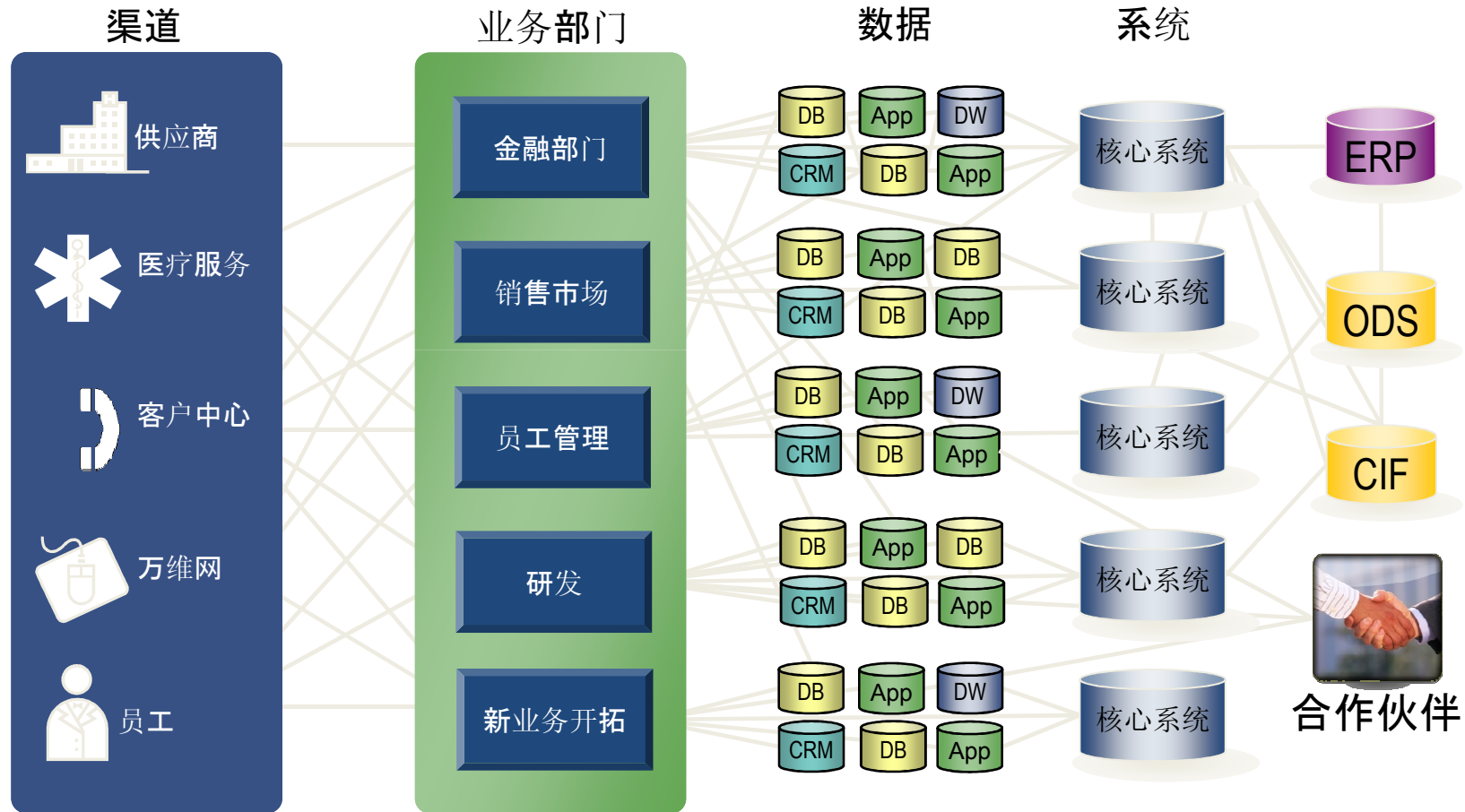


\*2009-2010 IBM Business Value Assessment Study





# 企业架构的复杂性日益增长 管理系统的性能是一个严重的挑战






## 低下的性能会严重影响业务能力



### Business

- 客户满意度下降
- 利润的达到有风险
- 降低员工的生产率
- 高基础设施投入
- 更高的ROI带来的压力



### IT

- 需要专业的技术知识
- 多层次的IT架构带来的问题定位难度增大
- 问题定位需要大量的人力投入和时间消耗
- 持续不断的业务改进会导致性能优化面临不断的挑战





## 谁/什么地方 需要关注性能问题

### 关注群体

- CIO
- IT Director
- Database Administrators
- Developers
- Administrators



CIO



IT Director



Developer



DBA/  
Administrator

### 有关的系统

- BI & Data Warehousing
- OLTP transactional systems
- DB2 environments
- ERP applications
- Application Implementation, Consolidation or Migration
- Custom & Packaged applications

现在客户是如何管理性能问题

- 使用传统的手工的方式，或者是分散的工具来度量性能问题

这为什么是一个挑战

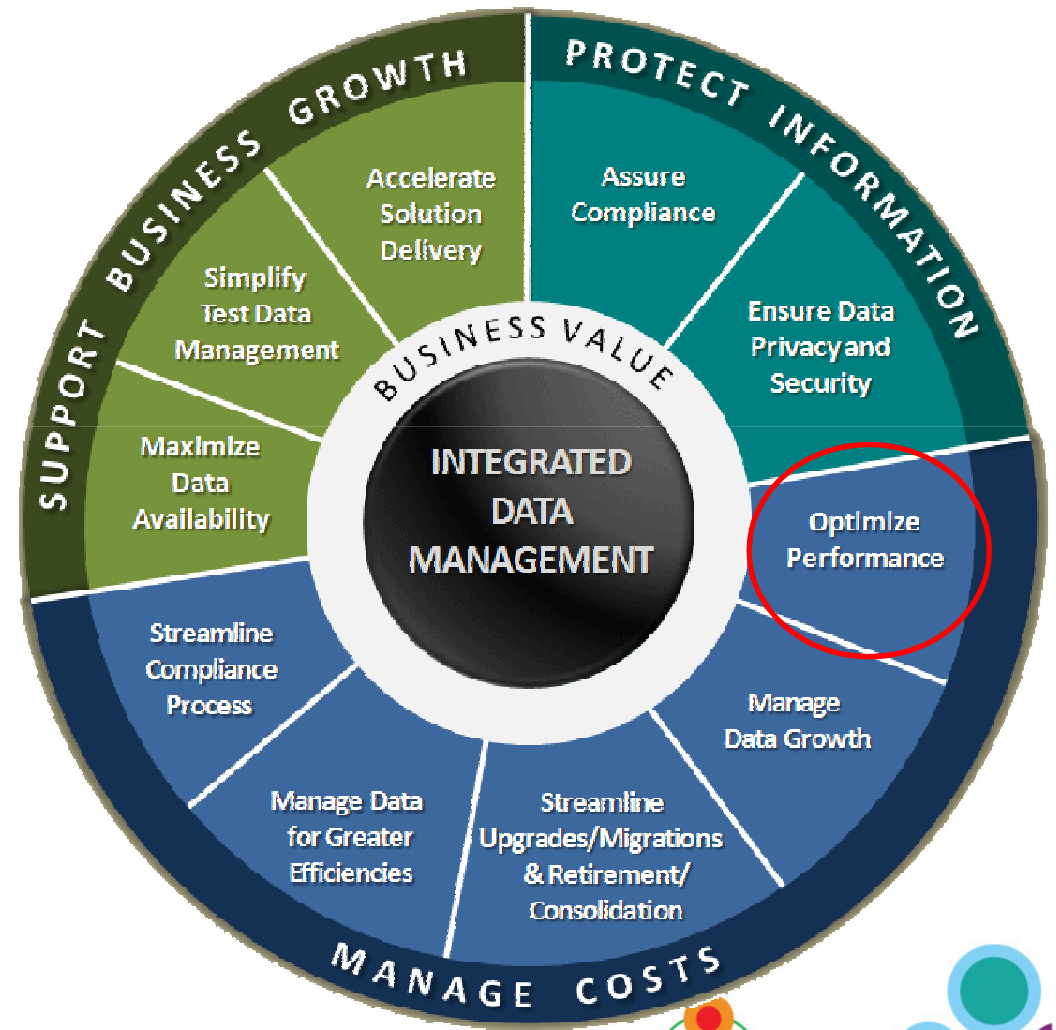
- 昂贵- 需要高度的专业性技巧
- 耗时- 收集大量的复杂的信息
- 不准确& 易错- 如何建立大量诊断信息之间的关联
- 治标不治本- 头疼医头脚疼医脚
- 事后诸葛亮- 通常是事情发生以后才去想办法解决





## 集成数据管理解决方案 - 模块化的现代业务模块

- 支持商业的成长
  - 增加利润
  - 维持客户关系
  - 进军新的市场
- 管理成本
  - 减少成本
  - 梳理基础架构
  - 集中共享的服务
  - 增强跨角色的协作





