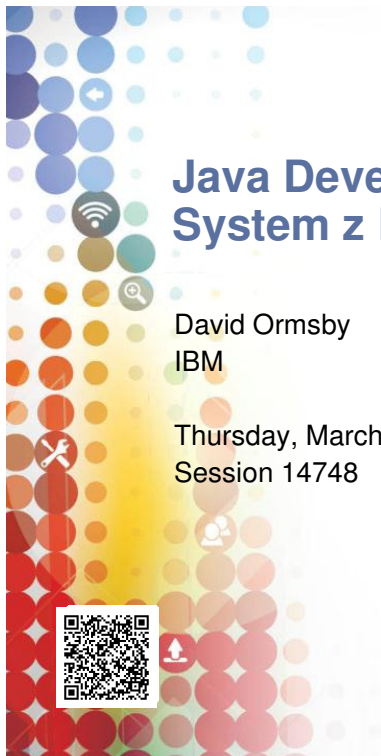
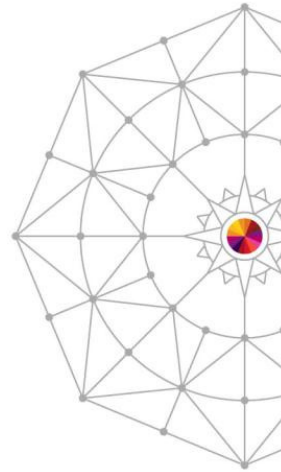




Java Development on System z Best Practices

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IBM

Thursday, March 13, 2014
Session 14748



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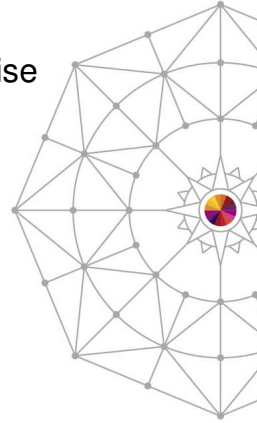
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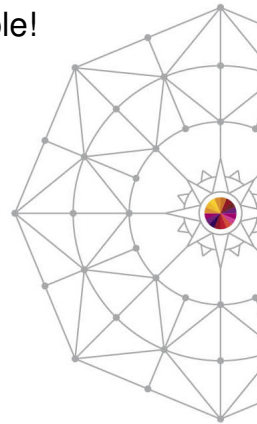
Session Objectives and Agenda

- IMS and Java
- Identifying the QoS needed for your enterprise
- Performance best practices

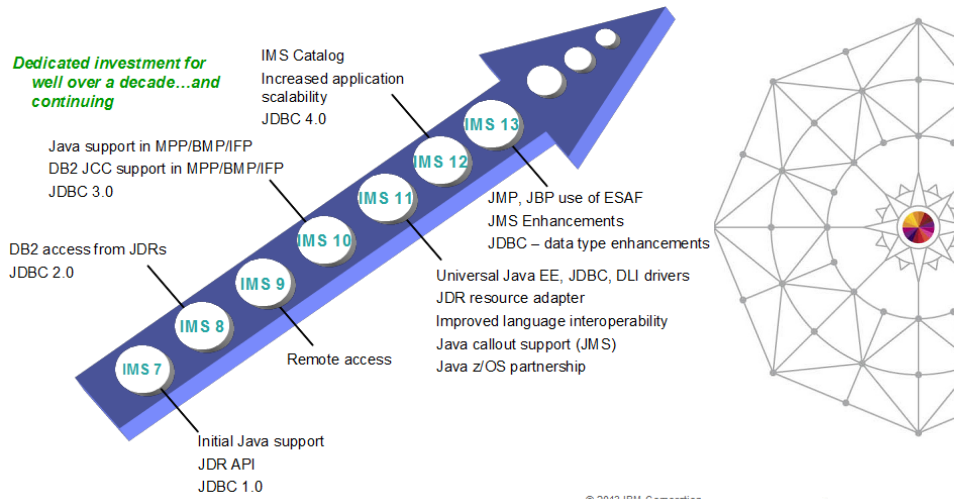


IMS and Java

- Making your IMS assets more widely available!



