IBM Software Group

WELCOME
IBM DB2 Performance Monitoring Clinic

DB2 Data Management Software

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DB2 for OS/390 and z/OS: Performance Tuning

Charles Lewis – Certified Technical Specialist

DB2 Information Management Software

e business on demand software

Topics

- Introduction to DB2 monitoring
- DB2 instrumentation and terminology
- DB2 application monitoring
- DB2 subsystem monitoring
- DB2 Connect monitoring
- Summary / Observations
- References

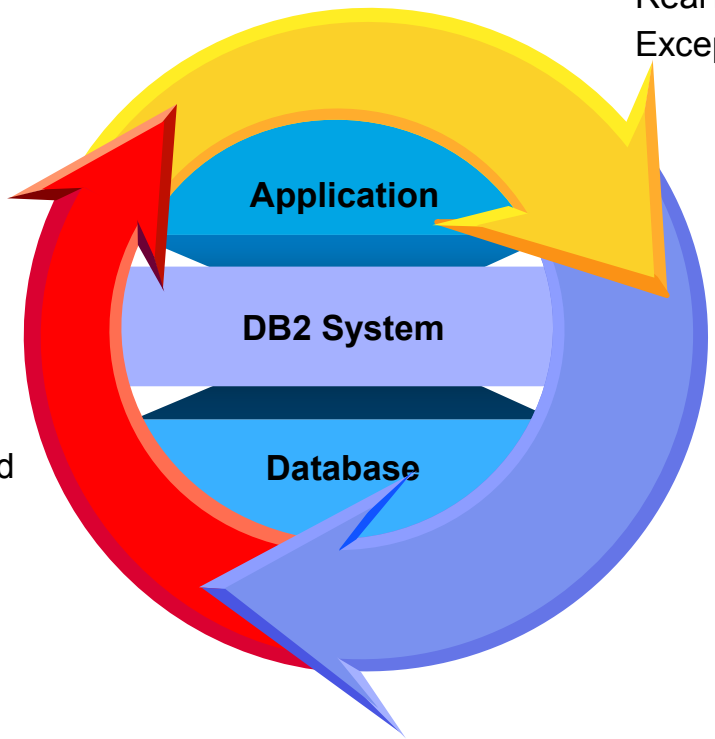
Performance Management

Goal: To Monitor, Analyze, Tune, and Control DB2 Systems and Applications to obtain Optimal Performance and Lowest Cost

Monitor

RealTime

Exception & Threshold Monitoring



Tune and Control

Cancel

Expert Analysis and Recommendations

Analyze

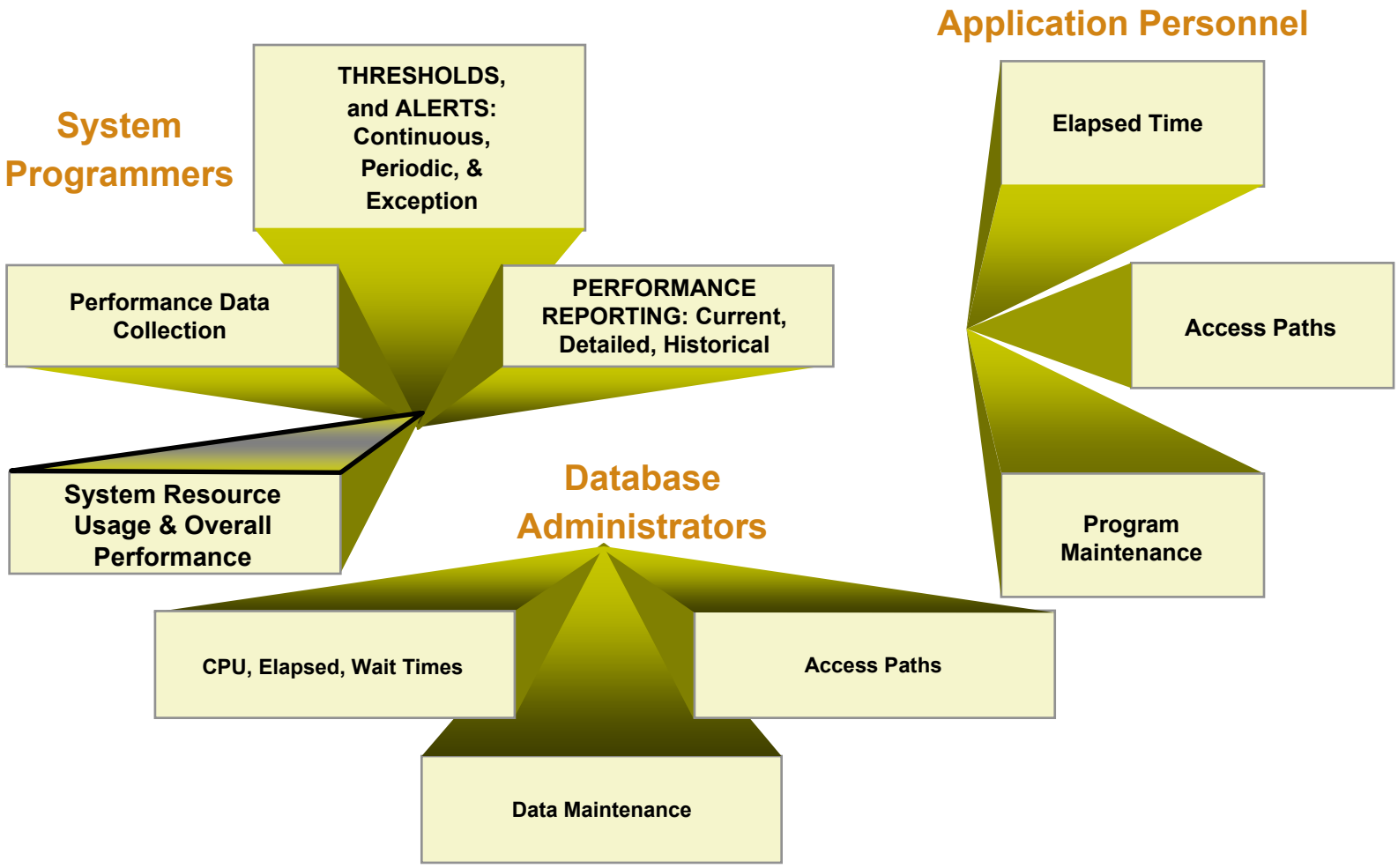
RealTime

Recent History

Detail

Simulation

When it Comes to Performance: Who Cares About What?



So who can influence DB2 Performance?

- Everyone....
  - Application developer
  - Database administrator
  - DB2 system support staff
  - OS/390 or z/OS systems support
  - and yes...also the USER!

What determines DB2 performance and throughput?

- Assuming valid user input....
  - Number and type of SQL calls
  - Database design
  - DB2 configuration (DB2 startup or z-parms)
    - Buffers, EDM pool, RID pool, Work database
    - Bind parameters
  - System resources
    - CPU (LPAR)
    - Real and Virtual Memory
    - I/O subsystem

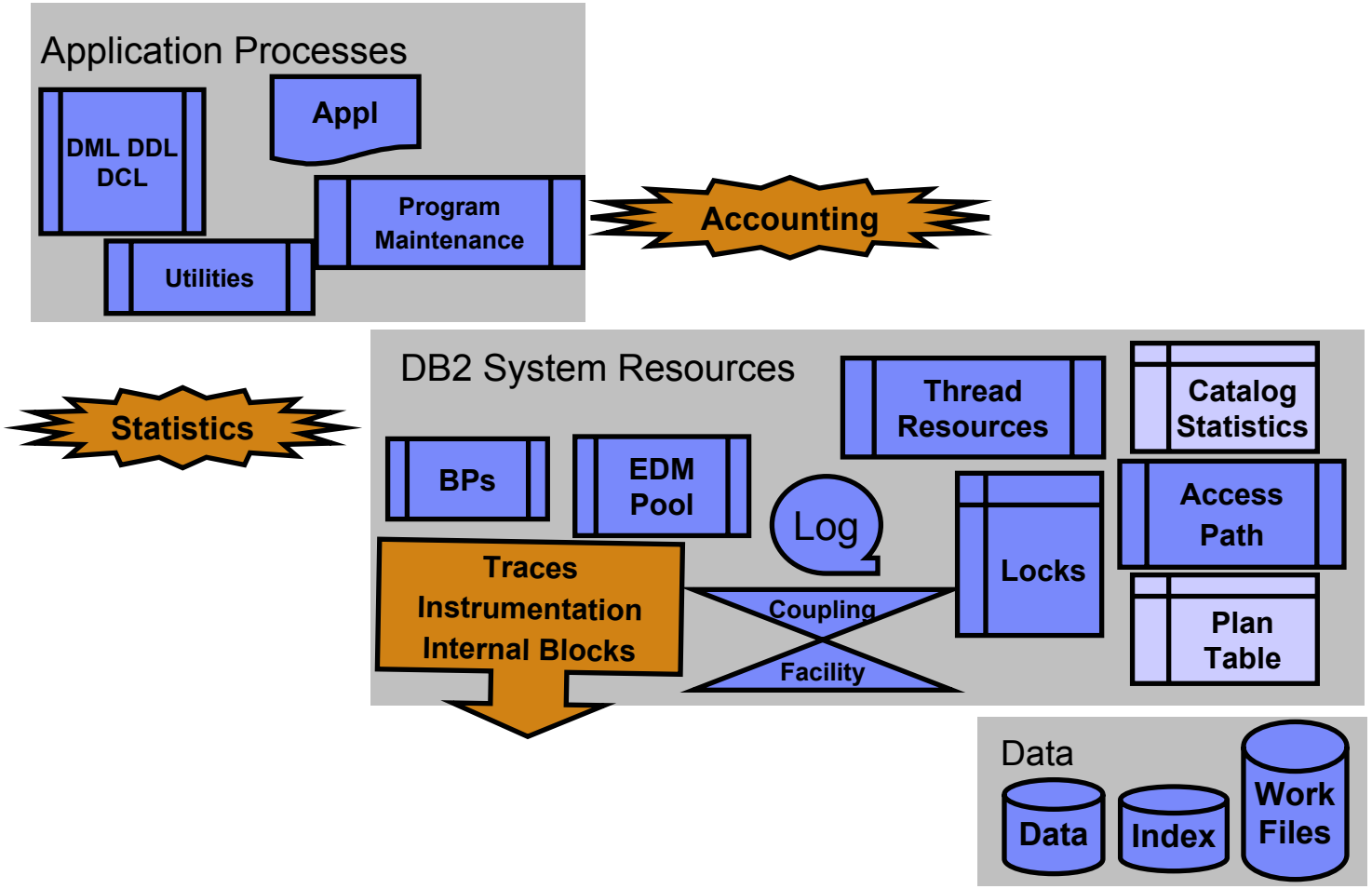
So how do you know if you have a problem

- Do you have service-level goals for DB2 performance?
  - System-wide objective?
  - Workload dependent?
  - Key / critical business applications
  - Batch, transaction, query

Does your DB2 Monitoring process include...?

- Ongoing - routine collection and review of performance data
  - Establish baseline for performance
  - Query historical data for trends / exceptions
  - Analysis of trace data
  - Analysis of performance reports
- Periodic - when you know or suspect something has changed
  - Workload changes
    - Prototype / stress testing for new applications
    - Changes in application or database design
    - Change in number of users or data volume
  - Capacity planning
    - Hardware upgrades
    - New software releases
    - Calibrate "charge-back" algorithms
- Exceptions - the phone rings....
  - Performance unacceptable to user
  - Exception condition met
  - Alert threshold exceeded

What DB2 resources should you monitor?



Performance data available to monitor the DB2 application and subsystem

- Trace types
  - Accounting
  - Statistics
  - Monitor
  - Performance
  - Audit
  - Global
  - Multiple trace classes per trace type
  - IFCID as basic unit of reporting
    - Instrumentation Facility Component Identifier

DB2 Trace Records

- Accounting & Statistics Records
  - Relatively inexpensive to collect
  - Most useful for initial analysis
    - Accounting report (not trace) by connection type or plan, and
    - Statistics report (not trace) for the same period
  - Should always be the first one to look at in any DB2 performance problem determination
  - Statistics Records are written as SMF 100 records
  - Accounting Records are written as SMF 101 records
- Performance Trace Records
  - Could become very expensive depending on the class / IFCIDs
  - Performance Records are written as SMF 102 records

DB2 Instrumentation

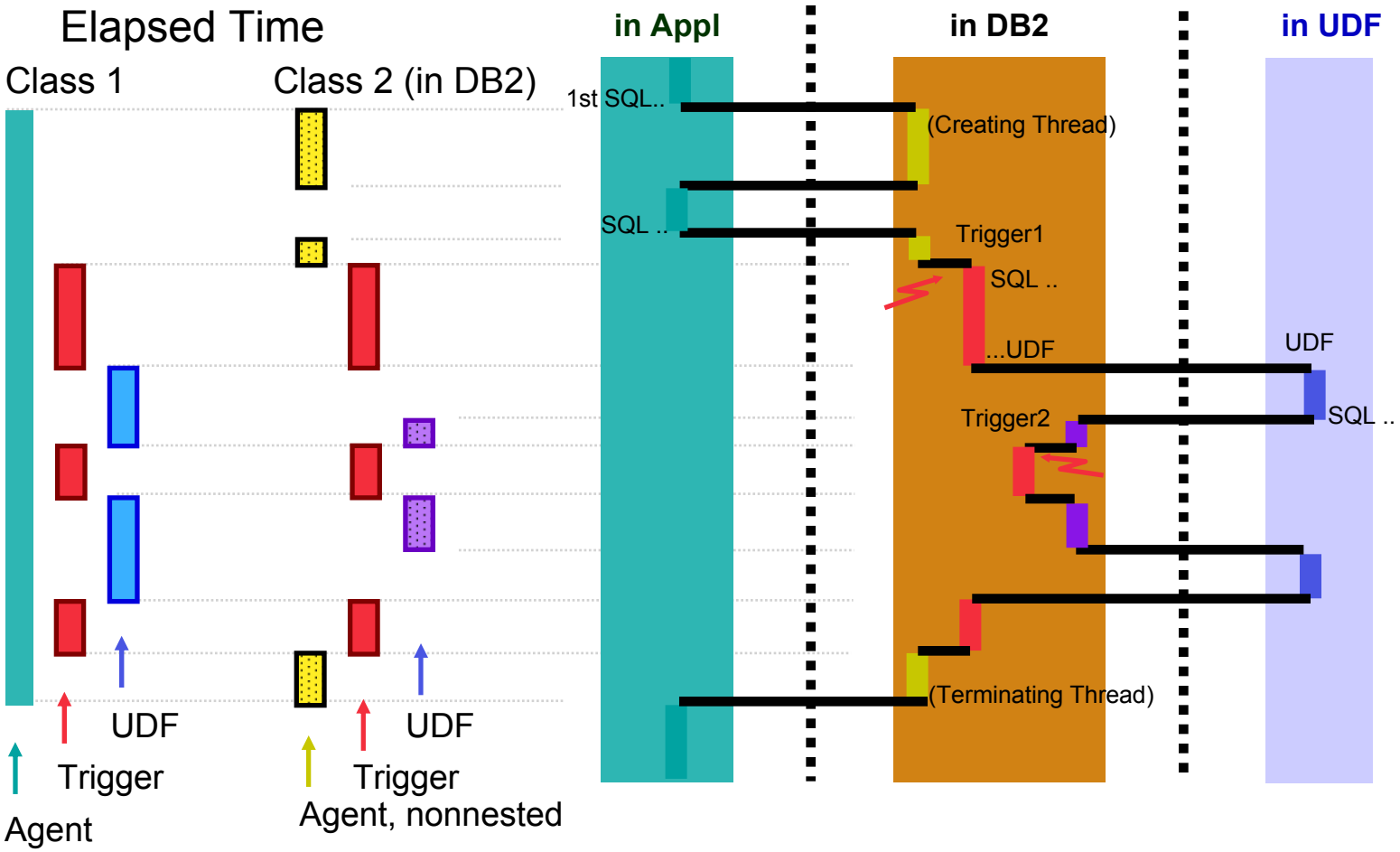
- How to Start, Modify, Stop traces
  - START TRACE(STAT) CLASS(1,3,4)
  - START TRACE(ACCTG) CLASS(1,2,3)
  - .....
  - MODIFY TRA(S) CLASS(1,3,4) TNO(1)
  - STOP TRA(A) TNO(2)
- Recommended traces to start
  - Accounting Class 1, (2), 3, (7), (8)
  - Statistic Class 1, 3, 4, (5)
  - Zparms : SMFACCT, SMFSTAT, STATTIME, SYNCHVAL
- DB2 Trace and 'typical' CPU overhead
  - DB2 accounting
    - Class 1: less than 5% CPU overhead
    - Class 2: 1 to 10% CPU overhead (higher % for Fetch intensive applications)
    - Class 3: less than 1% CPU overhead (could be higher if Latch contentions are higher)
    - Class 7 and 8: less than 1% CPU overhead
  - Monitor trace: similar to accounting
  - Statistics : negligible

DB2 Instrumentation

- Trace destination can be SMF or GTF or OPx
  - SMF is default for Accounting and Statistics Traces
  - GTF is default for Performance Trace
  - Can be overridden by DEST parameter
  - OPx buffers used by Online Monitors
- Trace gathering can be filtered using Planname, AuthID and Location
- Performance Trace can be started for Performance Classes or individual IFCIDs
  - Ex : -STA TRA(P) C(3,6,7)
  - -STA TRA(P) C(3,6,7) IFCID(198)
  - -STA TRA(P) C(30) IFCID(44,45,226,227)
  - DEST(SMF) PLAN(MYPLAN)
  - Performance Classes 30 to 32 are User Trace Classes
- Performance trace can also be started and limited to a number of trace entries using DSN1SDMP utility
- IFCID details are documented in DSNxxx.SDSNSAMP(DSNWMSGS)

DB2 Thread Level (Accounting) And Application Tuning

DB2 - Class 1 and Class 2 Times



DB2 Accounting Times Terminology

- Class 1
  - Application and DB2 time from connect to DB2 (thread creation) till disconnect (thread termination)
  - Both Class 1 Elapsed time and Class 1 CPU time are reported at the Plan level.
- Class 2
  - Time spent within DB2
  - Both Class 2 Elapsed time and Class 2 CPU time are reported at the Plan level.
- Class 3
  - Thread Suspension time, e.g. for Synchronous I/O, Lock / Latch Suspension, Service Class Switch suspension time etc... at the Plan level
- Class 7
  - Similar to Class 2, but on Package/DBRM level.
  - Both class 7 Elapsed time and Class 7 CPU time are reported.
- Class 8
  - Similar to Class 3, but on Package/DBRM level.

Accounting Class 1 and 2 ....

- IMS, TSO, CAF, Batch
  - Class 1 : Application + DB2 time
  - Class 2 : DB2 time only
- CICS
  - Application CPU time captured in CICS
  - Class 1 : DB2 + task switch time
  - Class 2 : DB2 time only
- For thread reuse, Class 1 can be much higher than Class 2 time because the time from commit to the first SQL call of next transaction to reuse the thread is also included.
- Class 2 elapsed time = Class 2 CPU + Class 3 wait + Not Accounted time
- Not Accounted time typically represents time beyond DB2 control such as paging, swapping, waiting for busy CPU etc.

