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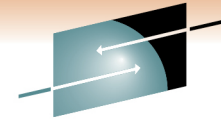
# DB2 Performance Tuning: Where do we start?

Jeff M. Sullivan  
IBM Systems and Technology Group Lab Services

Thursday, March 3, 2011: 11:00 AM-12:15 PM  
Room 211B (Anaheim Convention Center)



# So many places to look...



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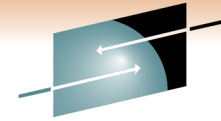
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# Agenda

- **The politics of performance**
  - The data base administrator role
  - Management expectations
  - DBA expectations
- **Performance Tuning Playbooks**
  - DB2 for z/OS
  - DB2 for LUW
- **DB2 biggest performance issues**
  - System related
  - Tooling
- **Performance Touch Points with DB2 for z/OS**



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# The data base administrator role



- **Protection of the company's data assets**
- **Availability of the company's data assets**
- **Fast delivery of the company's data assets**
- **Provide analysis on problems as required**

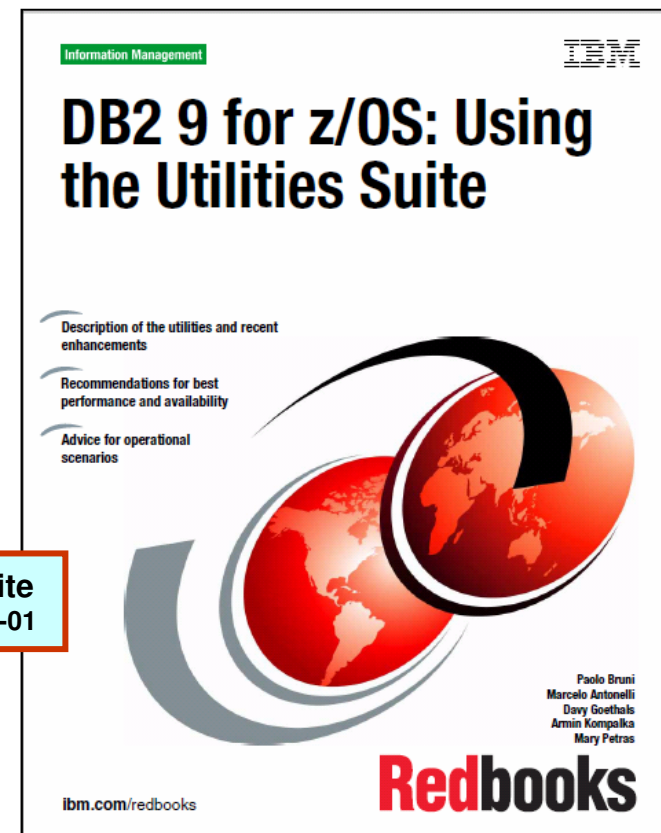
Protection, Availability, and Speed are the goals.

# Performance aspect – logging/recoverability

## Protection of the company's data assets

- Adequate backup and recovery
- Retention of logging media
- Ensuring adequate storage and retention of logs and backups
- Performing disaster recovery scenarios

**DB2 9 for z/OS: Using the Utilities Suite**  
February 2010 SG24-6289-01




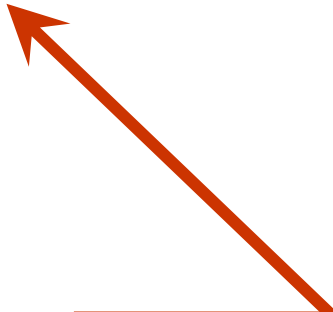
# Performance aspect – application and SQL, maintenance



## Availability of the company's data assets

- Reviewing data paths into and out of the DBMS
  - Efficiency
  - Connections
  - Minimal server "hops"
  - Outage prevention
- Routine maintenance (data growth)

- 
- Maintenance
  - Manage for growth
  - Data archival/purges

- 
- Application usage  
(OLTP vs Batch vs BI)
  - SQL coding

# Performance aspect – SLA/SLO



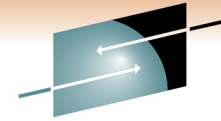
## Fast delivery of the company's data assets

- Creation of and meeting service level objectives
- Access paths and access strategies
- Ensure the data is delivered as quickly and efficiently as possible

- Performance data collection
- Measurable SLA/SLOs
- Object placement and I/O



# Management's expectation & perspective



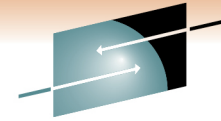
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- *Ability to look at the overall environment*
- *Make projections on the growth*
- *Plan for any future projects*

*Motivation: To rein in spending and control costs*

*To an I.T manager perspective:*

- *Making a pretty good estimate on how much the overall environment will grow*
- *Resolve outstanding issues that would enable postponing upgrades*
- *Not being blindsided by an issue not caught by the database administration staff*



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# Data base administrator's perspective

- *Faster mean time to problem resolution*
- *Get to the problem faster than having the users complain to his manager*

*Motivation: To not be blindsided by a problem*

*To a DBA this translates to:*

- *Monitoring by rules*
- *Responding quickly to the problems when they happen*
- *Planning for that next growth issue*

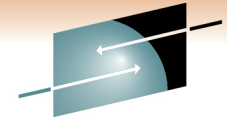
# A few words on performance “politics”



- Usually do not happen when applications are...
  - Unit tested
  - System tested or shakedown tested
  - Integration tested
- But when they happen, DBAs ask...
  - Is this a one-off situation?
  - Or is this a new “steady state”?
    - New workload
    - Existing work changes
    - DBA misstep

## The DBA “unwritten” Code

- (1) To minimize problem phone calls
- (2) To make the on-call rotation a non-item task
- (3) To never receive the problem from your boss



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## A few words on performance “myths”

“...If we tune the environment, we can reduce MIPS being used by the application...”



“...Performance tuning is easily resolved by finding the spikes and correcting for those spikes...”

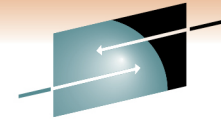


“...We’re getting performance problems in \_\_\_\_\_. We did not change anything...”



Better approach:

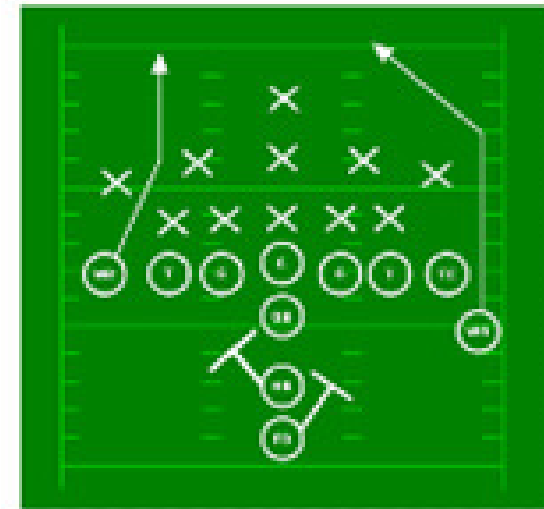
- Tune the application
- Put the “spikes” in context
  - New app(s)?
  - Change in app(s)?
  - Change in environment?
  - Continued growth?
- Consistent measurement – How do you know there is poor performance?



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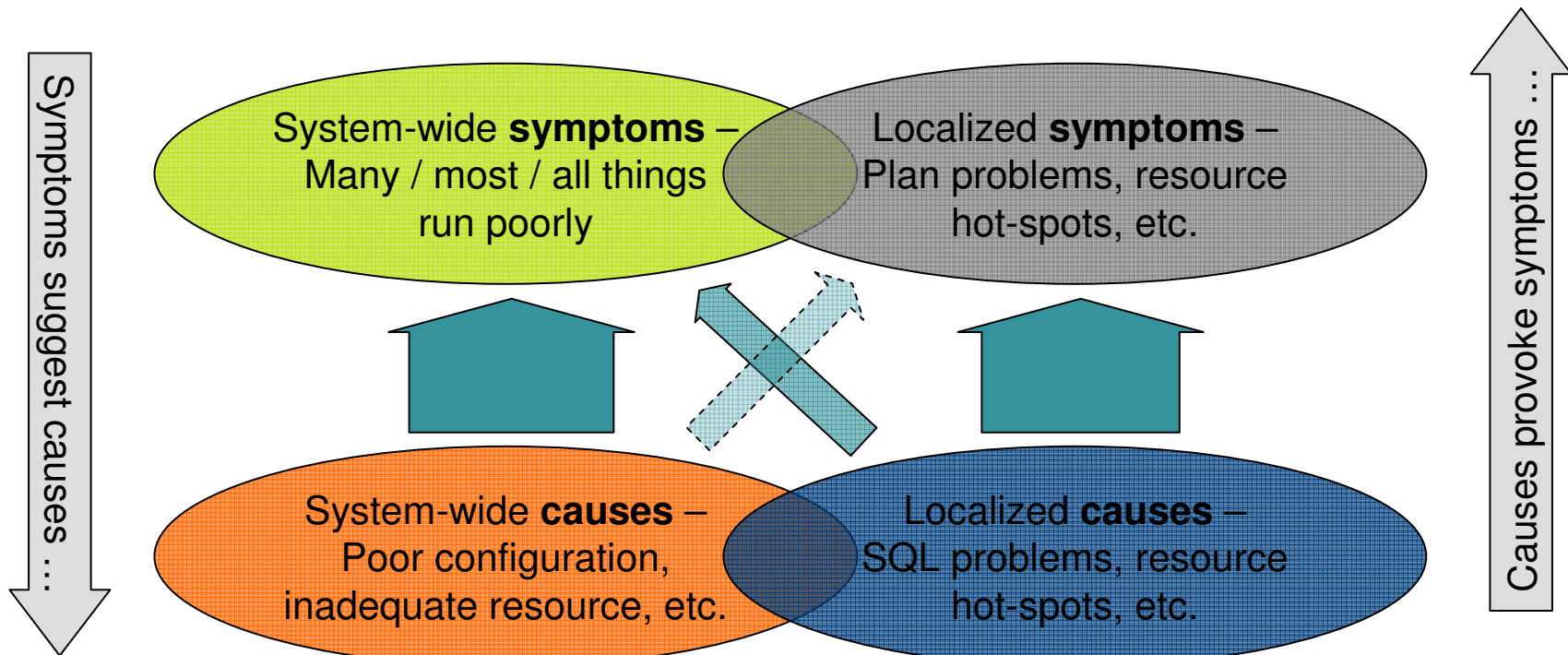


