

# Time for a Game Changer in Managing DB2 for z/OS Performance



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# Agenda

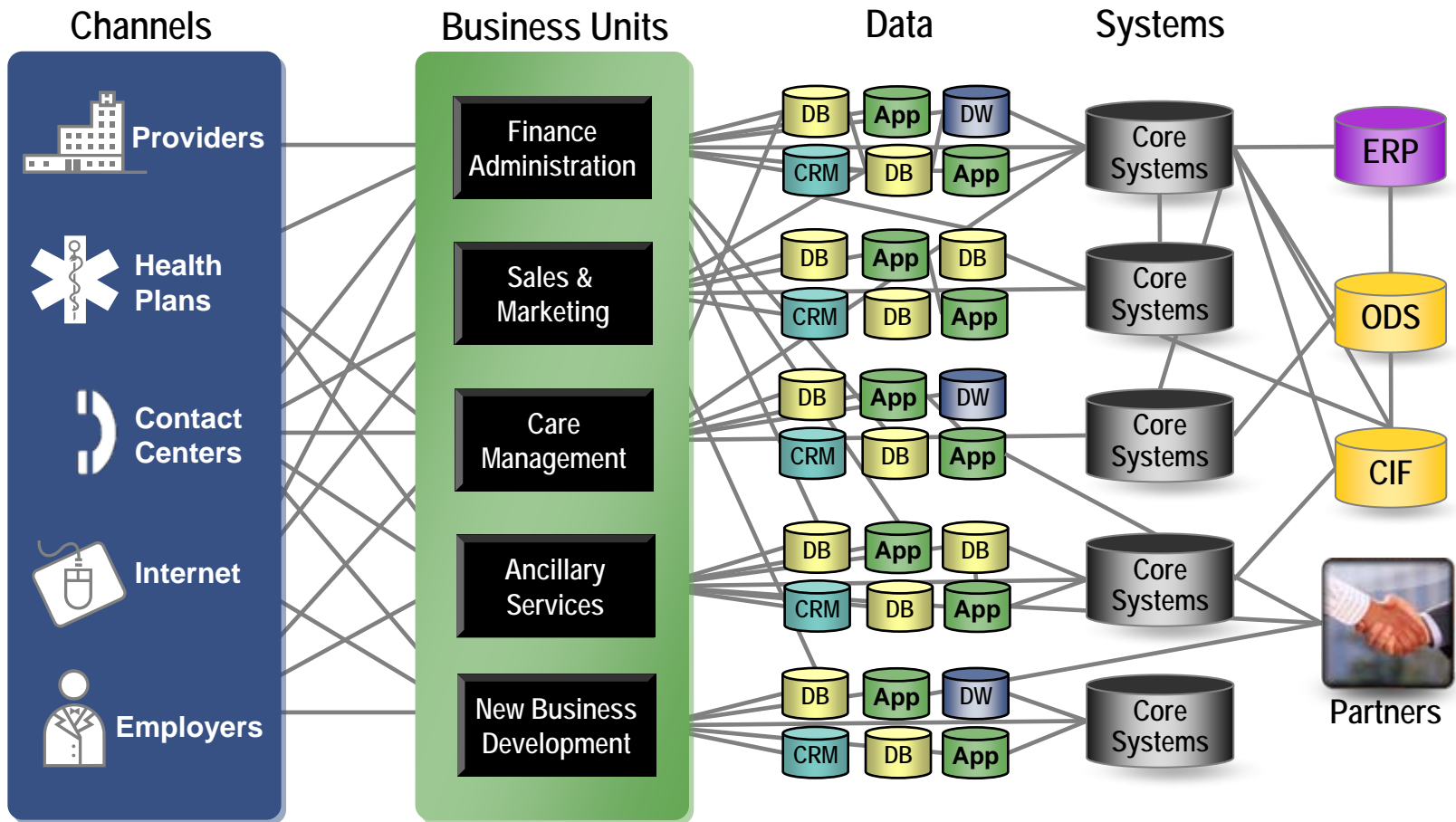
- Trends in Database Management Performance
- Monitoring with DB2 Instrumentation Data
  - DB2 trace records types
  - How to start trace data and collect them with minimal impact
  - How to interpret the records, system and application
- DB2 Monitoring - Top Down Approach
  - Important records, their content, and the reports
  - Top Down
    - Subsystem Level
    - Application Level
    - SQL Activity Level
    - Locking Activity Level
- Latest News from DB2 10 Trace Records

# Trends in Database/Performance Management

- **Data Volume growth** puts pressure on IT infrastructure, SLAs and performance
  - Average data growth per year is approximately 30%
  - Large critical application data growth rate is > 50%
- In the last 10 years the **number of objects** needing performance management has **increased**:
  - The number of objects that need management has increased **3X**
  - the number of objects per DBA has increased **4X**
- **Dynamic workloads** create **unpredictable performance**, increasing the complexity of performance tuning
- **Bad SQL** can impact performance creating major challenges if tuning is not done for applications
- Running **multiple databases** on a server has become the norm
- **90% of customers have more than one DBMS** → Resource/skill issues, consistent administration efforts, increased cost in administration, greater time to resolve issues impact SLAs

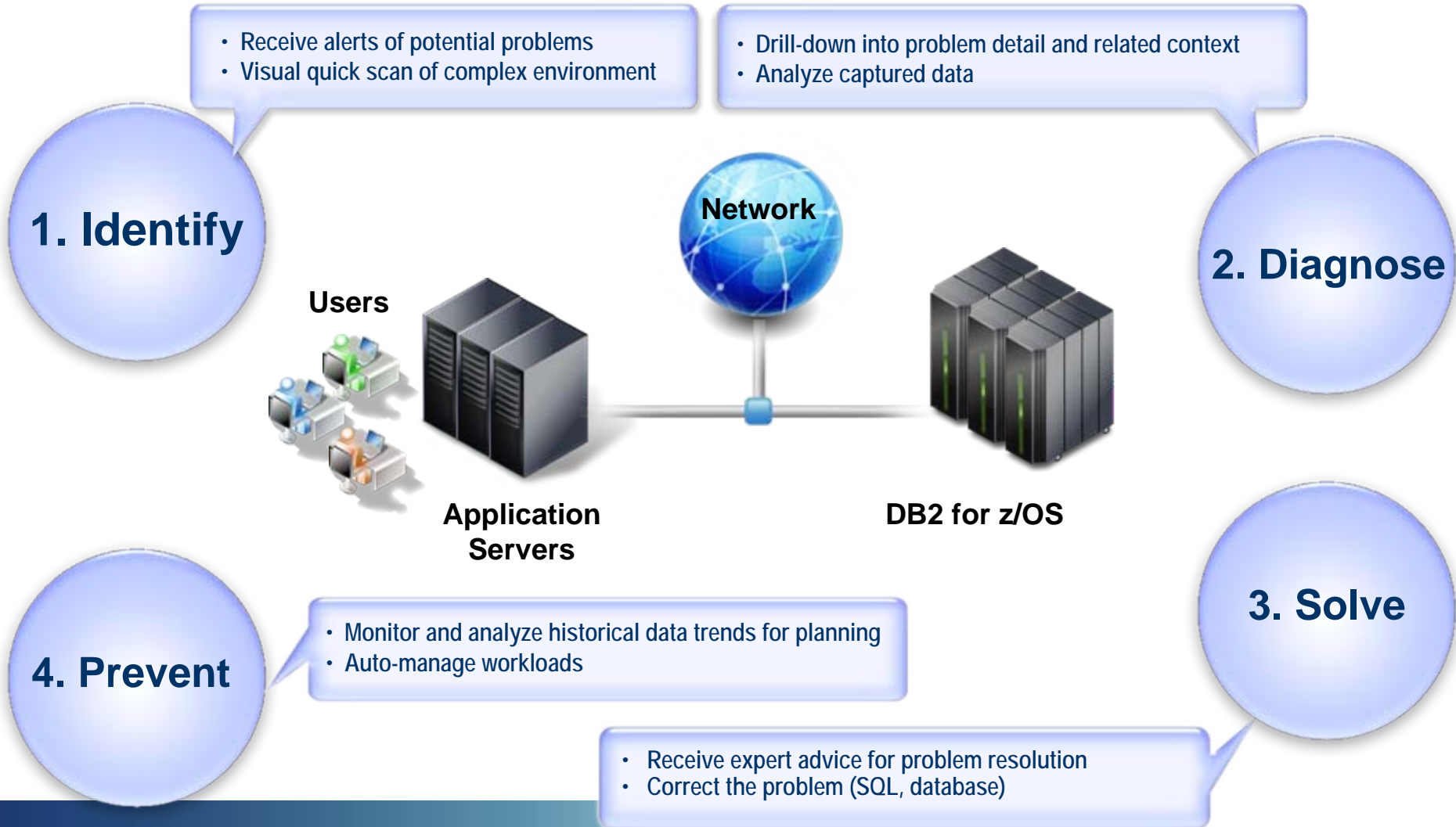
# Complexity of Enterprise Environments Continues to Grow

*Managing performance is a challenge*



# Identify, diagnose, solve and prevent performance problems

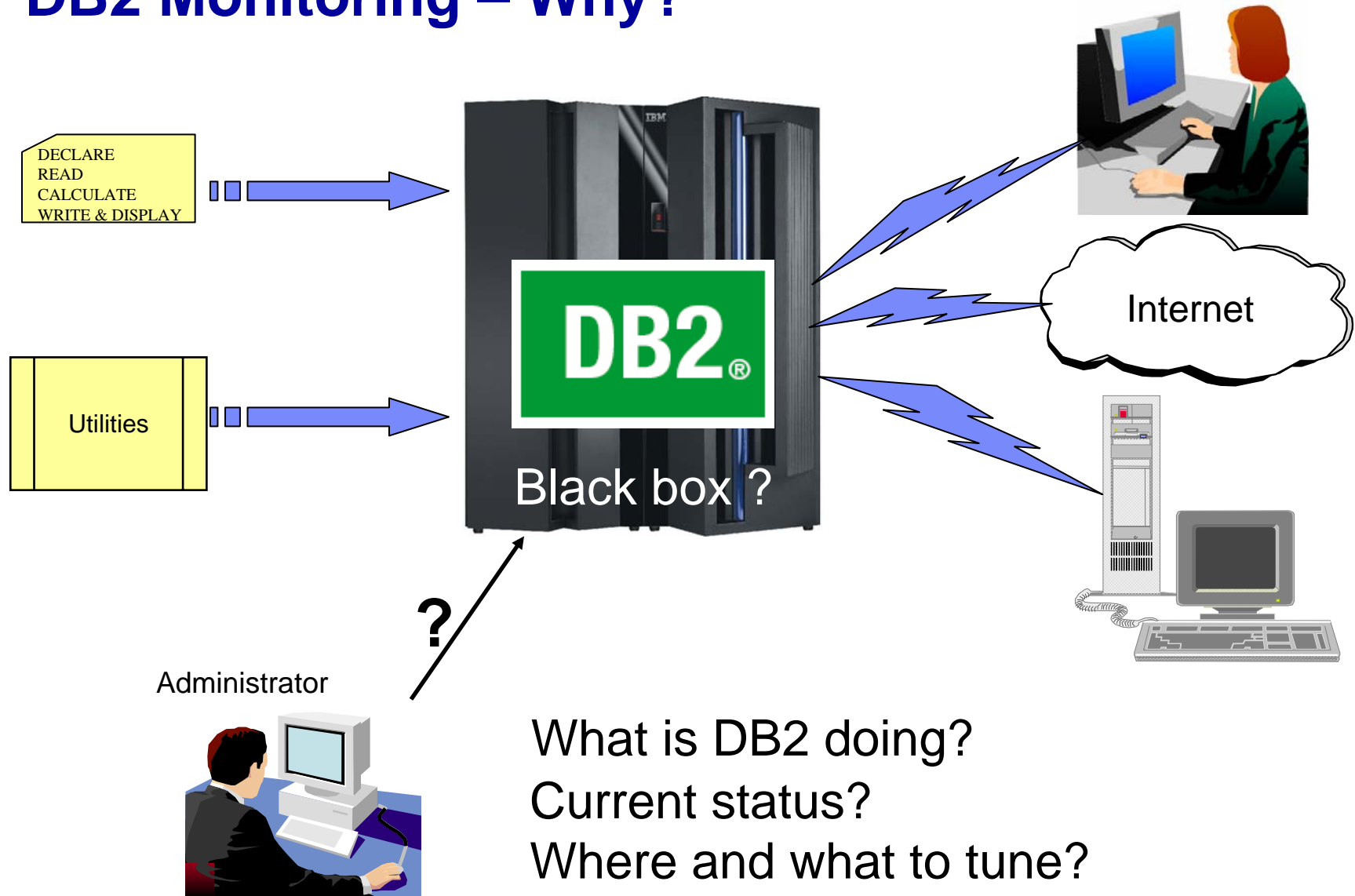
*The Need: To monitor and tune DB2 systems and applications to obtain optimal performance and lowest cost*