Accounting Class 3 Suspension Time

CLASS 3 SUSPENSIONS	AVERAGE TIME	AV.EVENT
LOCK/LATCH(DB2+IRLM)	0.000706	0.73
SYNCHRON. I/O	0.172023	34.94
DATABASE I/O	0.163672	33.94
LOG WRITE I/O	0.008352	1.00
OTHER READ I/O	0.014806	1.49
OTHER WRTE I/O	0.000000	0.00
SER.TASK SWTCH	0.017373	2.00
UPDATE COMMIT	0.016777	1.00
OPEN/CLOSE	0.000000	0.00
SYSLGRNG REC	0.000000	0.00
EXT/DEL/DEF	0.000000	0.00
OTHER SERVICE	0.000596	1.00
ARC.LOG(QUIES)	0.000000	0.00
ARC.LOG READ	0.000000	0.00
STOR.PRC SCHED	0.000000	0.00
UDF SCHEDULE	0.000000	0.00
DRAIN LOCK	0.000000	0.00
CLAIM RELEASE	0.000000	0.00
PAGE LATCH	0.000054	0.00
NOTIFY MSGS	0.000000	0.00
GLOBAL CONTENTION	0.000000	0.00
COMMIT PH1 WRITE I/O	0.000000	0.00
ASYNCH IXL REQUESTS	0.000238	0.01
TOTAL CLASS 3	0.205200	39.17

Elapsed Time Monitoring and Tuning

- Major Contributors to Elapsed Time
  - Database Synch I/O
    - Reduce by Bufferpool tuning
  - Log Synch I/O
    - Reduce by Log tuning - faster DASD
  - Service Task Switch time
    - New counters provide detailed breakdown

Service Task Switch Wait

- Service Task Switch (Synchronous Execution Unit Switch) happens when a DB2 System task needs to perform work on behalf of the Allied TCB (Application) to invoke functions under a different TCB or SRB in the same address space or in a different address space.
- Starting with V6 this counter is broken up into following contributions:

```
SER.TASK SWTCH
 Update Commit
 OPEN/CLOSE
 SYSLGRNG REC
 EXT/DEL/DEF
 OTHER SERVICE
```

... (includes commit logging)

... OPEN / CLOSE data set, HSM recall

... SysLog Range Recording

... Data Space Manager Services

... remaining contributions (Pre-format)

Connect to GBP (data sharing only)

Load Valid/Edit proc

-DIS DATABASE command processing ...

Asynchronous Pre-formatting in V7

CPU Time Monitoring and Tuning

- Major Contributors to CPU Time
  - DB2 access paths
  - Number and type of SQL statements executed
  - Number of columns returned
  - Degree of filtering by SQL predicates
    - # of index and data pages accessed to return data
  - Bind options
    - Acquire / Release

CPU Time Monitoring and Tuning....

- Major Contributors to CPU Time (cont.)
  - Placement of variable length data in a row
  - Application programming techniques used
    - Singleton SQL vs Cursor processing
    - Do - While or Begin/End program constructs rather duplicating same SQL call(s)

How do you know if you have a problem?

- Ongoing - routine collection and review of DB2 performance data
  - Definition, generation, & scheduling of customized DB2 performance reports
    - Identify the Top 10 or N number of Plans that execute most frequently and consume high DB2 (Class 2) CPU time
    - Identify the Top 10 or N number of Plans that execute most frequently and have high DB2 Class 2 Elapsed time
  - Create and maintain historical performance data for trend analysis
  - Create, execute, & schedule rules-of-thumb checks based on service-level objectives
  - Define & execute queries to analyze performance data to identify exception conditions

How do you know if you have a problem?

- Periodic - validate application assumptions
  - Collect and review performance data to
    - Determine "affordability" of applications
    - Estimate response-time and batch window to meet user requirements
    - Determine hardware requirements or impact of hardware changes
    - Determine benefits or impact of software maintenance or release changes

How do you know if you have a problem?

- Exception - instances of specific events or user specified thresholds exceeded
  - Event monitoring
    - Timeouts or deadlocks
    - EDM Pool full
    - Coupling facility rebuild
    - Authorization failure
    - .....
  - Thresholds reached
    - Elapsed, CPU, or wait time per Plan
    - Getpages, buffer updates per Plan
    - ....

Buffer Pool Analysis and Tuning

- Monitor and tune bufferpools to reduce or avoid excessive I/O
  - Bufferpool Hit Ratio (application and system)
  - Random vs sequential use of DB2 buffers
  - Backed by real storage (Number of page-ins for read/write > 0)
  - Determine read / write ratios
  - Object (tablespace / index) usage analysis
  - Determine appropriate bufferpool thresholds

Goal: Determine optimal bufferpool size, object replacement, and threshold settings

DB2 System Level (Statistics based) Tuning

System Tuning on CPU Time

Address space CPU time in a peak 10 minute Statistics interval

CPU TIMES	TCB TIME	SRB TIME	TOTAL TIME	/COMMIT
MSTR ADDRESS SPACE	0.280035	55.461024	55.741059	0.000491
DBM1 ADDRESS SPACE	0.015709	2:10.997199	2:11.012908	0.001154
IRLM	0.000647	2.590147	2.590794	0.000023
DDF ADDRESS SPACE	N/P	N/P	N/P	N/P
TOTAL	0.296391	3:09.048369	3:09.344760	0.001668

- All TCB and IRLM SRB times should be low relative to MSTR/DBM1 SRB times.
  - If not, needs further investigation.

Major DB2 Address Space CPU Consumers

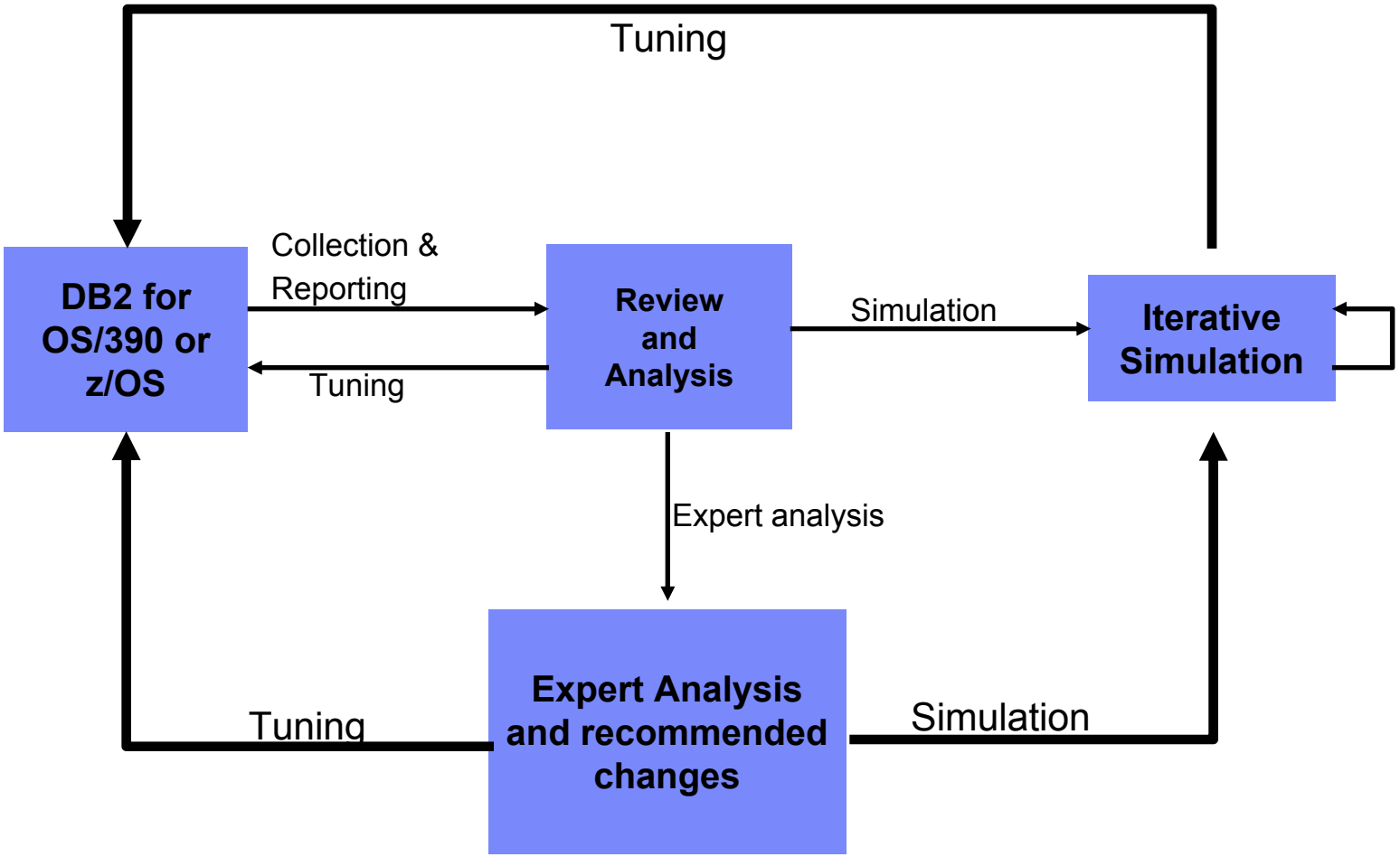
- Major MSTR SRB time
  - Physical log write, thread deallocation, update commit including GBP write and page P-lock unlock
- Major DBM1 SRB time
  - Deferred write, prefetch read, Castout, async GBP write, P-lock negotiation, Notify exit, GBP checkpoint, Delete Name (pageset close or pseudo-close to convert to non-GBP-dependency)
- Major DBM1 TCB time - Dataset open/close
- Major IRLM SRB time
  - Local IRLM latch contention, IRLM and XES global contention, async XES request, P-lock negotiation

Activities unique to data sharing are underlined.

DB2 statistics data for Bufferpools

- Monitor Buffer Pool Hit Ratio for Random Reads
- Monitor Deferred Write Thresholds
- Critical Counters
  - *Prefetch Disabled - No Buffer*
    - Minimize to zero by increasing VP
  - *Data Manager Critical Threshold*
    - Minimize to zero by increasing VP
  - *Page-In for Read / Write*
    - Check MVS paging - if short on CS reduce VP
  - *Synch Reads*
    - Minimize if possible by increasing VP

Buffer Pool Monitoring and Tuning Approach



EDM Pool Monitoring and Tuning

- Monitor EDM Pool statistics for
  - *FAILS DUE TO POOL FULL*
  - *REQ NOT FOUND IN EDMPOOL*
  - *PREP_STMT_HIT_RATIO*
- Monitor DBM1 virtual storage use - access impact of EDM Pool size
- Tune EDM pool size
  - Bind option Acquire Use
  - Bind option Release Commit for all but most frequently executed Plans/Packages
  - Compact DBD by Reorg and Modify if many Drop Table in Segmented Tablespace

System-Wide statistics of interest

- DB2 Logging rate
  - *LOG RATE FOR 1 LOG (MB/Sec)*
  - If Log data rate near max
    - Use faster Log DASD (ESS + Striping)
    - Reduce Log data size
    - ➡ Variable length record, Data Compression
- DB2 Output Log Buffer Unavailable
  - If *Output Log Buffer Unavailable* Increase Log Output Buffer
  - Log Buffers in MSTR address space
  - Ensure availability of enough CS to avoid paging

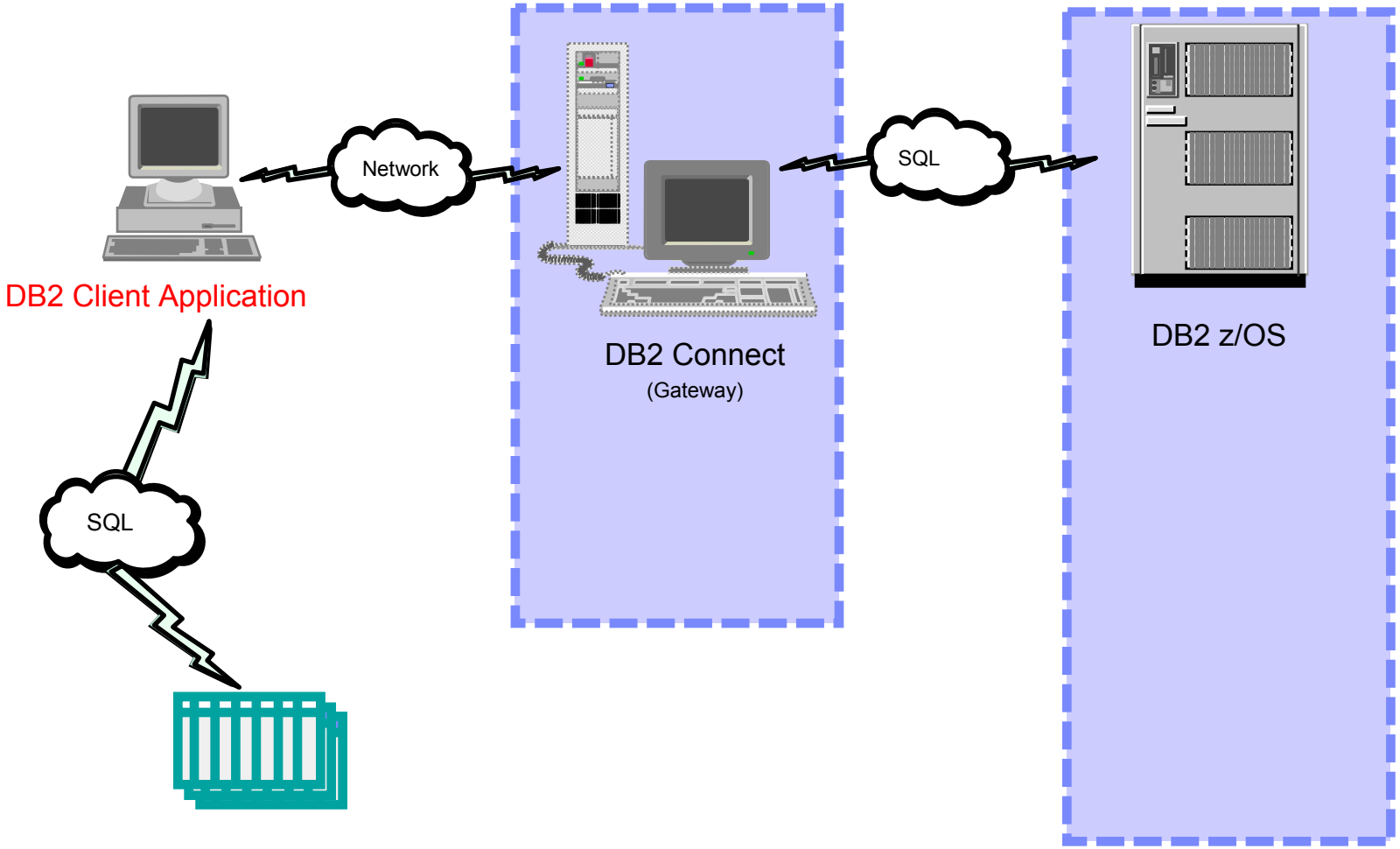
System-Wide statistics of interest

- DB2 Checkpoint Frequency
  - Impacts pages written per write I/O
  - All updated pages on deferred write queue scheduled for write
  - Use LOGLOAD or CHKTIME option of SET LOG command to dynamically change or LOGLOAD startup z-parm
- DB2 Timeouts / Deadlocks
  - Reflects problems with lock contention
  - Impacts application availability / stability
    - Influenced by application commit frequency
    - Influenced by order of application access
    - Influenced by BIND options

Monitoring and Tuning for Data Sharing

- Group Bufferpools
  - GBP *Write Engine Not Available* (< 1 to 5% of pages async written)
  - *Castout Engine Not Available* (< 1 to 5% of pages castout)
  - Optimize data page and directory entry ratio
- Locking issues
  - Global Contention
  - False Contention
  - Sizing coupling facility lock structures
- Coupling facility structure failures
  - Rebuild of GBP or lock structures

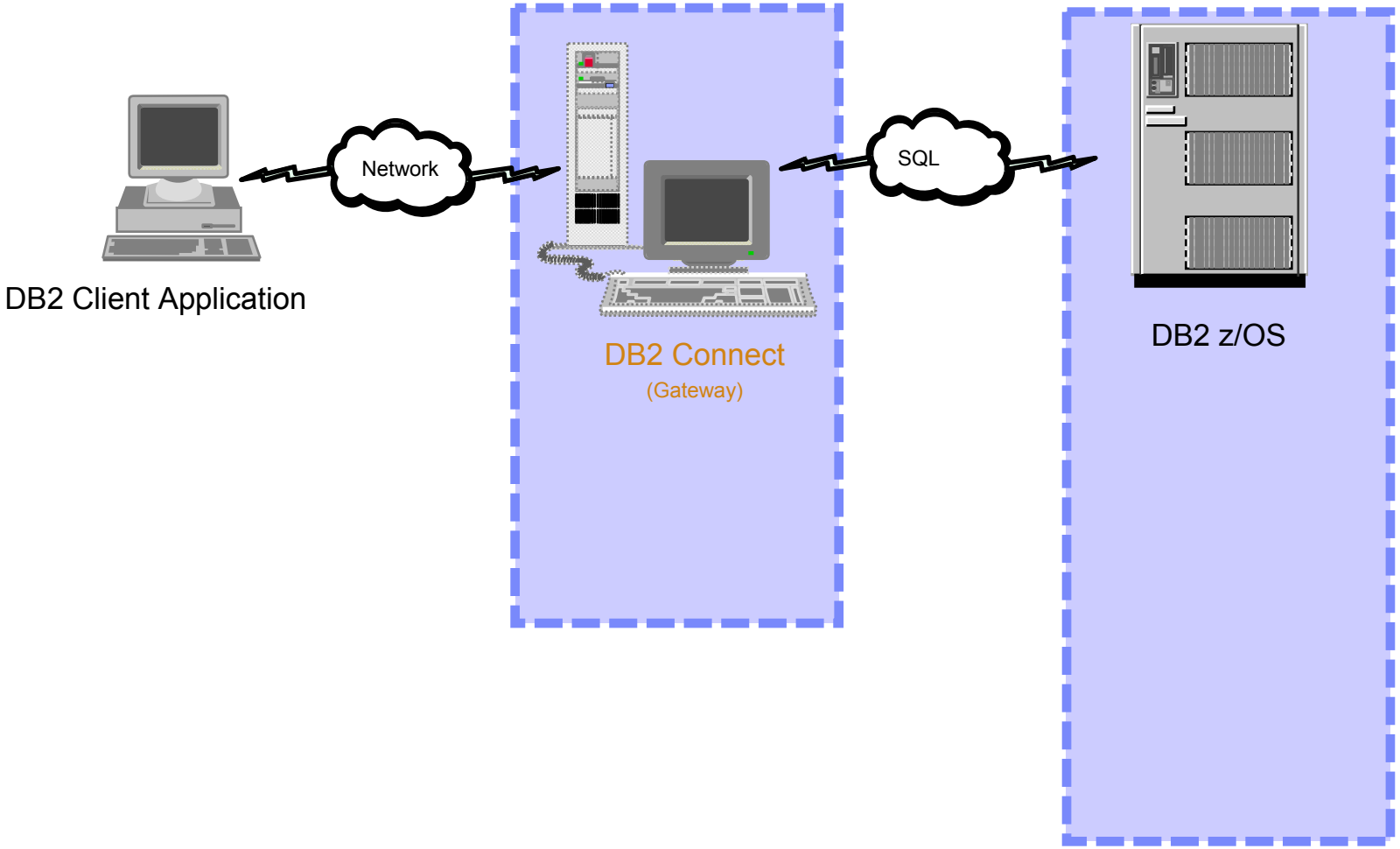
What about DB2 on the client platform?



What about DB2 on a client platform?

- Application architecture may also include DB2 distributed data access
  - DB2 for Linux, Unix or Windows
    - Elapsed time
    - CPU
    - Waits/Delays
  - Monitoring and tuning information often analyzed by same staff responsible for DB2 for z/OS

What about the DB2 Connect gateway?



DB2 Connect Performance information available includes:

- DB2 Connect statistics details
  - Gateway information for a specific connected DB2 server
- DB2 Connect thread details
  - Gateway information for a specific application thread
- DB2 Connect summary information
  - Gateway information independent of specific connected DB2 server

DB2 Connect - a DB2 server view

- DB2 Connect statistics details
  - Current connections to the DB2 server
  - Connections waiting on host reply
  - Connections waiting on client to send request
  - SQL statement time as seen by gateway
    - Time in DB2 Connect
    - Time on host
    - Time in network connection

DB2 Connect - an application view

- DB2 Connect application (thread) details
  - Overall transaction data
    - Number of SQL statements attempted
    - Inbound bytes sent
    - Outbound bytes received
    - Total host response time
    - Application idle time
    - .....

