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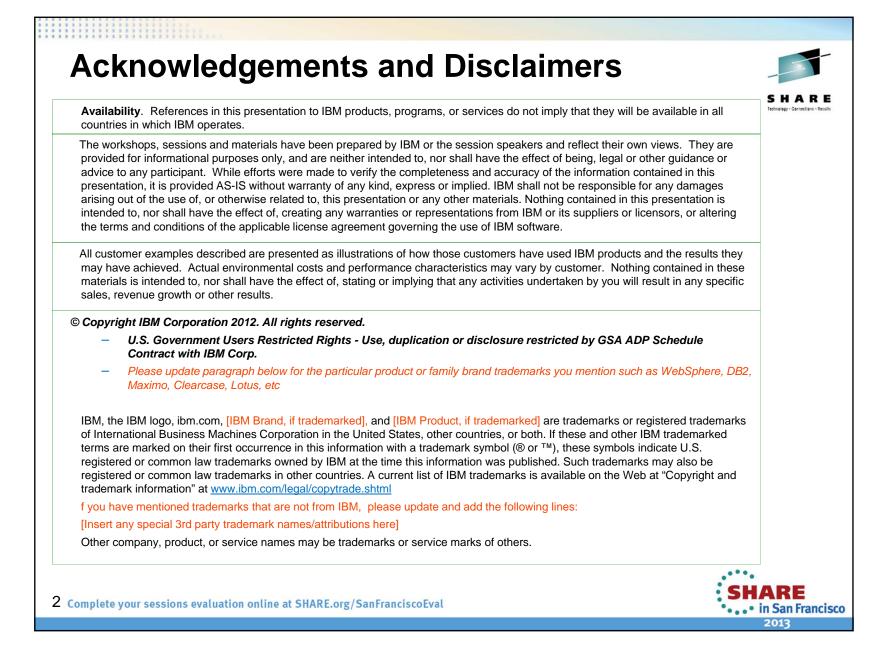


Master Data Management with DB2 for z/OS Hints and Tips to Run an IBM WebSphere Application Successfully

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2/6/2013 Session Number 12797





Agenda

-5

- Overview
- Infrastructure Setup
 - DB2 for z/OS for distributed Java applications
 - WebSphere Application Server
- Application Design Hints and Tips
 - DDL recommendations
 - Java coding best practice
- Application Performance
 - DB2 reports
 - Dynamic statement cache statistics and SQL tuning
 - Locking and concurrency
- Summary

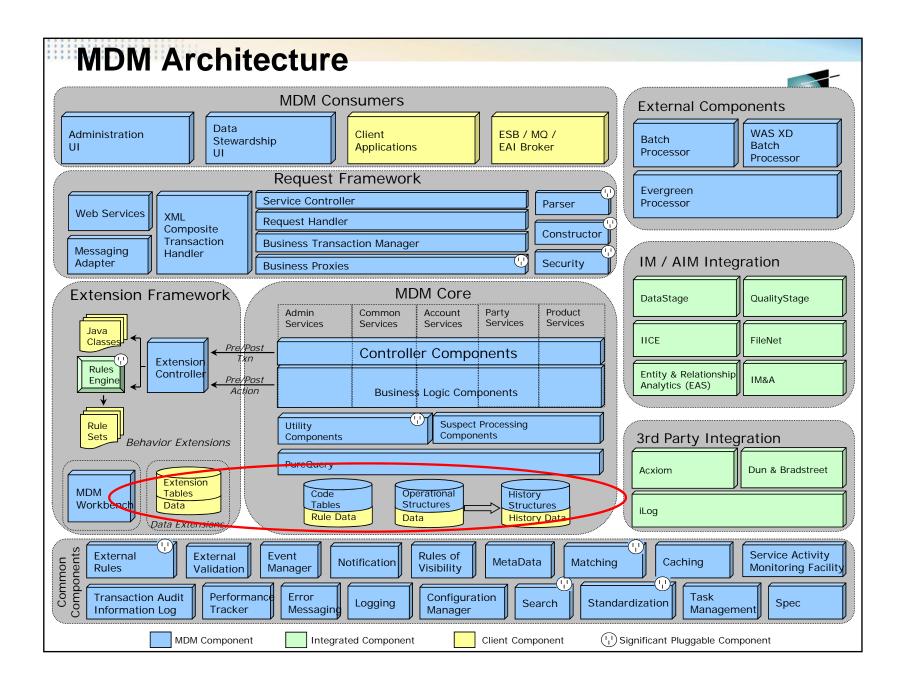


What is InfoSphere Master Data Management (MDM)?



