

IMS-Db2 Connection Pooling and JCC Statement Caching

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Agenda

- IMS-Db2 Connection pooling
 - Why
 - How
 - Performance measurements
- IMS-Db2 JCC Statement caching
 - Why
 - How
- Prerequisites
- Considerations



IMS-Db2 Connection Pooling

IMS-Db2 Thread Reuse Today

- Db2 thread creation is an important part of CPU/ET of short running IMS transactions
- Hence reusing the thread can have a significant performance benefit
- Today, IMS-Db2 threads can be reused for:
 - IFP transactions
 - WFI transactions
 - Via IMS class scheduling, queuing, and a PROCLIM count greater than one (Quick reschedule)
 - PWF1 Regions - if the next transaction is for the same transaction that just executed



IMS-Db2 Thread Reuse Enhancement

- Allow more thread reuse by creating a pool of threads on the Db2 side to match up with incoming IMS transactions
- In IMS 14, the IMS External Subsystem Attach Facility (ESAF) was enhanced to support the **ESAF Associate Thread exit routine**
 - Exit routine is used by Db2 to improve processing during the creation and termination of threads by pooling dependent region threads
 - ESAF Associate Thread exit routine is activated during SIGNON processing and is called prior to the SIGNON exit routine



Enabling IMS-Db2 Connection Pooling

- As indicated above, ESAF Connections (Threads) are currently torn down and created for each new IMS PGM or USER combination that is scheduled in IMS
- With this enhancement we can support a connection pool of up to 50 entries for a Db2 subsystem from a dependent region (BMP, MPP, IFP)
- Activated by using a new value for the ESMT parm in the IMS SSM member
 - SST=DB2,SSN=GRP1,LIT=SYS1,**ESMT=DSNMIN20**,REO=R,CRC=-
 - Since day#1 IMS users have been using DSNMIN10 as ESMT (External Subsystem Module Table) entry
 - DSNMIN10 supports only a one to one connection between a dependent region and Db2

