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Configuring WebSphere Data Interchange 3.3 for z/OS Stored Procedures in a WLM Application Environment

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Agenda

- What is a DB2 Stored Procedure?
- What is WLM?
- How and when does WDI use Stored Procedures?
- Do I need to use Stored Procedures?
- Refined instructions for enabling WDI stored procedures
- Common commands
- Problem determination

What is a DB2 Stored Procedure?

- For applications, such as WebSphere Data Interchange Client, that access the database across the network
- A stored procedure runs on the database server
- Combines programming with SQL on the server
- A client application calls the stored procedure which then performs the function locally
- Only the results the client application need are returned by the stored procedure

What is a DB2 Stored Procedure? (continued...)

- Benefits, in general, of using stored procedures:
 - ▶ Reduces network traffic by returning only the result set back to the client
 - ▶ Grouping SQL statements together can save on network traffic
 - ▶ Access to features and products that exist only on the server

What is WLM?

- WorkLoad Manager (WLM) is a component of z/OS
- Purpose of workload management is to balance available system resources such as DB2, CICS, batch, TSO, UNIX System Services, and WebSphere in response to incoming work requests
- DB2 uses WLM to allocate workload requests for DB2 stored procedures
- As requests for stored procedures come into DB2, WLM will determine whether additional resources such as a new WLM-managed address space are needed in order to process the requests.

What is WLM? (continued...)

- WLM manages the number of tasks (TCBs) that can run in each address space, and starts additional address spaces as needed.
- Support of DB2-established stored procedure address spaces (SPAS) is diminishing, and will be eliminated for new stored procedures in DB2 for z/OS V8
- Work Load Manager (WLM) SPAS is the direction
- Advantage of WLM SPAS is its ability to manage multiple address spaces as opposed to the single SPAS of DB2-established address spaces

When does WDI use Stored Procedures?

- Stored procedures are not used by any WDI batch or CICS processing, i.e. issued only from Client
- WDI uses DB2 stored procedures to submit (remote) Client requests
- Supports remote command submission which allows Client user to invoke any PERFORM command
 - ▶ New feature of WDI 3.3
 - ▶ Can also be used with service profiles
 - ▶ See WDI v3.3 User's Guide, Creating and editing Server commands

When does WDI use Stored Procedures? (continued...)

- Supports processing or reprocessing from WDI Client Document Store (aka Transaction Store):
 - ▶ Acknowledge
 - ▶ Hold, Release, Purge, Unpurge
 - ▶ Remove
 - ▶ Transform
 - ▶ Translate to Application
 - ▶ Envelope
 - ▶ Envelope and Send
 - ▶ Reconstruct
 - ▶ Reconstruct and Send

Do I need to use Stored Procedures?

- EDIDB2 TSO CLIST and EDIA CICS transaction are no longer supported on WDI 3.3.
- Similar Transaction Store capabilities are replaced by Client and stored procedures
- Equivalent EDIDB2 CLIST Utility command functionality replaced by remote command submission



Enabling WDI stored procedures

- This augments Steps 4 and 5 in section 2.1.11.2 of the WDI 3.3 for z/OS Installation Guide
- Create a new WLM application environment (AE) for WDI
- Named EDISP01, as shipped, but can be any name
- Use WLM panels to associate an AE name with the JCL procedure used to start an address space
 - ▶ See z/OS MVS Planning: Workload Management for details
<http://publibz.boulder.ibm.com/epubs/pdf/iea2w180.pdf>
- Update the WLM policy with new AE name
- Create JCL member in PROCLIB for new WLM Application Environment, EDISP01

Enabling WDI stored procedures (cont'd...)