IMS and Java: IMS 7 to IMS 13 highlights



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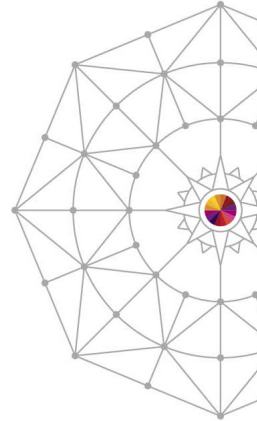
IMS Open Database

- Solution statement
 - Extend the reach of IMS data
 - Offer scalable, distributed, and high speed local access to IMS database resources
- Value
 - Business growth
 - Allow more flexibility in accessing IMS data to meet growth challenges
 - Market positioning
 - Allow IMS databases to be processed as a standards-based data server

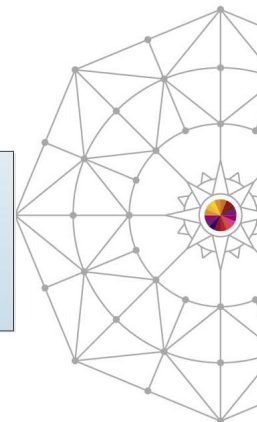
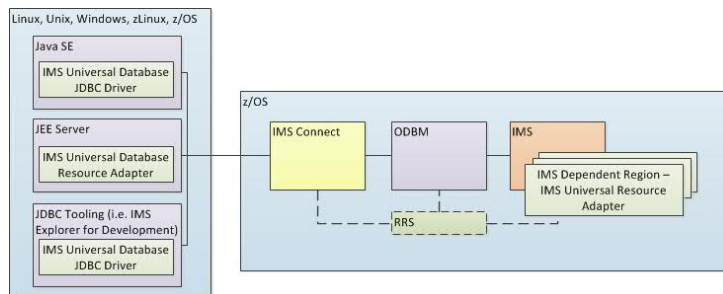
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IMS Open Database

- Key differentiators
 - Standards based approach
 - Java Connector architecture, JDBC, SQL, DRDA
 - Solution packaged with IMS
- Enables new application design frameworks and patterns
 - JCA 1.5 (Java EE)
 - JDBC



IMS Open Database Architecture



NOTE: Performance is based on measurements and projections using IMS benchmarks in a controlled environment. The results that any user will experience will vary depending upon many factors, including considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, the amount of zIIP capacity available during processing, and the workload processed. Therefore, results may vary significantly and no assurance can be given that an individual user will achieve results similar to those stated here. Results should be used for reference purposes only.

The test scenarios (hardware configuration and workloads) used in this document to generate performance data are not considered 'best performance case' scenarios. Performance may be better or worse depending on the hardware configuration, data set types and sizes, and the overall workload on the system.

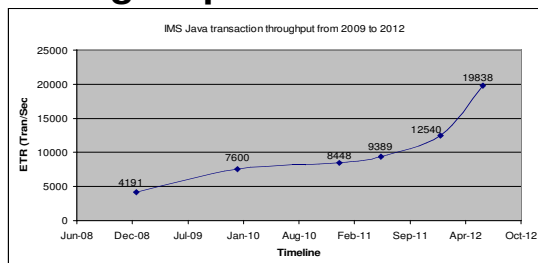
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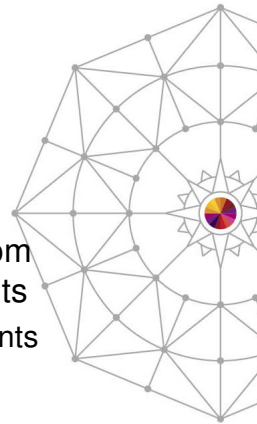
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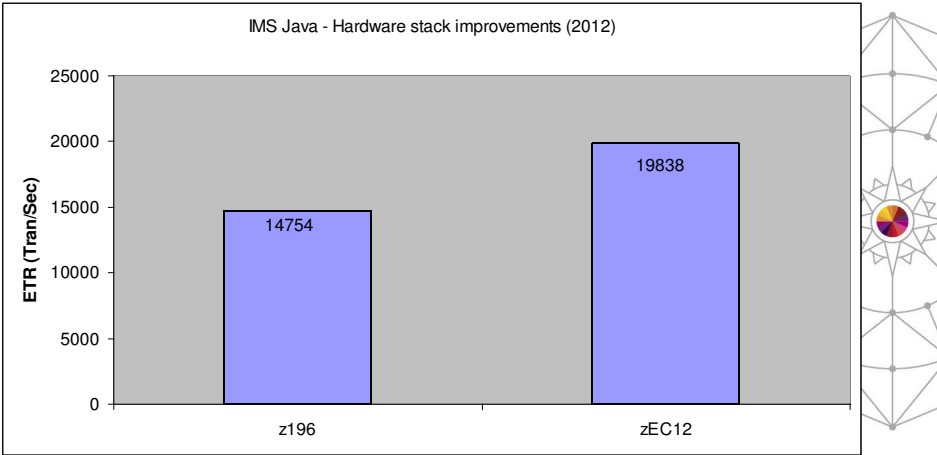
IMS JMP region performance