# MONITORING WITH DB2 INSTRUMENTATION DATA



# DB2 Monitoring – Why?





# For DB2 ... Someone has just reported a performance problem. Where do you start?

- **Could the problem be in DB2 itself?**
  - Did you run out of system resources?
- **Is the problem related to poorly coded SQL?**
  - Is the SQL static or dynamic?
  - What is the access path?
- **How about the network?**
- **When did the problem occur? Is this a one time occurrence, or has it happened before?**
- **Is the information stored in a history file somewhere?**
- **Do you have the knowledge, time, and expertise to do the analysis and determine the problem?**



# DB2 Tracing Facilities

- -STA TRACE ... results in the generation of trace records (IFCID's)
- Instrumentation Facility – software interface which organizes IFCID's and provides access
- IFCID's – represent internal events
  - Smallest tracing unit available in DB2
  - Used for problem determination
  - Written to
    - SMF
    - GTF
    - OP buffers
  - 2 types of calls
    - READA – detail IFCID's
    - READS – snapshot

# DB2's Instrumentation Facility Interface (IFI)

## ▪ Trace types

- Accounting – resource consumption by a thread
- Statistics – trend analysis / capacity planning
- Audit – security, access by user
- Performance – used to assist with performance benchmarks
- Monitor – trace information at the program or DBRM level; flow of events
- Global – debug DB2 (IBM)

## ▪ Class – consists of one or more IFCID's

- Quick way to turn on a lot of IFCID's at one time
- There exist multiple trace classes per trace type
  - Predefined trace records
  - Predefined processing (e.g. ACCTG CLASS(1,2,3,7,8))
  - User Trace Classes 30-32 – no predefined IFCIDs

## ▪ IFCID Records described in DSNxxx.SDSNIVPD(DSNWMSGs)

# DB2's Instrumentation Facility Interface (IFI)

Session A - [24 x 80]

File Edit View Communication Actions Window Help

Host: demomvs.demopkg.ibm. Port: 23 LU Name: Disconnect

Menu Utilities Compilers Help

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BROWSE DB2.V10.SDSNIVPD (DSNWMSG5) Line 00023516 Col 001 080  
 Command ==> Scroll ==> CSR

	CLASS	IFCID	COMMENTS
1 GLOBAL	01	00106	IBM SERVICE
1 GLOBAL	01	00132	IBM SERVICE
1 GLOBAL	01	00134	IBM SERVICE
1 GLOBAL	01	00138	IBM SERVICE
1 GLOBAL	02	00106	IBM SERVICE
1 GLOBAL	02	00131	IBM SERVICE
1 GLOBAL	02	00133	IBM SERVICE
1 GLOBAL	02	00139	IBM SERVICE
1 GLOBAL	03	00000	IBM SERVICE
1 GLOBAL	03	00038	IBM SERVICE
1 GLOBAL	03	00046	IBM SERVICE
1 GLOBAL	03	00047	IBM SERVICE
1 GLOBAL	03	00048	IBM SERVICE
1 GLOBAL	03	00049	IBM SERVICE
1 GLOBAL	03	00050	IBM SERVICE
1 GLOBAL	03	00051	IBM SERVICE
1 GLOBAL	03	00052	IBM SERVICE
1 GLOBAL	03	00056	IBM SERVICE
1 GLOBAL	03	00057	IBM SERVICE

04/015

Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00048 and port 23

start 5:57:56 Mail - Inbo... IBM Lotus ... Session A ... 3 Windo... Morelli DB... Microsoft ... 3 - zIM En... 100% 3:28 PM Friday

# DB2's Instrumentation Facility Interface (IFI)

Session A - [24 x 80]

File Edit View Communication Actions Window Help

Host: demomvs.demopkg.ibm. Port: 23 LU Name: Disconnect

Menu Utilities Compilers Help

---

BROWSE DB2.V10.SDSNIVPD (DSNWMSG5) Line 00023594 Col 001 080  
 Command ==> Scroll ==> CSR

1	STATISTICS	01	00001	SYSTEM SERVICES
1	STATISTICS	01	00002	DATABASE SERVICES
1	STATISTICS	01	00105	INTERNAL DBID OBID TO DB/TS
1	STATISTICS	01	00106	SYSTEM PARAMETERS IN EFFECT
1	STATISTICS	01	00202	BUFFER POOL ATTRIBUTES
1	STATISTICS	02	00152	USER-DEFINED STATISTICS TRACE
1	STATISTICS	03	00172	UNITS OF WORK INVOLVED IN DEADLOCK
1	STATISTICS	03	00196	LOCK TIMEOUT DETAILS
1	STATISTICS	03	00250	CONNECT/DISCONNECT FROM GBP
1	STATISTICS	03	00258	DATA SET EXTEND INFORMATION
1	STATISTICS	03	00330	ACTIVE LOG SHORTAGE
1	STATISTICS	03	00335	STALLED SYSTEM EVENT NOTIFICATION
1	STATISTICS	03	00337	LOCK ESCALATION
1	STATISTICS	04	00173	DYNAMIC SQL EXCEEDING ASUTIME
1	STATISTICS	04	00191	DATA CAPTURE FOR DDIS ERRORS
1	STATISTICS	04	00192	DDM LEVEL 6A HEADER ERRORS
1	STATISTICS	04	00193	UOW DISPOSITION/SQLCODE MISMATCH
1	STATISTICS	04	00194	INVALID SNA FMH-5 RECEIVED
1	STATISTICS	04	00195	FIRST FAILURE DATA CAPTURE FOR DRDS
1	STATISTICS	04	00203	HEURISTIC DECISION OCCURRED

05/015

Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00048 and port 23

start 5:58:56 Mail - Inbo... IBM Lotus ... Session A ... 3 Windo... Morelli DB... Microsoft ... 3 - zIM En... 100% 3:29 PM Friday

# DB2's Instrumentation Facility Interface (IFI)

TYPE	CLASS	DATA COLLECTED	IFCIDS ACTIVATED
STATISTICS	1	STATISTICAL DATA	1-2,105,106,202
	2	INSTALLATION-DEFINED STATISTICS RECORD	152
	3	DEADLOCK AND LOCK TIMEOUT INFORMATION, CONNECT OR DISCONNECT FROM A GROUP BUFFER POOL, LONG-RUNNING URS	172,196,250,261,262,313,258,335,337
	4	DB2 EXCEPTION CONDITIONS	173,191,192,193,194,195,203,204,205,206, 207,208,209,210,235,236,(238),267,268
	5	DATA SHARING GLOBAL STATISTICS	230,254
	6	DBM1 STORAGE SUMMARY	225
	8	BUFFER POOL DATA SET STATISTICS	199
	ACCOUNTING	1	ACCOUNTING DATA
2		IN DB2 TIME	232
3		WAIT TIME FOR I/O,LOCKS, LATCHES, DRAINS, AND CLAIMS	6-7,8-9,32-33,44-45,(51-52,56-57), 117-118,127-128,170,171,174-175, 213-214,215-216,226-227,242-243,329
4		INSTALLATION-DEFINED ACCOUNTING RECORD	151
5		TIME SPENT PROCESSING IFI REQUESTS	187
7		PACKAGE LEVEL ACCOUNTING IN-DB2 TIME	232,240
8		PACKAGE LEVEL ACCOUNTING WAIT TIME IN DB2	6-7,8-9,32-33,44-45,(51-52,56-57), 117-118,127-128,170,171,174-175, 213-214,215-216,226-227,241,242-243
MONITOR		1	ACTIVATES THE READS IFCIDS
	2	TIME IN DB2 (CPU AND ELAPSED)	254,306
	3	WAIT TIME IN DB2 FOR I/O, LOCKS, LATCHES, DRAINS AND CLAIMS. IT ALSO INCLUDES RESOURCE USAGE INFORMATION.	same as Accounting Class 3
	4	INSTALLATION-DEFINED MONITOR RECORD	155
	5	TIME SPENT PROCESSING IFI REQUESTS	same as Accounting Class 5
	6	DATA CAPTURE DATA	185
	7	PACKAGE LEVEL ACCOUNTING IN-DB2 TIME	same as Accounting Class 7
	8	PACKAGE LEVEL ACCOUNTING WAIT TIME IN DB2	same as Accounting Class 8
		STATEMENT LEVEL	124

# DB2's Instrumentation Facility Interface (IFI)

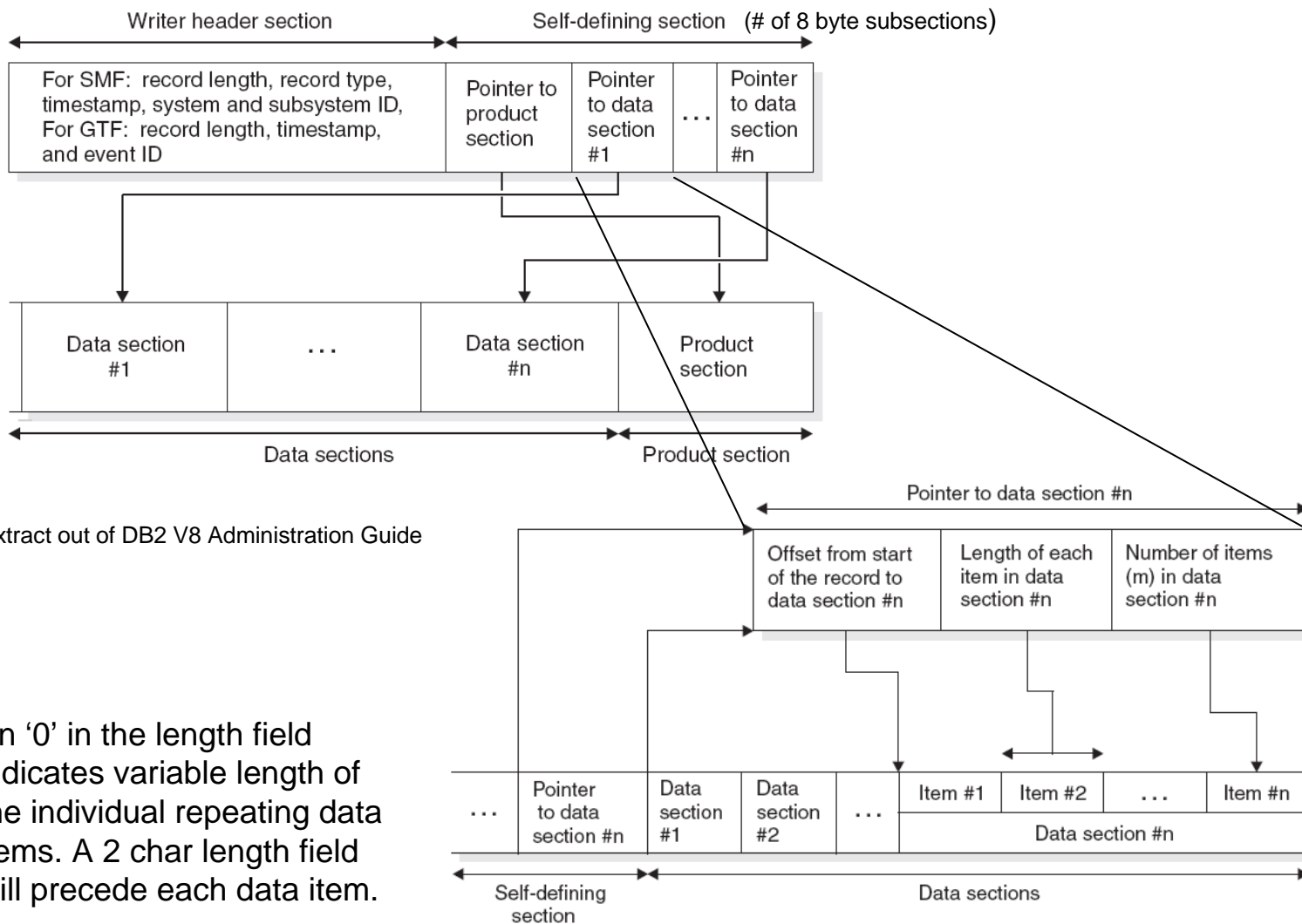
TYPE	CLASS	DATA COLLECTED	IFCIDS ACTIVATED
AUDIT	1	AUTHORIZATION FAILURES	140
	2	EXPLICIT GRANT AND REVOKE	141
	3	CREATE, DROP, AND ALTER OPERATIONS AGAINST AGAINST AUDIT TABLES	142
	4	FIRST CHANGE OF AUDITED OBJECT	143
	5	FIRST READ OF AUDITED OBJECT	144
	6	SQL STATEMENT AT BIND	145
	7	CHANGE IN AUTHORIZATION FOR AUDITED OBJECT	55,83,87,169,319
	8	UTILITY ACCESS TO ANY OBJECT	23,24,25,219,220
	9	INSTALLATION-DEFINED AUDIT RECORD	146
PERFORMANCE	1	BACKGROUND EVENTS	1-2,31,42-43,76-77,78-79,102,103,105, 106,107,153,
	2	SUBSYSTEM RELATED EVENTS	3,68-69,70-71,72-73,74-75,80-81, 82-83,84-85,86-87,88-89,106,174-175, 321,322
	3	SQL-RELATED EVENTS	22,53,55,58,59,60,61,62,63,64,65,66, 92,95-96,97,106,112,173,177,233,237, 272,311,324
	4	BUFFER MANAGER I/O AND EDM POOL REQUESTS	6-7,8-9-10,29-30,105,106,107,127-128, 226-227
	5	LOG MANAGER	32-33,34-35,36-37,38-39,40-41,104,106 114-115-116,117-118,119-120,(228-229)
	6	SUMMARY LOCK INFORMATION	20,44-45,105,106,107,172,196,213-214, 218,337
	7	DETAILED LOCK INFORMATION	21,105,106,107,223
	8	DATA MANAGER DETAIL	13-14,15-16-17-18,105,106,107,125, 221,222,231,305,311
	9	SORT DETAIL	26,27,28,95-96, 106