- From a business perspective
 - InfoSphere MDM manages master data for single or multiple domains – customers, citizens, suppliers, locations, products, services offerings, accounts or more
- From a technical perspective
 - It is a product using J2EE technology running in distributed WebSphere environment accessing the database via a JDBC type 4 driver
 - Provides pre-built and extensible data models
- From a DB2 for z/OS perspective
 - Very normalized data model which leads to many SQL per transaction
 - Uses random-random key by default, can be customized
- Uses triggers to maintain history tables 4 Complete your sessions evaluation online at SHARE.org/SanFranciscoEval





Business Value of MDM with DB2 for z/OS

- System Z and z/OS is centered around efficient sharing of resources
 - Tight integration between hardware, operating system, and subsystems
 - Proven disaster recovery capabilities
 - Workload Manager (WLM)
 - Mature systems management tools
- zEnterprise provides centrally managed environment for distributed application across X, P, Z
- DB2 for z/OS hosting enterprise databases
 - Unmatched availability
 - Unparalleled security







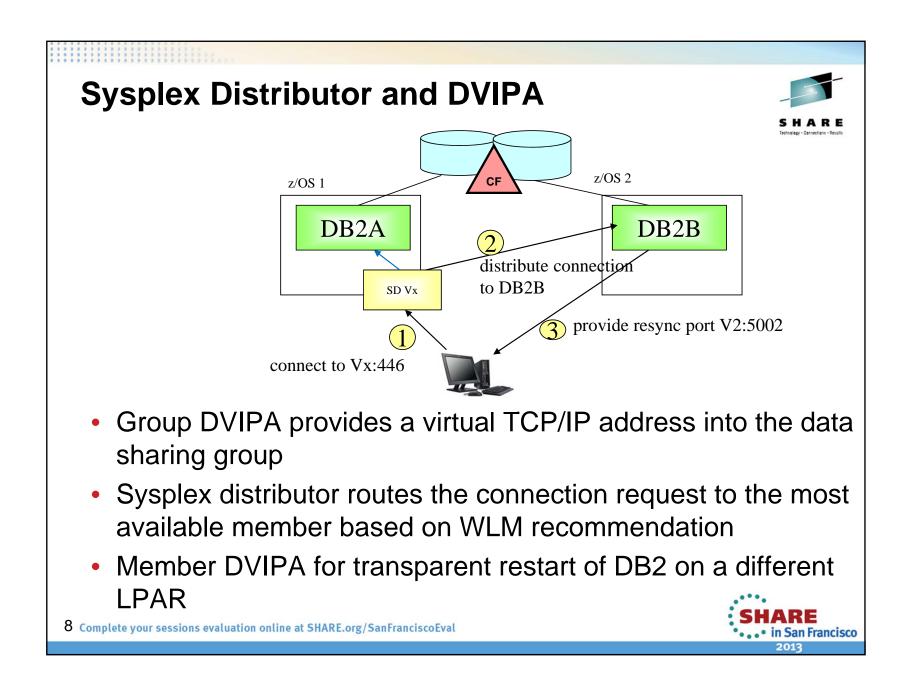
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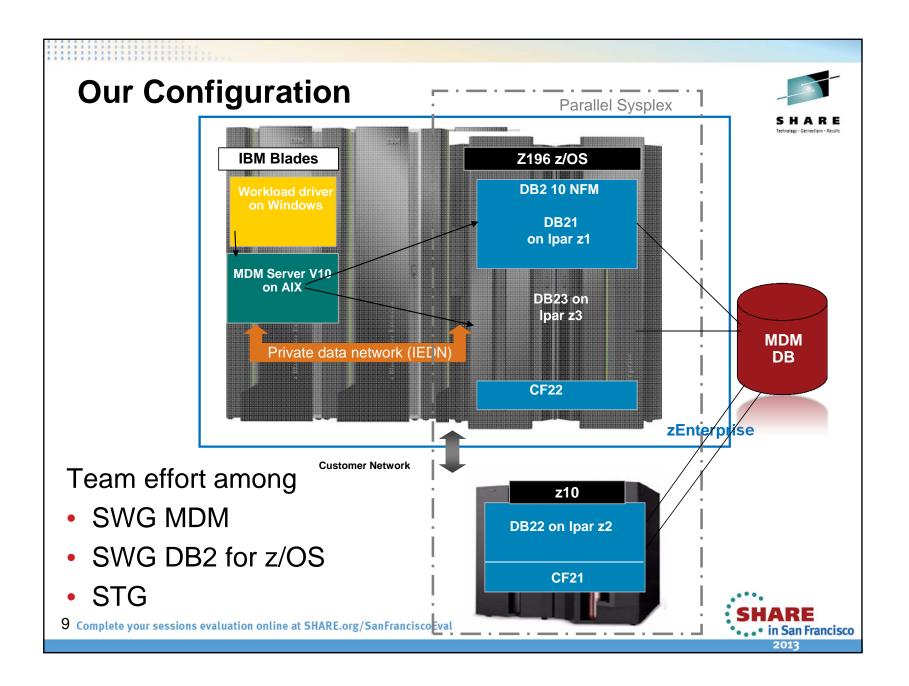
Database Related Infrastructure Setup

