

zOSSEC1 – IBM z/OS Connect Administration

A dive into Liberty and z/OS Connect
Administration

Mitch Johnson

mitchj@us.ibm.com

Washington Systems Center



IBM

IBM Z

Wildfire Team –
Washington System Center

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mitchj@us.ibm.com

Disclaimer

- The information in this presentation was derived from various product Knowledge Centers (KC).
- Additional information included in this presentation was distilled from years of experience implementing security using RACF with z/OS products like CICS, IMS, Db2, MQ, etc. as well as Java runtimes environments like WebSphere Application Server and Liberty.
- There will be additional information on slides that will be designated as Tech/Tips. These contain information that at perhaps at least interesting and hopefully, useful to the reader.
- A z/OS  or Liberty  or z/OS Connect  icon will appear on slides where the information is specific to these products. Don't hesitate to ask questions as to why the icon does or does not appear on certain slides.
- The examples, tips, etc. present in this material are based on firsthand experiences and are not necessarily sanctioned by Liberty or z/OS Connect development.

Agenda

- **Review OMVS, Liberty and RACF security/configuration**
- **Connecting z/OS Connect servers to other z/OS subsystems**
- **Useful Liberty features and MVS commands**
- **Where do I look when things go wrong?**
- **Managing and Monitoring Liberty and z/OS Connect**
- **Miscellaneous Odds and Ends**
- **Additional Material - sample administrative JCL**

**Let's start by reviewing some of the basic
Liberty and z/OS Connect
OMVS, Liberty and RACF
security/configuration details and options**



Use the `zosconnect` command to create a z/OS Connect Liberty Server

To create a server, use the `zosconnect` command:

```
zosconnect create serverName --template=templateName
```

Where *templateName* can be:

- `zosconnect:apiRequester` for an API requester enabled z/OS Connect server
- `zosconnect:default` template for base z/OS Connect servers

- `zosconnect:sampleCicsIpicCatalogManager` for a sample CICS enabled z/OS Connect server
- `zosconnect:sampleDb2Project` for a sample Db2 enabled z/OS Connect server
- `zosconnect:sampleDatabase` for a sample IMS database enabled z/OS Connect server
- `zosconnect:samplePhonebook` for a sample IMS transaction enabled z/OS Connect server
- `zosconnect:sampleMQStockManager` for a sample MQ enabled z/OS Connect server
- `zosconnect:sampleWolaCatalogManager` for a sample WOLA enabled z/OS Connect server

```
zosconnect create zceesrvr --template=zosconnect:apiRequester
```

- Where *serverName* is any value you wish, such as `zceesrvr` or `zCEEServer`, and this value will be the name of the server instance. The templates can be found in directory `/usr/lpp/IBM/zosconnect/v3r0/runtime/templates/servers`.
- Environment variable `WLP_USER_DIR` will be used to set the location of the configuration directory and files created by this command, default location is `/var/zosconnect/servers` where `/var/zosconnect` is default value for `WLP_USER_DIR`.

Issues with permission bits and ownership and group access is a common problem here.

Tech/Tip: Verify your OMVS environment*

- Prevent out-of-memory or other storage issues:
 - Verify the Java runtime is not being limited by system parameters, e.g., *MAXASSIZE* (2 147 483 647), *MAXTHREADS*, etc., for details see *BPXPRM setting* at URL https://www.ibm.com/docs/en/sdk-java-technology/8?topic=SSYKE2_8.0.0/com.ibm.java.vm.80.doc/docs/j9_configure_zos_bpxprm.html
 - Check the value of *ASSIZEMAX* in the OMVS segments of the identities involved and ensure it is adequate, see *MAXASSIZE* above.
 - Exclude OMVS from any IEFUSI exit, SUBSYS(OMVS,NOEXITS) in PARMLIB member *SMFRPMxx*.
- Start an OMVS shell session and verify that Java is fully operational by entering command ***java -version***, you see should results like this:

```
java version "1.8.0_301"
Java(TM) SE Runtime Environment (build 8.0.6.35 - pmz6480sr6fp35-20210714_01(SR6 FP35))
IBM J9 VM (build 2.9, JRE 1.8.0 z/OS s390x-64-Bit Compressed References 20210622_7763 (JIT enabled, AOT
enabled)
OpenJ9   - b1f3adb
OMR      - c2f4a18
IBM     - c24a144
JCL - 20210625_01 based on Oracle jdk8u301-b09
```

- Verify that RACF identities associated with started tasks have OMVS segments with UIDs and GIDs and valid HOME directories and that the identities can invoke Java commands.
- Verify the *zconsetup* script has been executed. My recommendation is to execute this script in the SMP/E target environment, otherwise it will be lost when service is applied and propagated to other images.

Tec-Tip: OMVS security - A review Unix file permissions

Owner	Group	Other																																																																					
<table border="1"> <thead> <tr> <th>Bit</th> <th>Read</th> <th>Write</th> <th>Execute</th> </tr> </thead> <tbody> <tr> <td></td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>Base-2 Value</td> <td>[4]</td> <td>[2]</td> <td>[1]</td> </tr> <tr> <td></td> <td>↓</td> <td>↓</td> <td>↓</td> </tr> <tr> <td></td> <td>4</td> <td>+</td> <td>2</td> <td>+</td> <td>1</td> <td>=</td> </tr> </tbody> </table> <p>7 The owner has READ, WRITE and EXECUTE</p>  <p>The owner of the file or directory</p> <pre>chmod -R * u+rwx zceesrv1</pre>	Bit	Read	Write	Execute		1	1	1	Base-2 Value	[4]	[2]	[1]		↓	↓	↓		4	+	2	+	1	=	<table border="1"> <thead> <tr> <th>Bit</th> <th>Read</th> <th>Write</th> <th>Execute</th> </tr> </thead> <tbody> <tr> <td></td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>Base-2 Value</td> <td>[4]</td> <td>[2]</td> <td>[1]</td> </tr> <tr> <td></td> <td>↓</td> <td>↓</td> <td>↓</td> </tr> <tr> <td></td> <td>4</td> <td>+</td> <td>0</td> <td>+</td> <td>1</td> <td>=</td> </tr> </tbody> </table> <p>5 The group has READ and EXECUTE, but not WRITE</p>  <p>IDs that are part of the group for the file or directory</p> <pre>chmod g+rwx server.xml</pre>	Bit	Read	Write	Execute		1	0	1	Base-2 Value	[4]	[2]	[1]		↓	↓	↓		4	+	0	+	1	=	<table border="1"> <thead> <tr> <th>Bit</th> <th>Read</th> <th>Write</th> <th>Execute</th> </tr> </thead> <tbody> <tr> <td></td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Base-2 Value</td> <td>[4]</td> <td>[2]</td> <td>[1]</td> </tr> <tr> <td></td> <td>↓</td> <td>↓</td> <td>↓</td> </tr> <tr> <td></td> <td>0</td> <td>+</td> <td>0</td> <td>+</td> <td>0</td> <td>=</td> </tr> </tbody> </table> <p>0 Others have nothing</p>  <p>IDs that are not the owner and not part of the group; that is, other</p> <pre>chmod -R * o+rx resources chmod -R * o-w resources/security</pre>	Bit	Read	Write	Execute		0	0	0	Base-2 Value	[4]	[2]	[1]		↓	↓	↓		0	+	0	+	0	=
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-R * indicates recursion



The default server configuration directories and files



ID=**LIBSERV**
Group=**LIBGRP**

```
export JAVA_HOME=<path_to_64_bit_Java>
export WLP_USER_DIR=/var/zosconnect
./zosconnect create zceesrvr
--template= zosconnect:apiRequester
```

```
/var/zosconnect      750 LIBSERV LIBGRP
/servers            750 LIBSERV LIBGRP
/zceesrvr          750 LIBSERV LIBGRP
/logs               777 LIBSERV LIBGRP
  messages.log     666 LIBSERV LIBGRP
/resources          750 LIBSERV LIBGRP
  /zosconnect       750 LIBSERV LIBGRP
    /apis           750 LIBSERV LIBGRP
    /apiRequesters  750 LIBSERV LIBGRP
  /rules            750 LIBSERV LIBGRP
  /services         750 LIBSERV LIBGRP
  server.xml        640 LIBSERV LIBGRP
  server.env        640 LIBSERV LIBGRP
/workarea           750 LIBSERV LIBGRP
```

The create command will create the directories and files under the <WLP_USER_DIR> and assign ownership based on the ID and Group that created the server

There are a few potential issues with this in a production setting:

- If you have multiple people with a need to change configuration files, do you share the password of LIBSERV?
(answer: **no**)
Sharing passwords is a bad practice. Better to take advantage SAF SURROGAT so permitted users can switch to the owning ID so they can make changes. In fact, LIBSERV should be a PROTECTED identity with no password in the first place.
- If you have multiple people with a need to read or update configuration files, do you simply connect them to LIBGRP?

(answer: **no**)

The owner group may be granted access to other resources (on z/OS SAF profiles notably: SERVER) and you do not want others inheriting that. Better to make the configuration group be something different from the owner group and grant READ/WRITE through that group.

One suggestion for settings of the server configuration permission bits



ID=**LIBSERV**
Group=**LIBGRP**

```
export JAVA_HOME=<path_to_64_bit_Java>
export WLP_USER_DIR=/var/zosconnect
./server create zceesrvr
```

/var/zosconnect	751	LIBSERV	LIBGRP
/servers	751	LIBSERV	LIBGRP
/zceesrv1	751	LIBSERV	LIBGRP
/logs	771	LIBSERV	LIBGRP
messages.log	644	LIBSERV	LIBGRP
/resources	751	LIBSERV	LIBGRP
/zosconnect	751	LIBSERV	LIBGRP
/apis	761	LIBSERV	LIBGRP
/apiRequesters	761	LIBSERV	LIBGRP
/rules	761	LIBSERV	LIBGRP
/services	761	LIBSERV	LIBGRP
server.xml	460	LIBSERV	ADMGRP
server.env	460	LIBSERV	ADMGRP
/workarea	750	LIBSERV	LIBGRP

```
export WLP_USER_DIR=/var/zosconnect
cd $WLP_USER_DIR
chmod o+x $WLP_USER_DIR/servers
chmod o+x $WLP_USER_DIR/servers/zceesrvr/resources
chmod -R o+x $WLP_USER_DIR/servers/zceesrvr/resources/*
```

~~Often you may be tempted to use command chmod R 777 *~~

Access for Owner, Group, Others depend on UID and GID as stored with the directory or file, not the actual SAF identity or group. This has implications when moving entire filesystems from one LPAR to another using utility ADRDSSU.

CWWKB0121I: The server process UMASK value is set to 0000

- sets permission bit for new files deployed using the RESTful artifacts to rw-rw-rw (666 x'OR 000)



Tech/Tip: Use SAF SURROGAT Resources

RACF Surrogate access allows a designated administrative identity the ability to invoke commands and perform functions as if they were running under the identity that will be used for the z/OS Connect server started task. This may be useful because identities associated with started task are normally restricted and cannot be used for accessing TSO or OMVS shells,

Use the following examples as guides and create the surrogate resources and permit access. In these examples, ***LIBSERV*** represents the RACF identity under which the z/OS Connect server will be running and ***adminUser*** represent the administrative RACF identity.

Define a SURROGAT profile for the server's SAF identity

RDEFINE SURROGAT BPX.SRV.*LIBSERV*

Define a SURROGAT submit profile to allow job submission as the server's SAF identity

RDEFINE SURROGAT *LIBSERV*.SUBMIT

Permit an administrative identity to act as a surrogate of the Liberty task identity

PERMIT BPX.SRV.*LIBSERV* CLASS(SURROGAT) ID(*adminGrp*) ACC(READ)

PERMIT *LIBSERV*.SUBMIT CLASS(SURROGAT) ID(*adminGrp*) ACC(READ)

Refresh the SURROGAT in storage profiles

SETROPTS RACLIST(SURROGAT) REFRESH

Now any identity in group *adminGrp* can submit JCL with the *USER=LIBSERV* parameter on the job card or use the OMVS switch user command (*su -s LIBSERV*) to execute OMVS scripts or commands as LIBSERV.

Tech/Tip: z/OS : Use SAF UNIXPRIV/FACILITY Resources



An alternative to using a surrogate access is to permit the identity under which the customization will be done to enhanced Unix privileges. Specially, permitting the identity to Unix privileges SUPERUSER.FILESYS, SUPERUSER.FILESYS.CHANGEPERMS and SUPERUSER.FILESYS.CHOWN.

- *Permit an administrative identity to write to any local directory or file*
PERMIT SUPERUSER.FILESYS CLASS(UNIXPRIV)
 ID(adminUser) ACC(CONTROL)
- *Permit an administrative identity to change permission bit of any local directory or file*
PERMIT SUPERUSER.FILESYS.CHANGEPERMS CLASS(UNIXPRIV)
 ID(adminUser) ACC(READ)
- *Permit an administrative identity to change the ownership of any directory or file*
PERMIT SUPERUSER.FILESYS.CHOWN CLASS(UNIXPRIV)
 ID(adminUser) ACC(READ)
- *Permit an administrative identity switch to root (su -s root) or the Enable superuser mode(SU) Setup option in ISHELL*
PERMIT BPX.SUPERUSER CLASS(FACILITY) ID(adminUser) ACC(READ)
- *Refresh the UNIXPRIV and/or FACILITY instorage profiles*
SETROPTS RACLIST(UNIXPRIV,FACILITY) REFRESH

https://www.ibm.com/support/knowledgecenter/en/SSLTBW_2.4.0/com.ibm.zos.v2r4.bpxb200/usspriv.htm

Use these commands only if you understand the implications.

Tech/Tip: z/OS : A JCL example of using SURROGAT/UNIXPRIV access



```
//ZCEESRVR JOB 'ZCEE',CLASS=A,REGION=0M,NOTIFY=&SYSUID,USER=LIBSERV
//*****
//** SET SYMBOLS
//*****
//EXPORT EXPORT SYMLIST=(*)
// SET JAVAHOME='/usr/lpp/java/J8.0_64'
// SET ZCEEPATH='/usr/lpp/IBM/zosconnect/v3r0'
// SET SERVER='zceesrvr'
// SET TEMPLATE='zosconnect:apiRequester'
// SET WLPUSER='var/zosconnect'
// SET USER='LIBSERV'
// SET GROUP='LIBGRP'
//*****
//** Step ZCEESRVR - Use the zosconnect command to create a server
//*****
//ZCEESRVR EXEC PGM=IKJEFT01,REGION=0M
//SYSTSPPRT DD SYSOUT=*
//SYSERR DD SYSOUT=*
//STDOUT DD SYSOUT=*
//SYSTSIN DD *,SYMBOLS=EXECSYS
BPXBATCH SH +
export JAVA_HOME=&JAVAHOME; +
export WLP_USER_DIR=&WLPUSER; +
&ZCEEPATH/bin/zosconnect create &SERVER +
--template=&TEMPLATE
//*****
//** Step CHOWN - Change directory and file ownership
//*****
//CHOWN EXEC PGM=IKJEFT01,REGION=0M
//SYSERR DD SYSOUT=*
//STDOUT DD SYSOUT=*
//SYSTSPPRT DD SYSOUT=*
//SYSTSIN DD *,SYMBOLS=EXECSYS
BPXBATCH SH +
export WLP_USER_DIR=&WLPUSER; +
chown -R &USER:&GROUP $WLP_USER_DIR/servers/&SERVER
```

Using SURROGAT RACF resources means there is no need provide LIBSERV's password, in fact LIBSERV may be protected and not even have a password. Any files or directories created will be owned by LIBSERV.

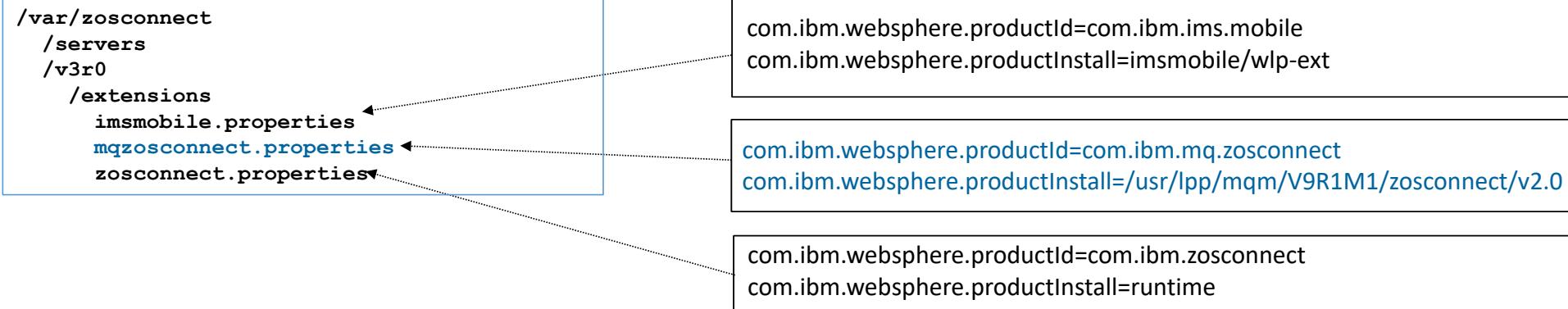
Alternative, use the change ownership command, *chown*, to change the user and group attributes of the user associated with the STARTED task. This requires UNIXPRIV RACF access.



LPAR specific Directories and Files created by zconsetup

The `zconsetup` script creates a symbolic link from the WLP `etc` directory (normally R/O) to a local R/W directory (creating a default configuration and local extension directories).

```
JOHNSON:/usr/lpp/IBM/zosconnect/v3r0/wlp/etc: ls -al
total 32
drwxrwxr-x  2 OMVSKERN 0          8192 Jun 24 10:24 .
drwxrwxr-x 10 OMVSKERN 0          8192 Jun 24 10:24 ..
lrwxrwxrwx  1 990023  0          31 Jul 27 2020 extensions -> /var/zosconnect/v3r0/extensions
```



- This directory structure and contents is created by invoking the `zconsetup` script and **must be created on each LPAR** on which z/OS Connect will execute. This is how the z/OS Connect Liberty server locates service provider executables. Note: the `com.ibm.websphere.productInstall` directive value is relative to directory `/usr/lpp/IBM/zosconnect/v3r0`.
- **MQ service provider is not shipped with z/OS Connect so the MQ executables are outside of the z/OS Connect directory structure.**
- Not creating this link will cause message `CWWKE0054E: Unable to open /usr/lpp/IBM/zosconnect/v3r0/wlp/etc/extensions/zosconnect.properties`



A Tour of a server's directories and files

```
/var/zosconnect/v3r0<
  /extensions
  ${WLP_USER_DIR}
  /servers
    /serverName<
      ims-admin-services.xml
      jvm.options
      /logs
      /resources
        /imsmobile-config
        /security
        /zosconnect
      server.env
      server.xml
      /workarea#*
      /tranlog #*
```

- The extensions subdirectory will always be in /var/zosconnect/v3r0

- Each server (serverName) will have a unique subdirectory in the location specified by WLP_USER_DIR, which **defaults to /var/zosconnect**.
- Important, use the same value for starting a server that was used when the server was created.

- The location of the *serverName* directory is based on the concatenation of the value of the *WLP_USER_DIR* environment variable with the constant *servers* and does not have to be in directory /var/zosconnect.
- The *serverName* directory structure and its initial contents are created by invoking the *zosconnect create serverName* script.
- serverName* can be a mount point with a dedicated file system mounted at this mount point (see above). This can be used to isolate servers to dedicated file systems.
- The number, size and output location of messages.log and trace files in the *logs* directory can be controlled with the Liberty <logging> configuration element or the output location controlled by using the *com.ibm.ws.logging.log.directory* Java directive as a JVM options override, more on this later.
- #These directories maintain state information and it is a good practice is to add the --clean parameter to the server startup JCL, e.g., PARMS='serverName --clean', especially after service is applied.



Tech/Tip: Use multiple mount points and ZFS file systems

Create the mount points and mount file systems prior to running zconsetup

```
mkdir -p /var/zosconnect  
mkdir -p /var/zosconnect/servers  
mkdir -p /var/zosconnect/group1  
mkdir -p /var/zosconnect/group2  
mkdir -p /var/zosconnect/group3
```

SYS1.PARMLIB (BPXPRM##)

```
MOUNT FILESYSTEM('OMVS.ZCEEVAR.ZFS')  
  MOUNTPOINT('/var/zosconnect')  
  TYPE(ZFS) MODE(READ)  
  
MOUNT FILESYSTEM('OMVS.ZCEE.SERVERS.ZFS')  
  MOUNTPOINT('/var/zosconnect/servers')  
  TYPE(ZFS) PARM('AGGRGROW') MODE(RDWR)  
  
MOUNT FILESYSTEM('OMVS.ZCEE.GROUP1.ZFS')  
  MOUNTPOINT('/var/zosconnect/group1')  
  TYPE(ZFS) PARM('AGGRGROW') MODE(RDWR)  
  
MOUNT FILESYSTEM('OMVS.ZCEE.GROUP2.ZFS')  
  MOUNTPOINT('/var/zosconnect/group2')  
  TYPE(ZFS) PARM('AGGRGROW') MODE(RDWR)  
  
MOUNT FILESYSTEM('OMVS.ZCEE.GROUP.ZFS')  
  MOUNTPOINT('/var/zosconnect/group3')  
  TYPE(ZFS) PARM('AGGRGROW') MODE(RDWR)
```

- Create a dedicated filesystem for the root z/OS Connect /var directory, e.g., /var/zosconnect/v3r0/extensions. This provides portability for migrations and system upgrades. Note: MODE(READ) will apply to /var/zosconnect/servers.

- Create a dedicated filesystem for each set or groups of servers. These filesystems will contain the server configuration directories for 1 or more servers.
- Each server's WLP_USER_DIR environment variable will be set to the mount point, e.g., *WLP_USER_DIR=/var/zosconnect/group1* when the server is created and in the server's startup JCL.

df -P | grep /var/zosconnect

Filesystem	512-blocks	Used	Available	Capacity	Mounted on
OMVS.ZCEEVAR.ZFS	69120	68658	462	100%	/var/zosconnect
OMVS.ZCEE.SERVERS.ZFS	159120	76455	82665	48%	/var/zosconnect/servers
OMVS.ZCEE.GROUP1.ZFS	135360	1506	133854	2%	/var/zosconnect/group1
OMVS.ZCEE.GROUP2.ZFS	4059360	2591284	1468076	64%	/var/zosconnect/group2
OMVS.ZCEE.GROUP3.ZFS	135360	17858	117502	14%	/var/zosconnect/group3



A Tour of Server Configuration Directories and Files

A z/OS Connect EE V3.0 server configuration structure looks like this:

```
 ${WLP_USER_DIR}
  /servers
    /zceesrv1
      /logs
        /ffdc
          messages.log
      /resources
        /zosconnect
          /apis
          /apiRequesters
          /rules
          /services
        server.xml
        server.env
      /tranlog
      /workarea
```

The messages.log file is the key output file for messages about Liberty and the processing taking place in the Liberty server. The output written to this file can be written to the SPOOL by including DD statement MSGLOG in the startup JCL, e.g.,
//MSGLOG DD SYSOUT=*,FREE=CLOSE,SPIN=(UNALLOC,1M)

The /zosconnect directory is where the deployed APIs, services, and API requester files will be placed.

The server.xml file is the key configuration file. It is here that z/OS Connect EE V3.0 definitions go which define the essential backend connectivity.

The *WLP_USER_DIR* environment variable sets the value of the root directory of the server's configuration files and directories, e.g., *WLP_USER_DIR=/var/zosconnect*



Tech/Tip: Liberty environment variables

Environment variables can be set to control which directories are used and the format of output.

- **WLP_LOGGING_CONSOLE_LOGLEVEL[#]** - The logging level used to filter messages written to system streams (STDOUT). The valid values are INFO, AUDIT, WARNING, ERROR, and OFF. By default, the WLP_LOGGING_CONSOLE_LOGLEVEL environment variable is set to AUDIT. Valid options are:

- **AUDIT** - Audit and warning messages will be written to the system output stream (STDOUT). Error messages will be written to the system error stream (STDERR).
- **ERROR** - Error messages will be written to the system error stream (STDERR).
- **INFO** - Info, audit, and warning messages will be written to the system output stream. Error messages will be written to the system error stream (STDERR)
- **OFF** - No server output is written to system streams (STDOUT). Only JVM output is written to system streams(STDOUT).
- **WARNING** - Warning messages will be written to the system output stream (STDOUT). Error messages will be written to the system error stream (STDERR).

STDOUT and STDERR refer to the DD statements in the server JCL, e.g., spool output.

- **WLP_LOGGING_CONSOLE_FORMAT[#]** - The required format for the console. Valid values are DEV, SIMPLE, or JSON format. By default, WLP_LOGGING_CONSOLE_FORMAT is set to DEV. Valid options are:

- **DEV** - Use the dev logging format.
- **JSON** - Use the JSON logging format.
- **SIMPLE** - Use the simple logging format. As of Liberty release 20.0.0.6 (z/OS Connect V3.034), this format writes the messages to STDOUT and STDERR with time stamps included.

- **WLP_OUTPUT_DIR[#]** - This environment variable can be used to specify an alternative location for server generated output such as logs, the workarea directory, and generated files.

- **WLP_USER_DIR** – This environment variables specifies where the runtime environment looks for shared resources and server definitions.

Environment variables can also be used in the server configuration files. For example, the following environment variables are automatically set in a Liberty server.

- **server.config.dir** – whose value will automatically be set to the value of variable WLP_USER_DIR concatenated with the name of the server, e.g. `/var/zosconnect/servers/serverName`
- **server.output.dir** - whose value will automatically be set to the value of variable WLP_OUTPUT_DIR concatenated with the name of the server, e.g. `/var/zosconnect/servers/serverName`
- **wlp.server.name** - whose value will automatically be set to the value of the server as provided in the `zosconnect run` command, e.g., PARMS value provided in the JCL procedure.

[#]These environment variables are not available to a z/OS Connect server, use Java directives instead.



Tech/Tip: Liberty Java Directives for controlling output

com.ibm.ws.logging.console.format (consoleFormat) - The required format for the console. Valid values are basic or json format.

com.ibm.ws.logging.console.log.level (consoleLogLevel) - This filter controls the granularity of messages that go to the console. The valid values are INFO, AUDIT, WARNING, ERROR, and OFF. By default, the console log level is set to AUDIT.

com.ibm.ws.logging.hideMessage (hideMessage) - Use this attribute to configure the messages that you want to hide from the `console.log` and `message.log` files. If the messages are configured to be hidden, then they are redirected to the `trace.log` file.

com.ibm.ws.logging.log.directory (logDirectory) - Use this attribute to set a directory for all log files, excluding the `console.log` file, but including FFDC. The default log location path is `WLP_OUTPUT_DIR/serverName/logs`

com.ibm.ws.logging.max.file.size (maxFileSize) - The maximum size (in MB) that a log file can reach before it is rolled. The Liberty runtime does only size-based log rolling. To disable this attribute, set the value to 0. The maximum file size is approximate. By default, the value is 20.

com.ibm.ws.logging.max.files (maxFiles) - If a maximum file size exists, this setting is used to determine how many of each of the log files are kept. This setting also applies to the number of exception logs that summarize exceptions that occurred on any day. So, if this number is 10, you might have 10 message logs, 10 trace logs, and 10 exception summaries in the `ffdc` directory. The default value is 2.

com.ibm.ws.logging.message.format (messageFormat) - The required format for the `messages.log` file. Valid values are basic or json format. By default, `messageFormat` is set to the environment variable `WLP_LOGGING_MESSAGE_FORMAT` (if set) or basic.

JVM Options example (JCL):

`JVM_OPTIONS=-Dcom.ibm.ws.logging.log.directory=/u/johnson/logs -Dcom.ibm.ws.logging.max.file.size=10`

bootstrap.properties example:

`com.ibm.ws.logging.message.file.name=basqstrtMessages.log
com.ibm.ws.logging.log.directory=/u/common/logs`

N.B. `consoleFormat`, `logDirectory`, etc. can be specified in the `<logging/>` Liberty configuration element. Note the recommendation for the attributes in red is for them to be provided in Java directives.

Tech/Tip: Initial server.xml configuration file



Default server.xml configuration file

Modified server.xml configuration file

```
<server description="zCEE Server">
<include location="${server.config.dir}/includes/safSecurity.xml"/>
<include location="${server.config.dir}/includes/ipicIDProp.xml"/>
<include location="${server.config.dir}/includes/keyring.xml"/>
<include location="${server.config.dir}/includes/groupAccess.xml"/>
<include location="${server.config.dir}/includes/shared.xml"/>
<include location="${server.config.dir}/includes/apiRequesterHTTPS.xml"/>
<include location="${server.config.dir}/includes/imsDatabase.xml"/>
<!-- Enable features -->
<featureManager>
    <feature>zosconnect:zosConnect-2.0</feature>
    <feature>zosconnect:zosConnectCommands-1.0</feature>
    <feature>apiDiscovery-1.0</feature>
</featureManager>
<!-- To access this server from a remote client add a host attribute
    <httpEndpoint id="defaultHttpEndpoint"
        host="*"
        httpPort="9090"
        httpsPort="9453" />
```

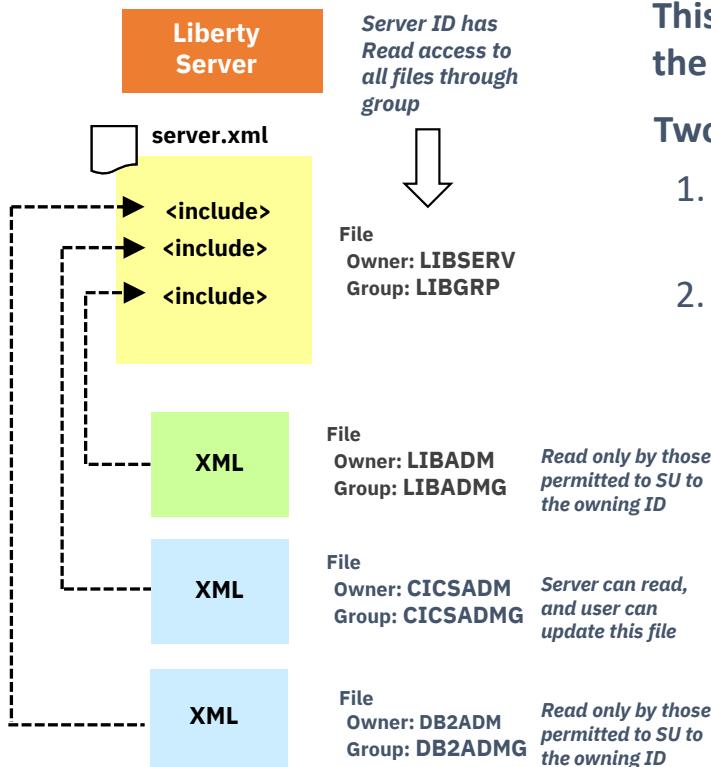
*Added in V3.0.48 with no HOLD information provided

Simplify maintenance by :

- Customizing just the ports
 - Using “include” statements to make further changes such as adding additional features and additional XML configuration elements.
 - Review <https://www.ibm.com/docs/en/was-liberty/nd?topic=liberty-configuration-element-merging-rules> to understand merging rules.



Take advantage of Liberty's supports server XML “include” file processing



This allows portions of the configuration to be held in files outside the main server.xml file

Two primary uses:

1. Hold sensitive configuration information in file that is READ to select people, but not the read group
2. Allow a user to update their portion of the server configuration, but not other parts of it

For the second use-case it is important to ensure the user can not override configuration in the main XML. Use the "onConflict" tag in the <include> element:

```
<include location="myIncludeFile.xml" onConflict="IGNORE"/>
```

This tells Liberty to ignore XML elements in include file that are also found in the main server.xml

It does not prevent them from injecting configuration elements not found in the main server.xml. If there is a concern about that, don't use include processing.