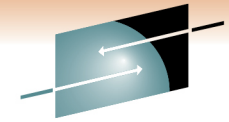
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# System-level vs. Local: Symptoms & Causes



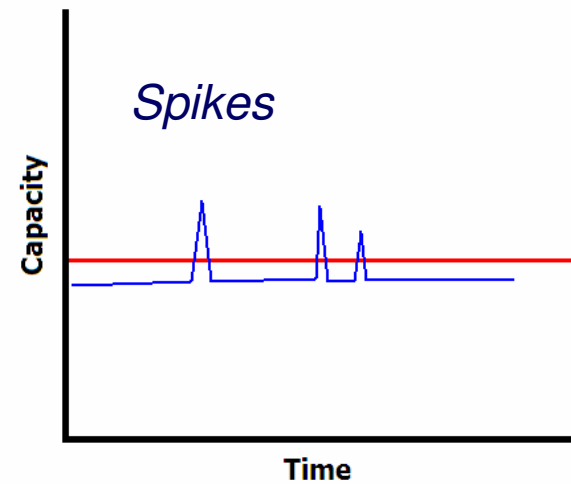
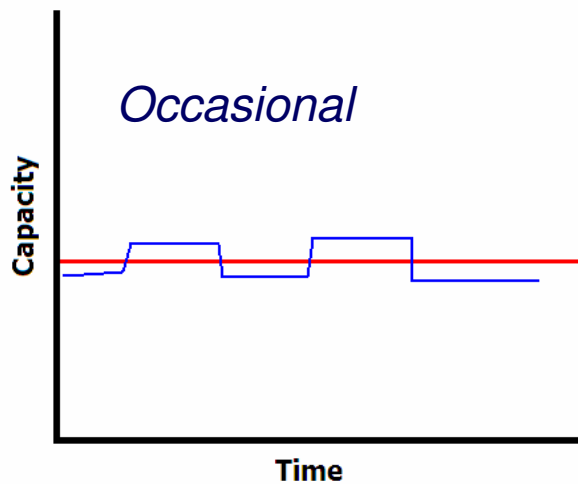
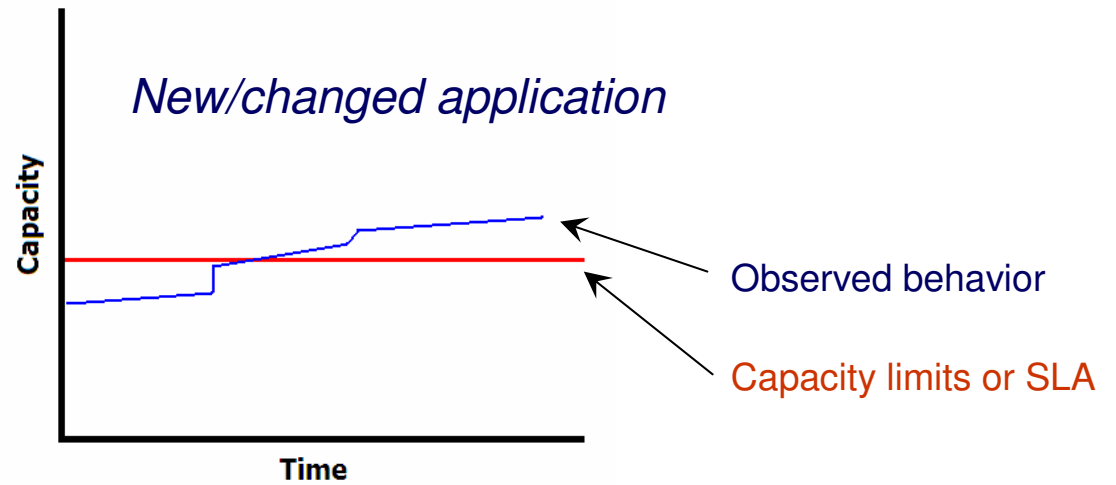
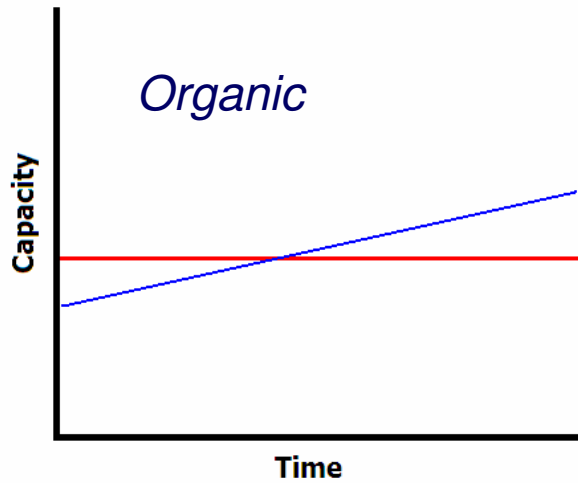
- Performance problems come in two main flavors
  - Localized, impacting a subset of statements or applications
  - Broad-scope, impacting the entire system
- Many individual problems can combine to create a system-level symptom!





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# Usage and Growth

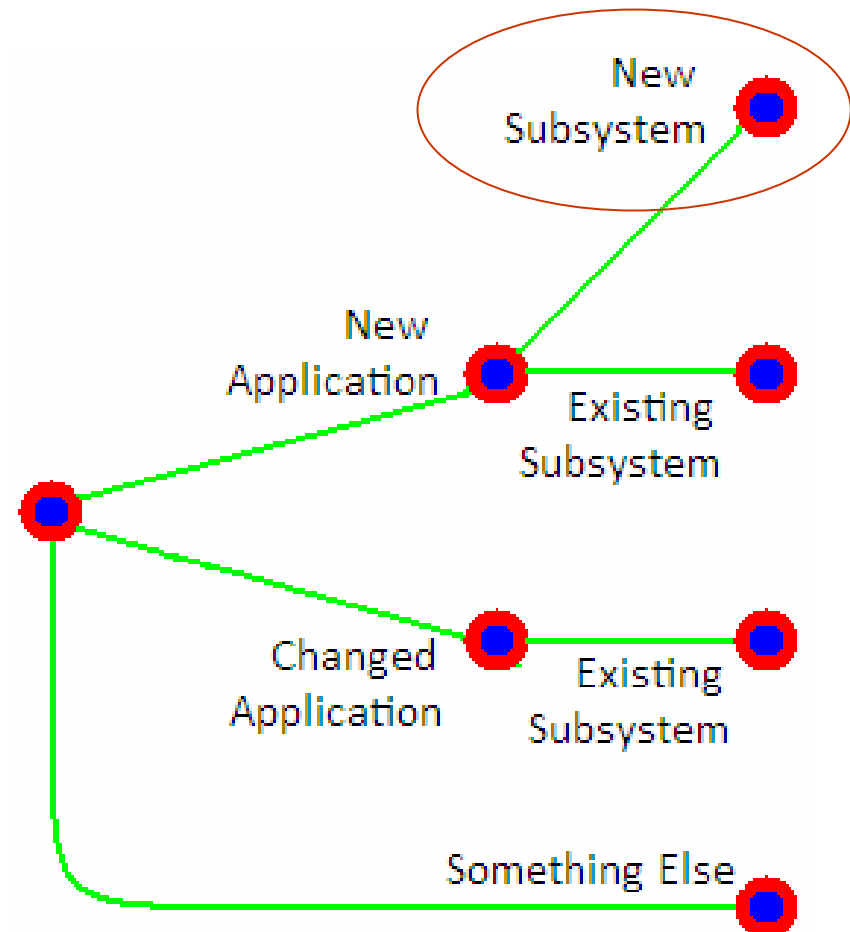


# Performance tuning playbooks

## DB2 for z/OS

New application on a new subsystem:

- zParm settings
- Above/below the line memory allocations
- WLM settings for service class pertaining to DB2
- SQL
  - If less than 5 SQLs running slow, tune the SQL
  - If more than 5 SQLs running slow, look at the I/O and bufferpool
- Locking behavior