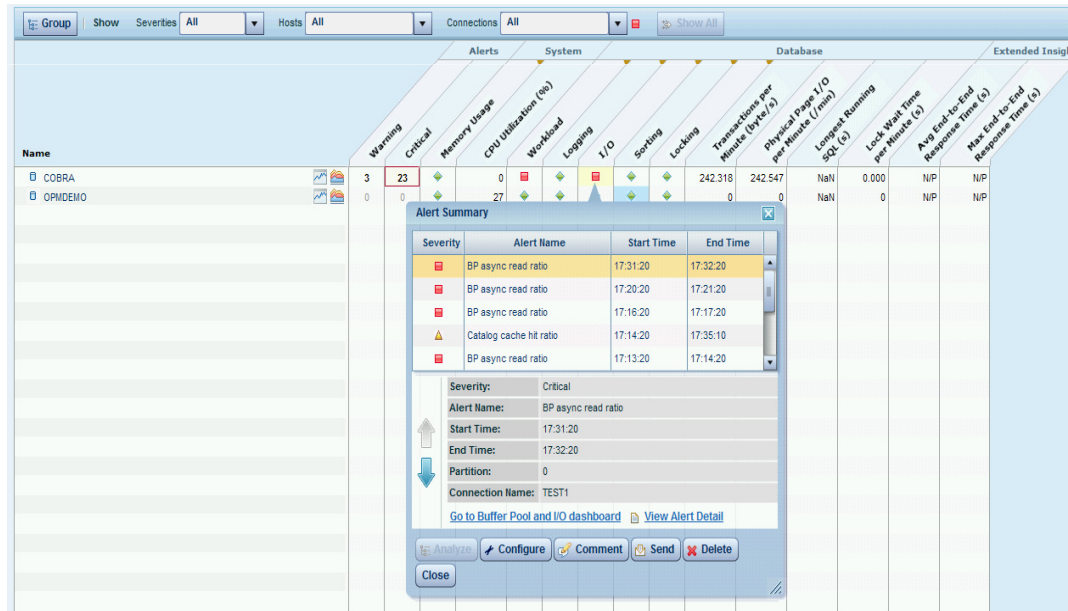


# Optim Performance Manager Extended Edition



优化性能

定位，诊断，解决并预防  
性能问题，防止对业务造成  
影响



## Requirements

- 定位，诊断，解决和预防性能问题
- 易于理解的，一步一步的步骤的进行性能管理
- 预先，预防性的增强系统的性能和系统的处理输出

## Benefits

- 减少基础设施架构的投入
- 增强服务能力并满足服务级别协议
- 增强生产率



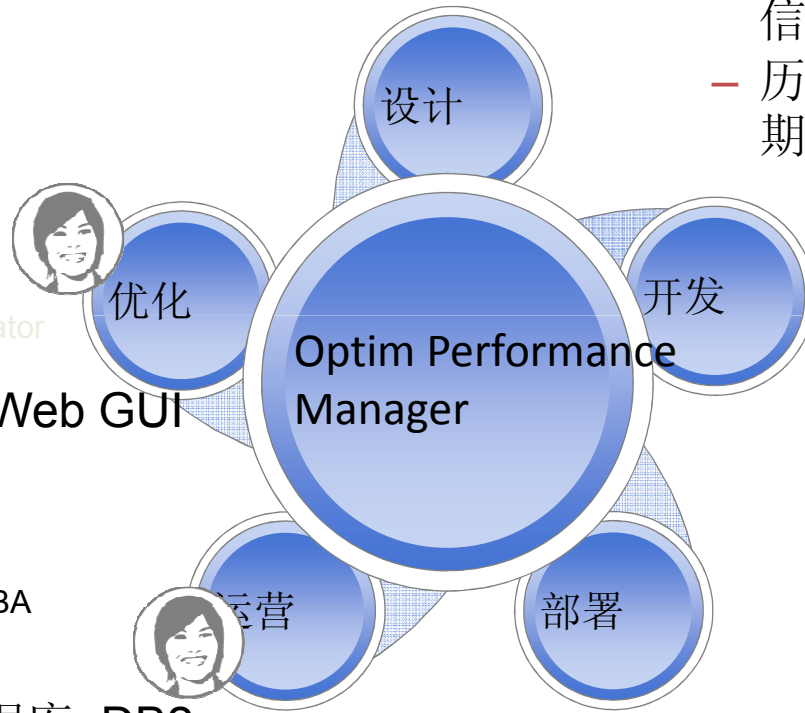


# Optim Performance Manager V4.1

- 趋势分析
  - 性能数据仓库捕获长期数据
  - 产生自定义报表

- 浏览历史信息
  - 用户能够回溯历史信息
  - 历史信息的存储时期可用户定制化

- 容易访问
  - Web GUI 访问
  - 容易设置授权来访问Web GUI



- 容易安装
  - 用户友好的安装
  - Web 配置

- 监控多个DB2实例
  - 多 DB2 实例, DB2 数据库, DB2 DPF
  - 连接OMEGAMON XE
  - WLM 支持

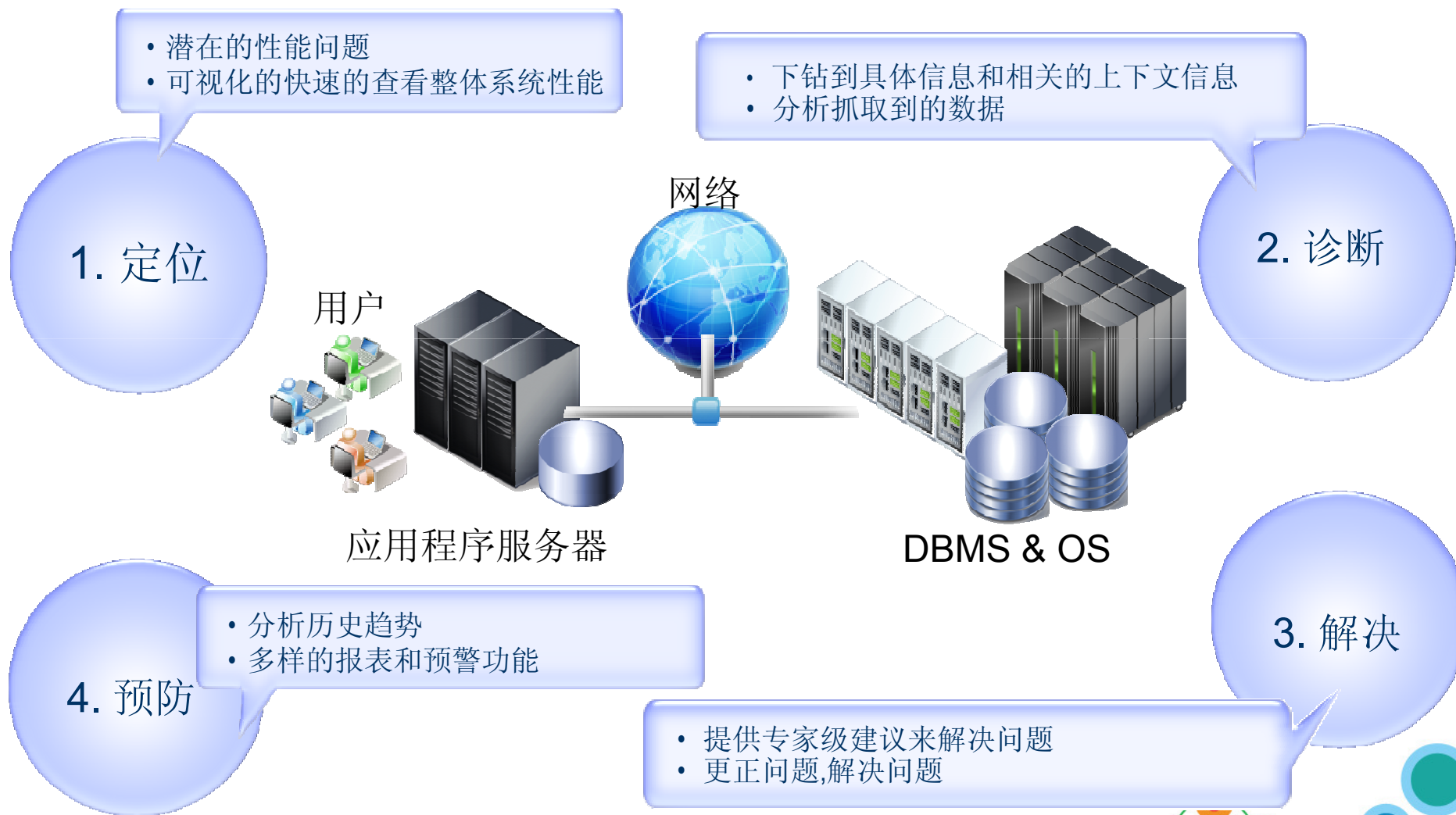
- 原生的警告和阈值
  - 达到阈值时警告
  - 用户能够回溯历史警报信息





# 向导型问题解决步骤

## 定位, 诊断, 解决和预防性能问题





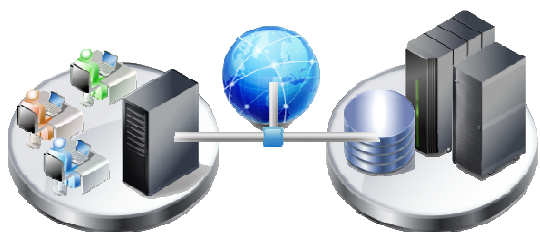
# 向导型问题解决步骤

## Step 1: 定位



- 性能仪表板来快速定位性能问题

- 健康概况
- 警报概况
- 总体概况



### ■ 专职，可下钻的在线仪表板

| 下钻仪表板    | 功能                           |
|----------|------------------------------|
| 活动SQL    | 定位和分析长时间运行的SQL语句             |
| 缓冲池和 I/O | 检查数据库I/O，并通过在表空间，缓冲池和表的参数来调整 |
| 日志       | 检查和调整日志性能                    |
| 锁定       | 定位和分析死锁，锁等待和锁超时              |
| 内存       | 检查数据库实例和数据库的内存消耗             |
| 实用工具     | 检查正在执行的实用工具的运行状况             |
| 工作负载     | 检查数据库整体的工作负载状况               |