Nesting of an include file within a include file is possible



Using “administration include” files to manage the server XML

- Setup a server.xml using ‘include’ statements and allow other administrator to manage those included files, but not the server.xml itself.
- Control what configuration can be overridden in included files using the ‘onConflict’ option provided with the include element (see Ignore, Replace, Merge).

https://www.ibm.com/support/knowledgecenter/en/SSAW57_liberty/com.ibm.websphere.wlp.nd.multiplatform.doc/ae/cwlp_config_include.html

server.xml (owned by ID ADMIN1)

```
<featureManager>
  <feature>appSecurity-1.0</feature>
<featureManager>
<include location="${server.config.dir}/includes/db2.xml onConflict="IGNORE"/>
<include location="${server.config.dir}/includes/cics.xml onConflict="IGNORE"/>
<include location="${server.config.dir}/includes/imsDb.xml onConflict="IGNORE"/>
```

db2.xml (owned and managed by a DBA)

```
<server description="Db2 REST">
  <zosconnect_zosConnectServiceRestClientConnection id="Db2Conn" host="wg31.washington.ibm.com" port="2446" basicAuthRef="dsn2Auth" />
  <zosconnect_zosConnectServiceRestClientBasicAuth id="dsn2Auth" applName=DSN2APPL"/>
</server>
```

cics.xml (owned and managed by a CICS administrator)

```
<server description="CICS">
  <featureManager> <feature>zosconnect:cicsService-1.0</feature> </featureManager>
  <zosconnect_cicsIpicConnection id="catalog" host="wg31" port="1491"/>
</server>
```

imsDB.xml (owned and managed by a IMS administrator)

```
<server description="IMS DATABASE">
  <featureManager> <feature>zosconnect:dbService-1.0</feature> </featureManager>
  <connectionFactory id="DFSIVPAConn"> <properties.imsudbJLocal databaseName="DFSIVPA" datastoreName="IVP1" driverType="4" portNumber="5555" datastoreServer="wg31" user="USER1" password="USER1" flattenTables="True"/> </connectionFactory>
</server>
```



Tech-Tip: Review configuration conflicts

```
ÝAUDIT  " CWWKG0102I: Found conflicting settings for cscvincAPI instance of zosconnect_endpointConnection
configuration.
Property port has conflicting values:
  Value 9443 is set in file:/var/zosconnect/servers/myServer/includes/apiRequesterHTTPS.xml.
  Value 9443 is set in file:/var/zosconnect/servers/myServer/includes/apiRequesterHTTPS.xml.
  Value 9463 is set in file:/var/zosconnect/servers/myServer/includes/oauth.xml.
Property port will be set to 9463.
Property host has conflicting values:
  Value https://dvipa.washington.ibm.com is set in
file:/var/zosconnect/servers/myServer/includes/apiRequesterHTTPS.xml.
  Value https://dvipa.washington.ibm.com is set in
file:/var/zosconnect/servers/myServer/includes/apiRequesterHTTPS.xml.
  Value https://mpz3.washington.ibm.com is set in file:/var/zosconnect/servers/myServer/includes/oauth.xml.
Property host will be set to https://mpz3.washington.ibm.com.
Property authenticationConfigRef has conflicting values:
  Value mySAFAuth is set in file:/var/zosconnect/servers/myServer/includes/apiRequesterHTTPS.xml.
  Value myoAuthConfig is set in file:/var/zosconnect/servers/myServer/includes/oauth.xml.
Property authenticationConfigRef will be set to myoAuthConfig.
```

onConflict="MERGE" Conflicting elements will be merged, and the last value encountered will be used.

onConflict="REPLACE" When elements conflict, the element in the included file will be ignored

onConflict="IGNORE" Conflicting elements in the included file are ignored.



Using a bootstrap.properties file to customize the server's configuration XML[#]

zceesrv1's bootstrap.properties

```
httpPort=9080
httpsPort=9443
ipicPort=1491
cicsHost=wg31.washington.ibm.com
network=ZOSCONN1
applid=ZOSCONN1
```

zceesrv2's bootstrap.properties

```
httpPort=9090
httpsPort=9453
ipicPort=1492
cicsHost=wg31.washington.ibm.com
network=ZOSCONN2
applid=ZOSCONN2
```

server.xml

```
<!-- To access this server from a remote client, add a host attribute to the following
element, e.g. host="*" -->
<httpEndpoint id="defaultHttpEndpoint"
    host="*"
    httpPort="${httpPort}"
    httpsPort="${httpsPort}" />
```

ipicIDProp.xml

```
<zosconnect_cicsIpicConnection id="catalog"
    host="${cicsHost}" port="${ipicPort}"
    zosConnectNetworkid="${network}" zosConnectApplid="${applid}"/>

<zosconnect_cicsIpicConnection id="cscvinc"
    host="${cicsHost}" port="${ipicPort}"
    zosConnectNetworkid="${network}" zosConnectApplid="${applid}"/>

<zosconnect_cicsIpicConnection id="miniloan"
    host="${cicsHost}" port="${ipicPort}"
    zosConnectNetworkid="${network}" zosConnectApplid="${applid}"/>
```

#Located in directory \${server.config.dir}



Sharing XML configuration files between servers

You could start by adding an “includes” directory to each server’s configuration directory and then add “include” statements to this local directory to each server’s server.xml file

```
<include location="${server.config.dir}/includes/basicSecurity.xml"/>
<include location="${server.config.dir}/includes/ipic.xml"/>
<include location="${server.config.dir}/includes/keyringInbound.xml"/>
<include location="${server.config.dir}/includes/groupAccess.xml"/>
<include location="${server.config.dir}/includes/shared.xml"/>
<include location="${server.config.dir}/includes/oauth.xml"/>
```

- /var/zosconnect/servers/zceesrv1/includes
- /var/zosconnect/servers/zceesrv2/includes
- /var/zosconnect/servers/zceesrv3/includes

Then change the include file in each server’s XML file as needed

```
<include location="${server.config.dir}/includes/safSecurity.xml"/>
<include location="${server.config.dir}/includes/ipicIDProp.xml"/>
<include location="${server.config.dir}/includes/keyringOutboundMutual.xml"/>
<include location="${server.config.dir}/includes/groupAccess.xml"/>
<include location="${server.config.dir}/includes/shared.xml"/>
<include location="${server.config.dir}/includes/oauth.xml"/>
```

**F ZCEESRV1,REFRESH,CONFIG
F ZCEESRV2,REFRESH,CONFIG
F ZCEESRV3,REFRESH,CONFIG**

Contents of the three “includes” directory

basicSecurity.xml
db2.xml
db2TLS.xml
groupAccess.xml
ipic.xml
ipicIDProp.xml
keyringInbound.xml
keystore.xml
keyringMutual.xml
keyringOutboundMutual.xml
safSecurity.xml

The issue here is that each of the included files must be maintained in 3 locations

So, let’s take this a step further



Sharing XML configuration files between servers

Replace the *includes* subdirectories with symbolic links. Now the included files can be in a shared location which then can be accessed from multiple servers on a single or from multiple LPARs. Updates to the “include” files are made in one administrative directory.

OMVS commands

Symbolic links to a shared local LPAR directory

```
ln -s /var/shared/zosconnect/includes /var/zosconnect/servers/zceesrv1/includes  
ln -s /var/shared/zosconnect/includes /var/zosconnect/servers/zceesrv2/includes  
ln -s /var/shared/zosconnect/includes /var/zosconnect/servers/zceesrv3/includes
```

Symbolic links to a shared Sysplex directory

```
ln -s /global/zosconnect/includes /var/zosconnect/servers/zceesrv1/includes  
ln -s /global/zosconnect/includes /var/zosconnect/servers/zceesrv2/includes  
ln -s /global/zosconnect/includes /var/zosconnect/servers/zceesrv3/includes
```

The server.xml file contains these “include” statements

```
<include location="${server.config.dir}/includes/safSecurity.xml"/>  
<include location="${server.config.dir}/includes/ipicIDProp.xml"/>  
<include location="${server.config.dir}/includes/keyringOutboundMutual.xml"/>  
<include location="${server.config.dir}/includes/groupAccess.xml"/>  
<include location="${server.config.dir}/includes/shared.xml"/>  
<include location="${server.config.dir}/includes/oauth.xml"/>
```



/var/shared/zosconnect/includes

Contents of the common “includes” directory

*basicSecurity.xml
db2.xml
db2TLS.xml
groupAccess.xml
ipic.xml
ipicIDProp.xml
keyringInbound.xml
keystore.xml
keyringMutual.xml
keyringOutboundMutual.xml
safSecurity.xml*

F ZCEESRV1,REFRESH,CONFIG

F ZCEESRV2,REFRESH,CONFIG

F ZCEESRV3,REFRESH,CONFIG

Consider creating an “include” file with just the include statements and then include this file in each server’s server.xml file.



Tech-TIP: A practical example-PTF V3.0.35 included a CORS update

July 2020

V3.0.35 (APAR PH26291)
Server code update

Enhancements

- The text of messages BAQR0417W and BAQR0418W has been updated. For more information, see z/OS Connect EE [Runtime Messages](#).

Fixes

- PH21761 A CICS region reports **SOS DFHSM0133 WBSEBUF** when z/OS Connect EE requester is in use.
- PH25345 Passing user credentials in the request body to the authentication server to obtain a JWT causes a NPE in z/OS Connect EE.
- PH21819 z/OS Connect EE sets some CORS headers automatically.

Attention

When this fix is applied, additional CORS configuration is required in `server.xml` to enable connections from the z/OS Connect EE API toolkit and JavaScript clients. For more information, see [Configuring Cross-Origin Resource Sharing on a z/OS Connect Enterprise Edition Server](#)

`cors.xml`

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="CORS entries">

    <!-- add cors to allow cross origin access, e.g. when using swagger doc from zOS Connect Enterprise
        Edition -->
    <cors id="defaultCORSConfig"
        domain="/"
        allowedOrigins="*"
        allowedMethods="GET, POST, PUT, DELETE, OPTIONS"
        allowedHeaders="Origin, Content-Type, Authorization, Cache-Control, Expires, Pragma"
        allowCredentials="true"
        maxAge="3600"/>

</server>
```

`server.xml`

```
<include location="${server.config.dir}/includes/cors.xml"/>
```



Sharing XML configuration files – using *variable* files

myServer.xml

```
<variable name= "unauthenticatedUser" value= "WSGUEST" />
<variable name="profilePrefix" value= "BBGZDFLT" />
```

zceeoipid.xml

```
<variable name= "unauthenticatedUser" value="ZCGUEST" />
<variable name="profilePrefix" value="EMJZDFLT" />
```

server.xml

```
<server description="new server">
<include location="${server.config.dir}/includes/safSecurity.xml"/>
<include location="${server.config.dir}/includes/${wlp.server.name}.xml"/>

    <!-- Enable features -->
    <featureManager>
        <feature>zosconnect:zosConnect-2.0</feature>
        <feature>zosconnect:zosConnectCommands-1.0</feature>
    </featureManager>
```

safSecurity.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="SAF security">

    <!-- Enable features -->
    <featureManager>
        <feature>appSecurity-2.0</feature>
        <feature>zosSecurity-1.0</feature>
    </featureManager>

    <webAppSecurity allowFailOverToBasicAuth="true" />
    <safRegistry id="saf" />
    <safAuthorization racRouteLog="ASIS" />
    <safCredentials unauthenticatedUser="${unauthenticatedUser}"
        profilePrefix="${profilePrefix}" />
</server>
```

Tech/Tip: Administrative – Use symbolic links for an administrative shortcut

- Create an “administration” subdirectory, e.g., `zcee` in directory `/var`
- Then create a symbolic link in the “administration” directory to each Liberty server’s configuration directory and other frequently accessed directories.

```
ls -al /var/zcee
drwxrwxrwx  4 JOHNSON  SYS1      8192 Aug 16 12:23 .
drwxrwxrwt 25 OMVSKERN SYS1      8192 Aug 16 11:56 ..
lrwxrwxrwx  1 JOHNSON  SYS1      57 Aug 16 12:22 CSCWLP -> /var/wlp/cics/CICS53Z/CSCWLP/wlp/usr/servers/defaultServer
lrwxrwxrwx  1 JOHNSON  SYS1      57 Aug 16 12:22 CICSWLP -> /var/wlp/cics/CICS53Z/CICSWLP/wlp/usr/servers/cicswlp
drwxrwxrwx  2 JOHNSON  SYS1      8192 Aug 16 15:30 hcd
lrwxrwxrwx  1 JOHNSON  SYS1      27 Jun 10 15:55 includes -> /global/zosconnect/includes
lrwxrwxrwx  1 JOHNSON  SYS1      28 Aug 16 10:12 mqweb -> /var/mqm/mqweb/servers/mqweb
lrwxrwxrwx  1 JOHNSON  SYS1      32 Jun  4 12:49 myServer -> /var/zosconnect/servers/myServer
drwxr-xr-x  2 JOHNSON  SYS1      8192 Aug 16 13:14 properties
lrwxrwxrwx  1 JOHNSON  SYS1      18 Aug 17 12:47 shared -> /var/shared/zosconnect/resources/zosconnect
lrwxrwxrwx  1 JOHNSON  SYS1      24 May 13 2020 walop3a -> /var/wlp/servers/walop3a
lrwxrwxrwx  1 JOHNSON  SYS1      24 May 13 2020 walrp3a -> /var/wlp/servers/walrp3a
lrwxrwxrwx  1 JOHNSON  SYS1      31 May 14 2020 wazs34a -> /var/zosconnect/servers/wazs34a
lrwxrwxrwx  1 JOHNSON  SYS1      24 Aug 16 10:32 wlphats -> /var/wlp/servers/wlphats
lrwxrwxrwx  1 JOHNSON  SYS1      36 Aug 16 10:31 zceearpir -> /var/ats/zosconnect/servers/zceearpir
lrwxrwxrwx  1 JOHNSON  SYS1      39 Aug 16 10:18 zceecics -> /var/cicsts/zosconnect/servers/zceecics
lrwxrwxrwx  1 JOHNSON  SYS1      35 Aug 16 10:31 zceedvm -> /var/ats/zosconnect/servers/zceedvm
lrwxrwxrwx  1 JOHNSON  SYS1      32 Jun 10 15:54 zceepid -> /var/zosconnect/servers/zceepid
lrwxrwxrwx  1 JOHNSON  SYS1      36 Aug 16 10:14 zceesrvr -> /var/ats/zosconnect/servers/zceesrvr
lrwxrwxrwx  1 JOHNSON  SYS1      44 Aug 16 11:57 zosmfServer -> /var/zosmf/configuration/servers/zosmfServer
```



Tech/Tip: Administrative – Use dedicated ZFS filesystem at the mount points

- Create mount points in the “administrative” directory for shared r/w directories
- Avoid creating directories and files in the root file system.
- Use a common or shared mount point
 - Use /var mount point for local read/write file systems
 - Use /global for sharing a mount point across multiple LPARs
- Use ZFS filesystems and use AGGRGROW to allow R/W ZFS filesystems to automatically go into extents (>16).

```
SYS1.PARMLIB(BPXPRM##)
MOUNT FILESYSTEM('OMVS.ZCEE.ZFS')
  MOUNTPOINT('/var/zcee')
  TYPE(ZFS) PARM('AGGRGROW') MODE(RDWR)
MOUNT FILESYSTEM('OMVS.ZCEEHCD.ZFS')
  MOUNTPOINT('/var/zcee/hcd')
  TYPE(ZFS) PARM('AGGRGROW') MODE(RDWR)
MOUNT FILESYSTEM('OMVS.ZCEE.SHARED.ZFS')
  MOUNTPOINT('/var/shared/zosconnect')
  TYPE(ZFS) PARM('AGGRGROW') MODE(RDWR)
```



Tech/Tip: Symbolic links can simplify commands in command shells and JCL

```
Performing commands:  
ln -s /global/zosconnect/includes /var/zcee/includes  
ln -s /var/zosconnect/servers/zceesrv1 /var/zcee/zceesrv1  
ln -s /var/zosconnect/servers/zceesrv2 /var/zcee/zceesrv2  
  
Changes the ln command from:  
ln -s /global/zosconnect/includes /var/zosconnect/servers/zceesrv1/includes  
ln -s /global/zosconnect/includes /var/zosconnect/servers/zceesrv2/includes  
  
To:  
ln -s /var/zcee/includes /var/zcee/zceesrv1/includes  
ln -s /var/zcee/includes /var/zcee/zceesrv2/includes
```

Directory Shortcuts

Which leads to shorter OMVS commands:

```
//EXPORT EXPORT SYMLIST=(*  
// SET SERVER='defaultServer'  
// SET SHARED='/var/zcee/shared'  
// SET WLPUSER='/var/zosconnect'  
//ZCEELN EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXEC SYS  
BPXBATCH SH +  
export serverName=&SERVER; +  
export sharedDir=&SHARED; +  
export WLP_USER_DIR=&WLPUSER; +  
ln -s $WLP_USER_DIR/servers/$serverName /var/zcee/$serverName; +  
ln -s $sharedDir/includes /var/zcee/$serverName/includes
```

OR

```
/u/johnson/.profile  
export serverName=defaultServer  
export sharedDir=/var/zcee/shared  
export WLP_USER_DIR=/var/zosconnect
```

```
//ZCEELN EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXEC SYS  
BPXBATCH SH +  
ln -s $WLP_USER_DIR/servers/$serverName /var/zcee/$serverName; +  
ln -s $sharedDir/includes /var/zcee/$serverName/includes
```



Also use symbolic links to share z/OS Connect artifacts in default locations

By default, each server has their own dedicated resources/zosconnect subdirectory

-  /var/zosconnect/servers/zceesrv1/resources/zosconnect
-  /var/zosconnect/servers/zceesrv2/resources/zosconnect
-  /var/zosconnect/servers/zceesrv3/resources/zosconnect

Contents of each of the "resources/zosconnect" directory

- /apis
- /apiRequesters
- /rules
- /services

Specify a shared alternative location for these artifacts using symbolic links.

OMVS commands

Symbolic links to a local file system

```
ln -s /var/shared/zosconnect/resources/zosconnect /var/zcee/shared
```

Or a symbolic links to a shared file system

```
ln -s /global/zosconnect/resources/zosconnect /var/zcee/shared
```

 /var/shared/zosconnect/resources/zosconnect/.....

 /global/zosconnect/resources/....

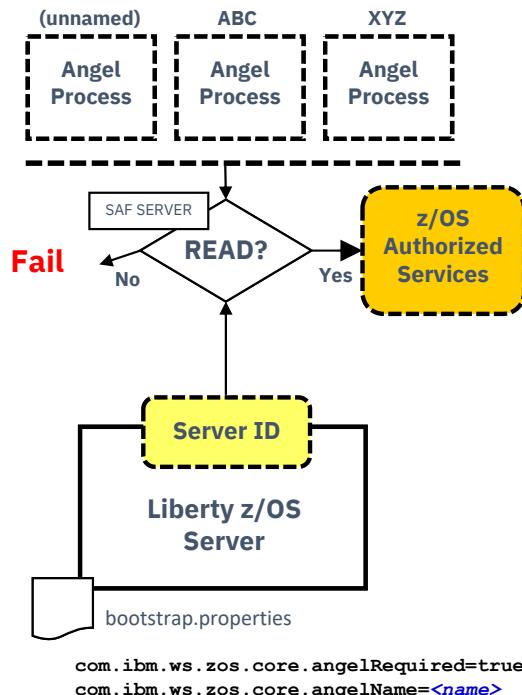
Then use the *location* attribute to override the default directories

```
shared.xml
<zosconnect_apiRequesters location="/var/zcee/shared/apiRequesters">
</zosconnect_apiRequesters>
<zosconnect_zosConnectAPIs location="/var/zcee/shared/apis">
</zosconnect_zosConnectAPIs>
<zosconnect_services location="/var/zcee/shared/services">
</zosconnect_services>
```

One directory for all APIs, API Requesters, Rules, and Services

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Slide 33

z/OS : The Angel process – what is this about?



The Angel Process is a started task that is used to protect access to z/OS privileged or authorized services. This is done with SAF SERVER profiles.

- Authorized services include: WOLA, SAF, WLM, RRS, DUMP
- The ability to start multiple Angel processes on an LPAR was introduced in 16.0.0.4. This is called "Named Angels". It provides a way to separate Angel usage between Liberty servers:
 - An Angel process can be started with a NAME='<name>' parameter (or it can be started as a "default" without a name). The name may be up to 54 characters.
 - Liberty servers can be pointed at a specific Angel with a bootstrap property

Best practice:

- You may create separate named Angels for isolation of Test and Production, but do not take this practice too far. A few Angels, yes; dozens, no.
- Establish automation routines to start the Angels at IPL
- Grant SAF GROUP access to the SERVER profiles, then connect server IDs as needed

List of current Liberty Features

https://www.ibm.com/support/knowledgecenter/SSEQTP_liberty/com.ibm.websphere.wlp.doc/ae/rwlp_feat.html

z/OS : SAF SERVER profiles related to the Angel



Best practice:

- Establish all the SERVER profiles ahead of time. Existence of profile does not grant access; READ to it does.
- Determine what access a server needs and grant only that; check "is available" messages in messages.log to verify

Tech/Tip: The SAFLOG parameter was added in a recent Liberty drop. If this parameter is set to Y, additional security related messages will be written to the JES messages and console if a Liberty server does not have authorization to use an angel-controlled privileged function. See URL

https://www.ibm.com/support/knowledgecenter/SS7K4U_liberty/com.ibm.websphere.wlp.zseries.doc/ae/rwlp_newinrelease.html

Liberty 21.0.6 add a new property to identify required services, com.ibm.ws.zos.core.angelRequiredServices, for more details see URL

<https://www.ibm.com/docs/en/was-liberty/zos?topic=overview-process-types-zos>

SAF APPL and EJBRole Resources

Connect z/OS Connect users to a common group

CONNECT (FRED,USER1,JOHNSON) GROUP(ZCEEUSRS)

Define a APPL profile for the server's SAF profilePrefix and permit access

RDEFINE APPL BBGZDFLT UACC(NONE) OWNER(SYS1)

PERMIT BBGZDFLT CLASS(APPL) ACCESS(READ) ID(WSGUEST#, ZCEEUSRS)

SETROPTS RACLIST(APPL) REFRESH

Define an EJBROLE profile for the server's SAF profilePrefix and permit access

**RDEFINE EJBROLE BBGZDFLT.zos.connect.access.roles.zosConnectAccess +
OWNER(SYS1) UACC(NONE)**

**PERMIT BBGZDFLT.zos.connect.access.roles.zosConnectAccess +
CLASS(EJBROLE) ID(ZCEEUSRS) ACCESS(READ)**

Refresh the EJBROLE in storage profiles

SETROPTS RACLIST(EJBROLE) REFRESH

```
<safCredentials unauthenticatedUser="WSGUEST" profilePrefix="BBGZDFLT" />
```

https://www.ibm.com/support/knowledgecenter/SS7K4U/liberty/com.ibm.websphere.wlp.zseries.doc/ae/twlp_config_security_saf.html
https://www.ibm.com/support/knowledgecenter/SS4SVW/beta/securing/saf_unauthenticated_id.html#concept_saf_unauthenticated_id

Tech/Tip: z/OS : ISPF/OMVS examples of using SURROGAT access



The image displays two windows from the z/OS ISPF/OMVS environment. The top window is titled 'WG31# - 3270' and shows the 'Setup' menu option circled in red. The bottom window is also titled 'WG31# - 3270' and shows the user's session environment.

Top Window (Setup):

- File Edit Settings View Communication Actions Window Help
- File Directory Special_file Tools File_systems Options **Setup** Help
- UNIX System Services ISPF Shell
- Enter a pathname and do one of these:
 - Press Enter.
 - Select an action bar choice.
 - Specify an action code or command on the command line.
- Return to this panel to work with a different pathname.
- More: +
- /var/zcee

EUID=200042

Bottom Window (Session Environment):

- File Edit Settings View Communication Actions Window Help
- IBM
Licensed Material - Property of IBM
5650-ZOS Copyright IBM Corp. 1993, 2017
(C) Copyright Mortice Kern Systems, Inc., 1985, 1996.
(C) Copyright Software Development Group, University of Waterloo, 1989.
- U.S. Government Users Restricted Rights -
Use, duplication or disclosure restricted by
GSA ADP Schedule Contract with IBM Corp.
- IBM is a registered trademark of the IBM Corp.
- Command ==> su libserv
- MA B
- Connected to remote server/host wg31a using lu/pool TCP00117 and port 23
- s id
uid=5504(USER3) gid=2(SYS1)
su -s libserv
\$ id
uid=200042(LIBSERV) gid=200034(LIBGRP) groups=200033(GMINVOKE),200036(ZCEEUSRS)
\$
- ====> -
- ESC=< 1=Help 2=SubCmd 3=HlpRetrn 4=Top 5=Bottom 6=TSO
7=BackScr 8=Scroll 9=NextSess 10=Refresh 11=FwdRetr 12=Retrieve
- MA B 29/007
- Connected to remote server/host wg31a using lu/pool TCP00108 and port 23

Super user is required to set some extended attributes and to use the *ps -ef* command to display all processes.

Connecting z/OS Connect servers to to z/OS subsystems



Tech-Tip: Liberty's “adminCenter” Feature

- Web browser interface to the server's configuration files

The screenshot shows two side-by-side views of the IBM Liberty adminCenter interface for editing the `server.xml` configuration file.

Left View (Design Tab):

- The title bar says "Server Config".
- The file name is "server.xml".
- The tab bar has "Design" (highlighted with a red circle) and "Source".
- The main area shows a tree view under "Server" with several "Include" entries.
- A "Description" field contains "new server".
- Buttons for "Add child" and "Remove" are visible.

Right View (Source Tab):

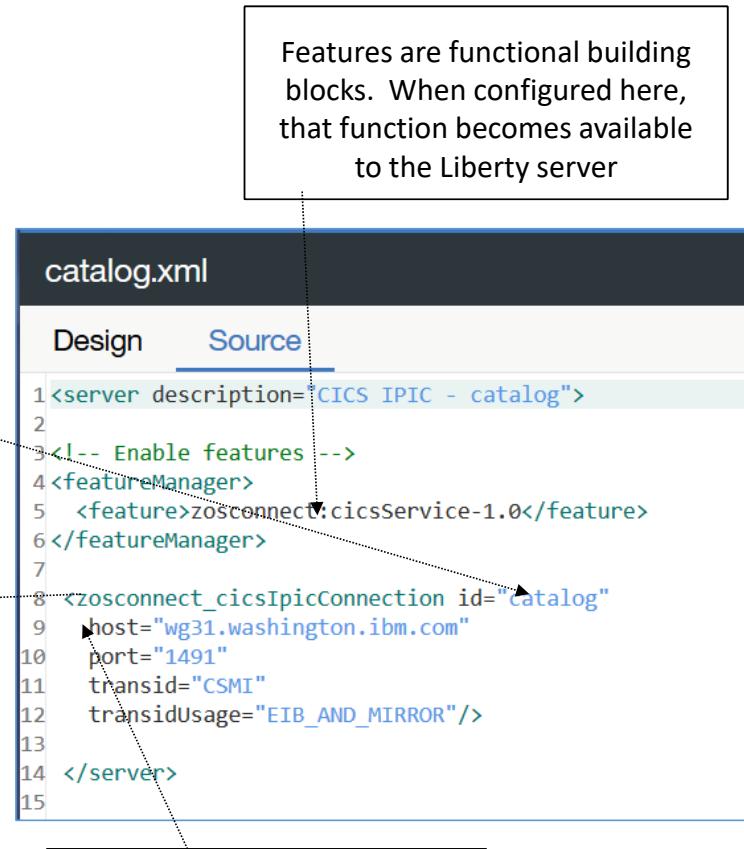
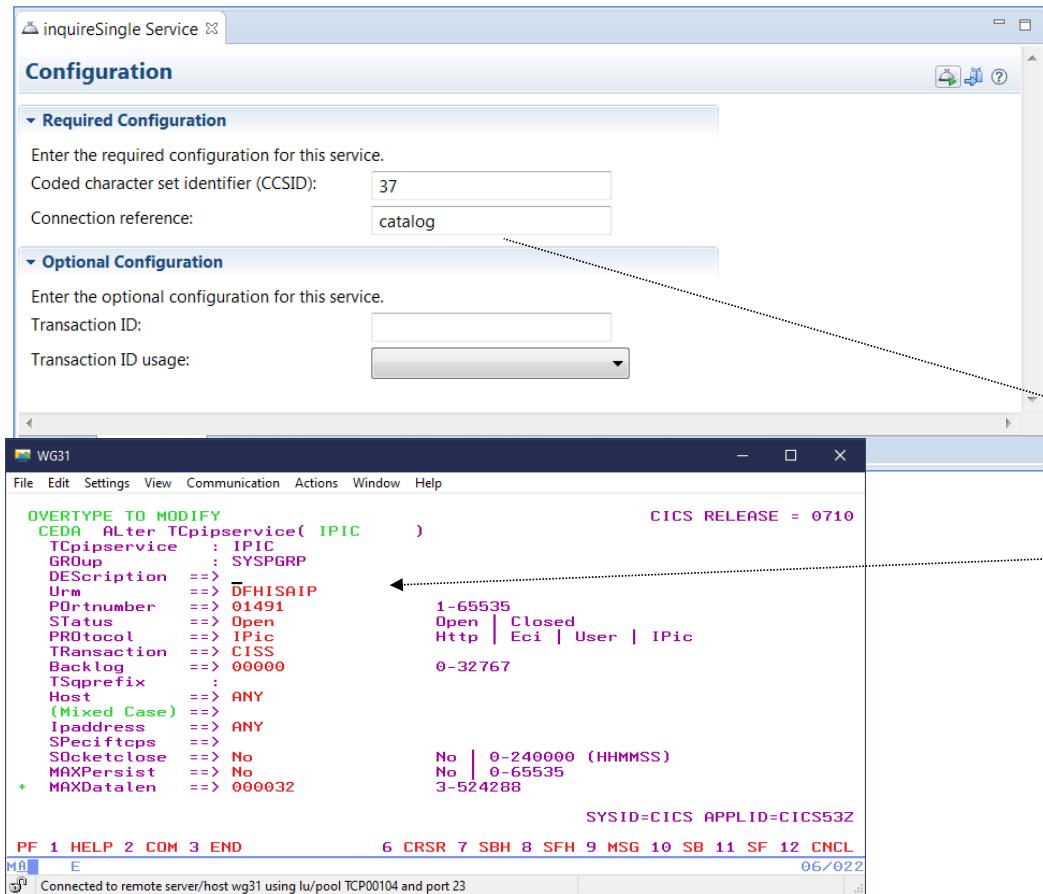
- The title bar says "Server Config".
- The file name is "server.xml".
- The tab bar has "Design" and "Source" (highlighted with a red circle).
- The main area displays the XML code for the `server.xml` file, starting with:

```
1<server description="new server">
2<include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/services/ims-services.xml" optional="true"/>
3<include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/interactions/ims-interactions.xml" optional="true"/>
4<include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/connections/ims-connections.xml" optional="true"/>
5<include location="${server.config.dir}/includes/safSecurity.xml"/>
6<include location="${server.config.dir}/includes/safTrace.xml"/>
7<include location="${server.config.dir}/includes/ipic.xml"/>
8<include location="${server.config.dir}/includes/keyring.xml"/>
9<include location="${server.config.dir}/includes/shared.xml"/>
10<include location="${server.config.dir}/includes/oauth.xml"/>
11<include location="${server.config.dir}/includes/audit.xml"/>
12<include location="${server.config.dir}/includes/mq.xml"/>
13<include location="${server.config.dir}/includes/db2.xml"/>
14<include location="${server.config.dir}/includes/wlm.xml"/>
15<include location="${server.config.dir}/includes/restConnector.xml"/>
16<include location="${server.config.dir}/includes/smf.xml"/>
17<include location="${server.config.dir}/includes/adminCenter.xml" />
```

Server XML - Accessing a CICS program using IPIC



The server.xml file is the key configuration file:



Define IPIC connection to CICS

Features are functional building blocks. When configured here, that function becomes available to the Liberty server

Server XML – Accessing an IMS Transaction using OTMA



ivtnoService Service Configuration

Required Configuration

Enter the required configuration for this service.