- Over 4x aggregate throughput improvement from 2009 to 2012 due to the following enhancements
 - Java version to version performance improvements
 - IMS improvements
 - Hardware improvements
 - DASD improvements



IMS JMP region performance Hardware stack improvements

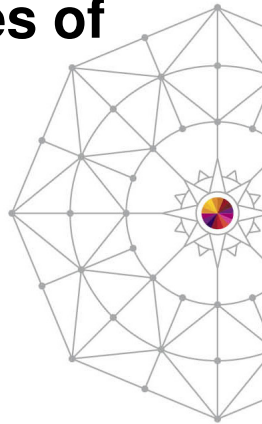


(Controlled measurement environment, results may vary)

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Identifying the qualities of service needed



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Know what database access is needed

- Does your Java workload need update privileges?
 - Since IMS cannot dynamically set transaction isolation levels dynamically such as through JDBC, it is important to identify what level of access is needed for different applications
 - If only read only access is needed, you can reduce locking contention by limiting Program Control Blocks (PCBs)
 - Uncommitted read access (PCBs with PROCOPTs 'G' and 'O')
 - Committed read access (PCBs with PROCOPTs 'G')
 - For analytics and reports that do not require real time data, uncommitted read access is highly recommended.



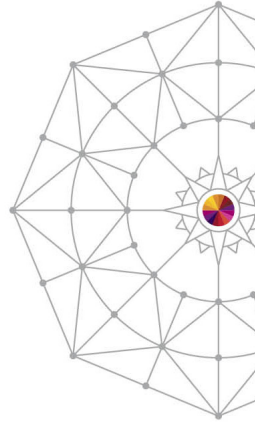
Know what data should be made available

- Is there data in a table that should not be accessible for security or usability reasons?
 - Some information should be restricted if it exposes privacy or internal business data
 - Customer data: social security numbers, birthdays, etc.
 - Supply chain information: vendors, pricing, etc.
 - Some information should be restricted from a usability perspective
 - A segment has 10 fields but only three of them are needed by external applications. It would be confusing to show all 10 to the application developer.
 - Segment and field information can be restricted using SENSEGs and SENFLDs



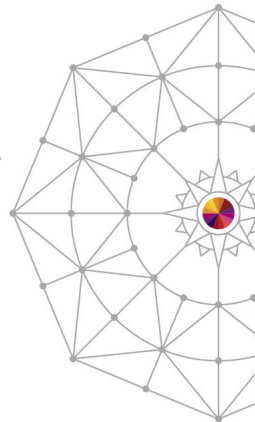
Determine how users are grouped

- Do we need new PSB/PCB resources?
 - Depends on who is using the resources and whether they need different PROCOPTs and SENSEG/SENFLD settings
 - If you have a mixed set of users where one group requires only read access privileges and the other group requires the occasional update, it is recommended that a separate PSB be created for each group.
 - If you have a set of users who require both read access for some cases and updates for other, it is recommended that a separate PCB be created for each type of usage.



Determine how users are grouped

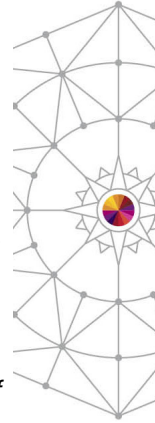
- Do we need new PSB/PCB resources?
 - The same logic applies for SENSEG/SENFLD settings.
 - The benefit of creating a new PSB also allows the DBA to provide a level of access control to their IMS data
 - This will allow splitting users among external and internal clients
 - As well as splitting among different groups within those types of clients
 - e.g., sales, human resources, finance, etc.



