



Understanding Distributed Processing Inside DB2 for z/OS

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Overview



- › Distributed Processing Fundamentals
- › Distributed threads – What can I see?
- › WLM, enclaves and SRBs
- › DDF and DB2 system considerations
- › Impact on critical resources

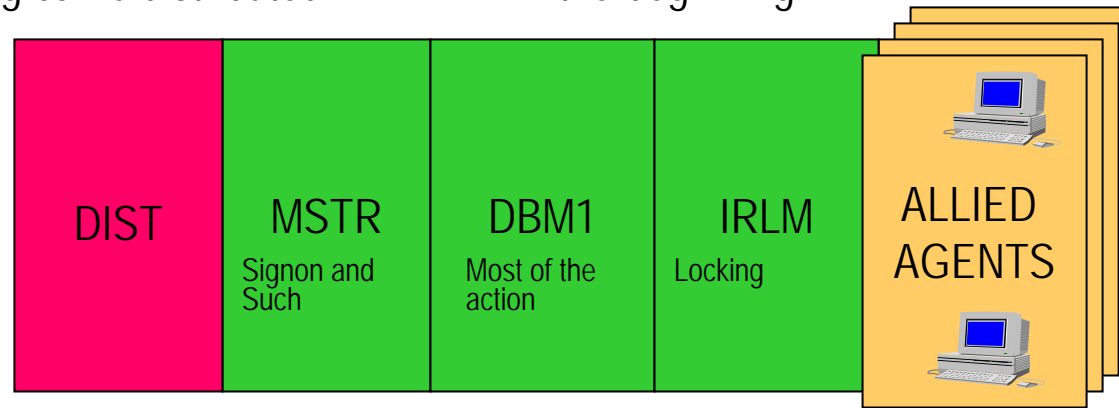
Distributed Fundamentals

A Quick Overview



Along came distributed

In the beginning



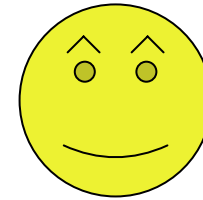
- › 3 DB2 operational address spaces in the beginning
 - Plus all the allied agent address spaces
 - CICS, IMS, TSO Attach
 - TSO Batch, Call Attach Facility
- › Distributed Data Facility (DDF) in DB2 V2R2
 - Private protocol only
 - Access using 3 part names or aliases
- › DRDA (Distributed Relational Database Architecture) first implemented in DB2 V2R3
- › Enhancements delivered in every release
 - DRDA support of stored procedures
 - DBAT user priority
 - TCP/IP, ODBC, CLI, JDBC
 - Much more . . .
- › DDCS grows up into DB2 Connect
- › Web-based access comes of age
 - Java, JDBC Universal Driver, Websphere . . .

What Do They Mean?



A few examples of terminology confusion

- › Type 2 inactive DBATs (not DBATs at all)
- › Type 1 inactive DBATs (never seen one?)
- › “Active” DBATs (not quite)
- › Clients, connections, conversations
 - (Simple one to one?)
- › Idle vs. pool thread timeout (what and when)



Basic Terminology Definitions



- › Application Server (AS) / Application Requester (AR)
 - DB2 for z/OS? DB2 Connect? ** Both!
- › Location (DB2 for z/OS term)
 - Or: RDB-Name, VTAM nodes, TCP/IP partners
- › Connection – between a requester and a server
 - TCP/IP ports, or VTAM LUNAMES
 - Either a client or a thread could have more than one
- › Network protocol – TCP/IP or SNA (VTAM)
- › Conversation – handle traffic on a connection
 - Also referred to as a session
 - DRDA – one per requester to handle SQL & open cursors
 - Private protocol – may have more, one per open cursor

More DB2 Terminology



› Thread types

- Allied / DBAT (server), Allied Dist (requester) / DBAT Dist (both)

› “Connect type” used to identify the remote location

- System-directed: 3-part names or aliases
- Application-directed: CONNECT statement

› Database access protocol

– DRDA

- Usually application-directed, can be system-directed
- Mostly TCP/IP, can be SNA (security)
- Requires remote bind

– Private Protocol (PP) – gradually disappearing

- Always system-directed, always SNA, always DB2-DB2
- No bind required, only dynamic SQL, limitations

Where are your DBAT Threads Coming From?



- › Other DB2 for z/OS subsystems
- › Primarily workstation clients or web users
- › Many connection possibilities:
 - DB2 Connect PE
 - DB2 Universal Driver for SQLJ and JDBC
 - Connection managers and “concentrators” to reduce resources required in DB2 for z/OS
 - DB2 Connect EE – Enterprise Edition
 - Websphere Application Server, SAP, others . . .