## Sidebar: Why 5 SQL statements?

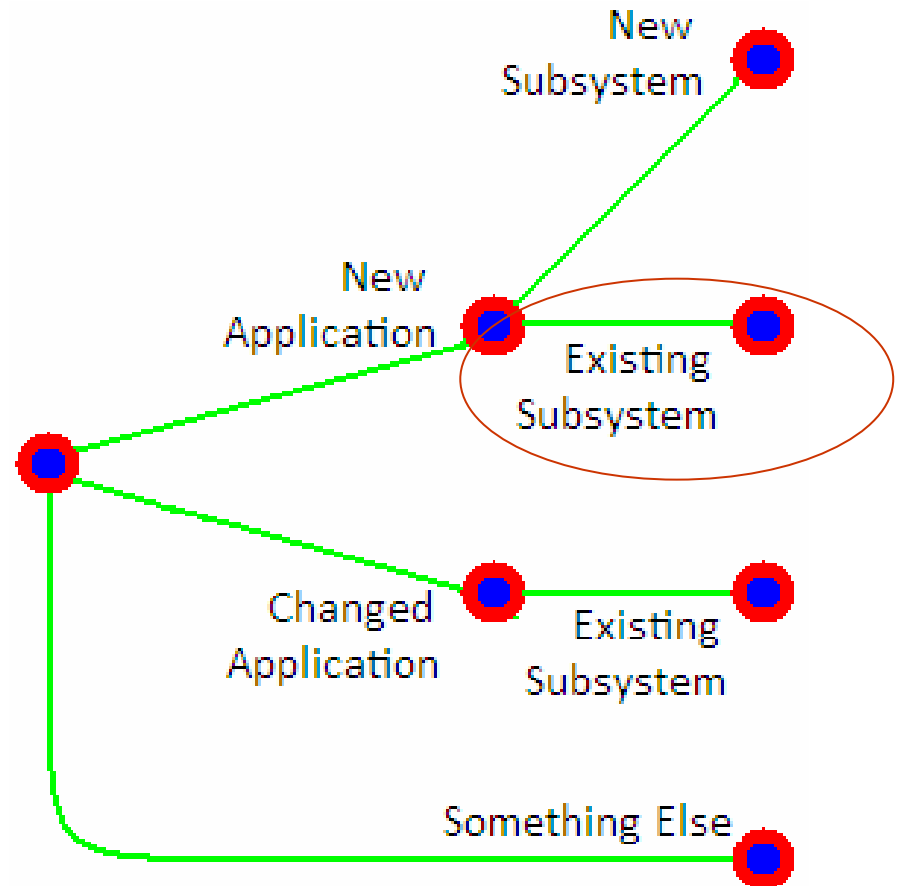
- Jeffy's rule of "10"
  - Most I/O is caused by no more than 10 tables/indexes
  - No more than 10% of all I/O data show high usage sync activity
  - Most applications have a top 10 list of poor performing SQL
- Of the top 10 poor performing SQL...
  - There are 2 to 3 versions running concurrently
  - Therefore, average of 5 SQL statements

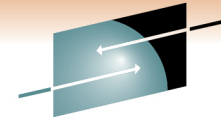
# Performance tuning playbooks

## DB2 for z/OS

New application on an existing subsystem hosting applications:

- Activity in the buffer pools and I/O
- SQL
  - If less than 5 SQLs running slow, tune the SQL
  - If more than 5 SQLs running slow, look at the I/O and bufferpool
- Locking behavior
- Capacity like tablespace growth





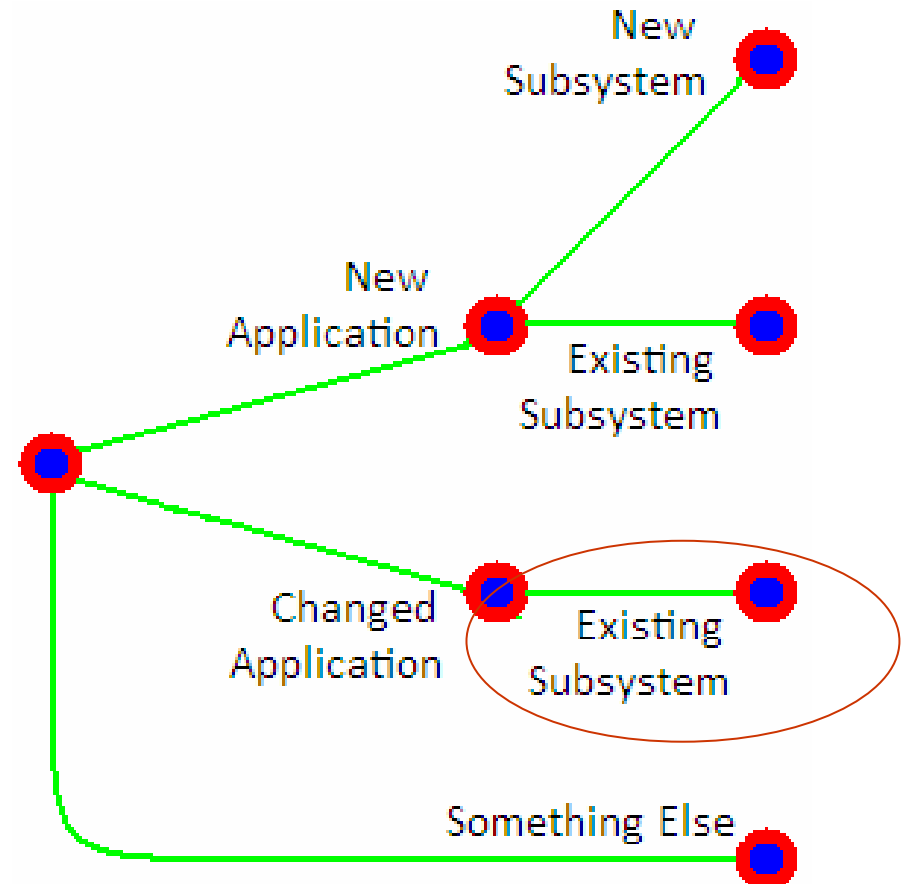
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# Performance tuning playbooks

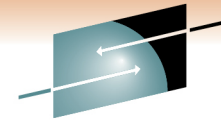
## DB2 for z/OS

Change to an existing application:

- SQL
  - If less than 5 SQLs running slow, tune the SQL
  - If more than 5 SQLs running slow, look at the I/O and bufferpool
- Locking behavior
- Activity on the subsystem



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# Performance tuning playbooks

## DB2 for z/OS

No perceptible change whatsoever  
(application and environment)

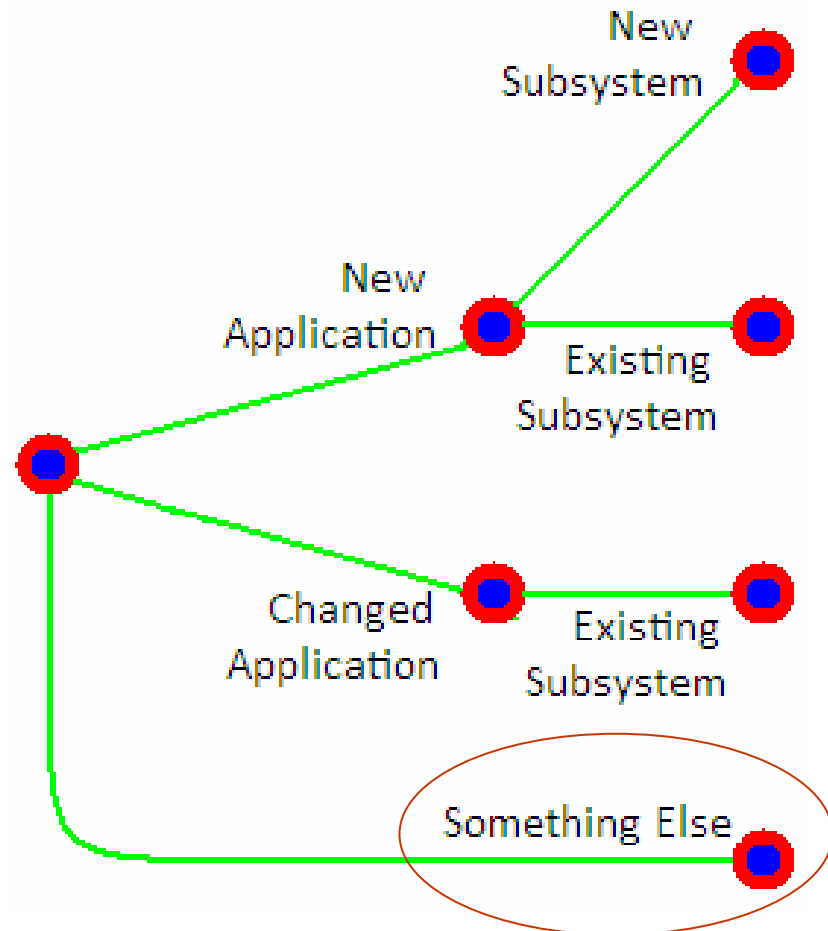
- Organic growth
- Something unexpected is running

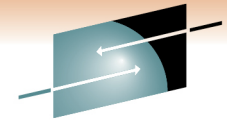
How did “you” hear about the problem?

- Tool showed problem
- Identified by an end-user or application programmer

What should be researched?