Know your deployment scenario



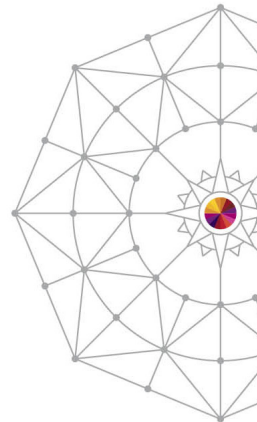
- Where will these Java applications be running?
 - Distributed deployment
 - Java EE application server
 - *The IMS Universal Database resource adapter is designed to work with JCA 1.5 compliant application servers*
 - *Allows for connection pooling and connection sharing*
 - JDBC based tools
 - *The IMS Universal JDBC driver works seamlessly with many JDBC based tools*
 - *Allows you to take advantage of common off the shelf tools such as Business Analytics and Data Exploration*



Know your deployment scenario



- Where will these Java applications be running?
 - Mainframe deployment
 - IMS Java dependent regions
 - *Fastest option for pure Java workload*
 - IMS traditional dependent regions
 - *Used for interoperability where a scheduled COBOL application calls into Java*



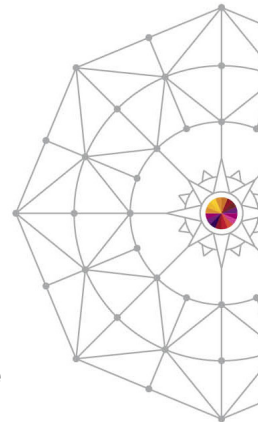
Java EE: is RRS required?

- RRS is only required for global transactions
 - Global transaction allows multiple databases to be updated in the same unit of work
 - The IMS Universal Database Resource Adapter supports both local and global transactions
 - Use the imsudbJXA.rar for global transactions
 - Use the imsudbJLocal.rar for local transactions
 - Global transactions are only supported in a bean or container managed environment
- RRS is not required for a multiple LPAR environment
 - e.g., SYSPLEX IMS regions



Security considerations

- ICON to ODBM
 - Depends on your RACF setting
 - For RACF=Y, IMS Connect will use SAF to authenticate the user and pass a RACF Object to ODBM
 - For RACF=N, ODBM will use the ODBM JOBCARD USERID
- ODBM to IMS
 - Depends on your RRS setting
 - For RRS=Y, ODBM will use the ODBA interface to IMS
 - For RRS=N, ODBM will use the CCTL interface to IMS. This is similar to CICS.



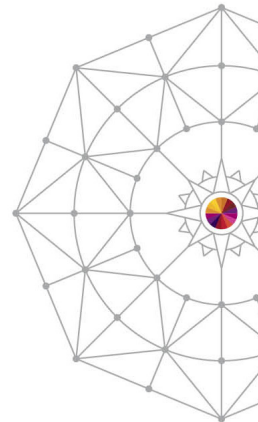
System configuration recommendations

- Configuration of IMS buffer pools can affect performance
 - IMS has tuning parameters to reduce database I/O by adjusting buffer settings so that larger blocks of data can be cached
 - Tools such as IMS Buffer Pool Analyzer for z/OS can analyze buffer pool environments and recommend changes to the number of buffers in each subpool for improved performance
 - For Fast Path databases, there is a Virtual Storage Option (VSO) feature that allows data to be mapped into virtual storage or coupling facility structures for faster access, reduced I/O and reduced locking contention.



System configuration recommendations

- Program scheduling
 - It is recommended that scheduling be set to parallel to allow for multiple simultaneous connections
 - This value can be set using Dynamic Resource Definition (DRD) through Type-2 commands such as CREATE PGM and UPDATE PGM and the parameter SCHDTYPE.