DB2 Connect - consolidated view across DB2 servers

- DB2 Connect gateway summary information
  - DB2 Connect gateway information
    - IP address
    - Node name
    - Version
  - Package statistics
    - Size distribution of messages (eg. # 512k, 1024k, 2048, etc msgs sent/recd)
    - Network time distribution (eg. 2ms, 4 ms, 8 ms...)

Summary - Observations...

- Leverage your efforts - make the easy to implement changes first
  - Tune the z/OS environment first
    - Workload management (WLM) policy
    - I/O subsystem
  - Change the data design
    - Create views
    - Add / remove / modify indexes
  - Modify application code
    - Tune SQL calls
    - Implement data purge/archive

Summary - Observations...

- A wealth of DB2 application, database, and system information is available
- Comprehensive DB2 tuning requires an end to end monitoring strategy
- Leverage your efforts to get optimal return for your tuning investment

Monitoring tool(s) are key to implementing your tuning strategy

References

- Capacity Planning for DB2 for OS/390 (SG24-2244)
- DB2 UDB for OS/390 and z/OS V7 Administration Guide, Part 5: Performance Monitoring and Tuning (SC26-9931-03)
- DB2 for OS/390 V5 Application Design Guidelines for High Performance (SG24-2233)
- DB2 for z/OS and OS/390 Tools for Performance Management (SG24-6508)
- IBM Redbooks Website : www.redbooks.ibm.com

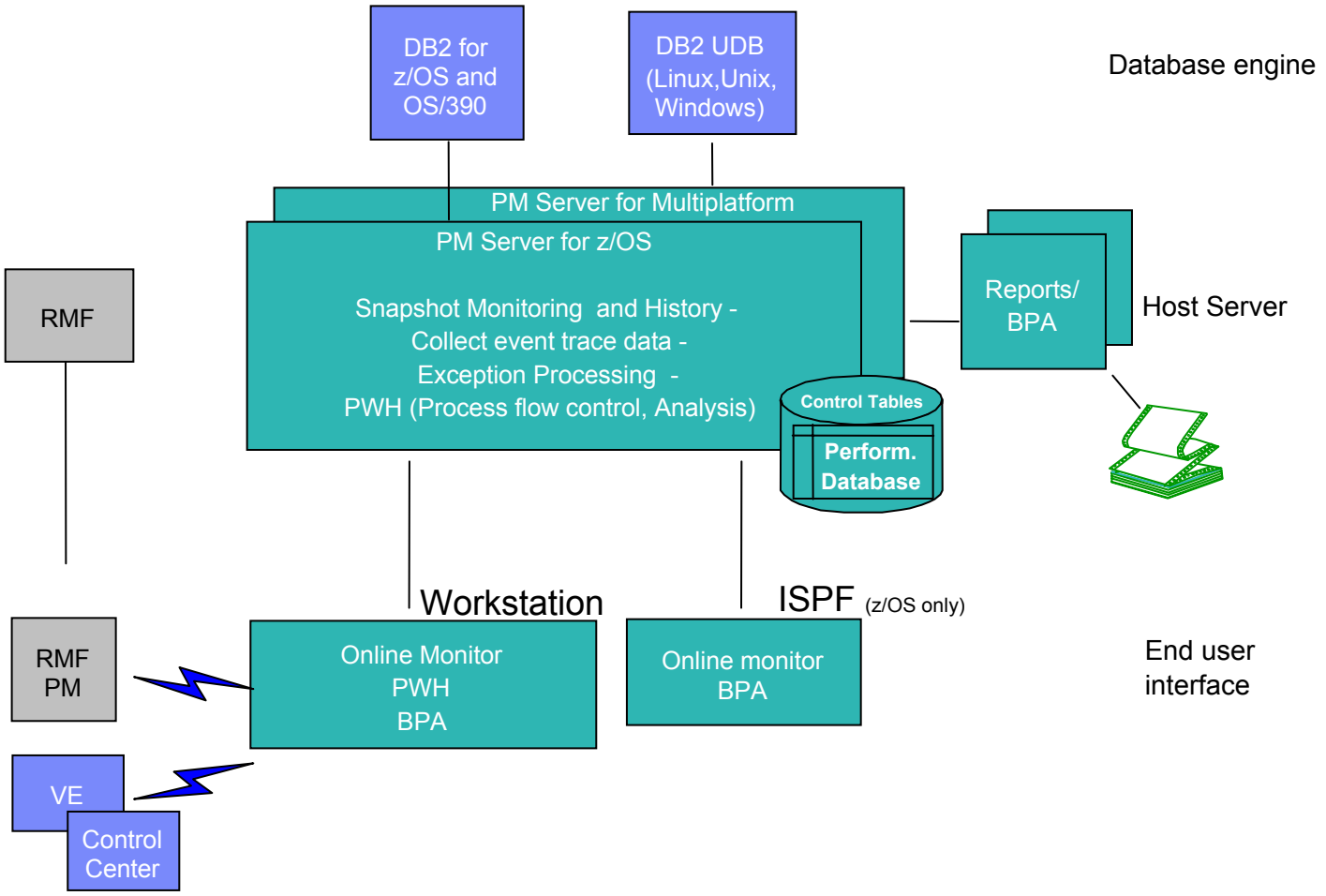
IBM Software Group:
DB2 Performance Expert for z/OS V2

Doug Clifton – Certified Technical Specialist

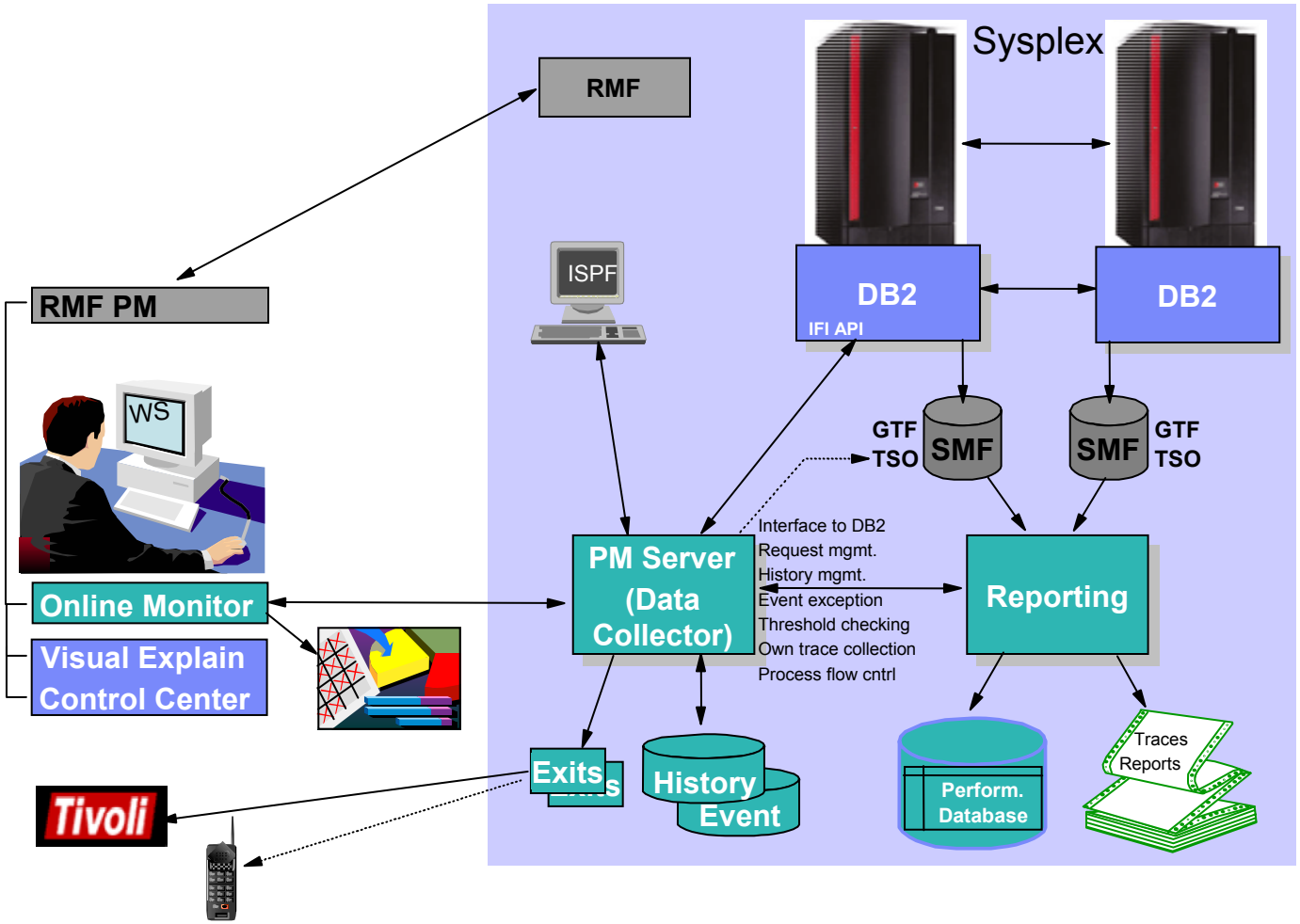
Topics

- DB2 Performance Expert for z/OS Architecture
- Application Monitoring
- Subsystem Monitoring
- DB2 Connect Monitoring
- DB2 Buffer Pool Analyzer
- Performance Warehouse
- Batch Reporting

DB2 Performance Expert Product Structure



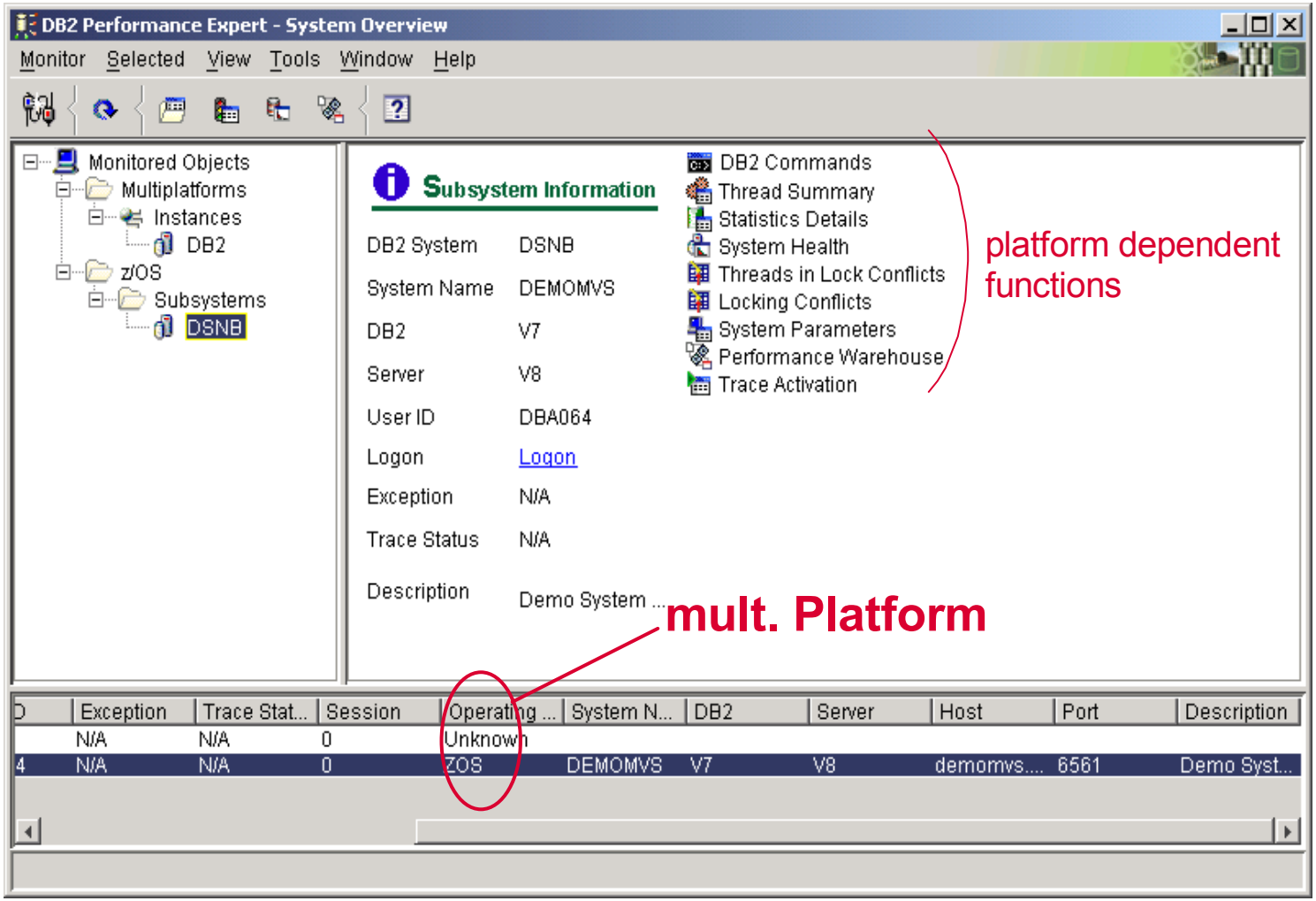
DB2PE for z/OS Architecture (monitoring & reporting)



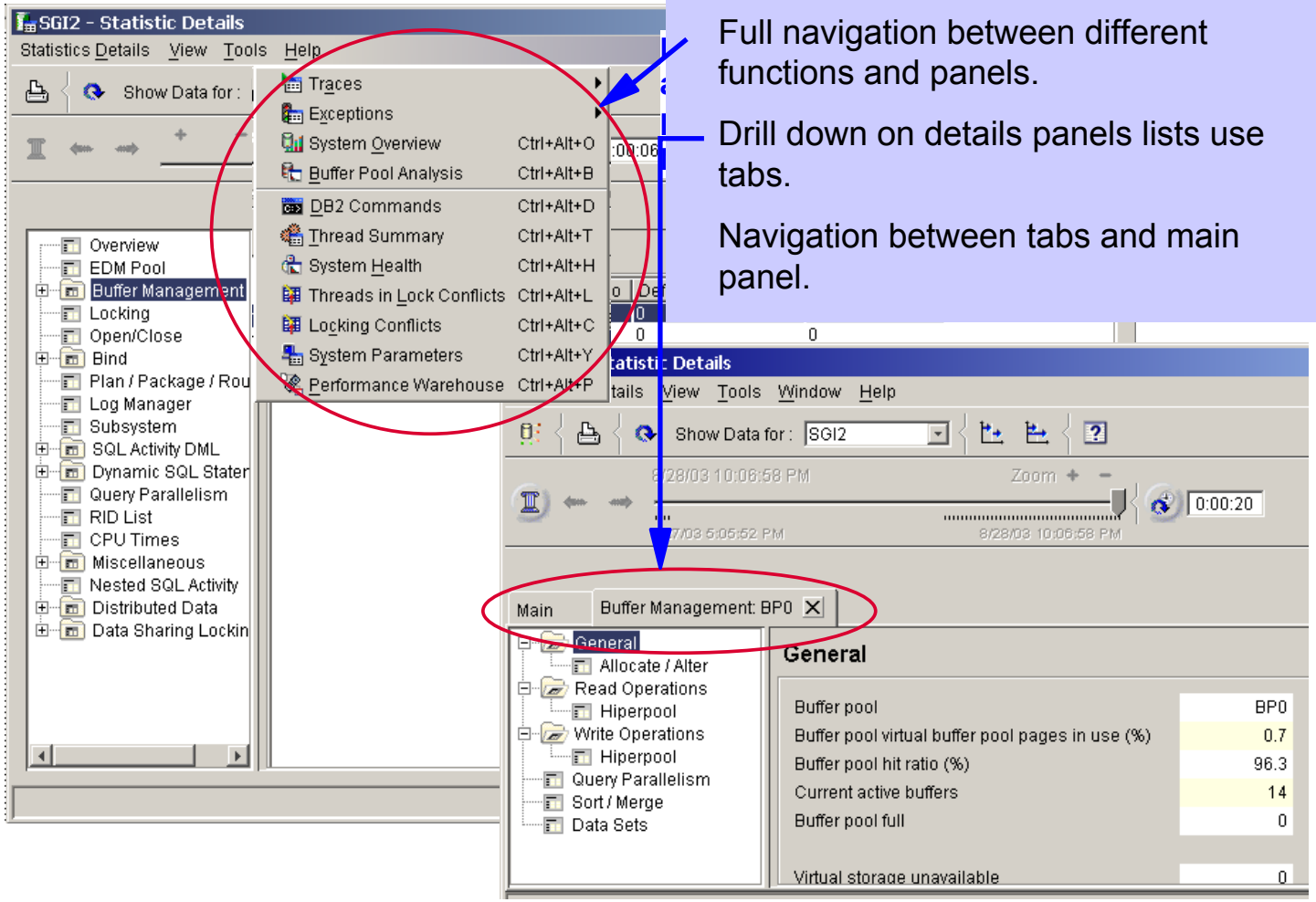
Extended Graphical Views and Navigation

- View DB2 Systems across your Enterprise
- Data Sharing Controls
- Structure and arrange your DB2 systems according to your priorities
- Extended design gives you a quick overview of the performance of the DB2 systems you are monitoring

Main System Overview Screen (DB2 for z/OS)