DBAT Thread identifiers - Basic



- › Connection Type **** WLM CT ****
 - DRDA or Private Protocol
- › Other IDs for DB2 to DB2 work (DRDA or PP)
 - All come from the remote requester thread
 - Even with a “hop”, they come from the requester
- › Other IDs for non-z/OS DRDA clients
 - Two unique identifiers
 - Connection Name = “SERVER”
 - Plan = “DISTSERV” **** WLM PN ****

More Identifiers from non-z/OS Clients



- › Clients can flow other identifiers to DB2 for z/OS
 - ODBC/CLI/VB (SQLSetConnectionAttr)
 - Non-OBDC (sqleseti)
 - JDBC (DB2Connection)
 - DRDA (ACCRDB prddta / sqlstt in EXCSQLSET)

- › Most important IDs supported in V8 with special registers
 - Client Accounting (see QMDA below)
 - Workstation Userid **** WLM SPM 1-16 ****
 - Workstation Name **** WLM SPM 17-34 ****
 - Workstation Application **** WLM PC 1-32 ****

Other Differences – DRDA Clients



- › **Package / Collection** ** WLM CN/PK **
 - First package accessed
- › **Stored procedure name** ** WLM PR **
 - If First SQL is a CALL
- › **AUTHID of client** ** WLM UI **
 - Often not unique for non-z/OS clients
- › **Original primary AUTHID**
 - Used to make initial connection to server
- › **Correlation ID** ** WLM CI **
 - DDM external name (EXTNAME) for client
- › **Accounting correlation token**
 - 22-byte token

More “Accounting” IDs



- › **Special section for thread “accounting” data**
 - Used for additional client identification
 - Only in the accounting record IFCID 03
- › **Product ID - shows the client source product**
 - SQL – DB2 for LUW / DB2 Connect
 - JCC – Universal JDBC Driver
 - DSN – DB2 for z/OS requester
- › **DSN accounting string (z/OS)**
 - A repeat of the QWHC identifiers, except:
 - MVS accounting string (QMDAACCT)

Non-z/OS Accounting IDs



› SQL or JCC Accounting

- Client platform
- Client application name
- Client AUTHID of an application process
- Accounting String **** WLM AI ****

› Also, IDs from the DB2 for z/OS server

- Subsystem instance **** WLM SI ****
- Subsystem collection name
(Data sharing group) **** WLM SSC ****
- Sysplex name **** WLM PX ****

DBAT Processing Modes



- › Mode is defined with the ZPARM CMTSTAT
 - “DDF Threads” on panel DSNTIPR
- › Two choices:
 - **INACTIVE** – highly recommended
 - Provides DBAT pooling for DRDA access
 - More effective WLM classification per UOW
 - **ACTIVE**
 - DBAT created for each new client application
 - DBAT held through commits
 - Use this only if the applications require it

WLM Enclaves



- › DDF threads are executed under enclave SRBs
 - Controlled by WLM
- › Thread priority set by WLM workload classification
 - Providing good DDF classifications is vital
- › Enclave completes = accounting data is ready
 - Defines class 1 elapsed times of a thread
 - (Not affected by rollup option)
- › Different for INACTIVE and ACTIVE modes