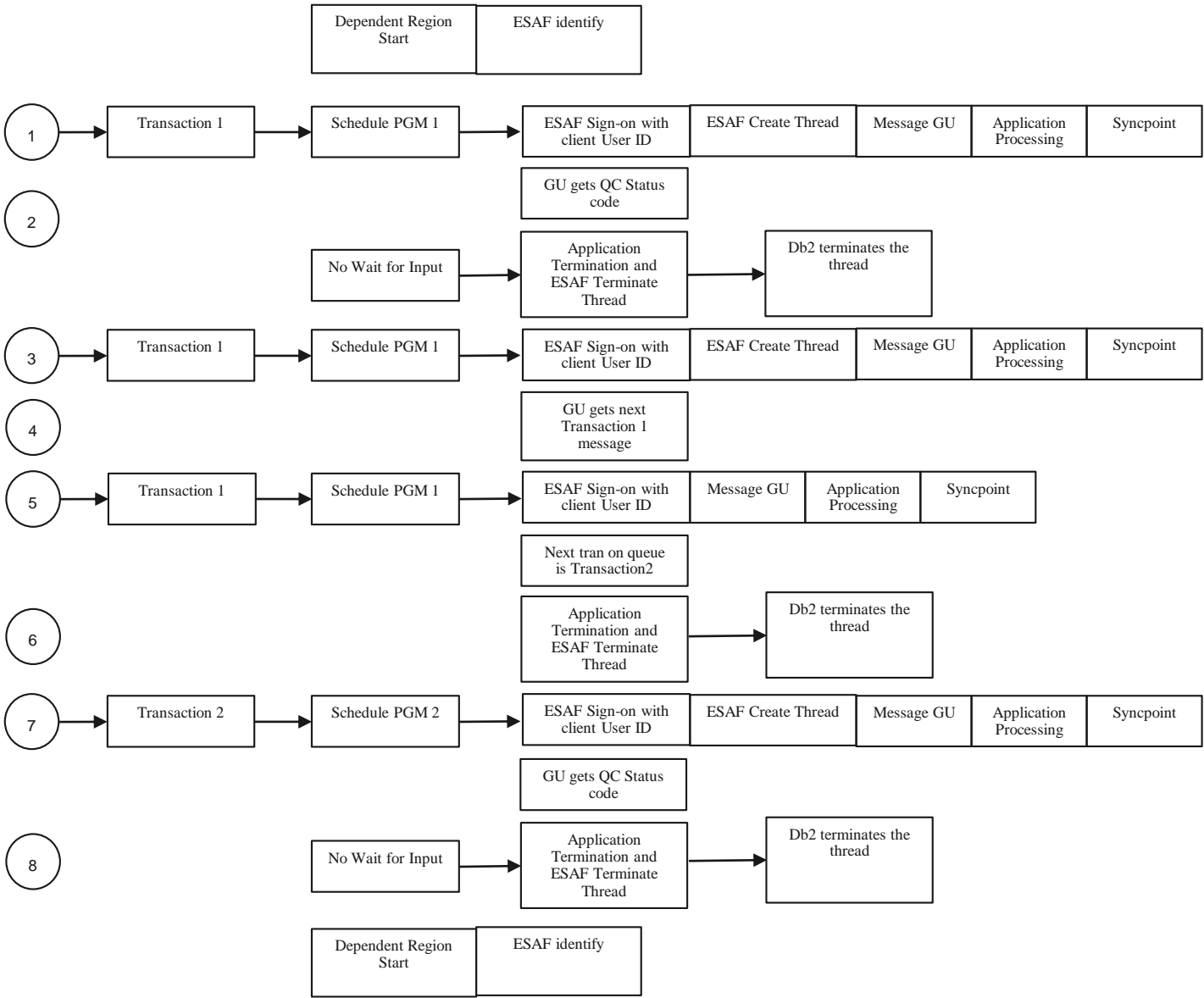


IMS-Db2 Connection Pooling

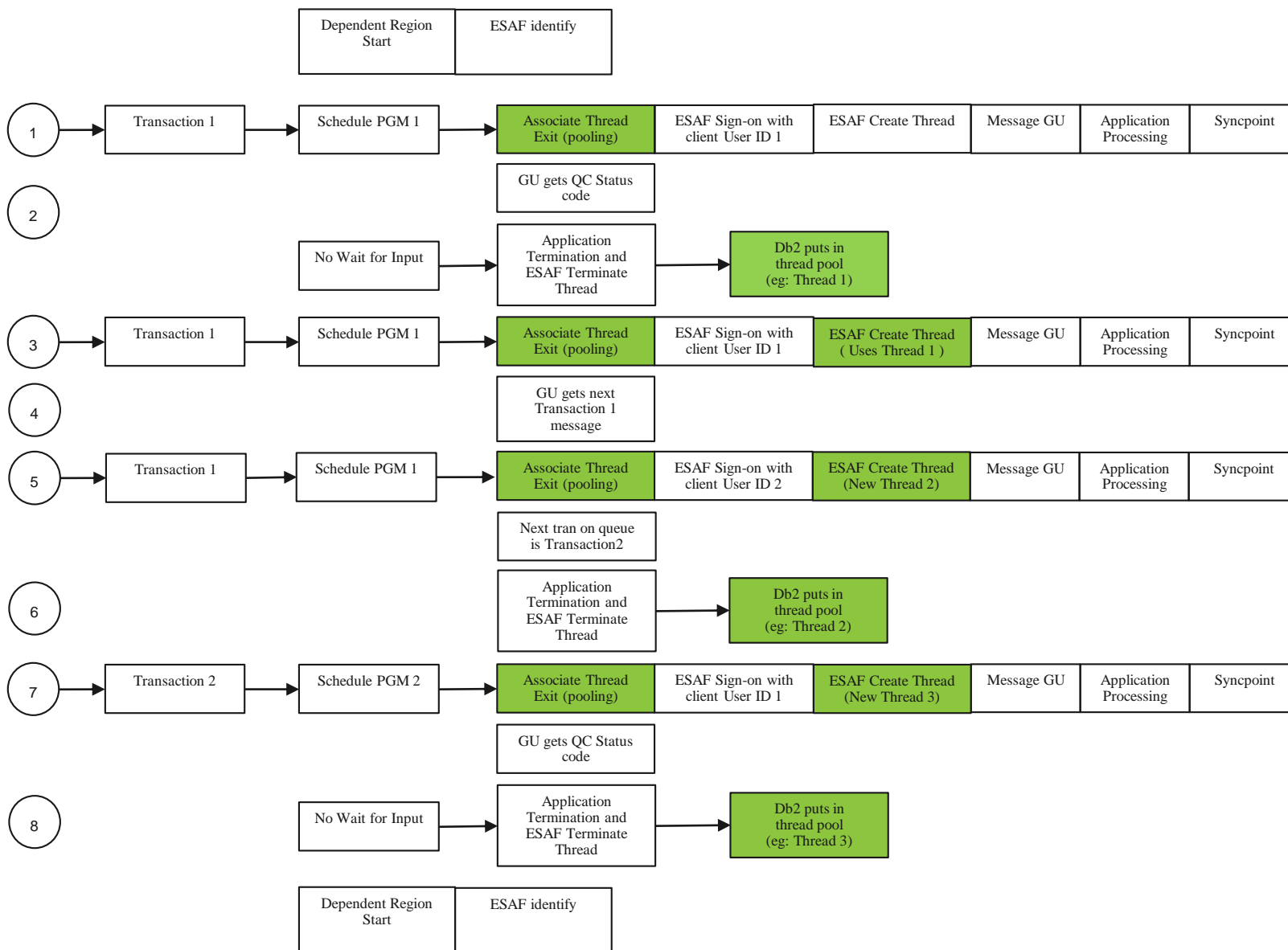
- Associate Thread exit routine is activated during SIGNON processing and is called prior to the SIGNON exit routine to see if we have an existing thread we can reuse
- Matching is done by Db2 plan name and the IMS active user name
- At application termination, ESAF thread terminate is invoked and puts the thread in the pool instead of terminating it
- Max 50 threads in the pool per dependent region
 - No external parm to control #threads in the connection pool
 - A new thread is created when new user/plan combination is used
 - Least recently used(LRU) thread will be replaced when the pool reaches the (max) limit of 50