# DB2's Instrumentation Facility Interface (IFI)

TYPE	CLASS	DATA COLLECTED	IFCIDS ACTIVATED
-----		-----	-----
	10	BIND, COMMANDS, AND UTILITIES	23-24-25,90,91,105,106,107,108-109, 110-111,201,219,220,256
	11	DISPATCHING	(46,47-48,49-50,51-52,56-57,93-94), 106,113
	12	STORAGE MANAGER	(98-99,100-101), 106
	13	EDIT AND VALIDATION EXITS	11,12,19,105,106,107
	14	IN AND OUT OF DB2	67,106,121-122
	15	INSTALLATION-DEFINED PERFORMANCE RECORD	154
	16	EVENTS ASSOCIATED WITH QUERIES TO OR FROM OTHER LOCATIONS	157,158,159,160-161,162-163,167,183
	17	DRAIN AND CLAIM DETAIL	211,212,213-214,215-216
	20	DATA SHARING SUMMARY	249,250,251,256,257,261,262,267-268
	21	DATA SHARING DETAIL	255,259,263,329
	22	AUTHORIZATION EXIT INFORMATION	314
GLOBAL	1	IBM SERVICE	106,(132,134,138)
	2	IBM SERVICE	106,(131,133,139)
	3	IBM SERVICE	0,38,46,47,48,49,50,51,52,56, 57,68,69,70,71,72,73,74, 75,76,77,80,81,82,83,84, 85,86,87,88,89,93,94,106,114, 115,116,117,174,175,(228-229), (252,260),(265-266),267-268
	4	IBM SERVICE	106,(130)
	5	IBM SERVICE (OVERFLOW HYBRID JOIN, HOST VARIABLE TRACING, DBD INVALIDATION)	190,(135,136,137),(247-248),249
	6	USER DEFINED SERVICEABILITY TRACE	156
	7	IBM SERVICE (DISTRIBUTED DATA)	164,165,166
	8	IBM SERVICE (DISTRIBUTED SQL)	168
	9	IBM SERVICE (DB2 PRIVATE PROTOCOL AND DRDA PROTOCOL)	180,181,182



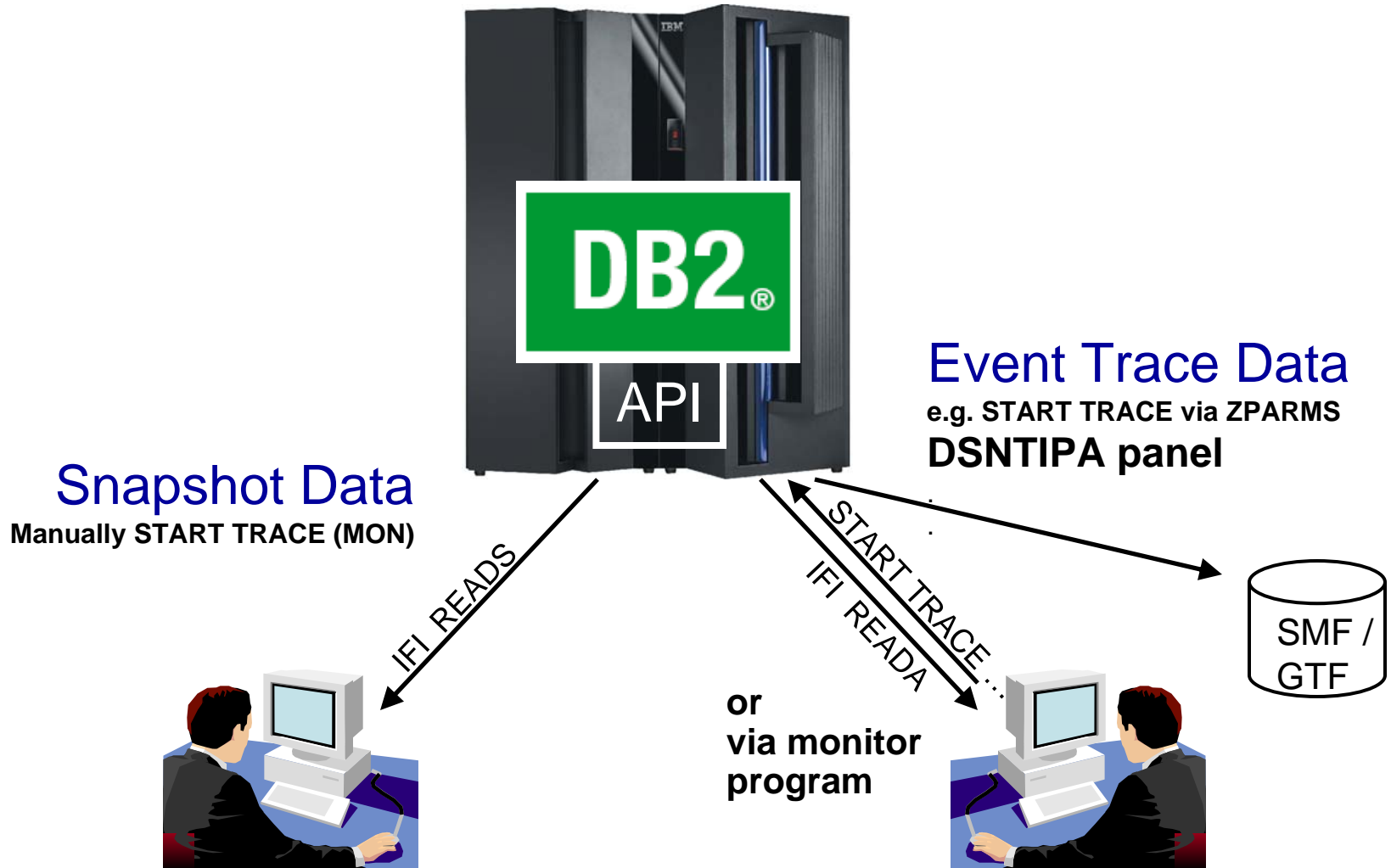
# How to interpret the records, system and application



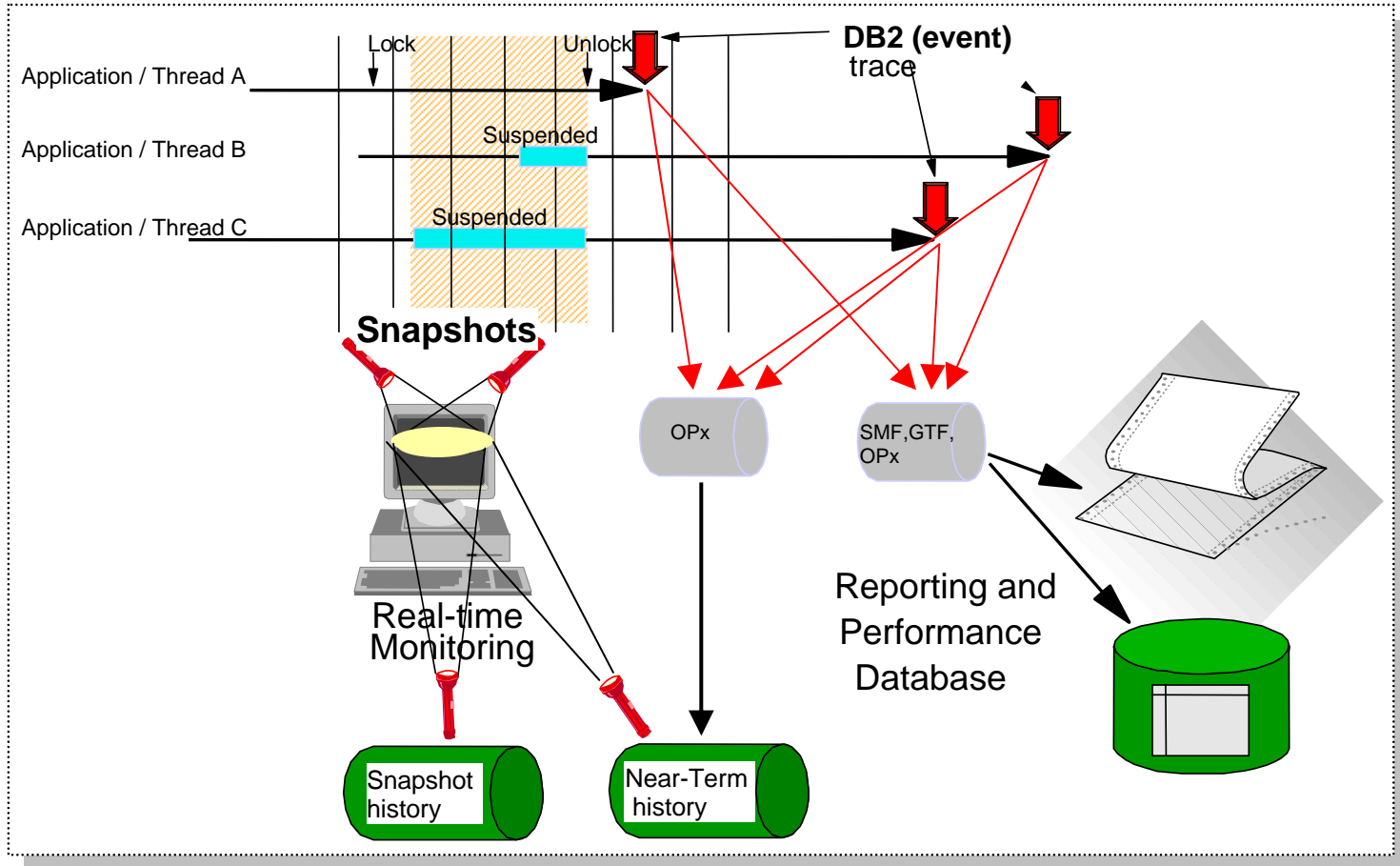
Extract out of DB2 V8 Administration Guide

An '0' in the length field indicates variable length of the individual repeating data items. A 2 char length field will precede each data item.