Connection profile: **IMSCONN**

Interaction profile: **IMSINTER**

Optional Configuration

Enter the optional configuration for this service.

IMS destination override:

Program name:

Overview Configuration

IMS Connect HWSCFG

```
HWS= (ID=IMS14HWS, XIBAREA=100, RACF=Y, RRS=N)
TCPIP= (HOSTNAME=TCPIP, PORTID= (4000, LOCAL) , RACFID=JOHNSON, TIMEOUT=
5000)
DATASTORE= (GROUP=OTMAGRP , ID=IVP1 , MEMBER=HWSMEM , TMEMBER=OTMAMEM)
IMSPLEX= (MEMBER=IMS14HWS, TMEMBER=PLEX1)
ODACCESS= (ODBMAUTOCONN=Y,
DRDAPORT= (ID=5555, PORTTMOT=6000) , ODBMTMOT=6000)
```

Connection

```
<server>
<imsmobile_imsConnection comment="" connectionFactoryRef="CF1" connectionTimeout="-1" connectionType="IMSCONNECT" id="IMSCONN"/>
<connectionFactory containerAuthDataRef="Connection1_Auth" id="CF1">
    <properties.gmoa hostName="wg31.washington.ibm.com" portNumber="4000"/>
</connectionFactory>

<authData id="Connection1_Auth" password="encryptedPassword1" user="userName1"/>
</server>
```

Interaction

```
<server>
<imsmobile_interaction comment="" commitMode="1" id="IMSINTER" imsConnectCodepage="Cp1047" imsConnectTimeout="0"
    imsDatastoreName="IVP1" interactionTimeout="-1" ltermOverrideName="" syncLevel="0"/>
</server>
```

Server XML – Accessing an IMS Database using ODBA



Service Project Editor: Configuration

Required Configuration

Enter the required configuration for this service.

Connection profile: DFSIVPACConn

ConnectionFactory

```
<connectionFactory id="DFSIVPACConn">
<properties.imsudbJLocal
  databaseName="DFSIVPA"
  datastoreName="IVP1"
  datastoreServer="wg31.washington.ibm.com"
  driverType="4"
  portNumber="5555"
  user="USER1"
  password="password"
  flattenTables="True"/>
</connectionFactory>
```

IMS Connect HWSCFG

```
HWS=(ID=IMS14HWS,XIBAREA=100,RACE=N,RRS=N)
TCPIP=(HOSTNAME=TCPIP,PORTID=(4000,LOCAL),RACFID=JOHNSON,TIMEOUT=5000)
DATASTORE=(GROUP=OTMAGRP,ID=IVP1, MEMBER=HWSMEM, TMEMBER=OTMAMEM)
IMSPLEX=(MEMBER=IMS14HWS, TMEMBER=PLEX1)
ODACCESS=(ODBMAUTOCONN=Y,
DRDAPORT=(ID=5555,PORTTMOT=6000),ODBMTMOT=6000)
```

Server XML - Accessing a Db2 REST service



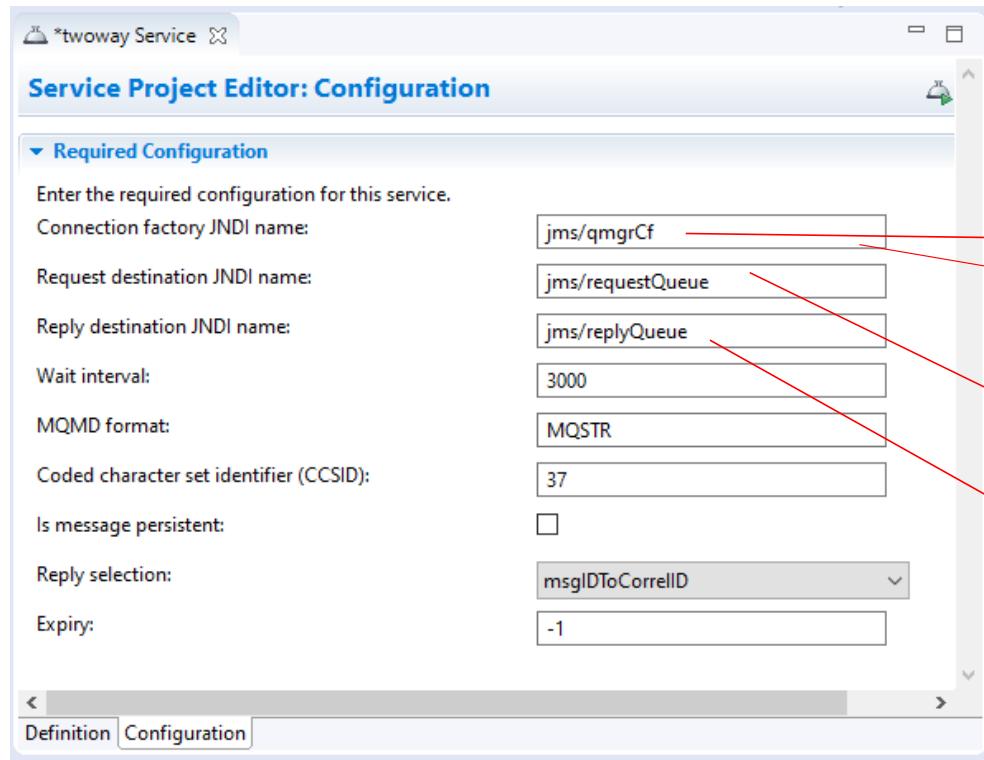
The screenshot shows the "Service Project Editor: Configuration" window for a service named "selectEmployee Service". The "Required Configuration" section contains a "Connection reference:" field with the value "db2conn". A red arrow points from this field to the "db2pass.xml" file on the right.

The "db2pass.xml" file is displayed in a code editor with two tabs: "Design" and "Source". The "Source" tab shows the following XML code:

```
1<server description="DB2 REST">
2
3<zosconnect_zosConnectServiceRestClientConnection id="db2conn">
4    host="wg31.washington.ibm.com"
5    port="2446"
6    basicAuthRef="dsn2Auth" />
7
8<zosconnect_zosConnectServiceRestClientBasicAuth id="dsn2Auth">
9    applName="DSN2APPL"/>
10
11</server>
12
```

Red arrows also point from the "host" and "port" attributes in the XML code back to their respective values in the "Required Configuration" section of the configuration editor.

Server XML - Using JMS to access MQ



The screenshot shows the 'mq.xml' configuration file with several JNDI names highlighted by red boxes:

```
2 <featureManager>
3   <feature>zosconnect:mqService-1.0</feature>
4 </featureManager>
5
6 <variable name="wmqJmsClient.rar.location"
7   value="/usr/lpp/mqm/V9R1M1/java/lib/jca/wmq.jmsra.rar"/>
8 <wmqJmsClient nativeLibraryPath="/usr/lpp/mqm/V9R1M1/java/lib"/>
9
10 <connectionManager id="ConMgr1" maxPoolSize="5"/>
11
12 <jmsConnectionFactory id="qmgrCF" jndiName="jms/qmgrCf">
13   connectionManagerRef="ConMgr1">
14   <properties.wmqJMS transportType="BINDINGS"
15     queueManager="QMZ1" />
16 </jmsConnectionFactory>
17
18 <jmsConnectionFactory id="qmgrCF2" jndiName="jms/qmgrCF2">
19   connectionManagerRef="ConMgr1">
20   <properties.wmqJMS transportType="CLIENT"
21     queueManager="ZMQ1"
22     channel="LIBERTY.DEF.SVRCONN"
23     hostName="wg31.washington.ibm.com"
24     port="1422" />
25 </jmsConnectionFactory>
26
27 <jmsQueue id="q1" jndiName="jms/default">
28   <properties.wmqJms
29     baseQueueName="ZCONN2.DEFAULT.MQZCEE.QUEUE"
30     CCSID="37"/>
31 </jmsQueue>
32
33 <jmsQueue id="requestQueue" jndiName="jms/request">
34   <properties.wmqJms
35     baseQueueName="ZCONN2.TRIGGER.REQUEST"
36     targetClient="MQ"
37     CCSID="37"/>
38 </jmsQueue>
39
40 <jmsQueue id="replyQueue" jndiName="jms/replyQueue">
41   <properties.wmqJms
42     baseQueueName="ZCONN2.TRIGGER.RESPONSE"
43     targetClient="MQ"
44     CCSID="37"/>
45 </jmsQueue>
46
47
```

Server XML – Accessing a HATS REST service



```
getCompany.properties - Notepad
File Edit Format View Help
provider=rest
name=getCompany
version=1.0
description=Obtain a list of companies
requestSchemaFile=getCompanyRequest.json
responseSchemaFile=getCompanyResponse.json
verb=POST
uri=/Trader/rest/GetCompany
connectionRef=HatsConn
```

Server Config

hats.xml

Read only Close

Design Source

```
<server description="HATS">
  <zosconnect_zosConnectServiceRestClientConnection id="HatsConn">
    host="wgs1.washington.ibm.com"
    port="29080" />
</server>
```

HATS Liberty server.xml

```
<!-- To access this server from a remote client, add a host attribute to the following element, e.g. host="*" -->
<httpEndpoint id="defaultHttpEndpoint">
  httpPort="29080" 
  host="*"
  httpsPort="29443" />
```

Server XML- Accessing an MVS application using WOLA



```
filea.properties - Notepad
File Edit Format View Help
name=Filea
version=1.0
provider=wola
description=Test COBOL batch program
language=COBOL
program=ATSFIL
register=FILEAZCON
connectionRef=wolaCF
requestStructure=./fileareq.cpy
responseStructure=./filearsp.cpy
```

Server Config

wola.xml

Read only Close

Design Source

```
<server description="WOLA">
  <featureManager>
    <feature>zosLocalAdapters-1.0</feature>
  </featureManager>
  <zosLocalAdapters wolaGroup="ZCEESRVR"
    wolaName2="ZCEESRVR"
    wolaName3="ZCEESRVR"/>
  <connectionFactory id="wolaCF"
    jndiName="eis/ola">
    <properties.ola/>
  </connectionFactory>
</server>
```

```
* SET THE VALUES FOR USE WITH WOLA REGISTRATION
MOVE 'FILEAZCON'          TO REG-REGNAME.
MOVE 'ZCEESRVR'            TO REG-DAEMONGRP.
MOVE 'ZCEESRVR'            TO REG-NODE.
MOVE 'ZCEESRVR'            TO REG-SVRNAME.
MOVE 'ATSFIL'              TO SVC-SERVICE-NAME.
INSPECT REG-DAEMONGRP CONVERTING ' ' to LOW-VALUES.
* Register to a Local Liberty server
CALL 'BBOA1REG' USING
  REG-DAEMONGRP,REG-NODE,REG-SVRNAME,REG-REGNAME,REG-MINCONN,REG-MAXCONN,REG-FLAGS,RSP-RC,RSP-RSN.
```

Server XML – Accessing a DVM server using WOLA



Server Config

dvs.xml

Read only Close

Design Source

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="new server">
  <!-- Enable features -->
  <featureManager>
    <feature>usr:dvsProvider</feature>
    <feature>zosLocalAdapters-1.0</feature>
  </featureManager>
  <!-- Adapter Details with WOLA Group Name (ZCEEDVM) -->
  <zosLocalAdapters wolaName3="NAME3"
    wolaName2="NAME2"
    wolaGroup="ZCEEDVM"/>
  <!-- DVS Service Details with Register Name (ZCEEDVM) -->
  <zosconnect_zosConnectService invokeURI="/dvs"
    serviceDescription=""
    serviceRef="dvsService"
    serviceName="dvsService"
    id="zosConnectDvsService"/>
  <usr_dvsService invokeURI="/dvs"
    serviceName="DVSS1"
    registerName="ZCEEDVM"
    connectionFactoryRef="wolaCF"
    id="dvsService"/>
  <connectionFactory jndiName="eis/ola" id="wolaCF">
    <properties.ola/>
  </connectionFactory>
  <zosconnect_zosConnectService serviceRef="svc1"
    serviceAsyncRequestTimeout="600s"
    serviceName="dvs1" id="sdef1"/>
  <zosconnect_localAdaptersConnectService
    connectionWaitTimeout="7200"
    connectionFactoryRef="wolaCF"
    serviceName="DVSS1"
    registerName="ZCEEDVM"
    id="svc1"/>
</server>
```

DVS.AVZS.SAVZEXEC (AVZSIN00)

```
/*
 * Enable z/OS Connect interface facility
 */
if DoThis then
  do
    /*
     * The following parameter enables the z/OS Connect interface
     * facility.
    */
    "MODIFY PARM NAME(ZCONNECT)           VALUE(YES)"
    "MODIFY PARM NAME(NETWORKBUFFERSIZE)   VALUE(96K)"
  /*
   * The "DEFINE ZCPATH" command(s) can be used to define
   * paths to z/OS Connect regions to handle requests.
   * Use a separate "DEFINE ZCPATH" command to define each
   * path required (Note that a single path can handle
   * several different requests)
   * refer to the documentation for details about the parameters,
   * and information about optional parameters.
  */
    "DEFINE ZCPATH",
    "  NAME(ZCEE)                           ",
    "  RNAME(ZCEEDVM)                      ",
    "  WNAME(ZCEEDVM)                      ",
    ""
  end
```

Server XML – Accessing a File Manager server



```
filea.properties - Notepad
File Edit Format View Help
name=filea
provider=filemanager
host=wg31.washington.ibm.com
version=1.0
port=2800
file=USER1.ZCEE.FILEA
template=USER1.ZCEE.TEMPLATE(FILEA)
connid=default
userid=USER1
passwd=USER1

Ln 1, Col 1 100% Windows (CRLF) UTF-8
```

Server Config

filemgr.xml

Read only Close

Design Source

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="new server">
  <!-- Enable features -->
  <featureManager>
    <feature>filemanager:fmProvider-2.0</feature>
  </featureManager>
  <FileManager_Connection id="default">
    <runport>2800</runport>
    <max_timeout>1800</max_timeout>
  </FileManager_Connection>
</server>
```

SYS1.PROCLIB(IPVSRV1)

```
//IPVSRV1 PROC PORT=2800,FAMILY='AF_INET',TRACE=N
//      SET ENV=''
//RUN      EXEC PGM=IPVSRV,REGION=40M,
//      PARM=('&ENV/&PORT &FAMILY &TRACE')
// SET IPV=SYSP.ADFZ.JCL          <== Update HLQ
//STEPLIB  DD DISP=SHR,DSN=ADFZ.SIPVMODA      <== ADFzCC APF LIBRARY
//SYSPRINT DD SYSOUT=*
//IPVTRACE DD SYSOUT=*
//STDOUT   DD SYSOUT=*
///* Server wide, then participating product configurations
//CONFIG   DD DISP=SHR,DSN=&IPV.(IPVCFG)
```

Server XML – Accessing a z/OS Connect API Provider



```
cscvinc.properties - Notepad
File Edit Format View Help
apiDescriptionFile=./cscvinc.json
dataStructuresLocation=./syslib
apiInfoFileLocation=./syslib
logFileDirectory=./logs
language=COBOL
connectionRef=cscvincAPI
requesterPrefix=csc

Ln 1, Col 1 100% Unix (LF) UTF-8
```

Server Config

apiRequesterHTTPS.xml

Design Source

```
<server description="API Requester">
  <!-- Enable features -->
  <featureManager>
    <feature>zosconnect:apiRequester-1.0</feature>
  </featureManager>
  <zosconnect_apiRequesters location="/global/zosconnect/resources/apiRequesters">
    <idAssertion>ASSERT_ONLY</idAssertion>
    <apiRequester name="cscvinc_1.0.0" requireSecure="false"/>
  </zosconnect_apiRequesters>
  <zosconnect_endpointConnection id="mqapi">
    host="http://dvipa.washington.ibm.com"
    port="9443"
    authenticationConfigRef="mySAFAuth"
    connectionTimeout="10s"
    receiveTimeout="40s" />
  <zosconnect_endpointConnection id="cscvincAPI">
    host="https://dvipa.washington.ibm.com"
    port="9443"
    connectionTimeout="10s"
    receiveTimeout="40s" />
  <zosconnect_endpointConnection id="miniloancicsAPI">
    host="https://dvipa.washington.ibm.com"
    port="9443"
    authenticationConfigRef="mySAFAuth"
    connectionTimeout="10s"
    receiveTimeout="40s" />
  <zsoauth_data id="mySAFAuth">
    user="USER1"
    password="user1" />
</server>
```

Server Config

server.xml

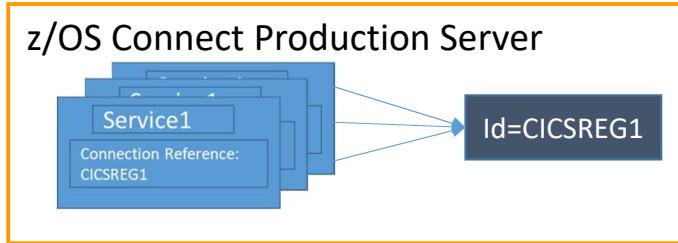
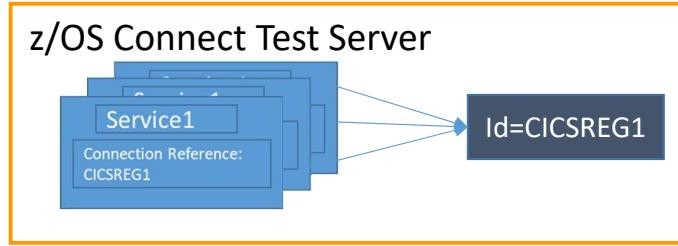
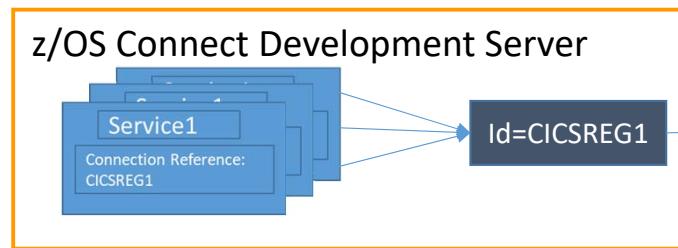
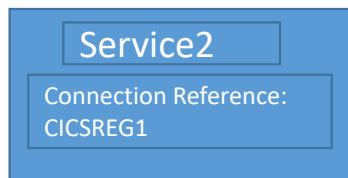
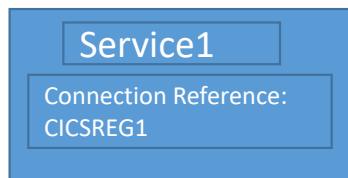
Design Source

```
<!-- To access this server from a remote client add a host attribute to the following
element, e.g. host="*" -->
<httpEndpoint host="">
  httpPort="9080"
  httpsPort="9443" <-- Red arrow points here
  id="defaultHttpEndpoint"/>
```



Use naming conventions for service connection references

Don't couple connection names to specific systems



?

CICS region CICSREG1

CICS region CICSTST1

CICS region CICSTST2

CICS region CICSPRD1

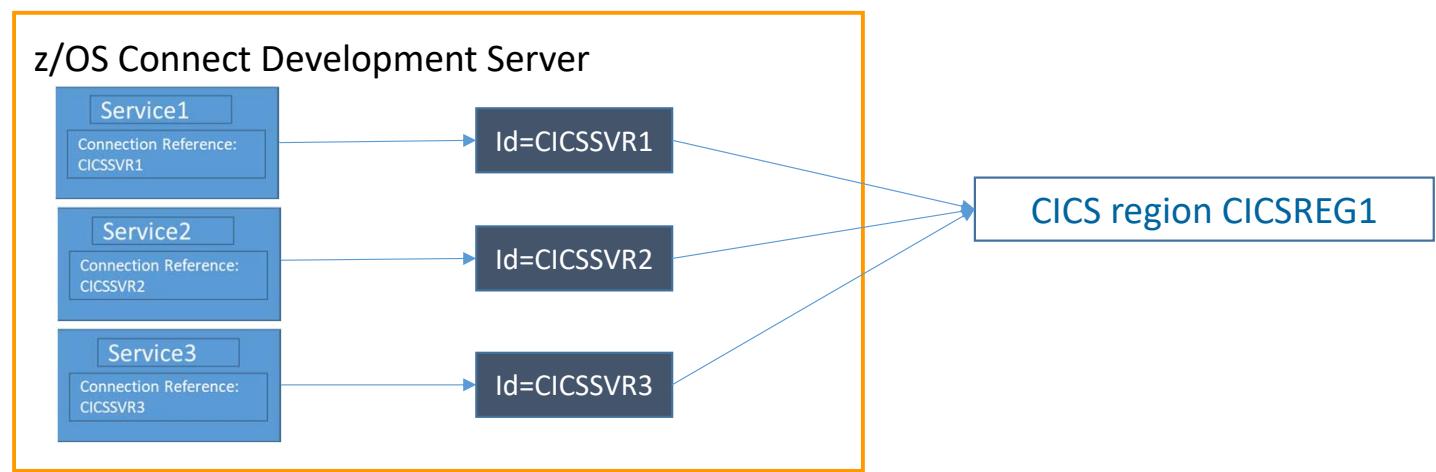
CICS region CICSPRD2

CICS region CICSPRD3



Use naming conventions for service connection references

Use application meaningful names for connection references

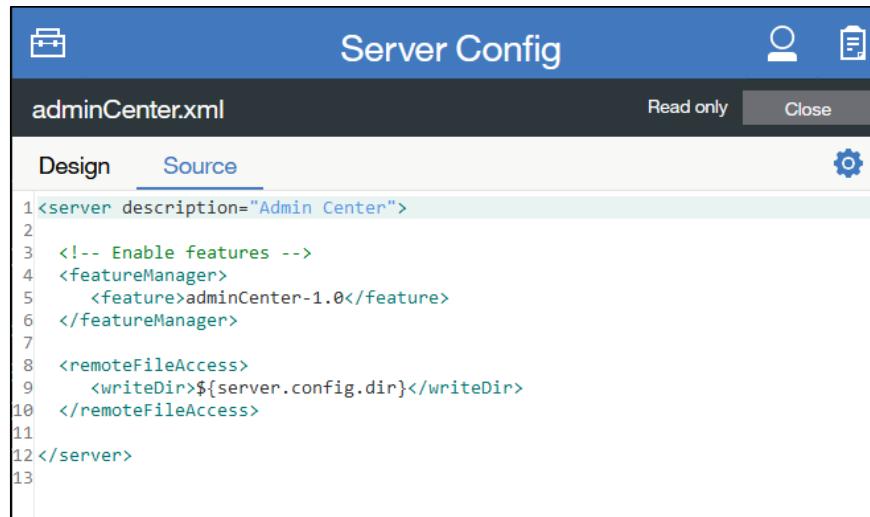


Useful Liberty features and MVS commands



Use the adminCenter-1.0 feature to update the server XML from a browser

Administrators can use a web interface to maintain the server XML configuration.



```
1<server description="Admin Center">
2
3    <!-- Enable features -->
4    <featureManager>
5        <feature>adminCenter-1.0</feature>
6    </featureManager>
7
8    <remoteFileAccess>
9        <writeDir>${server.config.dir}</writeDir>
10   </remoteFileAccess>
11
12</server>
13
```

```
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Administrator OWNER(SYS1) UACC(NONE)
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.Administrator CLASS(EJBROLE) ID(FRED) ACCESS(READ)
SETR RACLIST(EJBROLE) REFRESH
```



Tech-Tip: Liberty's “adminCenter” Feature to update server XML

- Web browser interface to the server's configuration files

The screenshot shows the IBM Liberty adminCenter interface for managing server configuration files. The left sidebar lists various configuration sections like z/OS Connect Manager, z/OS Logging, and Application Monitoring. The main area is titled 'Server Config' and shows the 'server.xml' file. The 'Source' tab is active, displaying the XML code for the server configuration. A content assist dropdown is open over the 'zosconnect_apiRequester' element, listing several options under the 'zosconnect_zosConnectServiceRestClientBasicAuth' category. The top right corner of the interface has a note: 'Press Ctrl+space for content assist'.

```
1 <server description="new server">
2   <include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/services/ims-services.xml" optional="true"/>
3   <include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/interactions/ims-interactions.xml" optional="true"/>
4   <include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/connections/ims-connections.xml" optional="true"/>
5   <include location="${server.config.dir}/includes/safSecurity.xml"/>
6   <include location="${server.config.dir}/includes/safTrace.xml"/>
7   <include location="${server.config.dir}/includes/ipic.xml"/>
8   <include location="${server.config.dir}/includes/shared.xml"/>
9   <include location="${server.config.dir}/includes/oauth.xml"/>
10  <include location="${server.config.dir}/includes/apiRequesterHTTPS.xml"/>
11  <include location="${server.config.dir}/includes/audit.xml"/>
12  <include location="${server.config.dir}/includes/mq.xml"/>
13  <include location="${server.config.dir}/includes/db2.xml"/>
14  <include location="${server.config.dir}/includes/wlm.xml"/>
15  <include location="${server.config.dir}/includes/restConnector.xml"/>
16  <include location="${server.config.dir}/includes/zosConnectAPIRequester.xml"/>
17  <include location="${server.config.dir}/includes/zosConnectAPIRequesterRequired.xml"/>
18  <wsSecurityProvider>
19    <zosconnect_apiRequester>
20      <zosconnect_apiRequesters>
21        <zosconnect_auditInterceptor>
22        <zosconnect_authData>
23        <zosconnect_authToken>
24        <zosconnect_authorizationInterceptor>
25        <zosconnect_authorizationServer>
26        <zosconnect_authToken>
27        <zosconnect_zosConnectServiceRestClientBasicAuth>
28          <!-- To access this server from a remote client add a host attribute to the following element, e.g. host="*" -->
29          <httpEndpoint host="*" httpPort="9080" httpsPort="9443" id="defaultHttpEndpoint"/>
30          <!-- add cors to allow cross origin access, e.g. when using swagger UI to fetch swagger doc from zOS Connect Enterprise Edition -->
31          <cors allowCredentials="true" allowedHeaders="Origin, Content-Type, Authorization, Cache-Control, Expires, Pragma" allowedMethods="GET, POST, PUT, PATCH, DELETE, HEAD, OPTIONS" maxAge="1800" />
32        </zosconnect_zosConnectServiceRestClientBasicAuth>
33      </zosconnect_apiRequesters>
34    </zosconnect_apiRequester>
35  </wsSecurityProvider>
36  <!-- Required z/OS Connect API Requester. -->
```

Use the restConnector-2.0 feature to see real time configuration details



A secure, REST administrative connector that enables remote access from a Java client or Web browser (GET only) or directly through an HTTPS call to the current runtime configuration.

Server Config

restConnector.xml

Read only Close

Design Source

```
1<?xml version="1.0" encoding="UTF-8"?>
2
3<server description="REST Connector">
4  <featureManager>
5    <feature>restConnector-2.0</feature>
6  </featureManager>
7
8</server>
9
```

URI Path is the concatenation of the path /ibm/api/config with the server XML configuration element and any optional query strings.