WLM Enclaves



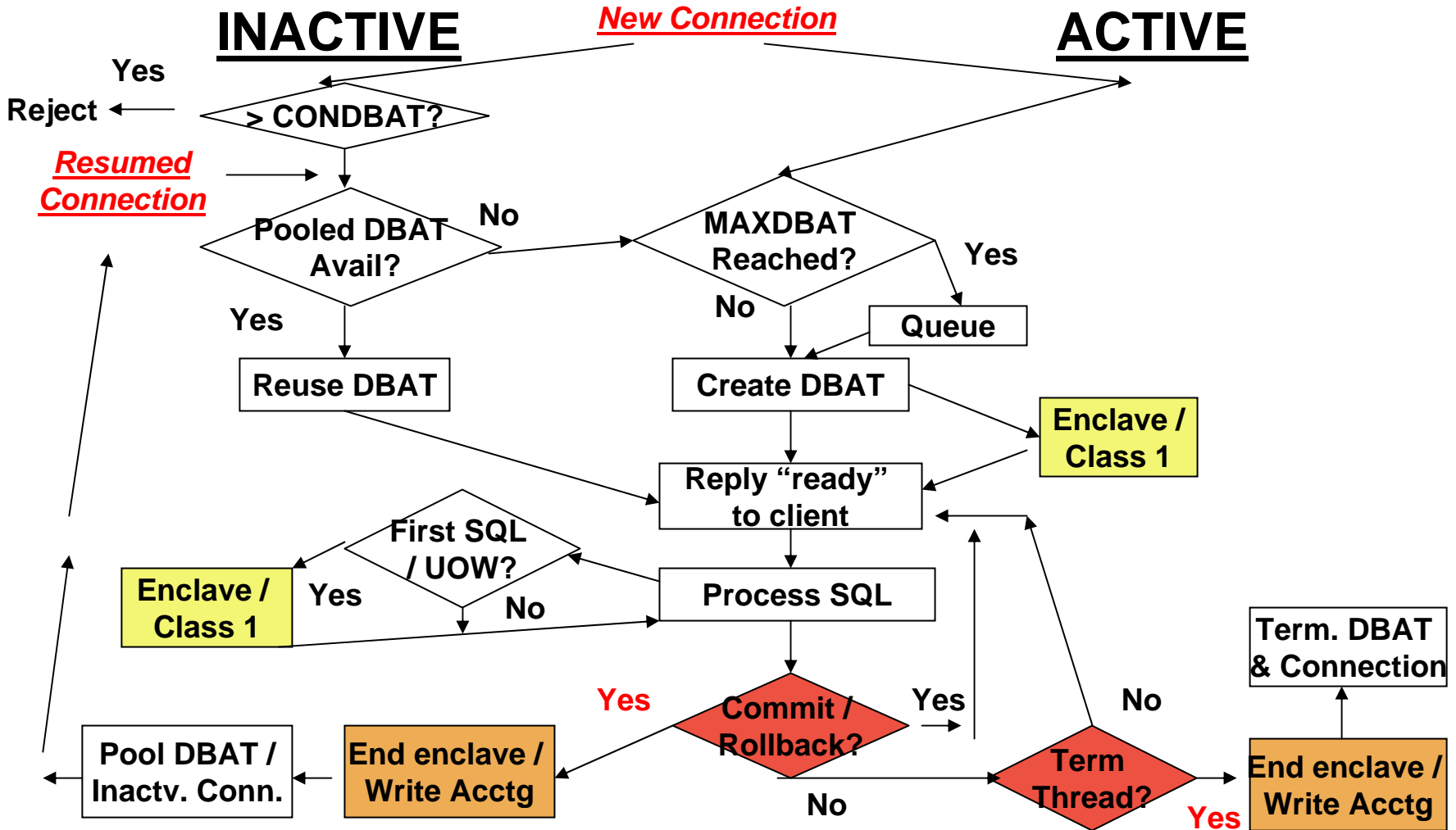
› INACTIVE mode

- No end user “think time” included
- Enclave is created when the first SQL is received
- Enclave is deleted at commit / rollback (thread complete)
- New enclave for each UOW, reclassified by WLM
- Can use multi-period response time or velocity goals

› ACTIVE mode

- End user “think time” is included
- Enclave is created when the DBAT is created
- Enclave is only deleted at thread termination
- Only one enclave, no reclassification
- Can only use a single-period velocity goal

Processing Diagram



DBATs and Accounting



- › **ACTIVE mode**
 - Only cut at thread termination, not at commit
- › **INACTIVE mode**
 - DRDA – at “clean” COMMIT or ROLLBACK
 - “Type 2 inactive”
 - DRDA with KEEP DYNAMIC(YES)
 - At “clean” commit (DB2 V8 and above)
 - PP DBAT – at commit or termination
 - At commit, if “Type 1 Inactive” (MAXTYPE1) allowed
 - Else only at termination
- › **Active thread is idle too long and is canceled**
 - At “Idle Thread Timeout” (IDTHTOIN), if allowed
 - Checked every 2 minutes

Accounting and DDF Rollup



- › Option in DB2 V8 to reduce accounting volume
 - Turned on if ZPARM ACCUMACC > 1
- › Data accumulated for specified # of threads
 - For matching IDs, based on ACCUMUID
 - Combination of the 3 workstation IDs
- › Accounting written when
 - “Too old” (staleness threshold)
 - “Too much” (internal storage threshold reached)
 - “Just enough” (limit threshold reached)
- › One accounting record reflects one or more threads
 - Currently no DDF statistics (QLAC) or QMDA accounting
 - Only one “ROLLUP” package
- › Active thread data only shows the current thread counts

Connection and Thread Processing

- Review of INACTIVE Mode



- › (1) A new connection (in DIST) is established
- › (2) DB2 attempts to allocate a DBAT
 - Use a pooled DBAT if possible
 - Allocate a new DBAT if possible (expensive)
 - Queue if MAXDBAT reached **(RQ)**
 - DBAT shows as pooled until SQL is received **(DA)**
- › (3) UOW processes SQL **(RA)**
 - Idle thread timeout can cause it to be canceled
- › (4) “Clean” commit or rollback completes the UOW
 - Frees the DBAT to be pooled, connection goes inactive **(R2)**
 - KEEP DYNAMIC(YES) keeps the DBAT until termination
- › (5) New SQL “resumes” the connection and a new UOW
- › (6) Disconnect frees the connection

"Real" DBAT Thread Status (#1)



- › Assigned to a remote client (RA or RX)
 - Actively processing executing SQL
 - Active but idle waiting for more SQL
 - Waiting for more work after “clean” commit, if:
 - INACTIVE mode – only:
 - KEEPDYNAMIC(YES) – all resources & DBAT kept
 - Type 1 inactive – PP only / some resources freed
 - ACTIVE mode – even after commit
 - All resources & DBAT kept until thread termination
 - Suspended to connect (PP only, temporary) (RN)

“Real” DBAT Thread Status (#2)



- › Pooled (DA)
- › DRDA clients only, with INACTIVE mode
 - Freed or newly created DBATs are pooled
 - Also referred to as “DBAT slots”
- › Available for reuse by any new / resumed request
 - (Still somewhat in “standby” for previous client)
- › Still uses resources (esp. DBM1 storage)!
 - Occasionally terminated to free storage
- › Still shown and counted as “active threads”
 - But connection name is “DISCONN”
 - Can be terminated if not used (POOLINAC)

Where are the Inactive Type 2 DBATs?



