t:Z Quickstart for Tomcat

T:Z QuickStart for Tomcat - User's Guide

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1. Introduction

Apache Tomcat is a pure-Java implementation of the *Java Servlet* and *JavaServer Pages* technologies and is licensed under the *Apache Version 2.0 Open source license*.

`T:Z Quickstart for Tomcat` is a distribution of Apache Tomcat which is specially packaged for easy installation, configuration, and operation on IBM's z/OS operating system.

1.1 Features

- Includes a vanilla Tomcat 6.0.18 distribution.
- Any patches required that allow Tomcat to function correctly on z/OS are included. These patches are also submitted upstream to the Apache Tomcat project.
- Additional Dovetailed Technologies developed JARs are included to enhance Tomcat on z/OS:
  - A `Tomcat security Realm` for authenticating users and roles using SAF (RACF).
  - A `zfile URL handler` which allows XML configuration files to be included from z/OS datasets.
- Packaged as a single TSO XMIT file which includes installation JCL, sample JCL, sample configuration files, and the Tomcat HFS/zFS filesystem.
- Sample JCL is provided that allows Tomcat can be run as a batch job or started task using the *IBM Java SDK JZOS batch launcher*, which is part of the IBM Java SDK for z/OS.
- A sample PDS includes JCL, a JZOS environment variable script, and Tomcat configuration XML so that editing Unix files is not required to customize Tomcat.
- The sample configuration includes support for DB2 JDBC type-2 and type-4 Datasource connections.
- Available free under the *Apache Version 2.0 License*.

1.2 System Requirements

- One of the following Java SDKs:
  - IBM 31 or 64-bit SDK for z/OS, Java Technology Edition, V5, SR3 or later
  - IBM 31 or 64-bit SDK for z/OS, Java Technology Edition, V6
- 10 MB of HFS or zFS file system space, plus any space required for your web applications.

1.3 Trademarks

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2. Installation

The following steps are required to install the `T:Z Quickstart for Tomcat` package.

1. *Download* the zip file to your workstation and extract the contents to a local directory.

2. Transfer the XMIT file from your workstation to the z/OS system. Please be sure that you upload the following files in binary (no translation).

   If you are uploading using FTP, use the following commands (substituting your own dataset high-level qualfier for "HLQ"):

```
ftp myzos.myco.com
(Log in with your host name, user ID, and password.)
ftp> bin
ftp> quote site recfm=fb
ftp> quote site lrecl=80
ftp> quote site cyl
ftp> quote site pri=8
ftp> put zos.tomcat.xmit 'HLQ.TOMCAT.XMIT'
ftp> quit
```

   If you are uploading using Personal Communications, then use the following commands to transfer the file. Be sure that you are logged on the host and within the READY mode (outside ISPF). Change the session string ("A:") and the destination "HLQ" as appropriate:

```
send zos.tomcat.xmit A:'HLQ.tomcat.xmit' recfm(f) lrecl(80)
  space(8,3) cylinders
```

   If you are uploading with an SSH sftp client like PuTTY with Co:Z SFTP on z/OS, you can use the following commands:

```
psftp myid@myzos.myco.com
psftp> ls /+mode=bin,recfm=fb,lrecl=80,space=cyl.8.3
psftp> put zos.tomcat.xmit //HLQ.TOMCAT.XMIT
```

3. To unload the XMIT dataset into a PDS, enter the following TSO command:

```
receive inda('HLQ.TOMCAT.XMIT')
```

   When prompted with the message: `Enter restore parameters..."`, enter the following, supplying

your own target dataset name:

```
da('HLQ.TOMCAT.INSTJCL')
```

Note

If you get an error `"Unable to issue message with prompt for reply"`, then enable prompting with the following TSO command:

```
profile prompt
```

4. Customize the `INSTALL` member of the `INSTJCL` PDS, following the comments included in the JCL. The `TCHOME` JCL symbol will reference an *empty* HFS or zFS directory that has 10MB of free space, plus any space that is required for your own web applications.

   Run this job and verify that all steps complete with a condition code of zero.

Note

It is also possible to have a single common Tomcat home (aka "CATALINA_HOME") directory that is shared by many Tomcat instances that have their own "CATALINA_BASE" directories that contain web applications and work/temp space.