Scenario – Without IMS-Db2 Connection Pooling



Scenario – With IMS-Db2 Connection Pooling



Performance Measurement

- IMS-DB2 IRWW workload
- 9.5% Total Db2 CPU time improvement
- Large improvement in Db2 MSTR CPU – most of the thread creation/deallocation work occurs there
- Large increase in DB2 Class1 ET
 - As the thread is reused, no Db2 accounting record is created

Note: all times are in seconds	Baseline (No IMS Thread Pooling) (A)	IMS Thread Pooling Enabled (B)	Delta (B-A)/A
Class 2 CPU/Commit	0.000292	0.000296	1.4%
MSTR CPU/Commit	0.000062	0.000024	-61.3%
DBM1 CPU/Commit	0.000026	0.000024	-7.7%
IRLM CPU/Commit	0.000000	0.000000	0.0%
Total DB2 CPU/Commit	0.000380	0.000344	-9.5%
Class 1 Elapsed/Commit	0.009355	0.228806	2345.8%



IMS-Db2 JCC Statement Caching

IMS-Db2 JCC Statement Caching

- Customers using persistent JVM MPP, BMP, and IFP regions that invokes Db2 JCC (via ESAF)
- Db2 JCC dynamically prepared SQL statements are not cached
 - Causes additional CPU utilization to re-prepare them in each transaction



Enabling IMS-Db2 JCC Statement Caching

- [Enable IMS-Db2 Connection pooling]
- Specify `DB2JCC_ESAF_THREAD_NOTIFICATION=YES` in IMS DFSJVMEV (ENVIRON=) member
- Set the `maxStatements` property in `com.ibm.db2.jcc.DB2BaseDataSource > 0`
- Set the Db2 system parameter `CACHEDYN=YES`
 - To enable global dynamic statement cache in Db2
- Set the `keepDynamic` property in `com.ibm.db2.jcc.DB2BaseDataSource` to `true`
 - Tell the application/driver to avoid re-issuing the prepare
- Bind the Db2 packages that will be invoked with the `KEEPDYNAMIC(YES)` option
 - Enables the use of local dynamic statement cache in Db2