Performance considerations: how to limit large scale queries



- Opening access to IMS also means opening to long running queries
- If read only access is needed, then uncommitted reads are recommended with the GO* procopts
 - Unqualified queries
 - Business analytics and reports
 - Applications that do paging
- Alternative ways to limit queries on the application side
 - Using the maxRows connection property
 - Using the FETCH FIRST SQL syntax



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Performance considerations: SQL to DL/I translation



- All SQL queries sent to IMS are translated to an equivalent DL/I call
- The IMS Universal Database JDBC driver has added support in the Connection.nativeSQL (String sql) method to show the DL/I translation
- This method can be used to analyze slow running SQL calls to see the underlying DL/I as well as determine if the SQL statement is valid for IMS
- The Connection.nativeSQL(String sql) support is integrated into the IMS Enterprise Suite Explorer for Development V2.2.0.1



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Performance considerations: SQL to DL/I translation



SQL to DL/I Call Translation

Connection profile: IMS EC01255

Name of PSB to query: BMP255

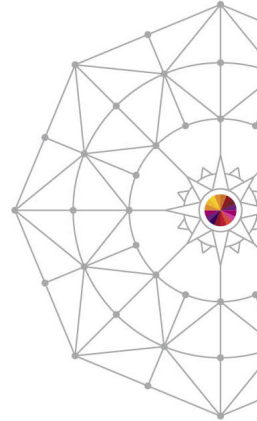
SQL statements:

```
SELECT * FROM PCB01.HOSPITAL WHERE  
HOSPNAME='SANTA TERESA'
```

DL/I calls:

```
GHU  HOSPITAL (HOSPNAMEQSANTA TERESA  )  
(LOOP)  
GHN  HOSPITAL (HOSPNAMEQSANTA TERESA  )|
```

Translate



Performance considerations: How many IMS Connect instances do I need?



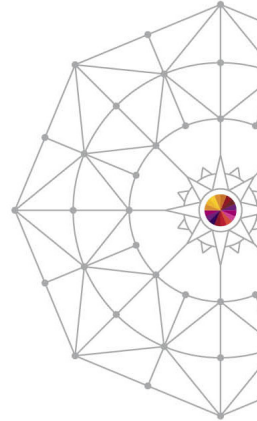
- This will depend on your workload and needs
- If you have a mix of both transactional and database workload going through IMS Connect
 - Beneficial to split the work across different IMS Connects
 - Minimize service impact in the case IMS Connect needs to be shut down
- If you have a mix of inquiry transactions that do not require security and update applications that do require security
 - Splitting the inquiry only transactions can reduce the security overhead associated with those IMS Connects



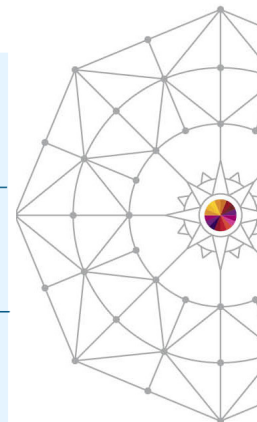
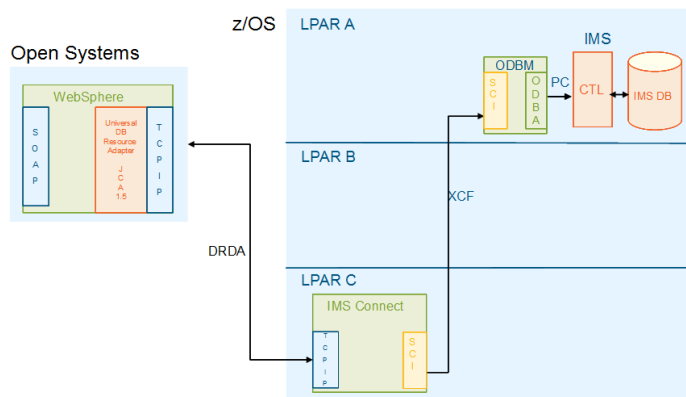
Performance considerations: How many IMS Connect instances do I need?