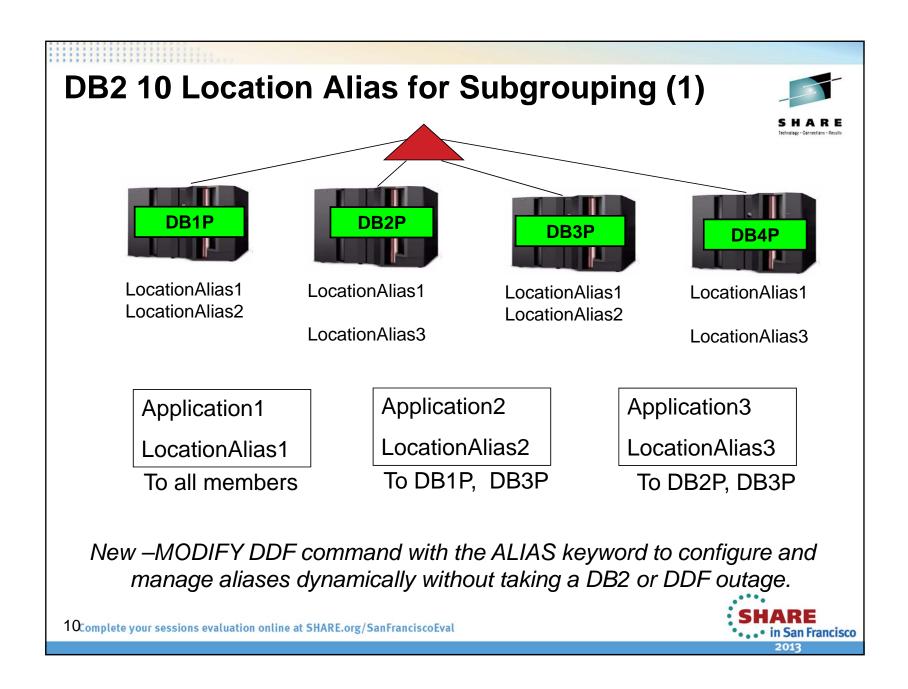
- DB2 setup for distributed Java applications
 - Group and member DVIPA
 - Provides continues availability for distributed access to DB2 group
 - DB2 location alias for sub grouping
 - Our choice to setup location alias for 2 member subgroup to limit MDM workload execution to 2 members on z196
 - DB2 10 High Performance DBAT
 - Review relevant zParms
 - WLM
- WebSphere Application Server
 - Data source properties for sysplex workload balancing
 - Connection pool properties

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DB2 Location Alias for Subgrouping (2)



- DB2 10 MODIFY DDF command with the ALIAS keyword to configure and manage aliases dynamically without taking a DB2 or DDF outage
 - Values are stored in the DDF communication record of DB2 BSDS and used during DDF start processing
- Example:
 - MODIFY DDF ALIAS(WQ2G13) ADD
 - Alias1 is created and is stopped by default.
 - MODIFY DDF ALIAS(WQ2G13) PORT(50260)
 - Alias1 is associated with port 50260.
 - MODIFY DDF ALIAS(WQ2G13) START
 - DDF will accept requests for WQ2G13 on port 50260. When a client connects to WQ2G13, member IP address is returned in the server list.
 - MODIFY DDF ALIAS(WQ2G13) STOP

WQ2G13 is stopped and will not accept new requests. Existing requests will be allowed to complete.



DB2 High Performance DBAT



- High Performance DBATs reduce CPU consumption by
 - Supporting RELEASE(DEALLOCATE) to avoid repeated package allocation/deallocation
 - Avoids processing to go inactive and then back to active
- Enable High Performance DBAT
 - BIND client packages into different collection coll2 with RELEASE(DEALLOCATE)
 - BIND other frequently executed packages with RELEASE(DEALLOCATE)
 - In case of MDM REBIND trigger packages
 - Set -MODIFY DDF PKGREL(BNDOPT) to enable
- In WAS datasource property definition point to new collection
 - E.g. jdbcCollection=coll2