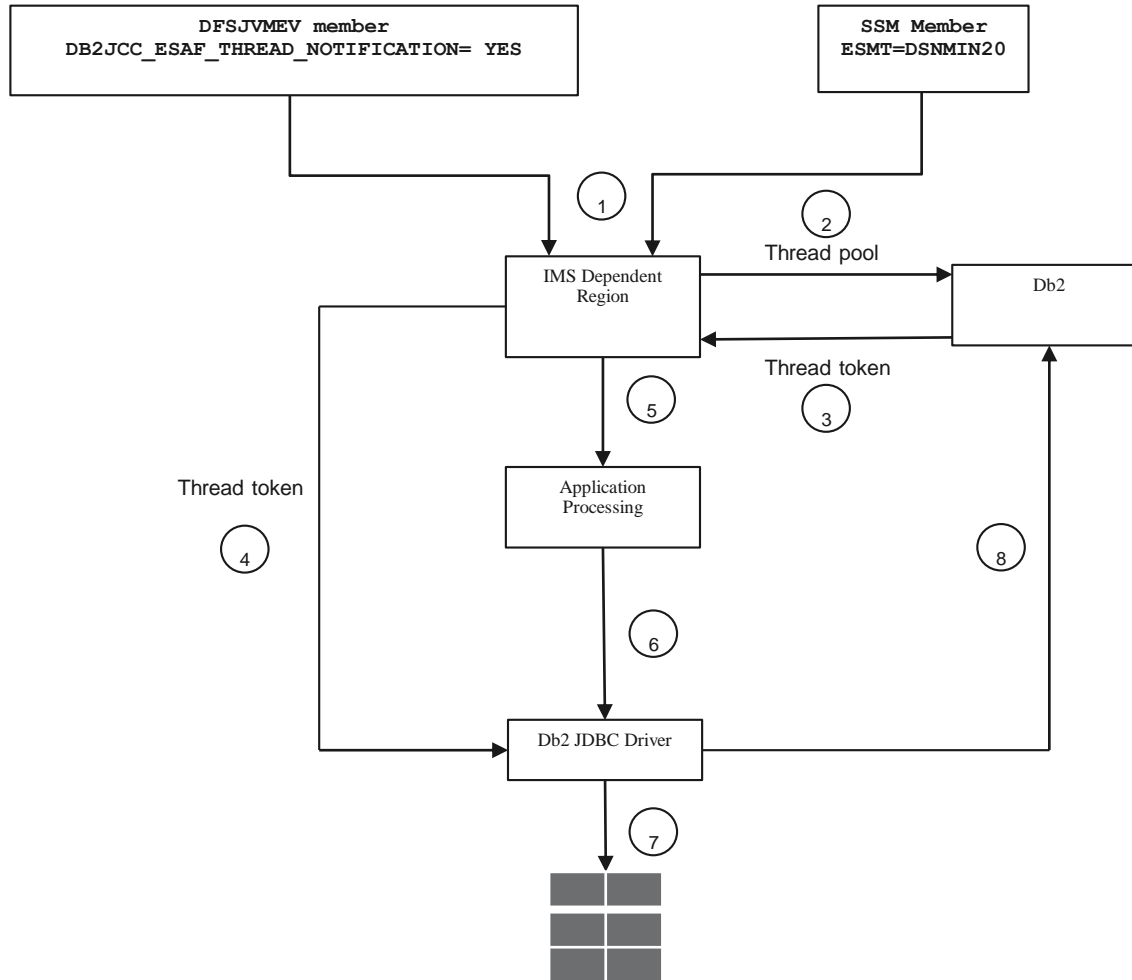


DB2JCC_ESAF_THREAD_NOTIFICATION=YES

- This property tells IMS to notify Db2 JCC which pool thread or connection **token** is in use
- This setting allows JCC to set context to the proper connection and to find any previously cached statements (triggered by setting the keepDynamic and maxStatements properties)
- The DB2JCC_ESAF_THREAD_NOTIFICATION property also allows JCC to clean up connections or statements that were purged from the ESAF Db2 thread pool and is required to keep things in sync



Scenario-ESAF Db2 JCC Statement Caching Enabled



Prerequisites and Considerations

Prerequisites

- IMS V15
 - APAR PI77938 [and PI84811]
- IMS V14
 - APAR PI60400 [and PI84116]
- For operation with Db2 11 for z/OS
 - APARs PI61982 and PI61983 are required and have to be applied BOTH at the same time
 - [and PI75155(PTF for PI61982 and IMS 13) and PI82626]
- For operation with Db2 12 for z/OS
 - APARs PI74192 and PI74193 are required and have to be applied BOTH at the same time
 - [and PI83019]
- Db2 for z/OS JCC driver Version 4.21.40 and above, or 3.71.32 and above



Considerations

- One dependent regions can have up to 50 threads into Db2 (instead of one)
 - Least recently used(LRU) thread will be replaced when the pool reaches limit of 50
- To control the number of Db2 threads from a dependent region, you can limit the number of user/plan combinations in a specific dependent region via (normal) IMS class scheduling
- May need to adjust CTHREAD ZPARM in Db2
 - MAX USERS field (aka CTHREAD subsystem parameter) = the maximum number of allied threads that are to be allocated concurrently. Allied threads are threads that are started at the local subsystem.
- Consider combining thread pooling with using RELEASE(DEALLOCATE) for further performance improvements



Considerations

- Using Db2 local statement cache will increase thread storage usage (ATB)
 - Make sure there is enough (real) storage available on the LPAR improvements
 - Adjust MAX KEPT DYN STMTS field (MAXKEEPD ZPARM)
 - The MAXKEEPD subsystem parameter specifies the maximum number of prepared, dynamic SQL statements that are to be saved past a commit point. This parameter applies to applications that run with the KEEP DYNAMIC(YES) bind option.



Questions ?

Thank You