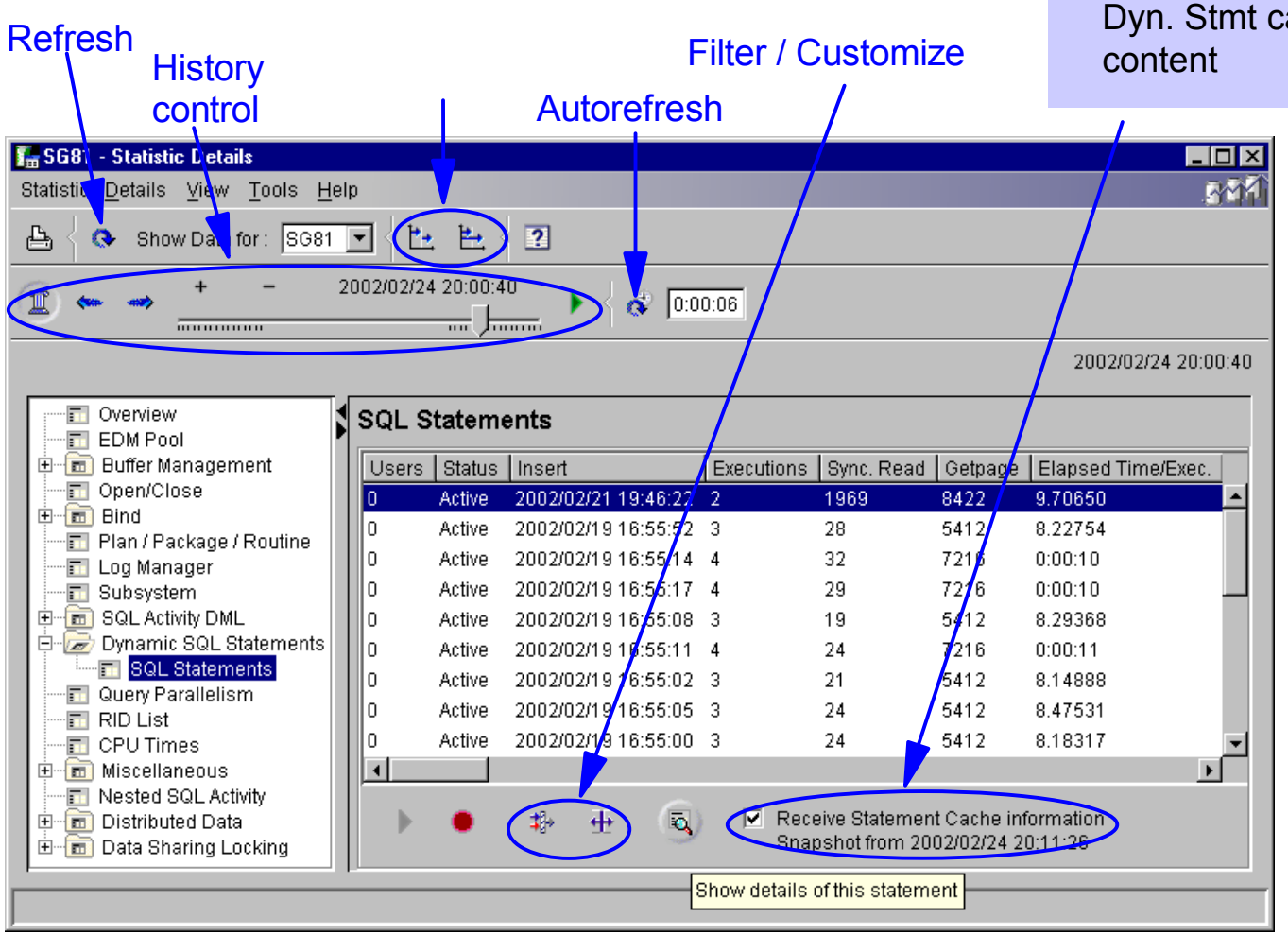


Improved navigation - less windows using tabs



GUI Options and Controls

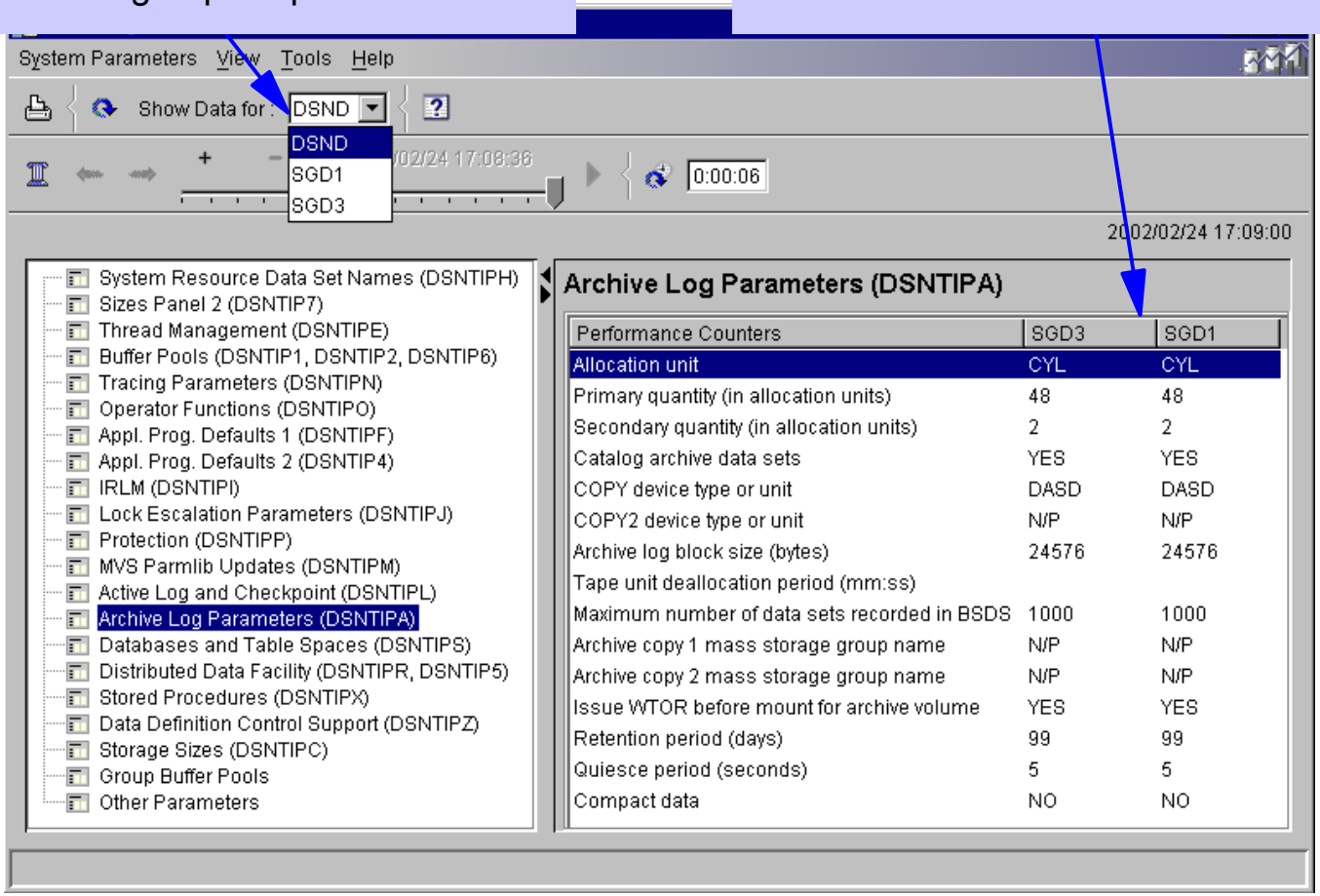
Select display of Dyn. Stmt cache content



Data Sharing Control

Member or group scope selection

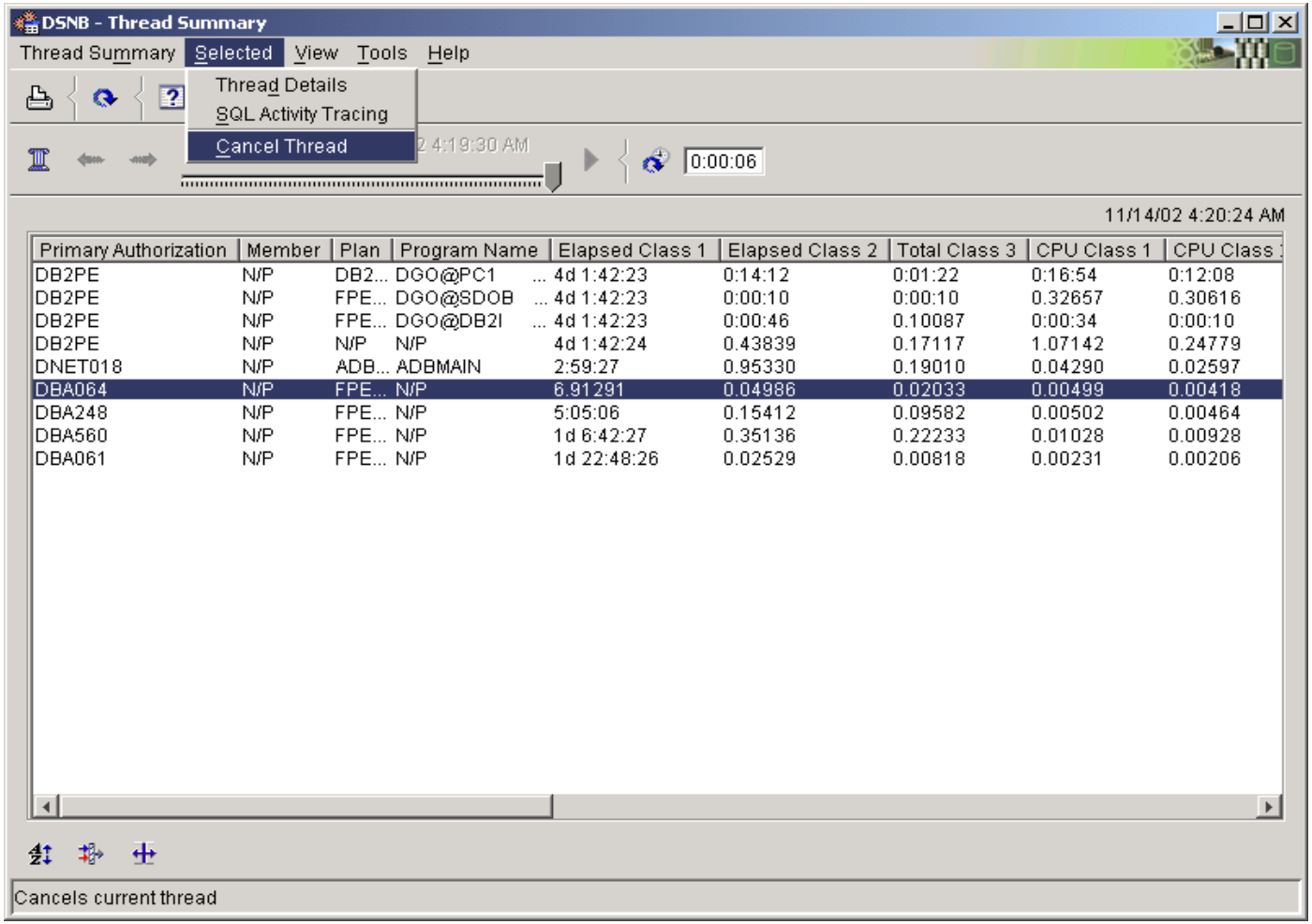
Members shown in table view



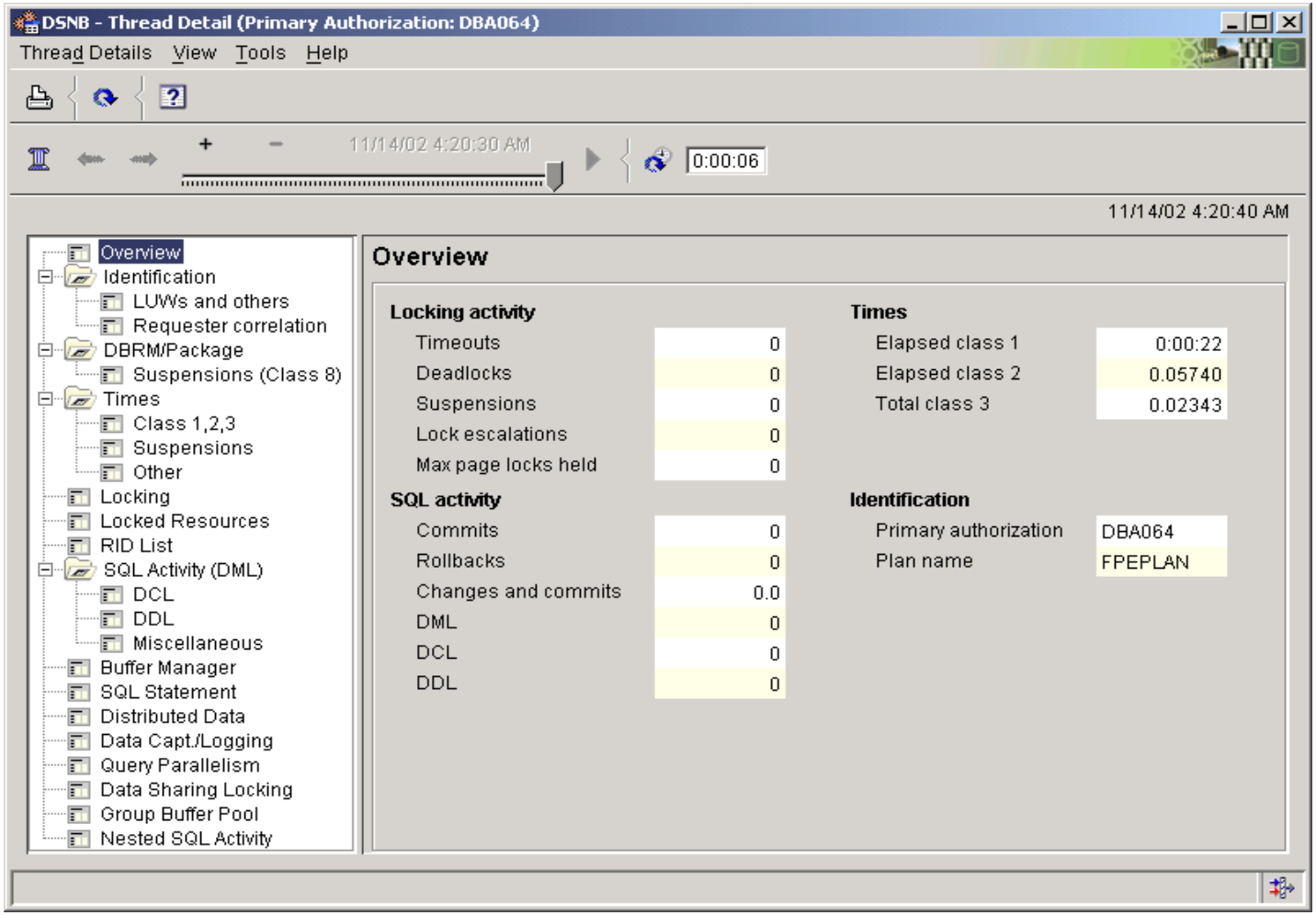
Application Monitoring

- View all connected threads
- View details of a selected thread
- Sort threads
- Cancel threads
- Create and view SQL activity traces

Application Monitoring – Thread Summary



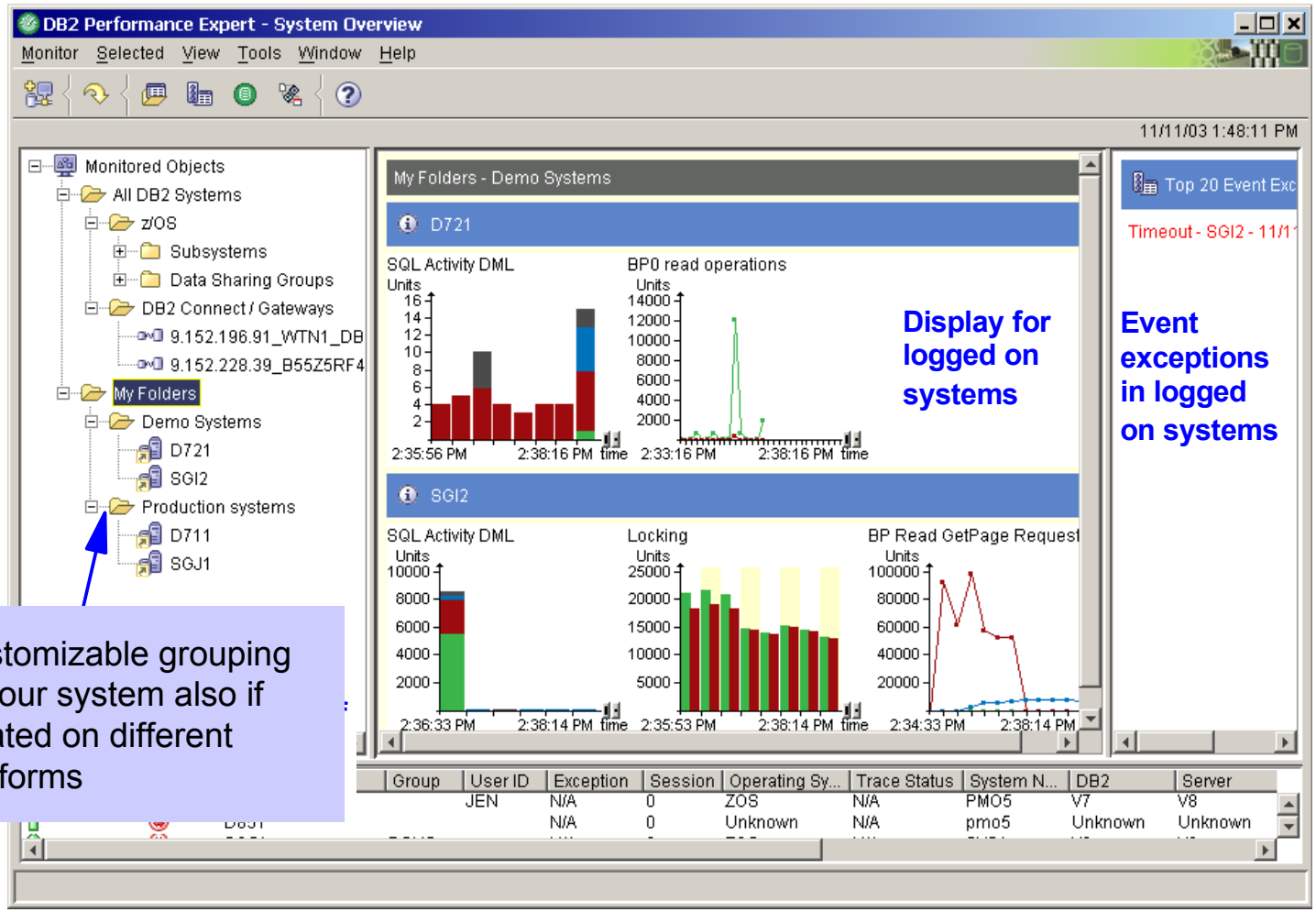
Application Monitoring – Thread Detail



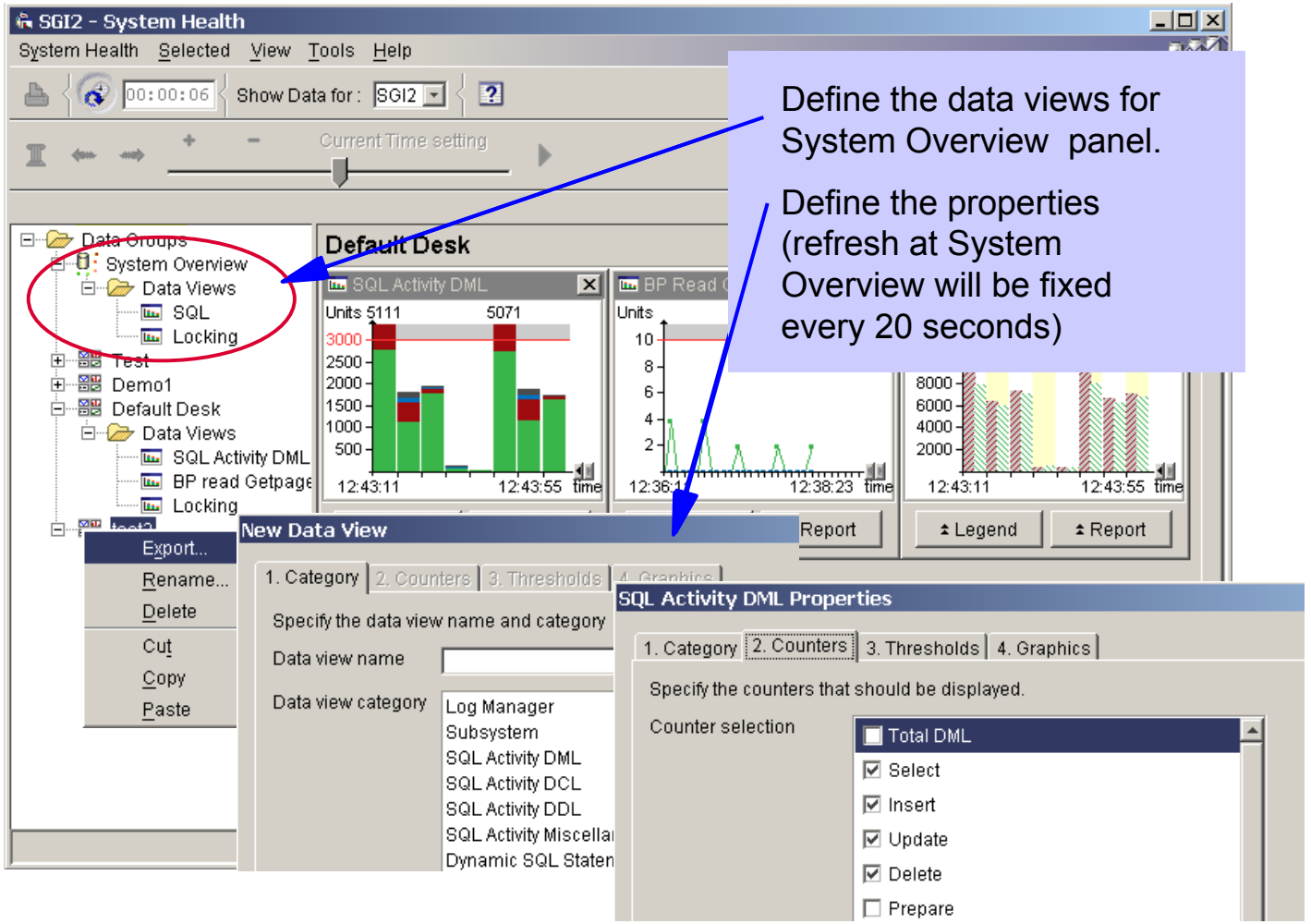
DB2 Subsystem Monitoring

- View important statistics and ratios of a DB2 subsystem in various levels of detail and processing modes
- View statistics information
- View SQL statements in the dynamic SQL cache
- View buffer pool statistics