# 向导型问题解决步骤

## Steps 2: 诊断

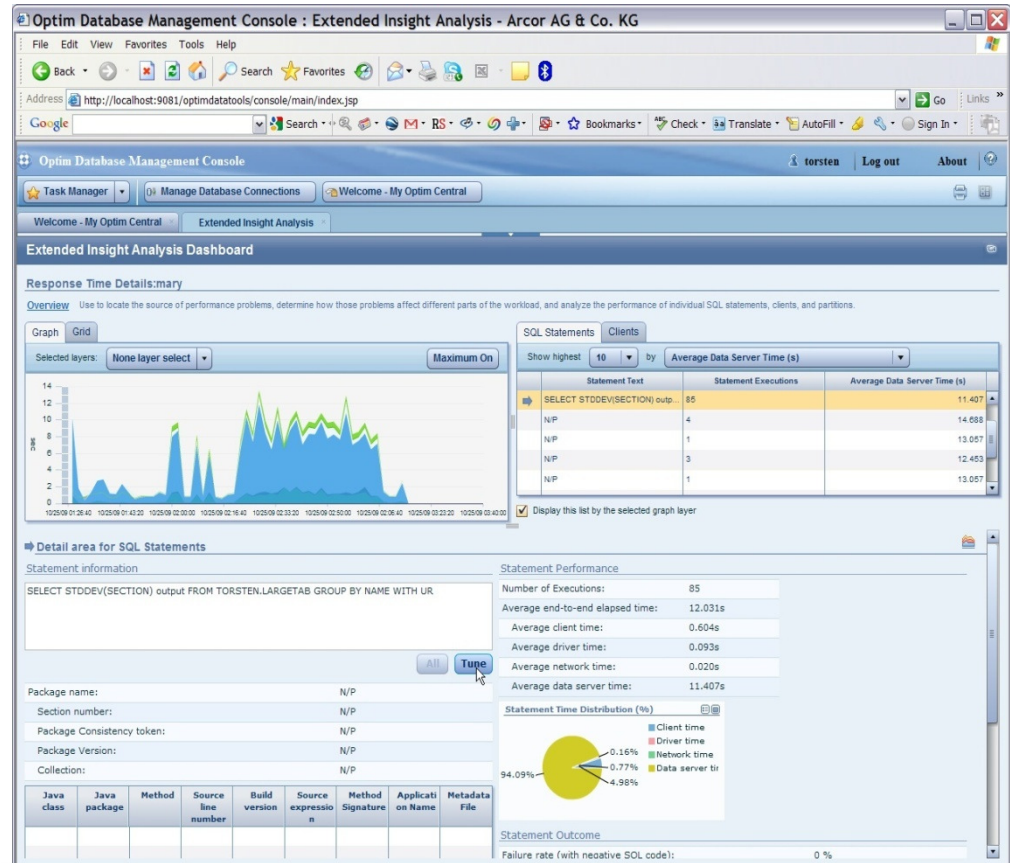


诊断和解决

- 下钻到问题具体信息
- 分析抓取到的数据

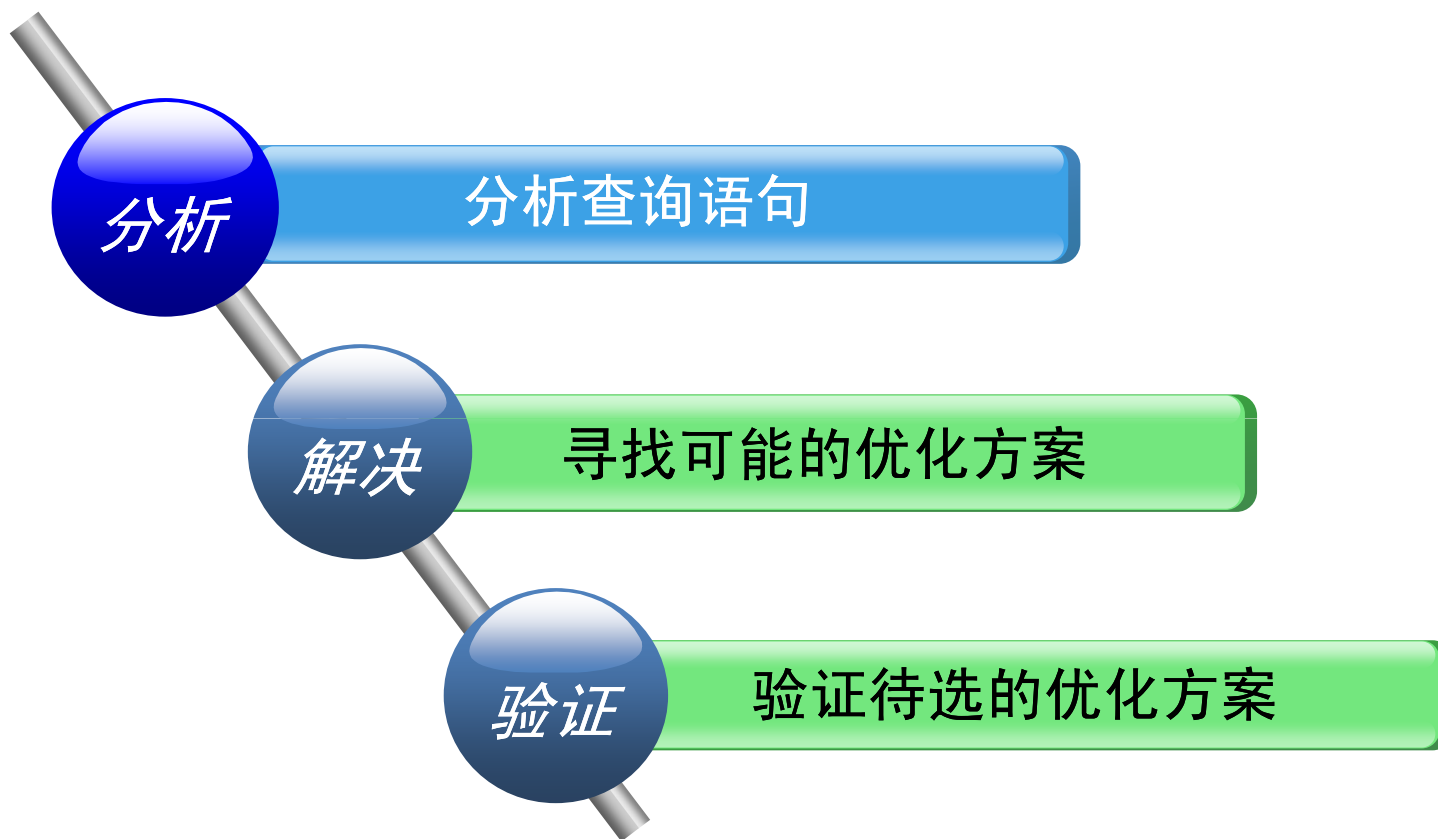
诊断和解决性能问题  
来最终的完成性能问题的管理

- 最终的解决问题，而不是临时的解决问题
  - ✓ 定位到产生问题的源代码
  - ✓ 提供专家级的建议来改善SQL
  - ✓ 在数据库的配置和调整上提供建议





## 基于OQT的性能调优





## 分析理解存在问题的查询语句

1

分析了解SQL查询语句

格式化查询  
添加统计信息标注

*What*

2

理解当前的访问计划

访问计划图

*How*





## 增加标注的查询语句——OQT Query Annotation

| Formatted Query                  | Annotation  |
|----------------------------------|---|
| SELECT *                         |   |
| FROM CDUGDEMO.TRANSINFO AS T     | CARDF=(missing) QUALIFIED_ROWS=6.306167 NPAGESF=(missing)             |
| , CDUGDEMO.ACCOUNTINFO AS A      | CARDF=500,000 QUALIFIED_ROWS=7.499961 NPAGESF=10,000                  |
| , CDUGDEMO.CARDINFO AS C         | CARDF=2,000,000 QUALIFIED_ROWS=134.31447 NPAGESF=20,000               |
| WHERE ( A.CUSTNO = ?             | COLCARDF=50,000   |
| AND YEAR( A.OPENDATE ) >= 2008   | FF=0.00002  |
| AND C.CLOSEDATE = '9999-12-31'   | COLCARDF=250 FF=0.333   |
| AND C.EXPIREDDATE < ?            | COLCARDF=1,000 FF=0.004   |
| AND C.CARDSTATUS IN ( 'A', 'F' ) | COLCARDF=3 FF=0.033   |
| AND T.CURCODE = '1'              | COLCARDF=(missing) MAX_FREQ=(missing) FF=0.5                          |
| AND T.OPERTYPE = 'W'             | COLCARDF=(missing) MAX_FREQ=(missing) FF=0.04                         |
| AND T.TRANSDATE > ?              | COLCARDF=(missing) MAX_FREQ=(missing) FF=0.04                         |
| AND A.ACCOUNTNO = C.ACCOUNTNO    | COLCARDF=500,000/500,000 MAX_FREQ=(missing)/(missing) FF=0.333        |
| AND C.CARDNO = T.CARDNO          | COLCARDF=2,000,000/(missing) MAX_FREQ=(missing)/(missing) FF=0.000002 |
| )                                | FF=0  |

CARDF missing?!