ZPARM Values for Distributed Access CONDBAT Includes inactive and active connections, may be large DB2 gueues DBAT requests to become active up to CONDBAT MAXDBAT Incl. V9, max. value could be limited by available storage in DBM1 (check IFCID 225) **CMTSTAT INACTIVE** prerequisite for sysplex workload balancing inactive connections use little storage in DIST and free up DBM1 resources **IDTHTOIN** • inactive connections are not subject to idle thread timeout Strongly recommended to not set to 0 – disable, default works well DB2 WAS DB2 zparm: **Connect/JCC:** Connection •MAXDBAT •max Agents/ Pool: ◆ •CONDBAT Transports •unused •IDTHTOIN •Connections timeout •DB2 MAX •max CLIENT connection CONNRETRIES) 13Complete your sessions evaluation online at SHARE.org/SanFranciscoEval in San Francisco 2013

-DISPLAY DDF Sample



DSNL0801 @WQ21 DSNLTDDF DISPLAY DDF REPORT FOLLOWS: DSNL081I STATUS=STARTD DSNL082I LOCATION LUNAME **GENERICLU** USIBMT6.DB2WQ21 -NONE DSNL083I USIBMDB2WQ2G DSNL084I TCPPORT=50200 SECPORT=0 RESPORT=50201 IPNAME=-NONE DSNL0851 IPADDR=::10.20.10.35 DSNL086I SQL DOMAIN=wq2q.pokprv.stglabs.ibm.com DSNL086I RESYNC DOMAIN=wg21.pokprv.stglabs.ibm.com SECPORT STATUS DSNL087I ALIAS PORT DSNL088I WQ2G1 50210 0 STARTD DSNL088I WQ2G12 50240 0 STARTD DSNL088I WQ2G13 50260 0 STARTD DSNL0891 MEMBER IPADDR=::10.20.10.31 DSNL090I DT=I CONDBAT= 10000 MDBAT= 200 DSNL092I ADBAT= 1 QUEDBAT= 0 INADBAT= 0 CONQUED= 0 DSNL093I DSCDBAT= 0 INACONN= 3 DSNL1001 LOCATION SERVER LIST: DSNL1011 WT IPADDR IPADDR DSNL102I 34 ::10.20.10.31 DSNL1021 17 :: 10.20.10.32 DSNL102I 11 ::10.20.10.33 **DSNL105I CURRENT DDF OPTIONS ARE:** DSNL106I PKGREL = BNDOPT DSNL099I DSNLTDDF DISPLAY DDF REPORT COMPLETE



WebSphere Connection Pool Properties

- Connection Timeout
 - How long to attempt connection creation before timeout
- Max Connections
 - Max connections from JVM instance
- Min Connections
 - Lazy minimum number of connections in pool
 - Consider setting min connections to 0 (zero) to free up unused resources in DB2 in a controlled way and to reduce the exposure of long living threads
- Reap Time
 - · How often cleanup of pool is scheduled in seconds
- Unused Timeout
 - How long to let a connection sit in the pool unused
 - Set WAS "connection unused time" to a smaller value than DB2 "idle thread timeout" to avoid stale connection conditions.
- Aged Timeout
 - How long to let a connection live before recycling
 - Set to 2 5 min if JCC type 2 on z/OS and JCC package bound with RELEASE(DEALLOCATE)
- Statement Object Cache



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resour additio		s that you conf	nterprise information system (EIS) req figure. For example, most database vi ss the database.	
New	Delete			
D	Ē ₩ ₽			
Select	Name 🗘	Value 🗘	Description 🗇	Required 🗘
You c	an administer the following resour	ces:		
	user	tsomdmdb		false
	password	****		false
	webSphereDefaultIsolationLevel	2	Set isolation level to TRANSACTION_READ_COMMITTED	false
	downgradeHoldCursorsUnderXa	true	Set for execution of BatchProcessor	false
	useRRASetEquals	true	Set for pME	false
	<u>currentSchema</u>	MDMPRF01		false
	<u>keepDynamic</u>	0		false
	idbcCollection	M10RELDA		false
Г	enableSysplexWLB	true		false



JDBC and DB2 Isolation Level



Possible values	JDBC Isolation Level	DB2 Isolation Level
8	TRANSACTION_SERIALIZABLE	Repeatable Read (RR)
4 (default)	TRANSACTION_REPEATABLE_READ	Read Stability (RS)
2	TRANSACTION_READ_COMMITTED	Cursor Stability (CS)
1	TRANSACTION_READ_UNCOMMITTED	Uncommitted Read (UR)