3. Basic Configuration and Operation

This section discusses the basic steps required to configure and run Tomcat using T:Z. You will only need to customize the sample JCL and configuration members distributed in the "SAMPJCL" PDS that you unloaded in *Chapter 2, Installation*

Note

For a really quick install, you might not need this documentation - just follow the `SAMPJCL($README)` instructions for customizing and starting TOMCAT

1. Edit the `SAMPJCL(TCENV)` member, which contains a shell script used to configure environment variables in order to run Java under the JZOS batch launcher. For now, just edit the section as shown below to match your installation:

```
# ------------------------------------------------------------------------
# $$$$$ Often you will only need to customize this section:
# ------------------------------------------------------------------------
export JAVA_HOME=/usr/lpp/java/J5.0  ❶
CATALINA_HOME=/usr/local/tomcat      ❷
CATALINA_BASE=/usr/local/tomcat
DB2_JDBC_HOME=/usr/lpp/db2910_jdbc   ❸
DB2_SSID=DSN9                        ❹
IJO="-Xms64m -Xmx128m"               ❺
```

   - ❶ Change to your Java SDK V5 or V6 home directory. See: *Section 1.2, "System Requirements"*
   - ❷ Set both this an CATALINA_BASE should be set to the directory where you installed the Tomcat filesystem ("TCHOME" in the INSTALL JCL).
   - ❸ If you have DB2, set this to the DB2 JDBC home directory which contains the JDBC driver jars. Otherwise this can be ignored.
   - ❹ If you have DB2 and will be using JDBC type-2 connections, set this to your DB2 subsystem id. Otherwise this can be ignored.
   - ❺ This is a reasonable starting point for min and max Java heap sizes, which you can update as necessary for your web applications.

2. Edit the `SAMPJCL(TCPROC)` member, which contains a sample stored procedure for running Tomcat using the JZOS Batch Launcher

```
//TCPROC PROC CNFGLIB=,          < (RQD) PDS w/ config XML & env script
//   TCENV=TCENV,                < Member of CNFLIB with STDENV script
//   JZOSLIB='SYS1.SIEALNKE', ❶ < JZOS launcher PDSE LIB
//   VERSION='50', ❷             < JZOSVM version: 50,56,60,66
//   LOGLVL='',                  < Debug LVL: +I(nfo) +D(ebug) +T(race)
//   REGSIZE='0M',               < Max region
//*  DB2PRFX=DSN910,❸            < Prefix for DB2 STEPLIBs, if used
//   LEPARM='',
```

```
//   JAVACLS='org.apache.catalina.startup.Bootstrap',
//   ARGS='start'
//JAVAJVM  EXEC PGM=JVMLDM&VERSION,REGION=&REGSIZE,
//   PARM='&LEPARM/&LOGLVL &JAVACLS &ARGS'
//STEPLIB  DD DISP=SHR,DSN=&JZOSLIB
//*❹       DD DISP=SHR,DSN=&DB2PRFX..SDSNEXIT < Uncomment for DB2
//*       DD DISP=SHR,DSN=&DB2PRFX..SDSNLOAD <  type-2
//*       DD DISP=SHR,DSN=&DB2PRFX..SDSNLOD2 <     JDBC
//STDENV   DD DISP=SHR,DSN=&CNFGLIB(&TCENV)   < STDENV shell script
//TCCONFIG DD DISP=SHR,DSN=&CNFGLIB           < Tomcat XML cnfig
//SYSPRINT DD SYSOUT=*                        < System stdout
//SYSOUT   DD SYSOUT=*                        < System stderr
//STDOUT   DD SYSOUT=*                        < Java System.out
//STDERR   DD SYSOUT=*                        < Java System.err
//CEEDUMP  DD SYSOUT=*
//ABNLIGNR DD DUMMY
// PEND
```

❶ Set this to the PDSE library containing JVMLDM50/56/60/66, the JZOS batch launcher
❷ Set this to match the JAVA SDK that you are using (JAVA_HOME in TCENV)
❸❹ Uncomment these and set to your DB2 library prefix if you are using JDBC type-2 connections.

3. Edit the `SAMPJCL(SERVVARS)` member, which contains XML entity definitions (variables) that are used to parameterize the Tomcat configuration XML, which is contained in member `SERVXML`.

   - The `httpPort` variable should be set be an available port that Tomcat will listen on for normal HTTP connections.
   - The `sslPort` variable may be set to the port that you wish to use for HTTPS (SSL/TLS) connections. By default, HTTPS support is not enabled (in the `SERVXML` member).
   - Several variables are available to configure the DB2 parameters for type-2 and type-4 JDBC connections. They may be ignored if you won't be using DB2 in you web applications.