# Start trace collection

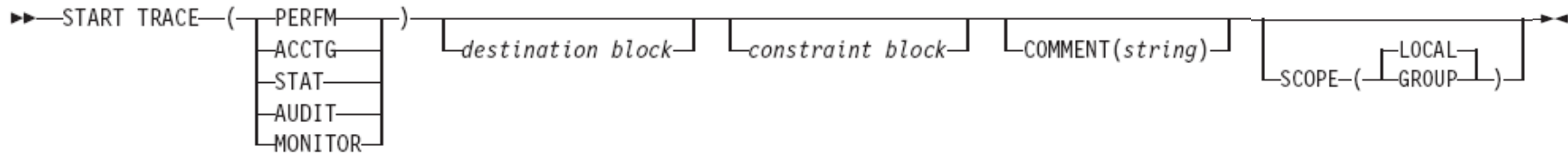


# DB2 Trace records – Trace Types



# Start trace collection

## ▪ START TRACE command



## ▪ Destinations

- SMF - Daily monitoring (Default for STAT, ACCTG, AUDIT)
- GTF - High volume (Default for PEFORM)
- OPx/n - Online monitoring (requires a monitor program to read OP-buffer with READA – Default for MONITOR )

## ▪ Constraint block / qualifications

- CLASS – set of IFCID's
- AUTHID
- PLAN
- LOCATION
- IFCID

## ▪ Headers (TDATA)

- CORrelation header
- CPU header
- DIStributed header
- TRAcE

# Start trace collection destinations

- SMF (System Management Facility)
  - DB2 trace records comes with SMF header
  - SMF 100 = Statistics data
  - SMF 101 = Accounting Data
  - SMF 102 = all other DB2 trace data
- GTF (General Trace Facility)
  - DB2 trace record comes with GTF header
  - Recommended for high volume DB2 traces
- OPx/n DB2 buffer
  - Need to be read (READA) and emptied by monitor program
  - Monitor program posted by DB2 if OP buffer fills up
  - Possible trace data lost if not read fast enough => DB2 doesn't wait and continues to process. Overflow and trace data lost is indicated to the monitor program in the IFCA (communication area)

# Start Trace collection and more ...

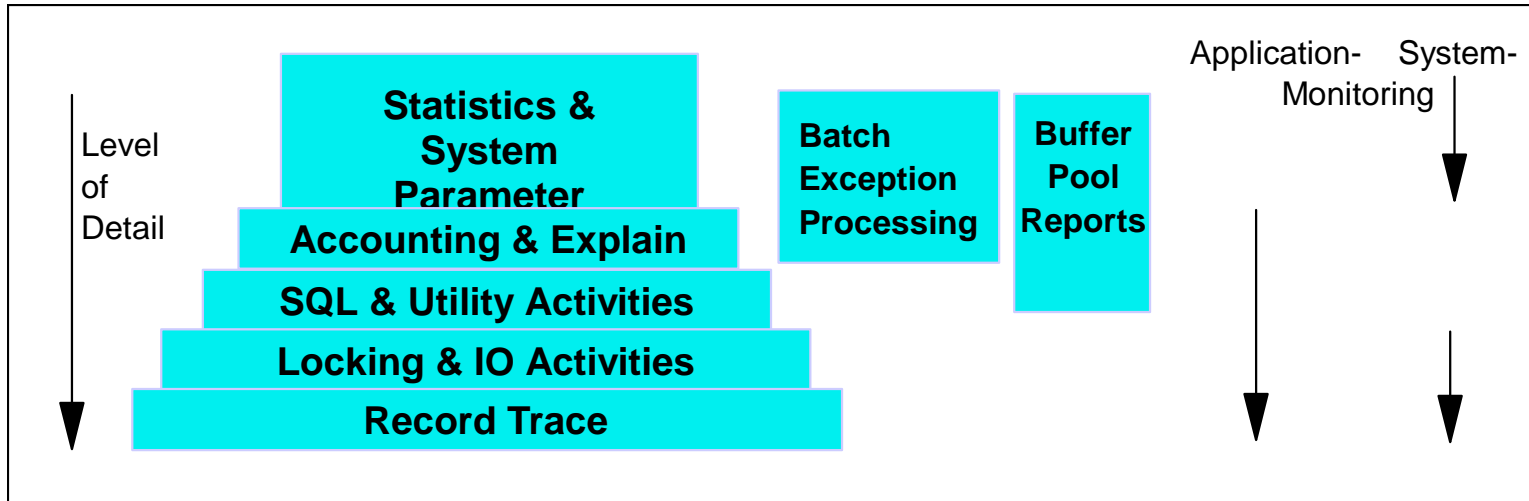
- How to start, modify, stop traces
  - START TRACE(A) CLASS(1,2,3) PLAN(CUST01) DEST(SMF)
  - MODIFY TRACE(A) CLASS(1,2,3,7,8) TNO(5)
  - STOP TRACE(A) TNO(5)
  
- Overhead
  - Accounting Class 1,3 plus Statistics Class 1,2,3,4: ~ 2-5 %
  - Audit: typically < 5 %
  - Performance: ~ 20- 100 %  
(Performance trace class 1-3: 5-30%)
  - Global: up to 100 %
  - Switch off all traces you don't need
  
- Recommended traces to start
  - Accounting Class 1, (2), 3, (7), (8)
  - Statistic Class 1, 3, (4), (5)

## DB2 Trace records – Monitoring – types/level

- Types of monitoring
  - Continuous / Periodic / Exception
  - Detailed with raw data / Summary per interval
  - **Batch : Reports based on traces**
  - Online : Real-time/snapshot via 3270 or GUI
  
- DB2 analysis and tuning
  - **Drill down approach**
  - System level (Statistics) tuning
  - Thread level (Accounting) tuning
  - Top processing (Heavy Hitter Analysis)
  - SQL tuning



# Reports



- Statistic Trace Information
- Accounting Trace Information
- Subsystem Parameters
- Locking
- SQL Activity
- I/O Activity
- Utility
- Audit
- Record Trace
- Explain

# Important records and their content

Level of detail (drill down hierarchy)

- Subsystem level

Statistics about subsystem resources and activities

IFCID 1 (System services), 2 (Database services), 199 (dataset statistics), 225 (DBM1 virtual storage summary), 230 (data sharing global statistics) / ZPARMS: 106,202,230 / plus other events 172, 196, 258, 313 ,330, 337

- Application level

Thread/plan/package/stored procedure executions

IFCID 3, 239 plus 148, 150

- SQL level

Single SQL start and end event: IFCID 59,60,61,64, 65, 66 (start), 58(end),63,22, (247 host variables)

plus as part of MON-trace class 1: 124,316,317,318

- I/O and lock level

Each single trace record....

# Is the problem really DB2?

- Compare total task elapse time vs Accounting Class 1 elapse time
  - Class 1 elapse – First SQL Call until Thread Termination

## **IF there is a large difference consider:**

- ✓ Application Design and Logic
- ✓ Inefficient application initialization
- ✓ Enqueue prior to DB2 thread creation
- ✓ Poor CICS or IMS scheduling performance

## Again ask - Is the problem really DB2?

- Compare Accounting Class 1 Elapse time to Accounting Class 2 in DB2 Time
  - Class 1 Elapse – First SQL call until thread termination
  - Class 2 in DB2 – Time a task spent inside DB2

### **IF there is a large difference consider:**

- ✓ Application Design and Logic
- ✓ Inefficient application code outside of DB2
- ✓ Enqueue resources outside of DB2 (HSM, Media Manager ...)
- ✓ Poor CICS or IMS performance
- ✓ Non-DB2 processing of rows retrieved
- ✓ Application and end-user think time
- ✓ Thread wait for reuse time



Look  
outside of  
DB2

# SUBSYSTEM LEVEL



# Important records and their content (1)

- IFCID 1 (statistics interval and real-time) - System Services
  - Address space data (TCB and SRB times?)
  - Instrumentation (destination) data (how many records written to which destination?)
  - Subsystem services data (sign-on, create/terminate thread, commit, rollback, etc.)
  - Command data (DB2 command executed)
  - Agent services data (IFI)
  - Log manager data (write, read, wait, active/archive log)
  - Distributed data facility + statistics (sent/received data)

STATISTICS SET REPORT – statistics captured from the time DB2 starts until it is stopped; logged at intervals

Systems related functions – DB2 Master

## Important records and their content (2)

- IFCID 2 (statistics interval and real-time) – Data Base Services
  - SQL Statement data (# of ... SQL statements)
  - Service controller data (bind data)
  - Buffer manager data (read, write and other BP data)
  - Data manager data (RID list and pool data)
  - Lock manager and RLF data (locks/latches, deadlocks, timeouts, escalation)
  - EDM pool data (EDM pool sections and usage)
  - Group buffer pool data (read, write and other GBP data)
  - Global locking data (L-locks and P-locks, XES)
  - Star join pool statistics (virtual memory used for start join)

Database related functions – DB2 Database Manager

Accumulated stats – Total # SELECT statements

Snapshot values - # open data sets at a point in time

Max or High water marks – Max # open data sets at any one time



## Important records and their content (225)

- IFCID 225 (Summary of storage manager pool) – Virtual Storage Summary
  - V7 DBM1 below 2GB bar (31 bit)
  - V8 below and above 2 GB storage (64 bit)
  - Fixed storage
    - Virtual pool, EDM, ...
  - Variable storage
    - Thread storage, local cache storage, RID, ...
  - Real storage