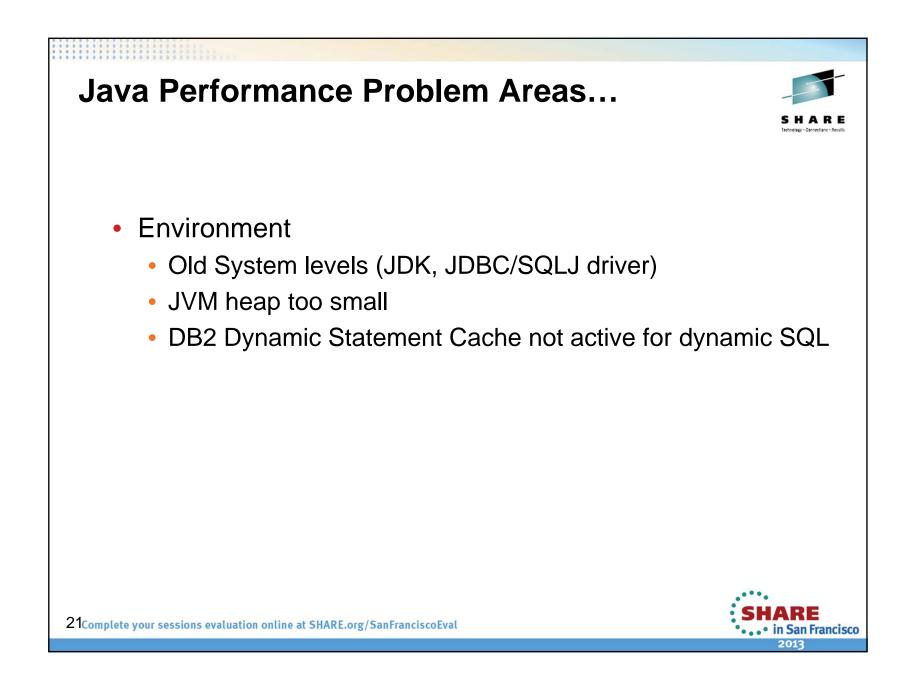
DDL Recommendation



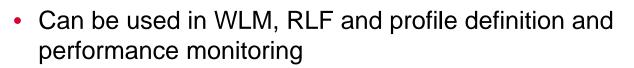
- DB2 behavior is influenced by DDL definitions, requires no application changes
 - Use COMPRESS YES
 - Strategic table space type is UTS (PBR and PBG) since DB2 10
 - UNICODE
 - CLOSE YES
 - TRACKMOD(NO) if not using incremental image copies
 - Review key generation algorithm, partitioning ranges, clustering
 - Choice of clustering index



Java Performance Problem Areas... Java Application autocommit(true) - default Mismatch of Java and DB2 data types Usage of String for numbers Retrieval of unused columns (select *) Transaction isolation JDBC • JDBC resources not closed (cursor, statements, connections) No usage of Parameter Markers E.g. select c1, c2 FROM t1 WHERE c3=? Cursor declared as WITH HOLD Usage of Statement() instead of preparedStatement() objects No object caching in WAS 20complete your sess in San Francisco



Use ClientInfo fields



- WebSphere Application Server Version 6.0 supports explicit and implicit setting of client information
 - Example how to call explicitly
 - ...

WSConnection conn = (WSConnection) ds.getConnection();

props.setProperty(WSConnection.CLIENT_ID, "user123");

conn.setClientInformation(props);

 Example how to call implicitly by turning on WebSphere Trace Group

WAS.clientinfo=all=enabled or

WAS.clientinfopluslogging=all=enabled

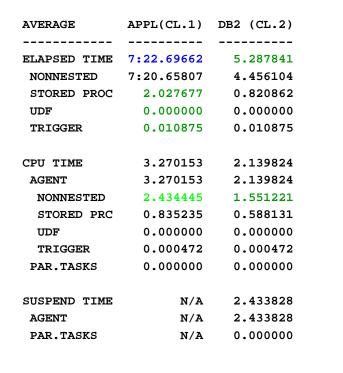


Using DB2 Accounting Reports (1)

Processing "in DB2" (Class 2) should be

the same regardless of connection type

- Time in DB2 is:
 - Local Access:
 - CL.2 non-nested ET +
 - CL.1 SP, UDF, trigger ET
 - Distr. Access:
 - CL 2 non-nested ET +
 - CL.1 SP, UDF, trigger ET +
 - Nonnested (CL.1 CPU CL.2 CPU)
- Time outside DB2 is
 - Total CL.1 ET time in DB2
 - (previous calculation)
 - Total CL.1 ET also includes idle time when thread is reused
 - Local Access: CPU spent in app.
 - Nonnested (CL.1 CPU CL.2 CPU)