CARDF=500,000

CARDF = 2,000,000

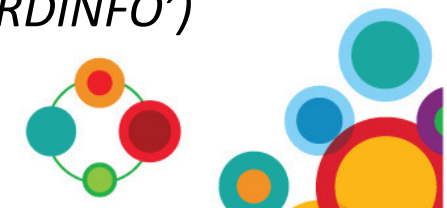
*Table cardinality – how many rows in the table?*

*SELECT TABNAME, CARD, NPAGES*

*FROM SYSCAT.TABLES*

*WHERE TABNAME IN ('TRANSINFO', 'ACCOUNTINTO', 'CARDINFO')*

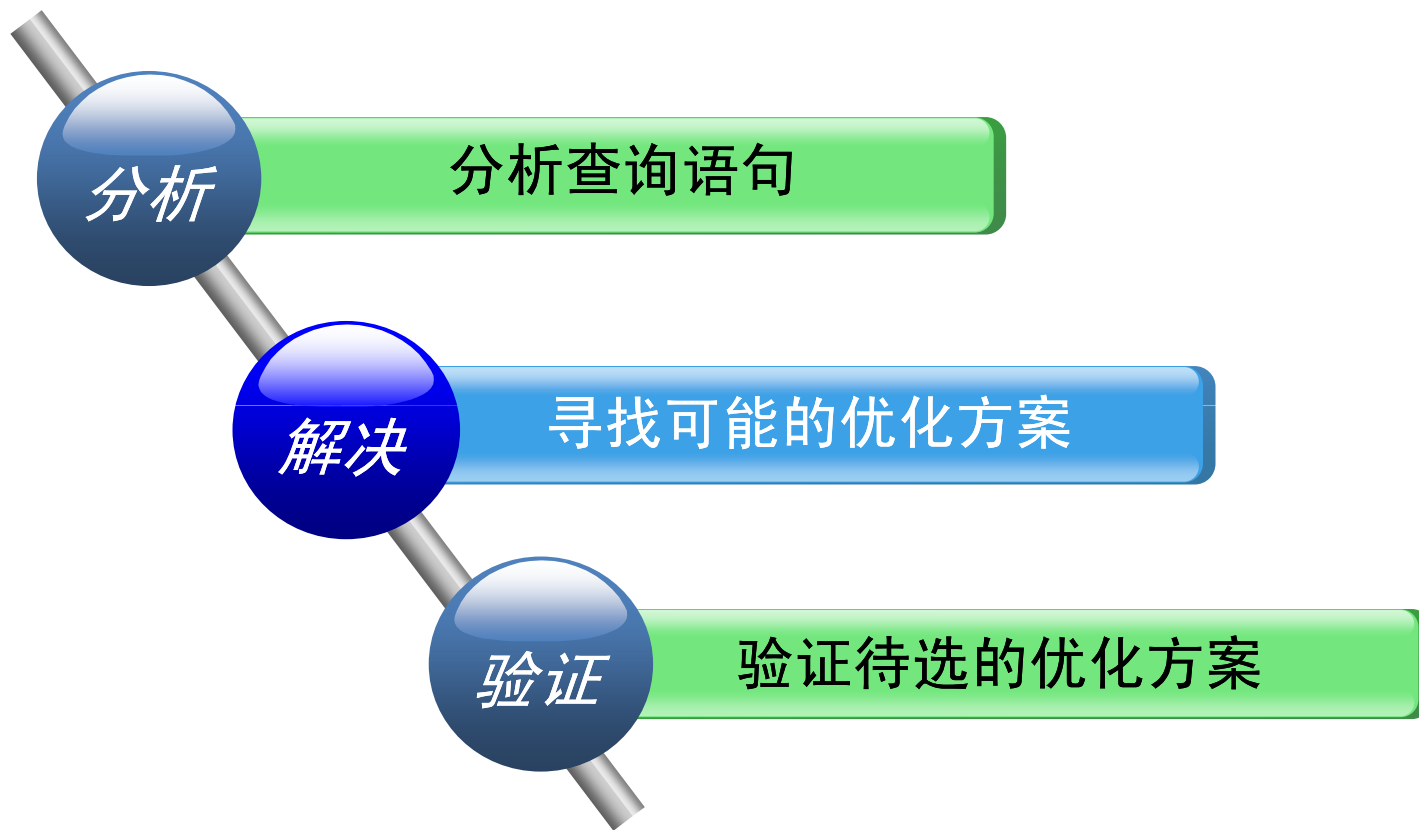
*AND TABSCHEMA = 'CDUGDEMO'*

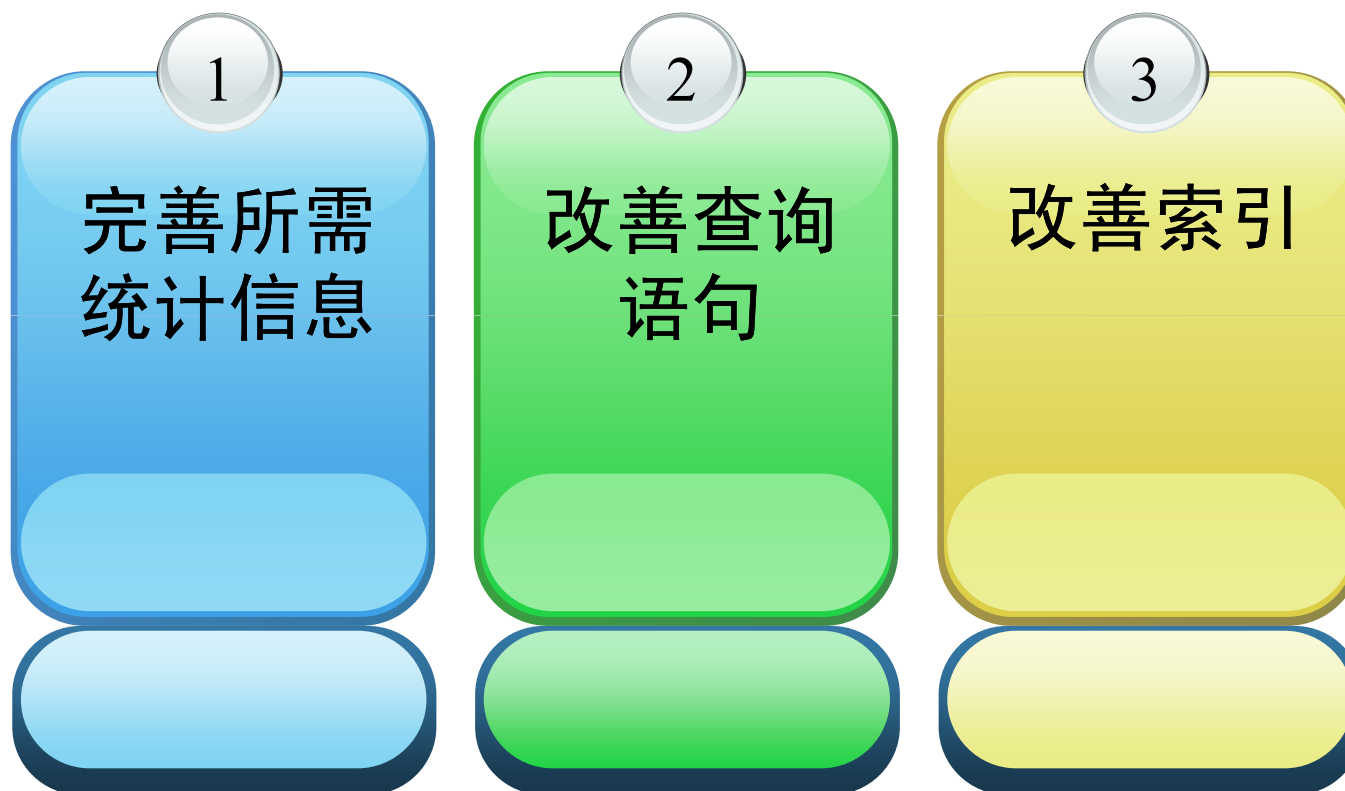






## 基于OQT的性能调优







# 设计新的索引——OQT Index Advisor



## Recommendation Detail

### Performance Improvement

Estimated performance improvement:  %  
 Disk space required (DASD space):  MB

预计对性能的提升  
以及对资源的消耗

### Customized and Recommended Indexes

[Add Index](#) [Edit Index](#) [Remove Index](#)

| Feature Details  | Creator | Object Name                        | Columns                       | Estimated Disk Space |
|--|---------|------------------------------------|-------------------------------|----------------------|
| <input checked="" type="checkbox"/> ACCOUNTINFO<br><input checked="" type="checkbox"/> Index | DB2OE   | ACCOUNTINFO_VIRT_IDX_1253611254765 | CUSTNO (ASC) , OPENDATE (ASC) | 13.58203125 M        |