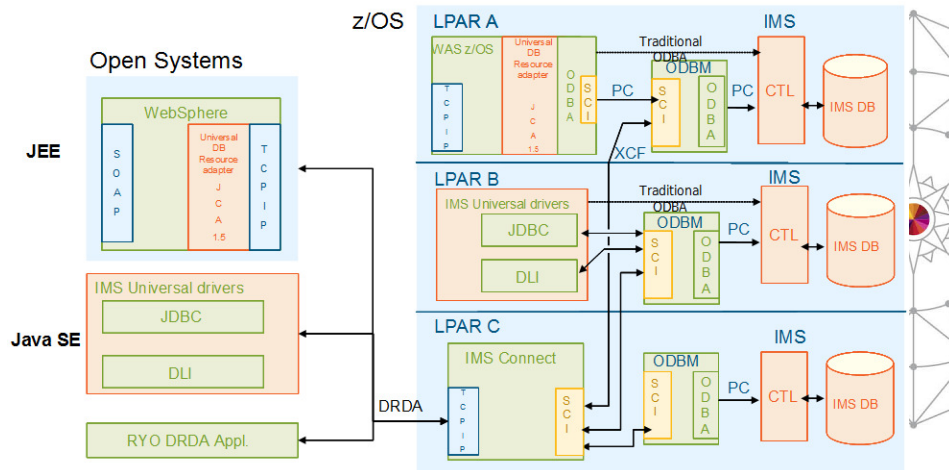
- This will depend on your workload and needs
- If you have a mix of local transactions (RRS=N) and global transactions (RRS=Y)
 - Splitting the transactions can reduce the RRS overhead for the locally scoped transactions



IMS Open Database environment

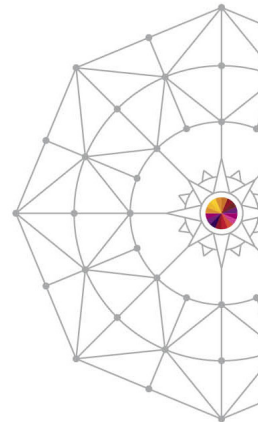


IMS Open Database environment



Topics: ODBA Best Practices

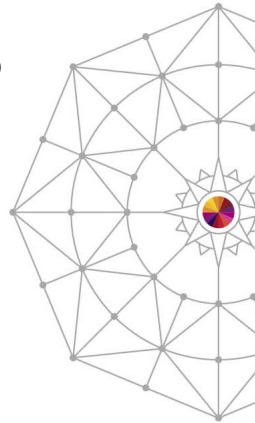
- You will learn how to
 - Avoid user errors when writing your applications
 - Configure ODBA environment to maximize performance and availability
 - Collect diagnostic information
 - Enable ODBA traces



Stop long running ODBA threads: ODBA stop region commands



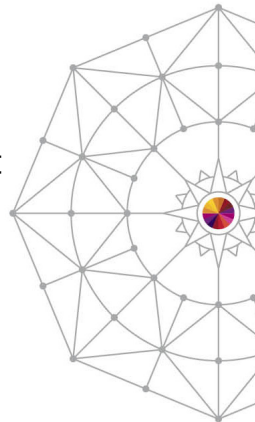
- Scenario: A banking customer notices that transactions are taking longer than normal to process
- After some investigation, it is determined that some ODBA stored procedure threads are running longer than intended
- Customer decides that these threads need to be terminated to improve system performance
- Need to avoid making the problem worse or creating a need for a system outage



Stop long running ODBA threads: Background



- Customers need a way to stop threads that are long running, looping, etc.
 - Threads use resources
 - Threads count towards max threads count
- Threads may become “hung”
 - That is, the thread cannot be stopped without taking an IMS outage
- We provide recommendations to minimize the likelihood of hung threads



Stop long running ODBA threads: ODBA stop region commands



- These commands work for any ODBA environment – WAS, IMS Connect, DB2 stored procedures, and so on
- IMS commands can be used to display and stop the threads
- Display the threads
 - DIS A REG
 - The output of this command shows thread numbers associated with the currently running threads
- Stop the threads (nn is the thread number obtained from the DISPLAY command)
- STOP REGION nn [ABDUMP]



Stop long running ODBA threads: ODBA stop region commands



```
00- 12.58.27      $dis a thread
- 12.58.27 JOB00146 DFS4445I CMD FROM MCS/E-MCS CONSOLE USERID=ZS1DMST1:
- DIS A THREAD SYS1
  12.58.27 JOB00146 DFS000I MESSAGE(S) FROM ID=SYS1
    REGID JOBNAME  TYPE  TRAN/STEP PROGRAM  STATUS          CLASS
      JBPRGN      JBP   NONE
      BATCHREG    BMP   NONE
      FPRGN       FP    NONE
      1 CICS1A     DBT   IEFPROC          AVAILABLE
      DBRAHTAM    DBRC
      DLIHTAM     DLS
*13218/125827*
```

```
00- 13.04.28      $sto thread 1
- 13.04.28 JOB00146 DFS4445I CMD FROM MCS/E-MCS CONSOLE USERID=ZS1DMST1:
- STO THREAD 1 SYS1
  13.04.28 JOB00146 DFS000I MESSAGE(S) FROM ID=SYS1
  DFS058I STOP COMMAND IN PROGRESS
```