4. Edit the `SAMPJCL(TCUSERS)` member, which contains XML entity definitions that are used to define the userids, passwords, and security roles for Tomcat *only if the Tomcat MemoryUserDatabase is configured in `SERVXML`*, which is the default.

   Tomcat will only prompt browsers to logon if required by a given web application in its web.xml security specifications. The Tomcat `Manager` web application, which is shipped with Tomcat, requires that users logon and have the `manager` role.

   If you will be using the default MemoryUserDatabase, update this file with the userids that you require and assign the `manager` role to at least one user so that you can manage your running Tomcat instance.

   See *Chapter 4, Using SAF Security in Tomcat* for information on configuring Tomcat to use SAF (RACF) for userid/password authentication and role authorization. If you use SAF, then the `TCUSERS` member is not used. If you do use `TCUSERS`, then only allow read access to it by Tomcat and authorized personnel.

5. Customize the `SAMPJCL(TCJOB)` member, which contains sample JCL for running Tomcat as a batch job. You will only need to customize the jobcard for your installation and set the `TCPROCLIB` variable to refer to

the SAMPJCL PDS.

```
//TOMCAT JOB (),'TOMCAT',MSGCLASS=H,NOTIFY=&SYSUID
//*****************************************************************
//* Batch job to run Apache Tomcat using the JZOS Batch JVM launcher
//*   See: SAMPJCL($README) for customization info
//*****************************************************************
//*
// SET TCPROCLB=TOMCAT.SAMPJCL     Proclib with TOMCAT PROC (this)
// SET TCCNFGLB=&TCPROCLB          Tomcat Config PDS (this)
//*
//PROCLIB JCLLIB ORDER=&TCPROCLB
//*
//TOMCAT EXEC PROC=TCPROC,
//   CNFGLIB=&TCCNFGLB,        < (RQD) PDS w/ config XML & env script
//   LOGLVL=''                 < Debug LVL: +I(nfo) +D(ebug) +T(race)
//
```

6. Submit the job!

   After a bit, output in the STDOUT DD SYSOUT file should contain something like:

```
Apr 19, 2009 12:05:54 PM org.apache.coyote.http11.Http11Protocol init
INFO: Initializing Coyote HTTP/1.1 on http-8080
Apr 19, 2009 12:05:54 PM org.apache.catalina.startup.Catalina load
INFO: Initialization processed in 1347 ms
Apr 19, 2009 12:05:55 PM org.apache.catalina.core.StandardService start
INFO: Starting service Catalina
Apr 19, 2009 12:05:55 PM org.apache.catalina.core.StandardEngine start
INFO: Starting Servlet Engine: Apache Tomcat/6.0.18
Apr 19, 2009 12:06:00 PM org.apache.coyote.http11.Http11Protocol start
INFO: Starting Coyote HTTP/1.1 on http-8080
Apr 19, 2009 12:06:00 PM org.apache.catalina.startup.Catalina start
INFO: Server startup in 6202 ms
```

   You should now be able to connect your browser to Tomcat at: `http://host:port`, substituting your host or ip address and the http port that you configured earlier.

   To gracefully shutdown Tomcat, you may use the MVS `STOP (P)` console command. Under the SDSF DA panel, this command can be issued using the "Y" prefix command.

4. Using SAF Security in Tomcat

This document describes how to configure t:Z QuickStart for Tomcat to use SAF (RACF) for J2EE user Authentication and Authorization.

Note

Configuring Tomcat to use SAF for user authentication and authorization is different than running Tomcat under a Java security manager.

Support for using SAF to authorize users, passwords, and roles is provided by the Dovetailed Technologies Tomcat SAF Realm, which is included as Java classes in package com.dovetail.zos.tomcat in `lib/zos-tomcat.jar`.

The Tomcat SAF Realm uses SDK APIs in the com.ibm.os390.security package to validate userid/passwords and assign roles by checking associated SAF entities. These APIs use system services that require that the Tomcat job have the following system authorities:

- The userid executing Tomcat must have read access to the BPX.SERVER SAF entity (or be a superuser).
- The Tomcat address space must be *"program controlled"*, which means that all of the load module libraries and DLLs that are loaded must be marked as program controlled. This is not the same as APF authorization, but is a system privilege required to check passwords and SAF entity access.

