



zSeries JAVA Stored Procedures

Infrastructure Definition

Gary V Roth
12/1/2004



zSeries JAVA Stored Procedures

- Technology Background
- Components
 - IBM provided Stored Procedures
 - WLM (Workload Manager)
 - DB2 System Libraries
 - USS Configuration
 - Java Version
 - Workstation
- Application Modules
- z990 Java Exploitation



Technology Background

- A Stored Procedure is a user written program that is callable with an SQL CALL statement.
- They can be called locally or from a remote system.
- Particularly advantageous in a distributed environment.



Technology Background

- Stored Procedures first introduced in DB2 V4
 - Limited use
 - Single SPAS address space
 - JDBC
- Major improvements in DB2 V6
 - Catalog enhancements
 - WLM address spaces
 - SQLJ
 - RRS requirement



Technology Background

- Additional performance improvements in DB2 V7
 - Unicode services required
- Extensive support added in DB2 V8
 - JDBC 2.0 , 3.0 spec
 - JDK 1.4
 - Single driver for JDBC type 2 and 4
 - Supports J2EE, JTS and JTA



Components

IBM Provided Stored Procedures

- DSNTPSMP – SQL Procedure Language processor
- DSNTJSPP – Java language module program preparation
- DSNTBIND – Called by DSNTJSPP to bind DBRM
- WLM_REFRESH – Used to issue commands to the WLM Application Environment



Components

JDBC Support

- DSNTJJCL – Bind default JDBC Packages and Plan
 - DSNJDBC1
 - DSNJDBC2
 - DSNJDBC3
 - DSNJDBC4

Components

Sample Programs of Interest

- DSNTEJ6W - Sample caller for Stored Procedure WLM_REFRESH
 - DSN8ED6

Components

WLM

- Application Environment Policies established (SYSPLEX wide)
 - DB2_WLM_DEF_ssid DEFAULT
 - DB2_WLM_JVA_ssid JAVA DEFAULT
 - DB2_WLM_UTL_ssid UTILITY
 - DB2_WLM_REX_ssid REXX SUPPORT
 - DB2_WLM_SPB_ssid PROC BUILD
 - DB2_WLM_SPJ_ssid JAVA BUILD

Components

WLM

- Typical Policy definition
 - Appl Environment Name . . .
DB2_WLM_JVA_ssid
 - Description Java DB2 SP
 - Subsystem type . . . DB2
 - Procedure name . . . DWLMxx0J
 - Start parameters . . .
DB2SSN=&IWMSSNM,NUMTCB=6

Components

WLM

- Application Program associated with WLM environment in Stored Procedure definition
- CREATE PROCEDURE schema.subschema
 - (inout char(10) inout)
 - LANGUAGE JAVA
 - EXTERNAL NAME 'PKG40723030844260.Java03.java03'
 - COLLID spcoll
 - WLM ENVIRONMENT DB2_WLM_JVA_ssid

Components

WLM

```

■ //*****
■ //*   JCL FOR RUNNING WLM-ESTABLISHED STORED PROCEDURES
■ //*   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.
■ //*****
■ //DWLMxx0J PROC DB2SSN=,NUMTCB=,APPLENV='DB2_WLM_JVA_ssid'
■ //PSTEP001 EXEC PGM=DSNX9WLM,TIME=1440,REGION=0M,
■ //      PARM='&DB2SSN,&NUMTCB,&APPLENV',
■ //STEPLIB DD DISP=SHR,DSN=DB2.ssid.DSNLOD2
■ //      DD DISP=SHR,DSN=DB2.ssid.DSNEXIT
■ //      DD DISP=SHR,DSN=DB2.ssid.DSNLOAD
■ //      DD DISP=SHR,DSN=SYS1.SCBCCMP
■ //      DD DISP=SHR,DSN=SYS1.SCEERUN
■ //JAVAENV DD DISP=SHR,DSN=DB2.ssid.JAVAENV
■ //JSPDEBUG DD SYSOUT=*
■ //CEEDUMP DD SYSOUT=*
■ //SYSPRINT DD SYSOUT=*
■ //SYSOUT DD SYSOUT=*
■ //JAVAOUT DD PATH='/DB2ssid/u/JAVAOUT.TXT',
■ //      PATHOPTS=(ORDWR,OCREAT,OAPPEND),
■ //      PATHMODE=(SIRUSR,SIWUSR,SIRGRP,SIWGRP,SIROTH,SIWOTH)
■ //JAVAERR DD PATH='/DB2ssid/u/JAVAERR.TXT',
■ //      PATHOPTS=(ORDWR,OCREAT,OAPPEND),
■ //      PATHMODE=(SIRUSR,SIWUSR,SIRGRP,SIWGRP,SIROTH,SIWOTH)

```

Components

DB2 System Libraries

- Every DB2 subsystem has the following set of libraries.
 - DB2.ssid.DSNLOAD IBM provided executables
 - DB2.ssid.DSNEXIT customer modified / customized modules
 - DB2.ssid.DSNLOD2 IBM provided executables
 - Must be PDSE
 - Java Runtime components
 - zSeries JDBC components

Components

USS Configuration

- HFS filesystem needed to support Java Runtime
 - DB2.lpar.DB2ssid.HFS
 - DB2ssid Mountpoint
 - /usr/lpp/ path contains IBM provided code
 - /u/ contains customized files
 - DSNTJSPP.properties
 - Db2sqljjdbc.properties



Components

USS Configuration

- Java Started Task refers to JAVAENV dd
 - XPLINK(ON),
 - ENVAR("DB2_HOME=/DB2ssid/usr/lpp/db2/db2710",
 - "JAVA_HOME=/JAVA14/J1.4",
 - "TZ=PST08",
 - "_CEE_RUNOPTS=/DB2ssid/u/javaspb/ceeopts",
 - "DB2SQLJPROPERTIES=/DB2ssid/u/javaspb/db2sqljjdbc.properties")

Components

Java Version

- zSeries Java toolkit must be installed
- Verify by issuing OMVS shell command
JAVA -FULLVERSION
- Response should verify that Java is installed and indicate the version



Components Workstation

- Delivered as part of DB2 Connect
 - Development Center
 - GUI interface with Wizards
 - 'C' module via SQL Procedure language
 - Java JDBC, no DBRM, Dynamic SQL
 - Java SQLJ, DBRM, Static SQL
 - Can use local Personal Edition or Distributed UDB for development
 - Promote to zSeries when complete
 - Ability to test procedure and setup



Components Workstation

- Delivered as part of DB2 Connect
 - Control Center
 - Ability to Display zSeries DB2 resources
 - If authorized, can stop and start these resources
 - No ISPF session invoked



Application Modules

- SQL Procedure modules are converted to 'C' and installed like other language modules.
- Java (SQLJ and JDBC) are encapsulated as .jar files and stored in the DB2 Catalog.
 - Both source and runtime.
 - SYSJAVA Database



Z990 Java Exploitation

- New zAAP Processor
- Separately configured processor that is dedicated to Java computing
- Requires zOS 1.6
- Requires DB2 V8 for Java Stored Procedures



Documentation

- **DB2 for z/OS Stored Procedures:
Through the CALL and Beyond SG24-7083**
 - <http://www.redbooks.ibm.com/abstracts/sg247083.html?Open>
- <http://www-106.ibm.com/developerworks/db2/library/techarticle/dm-0408rader/index.html>
- <http://www-106.ibm.com/developerworks/db2/library/techarticle/dm-0409rader/>