- › They are referenced often in various manuals
 - Pooled DBATs? **Not DBATs at all !**
- › **Actually, they are the inactive connections**
 - Associated with a remote requester
 - Waiting for more work
 - This speeds up response to additional SQL
 - Tracked in DIST, and use less storage (7.5K)
- › **Shown only with DIS THREAD TYPE(INACTIVE)**
 - Connection name is now "SERVER"
 - "Thread" status **(R2)**

And Inactive Type 1 DBATs?



- › These are real DBATs
- › Idle between UOWs
- › Only Private Protocol
 - Old style of inactive processing
- › The DBAT is still assigned
 - But resources are reduced
- › This can only occur if $\text{MAXTYPE1} > 0$
 - And limit is not reached

Understanding Thread Status



› Active thread displays

- Show both assigned and pooled DBATs
- Even though pooled DBATs aren't really "active"

› Inactive thread displays

- Show the inactive connections in DIST
 - While still "associated" with a pooled DBAT
 - Looks like the same requester is both active and inactive
- When pooled DBAT is terminated or reassigned
 - The requester "disappears" from active
 - Still shows as inactive until connection terminated

Conversation Processing



- › Conversations are used for actual traffic on a connection between two remote partners
- › When processing, the conversation is
 - Shown under the active thread
- › Otherwise, the conversation is
 - Shown under the inactive connection
 - After the initial connection until the first SQL
 - After a successful commit

Viewing Active Threads



- › Assigned DBATs are identified with SERVER
- › Pooled DBATs with DISCONN
 - Only the number is interesting (see statistics)
- › Extra DDF activity counts
- › Data sharing considerations
 - Various routing mechanisms across members
 - Need a group view of DBATs
 - To see complete distributed workload
 - In MVDB2, use SSI mode with a group context

Active DBATs (Data Sharing Members)



```
>W1 =THDDBAT===== (DBGK=====*) 01MAR2007==13:24:15====MUDB2====U====6
```

CMD	Correlation	DB2	Package	Elapsed	DDF Msgs	DDF Msgs	Total
---	Id	ID	Name	Time	Sent	Received	SQL
db2bp.exe		DB2K		00:00:00.00	0	0	0
javaw.exe		DB2K	SYSSH200	00:08:32.48	1	1	214
db2bp.exe		DB2K		00:00:00.00	0	0	0
db2bp.exe		DB1K		00:01:08.62	2	2	0
javaw.exe		DB1K	SYSSH200	00:01:07.22	3	3	123
db2bp.exe		DB1K	SQLC2F0A	00:04:02.51	5	5	3

Customize with workstation IDs, other values as needed
Scroll right to see more fields

```
+W1 =THDDBAT===== (DBGK=====*) 01MAR2007==13:24:15====MUDB2====U====6
```

CMD	Correlation	Workstation	Remote	Enclave	Auth ID
---	Id	Name	Location	Token	
db2bp.exe		JBARTHEL-HOU-98	172.18.60.221	00000000000000000000	DMRQA01
javaw.exe		JBARTHEL-HOU-98	172.18.60.221	000000240000000007	DMRQA01
db2bp.exe		JBARTHEL-HOU-98	172.18.60.221	00000000000000000000	DMRQA01
db2bp.exe		JBARTHEL-HOU-00	172.18.61.200	00000000000000000000	DMRQA02
javaw.exe		JBARTHEL-HOU-00	172.18.61.200	0000002C000000000B	DMRQA02
db2bp.exe		dwitkows-SJC-04	172.23.59.211	000000280000000009	BOLDJW1