- Sample WLM JCL:

```
/******  
/* JCL FOR RUNNING THE WLM-ESTABLISHED STORED PROCEDURES  
/* ADDRESS SPACE  
/* RGN -- THE MVS REGION SIZE FOR THE ADDRESS SPACE.  
/* DB2SSN -- THE DB2 SUBSYSTEM NAME.  
/* NUMTCB -- THE NUMBER OF TCBS USED TO PROCESS  
/* END USER REQUESTS.  
/* APPLENV -- THE MVS WLM APPLICATION ENVIRONMENT  
/* SUPPORTED BY THIS JCL PROCEDURE.  
/*  
/******  
//EDISP01 PROC RGN=0M,APPLENV=EDISP01,DB2SSN=DSN,NUMTCB=6  
//IEFPROC EXEC PGM=DSNX9WLM,REGION=&RGN,TIME=NOLIMIT,  
// PARM='&DB2SSN,&NUMTCB,&APPLENV'  
//STEPLIB DD DISP=SHR,DSN=DB2.RUNLIB.LOAD  
// DD DISP=SHR,DSN=DB2.SDSNEXIT  
// DD DISP=SHR,DSN=DB2.SDSNLOAD  
// DD DISP=SHR,DSN=SYS1.SCEERUN  
// DD DISP=SHR,DSN=EDI.V3R3M0.SEDILMD1  
// DD DISP=SHR,DSN=EDI.XMLV1R9.SIXMLOD1  
//EDITSIN DD DISP=SHR,DSN=EDI.STORPROC.EDITSIN  
//SYSOUT DD SYSOUT=*  
//SYSTSPRT DD SYSOUT=*  
//CEEDUMP DD SYSOUT=*  
//SYSPRINT DD SYSOUT=*  
//SYSABEND DD DUMMY  
//
```

Enabling WDI stored procedures (cont'd...)

- In this example, the AE name and the JCL Procedure name are the same, EDISP01
- Update DB2SSN with your DB2 subsystem name
- STEPLIB concatenation must include
 - ▶ DB2 loadlibs
 - ▶ Language (LE) SCEERUN loadlib
 - ▶ WDI installation load library EDI.V3R3M0.SEDILMD1
 - ▶ XML4C load library from the XML Toolkit v1.9 SIXMLOD1

Note: The installation guide contains a typo. Name SIXMMOD1 is incorrect.
- Include a dataset for dd EDITSIN. Allocate the dataset as fixed-block, record length 80

Enabling WDI stored procedures (cont'd...)

- EDITSIN supplies WDI with DB2 attachment information. A typical EDITSIN includes:
PLAN(EDIENU33) SYSTEM(DSN) CAF(8)
 - ▶ Specifies the DB2 plan used by WDI, the DB2 subsystem name, and a call attachment facility (CAF) parameter telling WDI to attach to DB2 using Resource Recovery Services attachment facility (RRSAF). The CAF value "8" is required whenever using a WLM address space.

- There are three stored procedures currently shipped with WDI 3.3:
 - ▶ EDIADDREQ
 - ▶ EDIEXEC1
 - ▶ EDIEXEC2

- If you do not use WLM AE name EDISP01, edit EDI.V3R3M0.SEDISQL1(EDISDB2)
 - ▶ Find CREATE PROCEDURE statements for the above procedures:
WLM ENVIRONMENT EDISP01
Change EDISP01 to your name
 - ▶ Current SQLID, e.g. EDIENU33, requires CREATE IN privilege to create a package in the EDI33001 collection-id

Enabling WDI stored procedures (cont'd...)