<https://mpz3.washington.ibm.com:9443/ibm/api/config/jmsQueue>
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectServiceRestClientConnection
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?id=miniloan
<https://mpz3.washington.ibm.com:9443/ibm/api/config/safCredentials>
<https://mpz3.washington.ibm.com:9443/ibm/api/config/connectionFactory>
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectManager
<https://mpz3.washington.ibm.com:9443/ibm/api/config/keyStore>
<https://mpz3.washington.ibm.com:9443/ibm/api/config/ssl>
<https://mpz3.washington.ibm.com:9443/ibm/api/config/sslDefault>
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectManager
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectAPIs
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_services
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_apiRequesters

```
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Administrator OWNER(SYS1) UACC(NONE)
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Reader OWNER(SYS1) UACC(NONE)
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.allAuthenticatedUsers OWNER(SYS1) UACC(NONE)
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.Administrator CLASS(EJBROLE) ID(USER1) ACCESS(READ)
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.Reader CLASS(EJBROLE) ID(ZCEEUSRS) ACCESS(READ)
SETR RACLIST(EJBROLE) REFRESH
```



restConnector-2.0 feature examples

<https://mpz3.washington.ibm.com:9443/ibm/api/config/safCredentials>

```
[{"configElementName": "safCredentials", "mapDistributedIdentities": false, "profilePrefix": "BBGZDFLT", "suppressAuthFailureMessages": true, "unauthenticatedUser": "WSGUEST"}]
```

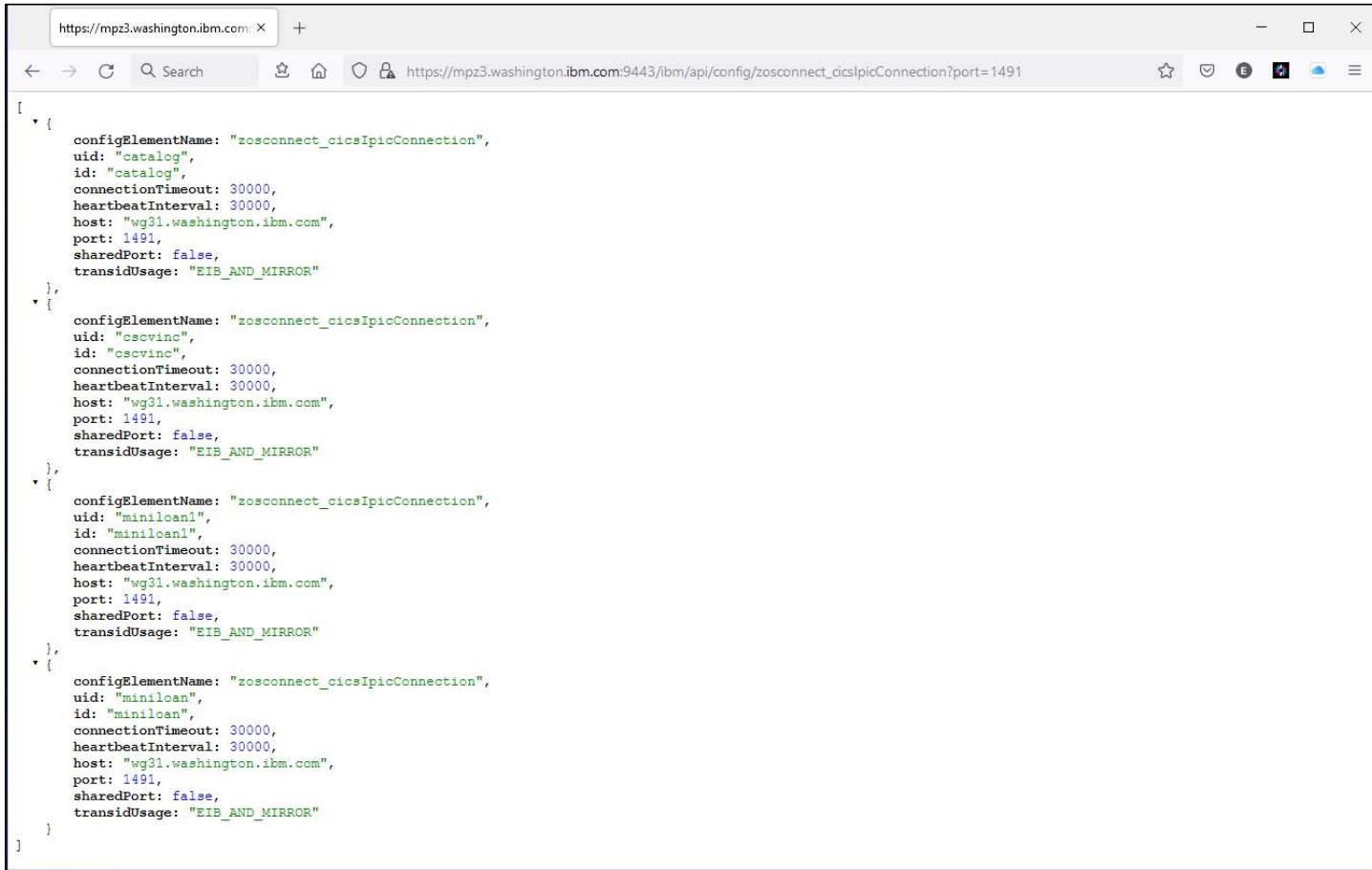
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectServiceRestClientConnection?port=2446

```
[{"configElementName": "zosconnect_zosConnectServiceRestClientConnection", "uid": "Db2Conn", "id": "Db2Conn", "allowChunking": true, "basicAuthRef": {"configElementName": "zosconnect_zosConnectServiceRestClientBasicAuth", "uid": "dns2Auth", "id": "dns2Auth", "password": "*****", "userName": "USER1"}, "connectionTimeout": 30000, "host": "sg31.washington.ibm.com", "port": "2446", "receiveTimeout": 60000} ]
```



restConnector-2.0 feature

https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491



The screenshot shows a web browser window with the URL https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491. The page displays a JSON array of five configuration elements. Each element has properties such as configElementName, uid, id, connectionTimeout, heartbeatInterval, host, port, sharedPort, and transidUsage.

```
[{"configElementName": "zosconnect_cicsIpicConnection", "uid": "catalog", "id": "catalog", "connectionTimeout": 30000, "heartbeatInterval": 30000, "host": "wg31.washington.ibm.com", "port": 1491, "sharedPort": false, "transidUsage": "EIB_AND_MIRROR"}, {"configElementName": "zosconnect_cicsIpicConnection", "uid": "cscvinc", "id": "cscvinc", "connectionTimeout": 30000, "heartbeatInterval": 30000, "host": "wg31.washington.ibm.com", "port": 1491, "sharedPort": false, "transidUsage": "EIB_AND_MIRROR"}, {"configElementName": "zosconnect_cicsIpicConnection", "uid": "minilcan1", "id": "minilcan1", "connectionTimeout": 30000, "heartbeatInterval": 30000, "host": "wg31.washington.ibm.com", "port": 1491, "sharedPort": false, "transidUsage": "EIB_AND_MIRROR"}, {"configElementName": "zosconnect_cicsIpicConnection", "uid": "minilcan", "id": "minilcan", "connectionTimeout": 30000, "heartbeatInterval": 30000, "host": "wg31.washington.ibm.com", "port": 1491, "sharedPort": false, "transidUsage": "EIB_AND_MIRROR"}, {"configElementName": "zosconnect_cicsIpicConnection", "uid": "minilcan", "id": "minilcan", "connectionTimeout": 30000, "heartbeatInterval": 30000, "host": "wg31.washington.ibm.com", "port": 1491, "sharedPort": false, "transidUsage": "EIB_AND_MIRROR"}]
```



restConnector-2.0 feature

https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_services

```
File Edit View History Bookmarks Tools Help
https://mpz3.washington.ibm.com:9443/ibm/api/cor ...
← → ⌘ ⌘ https://mpz3.washington.ibm.com:9443/ibm/api/cor ...
[ {
    configElementName: "zosconnect_services",
    location: "/global/zosconnect/resources/services",
    pollingRate: 5000,
    service: [
        {
            configElementName: "service",
            uid: "zosconnect_services/service[default-0]",
            name: "mqPutService",
            property: [
                {
                    configElementName: "property",
                    uid: "zosconnect_services/service[default-0]/property[default-0]",
                    name: "useCallerPrincipal",
                    value: "*****"
                }
            ],
            runGlobalInterceptors: true
        },
        updateTrigger: "disabled"
    ]
}
```

<https://mpz3.washington.ibm.com:9443/ibm/api/config/featureManager>

```
File Edit View History Bookmarks Tools Help
https://mpz3.washington.ibm.com:9443/ibm/api/config/fe ...
← → ⌘ ⌘ https://mpz3.washington.ibm.com:9443/ibm/api/config/fe ...
[ {
    configElementName: "featureManager",
    feature: [
        "appSecurity-2.0",
        "zosSecurity-1.0",
        "zosconnect:cicsService-1.0",
        "transportSecurity-1.0",
        "zosconnect:apiRequester-1.0",
        "zosconnect:apiRequester-1.0",
        "zosconnect:mqService-1.0",
        "zosWlm-1.0",
        "restConnector-2.0",
        "monitor-1.0",
        "zosRequestLogging-1.0",
        "adminCenter-1.0",
        "apiDiscovery-1.0",
        "zosconnect:zosConnect-2.0",
        "zosconnect:zosConnectCommands-1.0",
        "imsmobile:imsmobile-2.0"
    ],
    onError: "WARN"
}
```

Use the apiDiscovery-1.0 feature to execute RESTful APIs directly*



The screenshot shows a browser window titled "IBM REST API Documentation". The address bar indicates the URL is <https://mpz3.washington.ibm.com:9443/api/explorer/#/cscvinc>. The main content area is titled "Liberty REST APIs" and subtitle "Discover REST APIs available within Liberty". It lists several API endpoints under the "cscvinc" category:

Method	Endpoint	Operations
POST	/cscvinc/employee	Show/Hide List Operations Expand Operations
DELETE	/cscvinc/employee/{employee}	Show/Hide List Operations Expand Operations
GET	/cscvinc/employee/{employee}	Show/Hide List Operations Expand Operations
PUT	/cscvinc/employee/{employee}	Show/Hide List Operations Expand Operations

Below this, there are links to other categories: db2employee, filemgr, imsPhoneBook, jwtIvpDemoApi, miniloancics, mqapi, and phonebook, each with their own "Show/Hide", "List Operations", and "Expand Operations" links.

*V3.0.48

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mitchj@us.ibm.com



Liberty MVS Commands

F BAQSTRT,REFRESH,CONFIG

Process pending configuration updates. Configuration processing applies to the server.xml file, any files it includes

F BAQSTRT,REFRESH,KEYSTORE

Use the command to refresh the keystore instorage profiles for the server.

F BAQSTRT,REFRESH,KEYSTORE, ID=*OutboundKeyRing*

To refresh a specific keystore defined in the server XML with ID=OutboundKeyRing.

F BAQSTRT,CACHE,CLEAR,AUTH

Clears all users that are cached in the Liberty authentication cache.

F BAQZANGL,DISPLAY,SERVERS

Displays a list of servers currently connected to the angel

F BAQZANGL,DISPLAY,SERVERS,PID

Displays a list of servers currently connected to the angel code along with the server's PIDs.

```
CWWKB0067I ANGEL DISPLAY OF ACTIVE SERVERS
CWWKB0080I ACTIVE SERVER ASID 4d JOBNAM ZCEEAPIR PID 16777398
CWWKB0080I ACTIVE SERVER ASID 4b JOBNAM ZCEEDVM PID 50331780
CWWKB0080I ACTIVE SERVER ASID 4f JOBNAM WLPRPSRV PID 138
CWWKB0080I ACTIVE SERVER ASID 4a JOBNAM ZCEESRVR PID 50331815
CWWKB0080I ACTIVE SERVER ASID 50 JOBNAM ZCEEOPID PID 33554605
CWWKB0080I ACTIVE SERVER ASID 4c JOBNAM ZCEEHATS PID 143
CWWKB0080I ACTIVE SERVER ASID 4e JOBNAM WLPOPSRV PID 33554565
CWWKB0080I ACTIVE SERVER ASID 58 JOBNAM MQWEBS PID 152
```

F BAQZANGL,VERSION

Displays the version level of the angel

z/OS Connect MVS Commands



F BAQSTRT,ZCON,REFRESH

All updated z/OS Connect artifacts (APIs, services, and API Requesters) are reloaded.

F BAQSTRT,ZCON,CLEARTOKENCACHE

Clears all OAuth 2.0 access tokens and JWTs from the cache. The token cache is only applicable for OAuth 2.0 access tokens and JWTs that were generated either locally or by an external authentication server, when invoking API requesters.

F BAQSTRT,ZCON,CLEARSAFCACHE

Clears the SAF cache. The SAF cache contains SAF user IDs and any associated RACF groups in which the user ID resides. The SAF cache is only applicable to API requester, and only when ID assertion is enabled.

```
<feature>zosconnect:zosConnectCommands-1.0</feature>
```

Where do I look when things go wrong?

Issues and problems can be categorized

First realize that actual products problems do occur, but they are rare. In my experience most problems and issues can be resolved with a little investigation and some analysis. I have found that most problems and issues will fall in this these categories.

- **Basic Security issues**
 - Insufficient access to local SAF resources, e.g., APPL, EJBROLE, SERVER resources
 - Security issues related to XML configuration elements, safCredentials, sslDefault, keystore, etc.
- **Advanced Security issues**
 - Key ring access, e.g., FACILITY resources IRR.DIGTCERT or RDATALIB or IDIDMAP resources.
 - Key ring contents, e.g., missing certificates, key usage, personal and certificate authorities, private keys versus public keys.
 - Incorrect use of certificates in a TLS handshakes versus certificates used for token validation.
- **z/OS Connect XML Configuration issues**
 - Missing or misspelled configuration attributes (remember the Liberty XML parser is too forgiving)
- **External resource Issues**
 - Service provider configuration issues.
 - Timeouts
 - Network Firewalls
 - Resource Security
 - Other resource errors

Remember external symptoms will overlap. But the use of rigor in setting configuration standards and following a process in problem isolation/determination process will help reduce the impact of problems and issues.



messages.log - The anatomy of a message in the messages.log

```
*****
product = WAS FOR Z/OS 21.0.0.6, z/OS Connect 03.00.48 (wlp-1.0.53.c1210620210527-1900)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/zceepid/
java.home = /MA4RS1/usr/lpp/java/J8.0_64
java.version = 1.8.0_301
java.runtime = Java(TM) SE Runtime Environment (8.0.6.35 - pmz6480sr6fp35-20210714_01(SR6 FP35))
os = z/OS (02.04.00; s390x) (en_US)
process = 16843186@MPZ3
*****
[9/3/21 13:38:02:831 GMT] 00000013 com.ibm.ws.kernel.launch.internal.FrameworkManager
[9/3/21 13:38:04:439 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:466 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:470 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:473 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:476 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:481 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:610 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:612 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:628 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:679 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:680 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:680 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
-----
[9/3/21 13:38:42:347 GMT] 00000040 om.ibm.ws.app.manager.rar.internal.RARApplicationHandlerImpl
[9/3/21 13:38:42:419 GMT] 0000003e com.ibm.ws.jmx.connector.server.rest.RESTAppListener
[9/3/21 13:38:42:422 GMT] 0000003e com.ibm.ws.jmx.connector.server.rest.RESTAppListener
[9/3/21 13:38:42:428 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPEndpoint
[9/3/21 13:38:42:431 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPEndpoint
[9/3/21 13:38:42:437 GMT] 00000042 com.ibm.ws.webcontainer.osgi.mbeans.PluginGenerator
[9/3/21 13:38:42:489 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager
[9/3/21 13:38:42:490 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager
[9/3/21 13:38:42:490 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager
[9/3/21 13:41:31:640 GMT] 00000045 .security.openidconnect.client.internal.OidcClientConfigImpl
[9/3/21 13:41:31:691 GMT] 00000045 rity.authentication.filter.internal.AuthenticationFilterImpl
[9/3/21 13:41:32:824 GMT] 00000053 com.ibm.zosconnect.service.cics.internal.conn.isc.Connection
```

A CWWKE0001I: The server zceepid has been launched.
A CWWKG0028A: Processing included configuration resource
A CWWKB0125I: This server requested a REGION size of 0KB
I CWWKB0126I: MEMLIMIT=2000. MEMLIMIT CONFIGURATION SOUR
I CWWKB0122I: This server is connected to the default an
I CWWKB0103I: Authorized service group KERNEL is availab
I CWWKB0103I: Authorized service group LOCALCOM is avail
I CWWKB0103I: Authorized service group PRODMGR is availa
----- 148 Line(s) not Displayed
A J2CA7001I: Resource adapter imsudbJLocal installed in
I CWWKX0103I: The JMX REST connector is running and is a
I CWWKX0103I: The JMX REST connector is running and is a
I CWWKO0219I: TCP Channel defaultHttpEndpoint has been s
I CWWKO0219I: TCP Channel defaultHttpEndpoint-ssl has be
I SRVE9103I: A configuration file for a web server plugi
A CWWKF0012I: The server installed the following feature
I CWWKF0008I: Feature update completed in 37.484 seconds
A CWWKF0011I: The zceepid server is ready to run a smar
I CWWKS1700I: OpenID Connect client ATS configuration su
I CWWKS4358I: The authentication filter ATSAuthFilter co
I BAQR0680I: CICS connection cscvinc established with 10

- **WLP_LOGGING_CONSOLE_FORMAT - SIMPLE** - Use the simple logging format. As of Liberty release 20.0.0.6 (z/OS Connect V3.034), this format writes the messages to STDOUT and STDERR with time stamps included.



Basic security issues – Sometimes you are lucky

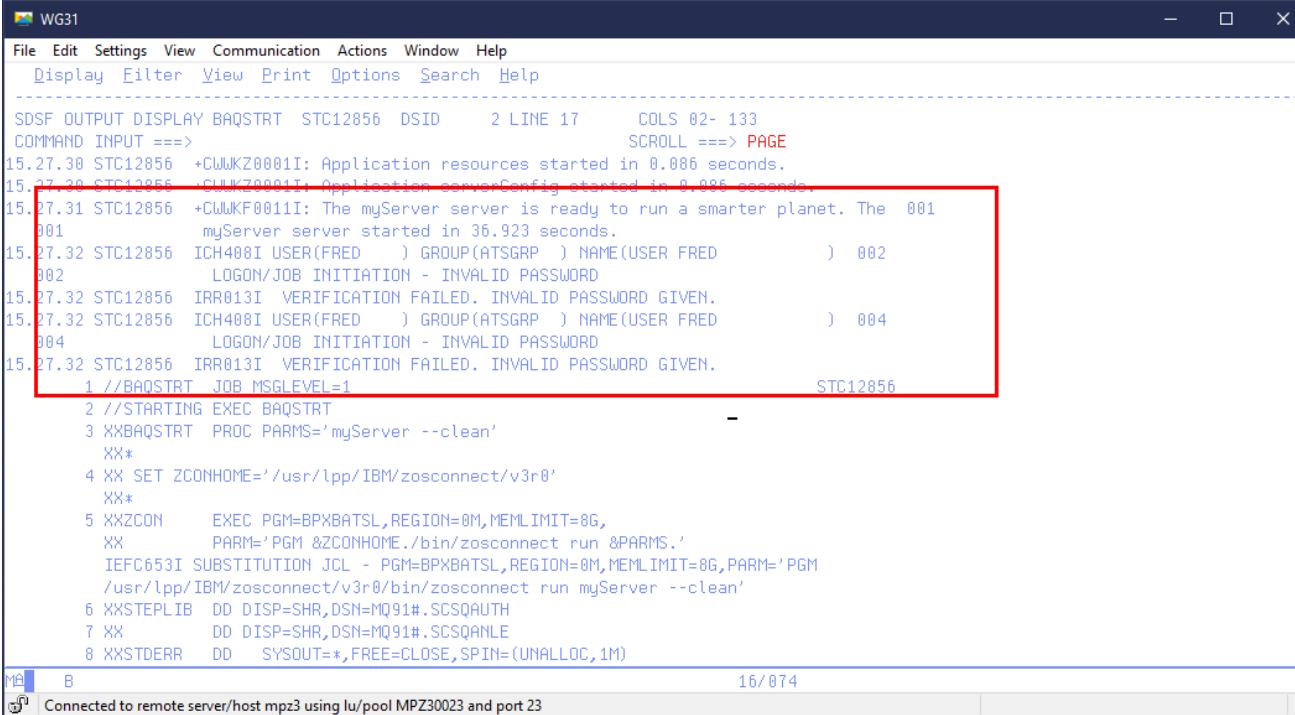
The STDOUT may show:

```
ÝAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified  
ÝAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified
```

And the messages.log displays:

```
CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
```

But the JESMSGLOG and SYSLOG displays:



```
WG31
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help

SDSF OUTPUT DISPLAY BAQSTRT STC12856 DSID 2 LINE 17 COLS 02- 133
COMMAND INPUT ==> SCROLL ==> PAGE
15.27.30 STC12856 +CWWKZ0001I: Application resources started in 0.086 seconds.
15.27.30 STC12856 +CWWKZ0001I: Application serverConfig started in 0.085 seconds.
15.27.31 STC12856 +CWWKF0011I: The myServer server is ready to run a smarter planet. The 001
001 myServer server started in 36.923 seconds.
15.27.32 STC12856 ICH408I USER(FRED ) GROUP(ATSGRP ) NAME(USER FRED ) 002
002 LOGON/JOB INITIATION - INVALID PASSWORD
15.27.32 STC12856 IRR013I VERIFICATION FAILED. INVALID PASSWORD GIVEN.
15.27.32 STC12856 ICH408I USER(FRED ) GROUP(ATSGRP ) NAME(USER FRED ) 004
004 LOGON/JOB INITIATION - INVALID PASSWORD
15.27.32 STC12856 IRR013I VERIFICATION FAILED. INVALID PASSWORD GIVEN.
1 //BADSTRT JOB MSGLEVEL=1 STC12856
2 //STARTING EXEC BAQSTRT
3 XXBAQSTRT PROC PARMs='myServer --clean'
XX*
4 XX SET ZCONHOME='/usr/lpp/IBM/zosconnect/v3r0'
XX*
5 XXZCON EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,
XX PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS.'
IEFC653I SUBSTITUTION JCL - PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,PARM='PGM
/usr/lpp/IBM/zosconnect/v3r0/bin/zosconnect run myServer --clean'
6 XXSTEPLIB DD DISP=SHR,DSN=MQ91#.SCSQAUTH
7 XX DD DISP=SHR,DSN=MQ91#.SCSQANLE
8 XXSTDERR DD SYSOUT=*,FREE=CLOSE,SPIN=(UNALLOC,1M)
```

MA B 16/074

Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23



Basic security issues – Some times you have to dig a little more

The STDOUT may show:

```
ÝAUDIT  .. CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified  
ÝAUDIT  .. CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified
```

But there are no SAF messages in the SYSLOG:

While the messages.log displays a SAF return code and reason code:

```
WG31  
File Edit Settings View Communication Actions Window Help  
File Edit Edit_Settings Menu Utilities Compilers Test Help  
VIEW      /MPZ3/var/zosconnect/servers/myServer/logs/messages.log  
Command ==> -  
Columns 00100 00223  
Scroll ==> PAGE  
000256 SAF return code 0x00000008. RACF return code 0x00000008. RACF reason code 0x00000020.  
000257 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000258 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000259 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000260 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000261 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000262 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000263 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000264 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000265 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000266 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000267 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000268 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000269 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000270 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000271 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000272 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000273 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000274 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000275 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
000276 CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD  
000277 CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
***** ***** Bottom of Data *****  
A B  
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23  
04/015
```

CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZDFLT. SAF return code 0x00000008. RACF return code 0x00000008. RACF reason code 0x00000020.

Tech-Tip: And be aware of hex v decimal return and reason codes



RACF return code 0x00000008. RACF reason code 0x00000020.

Table 1. initACEE create return codes

SAF return code	RACF® return code	RACF reason code	Explanation
0	0	0	The service was successful.
4	0	0	RACF is not installed.
8	8	4	Parameter list error occurred.
8	8	8	An internal error occurred during RACF processing.
8	8	12	Recovery environment could not be established.
8	8	16	User ID is not defined to RACF.
8	8	20	Password, Password Phrase or Pass Ticket is not valid.
8	8	24	Password or Password Phrase is expired.
8	8	28	User ID is revoked or user access to group is revoked.
8	8	32	The user does not have appropriate RACF access to either the SECLABEL, SERVAUTH profile, or APPL specified in the parmlist.
8	8	36	Certificate is not valid.
8	8	40	< No user ID is defined for this certificate. See Usage Note number 37. >
8	8	44	The client security label is not equivalent to the server's security label.
8	8	48	A managed ACEE is requested with a nested RACO in the Envir_In parameter.
8	12	InitUSP reason code	initUSP failed. See initUSP reason codes in Return and reason codes .

Hex '20' = Dec '32'

Root cause – No READ access to APPL resource BBGZDFLT

From URL <https://www.ibm.com/docs/en/zos/2.4.0?topic=acee-return-reason-codes>

mitchj@us.ibm.com

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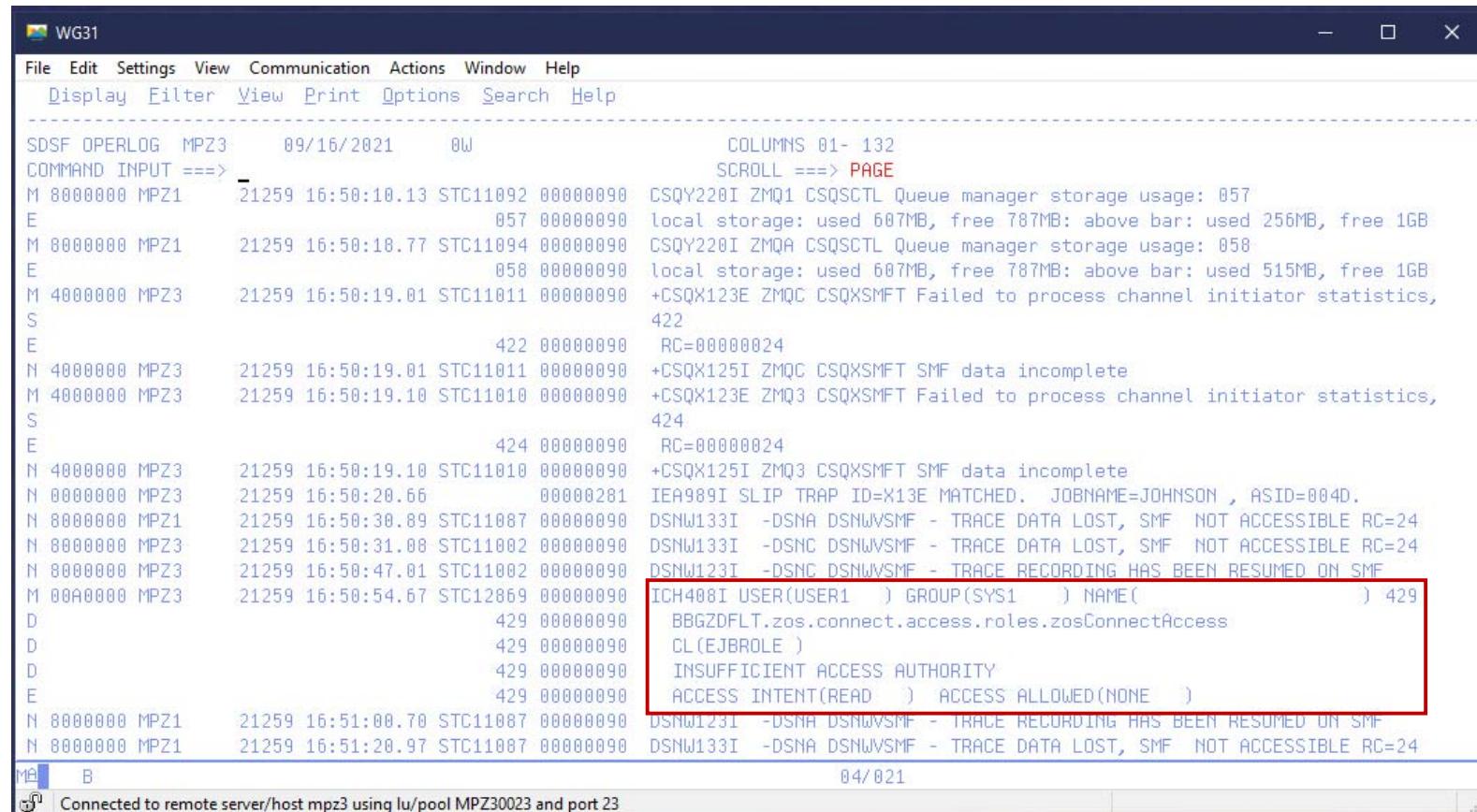
Basic security issues – Sometimes there is misdirection



The STDOUT may show:

Basis security issues - Use the SYSLOG/JESMSGGLG output

The SYSLOG shows a ICH408I message:



```

WG31
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF OPERLOG MPZ3 09/16/2021 0W COLUMNS 01- 132
COMMAND INPUT ===> SCROLL ==> PAGE
M 8000000 MPZ1 21259 16:50:10.13 STC11092 00000090 CSQY220I ZMQ1 CSQSCTL Queue manager storage usage: 057
E 057 00000090 local storage: used 607MB, free 787MB; above bar: used 256MB, free 1GB
M 8000000 MPZ1 21259 16:50:18.77 STC11094 00000090 CSQY220I ZMQA CSQSCTL Queue manager storage usage: 058
E 058 00000090 local storage: used 607MB, free 787MB; above bar: used 515MB, free 1GB
M 4000000 MPZ3 21259 16:50:19.01 STC11011 00000090 +CSQX123E ZMQC CSQXSMFT Failed to process channel initiator statistics,
S 422 RC=00000024
E 422 00000090
N 4000000 MPZ3 21259 16:50:19.01 STC11011 00000090 +CSQX125I ZMQC CSQXSMFT SMF data incomplete
M 4000000 MPZ3 21259 16:50:19.10 STC11010 00000090 +CSQX123E ZMQ3 CSQXSMFT Failed to process channel initiator statistics,
S 424 RC=00000024
E 424 00000090
N 4000000 MPZ3 21259 16:50:19.10 STC11010 00000090 +CSQX125I ZMQ3 CSQXSMFT SMF data incomplete
N 0000000 MPZ3 21259 16:50:20.66 000000281 IEA989I SLIP TRAP ID=X13E MATCHED. JOBNAME=JOHNSON , ASID=004D.
N 8000000 MPZ1 21259 16:50:30.89 STC11087 00000090 DSNW133I -DSNA DSNWVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
N 8000000 MPZ3 21259 16:50:31.08 STC11002 00000090 DSNW133I -DSNC DSNWVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
N 8000000 MPZ3 21259 16:50:47.01 STC11002 00000090 DSNW123T -DSNC DSNWVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
M 00A0000 MPZ3 21259 16:50:54.67 STC12869 00000090 ICH408I USER(USER1 ) GROUP(SYS1 ) NAME( ) 429
D 429 00000090 BBGZDFLT.zos.connect.access.roles.zosConnectAccess
D 429 00000090 CL(EJBROLE )
D 429 00000090 INSUFFICIENT ACCESS AUTHORITY
E 429 00000090 ACCESS INTENT(READ ) ACCESS ALLOWED(NONE )
N 8000000 MPZ1 21259 16:51:00.70 STC11087 00000090 DSNW123I -DSNA DSNWVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
N 8000000 MPZ1 21259 16:51:20.97 STC11087 00000090 DSNW133I -DSNA DSNWVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24

```

Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23

Symptom: client see HTTP 403 – Authorization Failed. There were no messages in STDOUT or messages.log locations. Root cause – No READ access to EJBROLE BBGZDFLT.zos.connect.access.roles.zosConnectAccess.

Basic security issues - SYSLOG/JESMSGGLG output (even more misdirection)



```
WG31
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
-----
SDSF OUTPUT DISPLAY BAQSTRT STC12862 DSID      2 LINE 0      COLS 02- 133
COMMAND INPUT ==>                                     SCROLL ==> PAGE
*****TOP OF DATA *****
J E S 2 J O B L O G -- S Y S T E M M P Z 3 -- N O D E W S C 1 0

16.31.55 STC12862 ---- THURSDAY, 16 SEP 2021 ----
16.31.55 STC12862 IEF695I START BAQSTRT WITH JOBNAME BAQSTRT IS ASSIGNED TO USER LIBSERV , GROUP LIBGRP
16.31.55 STC12862 $HASP373 BAQSTRT STARTED
16.32.03 STC12862 +CLWJKE0001I: The server myServer has been launched.
16.32.20 STC12862 BPXMF023I (LIBSERV) 282
   282          GMDIG7777I: IMS service provider (20210816-0926) for z/OS Connect
   282          Enterprise Edition initialized successfully.
16.32.50 STC12862 +CLWJKZ0001I: Application resources started in 14.912 seconds.
16.32.50 STC12862 +CLWJKZ0001I: Application serverConfig started in 14.910 seconds.
16.32.55 STC12862 +CLWJKF0011I: The myServer server is ready to run a smarter planet. The 285
   285          myServer server started in 51.809 seconds
16.43.25 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.25 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.25 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.25 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.26 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.26 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.

MA B                               04/021
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
```

Symptom: Client unable to connect. STDOUT contains message *CWWKS1100A: Authentication did not succeed for user ID user1. An invalid user ID or password was specified.*

Basic security issues - SYSLOG/JESMSGGLG output (even more misdirection)

There is no need to set the extended protection attribute for this Java shared object executable.
The root cause was that the angel was not active.

```
VIEW      /MPZ3/var/zosconnect/servers/myServer/logs/messages.log          Columns 00100 00223
Command ==>
000021 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/shared.xml
000022 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/oauth.xml
000023 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/audit.xml
000024 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/mq.xml
000025 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/db2.xml
000026 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/wlm.xml
000027 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/restConnector.xml
000028 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/smf.xml
000029 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/adminCenter.xml
000030 CUWKB0125I: This server requested a REGION size of 8KB. The below-the-line storage limit is 8MB and the above-the-line stor
000031 CUWKB0126I: MEM1 TMIT=2000... MEM1 TMIT CONFIGURATION SOURCE=TCI
000032 CUWKB0101I: The angel process is not available. No authorized services will be loaded. The reason code is 4.
000033 CUWKB0104I: Authorized service group KERNEL is not available.
000034 CUWKB0104I: Authorized service group LOCALCOM is not available.
000035 CUWKB0104I: Authorized service group PRODMGR is not available.
000036 CUWKB0104I: Authorized service group SAFCRED is not available.
000037 CUWKB0104I: Authorized service group TXRRS is not available.
000038 CUWKB0104I: Authorized service group WOLA is not available.
000039 CUWKB0104I: Authorized service group ZOSAIO is not available.
000040 CUWKB0104I: Authorized service group ZOSDUMP is not available.
000041 CUWKB0104I: Authorized service group ZOSWLM is not available.
000042 CUWKB0104I: Authorized service group CLIENT.WOLA is not available.
000043 CUWKB0108I: IBM Corp product z/OS Connect version 03.00 successfully registered with z/OS.
MA  B  14/009
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
```



External resource issues (HTTP 500) - CICS

The client sees:

```
HTTP/1.1 500 Internal Server Error
```

The STDOUT may show:

```
ÝWARNING " BAQR0429W: API db2employee encountered an error while processing a request under URL  
https://mpz3.washington.ibm.com:9443/db2/employee/948478.
```

While the messages.log display

```
[9/16/21 21:00:55:811 GMT] 00000051 com.ibm.zosconnect.service.cics.internal.conn.ISCECIRequest E BAQR0657E: Transaction  
abend MIJO occurred in CICS while using CICS connection cscvinc and service cscvincDeleteService.  
[9/16/21 21:00:55:815 GMT] 00000051 com.ibm.zosconnect.internal.web.ServiceProxyServlet W BAQR0429W: API cscvinc  
encountered an error while processing a request under URL https://mpz3.washington.ibm.com:9443/cscvinc/employee/948478.
```



External resource issues (HTTP 500) – Db2

The client sees:

```
HTTP/1.1 500 Internal Server Error
```

The STDOUT may show:

```
ÝWARNING `` BAQR0429W: API db2employee encountered an error while processing a request under URL  
https://mpz3.washington.ibm.com:9443/db2/employee/948478.
```

The messages.log displays:

```
[9/14/21 20:04:59:776 GMT] 00000048 osconnect.service.client.rest.internal.RestClientServiceImpl E BAQR0558E: The remote  
service invocation failed with [9/14/21 20:04:59:776 GMT] 00000048  
osconnect.service.client.rest.internal.RestClientServiceImpl E BAQR0558E: The remote service invocation failed with failed  
due to SQLCODE=-204 SQLSTATE=42704, USER1.EMPLOYEE IS AN UNDEFINED NAME. Error Location:DSNLJACC:35"}
```

```
[9/14/21 20:04:59:821 GMT] 00000048 com.ibm.ws.logging.internal.impl.IncidentImpl I FFDC1015I: An FFDC  
Incident has been created: "javax. ws.rs.InternalServerErrorException: HTTP 500 Internal Server Error  
com.ibm.zosconnect.service.client.rest.internal.SarRestClientServiceImpl 528" at ffdc_21.09.14_20.04.59.0.log
```

```
[9/14/21 20:04:59:826 GMT] 00000048 com.ibm.zosconnect.internal.web.ServiceProxyServlet W BAQR0429W: API db2employee  
encountered an error while processing a request under URL https://mpz3.washington.ibm.com:9443/db2/employee/details/000050.  
[9/14/21 20:05:00:045 GMT] 00000046 osconnect.service.client.rest.internal.RestClientServiceImpl E BAQR0558E: The remote  
service invocation failed with response message: HTTP 500 Internal Server Error and response body:  
{"StatusCode":500,"StatusDescription":"Service zCEEService.selectEmployee execution failed due to SQLCODE=-204  
SQLSTATE=42704, USER1.EMPLOYEE IS AN UNDEFINED NAME. Error Location:DSNLJACC:35"}
```

Tech-Tip: An HTTP 500 shortcut

A HTTP status code 500 occurs when a failure occurred at an external endpoint. It does not matter if the external endpoint is a z/OS resources or a REST API provider, or an authorization server, etc.