推荐的新索引

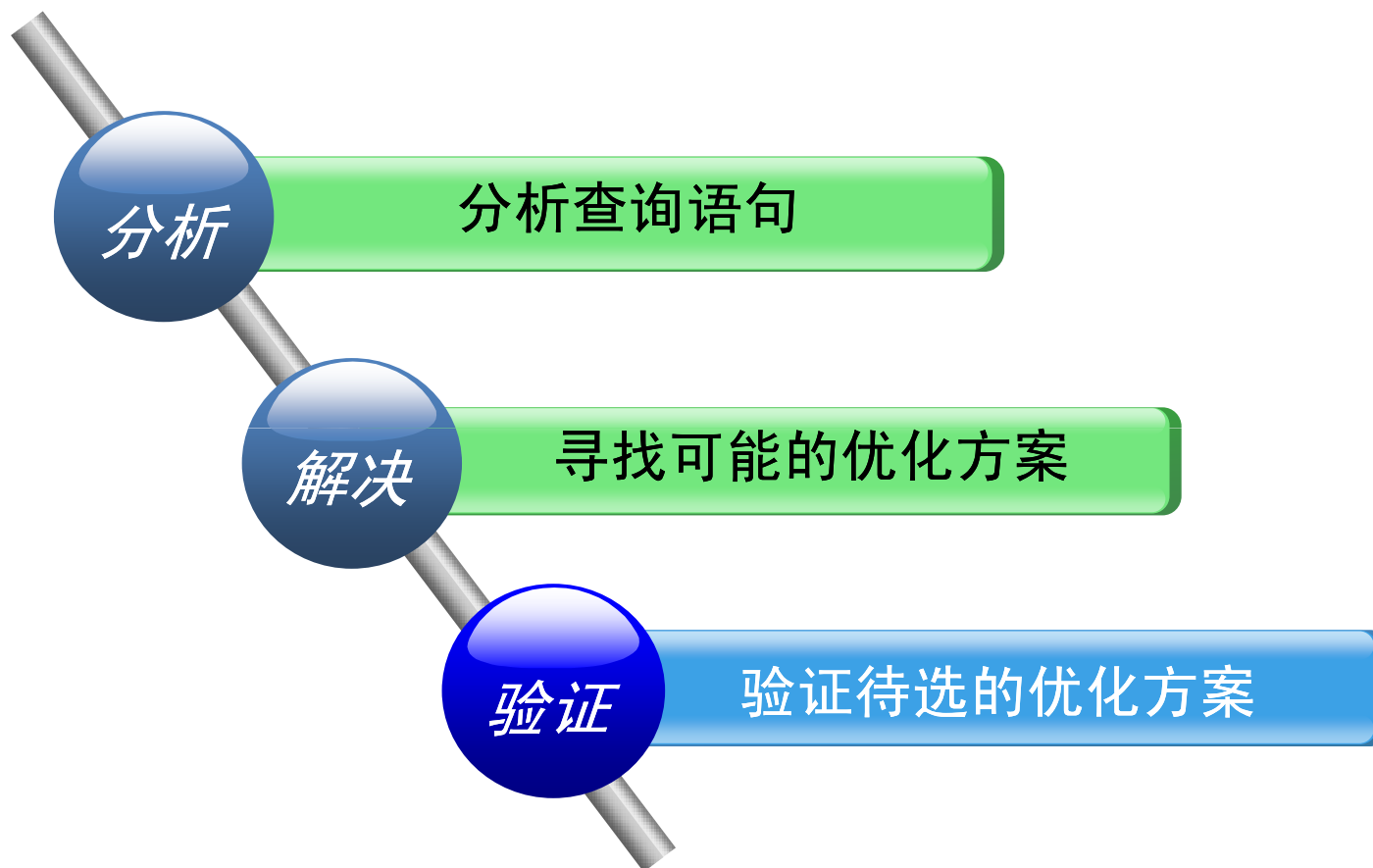
```
DDL Details
Save
CREATE INDEX "DB2OE"."ACCOUNTINFO_VIRT_IDX_1253611254765" ON
"CDUGDEMO"."ACCOUNTINFO" ("CUSTNO" ASC, "OPENDATE" ASC) NOT PADDED
FREEPAGE 0 PCTFREE 10;
```

该索引的DDL

### Existing indexes

| Feature Details  | Object Name     | Columns         |
|--|-----------------|-----------------|
| <input checked="" type="checkbox"/> ACCOUNTINFO<br>Index | IX_ACCOUNTIN... | ACCOUNTNO (ASC) |
| <input checked="" type="checkbox"/> ACCOUNTINFO<br>Index | IX_ACCOUNTIN... | BRANCHNO (ASC)  |







# 优化后访问计划发生改变

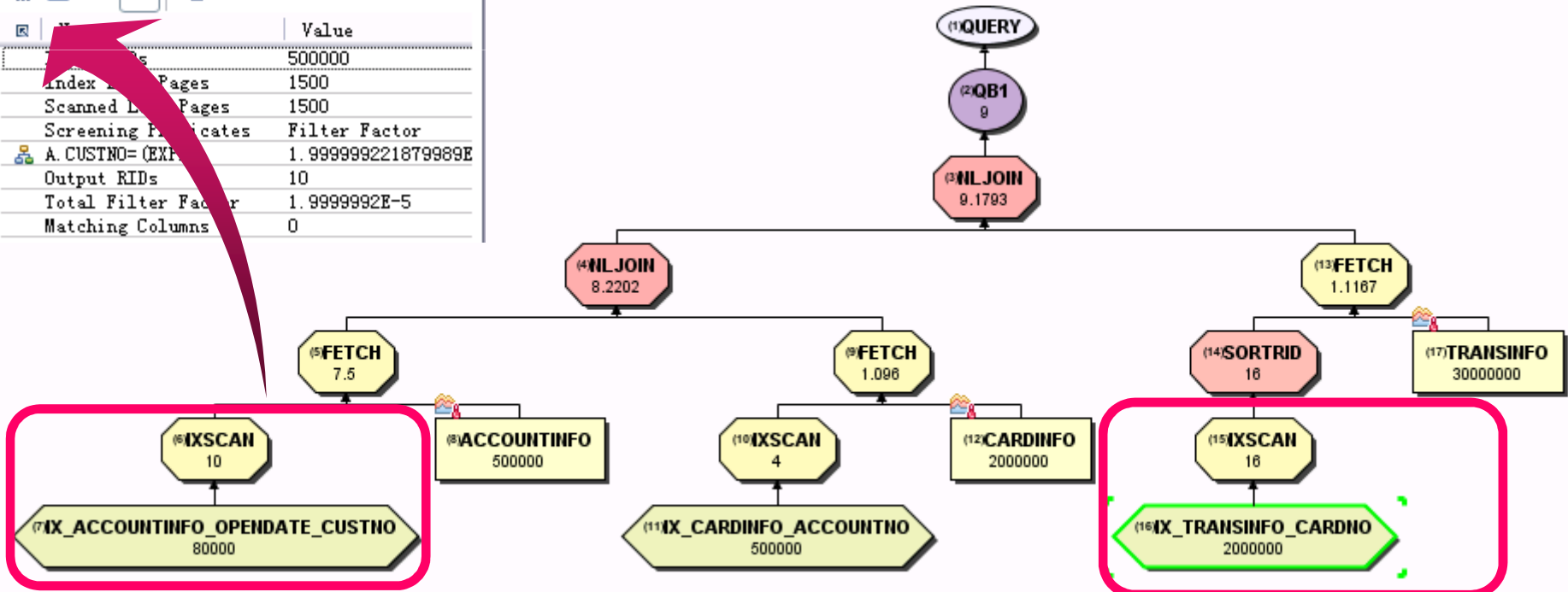
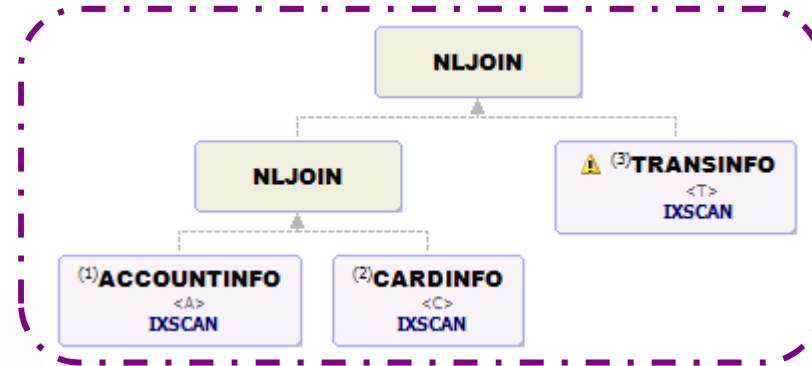
**Selected Node Descriptor: I...**

Description of Selected Node  
Displays information about the node that is highlighted in the diagram.

iscan  
Screening\_Predicates  
@ A.CUSTNO=(EXPR)

Attributes

| Attribute            | Value              |
|----------------------|--------------------|
| Index Pages          | 500000             |
| Index Leaf Pages     | 1500               |
| Scanned Leaf Pages   | 1500               |
| Screening Predicates | Filter Factor      |
| A.CUSTNO=(EXPR)      | 1.999999221879989E |
| Output RIDs          | 10                 |
| Total Filter Factor  | 1.9999992E-5       |
| Matching Columns     | 0                  |