- RACF considerations, i.e. what we did,
 - ▶ Chose a userid under which WLM and stored procedures will run, <wlm_userid>
 - ▶ This id must be authorized to run Resource Recovery Services attachment facility (RRSAF)
 - ▶ Use one of two ways RACF provides to associate user IDs and groups with started tasks:
 - Started procedures table
 - STARTED class
 - ▶ Create started profile, EDISP01.**, with OWNER = <wlm_userid>
 - ▶ Create RACF DSNR WLMENV profile, ssnm.WLMENV.EDISP01, with OWNER = DB2GRP and UACC(NONE)
 - Where “ssnm” is the DB2 subsystem name or data sharing group name
 - ▶ Permit <wlm_userid> and WDI Client userids READ access to the WLMENV profile, ssnm.WLMENV.EDIPS01
 - ▶ Create RACF DSNR WLM_REFRESH profile, ssnm.WLM_REFRESH.EDISP01
 - ▶ Permit <wlm_userid> and appropriate users READ access to the WLMENV profile, ssnm.WLM_REFRESH.EDISP01
 - ▶ Create RACF server profile, DB2.ssnm.EDISP01
 - ▶ Permit EDISP01 to the server profile, DB2.ssnm.EDISP01

Enabling WDI stored procedures (cont'd...)

- Add the OMVS external link for WDI's command script interpreter, EDISERVR.
 - ▶ DB2 will execute WDI as a RACF user ID defined in the RACF started procedures table or via STARTED class, i.e. <wlm_userid>
 - ▶ Create an OMVS segment for <wlm_userid>
 - Set the Home directory to, /u/<wlm_userid>
 - ▶ Open any shell interpreter available on z/OS, e.g. "OMVS" from ISPF (option 6)
 - ▶ Ensure the Home directory exists, cd /u/<wlm_userid>
 - Typically, this will be the present working directory after entering OMVS
 - If not, create directory, mkdir /u/<wlm_userid>
 - ▶ Change to the home directory, cd /u/<wlm_userid>
 - ▶ Add external link by executing "LN" command from home directory:
In -e EDISERVR /u/<wlm_userid>/EDISERVR
(Case is important)

Common commands

- Useful MVS system commands:
 - ▶ Display status of all WLM application environments:
`/D WLM,APPLENV=*`
 - ▶ Display specific status of a WLM AE:
`/D WLM,APPLENV=EDISP01`
 - ▶ Vary command to resume a WLM AE:
`/V WLM,APPLENV=EDISP01,RESUME`
 - ▶ If you make changes to WLM AE, to recycle:
`/V WLM,APPLENV=EDISP01,REFRESH`

- Link to z/OS Information Center, provides all MVS system commands:
<http://publib.boulder.ibm.com/infocenter/zos/v1r9/topic/com.ibm.zos.r9.ieag100/cmdref.htm#cmdref>

Common commands (continued...)

- Useful OMVS commands:

- ▶ Issue “OMVS” from ISPF command shell (option 6) to enter z/OS Unix System Services (USS)

- ▶ Commonly used Unix/AIX based commands from this USS shell

pwd	Show present working directory
cd	Change directory
chmod	Change permissions for files and directories
cp	Copy a file
ls	List file and directory
mkdir	Make a directory
rmdir	Remove an empty directory
rm	Remove a directory entry (e.g. delete a file)
rm -r <dir>	To delete the files in a directory and the directory itself in one step
exit	Exit OMVS command shell

- ▶ Link to z/OS Information Center, provides all USS commands:

<http://publib.boulder.ibm.com/infocenter/zos/v1r9/index.jsp?topic=/com.ibm.zos.r9.bpxa500/shcmdes.htm>

Common commands (continued...)

- Useful RACF commands:
 - ▶ Use RACF LISTUSER (List User Profile) command to display OMVS segment information:
 - LU <wlm_userid> OMVS
 - Shows OMVS info including Home directory
 - ▶ Can use RACF panels to change User profile options, e.g. to set Home directory
 - ▶ Link to z/OS Information Center, provides all RACF commands:
<http://publib.boulder.ibm.com/infocenter/zos/v1r9/index.jsp?topic=/com.ibm.zos.r9.icha400/ichza48016.htm>

Problem Determination

- WDI Client document store submission (e.g. Reconstruct) fails with:
16213 - Unable to submit the request. Verify the WDI stored procedures are properly installed and are available. The return code is "129". Contact support if the problem persists.