SHARE Technology - Connections - Results

Sample Accounting Report



AVERAGE	APPL(CL.1)	DB2 (CL.2)	IFI (CL.5)	CLASS 3 SUSPENSIONS	AVERAGE TIME	AV.EVENT	HIGHLIGHTS	Technology - Connections - Results
ELAPSED TIME	0.373569	0.311756	N/P	LOCK/LATCH(DB2+IRLM)	0.000975	0.73	#OCCURRENCES	: 194840
NONNESTED	0.322622	0.260809	N/A	IRLM LOCK+LATCH	0.000485	0.07	#ALLIEDS	: 0
STORED PROC	0.00000	0.00000	N/A	DB2 LATCH	0.000491	0.65	#ALLIEDS DISTRIB	: 0
UDF	0.00000	0.00000	N/A	SYNCHRON. I/O	0.062437	76.58	#DBATS	: 194840
TRIGGER	0.050947	0.050947	N/A	DATABASE I/O	0.061659	76.05	#DBATS DISTRIB.	: 0
				LOG WRITE I/O	0.000777	0.53	#NO PROGRAM DATA	: N/P
CP CPU TIME	0.011996	0.010076	N/P	OTHER READ I/O	0.013563	4.96	#NORMAL TERMINAT	: 0
AGENT	0.011996	0.010076	N/A	OTHER WRTE I/O	0.000654	0.53	#DDFRRSAF ROLLUP	: 9742
NONNESTED	0.010812	0.008892	N/P	SER.TASK SWTCH	0.000091	0.01	#ABNORMAL TERMIN	: 0
STORED PRC	0.00000	0.00000	N/A	UPDATE COMMIT	0.00000	0.00	#CP/X PARALLEL.	: 0
UDF	0.00000	0.00000	N/A	OPEN/CLOSE	0.000030	0.00	#IO PARALLELISM	: 0
TRIGGER	0.001184	0.001184	N/A	SYSLGRNG REC	0.00028	0.01	#INCREMENT. BIND	: 0
PAR.TASKS	0.00000	0.00000	N/A	EXT/DEL/DEF	0.000022	0.00	#COMMITS	: 194934
				OTHER SERVICE	0.000011	0.00	#ROLLBACKS	: 12
SECP CPU	0.001209	N/A	N/A	ARC.LOG(QUIES)	0.00000	0.00	#SVPT REQUESTS	: 0
				LOG READ	0.00000	0.00	#SVPT RELEASE	: 0
SE CPU TIME	0.012823	0.010668	N/A	DRAIN LOCK	0.001883	0.95	#SVPT ROLLBACK	: 0
NONNESTED	0.011492	0.009338	N/A	CLAIM RELEASE	0.00000	0.00	MAX SQL CASC LVL	: 1
STORED PROC	0.00000	0.00000	N/A	PAGE LATCH	0.005021	1.93	UPDATE/COMMIT	: 6.63
UDF	0.00000	0.00000	N/A	NOTIFY MSGS	0.00000	0.00	SYNCH I/O AVG.	: 0.000815
TRIGGER	0.001330	0.001330	N/A	GLOBAL CONTENTION	0.059414	34.84		
				COMMIT PH1 WRITE I/O	0.00000	0.00		
PAR.TASKS	0.00000	0.00000	N/A	ASYNCH CF REQUESTS	0.041127	34.56		
				TCP/IP LOB XML	0.00000	0.00		
SUSPEND TIME	0.00000	0.185165	N/A	TOTAL CLASS 3	0.185165	155.09		
AGENT	N/A	0.185165	N/A					
PAR.TASKS	N/A	0.00000	N/A				_	
STORED PROC	0.00000	N/A	N/A	I ook	alen at	RMF (CPU Activi	ty and
UDF	0.00000	N/A	N/A		also al			ty and
NOT ACCOUNT. DB2 ENT/EXIT	N/A N/A		N/A N/A	Coup	ling Fac	cility A	ctivity repo	orts
EN/EX-STPROC	N/A N/A	0.00	N/A N/A					
TIN/ EX-SIPROC	IV / M	0.00	IN / A					



Using DB2 Accounting Report (2)

- JDBC executes dynamic SQL
 - Check DB2 dynamic statement cache

DYNAMIC SQL STMT	AVERAGE	TOTAL	DYNAMIC SQL	STMT	AVERAGE	TOTAL
REOPTIMIZATION	0.00	0	REOPTIMIZATI	ON	0.00	0
NOT FOUND IN CACHE	0.06	12058	NOT FOUND IN	I CACHE	0.00	0
FOUND IN CACHE	0.00	273	FOUND IN CAC	HE.	11.78	3115688
IMPLICIT PREPARES	0.00	0	IMPLICIT PRE	PARES	0.00	0
PREPARES AVOIDED	0.00	0	PREPARES AVC	IDED	0.00	0
CACHE_LIMIT_EXCEEDED	0.00	0	CACHE_LIMIT_	EXCEEDED	0.00	0
PREP_STMT_PURGED	0.00	0	PREP_STMT_PU	IRGED	0.00	0
 Distributed acc Check distributed DISTRIBUTE REQUESTER 			SQL DML SELECT INSERT UPDATE DELETE	0.00 1.00 1.00	29 0	
SQL RECEIVED MESSAGES SENT MESSAGES RECEI BYTES SENT BYTES RECEIVED MESSAGES IN BU ROWS SENT BLOCKS SENT	: 2.00 : 4.00 : 4.00 : 713. : 616. : 516. : 15.1	93 00 88 4	DESCRIBE DESC.TBL PREPARE OPEN FETCH CLOSE	0.00 0.00 1.00	-	
25Complete your sessions evaluation o	nline at SHARE.org	/SanFranciscoEv	DML-ALL	17.14	497	SHARE •••• in San Francisco
						2013