The details of the failure are not provided **directly** to z/OS Connect, just the fact that a failure has occurred. The failure could be a security issue, an abend or something entirely. z/OS Connect may or may not have directly access to any details of the failure (it depends on the service provider). It does not mean the details do not exist; the details are just readily available.

The shortcut to identify the issue is review the messages in the messages.log and check to see if there is corresponding FFDC (first failure data collection) dump.

Let's step back - what is a Java stack trace?



```
[9/6/21 22:51:19:981 GMT] 00000039 com.ibm.ejs.j2c.ConnectionEventListener
A J2CA0056I: The Connection Manager received
a fatal connection error from the Resource Adapter for resource null. The exception is: javax.resource.spi.EISSystemException: ICO0001E:
com.ibm.connector2.ims.ico.IMSTCPIPManagedConnection@c341a0aa.processOutputOTMAMsg(Connection, InteractionSpec, Record, Record) error. IMS
Connect returned an error: RETCODE=[4], REASONCODE=[NFNDDST] [Datastore not found. ]
at com.ibm.connector2.ims.ico.IMSManagedConnection.processOutputOTMAMsg(IMSManagedConnection.java:4042)
at com.ibm.connector2.ims.ico.IMSTCPIPManagedConnection.callSendRecv(IMSTCPIPManagedConnection.java:241)
at com.ibm.connector2.ims.ico.IMSManagedConnection.call(IMSManagedConnection.java:1625)
at com.ibm.connector2.ims.ico.IMSConnection.call(IMSConnection.java:213)
at com.ibm.connector2.ims.ico.IMSInteraction.execute(IMSInteraction.java:586)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.executeTransServiceInputTMRA(Unknown Source)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.invokeTransactionService(Unknown Source)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.invoke(Unknown Source)
at com.ibm.ims.zconnect.provider.clients.GatewayServiceClient.doPost(Unknown Source)
at com.ibm.ims.zconnect.provider.clients.IMSClient.doInvoke(Unknown Source)
at com.ibm.ims.gateway.config.services.IMSZServiceHandlerImpl.invoke(Unknown Source)
at com.ibm.ims.gateway.config.services.IMSZServiceImpl.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ZosConnectServiceImpl.apiInvoke(Unknown Source)
at com.ibm.zosconnect.internal.ServiceManagerImpl.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ApiManagerImpl.invokeApi(Unknown Source)
at com.ibm.zosconnect.internal.web.ServiceProxyServlet$3.run(Unknown Source)
at com.ibm.ws.webcontainer.async.ServiceWrapper.wrapAndRun(ServiceWrapper.java:236)
at com.ibm.ws.webcontainer.async.ContextWrapper.run(ContextWrapper.java:28)
at com.ibm.ws.webcontainer.async.WrapperRunnableImpl.run(WrapperRunnableImpl.java:89)
at com.ibm.ws.threading.internal.ExecutorServiceImpl$RunnableWrapper.run(ExecutorServiceImpl.java:238)
at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1160)
at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:635)
at java.lang.Thread.run(Thread.java:825)
```

IMS service provider classes
z/OS Connect Java classes

A Google search of ICO00001E returned an explanation at URL: <https://www.ibm.com/docs/en/ims/13.1.0?topic=exceptions-ico0001e>

Root cause – Datastore mistyped in the interaction configuration



First Failure Data Collection (FFDC)

```
-----Start of DE processing----- = [9/7/21 14:19:291 GMT]
Exception = com.ibm.msg.client.jms.DetailedIllegalStateException
Source = com.ibm.zosconnect.service.mq.OneWayMQServiceInvocation
probeid = 0004
Stack Dump = com.ibm.msg.client.jms.DetailedIllegalStateException: JMSWMQ2002: Failed to get a message from destination 'ZCONN2.DEFAULT.MQZCEE.QUEUE'.
IBM MQ classes for JMS attempted to perform an MQGET; however IBM MQ reported an error.
Use the linked exception to determine the cause of this error.
at com.ibm.msg.client.wmq.common.internal.Reason.reasonToException(Reason.java:489)
at com.ibm.msg.client.wmq.common.internal.Reason.createException(Reason.java:215)
.
.
.
at com.ibm.zosconnect.service.mq.MQService.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ZosConnectServiceImpl.apiInvoke(Unknown Source)
at com.ibm.zosconnect.internal.ServiceManagerImpl.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ApiManagerImpl.invokeApi(Unknown Source)
at com.ibm.zosconnect.internal.web.ServiceProxyServlet$3.run(Unknown Source)
at com.ibm.ws.webcontainer.async.ServiceWrapper.wrapAndRun(ServiceWrapper.java:236)
at com.ibm.ws.webcontainer.async.ContextWrapper.run(ContextWrapper.java:28)
at com.ibm.ws.webcontainer.async.WrapperRunnableImpl.run(WrapperRunnableImpl.java:89)
at com.ibm.ws.threading.internal.ExecutorServiceImpl$RunnableWrapper.run(ExecutorServiceImpl.java:238)
at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1160)
at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:635)
at java.lang.Thread.run(Thread.java:825)
Caused by: com.ibm.mq.MQException: JMSCMQ0001: IBM MQ call failed with compcode '2' ('MQCC_FAILED') reason '2016' ('MQRC_GET_INHIBITED').
at com.ibm.msg.client.wmq.common.internal.Reason.createException(Reason.java:203)
... 25 more
```

MQ service provider classes

Root cause – Queue was configured to disable the MQPUT request

The FFDC dump is more than a Java stack trace



z/OS Connect Java classes

```
-----Start of DE processing----- = [9/7/21 20:26:12:394 GMT]
Exception = com.ibm.zosconnect.endpoint.connection.TokenConfigException
Source = com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl
probeid = 265
Stack Dump = com.ibm.zosconnect.endpoint.connection.TokenConfigException: BAQR1006E: An error occurred when z/OS Connect EE attempted to
access the authentication/authorization server. Error: javax.net.ssl.SSLHandshakeException: SSLHandshakeException invoking
https://wg31.washington.ibm.com:26213/oidc/endpoint/OP/token: com.ibm.jsse2.util.j: PKIX path building failed:
com.ibm.security.cert.IBMCertPathBuilderException: unable to find valid certification path to requested target
at com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl.requestAuthorizationServer(Unknown Source)
at com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl.getAuthData(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.restclient.RestClientImpl.handleAuthConfig(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.restclient.RestClientImpl.invoke(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.ARInvokeHandler.handle(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.ApiRequesterManagerImpl.invoke(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.ApiRequesterManagerProxyImpl$1.run(Unknown Source)
.
.
.

Dump of callerThis
Object type = com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl
copyright_notice = "Licensed Materials - Property of IBM 5655-CE3 (c) Copyright IBM Corp. 2017, 2021 All Rights Reserved
tc = class com.ibm.websphere.ras.TraceComponent@2d85bcc
strings[0] = "TraceComponent[com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl,class
com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl,[zosConnectApiRequesterToken],com.ibm.zosconnect.endpoint
.connection.internal.resources.ZosConnectEndpointConnection,null]"
CFG_ELEMENT_ID = "id"
CFG_GRANTTYPE = "grantType"
id = "myoAuthConfig"
grantType = "password"
authServer = class com.ibm.zosconnect.endpoint.connection.internal.AuthorizationServerImpl@ed6c1e8c
.
.
.

sslCertsRef = "OutboundSSLSettings"
connectionTimeout = 30000
receiveTimeout = 60000
id = "myoAuthServer"
```



The FFDC dump for a network issue

```
-----Start of DE processing----- = [6/6/21 14:56:01:242 GMT]
Exception = java.net.UnknownHostException
Source = com.ibm.zosconnect.service.cics.internal.conn.isc.ConnectionManager
probeid = 131
Stack Dump = java.net.UnknownHostException: wg31.washington.ibm.com
at java.net.InetAddress.getAllByName0 (InetAddress.java:1419)
at java.net.InetAddress.getAllByName (InetAddress.java:1323)
at java.net.InetAddress.getAllByName (InetAddress.java:1246)
at java.net.InetAddress.getByName (InetAddress.java:1196)
at com.ibm.zosconnect.service.cics.internal.conn.isc.ConnectionManager.createConnection (Unknown Source)
at com.ibm.zosconnect.service.cics.internal.conn.isc.ConnectionManager.getConnection (Unknown Source)
at com.ibm.zosconnect.service.cics.internal.conn.isc.SessionManager.getNewConversation (Unknown Source)
at com.ibm.zosconnect.service.cics.ServerECIRequest.executeISC (Unknown Source)
at com.ibm.zosconnect.service.cics.ServerECIRequest.execute (Unknown Source)
at com.ibm.zosconnect.service.cics.internal.CicsIpicConnection.flow (Unknown Source)
at com.ibm.zosconnect.service.cics.internal.CicsServiceImpl.flowRequest (Unknown Source)
at com.ibm.zosconnect.service.cics.internal.CicsServiceImpl.invoke (Unknown Source)
at com.ibm.zosconnect.internal.ZosConnectServiceImpl.apiInvoke (Unknown Source)
at com.ibm.zosconnect.internal.ServiceManagerImpl.invoke (Unknown Source)
at com.ibm.zosconnect.internal.ApiManagerImpl.invokeApi (Unknown Source)
```

Base Java classes
z/OS Connect Java classes

Root cause – Host wg31.washington.ibm.com was not configured in the DNS server

Tech/Tip: Use the TCPIP resolver trace to display name resolution information

```
ALLOC FILE(SYSTCPT) DA(*)
ping wg31.washington.ibm.com
Resolver Trace Initialization Complete -> 2021/09/12 12:54:37.36

res_init Resolver values:
Setup file warning messages = No
CTRACE TRACERES option = No
Global Tcp/Ip Dataset = SYS1.TCPIP.TCPPARMS(TCPDAT3)
Default Tcp/Ip Dataset = SYS1.TCPIP.TCPPARMS(TCPDAT3)
Local Tcp/Ip Dataset = //DD:SYSTCPD
                      ==> SYS1.TCPIP.TCPPARMS(TCPDAT3)
Translation Table = SYS1.TCPIP.STANDARD.TCPXLBIN
UserId/JobName = JOHNSON
Caller API = TCP/IP Sockets Extended
Caller Mode = EBCDIC
System Name = WSC13 (from VMCF)
UnresponsiveThreshold = 25
(G) DataSetPrefix = SYS1.TCPIP
(G) HostName = MPZ3
. . .
res_query Failed: RetVal = -1, RC = 1, Reason = 0x78981005
res_querydomain Failed: RetVal = -1, RC = 1, Reason = 0x78981005
res_search Failed: RetVal = -1, RC = 1, Reason = 0x78981005
GetAddrInfo Closing IOCTL Socket 0x00000000
BPX1CL0: RetVal = 0, RC = 0, Reason = 0x00000000
GetAddrInfo Failed: RetVal = -1, RC = 1, Reason = 0x78AE1004
GetAddrInfo Ended: 2021/09/12 12:55:32.364732
*****
EZ3111I Unknown host 'WG31.WASHINGTON.IBM.COM'
```

Root cause – Host wg31.washington.ibm.com was missing from SYS1.TCPIP.TCPPARMS(IPNODES)



Use the messages.log and FFDC log together

```
[9/12/21 14:56:45:613 GMT] 00000045 com.ibm.ws.logging.internal.impl.IncidentImpl           I FFDC1015I: An FFDC Incident has been  
created: "com.ibm.mq.connector.DetailedResourceException: MQJCA1011: Failed to allocate a JMS connection., error code: MQJCA1011 An internal  
error caused an attempt to allocate a connection to fail. See the linked exception for details of the failure.  
com.ibm.ejs.j2c.poolmanager.FreePool.createManagedConnectionWithMCWrapper 199" at ffdc_21.09.12_14.56.45.0.log  
  
[9/12/21 14:56:45:652 GMT] 00000045 com.ibm.ws.logging.internal.impl.IncidentImpl           I FFDC1015I: An FFDC Incident has been  
created: "com.ibm.msg.client.jms.DetailedJMSEException: MQJCA1011: Failed to allocate a JMS connection.  
  
An internal error caused an attempt to allocate a connection to fail.  
  
See the linked exception for details of the failure. com.ibm.zosconnect.service.mq.OneWayMQServiceInvocation 0004" at  
ffdc_21.09.12_14.56.45.1.log  
  
[9/12/21 14:56:45:652 GMT] 00000045 com.ibm.zosconnect.service.mq.MQServiceInvocation          E BAQM0056E: An unexpectedJMSEException  
occurred while processing a request for service 'mqGetService'. The exception message was 'MQJCA1011: Failed to allocate a JMS connection.'.
```

Spacing added between lines to improve readability

mitchj@us.ibm.com

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The FFDC dump showing additional JMS information



```
-----Start of DE processing----- = [9/12/21 14:56:45:567 GMT]
Exception = com.ibm.mq.connector.DetailedResourceException
Source = com.ibm.ejs.j2c.poolmanager.FreePool.createManagedConnectionWithMCWrapper
probeid = 004
Stack Dump = com.ibm.mq.connector.DetailedResourceException: MQJCA1011: Failed to allocate a JMS connection., error code: MQJCA1011 An
internal error caused an attempt to allocate a connection to fail. See the linked exception for details of the failure.
at com.ibm.mq.connector.services.JCAExceptionBuilder.buildException(JCAExceptionBuilder.java:169)
at com.ibm.mq.connector.services.JCAExceptionBuilder.buildException(JCAExceptionBuilder.java:135)
at com.ibm.mq.connector.ConnectionBuilder.createConnection(ConnectionBuilder.java:162)
at com.ibm.mq.connector.outbound.ManagedConnectionFactoryImpl.createConnection(ManagedConnectionFactoryImpl.java:655)
at com.ibm.mq.connector.outbound.ManagedConnectionImpl.<init>(ManagedConnectionImpl.java:200)
at com.ibm.mq.connector.outbound.ManagedConnectionFactoryImpl.createManagedConnection(ManagedConnectionFactoryImpl.java:248
at com.ibm.ejs.j2c.FreePool.createManagedConnectionWithMCWrapper(FreePool.java:1376)
at com.ibm.ejs.j2c.FreePool.createOrWaitForConnection(FreePool.java:1246)
at com.ibm.ejs.j2c.PoolManager.reserve(PoolManager.java:1438)
at com.ibm.ejs.j2c.ConnectionManager.allocateMCWrapper(ConnectionManager.java:574)
at com.ibm.ejs.j2c.ConnectionManager.allocateConnection(ConnectionManager.java:306)
at com.ibm.mq.connector.outbound.ConnectionFactoryImpl.createManagedJMSConnection(ConnectionFactoryImpl.java:309)
at com.ibm.mq.connector.outbound.ConnectionFactoryImpl.createConnectionInternal(ConnectionFactoryImpl.java:252)
at com.ibm.mq.connector.outbound.ConnectionFactoryImpl.createConnection(ConnectionFactoryImpl.java:225)
...
at java.lang.Thread.run(Thread.java:818)
Caused by: com.ibm.msg.client.jms.DetailedJMSEException: JMSFMQ6312: An exception occurred in the Java(tm) MQI.
The Java(tm) MQI has thrown an exception describing the problem.
See the linked exception for further information.
at sun.reflect.NativeConstructorAccessorImpl.newInstance0(Native Method)
...
... 27 more
Caused by: com.ibm.mq.jmqi.JmqiException: CC=2;RC=2495;AMQ8568: The native JNI library 'mqjrrs64' was not found. For a client installation
this is expected. [3=mqjrrs64]
at com.ibm.mq.jmqi.local.LocalMQ.loadLib(LocalMQ.java:1178)
Caused by: java.lang.UnsatisfiedLinkError: /usr/lpp/mqm/V9R1M0/java/lib/libmqjrrs64.so (EDC5205S DLL module not found.)
```

Root cause – configuration issue in the MQ resource adapter configuration, e.g., nativeLibraryPath.

mitchj@us.ibm.com

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A FFDC dump showing a SSL Handshake issue

```
. . . -----Start of DE processing----- = [6/16/21 17:59:45:534 GMT]
Exception = java.security.cert.CertPathValidatorException
Source = com.ibm.ws.ssl.core.WSX509TrustManager
probeid = checkServerTrusted
Stack Dump = java.security.cert.CertPathValidatorException: The certificate issued by CN=OpenIdProv, OU=CertAuth is not trusted; internal cause is: java.security.cert.CertPathValidatorException: Certificate chaining error
at com.ibm.security.cert.BasicChecker.<init>(BasicChecker.java:111)
at com.ibm.security.cert.PKIXCertPathValidatorImpl.engineValidate(PKIXCertPathValidatorImpl.java:220)
at java.security.cert.CertPathValidator.validate(CertPathValidator.java:278)
at com.ibm.jsse2.util.f.a(f.java:40)
at com.ibm.jsse2.util.f.b(f.java:143)
. . .
e = class com.ibm.jsse2.util.f@5728f8dd
f = null
z = class java.lang.String[37]
tsCfgAlias = "OutboundKeyRing"
tsFile = "safkeyring:///zCEE.KeyRing"
extendedInfo = class java.util.HashMap@5ebd51b
serialVersionUID = 362498820763181265
```

Root cause – CA used to sign server certificate was not present in outbound key ring.



Other common TLS handshake issues

- ***Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: null cert chain***

This exception occurs when the server configuration set to require client certificates (`clientAuthentication="true"`) and the client had no certificate to provide and no alternative authentication method was available.

- ***Error occurred during a read, exception:javax.net.ssl.SSLEException: Received fatal alert: bad_certificate error (handshake), vc=1083934466
Caught exception during unwrap, javax.net.ssl.SSLEException: Received fatal alert: bad_certificate***

This is usually caused when the client certificate presented to the server did not have a valid CA certificate for the client's personal certificate in the server's trust store key ring.

- ***CWWKO0801E: Unable to initialize SSL connection. Unauthorized access was denied or security settings have expired. Exception is javax.net.ssl.SSLHandshakeException: no cipher suites in common***

There may be many causes for this issue but first confirm the RACF identity under which the server is running has either READ access to FACILITY resources IRR.DIGTCERT.LISTRING and IRR.DIGTCERT.LIST or access to RDATALIB resources if virtual keyrings are being used.

The first FACILITY resource gives the identity access to their own key ring and the second allows access to the certificates. If if virtual keyrings are in use, then the identity needs READ or UPDATE authority to the <ringOwner>.<ringName>.LST resource in the RDATALIB class. READ access enables retrieving one's own private key, UPDATE access enables retrieving another's private key.

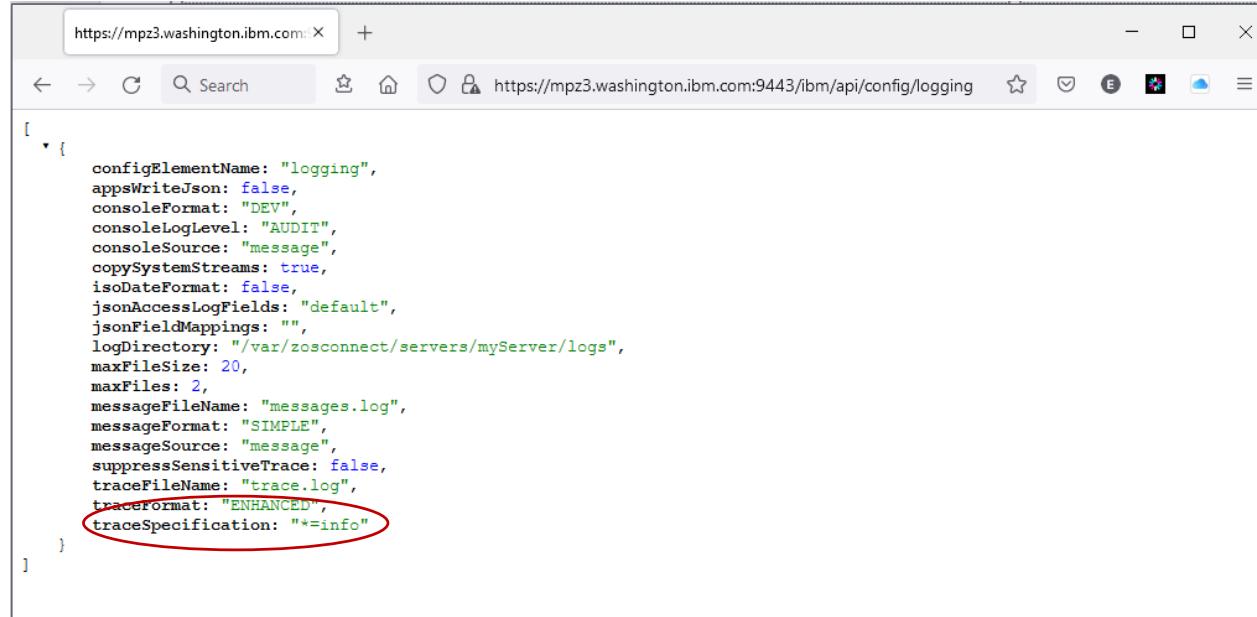
An alternative cause: For a TLS handshake to occur, the server must first have access to a private or site certificate that has a private key and the server must have access to that certificate's private key and no certificate with a private key is available.



trace.out – use as a last resort or at the request of Level 2

First, the current active trace specification settings can be displayed using the *restConnector* feature.

`https://mpz3.washington.ibm.com:9443/ibm/api/config/logging`



```
[{"configElementName": "logging", "appsWriteJson": false, "consoleFormat": "DEV", "consoleLogLevel": "AUDIT", "consoleSource": "message", "copySystemStreams": true, "isoDateFormat": false, "jsonAccessLogFields": "default", "jsonFieldMappings": "", "logDirectory": "/var/zosconnect/servers/myServer/logs", "maxFileSize": 20, "maxFiles": 2, "messageFileName": "messages.log", "messageFormat": "SIMPLE", "messageSource": "message", "suppressSensitiveTrace": false, "traceFileName": "trace.log", "tracerFormat": "ENHANCED", "traceSpecification": "*=info"}]
```

Enabling trace in z/OS Connect EE server

<https://www.ibm.com/docs/en/zosconnect/3.0?topic=problems-enabling-trace-in-zos-connect-ee>



Managing trace specification

- Use “include” file to save commonly used trace specifications.
- Add the “include” after the sever has started to avoid tracing the startup activity.

server.xml

```
<include location="${server.config.dir}/includes/safTrace.xml"/>
```

safTrace.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="security trace">
<logging traceSpecification="com.ibm.ws.security.*=all:
    SSLChannel=all:SSL=all:zosConnectSaf=all:zosConnect=all"/>
</server>
```

cicsTrace.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="CICS trace">
<logging traceSpecification="zosConnectServiceCics=all:
    com.ibm.zosconnect.wv*=FINEST:zosConnect=all"/>
</server>
```

imsTrace.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="IMS trace">
<logging traceSpecification="com.ibm.ims.*=all:
    com.ibm.j2ca.RAIMSTM=all:com.ibm.zosconnect.wv*=FINEST:
    zosConnect=all"/>
</server>
```

Enables enhanced tracing

(after adding an “include” file)
F BAQSTRT, REFRESH, CONFIG

Disable enhanced tracing

F BAQSTRT, LOGGING='*=INFO'
Or
F BAQSTRT, REFRESH, CONFIG
(after removing the “include” file)

trace.out file



mpz3

File Edit Settings View Communication Actions Window Help

File Edit Edit_Settings Menu Utilities Compilers Test Help

EDIT /MPZ3/usr/zosconnect/servers/myServer/logs/trace.log

Command ==>

003637 > getSSLConfig: DefaultSSLSettings Entry
003638 < getSSLConfig Exit
003639 SSLConfig.toString() {

003683 > determineIfCSIV2SettingsApply Entry
003684 (com.ibm.ssl.remoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
003685 < determineIfCSIV2SettingsApply (original settings) Exit

003730 3 keyStoreType: JCERACFKS
003731 3 trustStoreType: JCERACFKS

003734 3 keyStore: safkeuring:///Liberty.KeyRing
003735 3 keyStoreName: CellDefaultKeyStore
003736 3 keyStorePassword: *****
003737 3 trustStore: safkeuring:///Liberty.KeyRing
003738 3 trustStoreName: CellDefaultKeyStore
003739 3 trustStorePassword: *****

003741 (com.ibm.ssl.remoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)

004117 K 3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004119 3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain

004142 (com.ibm.ssl.remoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)

004144 > isTransportSecurityEnabled Entry
004145 < isTransportSecurityEnabled true Exit

004150 > getSSLConfig: DefaultSSLSettings Entry
004151 < getSSLConfig Exit
004152 SSLConfig.toString() {

004196 > determineIfCSIV2SettingsApply Entry
004197 (com.ibm.ssl.remoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004198 < determineIfCSIV2SettingsApply (original settings) Exit

004243 3 keyStoreType: JCERACFKS
004244 3 trustStoreType: JCERACFKS

004247 3 keyStore: safkeuring:///Liberty.KeyRing
004248 3 keyStoreName: CellDefaultKeyStore
004249 3 keyStorePassword: *****
004250 3 trustStore: safkeuring:///Liberty.KeyRing
004251 3 trustStoreName: CellDefaultKeyStore
004252 3 trustStorePassword: *****

004254 (com.ibm.ssl.remoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)

004630 K 3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004632 3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain

004655 (com.ibm.ssl.remoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)

004657 > isTransportSecurityEnabled Entry
004658 < isTransportSecurityEnabled true Exit

Columns 00101 00252
Scroll ==> PAGE

MA A 03/019

Connected to remote server/host mpz3 using lu/pool MPZ30006 and port 23

Use thread number and/or package name to control which trace records are displayed

Monitoring Java, Liberty and z/OS Connect



Java Health Center – Monitors the Java environment

Configuring the Monitoring Agent using JVM directives

Java Directives

- Xhealthcenter:level=headless
- Dcom.ibm.java.diagnostics.healthcenter.headless.output.directory=/var/zcee/hcd *run without a client directory where HCD will be stored*
- Dcom.ibm.java.diagnostics.healthcenter.socket.readwrite=on *collect socket sent/receive data*
- Dcom.ibm.java.diagnostics.healthcenter.headless.files.to.keep=2 *number of HCD files to retain*
- Dcom.ibm.java.diagnostics.healthcenter.headless.delay.start=value=0 *delay start value in minutes*
- Dcom.ibm.java.diagnostics.healthcenter.headless.run.pause.duration=0 *pause between runs, in minutes*
- Dcom.ibm.java.diagnostics.healthcenter.headless.run.duration=0 *run duration, in minutes*
- Dcom.ibm.java.diagnostics.healthcenter.headless.run.number.of.runs=0 *number of runs*
- Dcom.ibm.diagnostics.healthcenter.readonly=on *no client connections allowed*

Add directives to bootstrap.properties or a JVM properties file, e.g.,
/var/zcee/properties/zceeHCD.properties

```
-Dcom.ibm.tools.attach.enable=yes  
-Xhealthcenter:level=headless -Dcom.ibm.java.diagnostics.healthcenter.headless.output.directory=/var/zcee/hcd  
-Dcom.ibm.java.diagnostics.healthcenter.socket.readwrite=on -Dcom.ibm.diagnostics.healthcenter.readonly=on  
-Dcom.ibm.java.diagnostics.healthcenter.headless.run.duration=5  
-Dcom.ibm.java.diagnostics.healthcenter.headless.run.number.of.runs=1 #
```

All the health center directives should be on one line.

For details on these and other Health Center configuration properties, see URL

<https://www.ibm.com/docs/en/mon-diag-tools?topic=agent-health-center-configuration-properties>

Java Health Center – Monitoring Agent Configuration



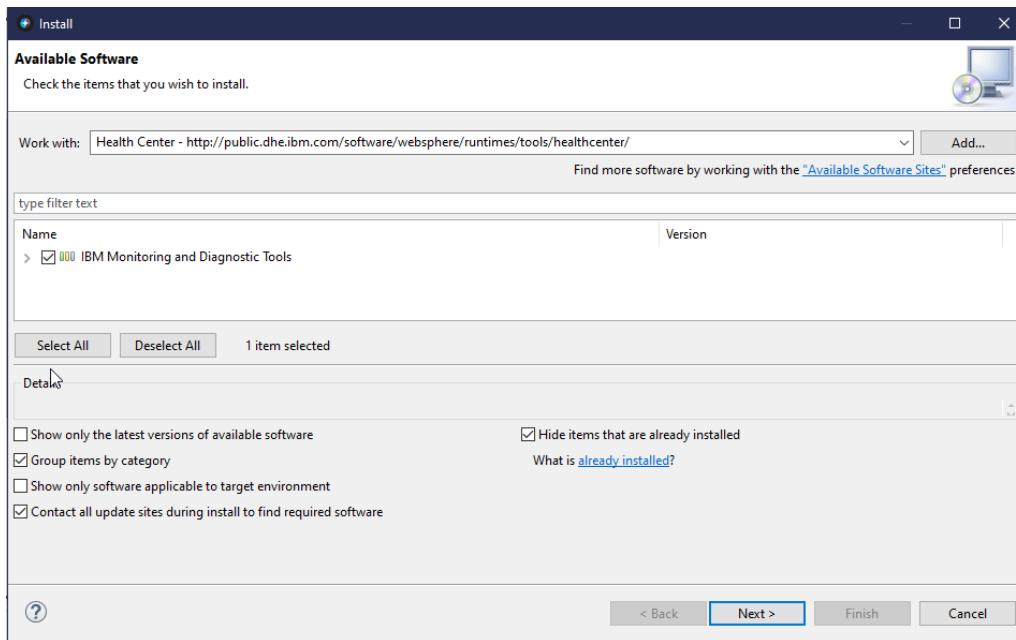
Set the JVM_OPTIONS environment variable to the properties file containing the health center directives