Return code 129 – ENOENT No such file, directory, or IPC member exists.

Return code 134 – ENOSYS The function is not implemented.

- Cause: Unix System Services spawn() function error likely due to missing home directory or missing external link
- Solution: Verify <wlm_userid> has an OMVS segment defined:
LU <wlm_userid> OMVS
 - ▶ If 'NO OMVS INFORMATION' is returned, then an OMVS segment needs to be added to the <wlm_userid>
 - ▶ If 'OMVS INFORMATION' is returned, check HOME setting and define external link under this directory
- For other USS return codes, see z/OS Information Center:
<http://publib.boulder.ibm.com/infocenter/zos/v1r9/index.jsp?topic=/com.ibm.zos.r9.bpxa800/errno.htm>

Problem Determination (continued...)

- WDI Client document store submission fails with:
16204 - An Error occurred while attempting to execute an sql stored procedure. The stored procedure was "EDIEXEC2". ODBC return code is: -1. Description: SQL0440N No authorized routine named "EDIENU33.EDIEXEC2" of type "" having compatible arguments was found.
- Cause:
 - ▶ Stored procedure not defined or cannot be found
 - ▶ The routine invoker is not authorized to execute the routine
- Solution:
 - ▶ Check for WLM address space running on z/OS
 - ▶ Verify that DB2 definitions, CREATE PROCEDURE, in EDI.V3R3M0.SEDISQL1(EDISDB2) were run and have the proper WLM ENVIRONMENT name specified for your environment
 - ▶ Verify that DB2 GRANT EXECUTE ON PROCEDURE commands were run in EDI.V3R3M0.SEDISQL1(EDISGRNT)
- For other SQL return codes, search DB2 for Windows Information Center:
<http://publib.boulder.ibm.com/infocenter/db2luw/v9/index.jsp>

Problem Determination (continued...)

- WDI Client document store submission fails with:
16204 - An Error occurred while attempting to execute an sql stored procedure. The stored procedure was "EDIEXEC2". ODBC return code is: -1. Description: SQL0471N Invocation of routine "EDIENU33.EDIEXEC2" failed due to reason "00E7900C".
- Cause: DB2 reason code 00E7900C indicates an SQL CALL statement could not be processed. The WLM application environment name specified for the user-written routine is not defined or is currently not available for DB2 use in the active WLM policy.
- Solution:
 - ▶ Use the -ALTER PROCEDURE or -ALTER FUNCTION command to update the WLM ENVIRONMENT to specify an application environment that is defined and active in the active WLM policy or update the WLM policy to contain a valid application environment name
 - ▶ If the WLM policy definition is updated, use the MVS WLM VARY command to activate this new definition
 - ▶ If the WLM application environment is quiesced, use the MVS WLM VARY APPLENV= applenv, RESUME command to activate the application environment, e.g. /V WLM,APPLENV=EDISP01,RESUME
- For other DB2 reason codes, search DB2 for z/OS Information Center:
<http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp>

Problem Determination (continued...)

- Another source of error messages may be from within the WLM application environment
 - ▶ Check for an active z/OS address space (job) for the WLM AE, e.g. EDISP01
 - ▶ Check any joblogs on job output queues
- Tracing of WDI Client remote submissions on z/OS:
 - ▶ The existence of directory "/tmp/edidproc" triggers WDI to write trace files to this directory
 - ▶ <wlm_userid> requires write permission to this directory
 - ▶ To set all permissions, OMVS command: `chmod 777 /tmp/edidproc`

Summary

- We discussed how DB2 uses a WLM address space for running stored procedures on z/OS
- And that WDI uses DB2 stored procedures only to submit (remote) Client requests
- WDI Client 3.3 is required to run transaction (Document) store functions previously available under TSO or CICS
- We also covered how to enable WDI stored procedures in a WLM application environment
- And lastly, how to diagnose common problems that you may encounter along the way

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