**Selected Node Descriptor: IB...**

Description of Selected Node

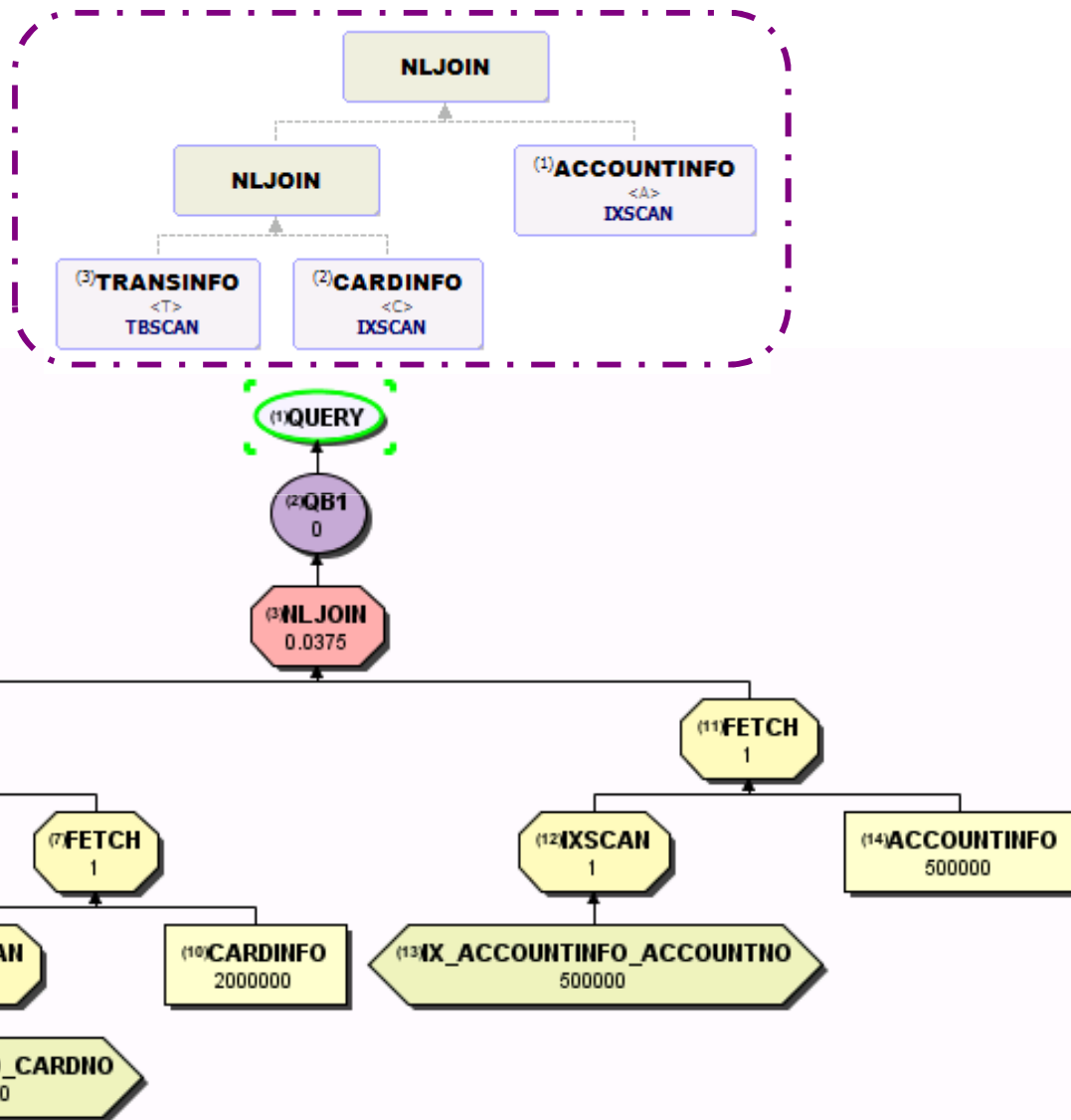
Displays information about the node that is highlighted in the diagram.

```

rscan
├── Stage1_Predicates
│   ├── @ T. CURCODE='1'
│   ├── @ T. OPERTYPE='W'
│   └── @ T. TRANSDATE> (EXPR)
└──
    
```

Attributes

| Name          | Value   |
|---------------|---------|
| Filter Factor | 0.04    |
| Type          | EQUAL   |
| Stage         | STAGE1  |
| Order         | 16448   |
| Marker        | N       |
| LHS Text      | CURCODE |
| RHS Text      | VALUE   |





# 向导型问题解决步骤 预防

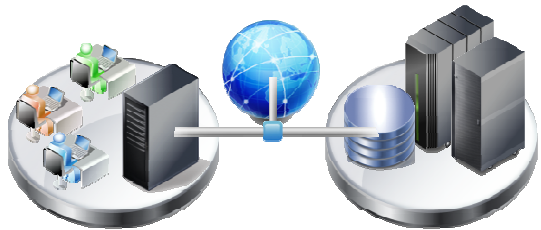
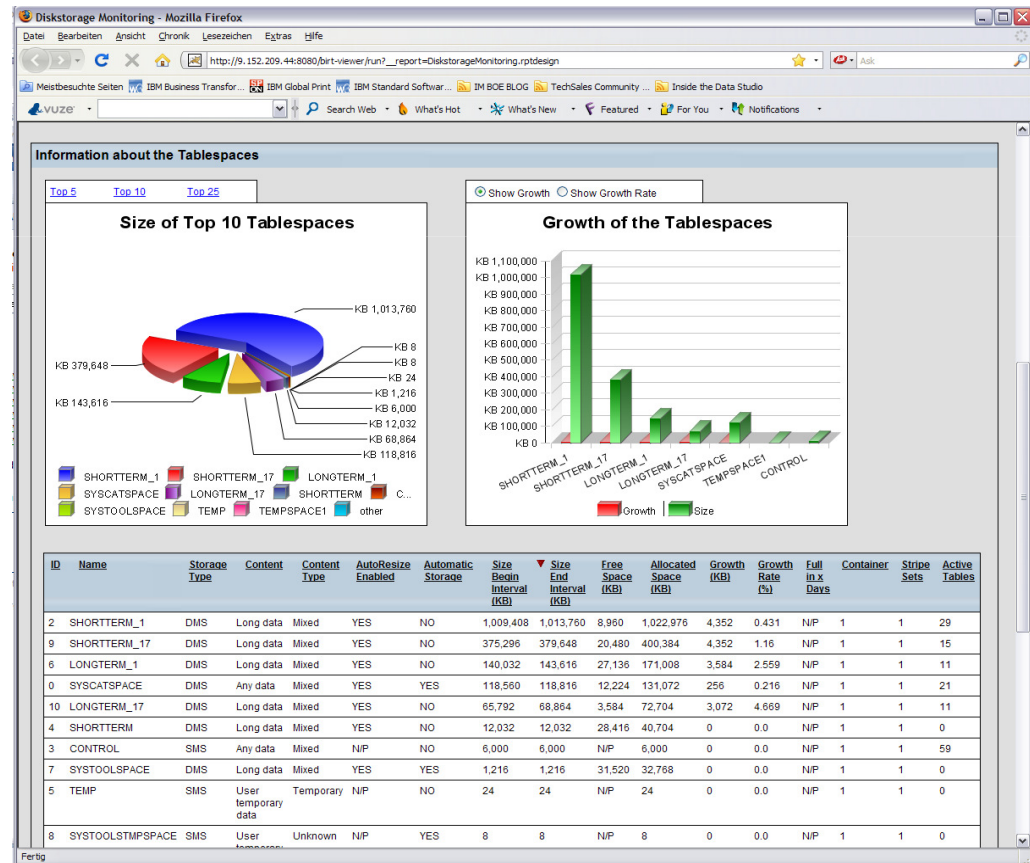


## 预防

- 监控和分析历史信息，作出趋势和规划
- 自动化管理工作
  - 负载

### 通过历史信息来预防性能问题

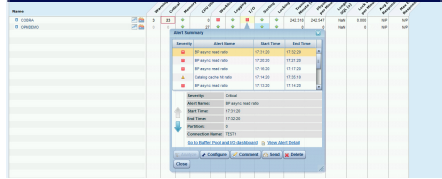
- 通过分析历史数据趋势来进行容量和增长规划
  - ✓ 给业务和IT 经理发送报告
- 确认最关键的业务能得到更多的资源
  - ✓ 提供工作负载的工具



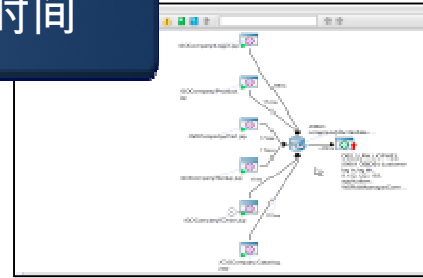
# Optim 性能管理解决方案

定位

定位数据库问题



定位响应时间



诊断

诊断问题



通过OPM仪表板来  
诊断问题

O/S 仪表板 with Tivoli  
Integration

Optim DB Administrator

解决

通过调整OS来  
解决问题



Optim Query  
Tuner and  
pureQuery

通过调整SQL  
解决问题



通过更改DB设置  
解决问题



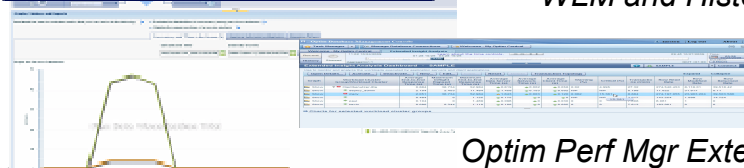
24

预防问题

Prevent problems with DB2 and OPM  
WLM and Historical Analysis

预防

Optim Perf Mgr alerts and  
overview dashboards



Optim Perf Mgr Extended Edition & Tivoli ITCAM







# 应用程序不工作？

## Users



Cannot find server - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites

Address <http://w3.ibm.com/>

**i** The page cannot be displayed

The page you are looking for is currently unavailable. The Web site might be experiencing technical difficulties, or you may need to adjust your browser settings.