Hyperlink ↑



Enclave views (MVzOS)



```
>W1 =WMENCLUZ=====SYSBDEMO=*=====05APR2007==14:18:45====MUMUS====D====1
Enclave Token      Service  Owner      Cumulative Exectn  Total  Total  %Idle  %
----- Class      Jobname    CPU Time  Velcty    Dly%    Use%  ----- Unkn
0000002400000087 DDF       DHM1DIST  00:00:22.1  30.00  70.00  30.00
```

```
>W1 =WMENCLAS=WMJINFO==SYSBDEMO=*=====05APR2007==14:19:31====MUMUS====D====1
Timeframe... Interval 0....50..100
Jobname..... ENCLAVE Sysplex Name INTLPLEX Total Use%.. 25.00
Type..... ENCLAVE System Name. SYSB %Use CPU.... 25.00
Serv. Class. DDF SMF I.D..... SYSB %Use DASD... 0.00
Rept. Class. Enclave Cnt. 0 Total Dly... 75.00
ASID..... 0 Velocity.... 25.00 %Dly CPU.... 75.00
Dmn..... 0 Velocity 2.. 25.00 %Dly DASD... 0.00
Period No... 2 Using Sampls 3 %Dly Stor... 0.00
Workload.... DDF Delay Sampls 9 %Dly Srvr... 0.00
Resource.... MPL Delays.. 0 %Dly MPL.... 0.00
Trxn RPGN... 0 Swpin Delays 0 %Dly Swpin.. 0.00
Userid RPGN. 0 Idle Samples 0 %Dly Quiesce 0.00
TrxC RPGN... 0 Unk. Delays. 0 %Idle... 0.00
Acct RPGN... 0 Sample Count 12 %Dly Unknown 0.00
Status..... Active Us/Del Count 12
```

Checking Client Connections



- › Many will be inactive connections
 - Shown as inactive threads (with client IDs)
- › Some have active DBATs
 - In-flight accounting data is available
- › Conversation is with DBAT or inactive connection and shows:
 - Whether the conversation is active in the network or suspended in DB2 waiting for a response
 - Last send/receive time stamp
 - Whether it is receiving or sending
 - The remote location (IP address) and “Sessid” - local and partner ports (for TCP/IP)

Inactive Thread (Connection) View



```
>W1 =THDINACT===== (DBGK=====*)=====) 01MAR2007==13:22:53====MUDB2====D====2
Connect  Current      Correlation      Plan          LUW          Workstatio
Name     Activity   Id              Auth ID      Name         ASID   Token   Name
SERVER   Inactive  DBAT db2bp.exe     DMRQA01     DISTSERV   273    3467   JBARTHEL-H
SERVER   Inactive  DBAT db2bp.exe     DMRQA01     DISTSERV   273    3493   JBARTHEL-H
```

Connection / Conversation Views



```
>W1 =DDFLOC=====DEDM=====*=====02MAR2007==12:09:43====MUDB2====U====4
```

DB2	Product	Tot Conn	Req Conn	Serv Conn	Inact Conn	Tot Cnv		
Target	Remote Location	Link Name	ID					
DEDM	::172.17.8.86		1	0	1	0	1	
DEDM	::172.21.22.183		4	0	4	1	4	
DEDM	DECE	::172.17.8.86	DSN08015	2	2	0	0	2
DEDM	DHH	LUDHH2	DSN08015	2	2	0	0	2

Hyperlink on “Tot Conn” to see details

```
>W1 =DDFLOC==DDFTHD==DEDM=====*=====02MAR2007==12:14:17====MUDB2====U====4
```

DB2	Age	Cnv	Workst	Correlation	Latest	Wor	
Target	Typ	Status	Cnt	User ID	ID	Send/Receive Time	Nam
DEDM	R/S	Active	2	boljxo1	db2bp.exe	2007.061 11:14:30.89	joo
DEDM	R/S	Active	2	boljxo1	db2bp.exe	2007.061 11:13:48.06	joo
DEDM	Srv	Active	1	boljxo	db2bp.exe	2007.061 11:12:53.16	joo
DEDM	Srv	Idle	1	boljxo	db2bp.exe	2007.061 11:11:46.91	joo

Analyzing DDF Thread Data



- › The accounting data is the first source
- › Still analyze other application considerations
 - Elapsed and CPU times, I/O, SQL counts . . .
- › But in addition:
 - Elapsed time inside / outside the DB2 server
 - Number of messages and blocks sent / received
- › Batch reports summarized by
 - The important DDF identifiers for your workloads