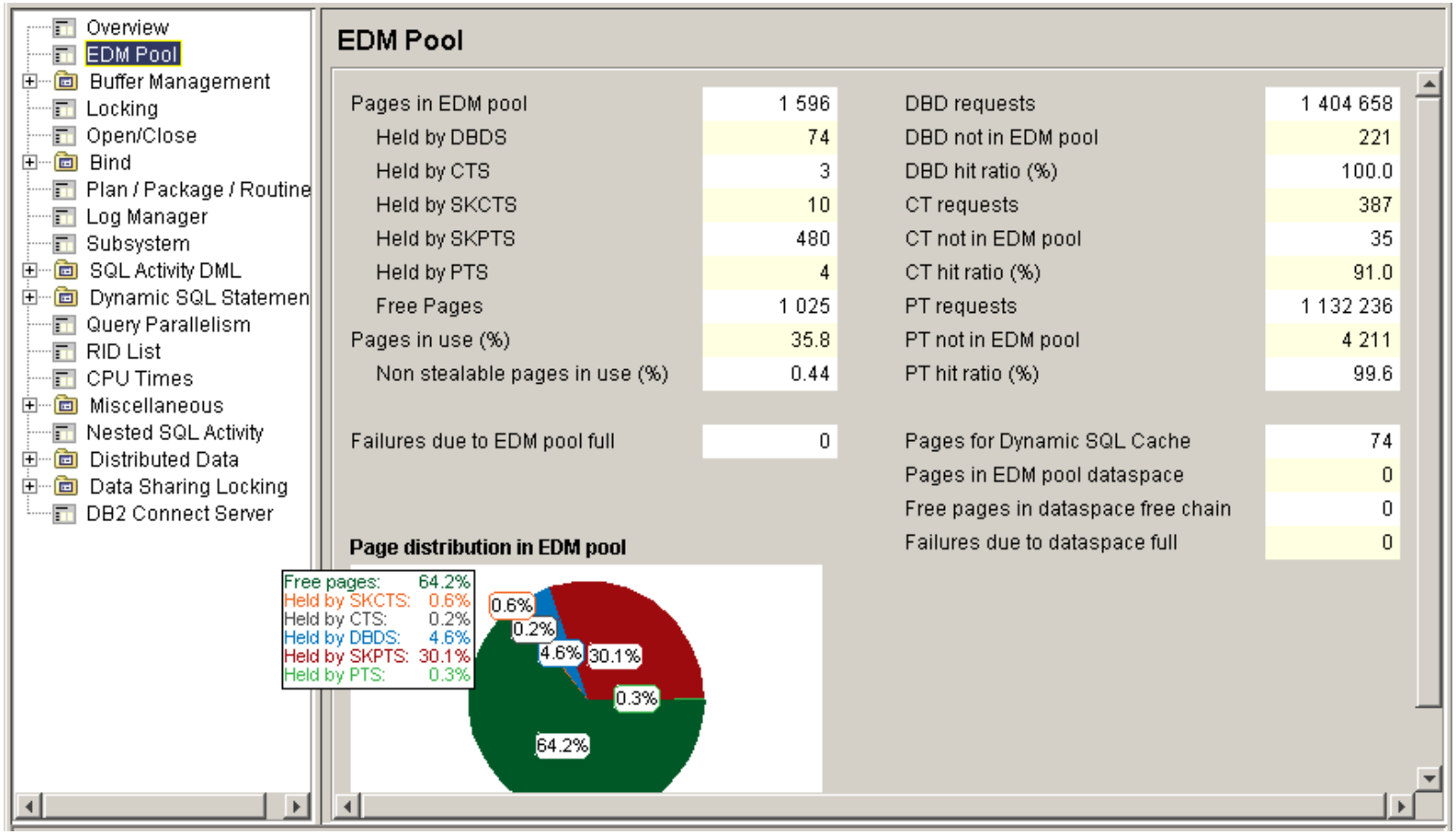
System Overview - Extended View



System Overview - data view definition and setup



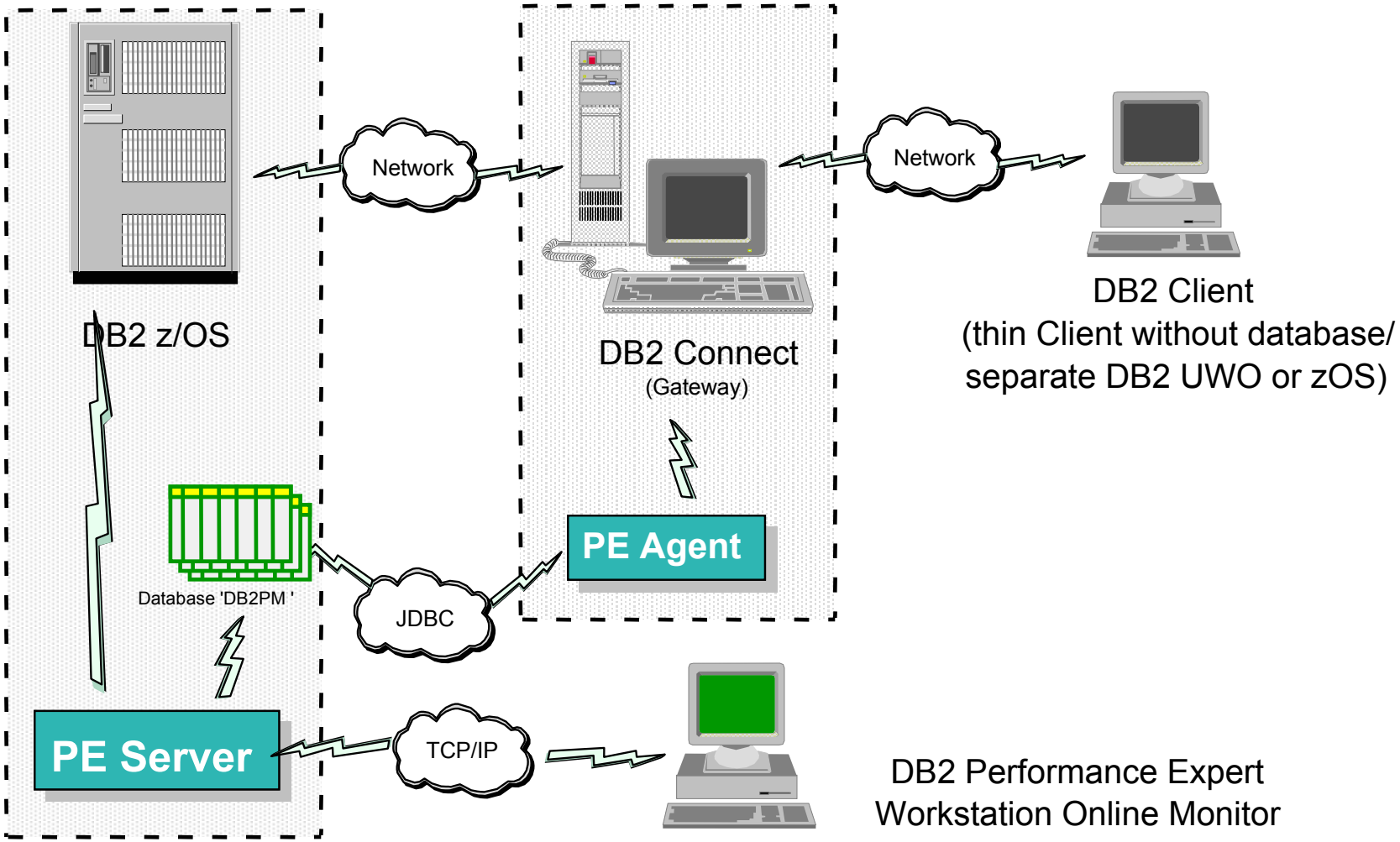
Graphs at detail panels



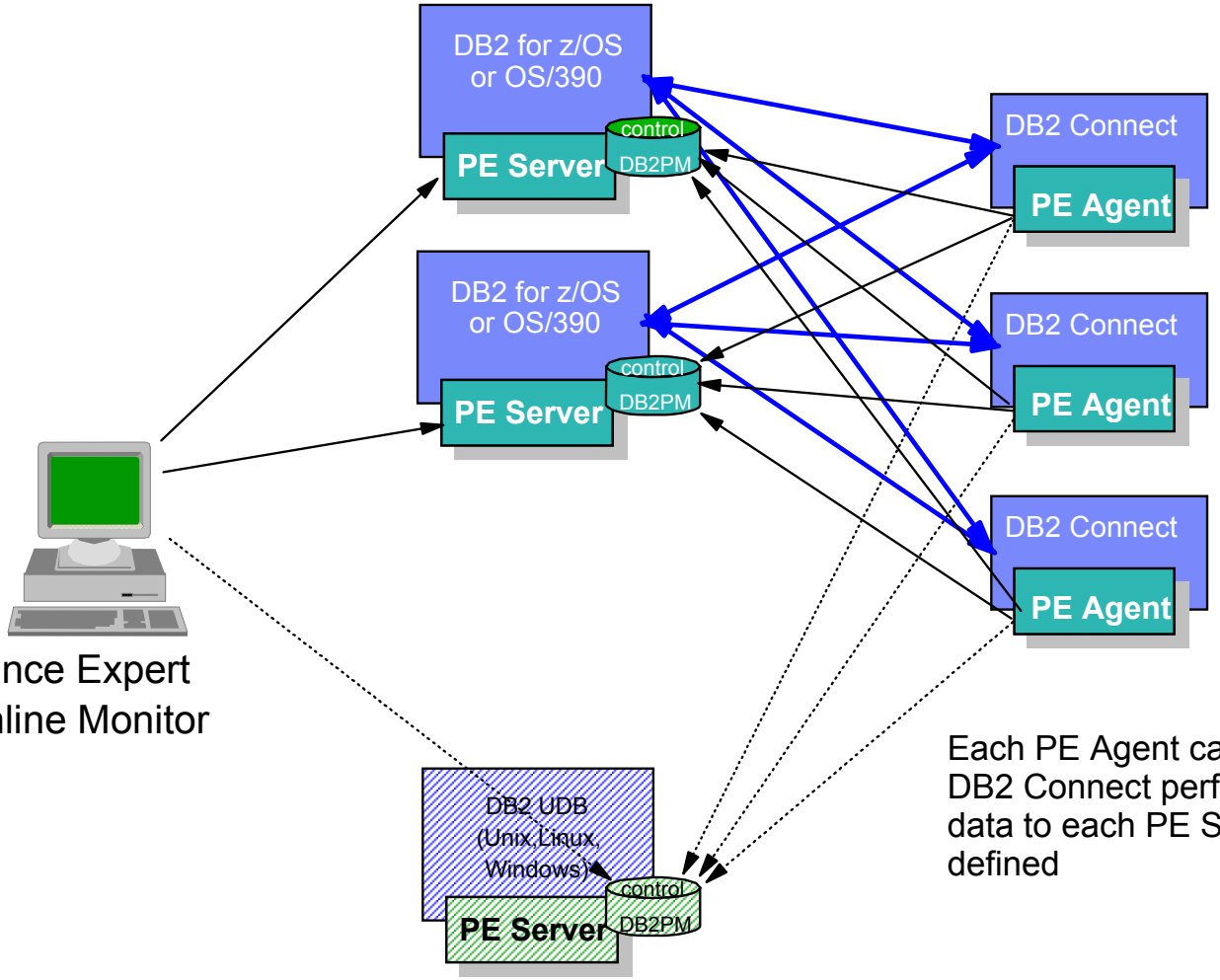
DB2 Connect Monitoring

- Different views to the DB2 Connect data
  - Select Statistics Details (of a selected DB2 subsystem)
    - Show DB2 Connect/Gateway information connected to the selected DB2 subsystem
  - Select Thread Summary + Details
    - Show DB2 Connect DCS applications information connected to the selected DB2 subsystem
  - Select DB2 Connect / Gateways
    - Show DB2 Connect/Gateway information independent on any selected DB2 subsystem

DB2 Connect Monitoring



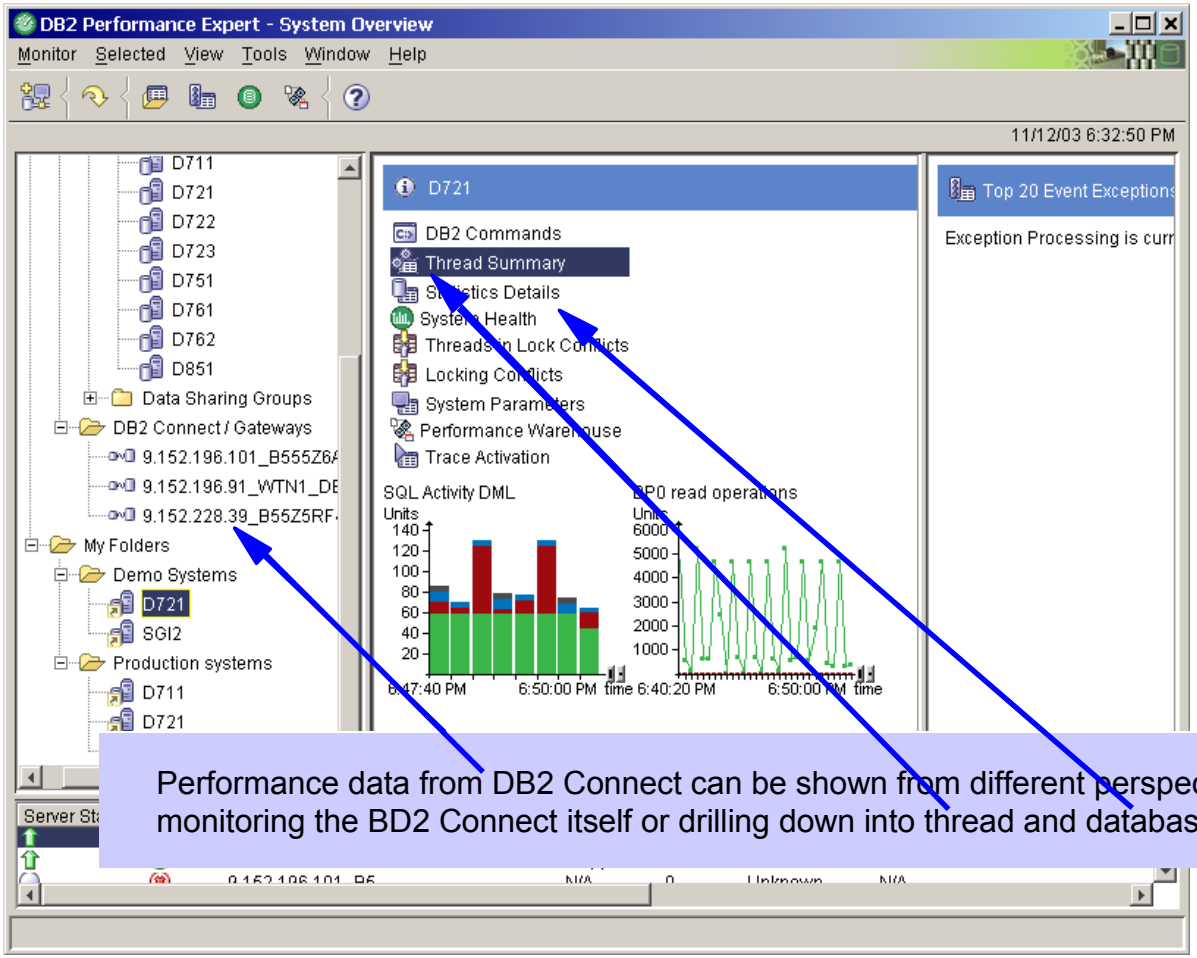
DB2 Connect Monitoring



DB2 Performance Expert Workstation Online Monitor

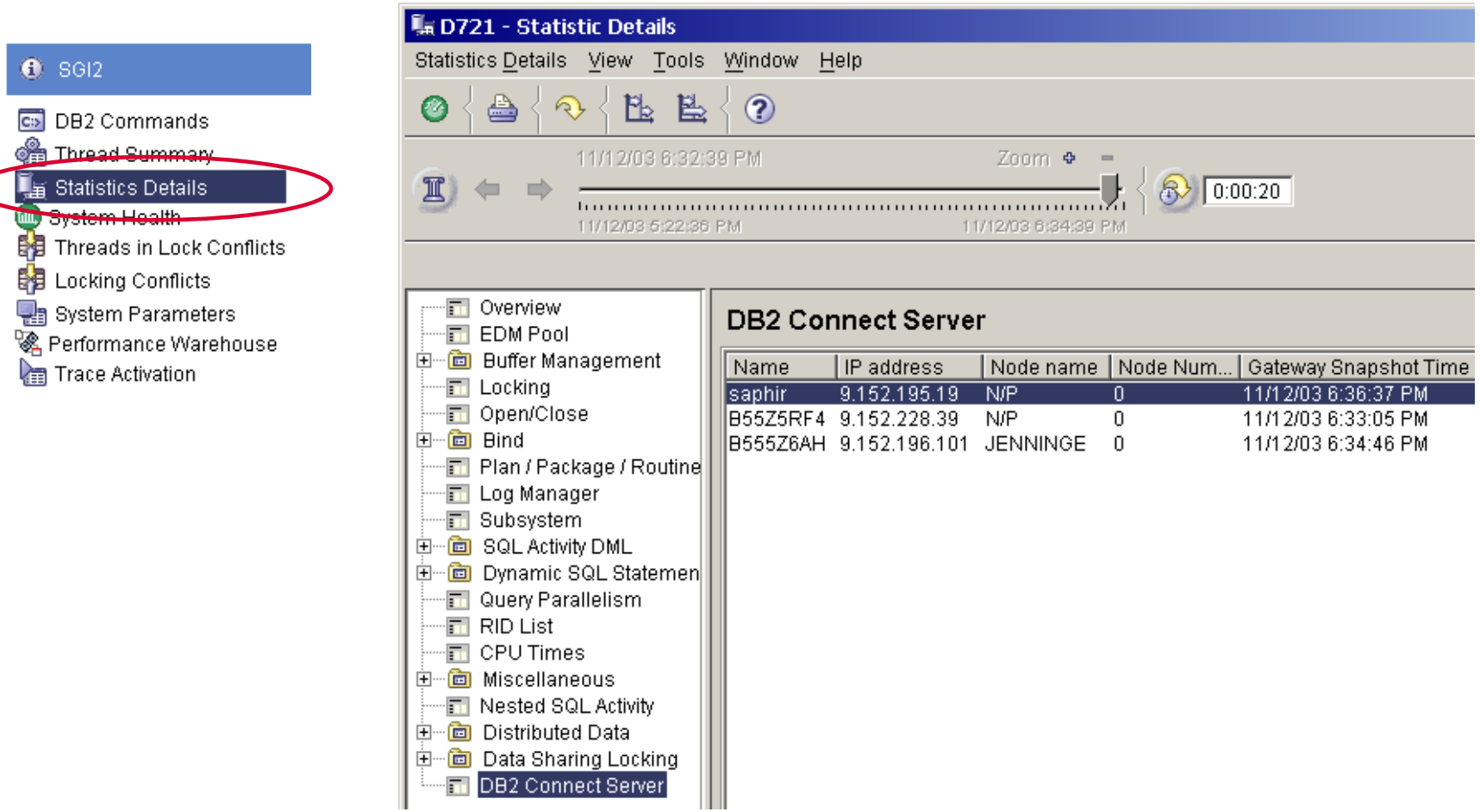
Each PE Agent can report the DB2 Connect performance data to each PE Server, if defined