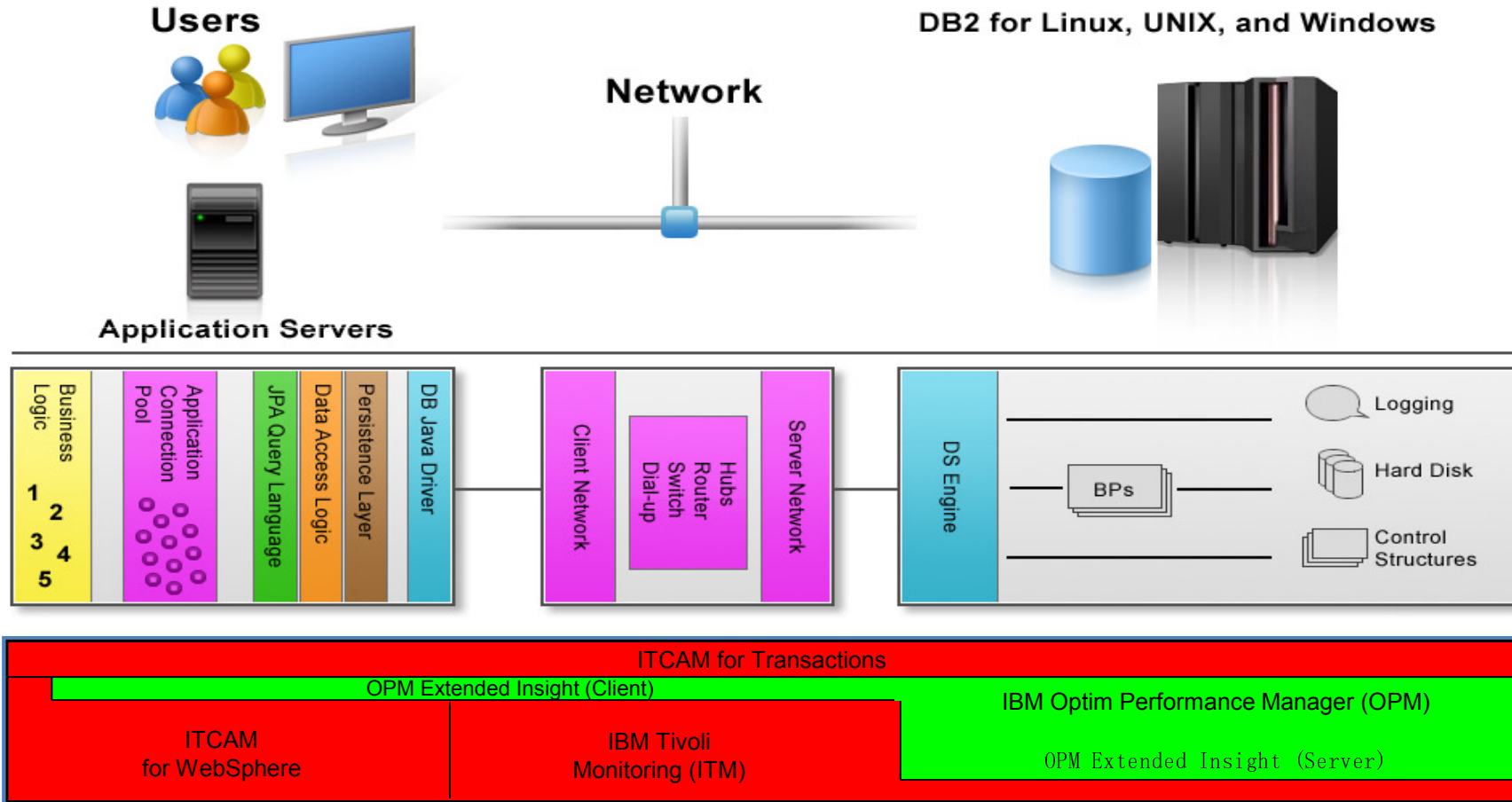
Please try the following:

- Click the Refresh button, or try again later.
- If you typed the page address in the Address bar, make sure that it is spelled correctly.
- To check your connection settings, click the **Tools** menu, and then click **Internet Options**. On the **Connections** tab, click **Settings**. The settings should match those provided by your local area network (LAN) administrator or Internet service provider (ISP).
- See if your Internet connection settings are being detected. You can set Microsoft Windows to examine your network and automatically discover network connection settings (if your network administrator has enabled this setting).
  1. Click the **Tools** menu, and then click **Internet Options**.
  2. On the **Connections** tab, click **LAN Settings**.
  3. Select **Automatically detect settings**, and then click **OK**.
- Some sites require 128-bit connection security. Click the **Help** menu and then click **About Internet Explorer** to determine what strength security you have installed.
- If you are trying to reach a secure site, make sure your Security settings can support it. Click the **Tools** menu, and then click **Internet Options**. On the Advanced tab, scroll to the Security section and check settings for SSL 2.0, SSL 3.0, TLS 1.0, PCT 1.0.
- Click the **Back** button to try another link.

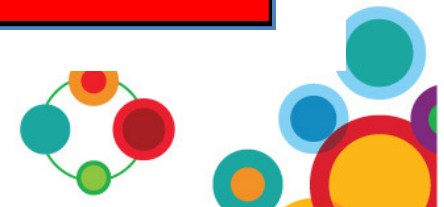




# 帮助定位问题所在..



↓  
details





# Extended Insight 是什么?

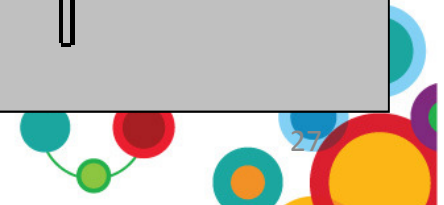
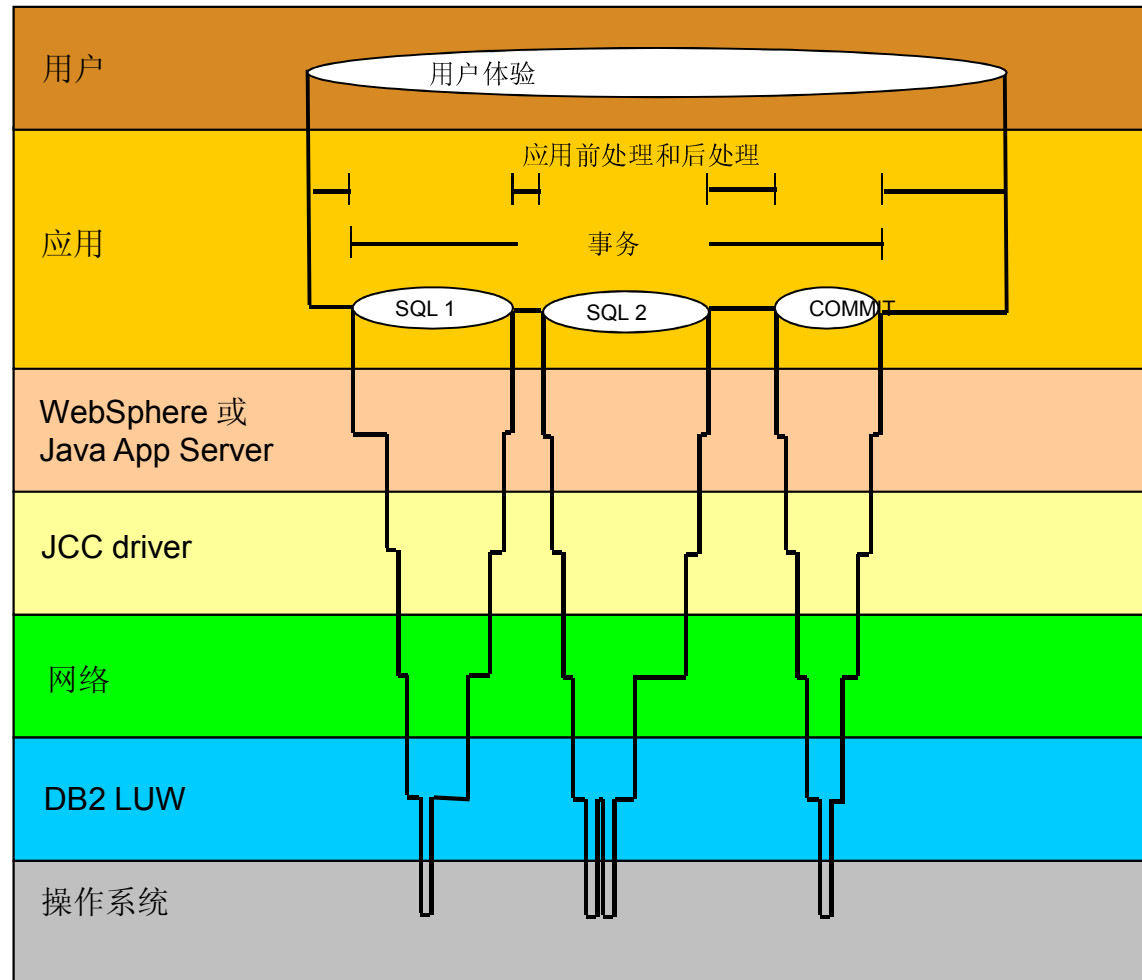
- 管理工作负载的服务协议级别的反应时间

谁 ■ 识别有问题的工作负载  
(用户, 客户机器, 应用等.)