Thread Accounting



```

BMC SOFTWARE ----- SUMMARY TRACE ENTRY ----- RX AVAILABLE
SERV ==> STRAC          INPUT  14:37:25  INTVL=> 3  LOG=> N  TGT==> DECE
PARM ==> DIST,SEQ=1    ROW 1 OF 135  SCROLL=> CSR
EXPAND:  MON(WKLD),  DETAIL,  HISTORY
         ACCOUNTING:  ENU,  ELAPSED,  SQLCOUNTS,  BPOOL,  LOCKS,  PRL,  PKG,  RTW,  DDF
         SUMMARIES:  SQL,  SCANS,  IO/LOCK,  SORTS
STOP.....01MAR 13.50.46.11 PLAN.....DISTSERV TYPE.....ALLIED
START.....n/a-ROLLUP  AUTHID.....BOLDJW1  CONNECT.....SERVER/DRDA
ELAPSED.....315 ms  ORIG PRIM AUTH...BOLDJW1  CORR ID.....db2bp.exe
TERM.....DDF/RRSAF #LIMIT  COMMITS.....2  ROLLBACKS.....0
-----
RUNTIME ANALYSIS      IN DB2      IN APPL.      TOTAL      %IN DB2(=)      TOTAL(*)
-----
ELAPSED TIME          46 ms      269 ms      315 ms      |=====|
CPU TIME              1,437 us   626 us     2,064 us   |<-----|
DB2 WAIT TIME        -none-
ZIIP CPU TIME        1,575 us   2,223 us
ZIIP-ELIGIBLE CP      0 us
-----
ACTIVITY              KEY INDICATORS
-----
TOTAL SQL.....6      SQL: SELECT= 0,  FETCH= 2
GETPAGES.....4      SQL: DYNAMIC(PREPARE)= 2
SYNC READS (PRL=00) ..0  DDF/RRSAF ROLL UP RECORD, COUNT= 2
    
```

```

----- ENVIRONMENTAL INDICATORS -----
LUWID.....AC173BD3.B912.0703012146160003
RLF TABLE ID..NOT ACTIVE
----- -Work Station Data- -----
WORKSTATION USER ID...boldjw1      WORKSTATION NAME..dwitkows-SJC-04
WORKSTATION TRANSACTION ID...db2bp.exe
    
```

Tracing Distributed Workloads



- › **Additional focus on one workload**
 - Summary exception trace (accounting)
 - Detail trace with important event IFCIDs
- › **All the usual qualifiers are available**
- › **For DDF, important to reduce the data:**
 - Filter by requesting location
 - Filter by Workstation ID(s)
 - In V9, DB2 also allows qualification by these IDs
- › **Exception Filters can be used to keep only threads that may need analysis (high In-DB2 elapsed, etc.)**

Start Trace Options



```
BMC SOFTWARE ----- REPLICATE DB2 TRACE REQUEST ----- PERFORMANCE MGMT
COMMAND ==>
TGT ==> DECE
TIME -- 14:30:09

PARM    ==> DIST      (Trace Identifier)      START ==>      (hh:mm:ss)
TYPE    ==> D        (S-Summary,D-Detail)     STOP  ==>      (hh:mm:ss/#min)
STORAGE ==> 12800K   (Display buffer size)   WRAP  ==> YES   (Y/N Wrap buffer)
LOGTRAC ==> Y        (Y/N log trace)         RST   ==> HOT   (HOT,PUR,QIS)
TITLE   ==> DBAT TRACE BY REQ. LOC

Specify Selection Criteria:
DB2PLAN ==>
DB2AUTH ==>
DB2LOC  ==> '172.23.59.211'
DB2CONN ==>
DB2CORR ==>
DB2PKG  ==>
CONNTYPE ==> DRDA
Additional Selection ==> Y (Y/N)

Specify additional trace options:      (*=processed)
Exception filters                      ==> Y_ (Y/N)
Detail Trace Options                   ==> Y (Y/N)
Trace Log Data Set Options             ==> Y (Y/N)      ENTER to process; END to cancel
```

Specify End User Work Station Criteria:

```
DB2UID  =>
DB2UTX  =>
DB2UWN  =>
```

Detail Traces



- › Detail traces can include selected event groups
 - Basic thread flow and SQL
 - Also can choose to add scans, I/O, locks
- › Another group to include specific DDF events
 - The volume can be high
 - Use it only when needed
 - To understand the conversation flow
- › Each event has a pop-up view with the IFCID details

Sample DTRAC View



```

BMC SOFTWARE -----  DETAIL TRACE ENTRY  -----  RX AVAILABLE
SERV ==> DTRAC          INPUT   14:42:52  INTVL=> 3  LOG=> N  TGT==> DECE
PARM ==> DIST,SEQ=1,LEVEL=3          ROW 1 OF 18  SCROLL=> CSR
EXPAND: LINESEL(DETAIL), HISTORY
START: 13:50:45 AUTH: BOLDJW1  PLAN: DISTSERV CORR: db2bp.exe  CONN: SERVER
=====
EVENT          AT          ELAPSED      CPU          DETAIL
-----
PKG-ALLOC      0.000
PREPARE  210      0.000 6,033 us    157 us *SQLC2F0A ISO=CS ACQ=USE  REL=COMIT
SQL-TEXT      0.006      *TYPE=DYNAMIC  TEXT=select * from sy+
OPEN  210      0.049   33 us     30 us *RC( 0) C=SQLCUR201
FETCH  210      0.049   270 us    227 us *RC( 100) C=SQLCUR201  D  PS( 2)
SEQ-SCAN      0.049   142 us    102 us *DB=DSNDB06  TS=SYSDDF  TB=LOCATIO+
SERV-DTM      0.138      *TYPE=COMMIT MESSAGE RECEIVED
LOCK-SUMMARY  0.174      *MAXPG(0) ESCL(0) TS( 1)
COMMIT-LSN    0.174      *LOCK-AVOID=Y PAGESETS=1
PKG-ALLOC      1.163
PREPARE  210      1.164   226 us    108 us *SQLC2F0A ISO=CS ACQ=USE  REL=COMIT
SQL-TEXT      1.164      *TYPE=DYNAMIC  TEXT=select * from sy+
OPEN  210      1.210    47 us     44 us *RC( 0) C=SQLCUR201
FETCH  210      1.210   192 us    176 us *RC( 100) C=SQLCUR201  D  PS( 2)
SEQ-SCAN      1.211    87 us     73 us *DB=DSNDB06  TS=SYSDDF  TB=LOCATIO+
SERV-DTM      1.302      *TYPE=COMMIT MESSAGE RECEIVED
LOCK-SUMMARY  1.302      *MAXPG(0) ESCL(0) TS( 1)
COMMIT-LSN    1.302      *LOCK-AVOID=Y PAGESETS=1
***** END OF DETAIL TRACE ENTRIES *****