Storage usage details

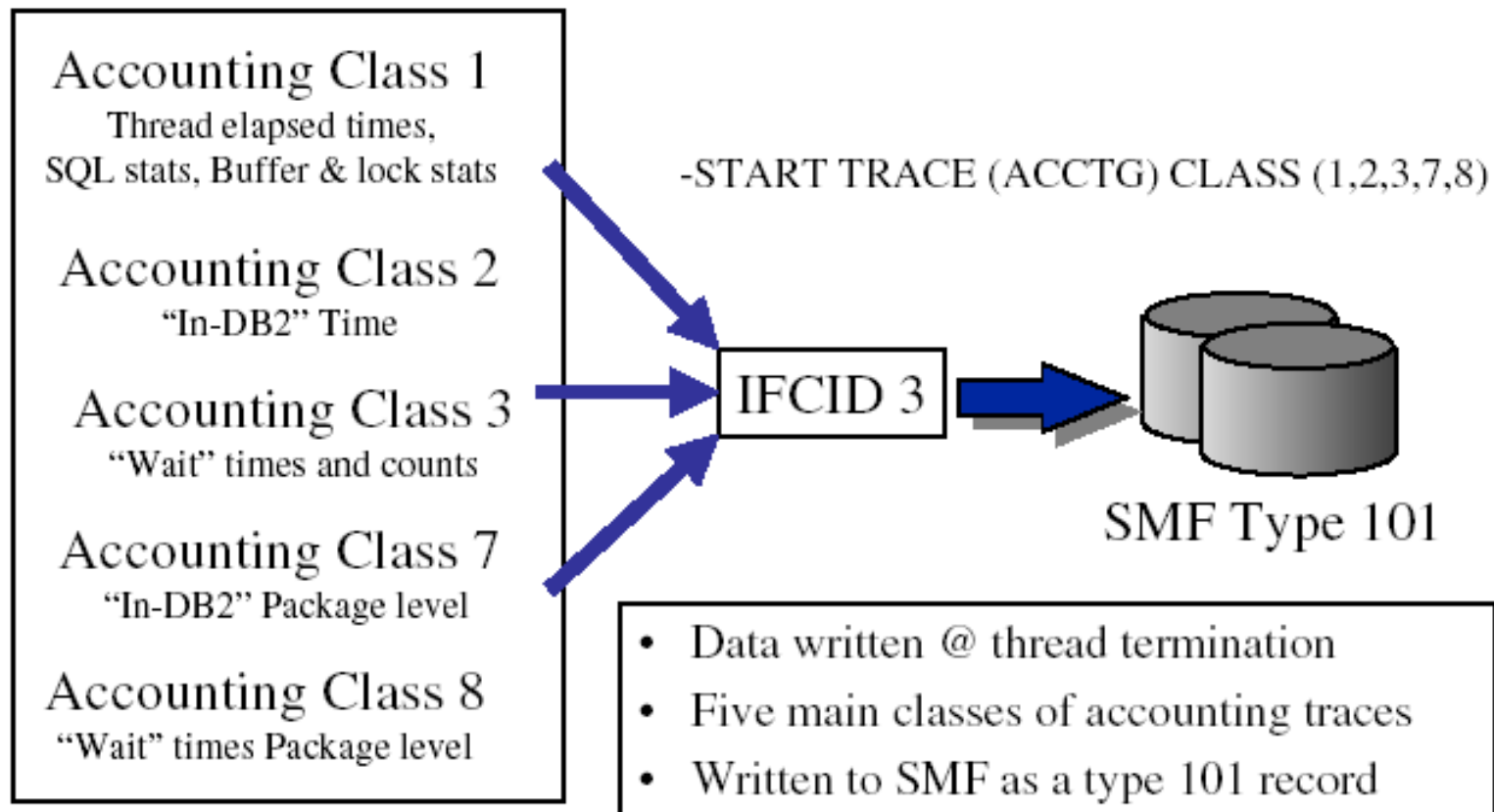


# APPLICATION LEVEL



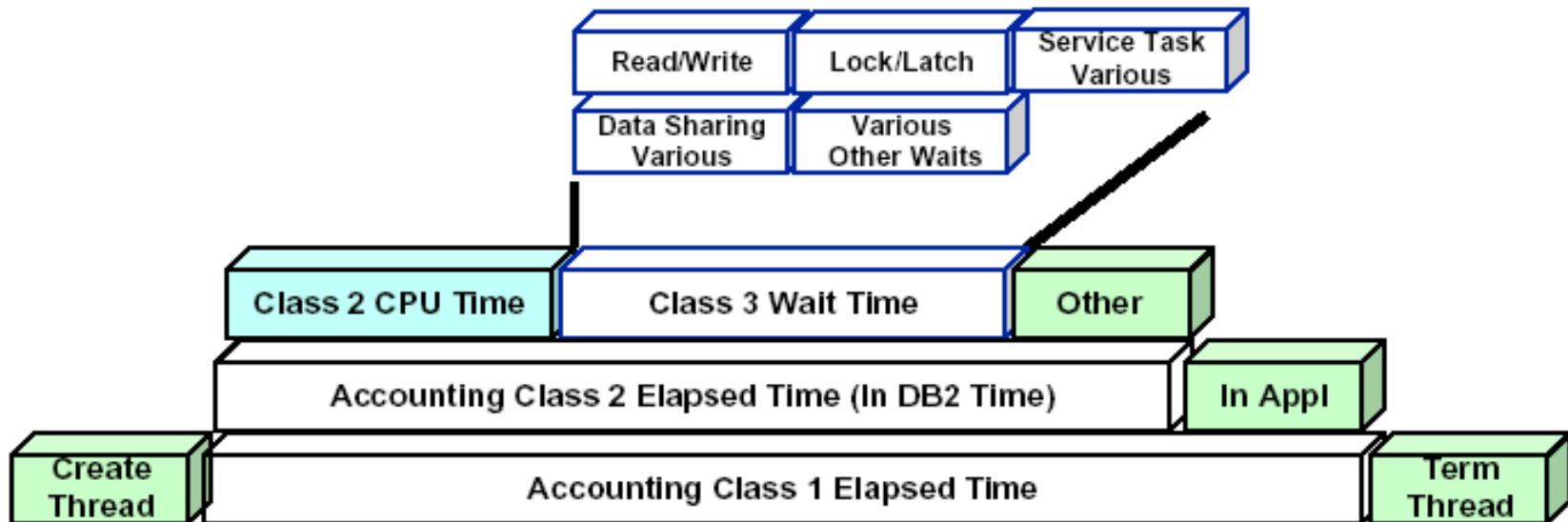
# Application Tuning – Top Down Approach

## Accounting Traces



# Application Tuning – Top Down Approach

## DB2 Accounting Traces General Usage



- Accounting traces provide a wealth of information at the application level
  - Elapsed time, CPU time, and wait time for DB2 applications
  - Wait counts and times (I/O, locks, latches, etc)
  - Scan information, Buffer information, SQL counts
- Use application trace data to determine application time line

# Important records and their content (3,239)

- IFCID 3 and 239
- Accounting data, written at end of thread
  - Class 1,2,3 times, identifications, # of SQL, BP and GBP usage, # of locks, DDF activities, nested activities, and ...
  - Package data
    - Class 7,8 times, # of SQL, BP usage
    - V7 first 10 in IFCID 3, 239 is overflow
    - V8 all package data in 239, none in 3
  - V8 accounting roll-up for DDF and RRSAF threads possible controlled by ACCUMACC and ACCUMUID
  - Inactive threads, thread reuse
  - Parallel threads separated or rolled-up into one IFCID 3 controlled by PTASKROL

# Accounting Report sample

LOCATION: DP3G	OMEGAMON XE FOR DB2 PERFORMANCE EXPERT (V3)	PAGE: 1-8
GROUP: DSNDP3G	ACCOUNTING REPORT - LONG	REQUESTED FROM: NOT SPECIFIED
		TO: NOT SPECIFIED
	ORDER: PLANNAME	INTERVAL FROM: 10/18/05 09:10:00.00
DB2 VERSION: V7	SCOPE: GROUP	TO: 10/18/05 11:35:00.00
PLANNAME: WFMUPRD	MEMBER: DP33	

ELAPSED TIME DISTRIBUTION				CLASS 2 TIME DISTRIBUTION			
APPL	!	=====	> 100%	CPU	!	=====	> 57%
DB2	!			NOTACC	!=>	2%	
SUSP	!			SUSP	!	=====	> 41%

AVERAGE	APPL(CL.1)	DB2 (CL.2)	IFI (CL.5)	CLASS 3 SUSPENSIONS	AVERAGE TIME	AV.EVENT	HIGHLIGHTS
ELAPSED TIME	5:23.85278	0.313100	N/P	LOCK/LATCH(DB2+IRLM)	0.004982	29.90	#OCCURRENCES : 476
NONNESTED	5:23.85278	0.313100	N/A	SYNCHRON. I/O	0.123539	197.03	#ALLIEDS : 476
STORED PROC	0.000000	0.000000	N/A	DATABASE I/O	0.123537	197.02	#ALLIEDS DISTRIB: 0
UDF	0.000000	0.000000	N/A	LOG WRITE I/O	0.000002	0.00	#DBATS : 0
TRIGGER	0.000000	0.000000	N/A	OTHER READ I/O	0.000000	0.00	#DBATS DISTRIB. : 0
				OTHER WRTE I/O	0.000000	0.00	#NO PROGRAM DATA: 0
CPU TIME	0.202512	0.177033	N/P	SER.TASK SWTCH	0.000023	0.00	#NORMAL TERMINAT: 476
AGENT	0.202512	0.177033	N/A	UPDATE COMMIT	0.000003	0.00	#ABNORMAL TERMIN: 0
NONNESTED	0.202512	0.177033	N/P	OPEN/CLOSE	0.000000	0.00	#CP/X PARALLEL. : 0
STORED PROC	0.000000	0.000000	N/A	SYSLGRNG REC	0.000020	0.00	#IO PARALLELISM : 0
UDF	0.000000	0.000000	N/A	EXT/DEL/DEF	0.000000	0.00	#INCREMENT. BIND: 0
TRIGGER	0.000000	0.000000	N/A	OTHER SERVICE	0.000000	0.00	#COMMITTS : 48664
PAR.TASKS	0.000000	0.000000	N/A	ARC.LOG(QUIES)	0.000000	0.00	#ROLLBACKS : 0
				ARC.LOG READ	0.000000	0.00	#SVPT REQUESTS : 0
SUSPEND TIME	0.000000	0.128554	N/A	DRAIN LOCK	0.000000	0.00	#SVPT RELEASE : 0
AGENT	N/A	0.128554	N/A	CLAIM RELEASE	0.000000	0.00	#SVPT ROLLBACK : 0
PAR.TASKS	N/A	0.000000	N/A	PAGE LATCH	0.000000	0.00	MAX SQL CASC LVL: 0
STORED PROC	0.000000	N/A	N/A	NOTIFY MSGS	0.000000	0.00	UPDATE/COMMIT : 0.01
UDF	0.000000	N/A	N/A	GLOBAL CONTENTION	0.000009	0.01	SYNCH I/O AVG. : 0.000627
				COMMIT PHI WRITE I/O	0.000000	0.00	
NOT ACCOUNT.	N/A	0.007513	N/A	ASYNCH CF REQUESTS	0.000000	0.00	
DB2 ENT/EXIT	N/A	1438.43	N/A	TOTAL CLASS 3	0.128554	226.93	
EN/EX-STPROC	N/A	0.00	N/A				
EN/EX-UDF	N/A	0.00	N/A				
DCAPT.DESCR.	N/A	N/A	N/P				
LOG EXTRACT.	N/A	N/A	N/P				



# Accounting Report sample

```

-----
| PROGRAM NAME                CLASS 7 CONSUMERS
| FIJDCAIB                    => 3%
| FIMDCHR
| FIMDEXR
| FIMDIRQ
| FIMDLIST                    =====> 6%
| FIMDMRPB                    =====> 53%
| FIMDMTO1                    => 2%
| FIMDMTO2
| FIMDMTO3                    => 2%
| FIMDMTO4                    =====> 11%
| FIMDPH0
| FIMDPH1                    =====> 22%
| FIMDREP
-----
    
```



FIMDMRPB	VALUE	FIMDMRPB	TIMES	FIMDMRPB	AVERAGE TIME	AVG.EV	TIME/EVENT
-----	-----	-----	-----	-----	-----	-----	-----
TYPE	PACKAGE	ELAP-CL7 TIME-AVG	6.680010	LOCK/LATCH	0.003073	46.50	0.000066
		CPU TIME	1.227790	SYNCHRONOUS I/O	3.218596	554.00	0.005810
LOCATION	SYSDSN8	AGENT	1.227790	OTHER READ I/O	1.379313	136.50	0.010105
COLLECTION ID	FIJ1	PAR.TASKS	0.000000	OTHER WRITE I/O	0.451942	17.00	0.026585
PROGRAM NAME	FIMDMRPB	SUSPENSION-CL8	5.380605	SERV.TASK SWITCH	0.327681	13.50	0.024273
		AGENT	5.380605	ARCH.LOG(QUIESCE)	0.000000	0.00	N/C
OCCURRENCES	2	PAR.TASKS	0.000000	ARCHIVE LOG READ	0.000000	0.00	N/C
SQL STMT - AVERAGE	10975.00	NOT ACCOUNTED	0.071615	STORED PROC SCHED	0.000000	0.00	N/C
SQL STMT - TOTAL	21950	AVG.DB2 ENTRY/EXIT	21978.00	UDF SCHEDULE	0.000000	0.00	N/C
STOR PROC EXECUTED	0	DB2 ENTRY/EXIT	43956	DRAIN LOCK	0.000000	0.00	N/C
UDF EXECUTED	0			CLAIM RELEASE	0.000000	0.00	N/C
USED BY STOR PROC	0	CPU SERVICE UNITS	5513.00	PAGE LATCH	0.000000	0.00	N/C
USED BY UDF	0	AGENT	5513.00	NOTIFY MESSAGES	0.000000	0.00	N/C
USED BY TRIGGER	0	PAR.TASKS	0.00	GLOBAL CONTENTION	0.000000	0.00	N/C
SUCC AUTH CHECK	0			TOTAL CL8 SUSPENS.	5.380605	767.50	0.007011