```
SYS1.PROCLIB(BAQSTRT)
//BAQSTRT PROC PARM='myServer --clean'
/*
// SET ZCONHOME='/usr/lpp/IBM/zosconnect/v3r0'
/*
//ZCON      EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,
//              PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS.'
//STEPLIB  DD DISP=SHR,DSN=MQ91#.SCSQAUTH
//          DD DISP=SHR,DSN=MQ91#.SCSQANLE
//STDERR   DD SYSOUT=*,FREE=CLOSE,SPIN=(UNALLOC,1M)
//STDOUT   DD SYSOUT=*
//STDIN    DD DUMMY
//STDENV   DD *
_BPX_SHAREAS=YES
JAVA_HOME=/usr/lpp/java/J8.0_64/
WLP_USER_DIR=/var/zosconnect
JVM_OPTIONS=-Xoptionsfile=/var/zcee/properties/zceeHCD.properties
```



Java Health Center – Client Configuration

The Java health center client can be installed in most Eclipse workspace, e.g., IBM z/OS Explorer, etc.



The plug-in is available for download from <http://public.dhe.ibm.com/software/websphere/runtimes/tools/healthcenter/>



Java Health Center – HEAP analysis example

smf - Eclipse

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CPU Classes Environment Events Garbage Collection I/O Locking Method Profiling Method Trace Native Memory Network Threads WebSphere Real Time

Analysis and Recommendations

① Heap usage seems to be growing over time. It increased by 33% in the last third of the log compared to the middle of the log. However, the number of collections decreased by 82%. This indicates that the rate at which your application is producing garbage seems to be slowing down. This may mean that your application will reach a steady-state at which the heap usage will no longer be increasing.

② The mean occupancy in the nursery is 34%. This is low, so the gencon policy is probably an optimal policy for this workload.

Heap and pause times Object allocations Samples by request site Samples by object

Used heap (after collection) Heap size Pause time

Size (MB) time (ms)

elapsed time (minutes)

Summary Call hierarchy Timeline

Concurrent collection count 10

GC Mode Default (gencon)

Global collections - Mean garbage collection pause 6.29 ms

Global collections - Mean interval between collections 2110 ms

Global collections - Number of collections 12

Largest memory request 199 KB

Mean garbage collection pause 3.5 ms

Mean interval between collections 129 ms

Minor collections - Mean garbage collection pause 3.39 ms

Minor collections - Mean interval between collections 134 ms

Minor collections - Number of collections 310

Minor collections - Total amount flipped 338073 KB

Minor collections - Total amount tenured 52.64 MB

Number of collections 322

Number of collections triggered by allocation failure 312

Proportion of time spent in garbage collection pauses (%) 2.71%

Proportion of time spent unpause (%) 97.29%

Rate of garbage collection 2643 MB/minute

Total amount flipped 338073 KB

Help - Eclipse

Search: Go Scope: All topics

Contents

- Introduction
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- Monitoring a running application
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 - Locking perspective (Java applications only)
 - Classes perspective (Java applications only)
 - CPU perspective
 - Environment perspective
 - Events perspective
 - Garbage collection perspective
 - Native memory perspective
 - Network perspective (Java applications only)
 - Threads perspective (Java applications only)
 - Method profiling perspective
 - WebSphere Real Time perspective (WebSphere C)
- Using the garbage collection perspective

Tool: IBM Monitoring and Diagnostic Tools - Health Center > IBM Monitoring and Diagnostic Tools - Health Center > Viewing the data collected > Garbage collection perspective

The Health Center garbage collection perspective has the following views:

Views for basic garbage collection information

These views are available for all application types:

- Heap and pause times: A graph of [heap usage](#) and [pause times](#).
- Summary: A [summary table](#) of important garbage collection metrics.

Views for detailed garbage collection information

These views are available only for Java applications, and only if you enable detailed garbage collection information (Java applications only):

- Object allocations: A table that shows the [allocation of objects](#) within a specified size range.
- Samples by request site: A profile of sampled object allocations, grouped by the call site of the allocation request.
- Samples by object: A profile of sampled object allocations, grouped by the type of object allocated.
- Call hierarchy: This view shows data when you select a row in the Object allocations, Samples by request site, or Samples by object views. For example, if you select a row in the Samples by object view, this view shows the hierarchy of calls to allocations of that object.
- Timeline: A visual indication of when object allocations were requested. This view shows data when you select a row in the Object allocations or Samples by request site views.

Heap usage

Java Health Center – Network analysis example



smf - Eclipse

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CPU Classes Environment Events Garbage Collection I/O Locking Method Profiling Method Trace Native Memory Network Threads WebSphere Real Time

Analysis and Recommendations

- Your application has made 1,270 open socket requests and 820 close socket requests.
- Your application has 17 open sockets.
- No problems detected

Sockets

Socket ID filter: Apply Clear

ID	Type	IP Address	Port	Data sent	Data received	State	Thread [ID] Name
102	Client	0:0:0:ffff:c0a8:11c9	1491	116043 bytes	42284 bytes	Closed	[0x29d2fa00] Equino...
103	Client	0:0:0:ffff:c0a8:11c9	65470	32953 bytes	38334 bytes	Open	[0x2a00aa00] Default...
112	Server	0:0:0:ffff:c0a8:3c	59411			Open	[0x2a253d00] Shared...
127	Server	0:0:0:ffff:c0a8:3c	2446	87343 bytes	98768 bytes	Closed	[0x2a019f00] Default...
136	Server	0:0:0:ffff:c0a8:11c9	9080			Open	[0x2b38c800] Default...
138	ServerS...	0:0:0:0:0	59412	4248 bytes	8818 bytes	Open	[0x2a253d00] Shared...
144	Server	0:0:0:ffff:c0a8:3c	9443			Open	[0x2a019f00] Default...
164	ServerS...	0:0:0:0:0	176			Open	[0x2a253d00] Shared...
183	Client	0:0:0:ffff:c0a8:11c9	4000	182558 bytes	186691 bytes	Closed	[0x2a00aa00] Default...
186	Server	0:0:0:ffff:c0a8:11f3	7883			Open	[0x2a14f400] Default...
196	Server	0:0:0:ffff:c0a8:3c	61723			Closed	[0x29fcbb00] Default...
204	Server	0:0:0:ffff:c0a8:11f3	7880	1428 bytes	602 bytes	Open	[0x2a253d00] Shared...
215	Client	0:0:0:ffff:c0a8:11c9	1491	116823 bytes	62048 bytes	Open	[0x2b38c800] Default...
226	Server	0:0:0:ffff:c0a8:11f3	7863	2447 bytes	1059 bytes	Closed	[0x2a00aa00] Default...
227	Server	0:0:0:ffff:c0a8:11f3	9463	9892 bytes	8675 bytes	Open	[0x2aa3c100] Default...
228	Server	0:0:0:ffff:c0a8:11f3	7849			Closed	[0x29fcbb00] Default...
230	Server	0:0:0:ffff:c0a8:11f3	7850	39936 bytes	54048 bytes	Open	[0x2a00aa00] Default...
231	Server	0:0:0:ffff:c0a8:11f3	9463	10868 bytes	7460 bytes	Open	[0x2a14f400] Default...
233	Server	0:0:0:ffff:c0a8:11f3	7810	22059 bytes	11436 bytes	Open	[0x2a00aa00] Default...
234	Server	0:0:0:ffff:c0a8:11f3				Closed	[0x2a00aa00] Default...

Sockets open Network I/O

c0a8:11c9 = 192.168.17.201



Java Health Center – Method Profiling

smf - Eclipse

File Edit Navigate Search Project Data Run Monitored System Window Help

Status Connection

CPU Classes Environment Events Garbage Collection I/O Locking Method Profiling Method Trace Native Memory Network Threads WebSphere Real Time

Analysis and Recommendations

- The method MD5.a() is consuming approximately 27% of the CPU cycles consumed by methods. It may be a good candidate for optimization.
- The monitored system generated more data than the client could consume, and so some samples have been lost. Profile accuracy should not be significantly affected.

Sample based profile

Filter methods: [] Apply Clear

Samples	Self (%)	Self	Tree (%)	Tree	Method
2806	27.17	██████	27.28	██████	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
562	5.44	██████	7.26	██████	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
440	4.26	██████	21.36	██████	com.ibm.ws.logging.internal.impl.BaseTraceService.publishTraceLogRecord(com.ibm.ws.loggii
264	2.56	██████	2.56	██████	java.math.Division.monReduction(int[], java.math.BigInteger, int)
183	1.77	██████	1.79	██████	java.math.Multiplication.square(int[], int, int)
172	1.67	██████	2.32	██████	javax.security.auth.Subject.toString(boolean)
150	1.45	██████	1.47	██████	java.math.Division.long.monReduction(int[], long[], int, long)
130	1.26	██████	1.83	██████	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
128	1.24	██████	1.55	██████	com.ibm.crypto.provider.P256PrimeField.a(int[])
115	1.11	██████	1.14	██████	java.math.Division.long.monReduceSq(long[], long[], long, long, int, int)
102	0.99	██████	5.32	██████	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
97	0.94	██████	1.91	██████	com.ibm.ws.logging.internal.impl.BaseTraceService.publishTraceLogRecord(com.ibm.ws.loggii
92	0.89	██████	1.21	██████	nra.eclipse.ocni.interpreter.OCNIInterpreter

Sample based profile

Filter methods: [] Apply Clear

Samples	Self (%)	Self	Tree (%)	Tree	Method
1768	45.63	██████	45.78	██████	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
173	4.46	██████	6.3	██████	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
152	3.92	██████	18.68	██████	com.ibm.ws.logging.internal.impl.BaseTraceService.publishTraceLogRecord(com.ibm.ws.loggii
111	2.86	██████	2.86	██████	java.math.Division.monReduction(int[], java.math.BigInteger, int)
96	2.48	██████	2.48	██████	java.math.Multiplication.square(int[], int, int)
56	1.45	██████	2.04	██████	com.ibm.crypto.provider.x.add(com.ibm.crypto.provider.EllipticPoint)
54	1.39	██████	1.45	██████	java.math.Division.long.monReduceSq(long[], long[], long, long, int, int)
54	1.39	██████	1.94	██████	javax.security.auth.Subject.toString(boolean)
53	1.37	██████	1.45	██████	java.math.Division.long.monMulSq(long[], int, long)
51	1.32	██████	1.63	██████	com.ibm.crypto.provider.P256PrimeField.a(int[])
43	1.11	██████	3.59	██████	java.math.Multiplication.multiply(int[], int[], int[], int, int)
39	1.01	██████	5.01	██████	com.ibm.ws.logging.internal.impl.BaseTraceFormatter.formatObj(java.lang.Object)
27	0.7	██████	1.42	██████	com.ibm.ws.logging.internal.impl.BaseTraceFormatter.createFormattedMessage(java.util.LoggingEvent)

Sample based profile

Invocation paths Called methods Timeline Method trace summary

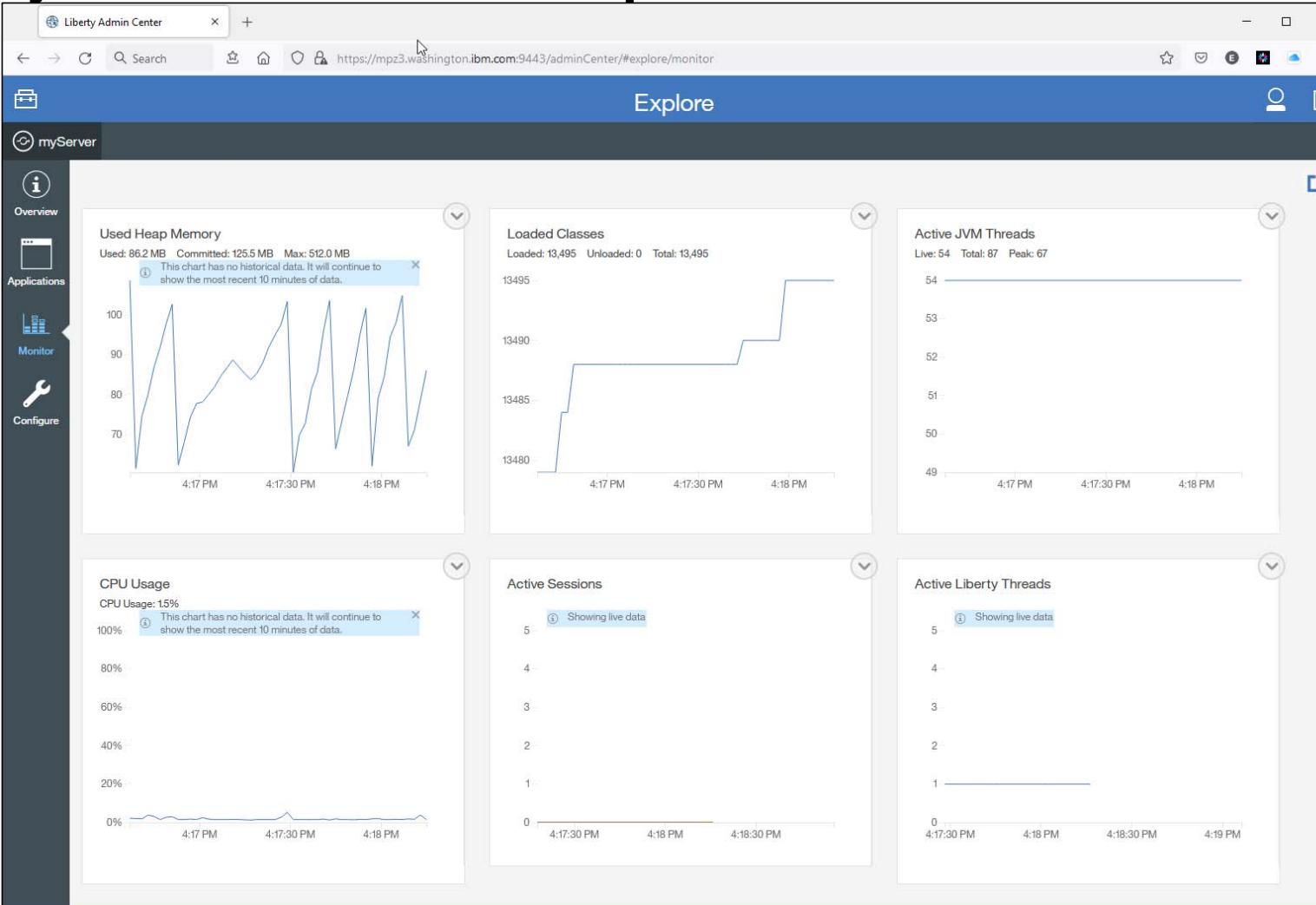
Samples over time

Invocation paths Called methods Timeline Method trace summary

number (#) elapsed time (minutes)

number (#) elapsed time (minutes)

Liberty Admin Center feature provides real time monitoring



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Slide 95

Workload Manager - Definitions

WLM Report Classes

Report Class Selection List Row 1 to 12 of 12

Action Codes: 1=Create, 2=Copy, 3=Modify, 4=Browse, 5=Print, 6=Delete, /=Menu Bar

Action	Name	Description	User	Date
	BAOSTC		JOHNSON	2021/09/04
	WMQFTE		JOHNSON	2011/08/31
	WMQFTER		JOHNSON	2011/08/31
	WMQFTEZ		JOHNSON	2011/08/31
	ZCEEADM		JOHNSON	2021/08/02
	ZCEEAPIR		JOHNSON	2021/08/05
	ZEECICS		JOHNSON	2021/08/05
	ZCEEDB2		JOHNSON	2021/08/05
	ZCEEIMS		JOHNSON	2021/08/05
	ZCEEMQ		JOHNSON	2021/08/05
	ZCEEOTHR		JOHNSON	2021/08/02
	ZCEESTC		JOHNSON	2021/09/02

***** Bottom of data *****

Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23 10/004

WLM Service Classes

Service-Class Xref Notes Options Help

Modify a Service Class Row 1 to 2 of 2

Command ==>

Service Class Name	Description	Workload Name	Base Resource Group	Cpu Critical	I/O Priority Group	Honor Priority
OPS_HIGH	System Tasks Velocity 70	STC_WKL	(name or ?)	NO	(YES or NO)	NORMAL

Specify BASE GOAL information. Action Codes: I=Insert new period, E>Edit period, D=Delete period.

-- Period -- Goal

Action	#	Duration	Imp.	Description
	1	1		Execution velocity of 70

***** Bottom of data *****

Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23 19/004

mitchj@us.ibm.com

WLM "CB" Classification Rules

Subsystem-Type Xref Notes Options Help

Modify Rules for the Subsystem Type Row 1 to 8 of 16

Command ==>

Subsystem Type . : CB Fold qualifier names? N Y or N

Description . . . WLP/zCEE Transactions

Action codes: A=After C=Copy M=Move I=Insert rule
B=Before D=Delete row R=Repeat IS=Insert Sub-rule
More ==>

Action	Type	Name	Start	Service	Report
1	CN	myServer		OPS_HIGH	ZCEEOTHR
2	TC	TCAPIR		OPS_HIGH	BAOSTC
2	TC	TCCICS		OPS_HIGH	ZCEEAPIR
2	TC	TCDB2		OPS_HIGH	ZCEEDB2
2	TC	TCIMS		OPS_HILO	ZCEEIMS
2	TC	TCMQ		OPS_MED	ZCEEMQ
2	TC	TCOTHR		OPS_LOW	ZCEEOTHR

Defaults: OPS_HIGH ZCEEOTHR

Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23 07/021

Subsystem-Type Xref Notes Options Help

Modify Rules for the Subsystem Type Row 9 to 16 of 16

Command ==>

Subsystem Type . : CB Fold qualifier names? N Y or N

Description . . . WLP/zCEE Transactions

Action codes: A=After C=Copy M=Move I=Insert rule
B=Before D=Delete row R=Repeat IS=Insert Sub-rule
More ==>

Action	Type	Name	Start	Service	Report
1	CN	zceex		OPS_HIGH	ZCEEOTHR
2	TC	TCAPIR		OPS_HIGH	ZCEESTC
2	TC	TCCICS		OPS_HIGH	ZCEEADM
2	TC	TCDB2		OPS_HIGH	ZCEEAPIR
2	TC	TCIMS		OPS_HILO	ZCEEDB2
2	TC	TCMQ		OPS_HILO	ZEECICS
2	TC	TCOTHR		OPS_MED	ZCEEIMS
2	TC	TCOTHR		OPS_HILO	ZCEEMQ

Defaults: OPS_HIGH ZCEEOTHR

Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23 07/021



Workload Manager – WLM Classification server XML

The corresponding required sever XML configuration

- Based on HTTP path matching (port and/or method can also be specified)
- The default value for the `wlmClassification` name is the name of the server
- See URL <https://www.ibm.com/docs/en/was-liberty/zos?topic=zos-wlm-classification> for more information

Server Config

wlm.xml

Design Source

```
1<?xml version="1.0" encoding="UTF-8"?>
2<server description="wlm">
3
4<featureManager>
5<feature>zosWlm-1.0</feature>
6</featureManager>
7
8<wlmClassification>
9<httpClassification transactionClass="TCCICS"
10resource="/cscvinc/employee/*" method="GET"/>
11<httpClassification transactionClass="TCDB2"
12resource="/db2/employee/*" method="GET"/>
13<httpClassification transactionClass="TCIMS"
14resource="/phonebook/contacts/*"/>
15<httpClassification transactionClass="TCIMS"
16resource="/phonebook/contacts" METHOD="POST"/>
17<httpClassification transactionClass="TCMQ"
18resource="/mqapi/*" METHOD="POST"/>
19<httpClassification transactionClass="TCMQ"
20resource="/mqapi/*" METHOD="GET"/>
21<httpClassification transactionClass="TCAPIR" resource="/zosConnect/apiRequesters/*"/>
22<httpClassification transactionClass="TCADM" resource="/zosConnect/**/*"/>
23<httpClassification transactionClass="TCOTHR" />
24</wlmClassification>
25
26<osWorkloadManager collectionName="${wlp.server.name}" />
27
28<zosWlmHealth interval="30" increment="15"/>
29
30</server>
31
```

Related to WLM CN name.



Workload Manager – Active HTTP Classification

<https://mpz3.washington.ibm.com:9443/ibm/api/config/httpClassification>

The screenshot shows a web browser window displaying a JSON array of configuration elements for "httpClassification". Each element is defined by its configElementName, uid, host, method, port, resource, and transactionClass. The elements are as follows:

```
[{"configElementName": "httpClassification", "uid": "wlmClassification[default-0]/httpClassification[default-4]", "host": "*", "method": "POST", "port": "*", "resource": "/mqapi/*", "transactionClass": "TCMQ"}, {"configElementName": "httpClassification", "uid": "wlmClassification[default-0]/httpClassification[default-5]", "host": "*", "method": "GET", "port": "*", "resource": "/mqapi/*", "transactionClass": "TCMQ"}, {"configElementName": "httpClassification", "uid": "wlmClassification[default-0]/httpClassification[default-6]", "host": "*", "method": "*", "port": "*", "resource": "/zosConnect/apiRequesters/*", "transactionClass": "TCAPIR"}, {"configElementName": "httpClassification", "uid": "wlmClassification[default-0]/httpClassification[default-7]", "host": "*", "method": "*", "port": "*", "resource": "/zosConnect/**/*", "transactionClass": "TCADM"}, {"configElementName": "httpClassification", "uid": "wlmClassification[default-0]/httpClassification[default-8]", "host": "*", "method": "*", "port": "*", "resource": "*", "transactionClass": "TCOTHR"}]
```

RMF SMF Type 72 Service Class Reports



```
mpz3
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF OUTPUT DISPLAY JOHNSONR JOB12740 DSID 112 LINE CHARS 'CICS' FOUND
COMMAND INPUT ==>
POLICY=WSCPOL REPORT CLAS
-TRANSACTIONS-- TRANS-TIME HHH.MM.SS.FFFFFF TRA
AVG 0.02 ACTUAL 108891 TOT
MPL 0.02 EXECUTION 108856 MOB
ENDED 96 QUEUED 34 CAT
END/S 0.16 R/S AFFIN 0 CAT
#SWAPS 0 INELIGIBLE 0
EXCTD 0 CONVERSION 0
STD DEV 762583
----SERVICE---- SERVICE TIME ---APPL %--- --P
IOC 0 CPU 1.967 CP 0.02 BLK
CPU 1739K SRB 0.000 IIPCP 0.02 ENQ
MSO 0 RCT 0.000 IIP 0.31 CRM
SRB 0 IIT 0.000 AAPCP 0.00 LCK
TOT 1739K HST 0.000 AAP N/A SUP
/SEC 2898 IIP 1.844
ABSRPTN 166K AAP N/A
TRX SERV 166K
MA A
Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23
mpz3
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF OUTPUT DISPLAY JOHNSONR JOB12740 DSID 112 LINE CHARS 'APIR' FOUND
COMMAND INPUT ==> SCROLL ==> PAGE
POLICY=WSCPOL REPORT CLASS=ZCEEAPIR PERIOD=1
-TRANSACTIONS-- TRANS-TIME HHH.MM.SS.FFFFFF TRANS-APPL%---CP-IIPCP/AAPCP-IIP/AAP ---ENCLAVES---
AVG 0.14 ACTUAL 424835 TOTAL 0.12 0.12 0.73 AVG ENC 0.14
MPL 0.14 EXECUTION 424707 MOBILE 0.00 0.00 0.00 REM ENC 0.00
ENDED 200 QUEUED 126 CATEGORYA 0.00 0.00 0.00 MS ENC 0.00
END/S 0.33 R/S AFFIN 0 CATEGORYB 0.00 0.00 0.00
#SWAPS 0 INELIGIBLE 0
EXCTD 0 CONVERSION 0
STD DEV 1.381943
----SERVICE---- SERVICE TIME ---APPL %--- --PROMOTED-- --DASD I/O--- ----STORAGE---- -PAGE-IN RATES-
IOC 0 CPU 5.073 CP 0.12 BLK 0.000 SSCHRT 2.4 AVG 0.00 SINGLE 0.0
CPU 4485K SRB 0.000 IIPCP 0.12 ENQ 0.000 RESP 0.4 TOTAL 0.00 BLOCK 0.0
MSO 0 RCT 0.000 IIP 0.73 CRM 0.000 CONN 0.3 SHARED 0.00 SHARED 0.0
SRB 0 IIT 0.000 AAPCP 0.00 LCK 0.000 DISC 0.0 HSP 0.0
TOT 4485K HST 0.000 AAP N/A SUP 0.000 Q+PEND 0.0
/SEC 7474 IIP 4.363 IOSQ 0.0
ABSRPTN 53K AAP N/A
TRX SERV 53K
MA A
Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23
05/057
```



Liberty SMF 120 Subtype 11

WebSphere Liberty Profile (WLP) can generate various types of SMF 120 records. Support for a SMF 120 record relevant for z/OS Connect was added in WLP V16.0.0.2. This record, a SMF 130 Subtype 11, is generated for each HTTP request received by the Liberty server. For more details and a description of the contents of this record, see URL <https://www.ibm.com/support/pages/liberty-zos-smf-120-11-version-2>

The screenshot shows the 'Server Config' interface with a blue header bar. In the center, it says 'Server Config'. On the left is a small icon of a server. On the right are icons for search, refresh, and close. Below the header, the title 'smf.xml' is displayed, followed by 'Read only' and a 'Close' button. There are two tabs: 'Design' and 'Source'. The 'Source' tab is selected, showing the XML code for the SMF configuration. The code is as follows:

```
1<?xml version="1.0" encoding="UTF-8"?>
2
3<server description="SMF">
4    <featureManager>
5        <feature>monitor-1.0</feature>
6        <feature>zosRequestLogging-1.0</feature>
7    </featureManager>
8
9</server>
10
```

Useful Plug-ins for WAS z/OS SMF 120.9 Browser

<https://www.ibm.com/support/pages/node/6355403>



Liberty SMF 120 Subtype 11 – WP102312 Plugin

LibertyExport.csv

Mitch Johnson M

File Home Insert Page Layout Formulas Data Review View Help ACROBAT

Cut Copy Format Painter

Font Alignment Number Styles

Clipboard

General Conditional Formatting Table Normal Bad Good Neutral Calculation Check Cell

Insert Delete Format Cells

AutoSum Fill Sort & Filter Ideas Sensitivity

Share Comments

AS9 : 166

SystemName JobName StartTime StartTime EndTime EndTime(EndTime) Response TranClass TotalCPU Start TotalCPU ET TotalCPU(TotalGP(ms)) TotalOffload(ms) userid mappedUser requestUF host port uri response targetPort remotePort remoteAddr

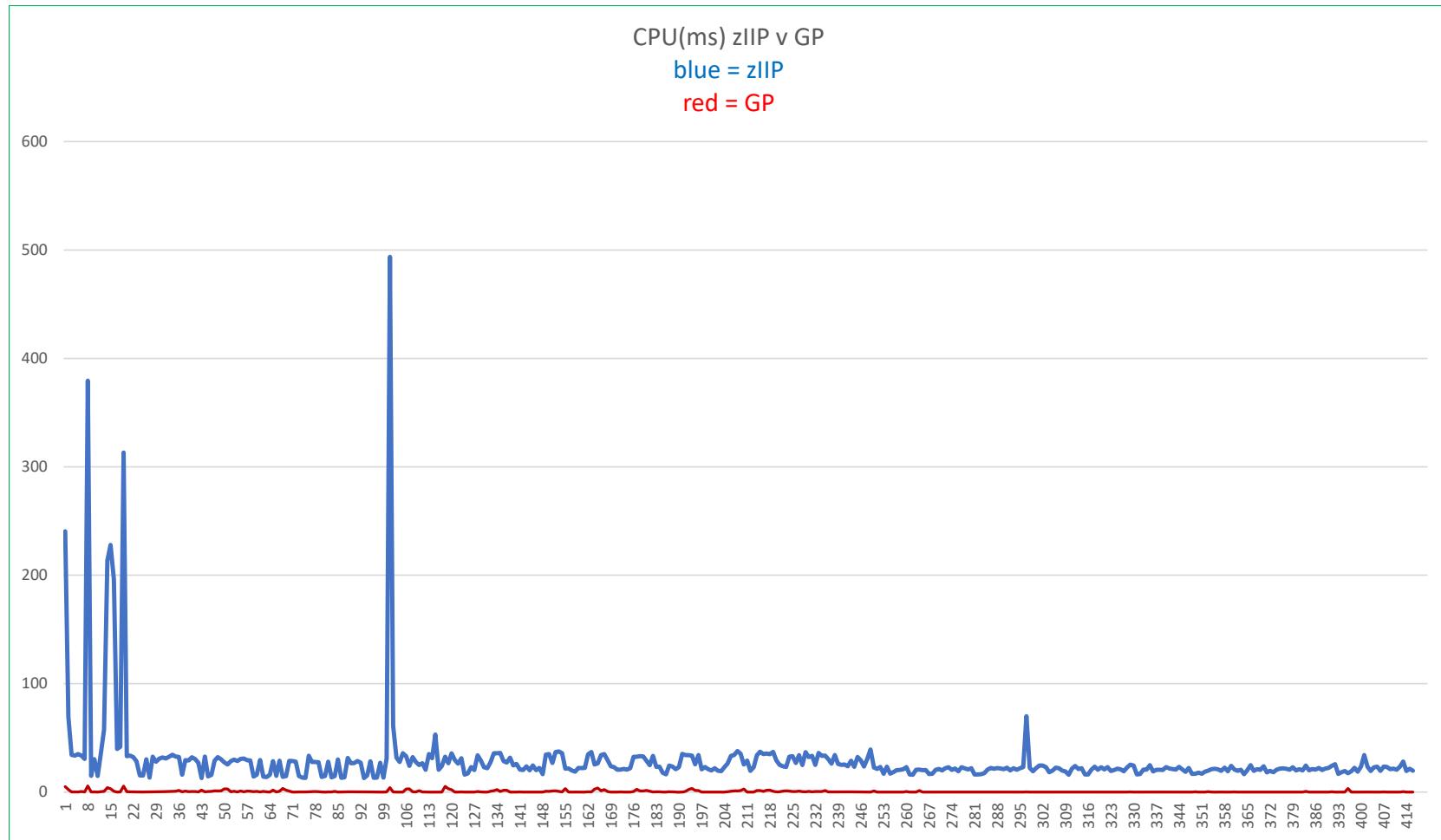
2 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	6080 TCAPIR	3314772936	4.32E+09	245.5195	5.0110927	240.50838 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4283 192.168.17.243
3 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	7030 TCAPIR	178821759	471750165	71.51572	2.334169	69.18156 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4286 192.168.17.243
4 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	374 TCAPIR	4327455460	4.469E+09	34.44008	0.10757129	34.332504 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4301 192.168.17.243
5 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	495 TCAPIR	2762287407	2.9E+09	33.65053	0.057430662	33.5931 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4304 192.168.17.243
6 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	500 TCAPIR	4484655211	6.429E+09	35.15451	0.12540185	35.020004 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4303 192.168.17.243
7 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	262 TCAPIR	4637789017	4.777E+09	34.10283	0.42818993	33.680042 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4305 192.168.17.243
8 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	293 TCAPIR	542458283	668050357	30.66213	0.053870115	30.608257 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4306 192.168.17.243
9 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	10493 TCAPIR	3802597962	5.38E+09	385.0374	5.576213	379.46115 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4285 192.168.17.243
10 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	185 TCAPIR	5384541333	5.446E+09	15.04486	0.15656103	14.888303 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4308 192.168.17.243
11 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	282 TCAPIR	1028119195	1.153E+09	30.38298	0.04661279	30.336363 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4309 192.168.17.243
12 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	163 TCAPIR	901260513	962209631	14.88016	0	14.880165 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4310 192.168.17.243
13 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	5126 TCAPIR	3137255105	3.284E+09	35.92899	0.33009765	35.598892 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4313 192.168.17.243
14 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	5122 TCAPIR	4890213483	5.128E+09	58.01673	0.61064285	57.406091 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4314 192.168.17.243
15 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	24315 TCAPIR	13036032356	1.393E+10	217.4406	4.0119	213.42871 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4282 192.168.17.243
16 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	3438 TCAPIR	1463812131	2.41E+09	290.9845	3.1036336	277.88091 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4284 192.168.17.243
17 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	12587 TCAPIR	1160912461	1.967E+09	196.8579	0.7669092	196.090961 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4315 192.168.17.243
18 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	6599 TCAPIR	5303866625	5.467E+09	39.79177	0.020269532	39.7614941 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4316 192.168.17.243
19 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	6565 TCAPIR	6143860672	6.315E+09	41.86705	0.16208105	41.7049671 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4317 192.168.17.243
20 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	25052 TCAPIR	262790027	3.928E+09	318.7149	5.498493	313.225461 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4281 192.168.17.243
21 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	7709 TCAPIR	4477460136	4.615E+09	33.52233	0.35891944	33.1634061 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4322 192.168.17.243
22 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	7682 TCAPIR	197302107	2.112E+09	33.81701	0.19548193	33.6215251 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4321 192.168.17.243
23 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	14950 TCAPIR	458083508	590213570	32.25832	0.0489917	32.2093241 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4323 192.168.17.243
24 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	14016 TCAPIR	61401222	178390269	28.56178	0.2347461	28.3270324 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4325 192.168.17.243
25 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	14088 TCAPIR	86069826	148846164	15.32625	0.0541626	15.2720911 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4326 192.168.17.243
26 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	14097 TCAPIR	5471350509	5.535E+09	15.43587	0.21740967	15.2184591 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4324 192.168.17.243
27 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	7051 TCAPIR	5358173556	5.482E+09	30.16547	0.001757324	30.1637151 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4328 192.168.17.243
28 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	7029 TCAPIR	2281578411	2.336E+09	13.27289	0	13.2728891 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4327 192.168.17.243
29 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	379 TCAPIR	1054429318	1.188E+09	32.66632	0.067269534	32.5990521 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4329 192.168.17.243
30 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	347 TCAPIR	644045567	759168227	28.10612	0.16462207	27.9414961 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4330 192.168.17.243
31 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	18550 TCAPIR	764059849	891747729	31.1738	0.4028291	30.7709711 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4336 192.168.17.243
32 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	18551 TCAPIR	5678912186	5.811E+09	32.35731	0.39294335	31.9643651 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4332 192.168.17.243
33 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	18557 TCAPIR	260836676	390012335	31.53703	0.6369346	30.9000911 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4331 192.168.17.243
34 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	18568 TCAPIR	252264630	387487083	33.01329	0.4126411	32.6006551 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4333 192.168.17.243
35 MPZ3	MPZPLEX BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	18571 TCAPIR	6167008451	6.311E+09	35.09796	0.69125974	34.4066961 USER1	/zosConn/mpz3.was	9080 /zosConnect/apiRequeste	166 9080	4334 192.168.17.243

Some fields have been hidden

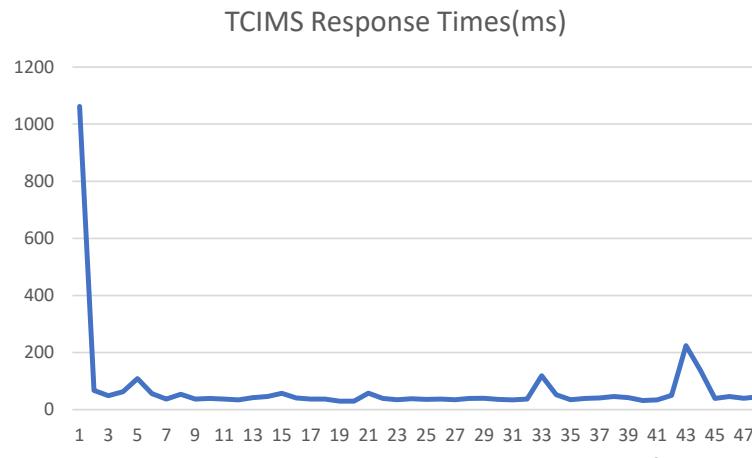
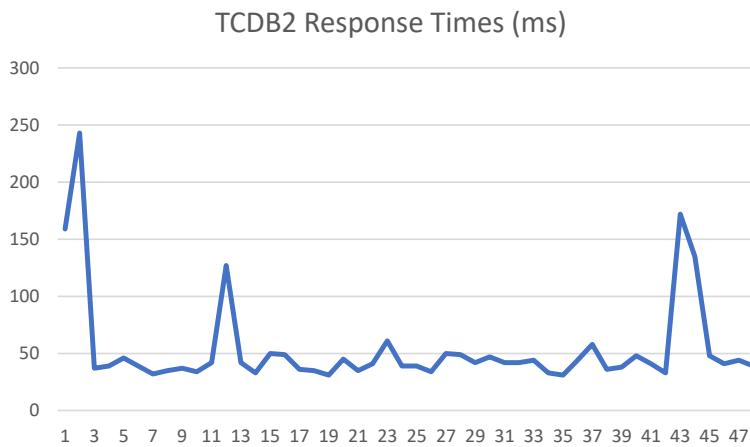
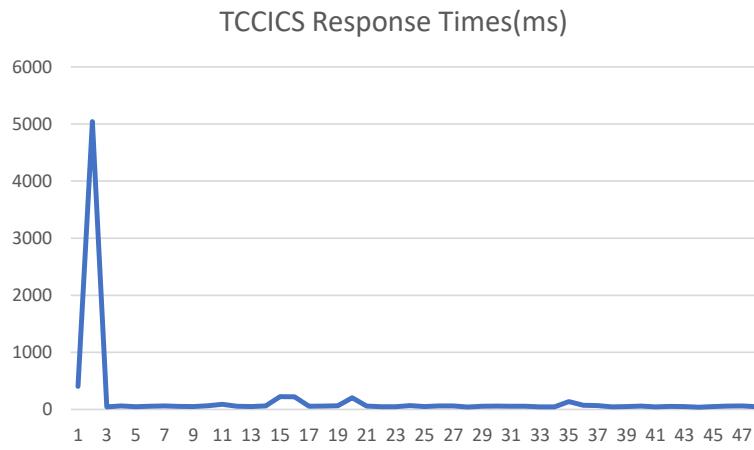
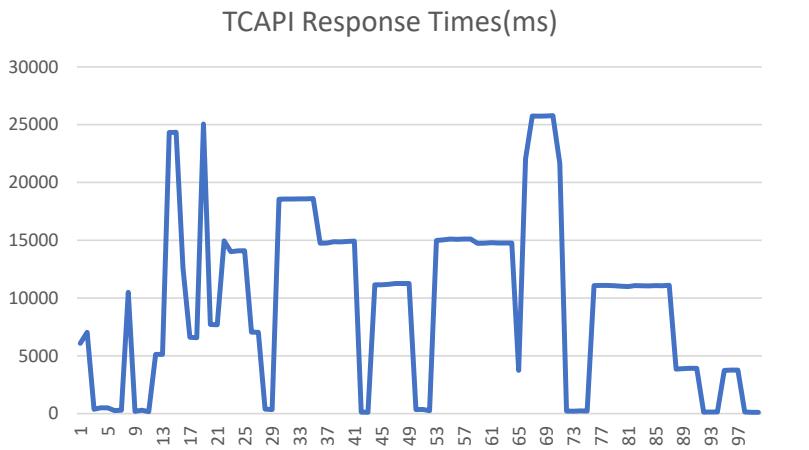
mitchj@us.ibm.com

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Liberty SMF 120 type 11 – GP v zIPP comparison example



Liberty SMF 120 type 11 – Response times comparisons example



z/OS Connect SMF 123 server XML configuration



SMF 123 records have two subtypes, and each subtype can have different versions.

- SMF type 123 subtype 1 records - Version 1 contains some basic information about both API provider and API requester requests. Version 2 supersedes version 1 and contains more detailed information about each API provider request, including information about to which system of record (SOR) the request was sent
- *SMF type 123 subtype 2 records - Version 2 supersedes subtype 1 version 1 and contains more detailed information about each API requester request, including information about to what HTTP endpoint the request was sent.*

Server Config

audit.xml

Read only Close

Design Source

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="SMF reporting">
  <zosconnect_zosConnectManager>
    globalInterceptorsRef="interceptorList_g"/>
  <zosconnect_authorizationInterceptor id="auth">
    safCacheTimeout="600"/>
  <zosconnect_auditInterceptor id="audit">
    apiRequesterSmfVersion="2"
    apiProviderSmfVersion="2"/>
  <zosconnect_zosConnectInterceptors id="interceptorList_g">
    interceptorRef="audit"/>
</server>
```

Server Config

audit.xml

Read only Close

Design Source

Server

z/OS Connect Manager

z/OS Connect Authorization Interceptor auth

z/OS Connect EE SMF Audit Interceptor audit

z/OS Connect Interceptors interceptorList_g

Sequence

0 (default)

The sequence in which this interceptor should be processed with respect to other configured interceptors implementing z/OS Connect's com.ibm.wsspi.zos.connect.Interceptor Service Provider Interface (SPI).

API provider SMF Version

2

The version of SMF 123 subtype 1 records to be written.

auditApiProviderRequestHeaders.name

(no value)

auditApiProviderRequestHeaders.desc

auditApiProviderResponseHeaders.name

(no value)

auditApiProviderResponseHeaders.desc

API requester SMF Version

2

The version of SMF 123 subtype 1 or subtype 2 records to be written.

z/OS Connect SMF 123 subtype 1 version 2 *

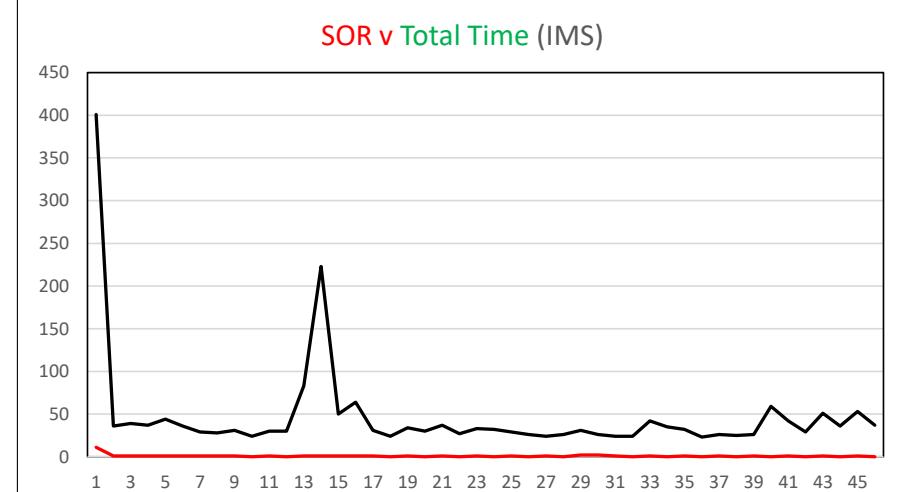
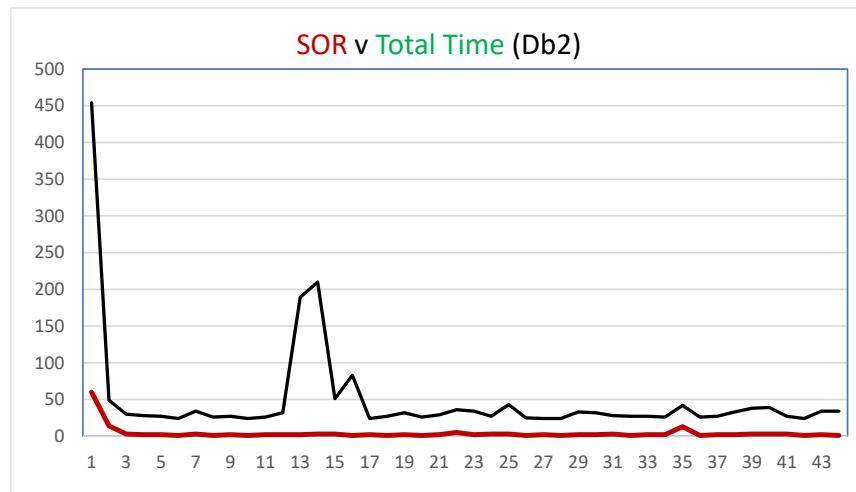
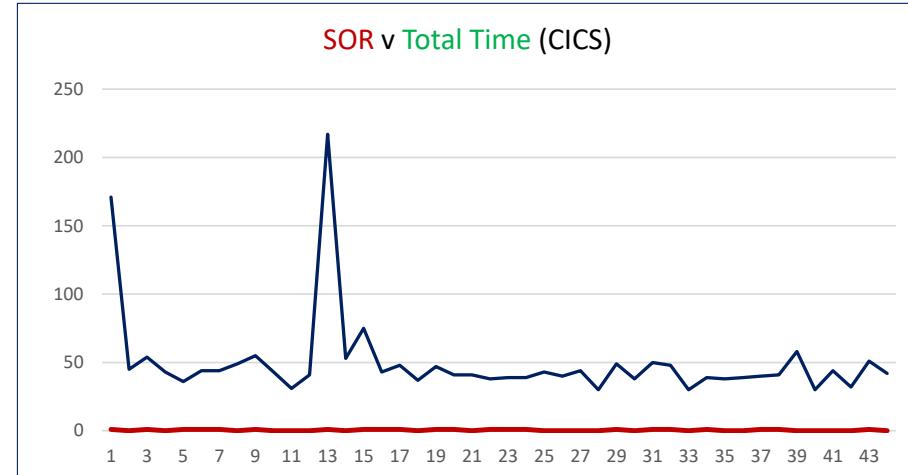
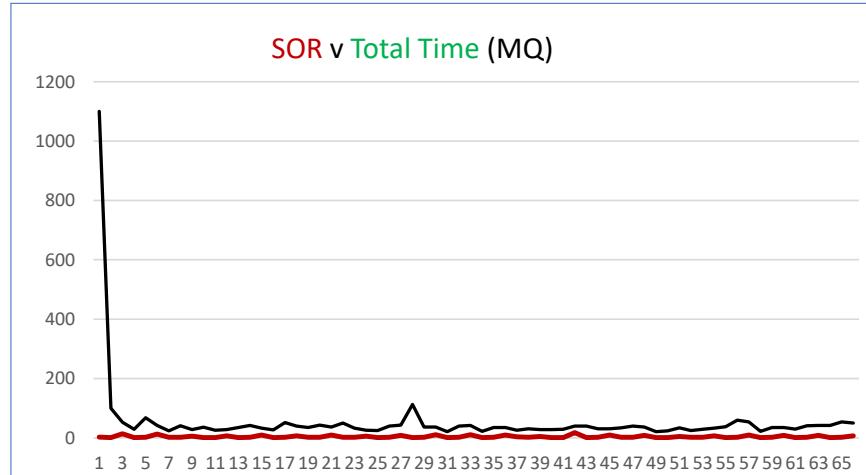


Some fields have been hidden

* Generated by using a modified version of the BAQSMFX sample program.

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z/OS Connect SMF 123 subtype 1 version 2 graph examples



z/OS Connect SMF 123 subtype 2 version 2 *



smfout.csv

2021/08/23 18:16:02.725340 UTC

SMF123_RSMF123_S SMF123_SUBTYPE_VERSION																												
27	123	2	2																									
30	SID	SSI	TRIPLET_C	TRIPLET_C	HTTP_REQ_STAT	REQ_RET	REQ_PAYL	RESP_PA1	USER_NA	USER_NA	ENDPOINT_I	ENDPOINT_I	TIME_ST	TIME_TIME_I	TII	TIME_ENPOI	StubTime	ZCInboun	TokenTim	EndPointTime	ZCOutbou	TotalTime(us)	TotalTime(s)	MVS_JOB				
31	MPZ3	ZCON	2	40	200	200	NO	0	272	USER1	GET	2021/08/2021/0220202:2021/08/2318:	95384	108577	6734453	131423	25653	7103301	7,103301	7,103301	7,103301	7,103301	7,103301	7,103301	7,103301	7,103301		
32	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	114313	7767	318	40583	2105	166276	166276	166276	166276	166276	166276	166276	166276	166276		
33	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	112903	7193	130	51158	1905	175644	175644	175644	175644	175644	175644	175644	175644	175644		
34	MPZ3	ZCON	2	40	200	200	NO	0	271	USER1	GET	2021/08/2021/0220202:2021/08/2318:	103999	102634	8843582	110850	3497	9166156	9,166156	9,166156	9,166156	9,166156	9,166156	9,166156	9,166156	9,166156		
35	MPZ3	ZCON	2	40	200	200	NO	0	271	USER1	GET	2021/08/2021/0220202:2021/08/2318:	82840	4956	128	65685	1900	156097	156097	156097	156097	156097	156097	156097	156097	156097		
36	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	116458	10778	288	58698	1778	189030	189030	189030	189030	189030	189030	189030	189030	189030		
37	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	149159	20483	614	102698	1760	277114	277114	277114	277114	277114	277114	277114	277114	277114		
38	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	153803	23181	285	101022	1775	281176	281176	281176	281176	281176	281176	281176	281176	281176		
39	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	140685	70595	11275606	113382	1920	11603168	11,603168	11,603168	11,603168	11,603168	11,603168	11,603168	11,603168	11,603168	11,603168	
40	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	108088	7624	222	65726	1746	184303	184303	184303	184303	184303	184303	184303	184303	184303		
41	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	119784	9945	282	76225	1773	209052	209052	209052	209052	209052	209052	209052	209052	209052		
42	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	94511	5061	132	44576	2427	147407	147407	147407	147407	147407	147407	147407	147407	147407		
43	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	56951	10497	126	118293	1703	189186	189186	189186	189186	189186	189186	189186	189186	189186		
44	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	55110	7646	210	122479	1616	187974	187974	187974	187974	187974	187974	187974	187974	187974		
45	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	119104	10588	354	109467	1604	242675	242675	242675	242675	242675	242675	242675	242675	242675		
46	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	3051028	17103	9999318	222997	1770	13292831	13,292831	13,292831	13,292831	13,292831	13,292831	13,292831	13,292831	13,292831	13,292831	
47	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	129965	20381	121	212563	1870	366316	366316	366316	366316	366316	366316	366316	366316	366316		
48	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	117036	17792	768	221666	1796	360790	360790	360790	360790	360790	360790	360790	360790	360790		
49	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	121667	23095	468	217285	1673	366393	366393	366393	366393	366393	366393	366393	366393	366393		
50	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	GET	2021/08/2021/0220202:2021/08/2318:	115629	13252	685	146376	1659	279825	279825	279825	279825	279825	279825	279825	279825	279825		
51	REC_TYPE SUBTYPE SUBTYPE VERSION																											
	smfout																											

Some fields have been hidden

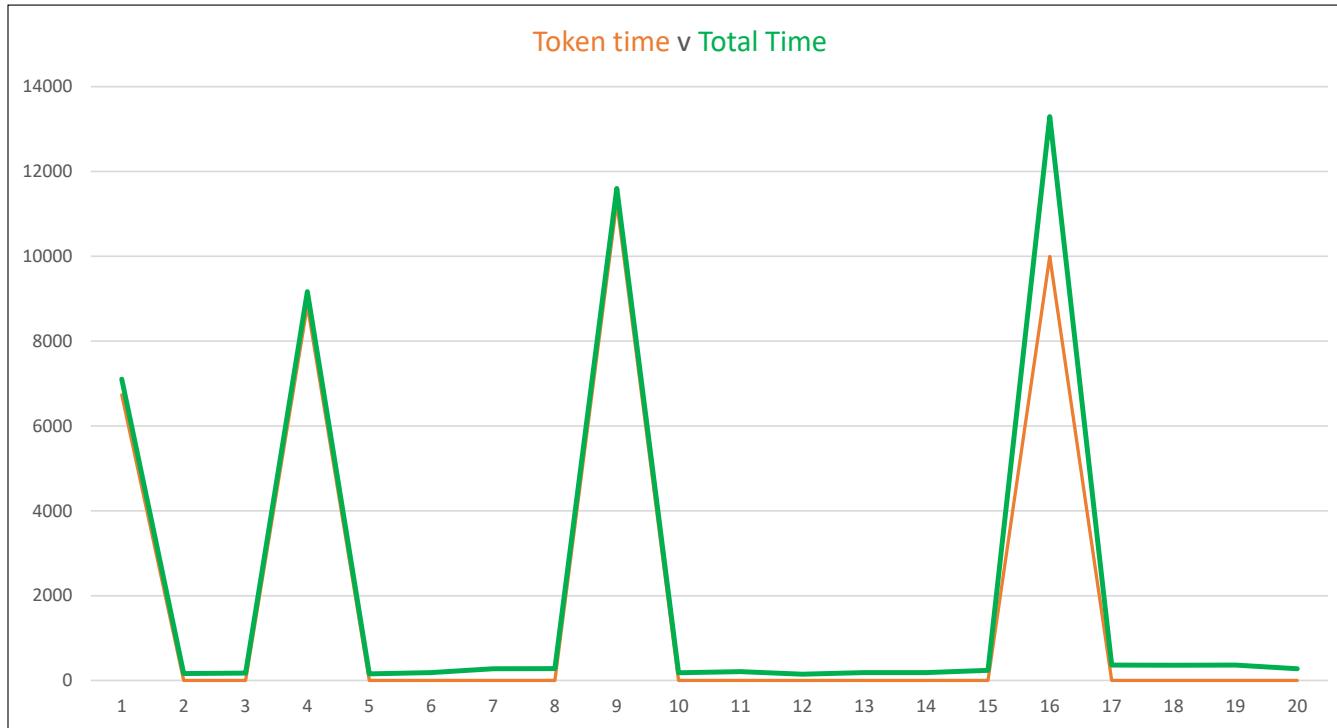
* Generated by using a modified version of the BAQSMFX sample program.

mitchj@us.ibm.com

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z/OS Connect SMF 123 subtype 2 version 2 graph example



BAQSMFP output



```
*****
* SMF123.1 V2 Request Data Section *
*****
SMF123S1_REQ_TYPE = API (1)
SMF123S1_HTTP_RESP_CODE = 500
SMF123S1_REQ_TIMED_OUT = NO
SMF123S1_USER_NAME = FRED
SMF123S1_USER_NAME_MAPPED =
SMF123S1_CLIENT_IP_ADDR = 192.168.0.60
SMF123S1_API_NAME = db2employee
SMF123S1_API_VERSION = 1.0.0
SMF123S1_SERVICE_NAME = selectEmployee
SMF123S1_SERVICE_VERSION = 1.0.0
SMF123S1_REQ_METHOD = GET
SMF123S1_REQ_QUERY_STR =
SMF123S1_REQ_TARGET_URI = /db2/employee/000010
SMF123S1_REQ_PAYLOAD_LEN = 0
SMF123S1_RESP_PAYLOAD_LEN = 0
SMF123S1_TIME_ZC_ENTRY = 0x000DA2FB8 38ED5494 04000000 08880001
UTC_CONV_TIME_ZC_ENTRY = 2021/08/19 15:30:24.905545 UTC
SMF123S1_TIME_ZC_EXIT = 0x000DA2FB8 38F3883F A8000000 08880001
UTC_CONV_TIME_ZC_EXIT = 2021/08/19 15:30:24.930947 UTC
SMF123S1_TIME_SOR_SENT = 0x000DA2FB8 38F232A9 76000000 08A00001
UTC_CONV_TIME_SOR_SENT = 2021/08/19 15:30:24.925482 UTC
SMF123S1_TIME_SOR_RECV = 0x000DA2FB8 38F300A4 AA000000 08880001
UTC_CONV_TIME_SOR_RECV = 2021/08/19 15:30:24.928778 UTC
SMF123S1_SP_NAME = restclient-1.0
SMF123S1_SOR_REFERENCE = Db2Conn
SMF123S1_SOR_IDENTIFIER = Db2:DSN2LOC,wg31.washington.ibm.com:2446
SMF123S1_SOR_RESOURCE = services/zCEEService/selectEmployee
SMF123S1_REQ_ID = 302
SMF123S1_TRACKING_TOKEN = 0x42415131 77734859 41514159 314E6670 31395046
35304455 312B6E7A 51454241
514E6F76 75446A74 564A5145 41413D3D 40404040 40404040 40404040
SMF123S1_REQ_HDR1 =
SMF123S1_REQ_HDR2 =
SMF123S1_REQ_HDR3 =
SMF123S1_REQ_HDR4 =
SMF123S1_RESP_HDR1 =
SMF123S1_RESP_HDR2 =
SMF123S1_RESP_HDR3 =
```

```
*****
* SMF123.2 V2 Request Data Section *
*****
SMF123S2_REQ_APP_TYPE = ZOS (3)
SMF123S2_HTTP_RESP_CODE = 200
SMF123S2_REQ_STATUS_CODE = 200
SMF123S2_REQ_RETRY = NO
SMF123S2_REQ_PAYLOAD_LEN = 0
SMF123S2_RESP_PAYLOAD_LEN = 269
SMF123S2_USER_NAME = USER1
SMF123S2_USER_NAME_MAPPED =
SMF123S2_USER_NAME_ASSERTED = USER1
SMF123S2_API_REQ_NAME = cscvinc_1.0.0
SMF123S2_API_REQ_VERSION = 1.0.0
SMF123S2_ENDPOINT_REFERENCE = cscvincAPI
SMF123S2_ENDPOINT_HOST = https://mpz3.washington.ibm.com
SMF123S2_ENDPOINT_PORT = 9463
SMF123S2_ENDPOINT_FULL_PATH = /cscvinc/employee/111111
SMF123S2_ENDPOINT_METHOD = GET
SMF123S2_ENDPOINT_QUERY_STR =
SMF123S2_TIME_STUB_SENT = 0x000DA2FC1 7D34CE8B 4A000000 084C0001
UTC_CONV_TIME_STUB_SENT = 2021/08/19 16:11:52.420584 UTC
SMF123S2_TIME_ZC_ENTRY = 0x000DA2FC1 7D58AE00 0E000000 08A00001
UTC_CONV_TIME_ZC_ENTRY = 2021/08/19 16:11:52.567534 UTC
SMF123S2_TIME_ZC_EXIT = 0x000DA2FC1 87DCB806 E6000000 08880001
UTC_CONV_TIME_ZC_EXIT = 2021/08/19 16:12:03.594112 UTC
SMF123S2_TIME_TOKEN_GET_START = 0x000DA2FC1 7D59D3A6 E6000000 08A00001
UTC_CONV_TIME_TOKEN_GET_START = 2021/08/19 16:11:52.572218 UTC
SMF123S2_TIME_TOKEN_GET_FINISH = 0x000DA2FC1 7D59DF85 CC000000 088C0001
UTC_CONV_TIME_TOKEN_GET_FINISH = 2021/08/19 16:11:52.572408 UTC
SMF123S2_TIME_ENDPOINT_SENT = 0x000DA2FC1 7D5A0328 04000000 088C0001
UTC_CONV_TIME_ENDPOINT_SENT = 2021/08/19 16:11:52.572978 UTC
SMF123S2_TIME_ENDPOINT RECEIVED = 0x000DA2FC1 87DCB816 58000000 08880001
UTC_CONV_TIME_ENDPOINT RECEIVED = 2021/08/19 16:12:03.593249 UTC
SMF123S2_MVS_JOBNAME = USER1GE2
SMF123S2_MVS_JOBID = JOB09543
SMF123S2_MVS_SYSNAME = MPZ3
SMF123S2_MVS_ASID = 54
SMF123S2_MVS_SID = MPZ3
SMF123S2_REQ_ID = 732
SMF123S2_TRACKING_TOKEN = 0x42415131 77734859 41514159 314E6670 31395046
35304455 312B6E7A 51454241
514E6F76 77583159 7275414F 40404040 40404040 40404040 40404040
SMF123S2_REQ_HDR1 =
SMF123S2_REQ_HDR2 =
SMF123S2_REQ_HDR3 =
```

CICS Performance Analyzer

V5R4M0		CICS Performance Analyzer z/OS Connect Summary					
ZCEE0001 Printed at 13:35:01 8/21/2021		Data from 11:30:24 8/19/2021 to 12:11:24 8/19/2021				Page 1	
Initial CICS PA report							
JOBNAME : BAQSTRT SPNAME : imsmobile-2.0							
Request: 49 Fail: 0 Timed out: 0 Get: 49 Post: 0 Put: 0 Delete: 0							
----- Maximum value Request details -----							
SOR Sent Latency	Avg .0326	Max .3781	Req ID 551	ZC Entry 19/08/2021 12:09:45.036778			
SOR Response	.0016	.0183	551	19/08/2021 12:09:45.036778			
ZC Exit Latency	.0025	.0048	504	19/08/2021 12:09:36.823661			
ZC Response	.0367	.3982	551	19/08/2021 12:09:45.036778			
ZC Time	.0351	.3799	551	19/08/2021 12:09:45.036778			
JOBNAME : BAQSTRT SPNAME : restclient-1.0							
Request: 50 Fail: 50 Timed out: 0 Get: 50 Post: 0 Put: 0 Delete: 0							
----- Maximum value Request details -----							
SOR Sent Latency	Avg .0478	Max .5953	Req ID 488	ZC Entry 19/08/2021 12:09:33.386614			
SOR Response	.0027	.0127	594	19/08/2021 12:09:52.016624			
ZC Exit Latency	.0014	.0029	524	19/08/2021 12:09:40.369997			
ZC Response	.0519	.6004	488	19/08/2021 12:09:33.386614			
ZC Time	.0492	.5972	488	19/08/2021 12:09:33.386614			
JOBNAME : BAQSTRT SPNAME : CICS-1.0							
Request: 49 Fail: 0 Timed out: 0 Get: 49 Post: 0 Put: 0 Delete: 0							
----- Maximum value Request details -----							
SOR Sent Latency	Avg .0300	Max .0589	Req ID 450	ZC Entry 19/08/2021 12:09:26.478282			
SOR Response	.0011	.0049	517	19/08/2021 12:09:39.019456			
ZC Exit Latency	.0077	.0138	450	19/08/2021 12:09:26.478282			
ZC Response	.0387	.0741	450	19/08/2021 12:09:26.478282			
ZC Time	.0376	.0727	450	19/08/2021 12:09:26.478282			

IBM z Omegamon for JVM

The image displays four windows from the IBM z Omegamon for JVM interface:

- WG31 - 3270**: Shows the "z/OS Connect Request Summary". It includes a table with columns: APIName, Service, SoR ID, Reference, Resource. A summary table at the top shows metrics for the last 30 minutes, hours, and date/time range. Below is a table of API requests with columns: API Name, Service, Method, HTTP Status, Request Count, Error Count, Timeout Count, Response Time Average.
- WG31 - 3270**: Shows the "Requests by Service Name". It includes a table with columns: Service Name, Request Count, Error Count, Timeout Count, Response Time Average, OS Connection Average.
- WG31 - 3270**: Shows the "z/OS Connect Request Detail" for a specific request. The details include event time (04/02/19 18:47:54.267), request type (API), API name (cscvinc), request URI (/cscvinc/employee/444444), query string, method (GET), port (9453), HTTP code (200 OK), timeout (No), service name (cscvincService), total request time (0.008006s), z/OS connection time (0.005515s), SoR response time (0.002491s), SoR ID (USIBMWZ.CICS58Z), SoR ref (cscvinc), SoR resource (CSMI,CSCVINC), remote address (192.168.0.141), request length (0), response length (302), correlator (e6e2d3d7d3c5e7400011000010d5ea50), operation (getCscvincService), provider (CICS-1.0), and user ID (Fred).
- CMS on platform WG31(z/OS)**: A terminal window showing the command "tel TCP00109 and port 23" and its output "01/002".