```



DDF Statistics



- › The next place to look are the statistics
- › Global statistics
 - Critical DB2 subsystem tuning information
- › Location statistics
 - Application impact on DB2 and network
 - DRDA_Remote_Locs (combined)
 - Private Protocol locations (separate)
- › DDF Address Space CPU usage
 - TCB and SRB

Global DDF Statistics - STDISTD



```

W1 =STDISTD=====DECE=====*****01MAR2007==13:33:48====MUDB2
DBAT Statistics Detail.....
Interval      Session
Maximums Reached.....
New DBATs Queued (MAXDBAT).....          0          5
Conversations Deallocated (CONDBAT).....   0          0
New/Resumed (Type 2) DBATs Queued (MAXDBAT) 1         40
Connections Terminated (MAXTYPE1).....    0          0

Status Values.....
Remote Connections - Maximum.....                10
Active DBATs - Current.....                      3
                  - Maximum.....                3
DBAT Slots Not Used - Current.....                0
                  - Maximum.....                1
Type 1 Inactive DBATs - Current.....              0
                  - Maximum.....                1
Type 2 Inactive DBATs - Current.....              6
                  - Maximum.....                6
Type 2 Queued (New/Resumed) - Current.....       2
                  - Maximum.....                4

Two-Phase Commit Activity.....
Cold Start Connections.....                    0          0
Warm Start Connections.....                    0          0
Resync Attempts.....                          0          0
Resync Succeeds.....                          0          0

Statistics.....
Requests that Required a DBAT.....              4
Requests that Used a Pool Thread.....           72
    
```

STDISTD View - Revised



```

W1 =STDISTD=====DECE=====*****01MAR2007==13:36:33====MUDB2==
DDF Global Statistics Detail.....
. DDF ZPARAMS.....
Status - Current and High Water Mark..... Current      HWM
Total DBATs - Active & Pooled.....          3             3
DBATs Pooled for Reuse (Type 2).....        0             1
Inactive DBATs (Type 1).....                0             1

Total Remote Connections.....                10
Type 2 Inactive Connections.....            6             6
Type 2 Connections Queued for DBAT.....     3             4

Maximums Reached..... Interval      Session
Queued for DBAT (MAXDBAT Reached).....      1             6
Connections Deallocated (CONDBAT Reached)..... 0             0
Type 1 Connections Terminated (MAXTYPE1 Reached) 0             0

DBAT Usage Statistics..... Interval      Session
New DBATs Created.....                      4             4
Pooled DBATs Reused.....                    72            72
New/Resumed (Type 2) Requests.....          2             41

Two-Phase Commit Activity..... Interval      Session
Cold Start Connections.....                 0             0
Warm Start Connections.....                 0             0
Resync Attempts.....                        0             0
Resync Succeeds.....                        0             0
Resync Failures.....                        0             0
    
```


Exception Monitoring



- › Review your current exceptions
 - Are DDF conditions being monitored?
- › Statistics
 - DBAT high water mark
 - Queuing for a DBAT?
 - DDF still active?
 - DBM1 storage usage
- › Accounting
 - Focus on DDF service levels
 - Filter for DBATs / most important work
 - Elapsed time / CPU usage

DDF-Related ZPARM Review



- › CMTSTAT – DDF Threads
- › IDTHTOIN – Idle Thread Timeout
- › TCPKPALV – TCP/IP Keepalive
- › POOLINAC – Pool Thread Timeout
- › ACCUMACC and ACCUMUID
- › MAXTYPE1 (PP) – Max Inactive DBATs
- › KEEPDYNAMIC(YES) / MAXKEEPD
- › EXTRAREQ / SRV – Extra Blocks REQ / SRV
- › And of course:
 - MAXDBAT – Max Remote Active
 - CONDBAT – Max Remote Connected