# Accounting Trace sample – Summary resource

LOCATION: SYSDSN7		DB2 PERFORMANCE MONITOR (V8)						PAGE: 1-1					
GROUP: DSN7		ACCOUNTING TRACE - SHORT						REQUESTED FROM: NOT SPECIFIED					
MEMBER: SG71								TO: NOT SPECIFIED					
SUBSYSTEM: SG71								ACTUAL FROM: 04/24/05 08:21:22.85					
DB2 VERSION: V8								PAGE DATE: 04/24/05					
PRIMAUTH	CORRNAME	CONNECT	ACCT	TIMESTAMP	COMMITTS	OPENS	UPDATES	INSERTS	EL. TIME(CL1)	EL. TIME(CL2)	GETPAGES	SYN.READ	LOCK SUS
PLANNAME	CORRNMBR	THR.TYPE	TERM.	CONDITION	SELECTS	FETCHES	DELETES	PREPARE	CPU TIME(CL1)	CPU TIME(CL2)	BUF.UPDT	TOT.PREF	LOCKOUTS
JEN	JENJBMRM	BATCH	08:21:22.855435		17	2429	322	2104	18.854923	12.994234	42692	1057	10
FIJ1BAT	'BLANK'	ALLIED	NORM DEALLOC		3505	6288	233	0	3.657565	2.598451	17997	351	0
-----													
PROGRAM NAME            TYPE            SQLSTMT    CL7 ELAP.TIME    CL7 CPU TIME    CL8 SUSP.TIME    CL8 SUSP													
FIMDPH0                PACKAGE            27            0.062866        0.003673        0.058697        2													
FIMDPH1                PACKAGE            403           3.598929        0.599123        2.994598        354													
FIMDIRQ                PACKAGE            2             0.002423        0.000706        0.001796        1													
FIMDCHR                PACKAGE            6             0.073416        0.001200        0.072333        2													
FIMDREP                PACKAGE            27            0.002771        0.002436        N/P            N/P													
FIMDEXR                PACKAGE            49            0.003984        0.003895        N/P            N/P													
FIMDMRPB               PACKAGE            10975        6.664664        1.235758        5.358279        751													
FIMDMTO1               PACKAGE            263           0.320842        0.039257        0.283440        62													
FIMDMTO2               PACKAGE            92            0.010085        0.008776        N/P            N/P													
FIMDMTO3               PACKAGE            250           0.326448        0.049734        0.274011        27													
FIMDMTO4               PACKAGE            4761        1.480512        0.557355        0.871868        132													
FIJDCAIB                PACKAGE            456           0.447282        0.096527        0.333334        66													
-----													
JEN	JENJBMRM	BATCH	08:21:28.538964		1	1	0	0	1.179661	1.046372	529	33	0
FIJ1BAT	'BLANK'	ALLIED	NORM DEALLOC		1159	229	0	0	0.166724	0.140499	0	7	0
-----													
PROGRAM NAME            TYPE            SQLSTMT    CL7 ELAP.TIME    CL7 CPU TIME    CL8 SUSP.TIME    CL8 SUSP													
FIMDLIST                PACKAGE            1390        1.046320        0.140450        0.896530        36													
-----													
JEN	JENJBMRM	BATCH	08:21:54.227988		17	2429	322	2104	15.795715	10.598735	42703	1082	5
FIJ1BAT	'BLANK'	ALLIED	NORM DEALLOC		3505	6288	233	0	3.630290	2.571737	17997	351	0
-----													
PROGRAM NAME            TYPE            SQLSTMT    CL7 ELAP.TIME    CL7 CPU TIME    CL8 SUSP.TIME    CL8 SUSP													
FIMDPH0                PACKAGE            27            0.004949        0.003169        0.001795        1													

# SQL ACTIVITY LEVEL



# What if Class 2 Time is Relatively Large?

- High Accounting Class 2 IN-DB2 Time
  - Class 2 in DB2 – Time a task spent INSIDE DB2

## **IF there is a large difference consider:**

- ✓ Number and type of SQL statements being performed
- ✓ Poor SQL coding techniques
- ✓ High DB2 GETPAGE counts
- ✓ Large DB2 scans and high I/O counts
- ✓ DB2 Lock / Latch delays
- ✓ Large DB2 sorts
- ✓ Too many columns returned by SQL



Look  
inside of  
DB2

# Is DB2 waiting? What is it waiting for?

- Compare Class 2 In-DB2 time vs Class 3 wait times
  - Class 2 In-DB2 – Time a task spent inside DB2
  - Class 3 Wait times – Time DB2 spent waiting for various events

## Review Class 3 Wait Counters

- ✓ I/O wait time counters
- ✓ Lock / :Latch wait time counters
- ✓ Service task wait time counters
- ✓ And others ...



Look  
inside of  
DB2

## Important records and their content (SQL activities)

- Start SQL (IFCID 59,60,61,64, 65, 66 ) and end SQL (IFCID 58)
  - Usage of CPU header required in order to calculate TCB times
- Correlate scan (15-18) , I/O (6-10), minibind (22, 63), sort (28,95,96), locking activity (29,44,45,213-216,218,226,227), and input host variables (247) to the SQL statement above
  - Usage of CORR header required to correlate activities to plan, package, and end user.

# Important records and their content (SQL activities)

– sample report

```

PREPARE          16:01:06.50    0.003611  0.001729 STMT#          1551 CURSOR: C1          SQLST:00000 SQLCO:    0
                                TEXT: SELECT MAX(WL_APP_VERSION) , WL_CRTD_TS FROM DMSYSWLD.WLDTVRN GROUP BY
                                WL_CRTD_TS ORDER BY WL_CRTD_TS DESC..
                                ATTR: DSNHATTR WITH RETURN..

--- MINIBIND -----
QUERYNO   : 1551          PLANNAME      : DSNREXX          COST           : 1627          PARALLELISM_DISABLED : N/A
QBLOCKNO  : 1            COLLID       : DSDYNAMICSQLCACHE  PROGNAME       : DSNREXX       CONSISTENCY_TOKEN   : 3B3B471F00000083
APPLNAME  : N/P          WHEN_OPTIMIZE : DEFAULT          OPT_HINT_IDENT : N/P           OPTIMIZE_HINTS_USED  : NO
UNITS     : 0            MILLI_SEC    : 0               COST_CATEGORY  : N/P           PARENT_Q_BLOCKNO    : 0
BIND_TIME : 06/16/05 17:01:06.50  VERSION      : N/P
MEMBER    : SDE1        STATEMENT_TYPE: SELECT          TIMESTAMP      : 2005/06/16 17:01:06.50
.....
PLANNO    : 1            METHOD        : FIRST TABLE ACCESSED  SORTN_UNIQ     : NO            SORTC_UNIQ        : NO
DATABASE  : DMSYSWLD    NEXTSTEP     : NOT APPLICABLE         SORTN_JOIN     : NO            SORTC_JOIN        : NO
OBJECT    : 61          ACESSTYPE   : TABLE SPACE SCAN (R)  SORTN_ORDBYLIST : NO            SORTC_ORDERBY    : NO
CREATOR   : DMSYSWLD    PAGE_RANGE   : NO                    SORTN_GRPBYLIST : NO            SORTC_GROUPBY    : NO
TNAME     : WLDTVRN     JOIN_TYPE    : NO                    SORTN_PGROUP_ID : 0             SORTC_PGROUP_ID  : 0
CORRELATION_NAME: N/P    MERGE_JOIN_COLS : 0                    ACCESS_DEGREE  : 0             JOIN_DEGREE       : 0
TSLOCKMODE : IS        PARALLELISM_MODE: NO                    ACCESS_PGROUP_ID: 0            JOIN_PGROUP_ID    : 0
COLUMN_FN_EVAL : N/A    INDEX_NUMBER  : 0                    PREFETCH       : SEQ           DIRECT_ROW_ACC    : NO
PAGES_FOR_TABLE : 501    TAB_CARDINALITY : 10000                STARJOIN       : NO
TABLE_TYPE : TABLE (T)
.....
PLANNO    : 2            METHOD        : EXTRA SORT NEEDED     SORTN_UNIQ     : NO            SORTC_UNIQ        : NO
DATABASE  : 0            NEXTSTEP     : NOT APPLICABLE         SORTN_JOIN     : YES           SORTC_JOIN        : NO
OBJECT    : 0            ACESSTYPE   : TABLE SPACE SCAN (W)  SORTN_ORDBYLIST : NO            SORTC_ORDERBY    : NO
CREATOR   :              PAGE_RANGE   : NO                    SORTN_GRPBYLIST : NO            SORTC_GROUPBY    : YES
TNAME     : 'BLANK'     JOIN_TYPE    : NO                    SORTN_PGROUP_ID : 0             SORTC_PGROUP_ID  : 0
CORRELATION_NAME: N/P    MERGE_JOIN_COLS : 0                    ACCESS_DEGREE  : 0             JOIN_DEGREE       : 0
TSLOCKMODE :              PARALLELISM_MODE: NO                    ACCESS_PGROUP_ID: 0            JOIN_PGROUP_ID    : 0
COLUMN_FN_EVAL : S      INDEX_NUMBER  : 0                    PREFETCH       : NO            DIRECT_ROW_ACC    : NO
PAGES_FOR_TABLE : 0      TAB_CARDINALITY : 0                    STARJOIN       : NO
TABLE_TYPE : X'00'

```

# Important records and their content (SQL activities)

```

OPEN                16:01:06.50      0.001180  0.000297  STMT#          1873  CURSOR: C1                ISO(CS)  SQLST:00000  SQLCO:      0
                                REOPTIMIZED(NO)  KEEP UPDATE  LOCKS(NO)   SCROLL(NO)  SENSITIVE(UNS)  TABLE(UNS)

--- WORKLOAD HILITE ---
SCANS      :    1  RECS/SORT:  1.00  I/O REQS:    N/P  SUSPENDS   :    N/P  EXITS      :    N/P  AMS        :    N/P
ROWSPROC   :    1  WORK/SORT:  1.00  AET/I/O    :    N/P  AET/SUSP   :    N/P  AET/EXIT   :    N/P  AET/AMS    :    N/P
PAGESCAN   :    2  PASS/SORT:  0.00  DATACAPT   :    N/P  RIDS UNUS  :    N/P  CHECKCON   :    N/P  DEGREE REDUCTION :    N/P
LOB_PAGSCAN:    0          LOB_UPD_PAGE :    0

--- SCAN ACTIVITY ---
-----ROWS-----  --QUALIFIED AT--  -----ROWS-----  --MASS-  --PAGES-  -----RI-----
DATABASE  PAGESET  SCANS  PROCESS  EXAMINE  STAGE 1  STAGE 2  INSERTS  UPDATES  DELETES  DELETES  SCANNED  SCANS  DELETES
MEMBER    TYPE
DMSYSWLD  WLDS001      1        1        1        1        1        0        0        0        1        2        0        0
SDE1      SEQD

--- SORT ACTIVITY - QW0095/96 ---
MEMBER      : SDE1      MAX RETURN CODE :      0  WORKFILES   :    1.00  RECORDS     :    1.00
TOTAL SORTS :      1  INITIAL WORKFILES :    1.00  RECORD SIZE :   23.00  SORT TYPE   :   ESA-REC
SORT KEYS   :    1.00  SORT COLUMNS   :    3.00  KEY SIZE    :   10.00  MERGE PASSES :    N/C
AET/SORT    : 0.001150  DATA SIZE      :   13.00  ROWS DELETED:    N/C
PARTITIONING:    NO  PARTITION TYPE  :    NONE  W-FILES PART:    N/C  PARTIT & SORTING:    NO

--- SORT ACTIVITY - QW0028 ---
NO. OF WORKFILES :      1  TOTAL MULTIPLE DS :      0  MULTIPLE DISTINCT SORTS :      0
REQUESTED WORKFILES :      0  ACTUAL WORKFILES   :      0  RECORDS IN WORKFILE     :      0
PARTITION PARALLEL :      0  RECORDS LAST MERGE :      0  PARTITIONING ONE RECORD :      0
PRE-SORTED RECORDS :      0  RECORDS MDS GROUPBY:      0  CURRENT MERGE PASS      :      0
TOTAL MDS GROUPS   :      0  RECORDS MDS GROUPS :      0  MAX REQUESTED           :      0
AVG REQUESTED      :      N/C  MAX NOT ACQUIRED    :      0  AVG NOT ACQUIRED        :      N/C

--- HOST VARIABLES ---
LOCATION : SYSDB2E          COLLID : JEN          PROGRAMME : DEPTSEL          PRECOMP_TIME : 05/23/05 14:31:31.89
STMT_NO : 2459            FORMAT : 0 - COMPRESSED  NO.SQLDA ENTRIES : 1

.....
ENTRY_NO. : 1            NAME :                NULL_INDICATOR : NO    SQLTYPE : 452
DATA_TYPE : FIXED-LENGTH CHARACTER STRING          DATA_LENGTH : 8
PRECISION : N/A  SCALE : N/A  ADDR_HOST_VAR : X'0012E438'  ADDR_IND_VAR : X'0012E850'
DATA      : FIMBMRPB
    
```