Dynamic Statement Cache Statistics



San Francisco

- Create DSN_STATEMENT_CACHE_TABLE to hold the SHARE statistics
 - Sample job DSNx10.SDSNSAMP(DSNTESC)
- START TRACE(P) CLASS(30) IFCID(316,317,318)
 - IFCID 316 contains the first 60 bytes of SQL text and execution statistics
 - IFCID 317 captures the full text of the SQL statement
 - IFCID 318 enables collecting the statistics
- Run the workload
- Issue statement EXPLAIN STMTCACHE ALL
 - Puts all the statements from the global cache and statistics information into DSN_STATEMENT_CACHE_TABLE
- Stop the performance trace
- Evaluate the cached dynamic statements performance by selecting on the inserted rows from the DSN_STATEMENT_CACHE_TABLE table



SHARE Technology - Connections - Result

Dynamic Statement Cache Statistics

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1	STAT_EXEC	STAT_GPAG	Avg_GPAG	STAT_EROW	STAT_PROW	STAT_SORT	STAT_INDX	STAT_RSCN	STAT_ELAP	STAT_CPU	STMT_TEXT
2	254634	19169138	75.28	254634	254634	0	254634	0	8432.114261	722.263	UPDATE LOCATIONGROUP SET LAST
3	254634	1580039	6.21	254634	254634	0	254634	0	5823.524417	169.371021	UPDATE CONTACTMETHODGROUP 5
4	127451	254961	2.00	0	127451	0	0	0	2010.754211	98.163196	INSERT INTO ADDRESS (LAST_UPDA1
5	254635	2843838	11.17	254639	254635	0	254635	0	3398.618713	217.631793	UPDATE CONTACTMETHOD SET LAS
6	127451	640620	5.03	3	1	0	127453	0	1362.365295	12.359935	SELECT LOCATIONGROUP.CONT_ID
7	127451	1274565	10.00	0	127451	0	0	0	1245.035217	102.210987	INSERT INTO PERSONNAME (LAST_U
8	4468	67014	15.00	13404	13404	0	13404	0	35.590686	1.177051	SELECT CONT_ID FROM CONTACT W
9	381627	6963157	18.25	774078	387036	381627	1542741	0	2925.884826	135.75365	SELECT PERSONNAME.GIVEN_NAME
10	254635	2546354	10.00	509270	254635	0	509270	0	1599.976379	46.772632	SELECT CONTACTMETHODGROUP.LC
11	1881111	58366712	31.03	9405137	1881111	3762221	9405488	13167776	10583.02832	1525.357727	SELECT CONTACT.LAST_VERIFIED_D
12	127451	1274687	10.00	2	127451	0	0	0	677.612121	78.515506	INSERT INTO IDENTIFIER (LAST_UPD,
13	387036	5761133	14.89	1160913	386971	0	1548014	0	2012.469787	95.110828	SELECT ADDRESSGROUP.LOCATION
14	17115	171133	10.00	34230	34230	0	34230	0	86.325321	3.131588	SELECT CONT_ID FROM CONTACT W
15	127451	254936	2.00	0	127451	0	0	0	559.817444	72.64899	INSERT INTO CONTACT (LAST_UPDA
16	127451	1274599	10.00	0	127451	0	0	0	533.54718	67.241306	INSERT INTO PERSON (LAST_UPDATE
17	127451	255140	2.00	8	127451	0	0	0	523.783996	63.988834	INSERT INTO CONTACTMETHOD (LAS
18	127451	2295390	18.01	4	127451	0	0	0	450.547668	63.055606	INSERT INTO CONTACTMETHODGRO
19	1881111	48529656	25.80	7523257	1880813	0	15047103	0	6529.708011	681.098938	SELECT LOCATIONGROUP.LAST_USE
20	97202	1506843	15.50	2	97202	0	0	0	335.98053	50.87688	INSERT INTO SUSPECT (LAST_UPDAT
21	127451	2294744	18.00	0	127451	0	0	0	404.56427	92.168506	INSERT INTO PERSONSEARCH (LAST
22	1881111	44875757	23.86	7523260	1880815	0	13166296	0	5880.524417	490.387024	SELECT LOCATIONGROUP.CONT_ID