DDF ZPARM View



```

W1 =ZPDDFD=====DECE=====*****=27FEB2007==19:23:12====MUDB2=
. PREU
. STATS
DDF - Dist Data Facility Definitions.....
Local Location..... DECE
DDF Startup Facility Name..... DDF
DDF Start Option.....(DDF)..... AUTO
Database Protocol for 3-Part Names.....(DBPROTCL).. DRDA
DDF Max Number of Facility Entries..... 1
DBAT Status after Commit.....(CMTSTAT).. INACTIVE
Idle Thread Timeout (Seconds).....(IDTHTOIN).. 1200
Minutes between Resync Periods.....(RESYNC)... 2
TCP/IP KEEPALIVE.....(TCPKPALU).. ENABLE
DDF Interval Cycle Frequency.....(SPRMINT)... 120
DDF Queued Conversation Time.....(SPRMQCT)... 120
DDF Receive Buffer Size.....(SPRMDRB)... 30720
Max Extra DRDA Query Blocks for DB2 Req... (EXTRAREQ).. 100
Max Extra DRDA Query Blocks for DB2 Sur... (EXTRASRU).. 100
Check Connection State.....(PKGLDTOL).. n/a
DBAT Thread Controls.....
. STATS
Max Concurrent Database Access Threads....(CONDBAT)... 10000
Maximum Remote Database Access Threads....(MAXDBAT)... 3
Maximum Type 1 Inactive Threads.....(MAXTYPE1).. 10
DDF Pool Thread Timeout Value.....(POOLINAC).. 1200
DDF-Related Authorization.....
Extended Security.....(EXTSEC)... N
ID Sent to Second Server.....(HOPAUTH)... BOTH
Accept Already Verified TCP/IP Connects... (TCPALVER).. Y
DDF RLF Access Error Parameter.....(RLFERRD)... NOLIMIT
DDF RLF Service Unit Limit.....(RLFERRD)... 0
. NEXT
  
```

DDF Resource Usage



- › CPU – TCB and SRB
 - In the DIST address space
 - Management of the DBATs and connections
 - For the threads themselves (enclave SRBs)
- › DBM1 storage (MAXDBAT, and CTHREAD)
 - Management of thread storage is critical
- › DIST address space
 - Storage likely not an issue (CONDBAT)
- › Dynamic SQL cache
 - Most distributed SQL is still dynamic
 - The cache is critical for good performance
 - Aim for an 80% or better hit ratio for SQL reuse

DBM1 Storage – DB2STORD View



W1 =DB2STORD=====DECE=====*****27FEB2007==19:25:03

DBM1 And MUS Storage Usage..... Quantity in MB

DBM1 Storage Summary Below 2 GB.....

Storage Available to DBM1.....	1515.32
Total DBM1 Storage In Use (1).....	58.27
Total MUS Storage In Use Below 2GB (5)..	106.67
Storage Cushion (4).....	118.61
Average Thread Footprint.....	0.84
Maximum Number of Possible Threads.....	1611



1) Total DBM1 Storage In Use..... 58.27

Total Getmained Storage (2).....	32.68
Total Variable Storage (3).....	17.70
Total Fixed Storage.....	0.11
Total Getmained Stack Storage.....	7.78

3) Total Variable Storage..... 17.70

Total Agent Local Storage.....	15.19
Total Agent System Storage.....	14.12
Number of PreFetch Engines.....	135
Number of Deferred Write Engines....	15
Number of Castout Engines.....	0
Number of GBP Write Engines.....	0
Number of P-Lock/Notify Exit engines	0
Total Agent Non-System Storage.....	1.07
Total Number Of Active User Threads..	1
Total Number of Active DBATs.....	1
Thread High Water Mark.....	9
DBAT High Water Mark.....	3



Dynamic Cache – STCACHED View



```
W1 =STCACHED=====DECE=====*=27FEB2007==19:31:43
```

Dynamic SQL Cache Details.....

. SQL Cache Statement Analysis.....

SQL Cache in Statement Pool.....

Total Pages.....		25600
Pages Used.....	0.07	17
Free Pages.....	99.93	25583

Global Cache Usage..... Interval Session

Requests.....	0	8
Inserts.....	0	6
Found in Cache(Short Prepare).....	0	2.0
Not Found in Cache(Long Prepare)....	0	6
Global Cache Hit Ratio.....	0.0	25.0
Failures - Data Space Full.....	n/a	n/a
Failures - Statement Pool Full.....	0	0



Local Cache Effectiveness..... Interval Session

Avoided PREPARE (Match).....	0	0
Implicit PREPARE (No Match).....	0	0
Local Cache Hit Ratio.....	0.0	0.0
Statement Discarded (>MAXKEEPD)....	0	0
Statement Purged (Drop/Alter/Revoke)	0	0



Extended Reporting



- › Distributed workloads are often volatile
 - Less insight and control
- › Can be useful to track activity over time
 - Store and query summary data in DB2 tables
- › When needed, distributed traces and monitoring
- › z/OS reporting on WLM can be helpful
 - Enclaves – SMF 30
 - Workloads by service class – SMF 72
- › MVzOS provides online views as well as reports



Questions?