Managing hung threads: Performance vs. availability



- If /STO REGION ABDUMP is ineffective, the thread is likely hung
- Additional steps are available for stopping the threads, but they risk an IMS outage
 - U0113 abend, etc.
- If threads are not impacting system performance, no immediate reason to eliminate them
- If IMS system is no longer operational due to hung threads, these recommendations may alleviate the situation
- A MODIFY command would abend IMS anyway, so little additional risk associated with using these techniques



Stop long running ODBA threads: Recycle address spaces

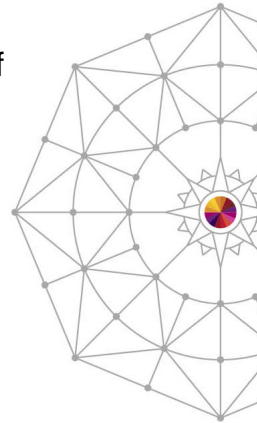


- You can cancel the WAS address space to terminate the threads associated with it. If you are using ODBM as part of a WAS environment, you can also cancel ODBM.
- If the cancel command is not accepted, you may need to FORCE the address space instead.
- If you are running DB2 stored procedures, you may be able to use DB2's DISPLAY THREAD and CANCEL THREAD commands to stop the thread
- Again – the techniques on this chart can result in an IMS outage! They are not recommended if you have a small number of hung threads on an otherwise operational ODBA system.



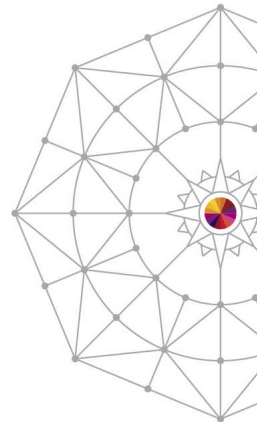
Recycling WLM to manage ODBA threads: VARY REFRESH

- Workload manager (WLM) is a separate product that is used to manage the priority of workloads on IMS and/or other products
- VARY REFRESH is used in a WLM environment to refresh (recycle) the WLM environment
- Some customers have tried to get rid of ODBA threads by using this command
- We **do not** recommend using this method, as it can lead to hung threads, as long as the IMS system is operational



ODBA transactions should run quickly

- Scenario: A banking customer writes an application to generate monthly bank statements. The application runs overnight as this is a task that does not need to be done during peak times.
- This is a large bank with many accounts, so the application takes several hours to run.
- Customers using ATMs late at night or from overseas begin complaining about slow response times.



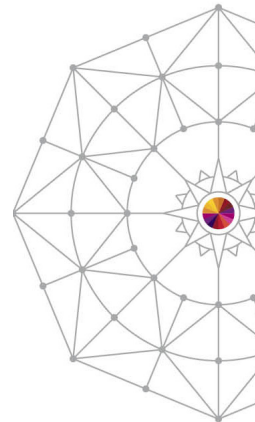
ODBA transactions should run quickly

- ODBA threads hold database locks
 - This means that the system may run more slowly
 - Certain commands such as /DBR cannot complete until the locks are released.
- You can measure execution times by inspecting the 07 and 08 log records. Third party monitoring tools are available for other measurements
- Recommendation: Design your applications so that ODBA transactions run in one second or less
- Similar recommendation for MPP stored procedures



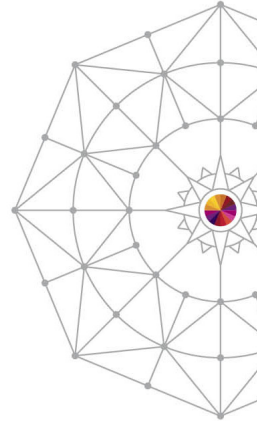
ODBA transactions -- timeouts

- You can use timeouts to control the running time of ODBA transactions.
- ODBMTMOT: ODACCESS parameter in IMS Connect configuration member HWSCFGxx. Applies only to the first input message after a socket connection.
- PORTTMOT: ODACCESS parameter in IMS Connect configuration member HWSCFGxx. Applies only to input messages that follow a previous input message.
- Timeout processing: Connect issues a DPSB to ODBM. For ODBMTMOT, return an error message to the client. In either case, a U210 is possible if uncommitted work is backed out.