何时 ■ 识别有问题的时间段

什么 ■ 识别有问题的SQLs

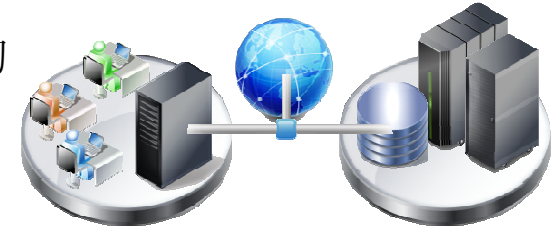
为什么 ■ 识别有问题的层





## 整体性能管理 -- OPM Extended Insight

- 对访问数据库的应用程序的负载的高级监控方案
  - 端到端数据库监控: 获得每一个预先定的工作负载, 如, 单个用户, 单个应用, 单个系统的响应时间和分解的时间 (应用、驱动、网络、数据库服务器)
  - 找到预先定义的单个工作负载中资源消耗最高的SQL语句
  - 识别出引发高负载的客户端
- 对以前产品(PE)的增强:
  - 同时支持JCC客户端应用和CLI应用
  - 原生支持 Cognos, SAP, SQW, and DataStage 等数据访问中间件
  - 深入分析工作负载在数据库如何执行 (I/O,锁等)
    - 锁等待、排序、队列、读、写以及其它时间分布指示器(需要DB2 V9.7 FP 1)
    - 按数据库分区(DPF)分析 (快速定位问题分区)
- 与Tivoli Composite Application Monitoring (ITCAM)集成
  - 获得更多得端到端的事务执行过程信息

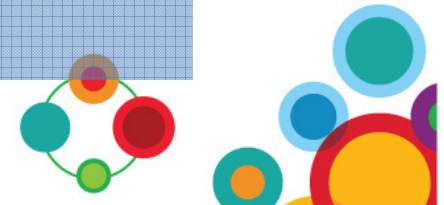




## Optim 性能管理解决方案关键商业价值

- ✓ 向导型问题解决的方式来管理性能
  - 定位，诊断，解决和预防问题，将问题解决在可能影响业务发生之前
  - 无缝的和Optim 家族集成来进行整体集成数据管理，进行商业优化
- ✓ 整体性能管理
  - 不仅管理数据库，还能管理应用程序的性能
  - Java™ 和 DB2 CLI 应用 for SAP, WebSphere, Cognos, InfoSphere DataStage, and InfoSphere SQL Warehouse 应用
  - 与Tivoli for enterprise performance analysis的集成
- ✓ 快速发布，即刻使用
  - 提供模板来进行配置，方便的向导式安装与维护

*Optim Performance Manager*  
• *Optim Query Tuner*





# Large Italian Insurance Provider - UGF



UNIPOL  
GRUPPO  
FINANZIARIO



## Challenge

- Reduce costs while improving quality of service for call center applications
- Optimize performance across 8 WebSphere Application Servers handling 4.5 million threads/day
- Deliver competitive applications to market faster without sacrificing quality
- Run reports to analyze performance
- Manage groups of SQL statements rather than single statements to improve efficiency
- Develop best practice for query optimization

## Solution

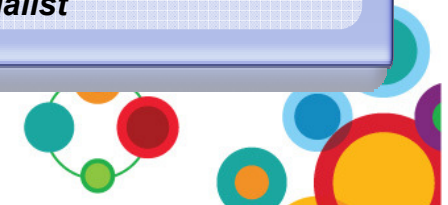
- IBM InfoSphere Optim Query Workload Tuner

## Business Benefits

- Reduced CPU cycles by 38% resulting in a significant drop in mainframe costs
- Improved performance with expert guidance to reduce reliance on special technical skills
- Increased organizational efficiency to deliver high performing applications faster
- Reduced and resolved performance problems by optimizing SQL workloads
- Establish robust, repeatable process for tuning SQL workloads

*"With InfoSphere Optim Query Workload Tuner, we were able to reduce CPU consumption on the mainframe by 38% resulting in significant costs savings."*

*Roberta Barnabe, DB2 Specialist*





# Consumer Product Company

## Challenge

- Develop a single, comprehensive view of performance across the enterprise
- Improve performance of business critical SAP applications
- Establish key performance indicators to ensure the DB2 and SAP environment support business goals
- Optimize the data warehouse to drive strategic decision making
- Run reports to analyze performance
- Identify performance bottlenecks and document resolution

## Solution

- IBM InfoSphere Optim Performance Manager Extended Edition

## Business Benefits

- Comprehensive, proactive performance management to prevent problems before negative impact
- Better resource utilization to minimize capital spending
- Document improvements in data warehouse and SAP application performance
- Empower junior DBAs to contribute sooner
- Immediate ROI in terms of cost & performance
- Improved performance without negative product impact

*“With InfoSphere Optim Performance Manager, our DBAs get a simple way to understand performance across the enterprise. Proactive alerts and the ability to set key performance indicators help optimize the performance of our data warehouse and SAP applications. We are also able to document cost savings with easy to use customizable reports.”*

*--Lead DB2 DBA*





# United States Senate



## Challenge

- Ensure service level agreements are satisfied, application response times increased from 3 seconds to up to 5 minutes!
- Prevent application outages, some outages lasted up to 2 days!
- Manage performance proactively to avoid production impact
- Empower IT staff to consistently solve highly technical performance problems
- Restore confidence in IT organization after application outages

## Solution

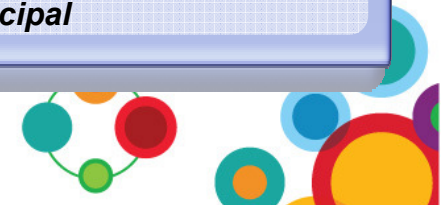
- IBM InfoSphere Optim Query Workload Tuner

## Business Benefits

- Ensured consistent application response time to satisfy service level agreements
- Improved performance with expert guidance and reduced reliance on specialized technical skills
- Focused on performance tuning not only post-production but also during development
- Optimized database design to improve application response time from 3 seconds to 10 milliseconds
- Improved performance for high priority queries from several minutes to sub-seconds

*“With InfoSphere Optim Query Workload Tuner, we were able to reduce workload on the mainframe by as much as 85%.”*

*Lloyd Matthews, DBA – Principal*







## Challenge

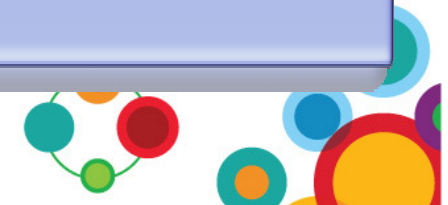
- Slow, unpredictable application response times resulting from poorly formed SQL
- Lack of insight into where and when performance bottlenecks occur
- Deep technical skill required to diagnose performance problems
- Inability to recreate performance problems making it impossible to diagnose issues
- Insufficient data to determine root cause
- Employees unable to complete routine tasks due to long application response times
- Inefficient use of human and IT resources
- Declining customer satisfaction

## Solution

- IBM InfoSphere Optim Performance Manager Extended Edition
- IBM InfoSphere Optim Query Workload Tuner

## Business Benefits

- Improved performance with optimized SQL statements
- Analyzed performance based on historical trends
- Identified performance bottlenecks before production impact to improve end user satisfaction
- Permanently solve performance problems rather than temporary workarounds
- Empowered IT staff to efficiently identify, diagnose, solve and prevent performance issues





## Challenge

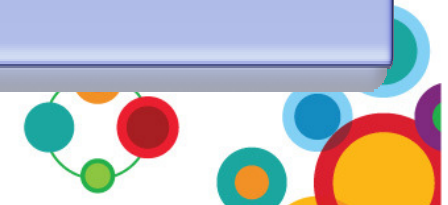
- Need to optimize performance in a large ERP implementation
- End users complaining about slow systems yet all performance indicators are green
- Transactions taking more than 3 seconds, above requirements defined in SLAs
- IT uncertain of root cause since existing software offers no insight into the problem
- Inability to get deep diagnostics on DB2

## Solution

- IBM InfoSphere Optim Performance Manager Extended Edition

## Business Benefits

- Resolved performance issue through deep diagnostics for DB2
- Identified, diagnosed and solved performance issues
- Integrated InfoSphere Optim with existing IBM software including DB2 and Tivoli
- Rewrote SQL statements to dramatically improve performance
- Diagnosed problems 70% faster





Thank you  
Questions?