DB2 Connect Monitoring - Display of data from different places

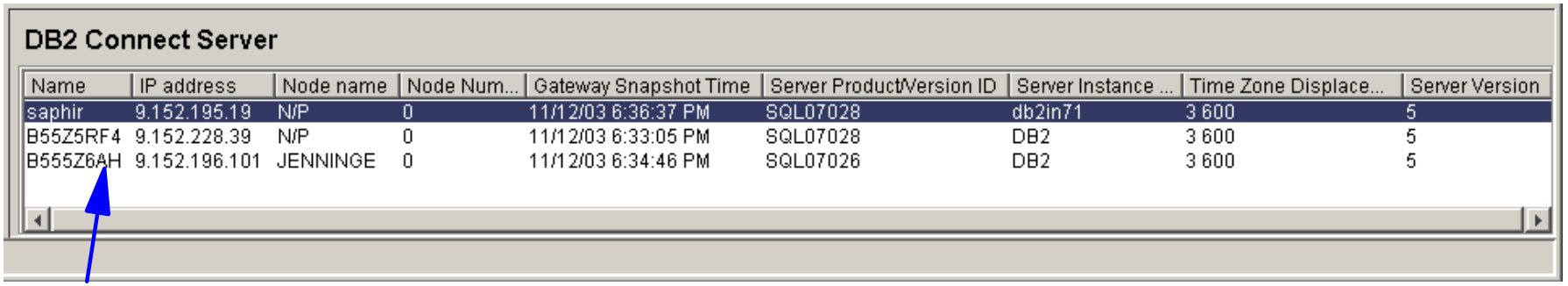


DB2 Connect Monitoring – Statistics Detail

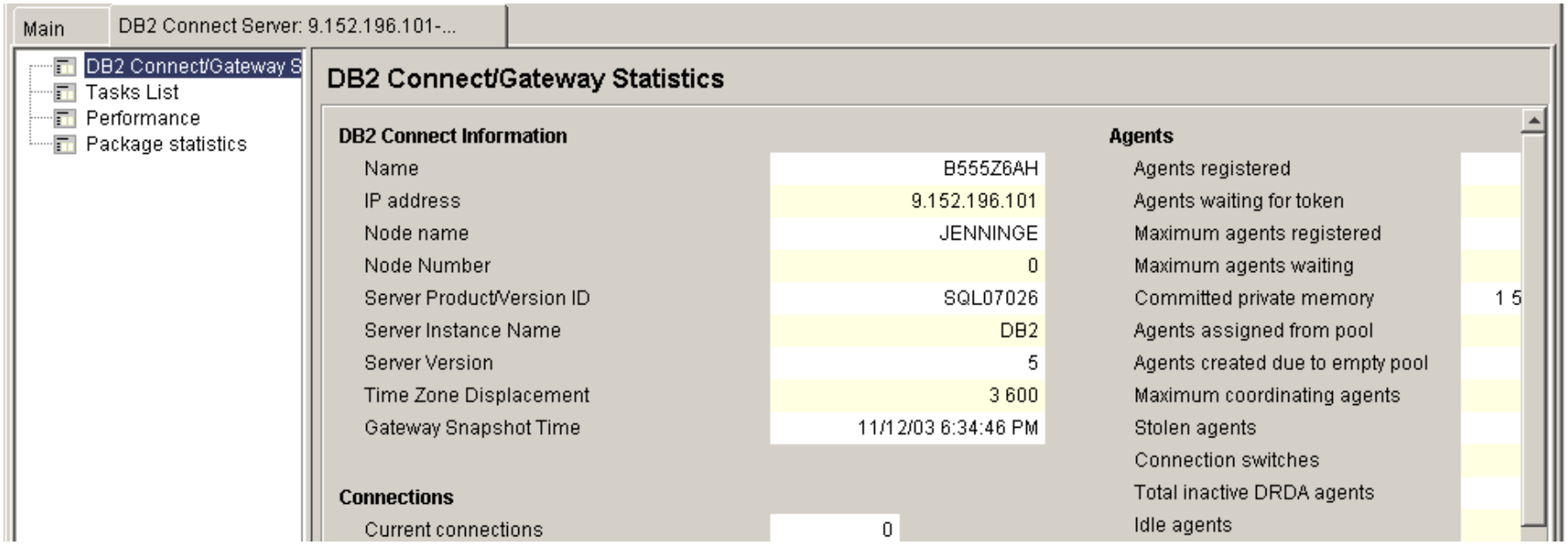
Show DB2 Connect/Gateway information connected to the selected DB2 subsystem



DB2 Connect Monitoring - Statistics Details / DB2 Connect



Select and drill down into more details



DB2 Connect Monitoring - Statistics Details / DB2 Connect

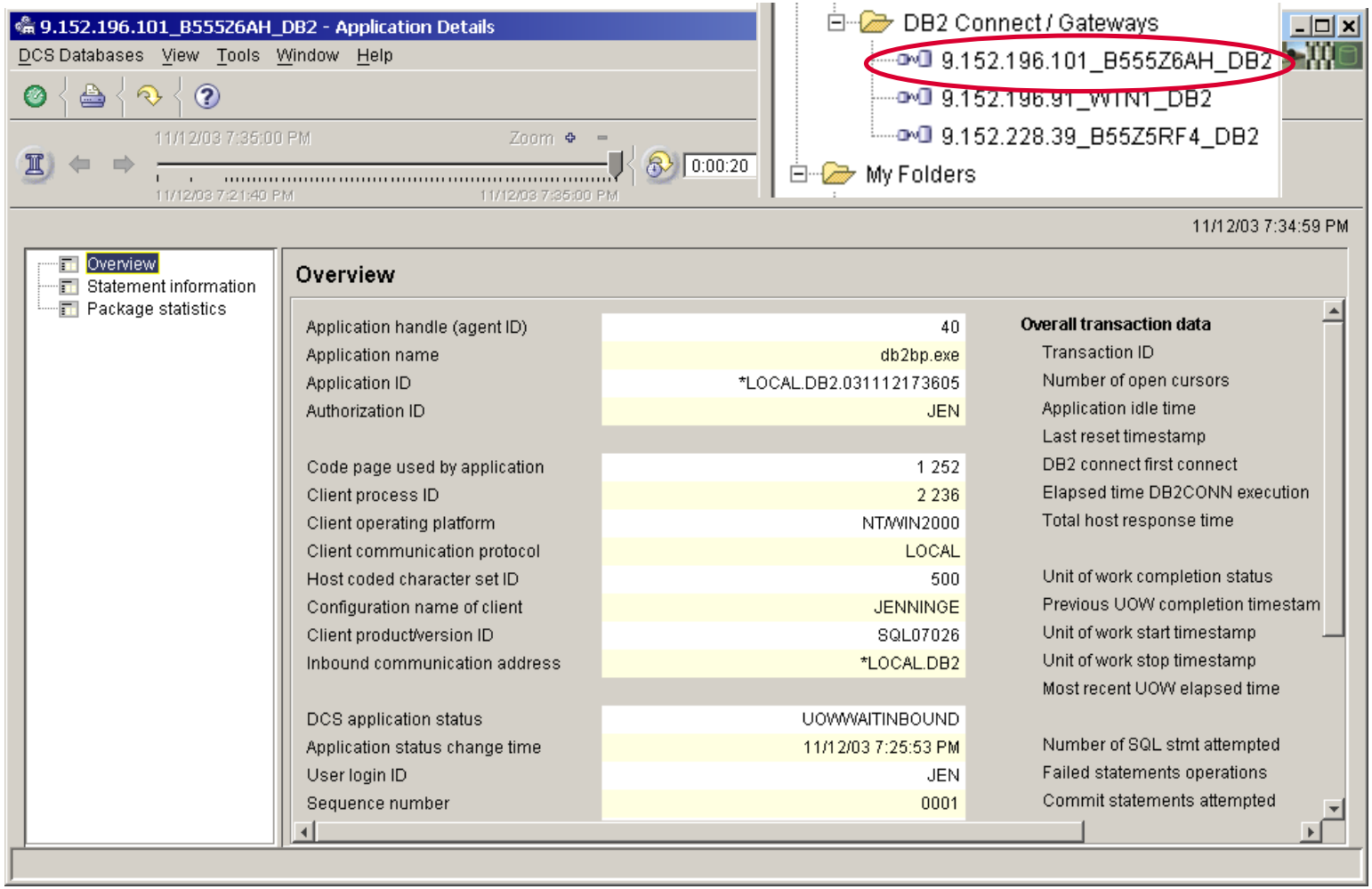
Main | DB2 Connect Server: 9.152.196.101-...

- DB2 Connect/G
- Tasks List
- Performance
- Package statis

Tasks List

Process name	Process owner name	Gateway process ID	User process ti...	System process time	Overall process time	Memory us
javaw.exe	N/P	2 068	0.00002	0.00000	0.00002	N/P
nlnotes.exe	N/P	1 976	0.00001	0.00000	0.00001	N/P
WinMgmt.exe	N/P	1 120	0.00000	0.00000	0.00000	N/P
java.exe	N/P	2 132	0.00000	0.00000	0.00000	N/P
explorer.exe	N/P	1 552	0.00000	0.00000	0.00000	N/P
nupdate.exe	N/P	668	0.00000	0.00000	0.00000	N/P
svchost.exe	N/P	484	0.00000	0.00000	0.00000	N/P
nwrdaemn.exe	N/P	640	0.00000	0.00000	0.00000	N/P
pcsws.exe	N/P	1 508	0.00000	0.00000	0.00000	N/P
System.exe	N/P	8	0.00000	0.00000	0.00000	N/P
SMSS.exe	N/P	184	0.00000	0.00000	0.00000	N/P
CSRSS.exe	N/P	208	0.00000	0.00000	0.00000	N/P
WINLOGON.exe	N/P	228	0.00000	0.00000	0.00000	N/P
SERVICES.exe	N/P	256	0.00000	0.00000	0.00000	N/P
LSASS.exe	N/P	268	0.00000	0.00000	0.00000	N/P
ibmpmsvc.exe	N/P	364	0.00000	0.00000	0.00000	N/P
svchost.exe	N/P	104	0.00000	0.00000	0.00000	N/P
spoolsv.exe	N/P	536	0.00000	0.00000	0.00000	N/P
trcboot.exe	N/P	564	0.00000	0.00000	0.00000	N/P
pcs_agnt.exe	N/P	596	0.00000	0.00000	0.00000	N/P
db2syscs.exe	N/P	652	0.00000	0.00000	0.00000	N/P
db2jds.exe	N/P	680	0.00000	0.00000	0.00000	N/P
db2licd.exe	N/P	696	0.00000	0.00000	0.00000	N/P

DB2 Connect Monitoring - DB2 Connect / Gateway



DB2 Connect Monitoring - Thread Details / DB2 Connect

Overview

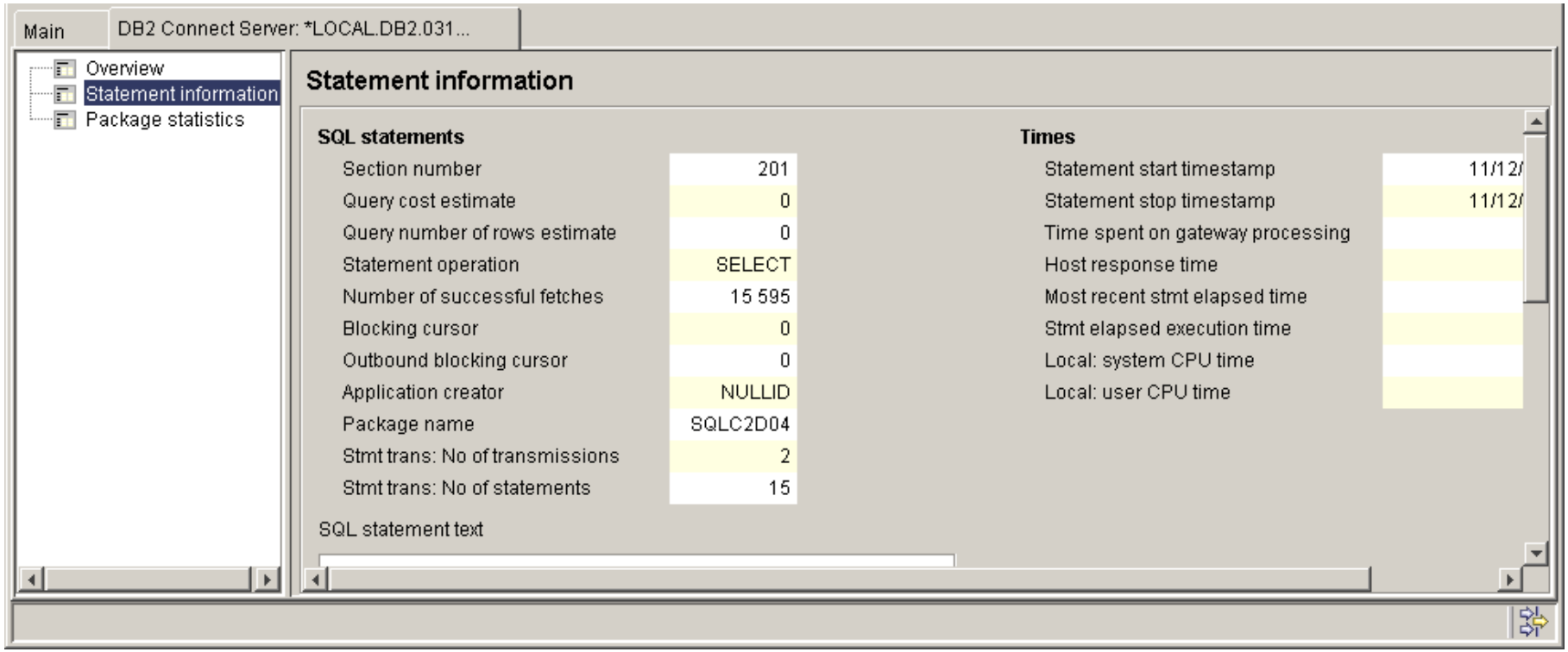
Application information

Application handle (agent ID)	40
Application name	db2bp.exe
Application ID	*LOCAL.DB2.031112173605
Authorization ID	JEN
Code page used by application	1 252
Client process ID	2 236
Client operating platform	NT/WIN2000
Client communication protocol	LOCAL
Host coded character set ID	500
Configuration name of client	JENNINGE
Client product/version ID	SQL07026
Inbound communication address	*LOCAL.DB2
DCS application status	UOWWAITINBOUND
Application status change time	11/12/03 6:40:53 PM
User login ID	JEN
Sequence number	0001
Database alias at the gateway	D721
DCS database name	DCS1367
Outbound application ID	G998C465.N704.031112173606
Outbound sequence number	0000
Outbound communication address	9.164.156.222 5721
Outbound communication protocol	TCPIP

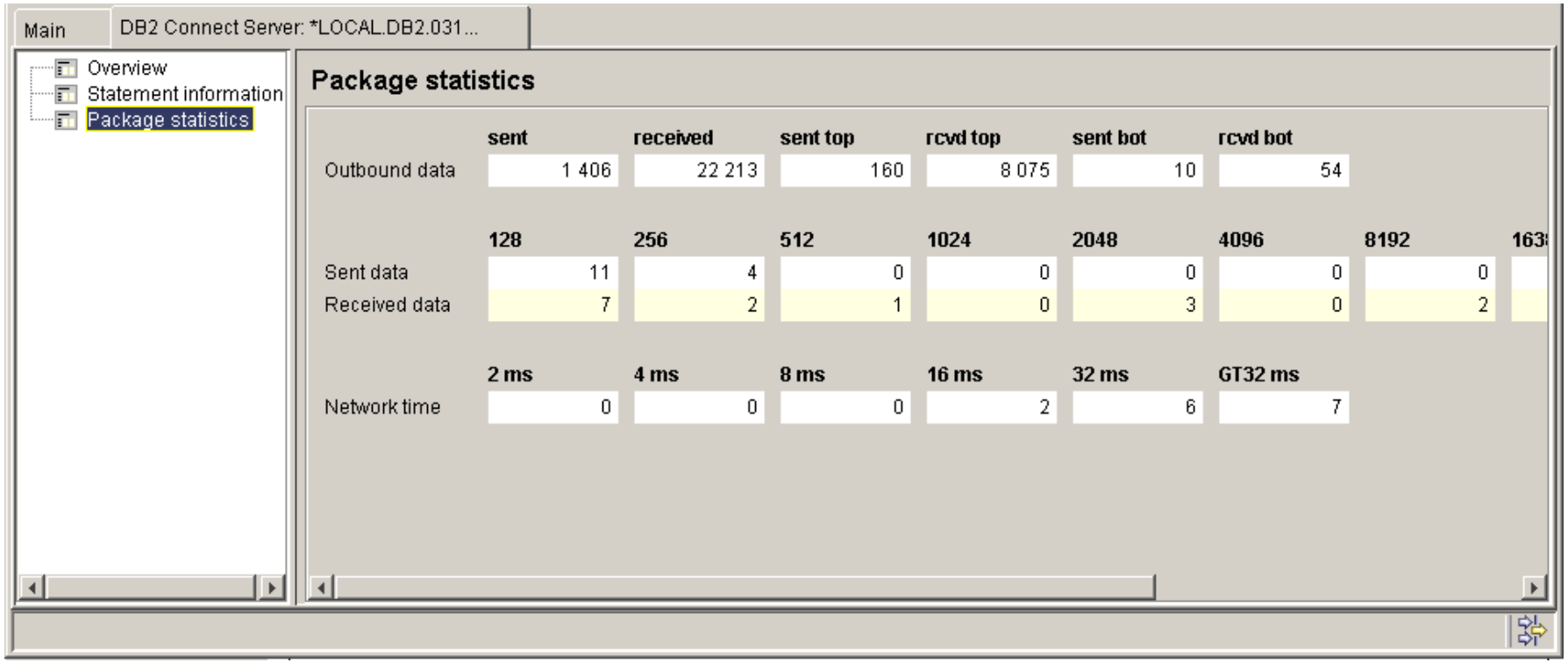
Overall transaction data

Transaction ID	N/P
Number of open cursors	0
Application idle time	0.00185
Last reset timestamp	N/P
DB2 connect first connect	11/12/03 6:36:05 PM
Elapsed time DB2CONN execution	0.00382
Total host response time	1.00323
Unit of work completion status	ROLLBACK
Previous UOW completion timestamp	11/12/03 6:36:23 PM
Unit of work start timestamp	11/12/03 6:40:06 PM
Unit of work stop timestamp	11/12/03 6:40:53 PM
Most recent UOW elapsed time	0:00:47
Number of SQL stmt attempted	58
Failed statements operations	0
Commit statements attempted	2
Rollback statements attempted	1
Rows selected	44
Number of transmissions	20
Total Stmt Exec elapsed time	0.43596
Total inbound bytes sent	0
Inbound bytes received	2 748