# Usage scenarios, collect SQL activities and generate report with correlated, sort, scan and host variable data

```

...
CLOSE          16:01:07.12    0.000017  0.000017  STMT#          2201  CURSOR:  C1                SQLST:00000  SQLCO:      0

1 CALL          16:01:07.12    9.303514                STMT#    0  PROCEDURE:  DPTDEL                SQLSTATE: 00000  SQLCODE:    0
SCHEDULE TIME:  0.001187  SCHEDULE TCB: 24.510190  SCHEMA :  DMSYSWLD

PACKAGE
SYSDB2E.DMSYSWLD.DPTDEL.X'1797259A0463F578'
ACQUIRE(USE)   REOPT(N)  RELEASE(COMMIT)  ISO(CS)  DYNAMICRULES(RUN)
PREPARE(NODEFER)  KEEP(DYNAMIC(NO)  PROTOCOL(DRDA)  OPTHINT(N/P)

2 CALL          16:01:07.12    0.015642                STMT#    0  PROCEDURE:  DPTSEL                SQLSTATE: 00000  SQLCODE:    0
SCHEDULE TIME:  N/P          SCHEDULE TCB:  N/P          SCHEMA :  DMSYSWLD

PACKAGE
SYSDB2E.DMSYSWLD.DPTSEL.X'1797256406039B3C'
ACQUIRE(USE)   REOPT(N)  RELEASE(COMMIT)  ISO(CS)  DYNAMICRULES(RUN)
PREPARE(NODEFER)  KEEP(DYNAMIC(NO)  PROTOCOL(DRDA)  OPTHINT(N/P)

2 SELECT        16:01:07.12    0.001539  0.000201  STMT#          227                ISO(CS)  SQLST:00000  SQLCO:      0
REOPTIMIZED(NO)  KEEP UPDATE LOCKS(N/A)

--- WORKLOAD HILITE ---
SCANS      :    1  RECS/SORT:  N/P  I/O REQS:    2  SUSPENDS   :    N/P  EXITS      :    N/P  AMS        :    N/P
ROWSPROC:    1  WORK/SORT:  N/P  AET/I/O :  0.000684  AET/SUSP   :    N/P  AET/EXIT   :    N/P  AET/AMS    :    N/P
PAGESCAN:    2  PASS/SORT:  N/P  DATACAPT:  N/P  RIDS UNUSED:  N/P  CHECKCON   :    N/P  DEGREE REDUCTION :    N/P
LOB_PAGSCAN:    0          LOB_UPD_PAGE :    0

--- SCAN ACTIVITY ---
-----ROWS-----  --QUALIFIED AT--  -----ROWS-----  --MASS-  --PAGES-  -----RI-
DATABASE  PAGESET  SCANS  PROCESS  EXAMINE  STAGE 1  STAGE 2  INSERTS  UPDATES  DELETES  DELETES  SCANNED  SCANS  DELETES
MEMBER    TYPE
DMSYSWLD  4          1          1          0          0          1          0          0          0          1          2          0          0
SDE1     INDX

--- I/O ACTIVITY ---
DATABASE  PAGESET  - I/O REQUEST -  ----- READ REQUEST (WITH OR WITHOUT I/O) -----  ----- WRITE REQUEST -----
MEMBER    BP      TOTAL    AET    TOTAL  TYPE  AET/WITH  %WITH PAGE/WITH  %WITHOUT  TOTAL  TYPE  CAST    AET  PAGE/WRIT
DMSYSWLD  WLDXDPT1
SDE1     BP4          2  0.0007          2  SYNCH  0.000684  100.00  1.00  0.00

2 DESCRIBE     16:01:07.13                STMT#          341                SQLST:00000  SQLCO:      0

2 SELECT        16:01:07.13    0.011678  0.002066  STMT#          256                ISO(CS)  SQLST:00000  SQLCO:      0
REOPTIMIZED(NO)  KEEP UPDATE LOCKS(N/A)

--- WORKLOAD HILITE ---
SCANS      :    1  RECS/SORT:  N/P  I/O REQS:    2  SUSPENDS   :    N/P  EXITS      :    N/P  AMS        :    N/P
ROWSPROC:  1987  WORK/SORT:  N/P  AET/I/O :  0.000739  AET/SUSP   :    N/P  AET/EXIT   :    N/P  AET/AMS    :    N/P
PAGESCAN:   53  PASS/SORT:  N/P  DATACAPT:  N/P  RIDS UNUSED:  N/P  CHECKCON   :    N/P  DEGREE REDUCTION :    N/P
LOB_PAGSCAN:    0          LOB_UPD_PAGE :    0
    
```

# LOCKING ACTIVITY LEVEL



# Is DB2 waiting for something?

- Compare Class 2 In-DB2 time relative to Class 2 In-DB2 CPU time
  - Class 2 In-DB2 – Time a task spent inside DB2
  - Class 2 in DB2 CPU time – CPU time a task spent INSIDE DB2 doing SQL

## **IF a large difference consider:**

- ✓ Various possible delays
- ✓ DB2 measured class 3 delays
  - Poor index usage
  - High DB2 GETPAGE counts
  - Large DB2 scans and high I/O counts
  - DB2 Lock / Latch delays
  - Large DB2 sorts
- ✓ Unaccounted for delays



Look  
**inside of**  
DB2

## What is the Breakdown of Class 2 Time?

- Compare Class 2 In-DB2 Time Relative to Class 2 In-DB2 CPU time
  - Class 2 in-DB2 – Time a task spent inside DB2
  - Class 2 in-DB2 CPU time – CPU time spent INSIDE-DB2 doing SQL etc

### **IF CPU is a high percentage consider:**

- ✓ Poor SQL coding technique
- ✓ Number and type of SQL calls being performed
- ✓ Large amount of dynamic SQL
- ✓ Number of columns returned by SQL
- ✓ Unnecessary rows retrieved by SQL
- ✓ EDITPROC and FIELDPROC processing
- ✓ Large SORTs
- ✓ Too frequent commits
- ✓ Excessive locking



Look  
inside of  
DB2

# What is DB2 Waiting For? High Lock / Latch Wait Time

- High Accounting Class 3 Lock / Latch Wait Time

## High Lock / Latch Wait Time Consider:

- ✓ Needlessly large number of locks taken
- ✓ Locks being held for a long duration
- ✓ Lock escalation
- ✓ Commits to infrequent
- ✓ Lock timeouts and deadlocks
- ✓ Maximum of concurrent applications
- ✓ Sequence in which applications update

## Important records and their content (Locks)

- Lock suspend or an identify call to the IRLM, if a lock request cannot be satisfied immediate and lock resume (IFCID 44 and 45), wait time reported if ACCTG Class 3 and/or Class 8 is started.
- Wait on drain lock and claims and the end of drain lock, resp. claim (IFCID 213-214, 215-216)
- Wait of an agent for a page latch currently held under another agent (IFCID 226-227)
- Deadlock (IFCID 172) and
- Timeout (IFCID 196)

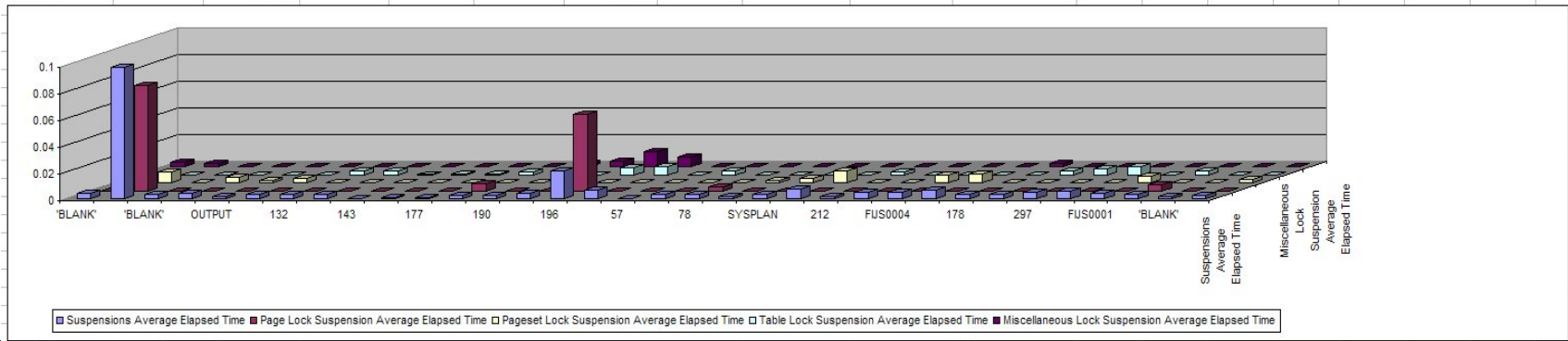
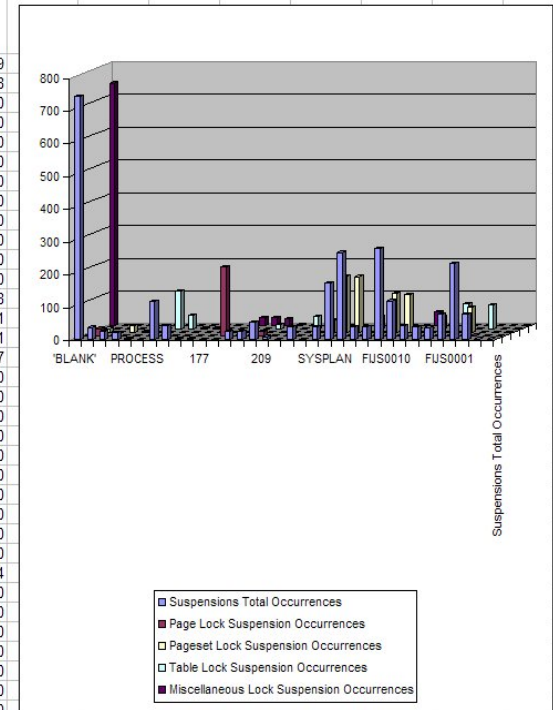
# Important records and their content (Locks)