The following steps are required to configure t:Z QuickStart for Tomcat to use SAF:

1. Set the program controlled extended attribute on any DLLs that you added to the SDK runtime environment.

   These would include any installation JNI libraries that you added to your LIBPATH in TCENV. If you configured TCENV to use an alphaWorks version of JZOS, rather than the SDK-supplied version, then the alphaWorks JZOS native libraries must also be program controlled. If neither of these apply, then you may ignore this step.

```
extattr +p libjzos*.so
```

Note

Your userid must be authorized for READ access to the `BPX.FILEATTR.PROGCTL` SAF entity to set this attribute.

2. All libraries with modules loaded by the Tomcat job must be *program controlled*. These include the JZOS Batch Launcher load module (JVMLDMxx) as well as the c/c++ runtime libraries used by Java.

```
RALTER PROGRAM * ADDMEM ('<JZOS_PDSE_LOADLIB>'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('SYS1.LINKLIB'//NOPADCHK) UACC(READ)
```

```
RALTER PROGRAM * ADDMEM ('SYS1.CSSLIB'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('CEE.SCEERUN'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('CEE.SCEERUN2'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('CBC.SCLBDLL'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('SYS1.SEZALINK'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('SYS1.SEZALNKE'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('DSN910.SDSNEXIT'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('DSN910.SDSNLOAD'//NOPADCHK) UACC(READ)
RALTER PROGRAM * ADDMEM ('DSN910.SDSNLOD2'//NOPADCHK) UACC(READ)
SETROPTS WHEN(PROGRAM) REFRESH
```

Note

Many of these libraries may already be program controlled. The TSO command `RLIST PROGRAM * ALL` can be used to check the status of all libraries

3. Edit the `SAMPJCL(SERVXML)` member, which contains the Tomcat configuration XML. Near the bottom, locate and edit the `Realm` tag so that default UserDatabase Realm is commented out and the SafRoleDatabase is uncommented.

   The result should be as follows:

```
<!-- This Realm uses the UserDatabase configured in the global JNDI
     resources under the key "UserDatabase".  Any edits
     that are performed against this UserDatabase are immediately
     available for use by the Realm.  -->
<!--
<Realm className="org.apache.catalina.realm.UserDatabaseRealm"
       resourceName="UserDatabase"/>
-->

<!-- For SAF(RACF) Authentication, replace the Realm above with: -->
<Realm className="com.dovetail.zos.tomcat.SafRealm"
       resourceName="SafRoleDatabase"/>
```

4. Edit `SAMPJCL(SAFROLES)` and define the Tomcat (J2EE) roles and the SAF entities that will be used to grant them.

```
<role rolename="manager"
      safclass="EJBROLE" safentity="TCAT.DEV.MANAGER" saflevel="READ"/>

<role rolename="myrole"
      safclass="EJBROLE" safentity="TCAT.DEV.MYROLE" saflevel="READ"/>
```

5. Use the following TSO commands to define a new SAF entity and grant a user access to it:

```
RDEFINE EJBROLE TCAT.DEV.MANAGER UACC(NONE)
PERMIT TCAT.DEV.MANAGER CLASS(EJBROLE) ID(<user_id>) ACCESS(READ)
SETROPTS RACLIST(FACILITY) REFRESH
```

6. Restart Tomcat and attempt to access a protected resource such as the Tomcat manager page: `http://host:port/manager/html`

   Supply your SAF userid and password when prompted to logon. If everything is setup and configured correctly, then the Tomcat manager page will display. If not, check the job's STDOUT and STDERR files for more information.

Note

If you receive an error message in the log indicating that the address space is not properly program controlled, check the system log for an IBM message that indicates which load module library or DLL is causing the problem.

5. For More Information...

Refer to the following sources for more information on using `t:Z QuickStart for Tomcat` on z/OS:

- *http://tomcat.apache.org/* for general information on Tomcat including documentation, source code, bug reports, FAQs, etc.
- *http://dovetail.com/forum* for free support forums, including a forum dedicated to using Tomcat on z/OS. Questions and problems on using `t:Z QuickStart for Tomcat`, especially those that are not general Tomcat questions should be posted here.
- *http://www.ibm.com/servers/eserver/zseries/software/java/products/jzos/overview.html* for more information on using the IBM JZOS batch launcher.
- *http://www.alphaworks.ibm.com/tech/zosjavabatchtk* - the alphaWorks JZOS site which also contains the `JZOS Batch Cookbook`.

Appendix A. License

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