Connect Monitoring - Thread Details / DB2 Connect



DB2 Connect Monitoring - Thread Details / DB2 Connect

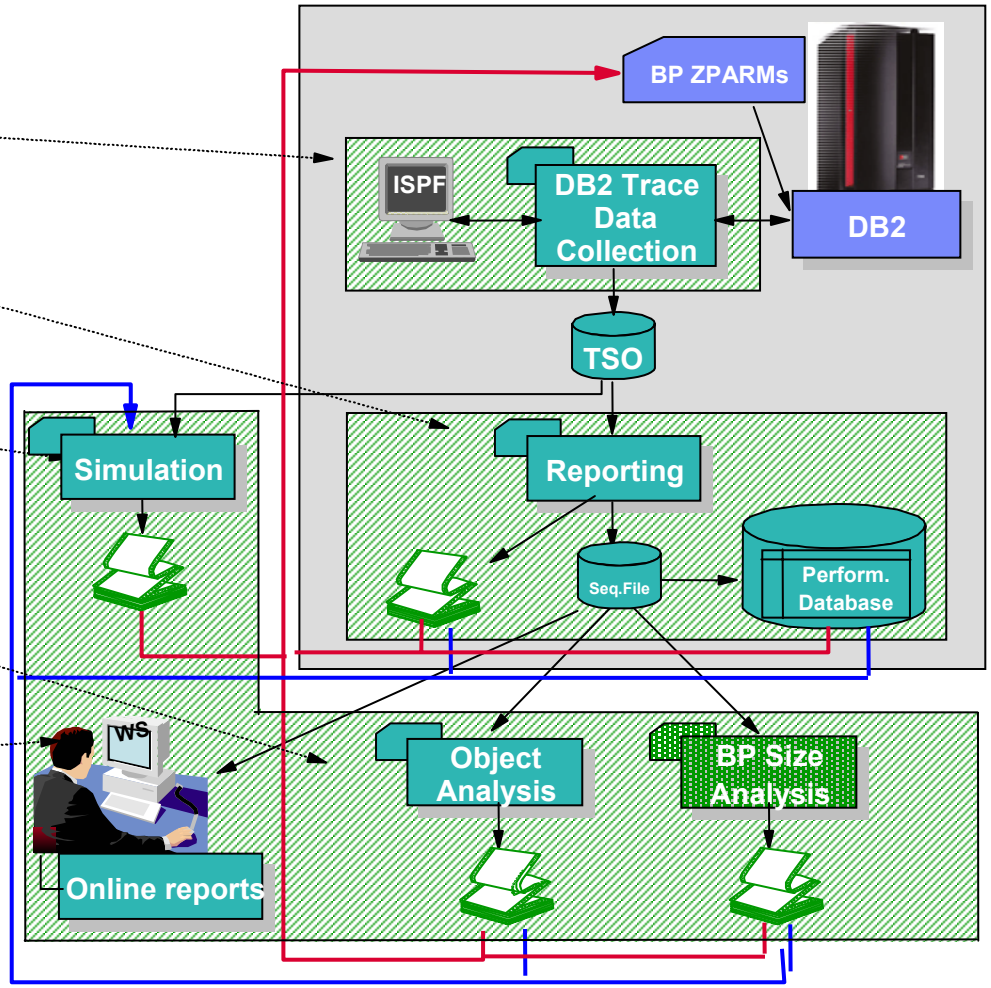


DB2 Buffer Pool Analyzer

- Easy monitoring of the performance of buffer pools and group buffer pools to detect bottlenecks, trends, and unused resources
- Fast adaptation of buffer pool parameters to changing DB2 usage conditions
- Optimize use of buffer pools by aligning buffer pool size and object placement to available resources
- Non-disruptive simulation of buffer pool behavior to test the impact of changes before they are applied
- Long-term analysis of factual performance for improved prediction of future performance and resource needs

DB2PE for z/OS Architecture (Buffer Pool Analyzer)

- Data Collection
- Reporting
- Simulation
- Expert Analysis
- GUI



Buffer Pool Analyzer

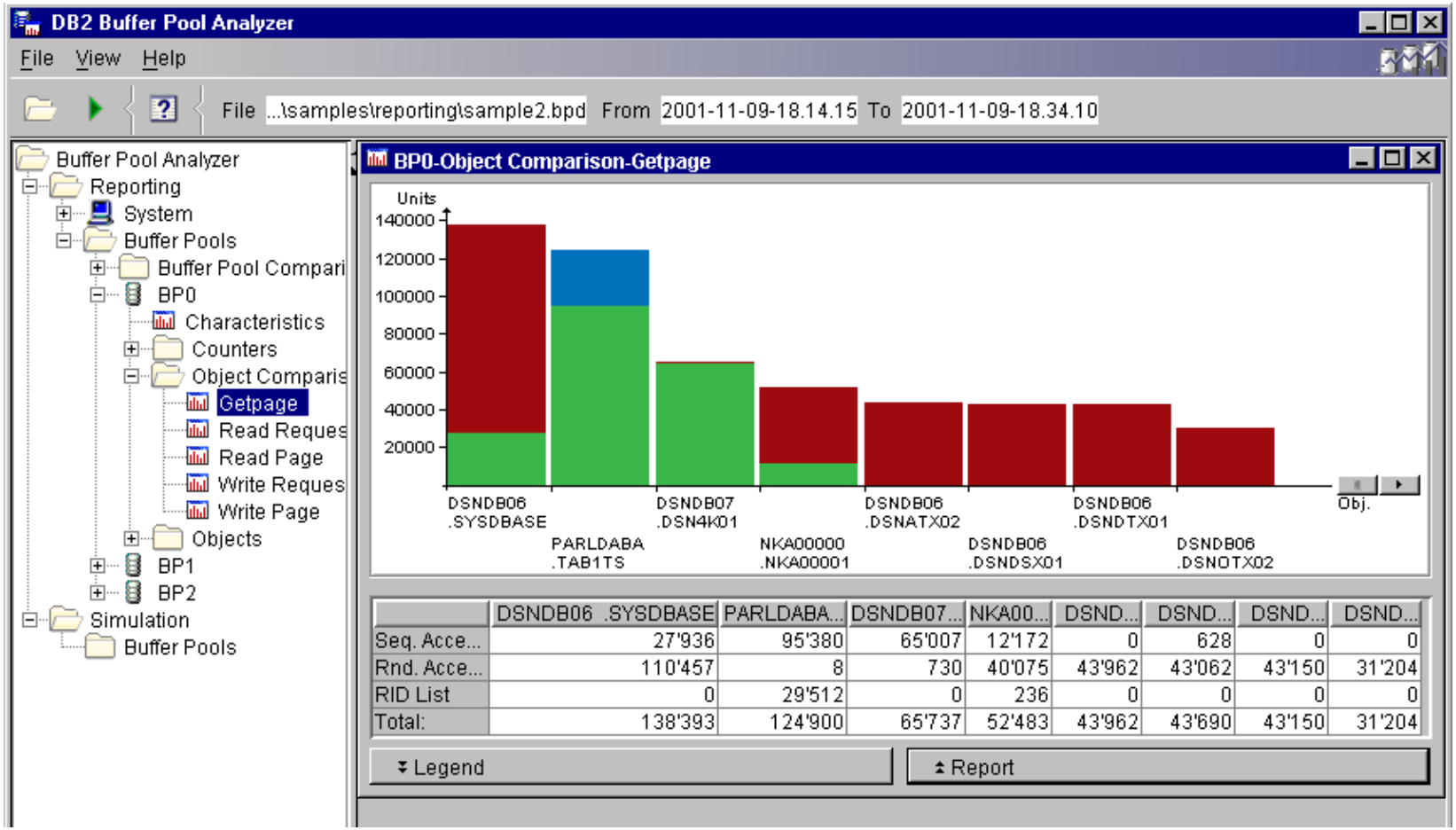
- Multiple Levels of Data Collection Available
  - Over Specified Period
  - Short Intervals
  - Sampling over Long Interval
  - Summary/Detail
- Modes of Data Collection via IFI
  - ISPF online
  - Batch mode
- Expert Analysis with Recommendations
  - Object Placement
  - Buffer Pool Sizing and Thresholds
- Simulation of Changes
  - Buffer Pool Sizes and Thresholds
  - Object Placement
  - Iterative Simulation over a Range
- Comprehensive Reports for Printing or Browsing, options include:
  - Sorted by various identifiers (e.g. BP, Plan, Object, ID)
  - Sorted by activity counters (e.g. GP, sync prefetch)
  - Top Reports
  - Filtered (e.g. specific BP, plan)
  - Highlight report to point only on critical performance counters
  - Group Buffer Pool
- Load Data into DB2 Table for Additional Analysis
- Batch Reports or Display Reports and Simulation Results with Graphical User Interface
  - Pie Charts
  - Graphs
  - Tables/Spreadsheet
  - Long Term Trend Analysis

Buffer Pool Analyzer – Sample Report

The highlight report pages indicates those critical counters which are unequal zero

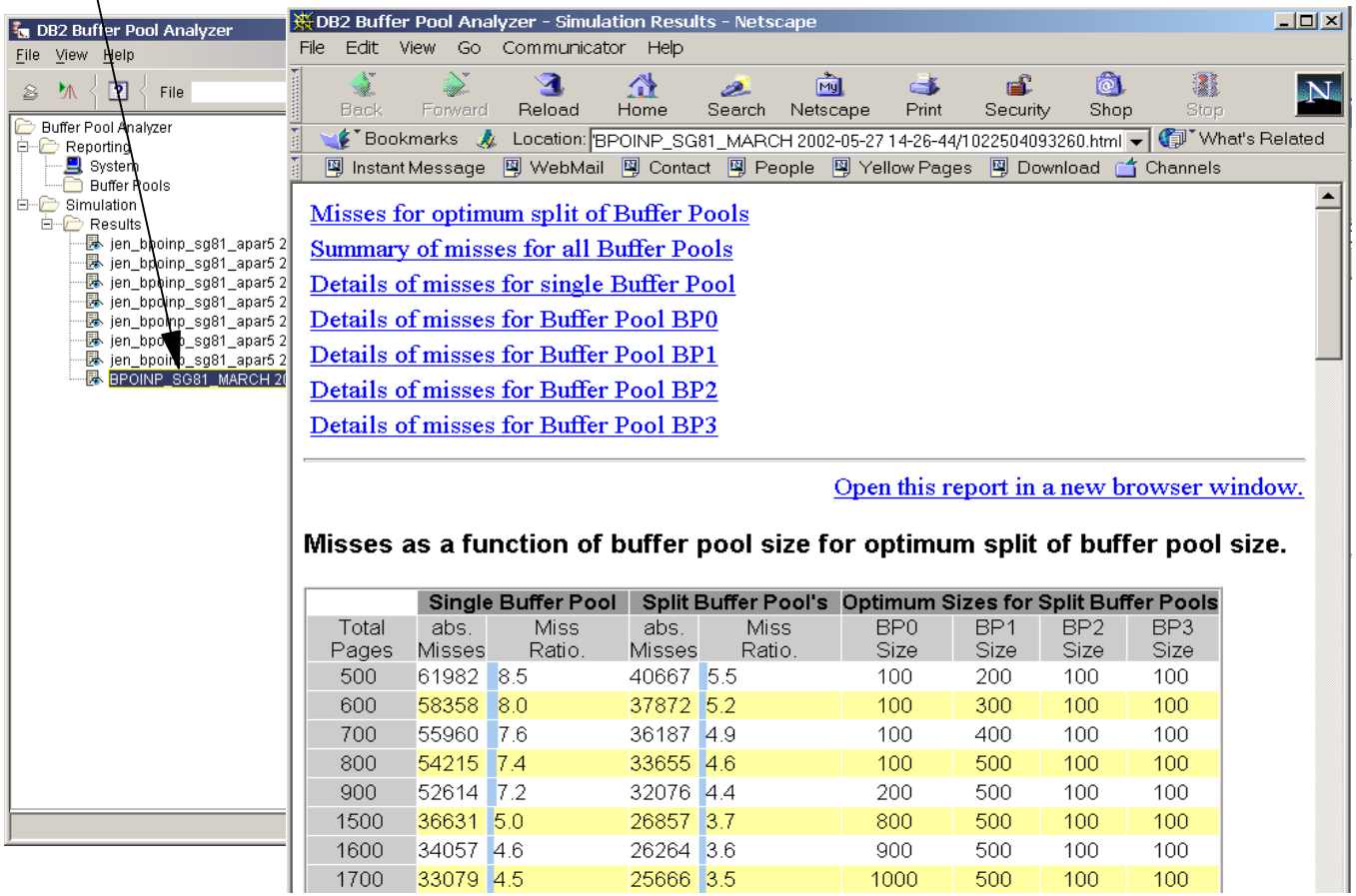
```
     DB2 PERFORMANCE EXPERT (V2) - BUFFER POOL ACTIVITY REPORT      PAGE: 1-10
                              ORDER: BPID-QPAGESET
                   SORTBY: ASYNCPAGE  TOP: 13  LEVEL: SUMMARY
GROUP:      N/P          LOCATION:       DB2F              DB2 VERSION: V6
MEMBER:     N/P          REQUESTED FROM: NOT SPECIFIED     TO: NOT SPECIFIED
SUBSYSTEM: DB2F          INTERVAL FROM:  06/28/02 17:20:25 TO: 06/28/02 19:00:52

                  =======  Buffer Pool Statistics (highlights) ==========
BUFFER  POOL ID                  BP0        BP1        BP2        BP3        BP4
----------------------- ---------- ---------- ---------- ---------- ----------
Buffers allocated             10000      14000      10000      12000       3000
Paral.query req.reduced           0       192*       197*        4*         1*
System hit ratio              99.54      99.94      92.41      92.25      99.98
Application hit ratio         99.76     100.00      95.57      96.81      99.99
Getpage request              169811     177741     103034    1796199     181816
Synchron.read sequent.            4          0          8        214          0
 Page-ins required              139*         0       1433*       179*        38*
Write
 Write eng not available         42*       591*        17*       5022*         3*
Hiperpool
 Buffers allocated            20000          0      20000      24000       6000
 Hit ratio                    12.13        n/c      35.21      47.66        n/c
======================== ========== ========== ========== ========== ==========
BUFFER  POOL ID                  BP5        BP6      BP32K
----------------------- ---------- ---------- ----------
Buffers allocated              5000       1000       1000
Reached threshold
Current active buffer           118*          0         4*
System hit ratio              99.56        n/c      99.58
Application hit ratio         99.73        n/c      99.58
Getpage request               50028          0       5909
Synchron.read sequent.            0          0          0
 Page-ins required              101*          0         17*
Write
 Write eng not available         16*          0         3*
Hiperpool
 Buffers allocated            10000       2000
 Hit ratio                     0.00        n/c
======================== ========== ========
```

BPA – Most Used Objects Graph



BPA – Simulation Report

Opening the simulation result will show the reports in your preferred browser.

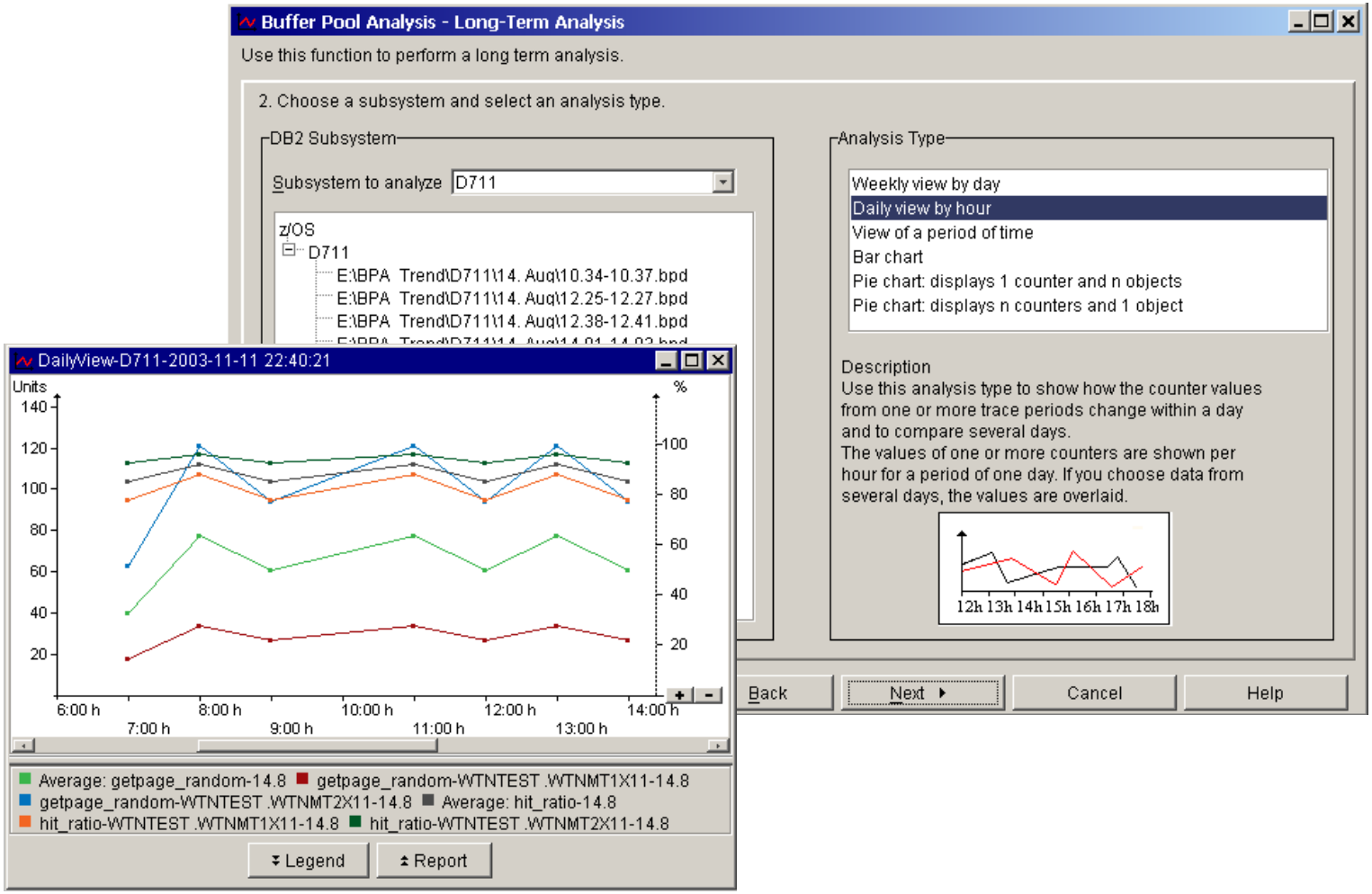


	Single Buffer Pool		Split Buffer Pool's		Optimum Sizes for Split Buffer Pools			
Total Pages	abs. Misses	Miss Ratio.	abs. Misses	Miss Ratio.	BP0 Size	BP1 Size	BP2 Size	BP3 Size
500	61982	8.5	40667	5.5	100	200	100	100
600	58358	8.0	37872	5.2	100	300	100	100
700	55960	7.6	36187	4.9	100	400	100	100
800	54215	7.4	33655	4.6	100	500	100	100
900	52614	7.2	32076	4.4	200	500	100	100
1500	36631	5.0	26857	3.7	800	500	100	100
1600	34057	4.6	26264	3.6	900	500	100	100
1700	33079	4.5	25666	3.5	1000	500	100	100

BPA – Object Placement Utility

```
                DB2 Buffer Pool Analyzer (V1) - Object Placement Utility

 Run date:  11/03/01 15:21:45                                          Page:
7
 Group:     N/P               Location:  PMO2D721            DB2 Version:
V71
 Member:    N/P               Subsystem: D721

                       DB2 commands and ALTER statements
                       ---------------------------------

 -STOP DATABASE(DSNDB07) SPACENAM(DSN4K01)
 ALTER TABLESPACE DSNDB07.DSN4K01 BUFFERPOOL BP1;
 -START DATABASE(DSNDB07) SPACENAM(DSN4K01)

 -STOP DATABASE(NKA00000) SPACENAM(IXSP0000)
 ALTER TABLESPACE NKA00000.IXSP0000 BUFFERPOOL BP3;
 -START DATABASE(NKA00000) SPACENAM(IXSP0000)

 -STOP DATABASE(NKA00000) SPACENAM(IXSQ0000)
 ALTER TABLESPACE NKA00000.IXSQ0000 BUFFERPOOL BP3;
 -START DATABASE(NKA00000) SPACENAM(IXSQ0000)

 -STOP DATABASE(NKA00000) SPACENAM(NKA00001)
 ALTER TABLESPACE NKA00000.NKA00001 BUFFERPOOL BP5;
 -START DATABASE(NKA00000) SPACENAM(NKA00001)

 -STOP DATABASE(PARLDABA) SPACENAM(TAB1TS)
 ALTER TABLESPACE PARLDABA.TAB1TS BUFFERPOOL BP5;
 -START DATABASE(PARLDABA) SPACENAM(TAB1TS)

 -STOP DATABASE(PARLDABA) SPACENAM(XTAB2)
 ALTER TABLESPACE PARLDABA.XTAB2 BUFFERPOOL BP2;
 -START DATABASE(PARLDABA) SPACENAM(XTAB2)

 -STOP DATABASE(WTNTEST) SPACENAM(WTNMTS1)
 ALTER TABLESPACE WTNTEST.WTNMTS1 BUFFERPOOL BP3;
 -START DATABASE(WTNTEST) SPACENAM(WTNMTS1)
```