- Check for something unexpected additional (Heavy utilities running)
- SQL to find the long running queries, then
- RUNSTATS on tables identified in the long running queries
- Followed by a health check across-the-board
- Trend analysis and capacity planning like table space growth





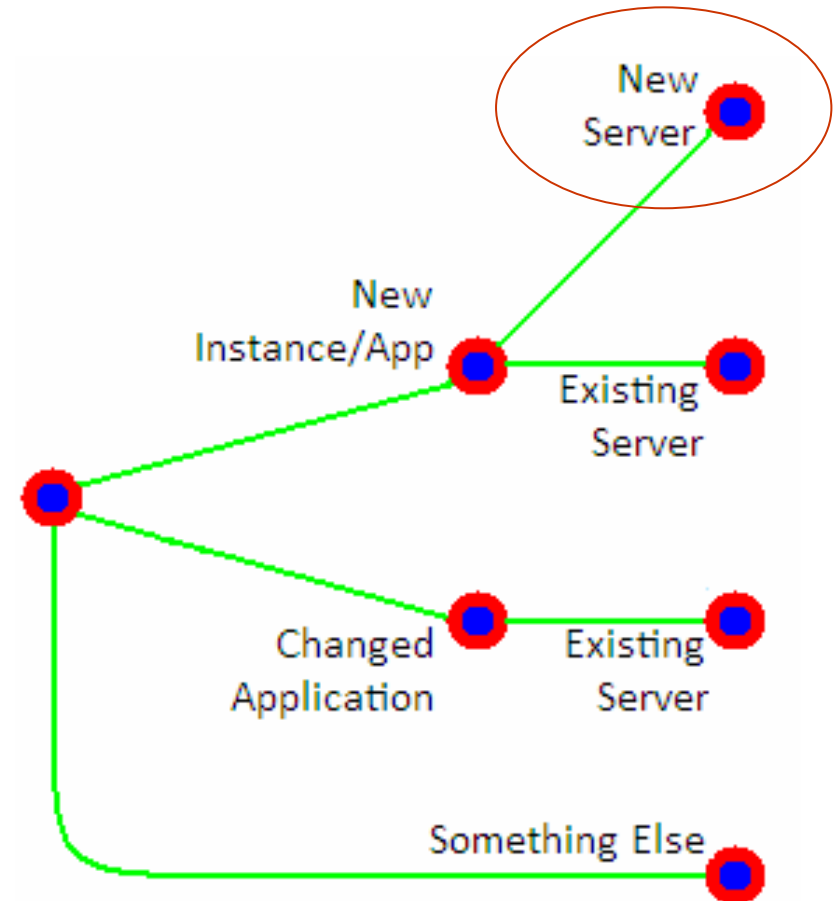
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# Performance tuning playbooks

## DB2 for LUW

New application on a new wide open DBMS server

- Inappropriate instance/database level/DB2 WLM settings
- SQL
  - If less than 5 SQLs running slow, tune the SQL
  - If more than 5 SQLs running slow, look at the I/O and bufferpool
- Locking behavior due to application concurrency



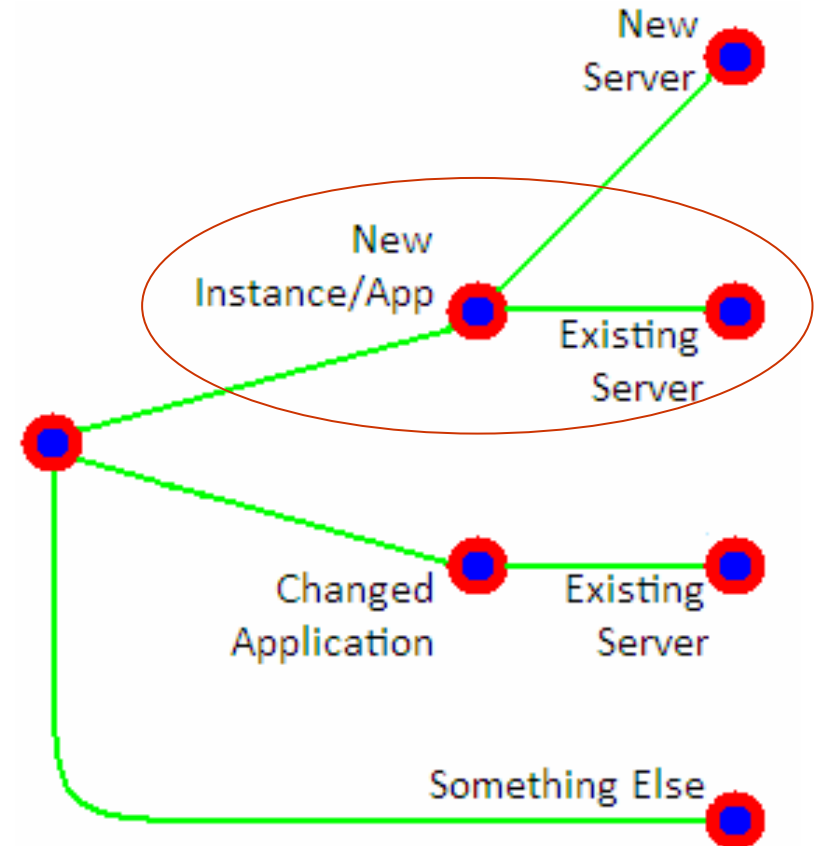
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# Performance tuning playbooks

## DB2 for LUW

New application on an existing DBMS server

- Activity on the server
- Instance/database level settings
- SQL
  - If less than 5 SQLs running slow, tune the SQL
  - If more than 5 SQLs running slow, look at the I/O and bufferpool
- Locking behavior

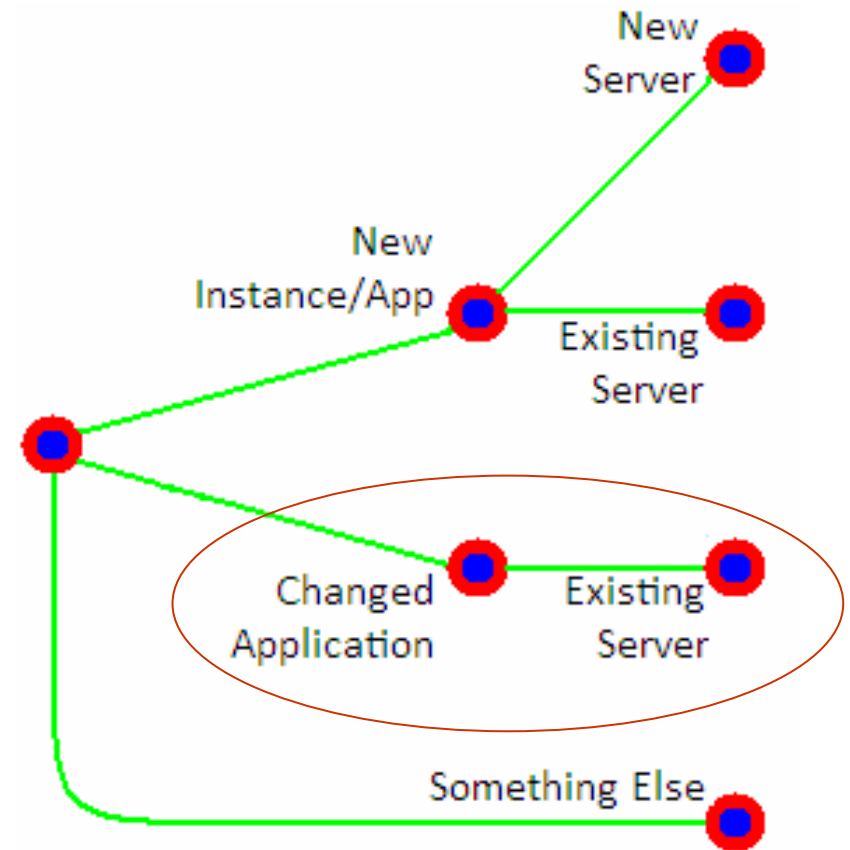


# Performance tuning playbooks

## DB2 for LUW

### Changed application

- SQL
  - If less than 5 SQLs running slow, tune the SQL
  - If more than 5 SQLs running slow, look at the I/O and bufferpool
- Instance/database level settings
- Locking behavior
- Activity on the server



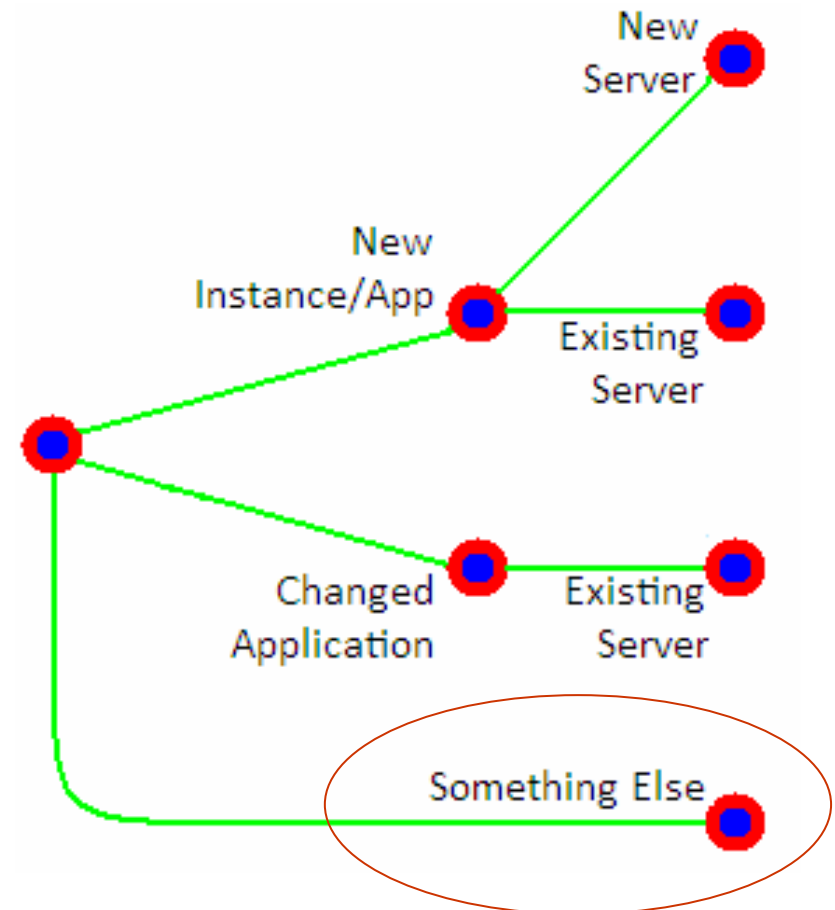
# Performance tuning playbooks DB2 for LUW

No perceptible change whatsoever  
(application and environment)

- Organic growth
- Something unexpected encountered

What should be researched?