DB2 10 – Simplified Performance Analysis of Dynamic SQL



in San Francisco

- Static SQL packages can be bound with explain to review access path
- EXPLAIN of dynamic SQL without changing existing source code via DB2 special register
 - NO default
 - YES PLAN tables are populated and statements are executed
 - EXPLAIN PLAN tables are populated, SQL is not executed Intended for tooling without execute authority
- In JCC via connection property currentExplainMode
 - JCC flows CURRENT EXPLAIN MODE special register setting from the connection property on behalf of application
 - PLAN tables are populated as statements execute
 - STMTCACHE table is populated if IFCID 316,317,318 started

SQL Tuning



- Use dynamic statement cache statistics to identify top-10 frequently executed SQL and top-10 SQL with most CPU consumption
- Consider consolidating repetitive small queries with large queries with JOINs, use DB2 join rather than application join.
- Use inline extension rather than external extension
 - Explosion of SQL
- Use DB2 10 system time instead of triggers to populate history tables

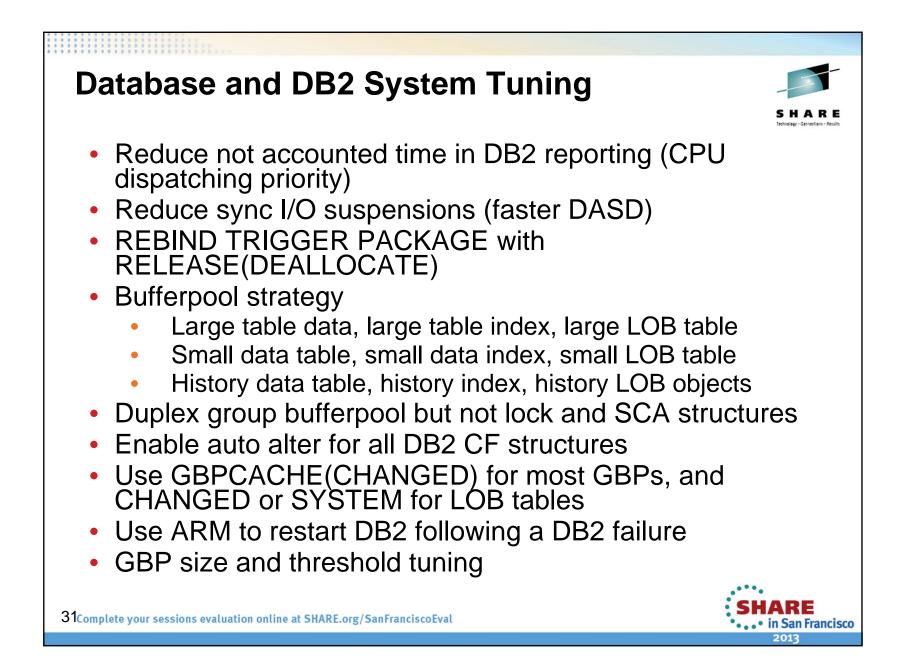


Locking and Concurrency



- If deadlocks and timeouts, turn on DB2 Performance Trace class(6)
 - Use LOCKSIZE ROW selectively for top reported tables
 - Combine with MEMBER CLUSTER if data sharing to reduces page P-lock and page latch contention on data pages
 - Can be defined via deferred ALTER/REORG in DB2 10
- Review indexes
 - Missing index causing table scan and deadlocks
 - Drop unused indexes and RIs
- Zparm SKIPUNCI skip uncommitted inserts for ISOLATION(CS|RS)
- Zparm EVALUNC evaluated uncommitted data for ISOLATION(CS|RS)





Summary



- Business critical distributed WebSphere applications with DB2 for z/OS as enterprise database server have been implemented commonly and successfully for a couple of years now
- Going through installation checklist is highly recommended prior to each implementation to ensure success
 - Communication among WAS Administrator, DB2 System Programmer, and Application Architect
- No shortcuts in respect to setup for availability
 - User sees application availability and not DB2 system availability
- Monitor and react proactively and do not wait until users complain

Workload behavior changes over time



References



- Redbook SG24-7817, System z Parallel Sysplex Best Practices, Part 4 DB2 sysplex best practices in <u>http://www.redbooks.ibm.com/redpieces/abstracts/sg2478</u> <u>17.html</u>.
- SC19-2973-04, DB2 10 for z/OS Data Sharing: Planning and Administration.
- IBM developerWorks DB2 for z/OS with best practices presentations. Please refer to

http://www.ibm.com/developerworks/data/bestpractices/db 2zos/



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Closing Slide - Master Data Management with DB2 for z/OS Hints and Tips to Run an IBM WebSphere Application Successfully

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2/6/2013 Session Number 12797