Buffer Pool Analyzer - Long term trend analysis

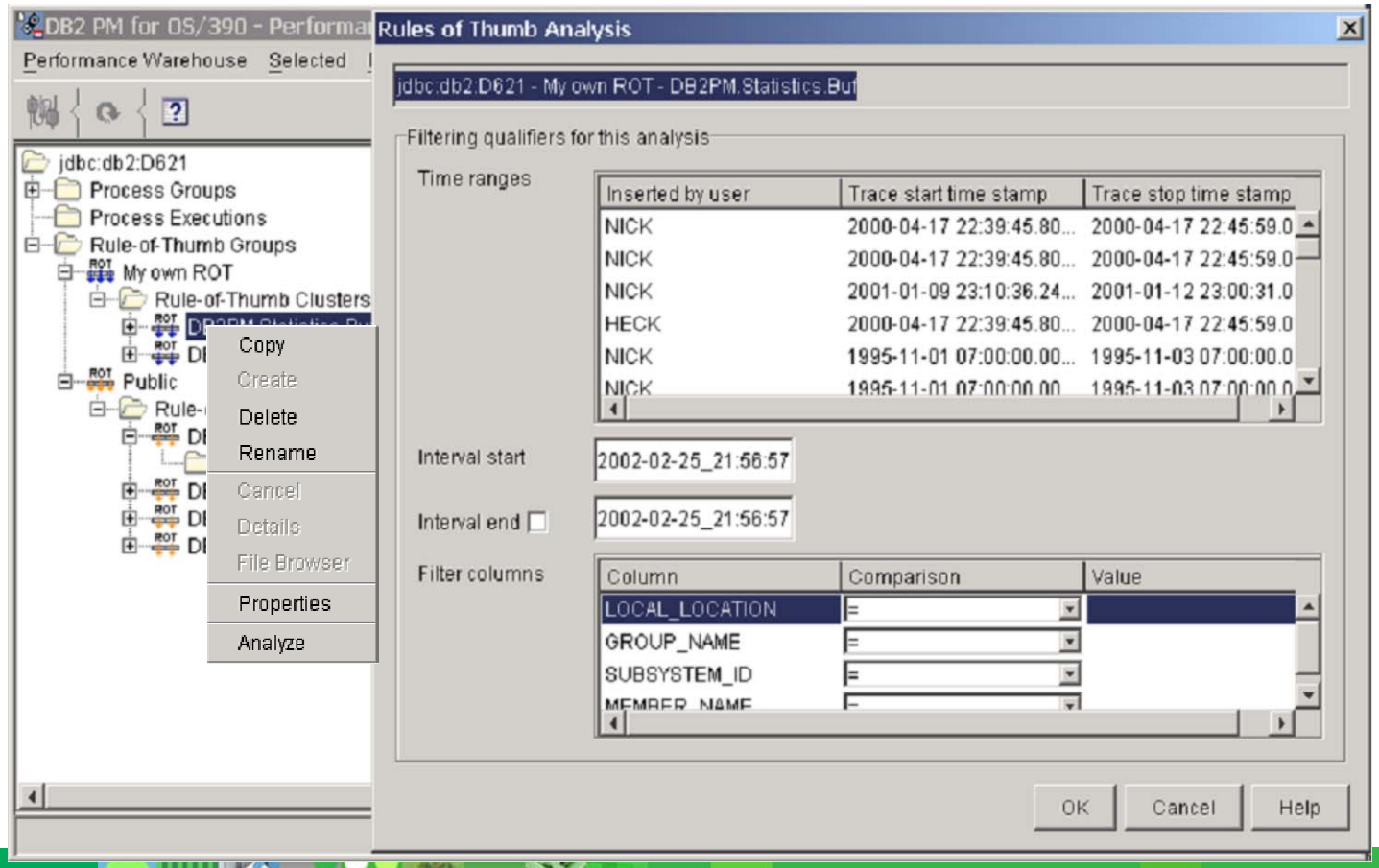


Performance Warehouse

- Performance Warehouse provides a process-oriented view of performance-analysis tasks.
- Automate tasks that previously required user interaction, such as loading DB2 data into a performance database or generating reports.

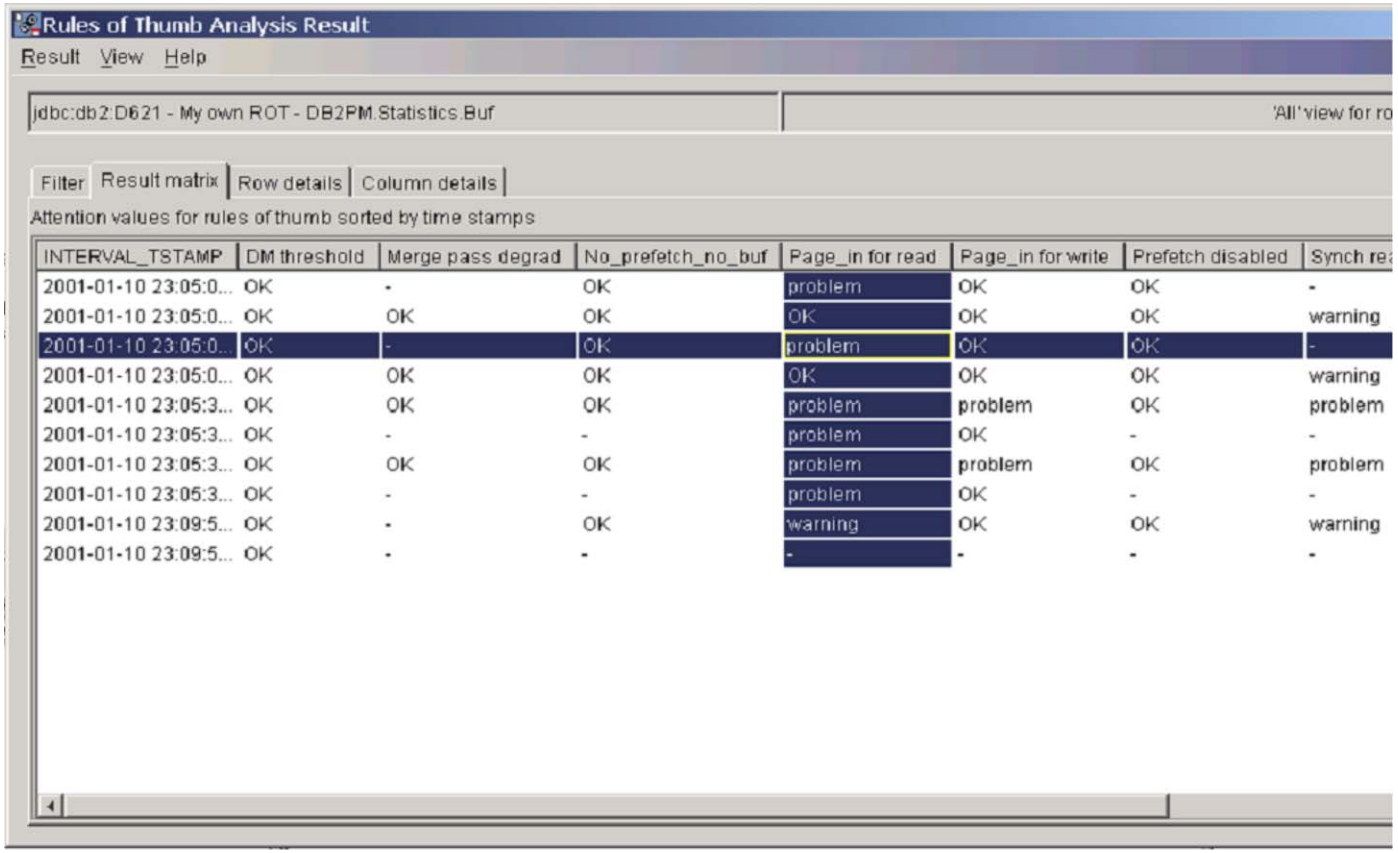
Performance Warehouse - Analysis

Starting analysis with the ROT selected you need to select the set performance data (by time period and several filters (optional)) stored in your performance database.



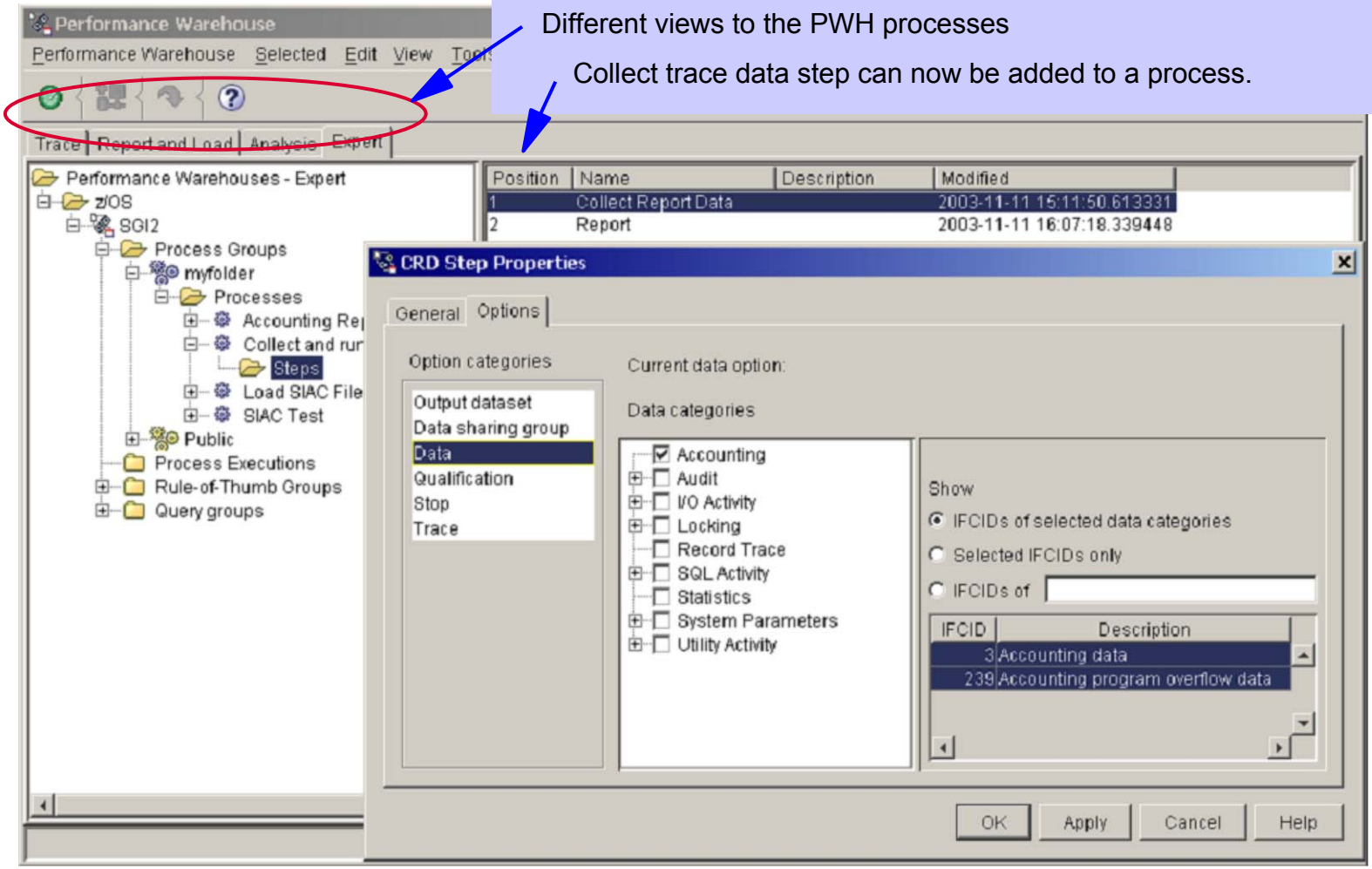
Performance Warehouse – Analysis Results

Depending on the selected ROT and the performance data you may get a result matrix, select row and column to get more specific information



INTERVAL_TSTAMP	DM threshold	Merge pass degrad	No_prefetch_no_buf	Page_in for read	Page_in for write	Prefetch disabled	Synch re
2001-01-10 23:05:0...	OK	-	OK	problem	OK	OK	-
2001-01-10 23:05:0...	OK	OK	OK	OK	OK	OK	warning
2001-01-10 23:05:0...	OK	-	OK	problem	OK	OK	-
2001-01-10 23:05:0...	OK	OK	OK	OK	OK	OK	warning
2001-01-10 23:05:3...	OK	OK	OK	problem	problem	OK	problem
2001-01-10 23:05:3...	OK	-	-	problem	OK	-	-
2001-01-10 23:05:3...	OK	OK	OK	problem	problem	OK	problem
2001-01-10 23:05:3...	OK	-	-	problem	OK	-	-
2001-01-10 23:09:5...	OK	-	OK	warning	OK	OK	warning
2001-01-10 23:09:5...	OK	-	-	-	-	-	-

Collect Report Data - now incorporated into PWH process

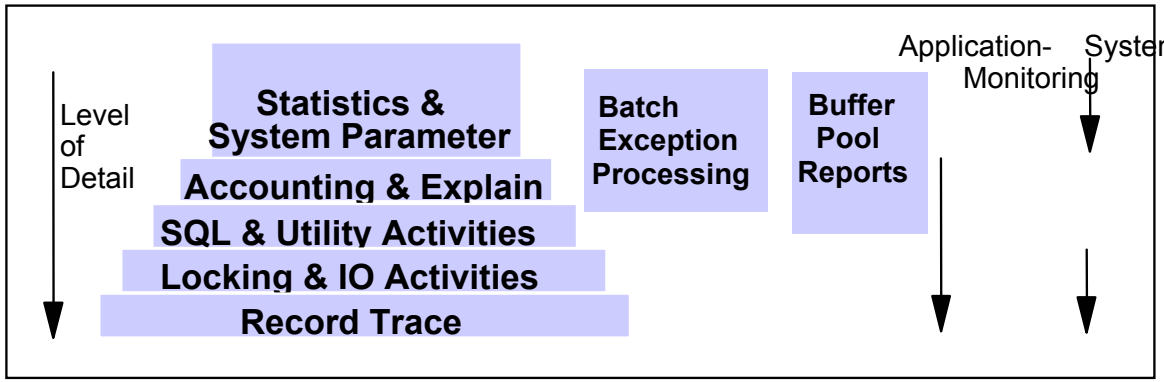


Batch Reporting

- Historical information about DB2 system and application performance.
- System-wide performance data shows information about topics like CPU times, buffer pool usage, locking, log and I/O activity.
- Application data shows how individual programs are behaving in DB2.

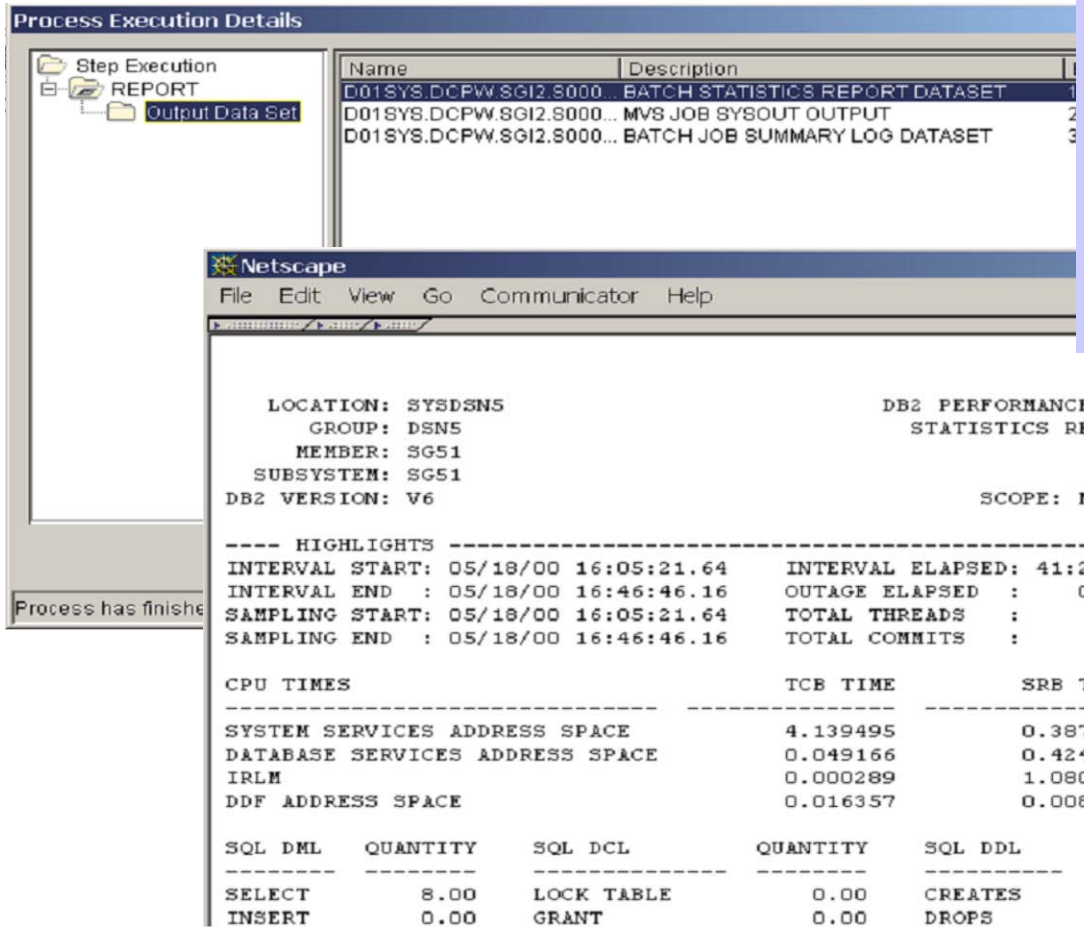
Batch Reporting

- Report facility which
- Takes SMF, GTF or TSO data sets (collected by DB2 Performance Expert Collect Report Data) as input
- Generates a variety of customizable reports and traces:



- Invocation via MVS JCL or via workstation GUI (Statistics & Accounting Report)
- Result shown in browser window
- Integrated into monitoring (SQL activity tracing)
- Reduction of trace information for loading into the Performance DB

GUI – Batch Reporting



Functions to control the generation and browsing of a report are provided together with the Performance Warehouse functions

DB2 Performance Expert for z/OS Summary

- Monitors, analyzes and tunes the performance of IBM DB2 Universal Database and DB2 applications
- Features an enhanced end-user interface with new graphical data views
- Includes a performance warehouse for storing performance data and analysis tools
- Enables you to quickly and easily identify performance bottlenecks using pre-defined rules of thumb

References

- IBM Database Tools on the web:

http://www.ibm.com/software/data/db2imstools/

- DB2 Performance Expert for z/OS Manuals:

http://www.ibm.com/software/data/db2imstools/db2tools-library.html

- Redbooks:

http://publib-b.boulder.ibm.com/cgi-in/searchsite.cgi?query=DM+Tools

DB2 Performance Expert for z/OS, SG24-6867-00

DB2 for z/OS and OS/390 Tools for Performance Management, SG24-6508-00

Questions and Answers!

We will now be conducting a Q & A session.
Please press ***1** so the operator can open your line to ask a question.

- IBM would like to offer more of these training sessions. Please send feedback to dbowling@us.ibm.com or reply to the email questionnaire that will be sent to you in the next few days.
- If there are other members of your team that could benefit from hearing this presentation, please have them dial in and listen to the upcoming replay that will be available early next week.

Thank you for your time!

For more information about the DB2 an IMS Tools, please visit our website at : www.ibm.com/software/data/db2imstools/

- **Lab Outreach program – DB2 Lab coming to a city near you:**

Seattle	March 15 - IMS March 16 - DB2
Chicago	March 16 - IMS March 17 - DB2
Dallas	March 17 - IMS March 18 - DB2
NYC	March 18 – IMS March 19 - DB2

- **Upcoming Webcasts:**

  March 04: Leverage zSeries Hardware & Software Automation Capability to Improve System, Data and Application productivity