MINTHRD and MAXTHRD

- The DRA startup parameters MINTHRD and MAXTHRD control the minimum and maximum number of threads that can be active at a given time



MINTHRD and MAXTHRD

- You may choose to set MINTHRD high enough to cover most typical conditions, while setting MAXTHRD higher, allowing additional threads to be dynamically created to better handle peak loads.
 - Advantage: Match the number of threads to the demands of your workload during both peak and off peak times. Avoid delays that can result from transactions waiting for a thread when MAXTHRD is reached.
 - Disadvantage: Some customers have encountered problems due to the resulting creation and destruction of threads. This overhead is particularly significant in an RRS=N environment.



MINTHRD and MAXTHRD

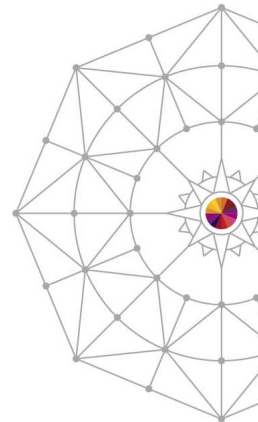
- Instead, you may set MINTHRD equal to MAXTHRD in order to prevent the creation and destruction of threads.
- Advantage: Minimize the probability of hung thread problems. Threads are only created during initialization, and are neither created nor destroyed later.
- Disadvantage: It is more challenging to match the thread count to the size of the workload.



```
DFSPPR DSECT=NO,PPBOP=10,PPDOF=5,CNBA=60,DBCTLID=SYS1,
MINTHRD=5,MAXTHRD=5,FUNCLV=2,IDRETRY=100,
SSO=0,TIMEOUT=100,TIMER=99,
DSNAME=IMSTEST0.1%%TS%.ODBA,RESLIB
```

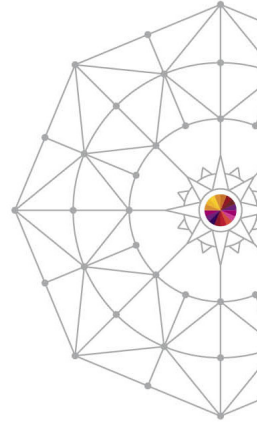
ODBA traceability

- Customers have asked for improved traceability for ODBA
- SPE is currently in development
- Enhance internal tracing in ODBA to provide faster, more efficient problem diagnosis
- Intended to be shipped via multiple APARs
 - PM90700 (currently available)
 - PM95553
 - PI07922



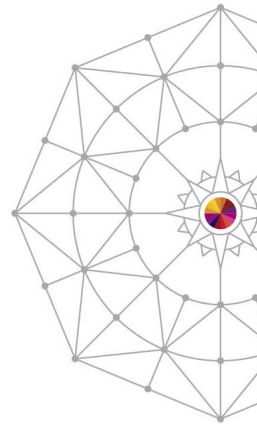
Diagnostic setup

- IBM has developed a set of recommended system configurations to use when gathering data for IBM software support
- Enable the RREST, DISP, and SCHD traces
- Enable the RRS CTRACE
- Slip for U0711 abend
- Display the currently active threads
 - DIS A THREAD
- Take a dump of any hung threads
- All documentation should be collected from a single occurrence of the error

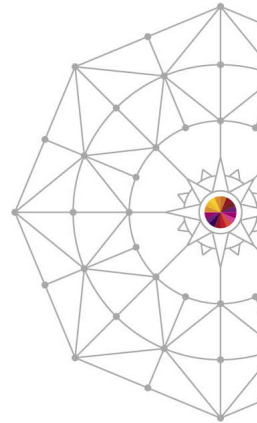


Diagnostic resources

- ODBA abends, which are documented along with other IMS abend codes
 - IMS documentation:
<https://ibm.biz/BdxNmu>
- AIB return and reason codes
 - IMS documentation:
<https://ibm.biz/BdxNmV>
- ODBA best practices paper
 - DeveloperWorks:
<https://ibm.biz/BdxNmb>



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