PRMAUTH ORIGAUTH PLANNAME	CORRNAME CORRNMBR CONNECT	CONNTYPE INSTANCE	EVENT TIMESTAMP RELATED TIMESTAMP	EVENT	---	LOCK	RESOURCE	---	EVENT SPECIFIC DATA
					TYPE	NAME			
T3270A T3270A NOPID	NOPID 0002 IMSA	IMS-MPP A9BA4BA9A1A6	19:33:17.42944643	LOCK SUSPEND	OPENLOCK	DB	-TPCCE1 -TSTCK000		DURATION-MANUAL STATE-X ORIG.RSN-INTER SYSTEM NMODIFY GLOBAL L-LOCK PARENT -X'01020010' HASH -X'00002240'
			19:33:17.43110459 19:33:17.42944643	LOCK RESUME	OPENLOCK	DB	-TPCCE1 -TSTCK000		SUSP.TIME -0.001658 LOCAL CONTENTION-N DURATION -MANUAL LATCH CONTENTION-N STATE -X IRLM QUEUED REQ -N RESUME RSN-NORMAL GLOBAL CONT. -Y- XES PROP -Y NOTIFY MSG SENT -N XES FORC -N FALSE CONTENTION XES ASYN -Y RETAINED LOCK Y NMODIFY GLOBAL L-LOCK PARENT -X'01020010' HASH -X'00002240'
SYSOPR SYSOPR 'BLANK'	TLPLKP KPD002 SSDQ	'BLANK' A9BA4771D452	19:34:12.48749093	LOCK SUSPEND	GBP	CAST	BPID-GBP0		DURATION-INTEREST STATE-S ORIG.RSN-INTER SYSTEM NMODIFY GLOBAL P-LOCK HASH -X'00000000'
			19:34:29.49145978 19:34:12.48749093	LOCK RESUME	GBP	CAST	BPID-GBP0		SUSP.TIME -17.00397 LOCAL CONTENTION-N DURATION -INTEREST LATCH CONTENTION-N STATE -S IRLM QUEUED REQ -N RESUME RSN-NORMAL GLOBAL CONT. -Y- XES PROP -Y NOTIFY MSG SENT -N XES FORC -N FALSE CONTENTION XES ASYN -Y RETAINED LOCK -Y NMODIFY GLOBAL P-LOCK HASH -X'00000000'
T3270A T3270A NOPID	NOPID 0002 IMSA	IMS-MPP A9BA4BA9A1A6	19:36:28.73824331	LOCK SUSPEND	PAGEPLCK	DB	-TPCCE1 -XNORD000 PAGE-X'00000001' BPID-BP0		DURATION-INTEREST STATE-S ORIG.RSN-INTER SYSTEM NMODIFY GLOBAL P-LOCK HASH -X'000201CF'
			19:36:28.78801059 19:36:28.73824331	LOCK RESUME	PAGEPLCK	DB	-TPCCE1 -XNORD000 PAGE-X'00000001' BPID-BP0		SUSP.TIME -0.049767 LOCAL CONTENTION-N DURATION -INTEREST LATCH CONTENTION-N STATE -S IRLM QUEUED REQ -N RESUME RSN-NORMAL GLOBAL CONT. -Y- XES PROP -Y NOTIFY MSG SENT -N XES FORC -Y FALSE CONTENTION XES ASYN -Y RETAINED LOCK -Y NMODIFY GLOBAL P-LOCK HASH -X'000201CF'



# Important records and their content (Locks)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
PAGESET	Suspensions Total Occurrences	Suspensions Average Elapsed Time	Page Lock Suspension Occurrences	Suspension Average Elapsed Time	Pageset Lock Suspension Occurrences	Pageset Lock Suspension Average Elapsed Time	Table Lock Suspension Occurrences	Table Lock Suspension Average Elapsed Time	Miscellaneous Lock Suspension Occurrences	Miscellaneous Lock Suspension Average Elapsed Time								
'BLANK'	742	0.003699	0	0	0	0	0	0	742	0.003699								
TSPARALL	37	0.0980384	23	0.0789808	13	0.008176	0	0	1	0.002338								
'BLANK'	24	0.003171	0	0	0	0	0	0	0	0								
ONLINE	22	0.003882	0	0	22	0.003882	0	0	0	0								
OUTPUT	3	0.0018	0	0	3	0.0018	0	0	0	0								
PROCESS	20K	0.003261	0	0	20K	0.003261	0	0	0	0								
132	117	0.002834	0	0	0	0	117	0.002834	0	0								
137	42	0.00333	0	0	0	0	42	0.00333	0	0								
143	3	0.000188	0	0	0	0	3	0.000188	0	0								
163	3	0.000653	0	0	0	0	3	0.000653	0	0								
177	1	0.000469	0	0	0	0	1	0.000469	0	0								
182	20K	0.002304	212	0.005138	0	0	20K	0.002273	0	0								
190	25	0.002738	0	0	0	0	0	0	25	0.002738								
193	25	0.004181	0	0	0	0	0	0	25	0.004181								
196	52	0.021106	13	0.057345	0	0	16	0.005383	23	0.011561								
209	9	0.006638	0	0	0	0	5	0.006054	4	0.007367								
57	1	0.000107	0	0	0	0	1	0.000107	0	0								
65	39	0.002986	0	0	0	0	39	0.002986	0	0								
78	1	0.00303	1	0.00303	0	0	0	0	0	0								
SYSEBCDC	39	0.001769	0	0	39	0.001769	0	0	0	0								
SYSPLAN	172	0.003494	0	0	172	0.003494	0	0	0	0								
SYSUSER	266	0.00686	0	0	171	0.008854	0	0	0	0								
212	39	0.001839	0	0	0	0	39	0.001839	0	0								
'BLANK'	38	0.004654	0	0	0	0	0	0	0	0								
FUS0004	277	0.004616	0	0	120	0.005528	0	0	0	0								
FUS0010	118	0.006216	0	0	118	0.006216	0	0	0	0								
178	42	0.002884	0	0	0	0	0	0	42	0.002884								
276	40	0.003099	0	0	0	0	40	0.003099	0	0								
297	37	0.00454	0	0	0	0	37	0.00454	0	0								
47	78	0.005881	0	0	0	0	78	0.005881	0	0								
FUS0001	231	0.004185	0	0	77	0.004603	0	0	0	0								
14	77	0.002875	2	0.004309	0	0	75	0.002837	0	0								
'BLANK'	2	0.001958	0	0	0	0	0	0	0	0								
DSN4K01	2	0.00221	0	0	2	0.00221	0	0	0	0								





# DB2 10 PERFORMANCE METRICS



# What is New and important with DB2 10

- DB2 traces and IFCID types impacted by DB2 10 (major) changes
  - ACCOUNTING
    - Separation of Lock and Latch wait times
    - More granularity on package level although ACCUMAC >1 is used
  - STATISTICS
    - Statistics trace interval always 1 min
    - IFCID 225 (storage) changes and restructuring
    - Multiple IFCID 2 for each 25 buffer pools (>25 buffer pool usage)
    - Dyn.SQL stmt cache enhancements - New static SQL cache
    - EDM Pool and other working memory moved above the bar
    - Extension of lot of fields from 32bit to 64bit
  - Audit
    - Row-level and Column-level access control
    - New DBA privileges
  - ZPARMs – new and updated

# New DB2 10 performance metrics related line items

## Accounting / Statistics

- Breakout plan and package suspension **wait times for locks** and **wait times for latches**. (Class 3, 8)

CLASS 3 SUSPENSIONS	AVERAGE TIME	AV.EVENT
-----	-----	-----
LOCK/LATCH(DB2+IRLM)	0.000000	0.00
IRLM LOCK+LATCH	0.000000	0.00
DB2 LATCH	0.000000	0.00
SYNCHRON. I/O	0.000000	0.00
DATABASE I/O	0.000000	0.00
...		

- Enhanced SQL Monitoring Support
  - DB2 10 improves the support for monitoring within DB2 for z/OS, providing additional performance and diagnostic monitoring capability for both static and dynamic SQL. A unique **statement execution identifier** is introduced; **statement type and statement execution identifier** are **externalized** that can be used to correlate statement execution on the server with the client application.
    - Updated IFCIDs related to SQL execution
    - New **Static SQL Statement Cache** (flag IFCID 400, like 318 for dynamic SQL) ==>

# New DB2 10 performance metrics related line items

Accounting / Statistics

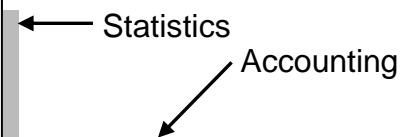
## Dynamic Statement Cache Enhancements

- DB2 10 will allow **literal constants referenced in dynamic SQL statements** to be replaced by special markers. It introduces a new PREPARE statement attribute **CONCENTRATE STATEMENTS WITH LITERALS**. **Those literals/constants are not cached** with the statement in the dynamic SQL statement cache (New additional cache match criteria *"literal reusability"*).
- Statistics (316 and 2), Accounting (3 , 148) => Batch report and Real-time monitoring

DYNAMIC SQL STMT	QUANTITY	/SECOND	/THREAD	/COMMIT	
-----	-----	-----	-----	-----	
PREPARE REQUESTS	3956.00	0.05	172.00	1.95	
FULL PREPARES	0.00	0.00	0.00	0.00	
SHORT PREPARES	6909.00	0.08	300.3		
GLOBAL CACHE HIT RATIO (%)	100.00	N/A	N/A		
IMPLICIT PREPARES	0.00	0.00	0.0		
PREPARES AVOIDED	0.00	0.00	0.0		
CACHE LIMIT EXCEEDED	0.00	0.00	0.0		
PREP STMT PURGED	0.00	0.00	0.0		
LOCAL CACHE HIT RATIO (%)	N/C	N/A	N/A		
CSWL - STMTS PARSED	0.00	0.00	0.0		
CSWL - LITS REPLACED	0.00	0.00	0.0		
CSWL - MATCHES FOUND	0.00	0.00	0.0		
CSWL - DUPLS CREATED	0.00	0.00	0.0		

DYNAMIC SQL STMT	AVERAGE	TOTAL
-----	-----	-----
REOPTIMIZATION	0.00	0
NOT FOUND IN CACHE	0.00	0
FOUND IN CACHE	0.00	0
IMPLICIT PREPARES	0.00	0
PREPARES AVOIDED	0.00	0
CACHE_LIMIT_EXCEEDED	0.00	0
PREP_STMT_PURGED	0.00	0
CSWL - STMTS PARSED	0.00	0
CSWL - LITS REPLACED	0.00	0
CSWL - MATCHES FOUND	0.00	0
CSWL - DUPLS CREATED	0.00	0



# New DB2 10 performance metrics related line items

## Statistics

- Reduction of Virtual Storage Constraints
  - DB2 10 provides more **relief to the virtual storage constraint** below the 2 GB bar, by **moving more EDM pool and working memory control blocks** above the 2 GB bar.
    - Major Restructuring of IFCID 225
  
- 64bit Extension for a lot of fields
  - Statistics, etc.

# New DB2 10 performance metrics related line items

## Audit

- Row-level and Column-level access control
  - DB2 10 introduces a new method of implementing **row-level and column-level access control** as an additional layer of security. Row-level and column-level access control can be used to control access to a table at the row level, column level, or both (CREATE PERMISSION FOR ROWS, CREATE MASK, etc.)
  
- New DBA privileges with finer granularity
  - DB2 10 additional authorities and privileges (more stringent regulatory compliance and auditing DB2 requirements)
  - DB2 10 implements **separation of duties** and **least privilege** by introducing new authorities and privileges (SYSADM, SECADM, DBADM, DATAACCESS, EXPLAIN, SQLADM, ...)

# Summary

- DB2 (event) traces are a great source for deep dive problem analysis
- DB2 snapshot data is useful for status and health check
- Start and collect only traces needed
- Use tools like spreadsheets and DB2 tables for more sophisticated analysis, if possible.
- Rely on performance data provided via DB2 API

# References

## Internet:

DB2 for z/OS Performance Monitoring and Tuning Guide (SC18-9851)

<http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/topic/com.ibm.db29.doc.perf/dsnpfk17.pdf?noframes=true>

DM Tools Library (complete library of all tools, including additional updates)

<http://www-306.ibm.com/software/data/db2imstools/db2tools-library.html>

## Redbooks:

DB2 9 for z/OS Performance Topics (SG24-7473)

<http://www.redbooks.ibm.com/abstracts/sg247473.html> (update 12/2009)

DB2 UDB for z/OS Version 8 Performance Topics (SG24-6465)

<http://www.redbooks.ibm.com/abstracts/SG246465.html?Open> (update 10/2007)

A Deep Blue View of DB2 Performance: IBM Tivoli OMEGAMON XE for DB2 Performance Expert on z/OS V3.1.0 (SG24-7224-00)

<http://www.redbooks.ibm.com/abstracts/sg247224.html> (April 2006)

DB2 for z/OS and OS/390 Tools for Performance Management

<http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg246508.html> (Nov.2001)



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