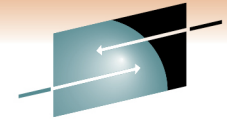
- SQL - long running queries
- RUNSTATS - on tables identified in the long running queries
- Something unexpected
- Trend analysis and capacity planning



Best Practices Tuning and Monitoring Database System Performance  
<http://www.ibm.com/developerworks/data/bestpractices/systemperformance/>



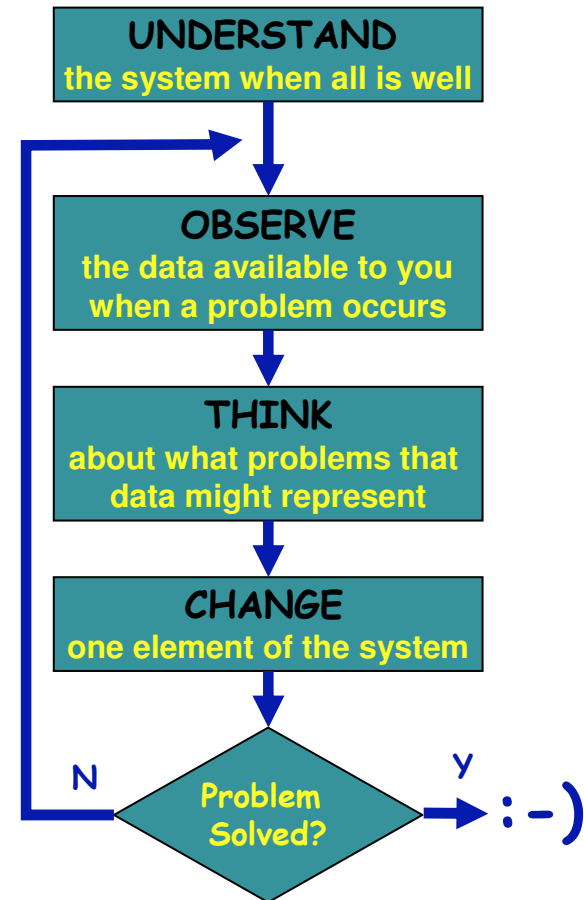
# A Thoughtful, Enlightened Strategy



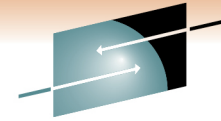
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Structured, methodical, closed-loop approach

- Be prepared! Understand how the system works when things are well
- Look at high-level performance symptoms with tooling
  - Optim Performance Manager
  - Omegamon XE
  - Iostat / db2look
  - Resource Management Facility
  - Other tools
- “Divide and conquer” the problem
  - What causes do the symptoms indicate?
  - What do they rule out?
- Make one or more hypotheses
- Important: change one thing at a time!



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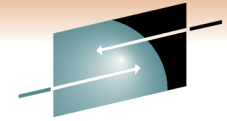
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# DB2 biggest performance issues



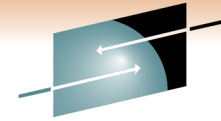
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## Underestimating the effects of ...

- the DB2 setup
- the I/O (DB2 for z/OS)
- poorly written SQL
- the workload



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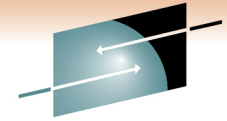
# DB2 setup - Buffer pool strategy

- All I/O is buffered, no direct reads
  - DB2 does many operations autonomously (Predictable)
  - Unexpected things in the buffer pool (Unpredictable)
- DB2 has to “drop what it is doing” to perform a read
- Contention
  - Buffer pool too small
  - Competition within the pool
  - Threshold settings not reflective of usage

**DB2 9 for z/OS: Buffer Pool Monitoring and Tuning**

<http://www.redbooks.ibm.com/redpieces/abstracts/redp4604.html>

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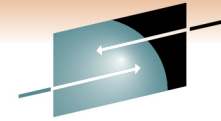
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# DB2 setup - Connections

- Know thy traffic
  - Application traffic
  - Server-to-server traffic and latency
  - Workload and usage
- Contention
  - Number of hops
  - Latency
  - Number of connections
  - Settings not reflective of usage

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## Underestimating the I/O – High usage objects/Logical Control Unit

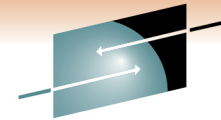
- Highly used DB2 objects
  - Table spaces
  - Index spaces
- Highly used disk controllers
- Combination of both

**DB2 9 for z/OS and Storage Management (SG24-7823-00)**

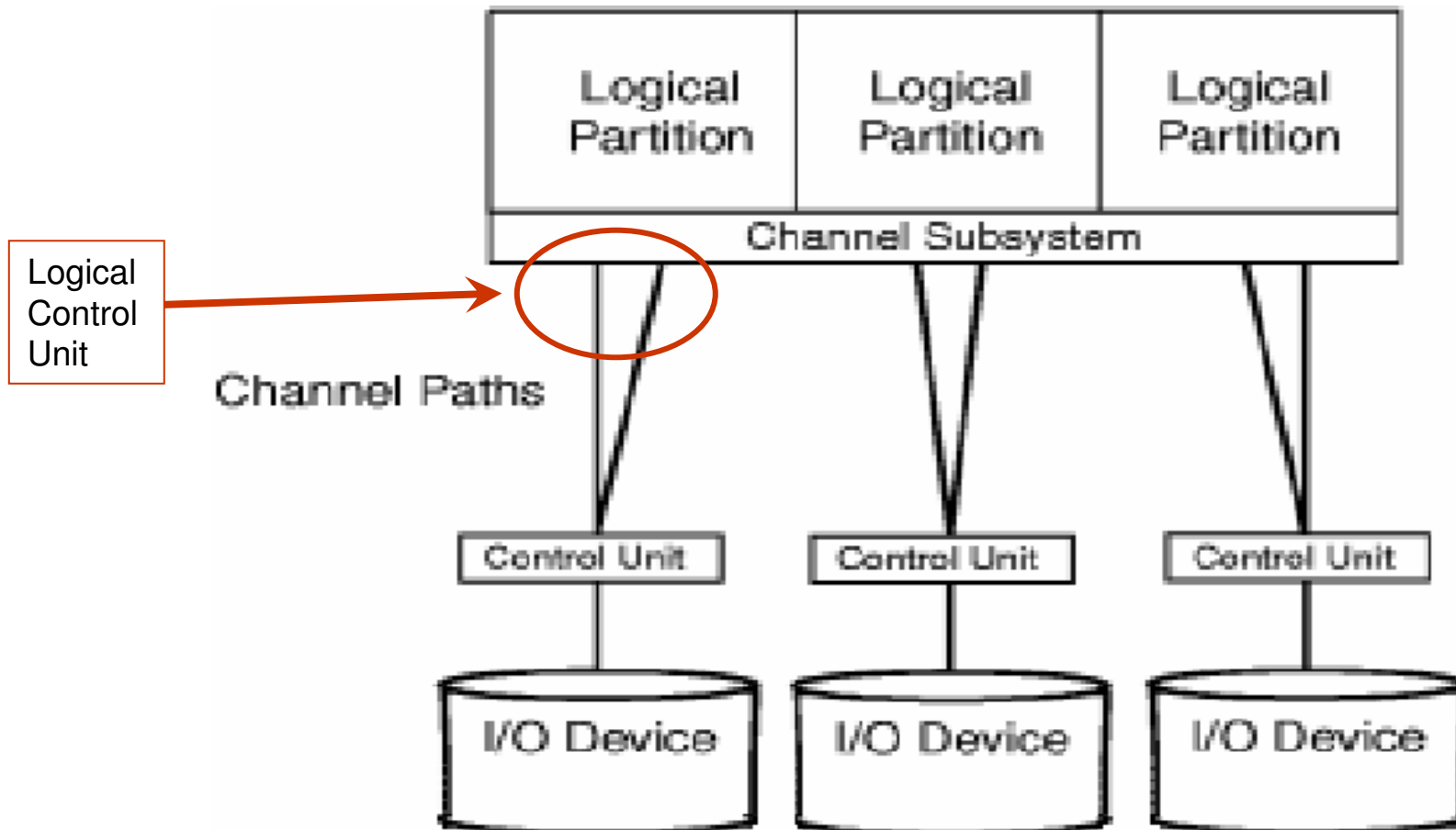
<http://www.redbooks.ibm.com/abstracts/sg247823.html?Open>

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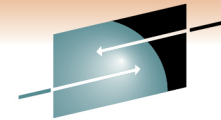
# Bottlenecks due to bad placement of DB2 objects on DASD



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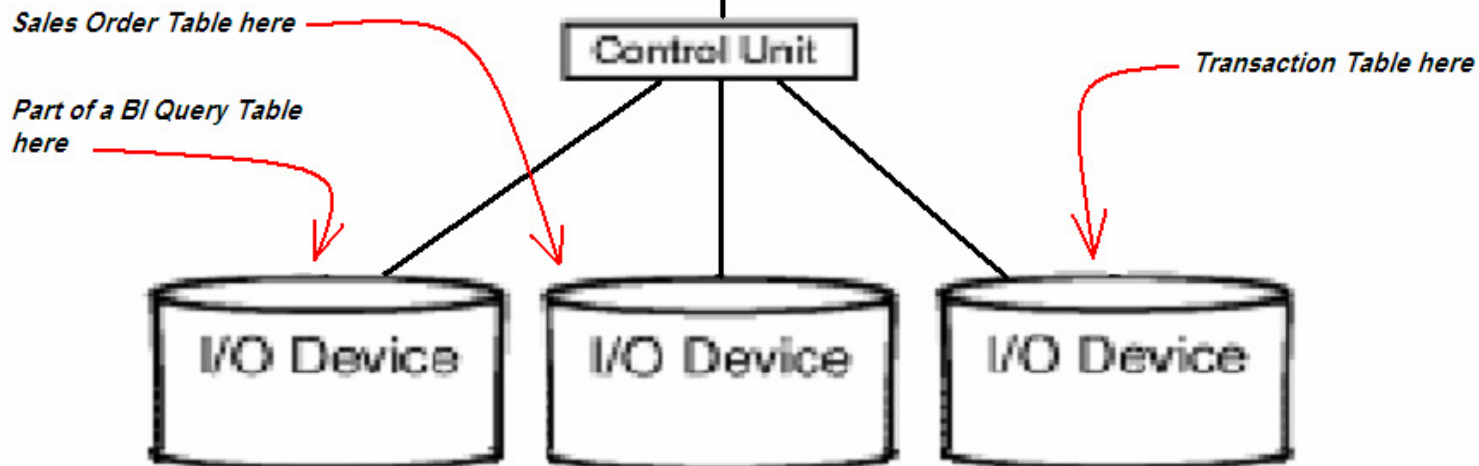
# Consider this example



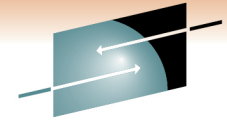
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- Observed conditions:**
- Slow conditions in online ordering system
  - One particular BI query might be slow
  - BP hit ratios may show low hit ratio and altering the size makes little improvement
  - Just started happening







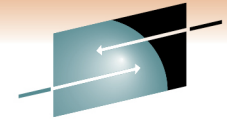
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## Poorly written SQL and the workload

- Dynamic SQL challenge
- Need to find the “bad” SQL
- How do you know the “good” SQL from the “bad” SQL
- Situation of execution
  - One-off inconsistent
  - Same time / same day-of-week but different day
  - Did it just start happening without change
- Dynamic SQL – Finding the application



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# Sequence to the Hunt for Bad SQL

- Capturing the SQL
  - On-line monitors
  - If that doesn't work, set a trace
- Analyzing/Tuning the SQL
- Getting the SQL changed
  - Hopefully there is a feedback/code review process
  - Regression test "sandbox"

Omegamon XE or equivalent

Scanning the dynamic statement cache:

- Data Studio Standalone
- Optim Query Tuner
- Query Workload Tuner

Optim Query Tuner for DB2 for z/OS or equivalent

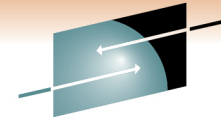
Data Studio Standalone:

- Query formatter
- Access plan graph
- Statistics advisor

Optim Performance Manager

pureQuery

- Static binding plus WLM

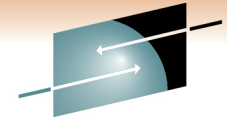


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# You have the SQL, now what?

1. Minimize I/O
  - Find in the buffer pool
2. Minimize synchronous activity
  - Have DB2 predictably prefetch into the buffer pool
3. Combine SQL operations to minimize CPU instructions
  - Find an SQL guru
  - Use tooling
    - OQT - Tune SQL pre-production while costs and impact are low
    - OQWT - Optimize workload for peak performance

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# Tooling in Performance Management

## DB2 for z/OS

OMEGAMON XE DB2 Performance Expert  
OMEGAMON XE DB2 Performance Monitor  
DB2 Buffer Pool Analyzer  
Optim Query [Workload] Tuner  
DB2 Query Monitor  
DB2 Performance Toolkit SAP Edition

## DB2 for LUW

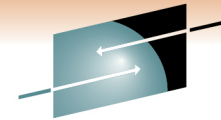
Optim Performance Manager  
Optim Query Tuner

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

<http://www.redbooks.ibm.com/redpieces/abstracts/sg247925.html?Open>

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# Optim Performance Manager DB2 for LUW



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Optim Performance Manager: Health Summary - Mozilla Firefox: IBM Edition

http://localhost:9080/optimdatatools/console/main/index.jsp#actTask%3DHEALTH\_SUMMARY\_KEY%3Bdsconsole\_startup\_tasks%3Dwelcome%2CgroupedConnMgt.id%2CIO\_DASHBOARD\_KEY%2CMEMOI

Optim Performance Manager Health Summary

Task Manager | Manage Database Connections | Welcome - My Optim Central

Refresh: Stopped | Period: 04/05/10 11:43 - 04/05/10 12:43 | Time zone: GMT -07:00 | Duration: 1 Hour

Health Summary:

Group | Show highest | Severities: All | Hosts: All | Connections: All | Show All

Name	Warning	Critical	Memory Usage	CPU Utilization (%)	Workload	Logging	I/O	Sorting	Locking	Transactions (/min)	Physical Page I/O (/min)	Lock Wait Time (sec)	Average End-to-End Response Time (sec)	Maximum End-to-End Response Time (sec)
GSDB LOC	1	5	24							654.441	82,718....	0	0.174	25.313
DiscoveryDB	N/P	N/P	N/P	N/P	N/P	N/P	N/P	N/P	N/P	N/P	N/P	N/P	N/P	N/P

**Alert Summary**

Severity	Alert Name	Last Alert Value	Start Time	End Time
Warning	Failing Transactions	9 %	04/05 11:...	04/05 11:...
Critical	Rows Read per Fetched Row	63156.08	04/05 11:...	N/P

Severity: Warning  
Alert name: Failing Transactions  
Last alert value: 9 %  
Start time: 04/05/10 11:53:03  
End time: 04/05/10 11:53:58  
Partition/Member: 0  
Connection name: GSDB\_LOC

Workload Dashboard | View Alert Detail

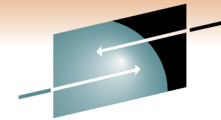
Analyze... | Configure... | Comment | Send | Delete

Close

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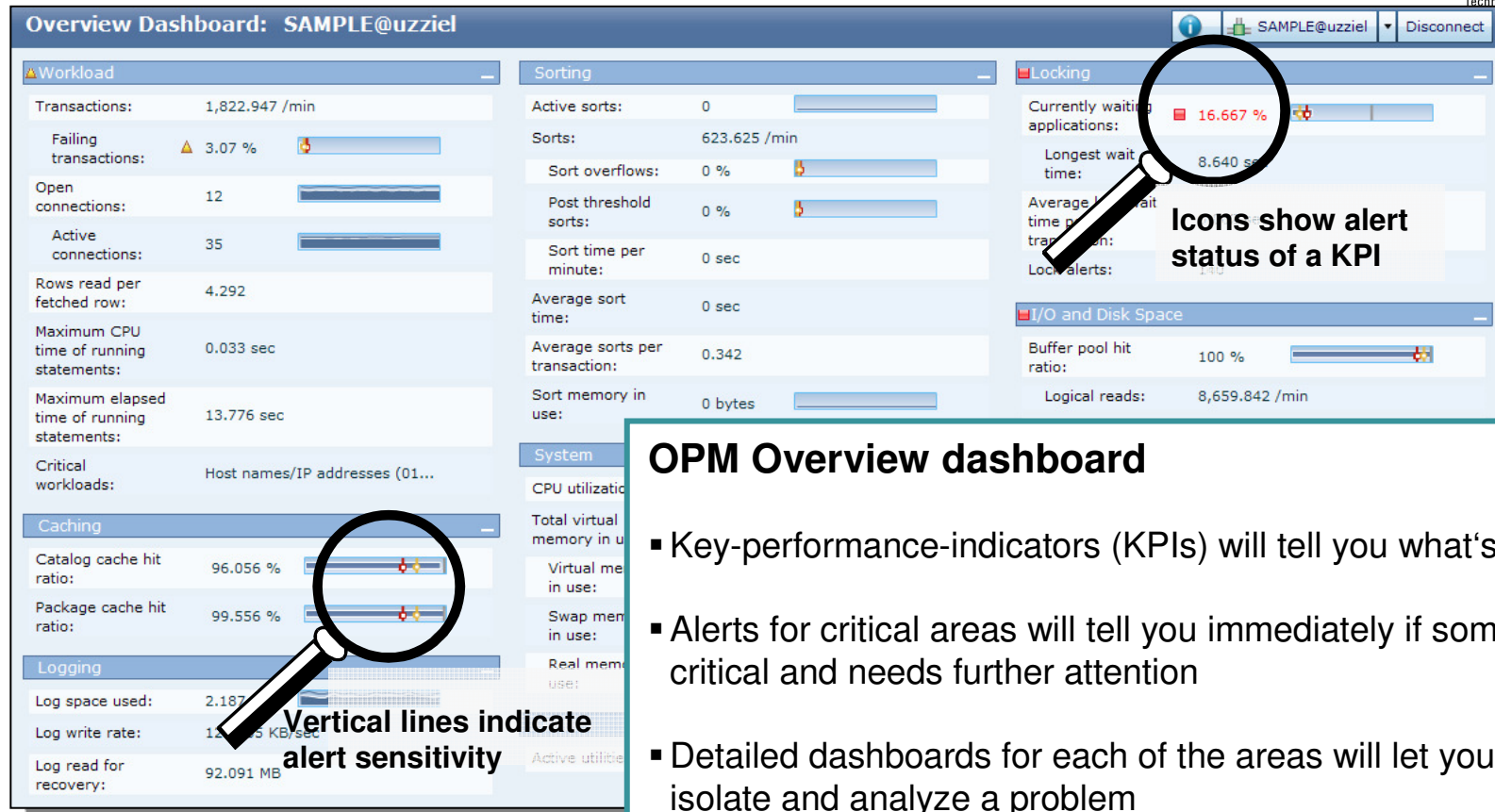
# Optim Performance Manager Dashboard

## DB2 for LUW



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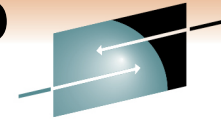


### OPM Overview dashboard

- Key-performance-indicators (KPIs) will tell you what's going on
- Alerts for critical areas will tell you immediately if something is critical and needs further attention
- Detailed dashboards for each of the areas will let you then isolate and analyze a problem
- Historical information lets you go back in time and see how a problem arose, or if problems occurred in the past

# DB2 Developer Workbench vs. Data Studio

## DB2 for z/OS and LUW



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*before*

*now*

### **IBM DB2 Developer Workbench V9.1**

- SQL Query Editor
- SQLJ Editor
- SQL Builder
- XQuery Builder
- SQL Routine Debugger
- Java Routine Debugger
- XML Editor
- XML Schema Editor
- Data Management
- Visual Explain
- Project Management

### **IBM Data Studio V2.2**

- Integrated Query Editor – SQL + XQuery
  - SQLJ Editor
  - SQL Builder
  - XQuery Builder
  - SQL Routine Debugger
  - Java Routine Debugger
  - XML Editor
  - XML Schema Editor
  - Data Management
  - Visual Explain
  - Project Management
- ER Diagramming
  - Data Distribution Viewer
  - Object Management
  - Browse & Update Statistics
  - Security Access Control
  - Connection Management integration with Kerberos and LDAP
  - Data Web Services
  - IDS Server Support

**No-charge**

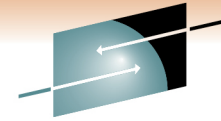
***Data Studio is a full replacement of  
DB2 Developer Workbench  
plus much more***

- **DB2 for Linux, Unix, Windows v8.x, v9.x**
- **DB2 for z/OS v7, v8, v9**
- **DB2 for i5/OS v5r2, v5r3, v5r4**
- **Informix Dynamic Server (IDS) v9.x, v10.x, v11**

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# Data Studio V2.2

## DB2 for z/OS and LUW



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The screenshot displays the IBM Data Studio V2.2 interface. The main window shows a SQL script in the 'Script1.sql' editor:

```
select * from sysibm.LOCATIONS;  
select * from sysibm.IPLIST;  
select * from sysibm.IPNAMES;  
select * from sysibm.LUNAMES;
```

The 'Access Plan Diagram' pane shows the following execution plan:

- Node 1: QUERY (Query return)
- Node 2: QB1 (Query Block)
- Node 3: TBSCAN (Table Scan)
- Node 4: LOCATIONS (Table Access)

A context menu is open over the diagram, listing various actions and their keyboard shortcuts:

- Undo (Ctrl+Z)
- Revert File
- Save (Ctrl+S)
- Show In (Alt+Shift+W)
- Cut (Ctrl+X)
- Copy (Ctrl+C)
- Paste (Shift+Insert)
- Validate
- Team
- Compare With
- Replace With
- Preferences...
- Content Assist (Ctrl+Space)
- Content Tip (Ctrl+Shift+Space)
- Format SQL (Ctrl+Shift+F)
- Toggle Comment (Ctrl+/)
- Validate Statement Syntax
- Use Database Connection...
- Run SQL (F5)
- Set Statement Terminator
- Validate Table References
- Start Tuning...
- Open Visual Explain

An orange starburst graphic with the text 'No-charge' is overlaid on the right side of the interface.

Visual Explain made easy in Data Studio V2.2



# Other tooling

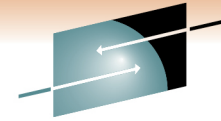
## DB2 for z/OS high usage objects & LCU issues



- Methods
  - RMF I/O activity by VOLSER reports
  - SMF type 42 records (SMS: subtype 6)
- Observation: There are, on average, 10 tables accessed exponentially above all other tables

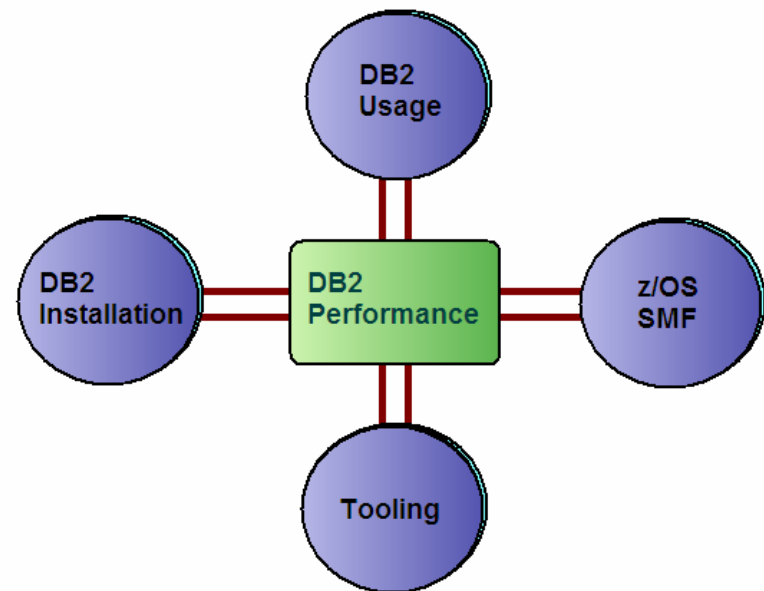
### SMF Type 42 Parser for zOS

<https://www.ibm.com/developerworks/mydeveloperworks/files/app?lang=en#/person/100000P902/file/b72b69d9-9ca6-4cdc-bd58-074f3286d0e2>

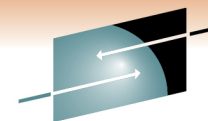


# Agenda

- **The politics of performance**
  - The data base administrator role
  - Management expectations
  - DBA expectations
- **Performance Tuning Playbooks**
  - DB2 for z/OS
  - DB2 for LUW
- **DB2 biggest performance issues**
  - System related
  - Tooling
- **Performance Touch Points with DB2 for z/OS**



# Performance Touch Points with DB2 for z/OS



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## DB2 Installation

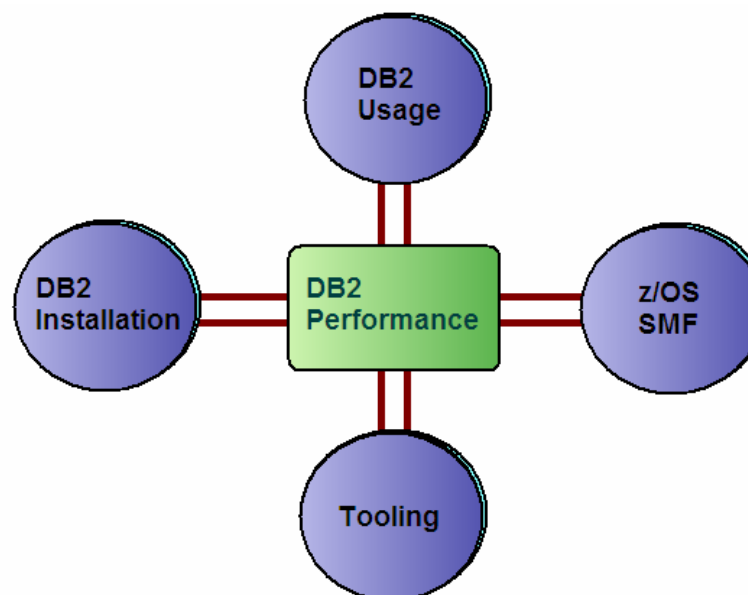
- SMFACCT=(1,2,3) and SMFSTAT=(1,3,4)
- Log sizes - dual for onsite/offsite

## DB2 Usage

- Table spaces sized for manageability
- Buffer pool strategy
- Understand the usage for any new feature
  - PGFIX
  - Use sliding scale if not constrained by DASD

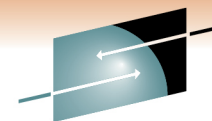
## z/OS

- SMF Records
  - Use appropriate interval
  - Type 100:102
  - Type 42
  - Need type 30 records with intervals



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# Performance Touch Points with DB2 for z/OS



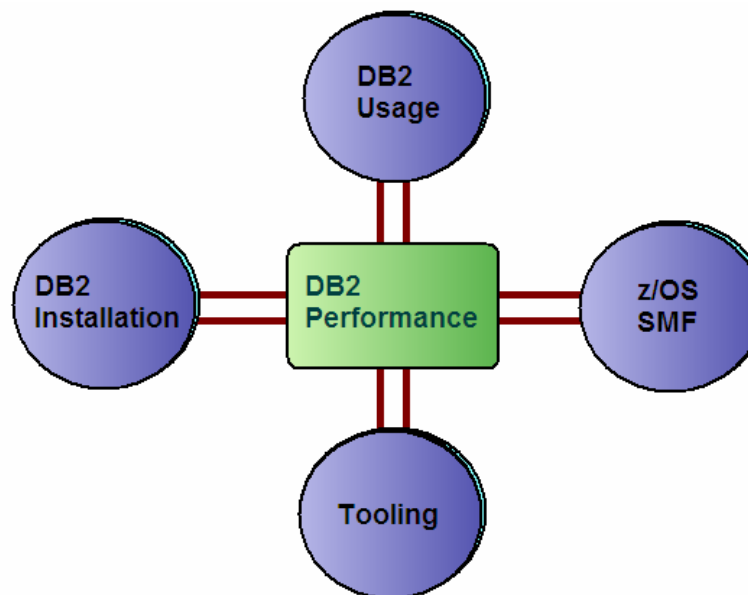
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## Tooling

- Omegamon XE for DB2 or equivalent
- DB2PE or equivalent
- Data Studio (OSC replacement)
- Optim Query Tuner
- Optim Workload Query Tuner

## Optional Tooling

- RMF or equivalent
  - RMF Spreadsheet Reporter
- Optim Performance Manager (DB2 for LUW on zLinux)



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# Performance Touch Points with DB2 for z/OS – Links to tools



IBM Data Studio and pureQuery

<http://www-01.ibm.com/software/data/optim/>

DB2 Accessories Suite for z/OS

<http://www-01.ibm.com/software/data/db2imstools/db2tools/accessories-suite/>

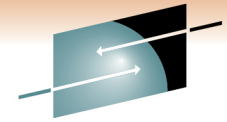
SMF Type 42 Parser for z/OS

<https://www.ibm.com/developerworks/mydeveloperworks/files/app?lang=en#/person/100000P902/file/b72b69d9-9ca6-4cdc-bd58-074f3286d0e2>

IBM Tivoli Monitoring zOMEGAMON and Related Products Best Practices Informational links

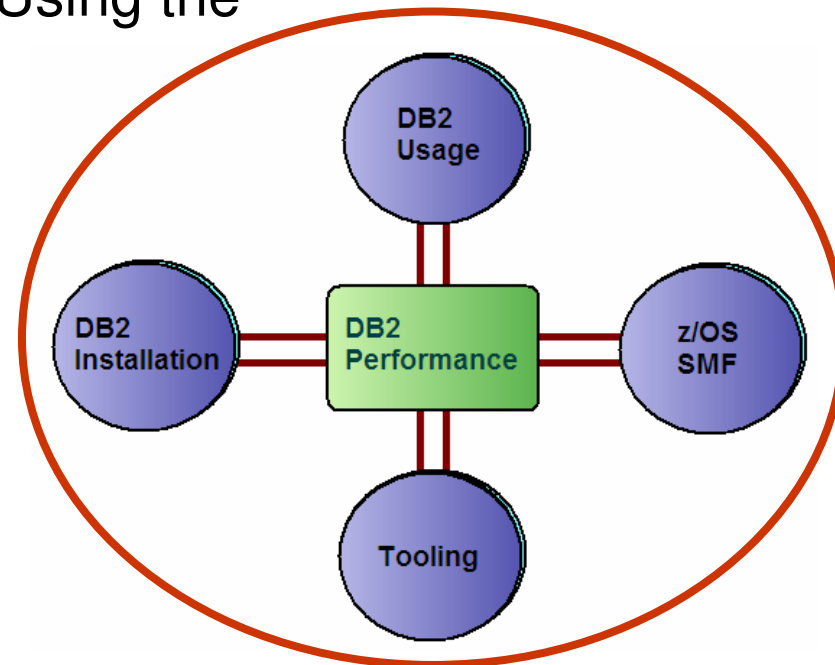
<http://www.ibm.com/developerworks/wikis/download/attachments/141165182/Best+Practices+Links.pdf?version=1>

# Performance Touch Points with DB2 for z/OS - Training

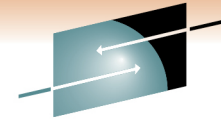


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- CV960 - DB2 9 for z/OS Application Performance and Tuning
- CV950 - DB2 9 for z/OS System Performance Analysis and Tuning
- ES545 - Basic z/OS Tuning Using the Workload Manager (WLM)



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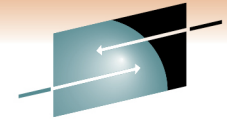
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## In Summary

- It is possible to performance tune ad infinitum, ad nauseam...Don't!
- Tune to the level of what you, your end-users, and the company can live with
- Meet your service level agreements and service level objectives
- Remember these 3 guidelines:
  - Bottlenecks can be either Memory, I/O, or Processor but in most cases it is a combination of factors
  - The limit of any machine is ultimately a bottleneck by definition
  - Workload and performance management is the art of juggling what you can live with

# Additional sessions on performance



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## **Two for One: Optim Solutions Update and Optimizing DB2 for z/OS Query Performance**

Friday, March 4, 2011: 11:00 AM-12:00 PM

Room 201A (Anaheim Convention Center)

Speaker: Bryan Smith (IBM Corporation)

## **DB2 Statistics and Data Studio**

Wednesday, March 2, 2011: 9:30 AM-10:30 AM

Room 211B (Anaheim Convention Center)

Speaker: Bryan Smith (IBM Corporation)

## **pureQuery**

Thursday, March 3, 2011: 6:00 PM-7:00 PM

Room 211A (Anaheim Convention Center)

Speaker: Bryan Smith (IBM Corporation)

## **DB2 10 performance topics**

Tuesday, March 1, 2011: 11:00 AM-12:00 PM

Room 211A (Anaheim Convention Center)

Speaker: Roger Miller (IBM Corporation)

## **z/OS Performance Monitoring Tools Shoot-Out: ASG, BMC, CA, Rocket**

Tuesday, March 1, 2011: 9:30 AM-10:30 AM

Room 201B (Anaheim Convention Center)



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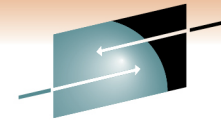




Systems and Technology Group  
Lab Services and Training

[www.ibm.com/systems/services/labservices](http://www.ibm.com/systems/services/labservices)

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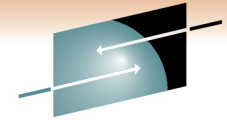


Thank You!!!



Jeff M. Sullivan  
[jeffsull@us.ibm.com](mailto:jeffsull@us.ibm.com)

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# Reference Slides



# The data base administrator - Job description



Protection, Availability, and Speed are the goals.

- **Protection of the company's data assets**
  - Adequate backup and recovery
  - Retention of logging media
  - Ensuring adequate storage and retention of logs and backups
  - Performing disaster recovery scenarios
  - Making sure any recovery performed is done efficiently with little data loss and little outage
  - Jealous data protection and being involved with any change in the system
- **Availability of the company's data assets on an as-required basis**
  - Ensuring the correct security roles and responsibilities are delivered to the correct organizations
  - Reviewing that all required paths into and out of the DBMS are efficient with such things as connections, minimal server "hops", prevention of any outage (including failover of a server in the chain)
  - Making sure all software is up-to-date
  - Performing proactive routine maintenance including REORGS, RUNSTATS, space usage (organic growth), and review of DBMS usage for memory and I/O
- **Fast delivery of the company's data assets to those authorized**
  - Involvement with creation of and meeting service level objectives
  - Reviewing (and creating) table, view, access paths and access strategies with application personal
  - Ensure that the DBMS, the DBMS servers, and the data is delivered as quickly and efficiently as possible
- **Provide analysis on problems as required**

# DB2 for z/OS Buffer Pool Recommendations



- A buffer pool strategy should...
  - Separate, at a minimum, by tablespaces and indexes
  - Separate highly accessed tablespaces and indexes from the less active tablespaces and indexes
  - Separate by random (online, OLTP) versus sequential access
  - Separate by size
- A good subsystem buffer pool strategy should...
  - Put work tablespaces into their own pool
  - Put temporary tablespaces into their own pool
  - DB2 Catalog into their own pool

## **DB2 9 for z/OS: Buffer Pool Monitoring and Tuning**

<http://www.redbooks.ibm.com/redpieces/abstracts/redp4604.html>

# Recommended DB2 buffer pool Strategy



BP0 – DB2 Catalog

BP1 – Small-sized Reference  
Tablespaces

BP2 – Small-sized Reference  
Indexspaces

BP3 to BP6, BP8 to BP9 –  
expansion/isolation for  
performance

bottlenecks in BP1 and BP2

BP7 – Sort DSNDB07

BP10 to BP19 – Tablespace buffer  
pools

BP10 – Medium-sized Sequential Access

BP11 – Medium-sized Random Access

BP12 – Large-sized Sequential Access

BP13 – Large-sized Random Access

BP14 to BP19 – expansion/isolation for  
performance

bottlenecks

BP20 to BP29 – Indexspace buffer pools

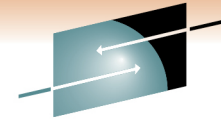
BP20 – Medium-sized Sequential Access

BP21 – Medium-sized Random Access

BP22 – Large-sized Sequential Access

BP23 – Large-sized Random Access

BP24 to BP29 – expansion/isolation for  
performance bottlenecks



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# Spike analysis technique

- Look for the spikes in anything and do cross-comparisons
- Adjust one setting at a time to correct
  - SQL spike:  
Correct (tune) SQL and cross collaborate with table activity
  - I/O spike:  
Review type of activity, cross collaborate with bufferpool and SQL activity
  - Bufferpool spike:  
Review type of spike, cross collaborate with I/O and SQL activity
  - Memory spike:  
Review reasons (DB2 for LUW - STMM?), cross compare with bufferpool, I/O and SQL activity
  - Locking issues:  
Review application for commit behavior, tune SQL, change config parameters.