IBM z Omegamon for JVM

WG31 - 3270

File Edit View Communication Actions Window Help

File Edit View Tools Navigate Help 04/02/2019 18:59:29
Auto Update : Off
SMF ID : WG31
Coll ID : KJJ1

Command ==> z/OS Connect Request Detail

```

Event time..... 04/02/19 18:49:14.525
Request Type... API
API name..... filequeue
Request URI.... /filequeue/mq
Query String...
Method..... GET
Port..... 9453
HTTP code.... 200 (OK)
Timeout..... No
Service Name... FileaQueue
Total Req Time. 0.016206s
z/OS Conn Time. 0.016206s
SoR Resp Time. 0.000000s
SoR ID..... NONE
SoR Ref..... NONE
SoR Resource... NONE
Remote Address.. 192.168.0.141
Request Length.. 0
Response Length. 191
Correlator.... e6e2d3d7d3c5e7400011000010d5ea51
Operation.... getFilea
Provider..... IBM MQ for z/OS
User ID..... Fred

```

VERIFY | BACK | HOME Hub WG31:CMS on platform WG31(z/OS) 01/002

Connected to remote server/host wg31a using lu/pool TCP00109 and port 23

Event time..... 04/02/19 18:48:34.790
Request Type... API
API name..... db2employee
Request URI.... /db2/employee/000020
Query String...
Method..... GET
Port..... 9453
HTTP code.... 200 (OK)
Timeout..... No
Service Name... selectEmployee
Total Req Time. 0.022592s
z/OS Conn Time. 0.022592s
SoR Resp Time. 0.000000s
SoR ID..... NONE
SoR Ref..... NONE
SoR Resource... NONE
Remote Address.. 192.168.0.141
Request Length.. 0
Response Length. 326
Correlator.... e6e2d3d7d3c5e7400011000010d5ea50
Operation.... getSelectEmployee
Provider..... restclient-1.0
User ID..... Fred

VERIFY | BACK | HOME Hub WG31:CMS on platform WG31(z/OS) 01/002

Connected to remote server/host wg31a using lu/pool TCP00109 and port 23

WG31 - 3270

File Edit View Communication Actions Window Help

File Edit View Tools Navigate Help 04/02/2019 19:00:52
Auto Update : Off
SMF ID : WG31
Coll ID : KJJ1

Command ==> z/OS Connect Request Detail

```

Event time..... 04/02/19 18:47:54.267
Request Type... API
API name..... cscvinc
Request URI.... /cscvinc/employee/444444
Query String...
Method..... GET
Port..... 9453
HTTP code.... 200 (OK)
Timeout..... No
Service Name... cscvincService
Total Req Time. 0.000006s
z/OS Conn Time. 0.005515s
SoR Resp Time. 0.002491s
SoR ID..... USIBMWZ.CICS532
SoR Ref... cscvinc
SoR Resource... CSM1,CSCVINC
Remote Address.. 192.168.0.141
Request Length.. 0
Response Length. 302
Correlator.... e6e2d3d7d3c5e7400011000010d5ea50
Operation.... getGscvincService
Provider..... CICS-1.0
User ID..... Fred

```

VERIFY | BACK | HOME Hub WG31:CMS on platform WG31(z/OS) 01/002

Connected to remote server/host wg31a using lu/pool TCP00109 and port 23

```

Request Type... API
API name..... phonebook
Request URI.... /phonebook/contacts/LAST1
Query String...
Method..... GET
Port..... 9453
HTTP code.... 200 (OK)
Timeout..... No
Service Name... ivtnoService
Total Req Time. 0.345265s
z/OS Conn Time. 0.163460s
SoR Resp Time. 0.181805s
SoR ID..... IVP1
SoR Ref... IMSCONN
SoR Resource... IVTNO
Remote Address.. 192.168.0.141
Request Length.. 0
Response Length. 158
Correlator.... e6e2d3d7d3c5e7400011000010d5ea55
Operation.... getPhoneBookService1
Provider..... imsmobile-2.0
User ID..... Fred

```

VERIFY | BACK | HOME Hub WG31:CMS on platform WG31(z/OS) 01/002

Connected to remote server/host wg31a using lu/pool TCP00109 and port 23

Miscellaneous Odds and Ends



z/OS Connect administration API

Interface providing meta-data and life-cycle operations for z/OS Connect services, APIs and API requesters.

APIs : Operations for working with APIs

Show/Hide | List Operations | Expand Operations

GET	/apis	Returns a list of all the deployed z/OS Connect APIs
POST	/apis	Deploys a new API into z/OS Connect
DELETE	/apis/{apiName}	Undeploys an API from z/OS Connect
GET	/apis/{apiName}	Returns detailed information about a z/OS Connect API
PUT	/apis/{apiName}	Updates an existing z/OS Connect API

Services : Operations for working with services

Show/Hide | List Operations | Expand Operations

GET	/services	Returns a list of all the deployed z/OS Connect services
POST	/services	Deploys a new service into z/OS Connect
DELETE	/services/{serviceName}	Undeploys a service from z/OS Connect
GET	/services/{serviceName}	Returns detailed information about a z/OS Connect service
PUT	/services/{serviceName}	Updates an existing z/OS Connect service
GET	/services/{serviceName}/schema/{schemaType}	Returns the request or response schema for a z/OS Connect service

API Requesters : Operations that work with API Requesters.

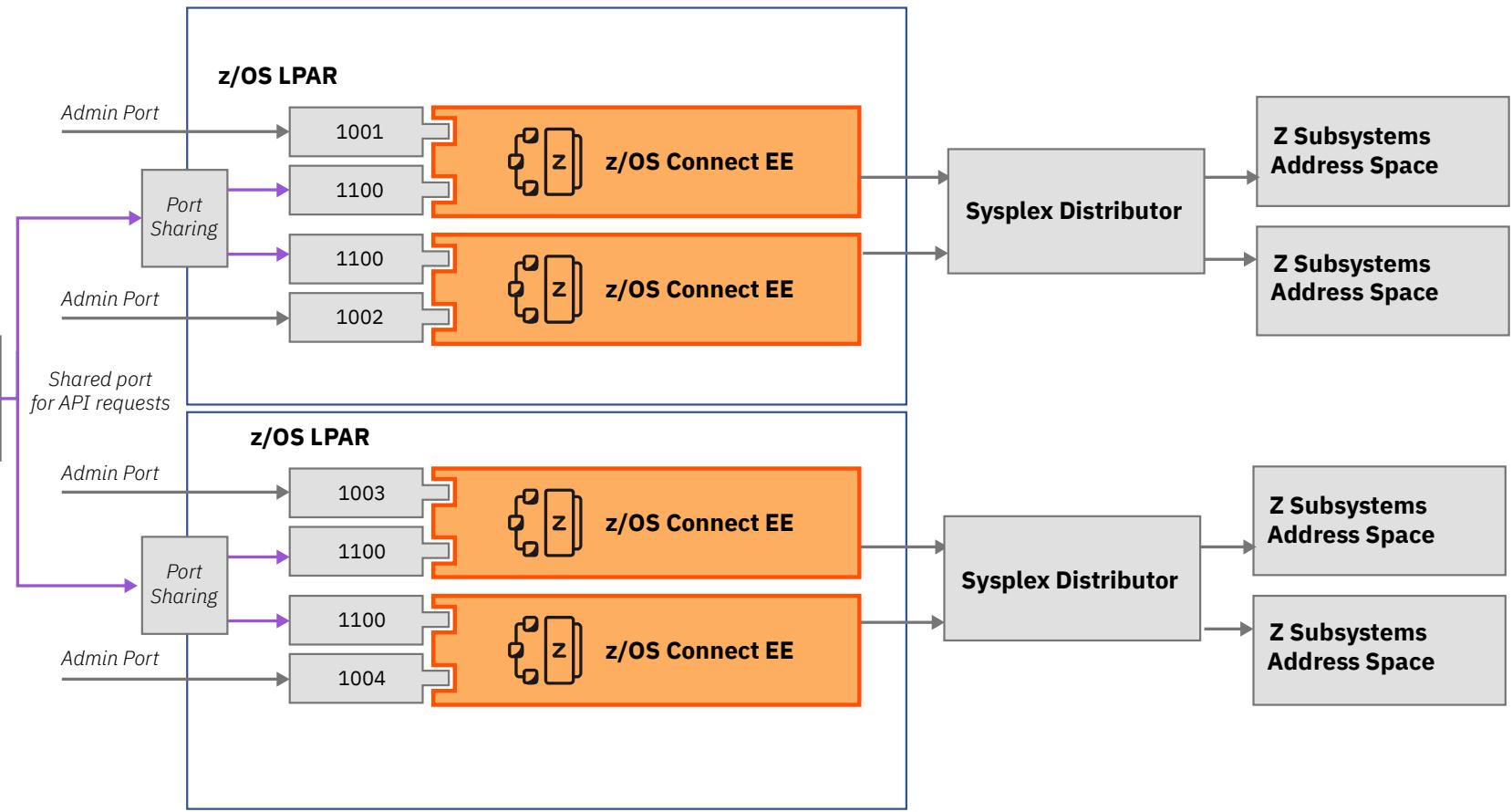
Show/Hide | List Operations | Expand Operations

GET	/apiRequesters	Returns a list of all the deployed z/OS Connect API Requesters
POST	/apiRequesters	Deploys a new API Requester into z/OS Connect and invoke an API Requester call
DELETE	/apiRequesters/{apiRequesterName}	Undeploys an API Requester from z/OS Connect
GET	/apiRequesters/{apiRequesterName}	Returns the detailed information about a z/OS Connect API Requester
PUT	/apiRequesters/{apiRequesterName}	Updates an existing z/OS Connect API Requester



High Availability

Topology



ibm.biz/zosconnect-ha-concepts

ibm.biz/zosconnect-scenarios



Sysplex DVIPAs

SYS1.TCPIP.TCPPARMS (IPNODES)

```
192.168.17.241 MPZ1.DMZ MPZ1 mpz1.washington.ibm.com  
192.168.17.242 MPZ2.DMZ MPZ2 mpz2.washington.ibm.com  
192.168.17.243 MPZ3.DMZ MPZ3 mpz3.washington.ibm.com  
192.168.17.240 dvipa dvipa.washington.ibm.com
```

SYS1.TCPIP.TCPPARMS (PROFMPZ3)

```
IPCONFIG SYSPLEXROUTING
```

```
DYNAMICXCF 172.1.1.243 255.255.255.0 3
```

```
VIPADYNAMIC
```

```
VIPADEFINE 255.255.255.0 192.168.17.240
```

```
VIPADISTRIBUTE DEFINE DISTM ROUNDROBIN|BASEWLM 192.168.17.240
```

```
PORT 23 1416 1491 2446 9443 9453 9463
```

```
DESTIP
```

```
172.1.1.241
```

```
172.1.1.242
```

```
172.1.1.243
```

```
ENDVIPADYNAMIC
```

HOMETEST

```
EZA0619I Running IBM MVS TCP/IP CS V2R4 TCP/IP Configuration Tester  
EZA0602I TCP Host Name is: MPZ3
```

```
EZA0605I Using Name Server to Resolve MPZ3
```

```
EZA0611I The following IP addresses correspond to TCP Host Name: MPZ3
```

```
EZA0612I 192.168.17.243
```

```
EZA0614I The following IP addresses are the HOME IP addresses defined in PROFILE.TCPIP:
```

```
EZA0615I 192.168.17.243
```

```
EZA0615I 172.1.1.243
```

```
EZA0615I 192.168.17.240
```

```
EZA0615I 127.0.0.1
```

```
EZA0618I All IP addresses for MPZ3 are in the HOME list!
```

```
EZA0622I Hometest was successful - all Tests Passed!
```

```
<zosconnect_cicsIpicConnection id="cscvinc"  
host="dvipa.washington.ibm.com"  
port="1491"/>  
<zosconnect_endpointConnection id="mqapi"  
host="http://dvipa.washington.ibm.com"  
port="9453"  
basicAuthRef="myBasicAuth"  
connectionTimeout="10s"  
receiveTimeout="20s" />
```

The screenshot shows a web browser displaying the REST API Documentation for a Liberty server. The URL in the address bar is <https://dvipa.washington.ibm.com:9443/api/explorer/>. The page title is "IBM". Below the title, it says "Liberty REST APIs" and "Discover REST APIs available within Liberty". There is a table listing various REST endpoints under the "cscvinc" service, each with a color-coded button for method (POST, DELETE, GET, PUT) and a link to the operation details. Other services listed include db2employee, filemgr, imsPhoneBook, jwtvpDemoApi, miniloancics, mqapi, and phonebook.

cscvinc	
POST	/cscvinc/employee
DELETE	/cscvinc/employee/{employee}
GET	/cscvinc/employee/{employee}
PUT	/cscvinc/employee/{employee}
db2employee	
filemgr	
imsPhoneBook	
jwtvpDemoApi	
miniloancics	
mqapi	
phonebook	

Displaying zCEE messages on the console and/or STDERR spool



server.xml

```
<zosLogging wtoMessage=
  "BAQR0657E,BAQR0658E,BAQR0660E,BAQR0686E,BAQR0687E"
  hardCopyMessage=
  "BAQR0657E,BAQR0658E,BAQR0660E,BAQR0686E,BAQR0687E"/>
```

MVS Console

```
18.12.02 STC00137 +BAQR0686E: Program CSCVINC is not available in the CICS region with
  811           connection ID cscvinc; service cscvincService failed.
18.12.02 STC00137 +BAQR0686E: Program CSCVINC is not available in the CICS region with
  812           connection ID cscvinc; service cscvincService failed.
19.07.12 STC00137 +BAQR0657E: Transaction abend MIJO occurred in CICS while using
  745           connection cscvinc and service cscvincService.
```

STDERR

```
ÝERROR   `` BAQR0686E: Program CSCVINC is not available in the CICS region with connection cscvinc and service cscvincService.
ÝERROR   `` BAQR0686E: Program CSCVINC is not available in the CICS region with connection cscvinc and service cscvincService.
ÝERROR   `` BAQR0657E: Transaction abend MIJO occurred in CICS while using CICS connection cscvinc and service cscvincService.
```

Provide remote access to configuration/log information



This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
<server description="new server">
<include location="${server.config.dir}/includes/safSecurity.xml"/>
<include location="${server.config.dir}/includes/ipicSSLIDProp.xml"/>
<include location="${server.config.dir}/includes/keyringOutbound.xml"/>
<include location="${server.config.dir}/includes/groupAccess.xml"/>
<include location="${server.config.dir}/includes/shared.xml"/>
<include location="${server.config.dir}/includes/oauth.xml"/>
<include location="${server.config.dir}/includes/adminCenter.xml"/>
<include location="${server.config.dir}/includes/sslConfig.xml"/>
<include location="${server.config.dir}/includes/sslKeyStore.xml"/>
<!-- Enable features -->
<featureManager>
<feature>zosconnect:zosConnect</feature>
<feature>zosconnect:zosConnect</feature>
</featureManager>
<!--
   To access this server from
-->
<httpEndpoint id="defaultHttpEndpoint">
<!--
   add cors to allow cross origin
-->
```

product = WAS FOR Z/OS 20.0.0.6, z/OS Connect 03.00.41 (Wlp-1.0.41.c1200620200528-0414)
wlp.install.dir = /shared/IBM/zosconnect/wlp20/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/J8_0_44
java.version = 1.8.0_261
java.vendor = IBM Corporation SE Runtime Environment (8.0.6.15 - pmz6480sr6fp15-20200724_01(SR6)
process = 16778879@qsg1

[2/19/21 15:48:15:901 GMT] 00000000 com.ibm.ws.kernel.
[2/19/21 15:48:19:069 GMT] 000000017 com.ibm.ws.config.
[var/zosconnect/servers/myServer/includes/safSecurity.
[2/19/21 15:48:19:899 GMT] 000000017 com.ibm.ws.config.

```
<webApplication id="serverConfig-location" name="serverConfig"
  location="${server.config.dir}">
  <web-ext context-root="/server/config"
    enable-file-serving="true" enable-directory-browsing="true">
    <file-serving-attribute name="extendedDocumentRoot"
      value="${server.config.dir}" />
  </web-ext>
</webApplication>
```



Provide remote access to z/OS Connect archives files

The screenshot displays two browser windows and a code snippet. The left browser window shows the index of the `/resources/zosConnect` directory, listing four directories: `apis`, `services`, `apiRequesters`, and `rules`. The right browser window shows the index of the `/resources/zosConnect/services` directory, listing three SAR files: `cscvincDeleteService.sar`, `cscvincInsertService.sar`, and `cscvincSelectService.sar`. A modal dialog box is open over the right window, titled "Opening cscvincSelectService.sar", asking "What should Firefox do with this file?", with the "Open with Applications\WINZIP32.EXE (default)" option selected. The code snippet at the bottom left is an Apache configuration snippet for a web application named "resources-location". It includes context-root mapping, file serving attributes, and extended document root settings.

Name	Last Modified	Size	Description
apis	Fri Feb 19 13:46:13 GMT 2021	-	Directory
services	Sat Feb 20 20:54:41 GMT 2021	-	Directory
apiRequesters	Wed Feb 07 17:59:04 GMT 2018	-	Directory
rules	Tue Jan 26 20:34:05 GMT 2021	-	Directory

Name	Last Modified	Size	Description
cscvincDeleteService.sar	Thu Feb 18 18:02:19 GMT 2021	4362	File
cscvincInsertService.sar	Thu Feb 18 18:02:19 GMT 2021	4491	File
cscvincSelectService.sar	Thu Feb 18 18:02:19 GMT 2021	4590	File

```
<webApplication id="resources-location" name="resources" location="${server.config.dir}/resources/zosconnect">
<web-ext context-root="/resources/zosConnect" enable-file-serving="true" enable-directory-browsing="true">
<file-serving-attribute name="extendedDocumentRoot" value="${server.config.dir}/resources/zosconnect"/>
</web-ext>
</webApplication>
```

Today we covered

- **A Review OMVS, Liberty and RACF security/configuration**
- **Connecting z/OS Connect servers to other z/OS subsystems**
- **Useful Liberty features and MVS commands**
- **Where do look when things go wrong**
- **Managing and Monitoring Liberty and z/OS Connect**
- **Miscellaneous Odds and Ends**
- **Additional Material - sample administrative JCL**

z/OS Connect Wildfire Github Site

<https://ibm.biz/Bdf8BZ>

A screenshot of two browser windows side-by-side. The left window shows the main repository page for 'ibm-wsc/zCONNEE-Wildfire-Workshop'. The right window shows the contents of the 'xml' directory within the repository.

The left browser window displays the repository's main page. The right browser window displays the contents of the 'xml' directory.

Left Browser Window (Repository Page):

- Code tab selected.
- Issues: 1
- Pull requests: 0
- Actions: 0
- Projects: 0
- Wiki: 0
- Security: 0
- Insights: 0
- Settings: 0

Right Browser Window (xml Directory):

- Code tab selected.
- Issues: 1
- Pull requests: 0
- Actions: 0
- Projects: 0
- Wiki: 0
- Security: 0
- Insights: 0
- Settings: 0

xml Directory Contents:

File	Action	Last Modified
adminCenter.xml	Add files via upload	14 months ago
apiRequester.xml	Add files via upload	14 months ago
apiRequesterHTTPS.xml	Add files via upload	14 months ago
apiRequesterTrace.xml	Add files via upload	14 months ago
atssaf.xml	Add files via upload	4 months ago
basicSecurity.xml	Add files via upload	14 months ago
cicsTrace.xml	Add files via upload	14 months ago
cors.xml	Add files via upload	11 months ago
db2.xml	Add files via upload	14 months ago
db2TLS.xml	Add files via upload	14 months ago

mitchj@us.ibm.com

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Thank you for listening and your questions.

Additional Material

Sample Administrative JCL

Sample JCL - Check Java installation by display Java version information

```
//JOHNSONS JOB (ACCOUNT),JOHNSON,NOTIFY=JOHNSON,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1),USER=LIBSERV  
//*****  
//* SET SYMBOLS  
//*****  
//EXPORT EXPORT SYMLIST=(*)  
// SET JAVAHOME='/usr/lpp/java/J8.0_64'  
//*****  
/* STEP JAVA - INVOKE THE java -version COMMAND  
//*****  
/JAVA EXEC PGM=IKJEFT01,REGION=0M  
/SYSTSPRT DD SYSOUT=*  
/SYSERR DD SYSOUT=*  
/STDOUT DD SYSOUT=*  
/STDENV DD DUMMY  
/SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH +  
export JAVA_HOME=&JAVAHOME; +  
$JAVA_HOME/bin/java -version
```

Sample JCL - Executing the z/OS Connect zconsetup script using JCL

```
//JOHNONS JOB (ACCOUNT), JOHNSON, NOTIFY=JOHNSON, REGION=0M,  
// CLASS=A, MSGCLASS=H, MSGLEVEL=(1,1)  
//*****  
/* Step IEBCOPY - Set common environment variables  
//*****  
//IEBGENER EXEC PGM=IEBGENER  
//SYSPRINT DD SYSOUT=*  
//SYSUT1 DD *  
JAVA_HOME=/usr/lpp/java/J8.0_64  
ZCEEPATH=/usr/lpp/IBM/zosconnect/v3r0  
//SYSUT2 DD DSN=&&STDENV,DISP=(,PASS),  
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=80),SPACE=(TRK,(1,1))  
//SYSIN DD DUMMY  
//*****  
/* Step ZCSETUP - Invoke the zconsetup script  
//*****  
//ZCSETUP EXEC PGM=IKJEFT01,REGION=0M  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//STDENV DD DSN=&&STDENV,DISP=(OLD,DELETE)  
//SYSTSPRT DD SYSOUT=*  
//SYSTSIN DD *  
BPXBATCH SH $ZCEEPATH/bin/zconsetup install
```

Sample JCL - Executing the z/OS Connect Build Toolkit on z/OS

```
//JOHNSONS JOB (ACCOUNT),JOHNSON,NOTIFY=&SYSUID,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)  
//*****  
///* SET SYMBOLS  
//*****  
//EXPORT EXPORT SYMLIST=(*)  
// SET WORKDIR='u/johnson/zconbt'  
// SET ZCONDIR='/usr/lpp/IBM/zosconnect/v3r0/zconbt/bin'  
//ZCONBT EXEC PGM=IKJEFT01,REGION=0M,MEMLIMIT=4G  
//SYSTSPPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH +  
  export WORKDIR=&WORKDIR; +  
  export ZCONDIR=&ZCONDIR; +  
  cd $WORKDIR; +  
  $ZCONDIR/zconbt.zos -p cscvinc.properties -f=cscvinc.ara; +  
  cp -v $WORKDIR/syslib/* "///JOHNSON.ZCONBT.COPYLIB"
```

cscvinc.properties

```
apiDescriptionFile=./cscvinc.json  
dataStructuresLocation=./syslib  
apiInfoFileLocation=./syslib  
logFileDirectory=./logs  
language=COBOL  
connectionRef=cscvincAPI  
requesterPrefix=csc
```

This assumes the zconbt.zip files was expanded into directory /usr/lpp/IBM/zosconnect/v3r0/zconbt using command *jar -tf zconbt.zip* and that the property file and Swagger JSON document are encoded in ASCII in directory /u/johnson/zconbt.

Sample JCL - Executing multiple OMVS commands in one step

```
//*****  
//* SET SYMBOLS  
//*****  
//EXPORT EXPORT SYMLIST=(*)  
// SET CURL= '/usr/lpp/rocket/curl'  
//*****  
//* CURL Procedure  
//*****  
//CURL PROC  
//CURL EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
// PEND  
//*****  
//* STEP CURL - use cURL to deploy API cscvinc  
//*****  
//DEPLOY EXEC CURL  
BPXBATCH SH export CURL=&CURL; +  
$CURL/bin/curl -X PUT -s +  
--cacert /u/johnson/CERTAUTH.PEM --user FRED:FRED +  
https://wg31.washington.ibm.com:9445/zosConnect/apis/cscvinc?status=sto+  
pped > null; +  
$CURL/bin/curl -X DELETE -s +  
--cacert /u/johnson/CERTAUTH.PEM --user FRED:FRED +  
https://wg31.washington.ibm.com:9445/zosConnect/apis/cscvinc > null; +  
$CURL/bin/curl -X POST -s +  
--cacert /u/johnson/CERTAUTH.PEM --user FRED:FRED +  
--data-binary @/u/johnson/cscvinc.aar +  
--header "Content-Type: application/zip" +  
https://wg31.washington.ibm.com:9445/zosConnect/apis  
//*****  
//* STEP CURL - use cURL to invoke the API cscvinc  
//*****  
//INVOKE EXEC CURL  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH export CURL=&CURL; $CURL/bin/curl -X GET -s +  
--cacert /u/johnson/CERTAUTH.PEM --user FRED:FRED +  
https://wg31.washington.ibm.com:9445/cscvinc/employee/000100
```

Always be aware of the beginning and trailing spaces.

[https://www.rocketsoftware.com/
platforms/ibm-z/curl-for-zos](https://www.rocketsoftware.com/platforms/ibm-z/curl-for-zos)

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Sample JCL - Executing the Liberty *productInfo* command

```
//*****  
//** SET SYMBOLS  
//*****  
//EXPORT EXPORT SYMLIST=(*)  
// SET WLPDIR='/usr/lpp/IBM/zosconnect/v3r0/wlp'  
//PRODINFO EXEC PGM=IKJEFT01,REGION=0M,MEMLIMIT=4G  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH +  
$WLPDIR/bin/productInfo version; +  
$WLPDIR/bin/productInfo featureInfo | grep cics; +  
$WLPDIR/bin/productInfo featureInfo | grep mq; +  
$WLPDIR/bin/productInfo featureInfo | grep ims; +  
$WLPDIR/bin/productInfo validate | grep 'Product validation'
```

```
Product name: z/OS Connect  
Product version: 03.00.48  
Product edition: z/OS Connect Enterprise Edition
```

```
cicsService-1.0 "1.0.0"  
wmqJmsClient-1.1 "1.0.0"  
wmqJmsClient-2.0 "1.0.0"  
Product Extension: mqzosconnect  
mqService-1.0 "1.0.0"  
Product Extension: imsmobile  
imsmobile-2.0 "2.0.0.202108160933"  
Product validation completed successfully.
```

```
productInfo featureInfo  
productInfo version  
productInfo validate
```

Sample JCL - Copy WOLA executables from OMVS to a PDSE

```
//JOHNSONS JOB (ACCOUNT),JOHNSON,NOTIFY=JOHNSON,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)  
//*****  
//** SET SYMBOLS  
//*****  
//EXPORT EXPORT SYMLIST=(*)  
// SET DSNAME='USER1.WOLA2106.LOADLIB'  
// SET ZCEEPATH='/usr/lpp/IBM/zosconnect/v3r0'  
// SET JAVAHOME='/usr/lpp/java/J8.0_64'  
//*****  
//** Step ALLOC - Allocate a PDSE load library  
//*****  
//ALLOC EXEC PGM=IDCAMS  
//SYSPRINT DD SYSOUT=*  
//SYSIN DD *,SYMBOLS=EXECSYS  
DELETE '&DSNAME'  
SET MAXCC=0  
ALLOC DSNAME('&DSNAME') -  
    NEW CATALOG SPACE(2,1) DSORG(PO) CYLINDERS -  
    RECFM(U) DSNTYPE(LIBRARY)  
//*****  
//** Step WOLACOPY - copy the WOLA executables to the PDSE  
//*****  
//WOLACOPY EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH +  
  export JAVA_HOME=&JAVAHOME; +  
  export DSNAME=&DSNAME; +  
  cp -Xv &ZCEEPATH/wlp/clients/zos/* "//$DSNAME"
```

Sample JCL - BBOSMFV (Extract Liberty SMF 120 Subtype 11 records)

```
//JOHNSONS JOB (ACCOUNT),JOHNSON,NOTIFY=JOHNSON,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)  
//EXPORT EXPORT SYMLIST=(*)  
// SET REPORT='LibertyExport'  
//JAVA EXEC PROC=JVMPRC86,  
// JAVACLS='com.ibm.ws390.sm.smfview.JclSmf'  
//STDENV DD DISP=SHR,DSN=JOHNSON.JCLLIB.CNTL(STDENV)  
//SMFDATA DD DISP=SHR,DSN=MPZ3.DUMPSMF  
//SMFENV DD *,SYMBOLS=EXECSYS  
# Specify the plugin to use  
plugin=&REPORT  
# Specify where the output goes  
output=/u/johnson/&REPORT..csv  
# Uncomment (and change the value as appropriate) to filter  
#matchServer=BAQSTRT
```

```
JOHNSON.JCLLIB.CNTL (STDENV)  
. /etc/profile  
export JAVA_HOME=/usr/lpp/java/J8.0_64  
export PATH=/bin:"${JAVA_HOME}"/bin  
  
LIBPATH=/lib:/usr/lib:"${JAVA_HOME}"/bin  
LIBPATH="$LIBPATH":${JAVA_HOME}/lib/s390x  
LIBPATH="$LIBPATH":${JAVA_HOME}/lib/s390x/j9vm  
LIBPATH="$LIBPATH":${JAVA_HOME}/bin/classic  
export LIBPATH="$LIBPATH":  
  
# Customize your CLASSPATH here  
APP_HOME=${JAVA_HOME}  
CLASSPATH=$APP_HOME:${JAVA_HOME}/lib:${JAVA_HOME}/lib/ext  
CLASSPATH=/u/johnson/lib/bbosmfv.jar:$CLASSPATH  
CLASSPATH=/u/johnson/lib/WP102312_Plugins.jar:$CLASSPATH  
  
# Add Application required jars to end of CLASSPATH  
for i in "${APP_HOME}/*.jar; do  
    CLASSPATH="$CLASSPATH":$i"  
done  
export CLASSPATH="$CLASSPATH":  
  
# Configure JVM options  
IJO="-Xms16m -Xmx128m"  
export IBM_JAVA_OPTIONS="$IJO "
```

Sample JCL – Using ADRDSSU to dump/restore MVS data sets



ZCEEDUMP

```
//EXPORT EXEC PGM=IDCAMS  
// SET ZCEELVL=349  
//DELETE EXEC PGM=ADRDSSU,REGION=2048K  
//SYSPRINT DD SYSOUT=*  
//SYSIN DD *,SYMBOLS=EXECSYS  
    DELETE IBM.ZCEE30.BKUP&ZCEELVL.  
    SET MAXCC=0  
//DUMP EXEC PGM=ADRDSSU,REGION=2048K  
//SYSPRINT DD SYSOUT=*  
//DUMPDD DD DSN=IBM.ZCEE30.BKUP&ZCEELVL.,  
//          DISP=(NEW,CATLG),  
//          UNIT=SYSDA,SPACE=(CYL,(3000,2000,0),RLSE)  
//SYSIN DD *,SYMBOLS=EXECSYS  
    DUMP DATASET(INCLUDE( -  
        ZCEE30.SBAQ* -  
        ZCEE30.WOLA*.* -  
        OMVS.ZCEE*.* -  
    )) OPTIMIZE(4) OUTDDNAME(DUMPDD) TOLERATE(ENQF)
```

ZCEERSTR

```
//RESTORE EXEC PGM=ADRDSSU,REGION=2048K  
//SYSPRINT DD SYSOUT=*  
//DUMPDD DD DISP=SHR,DSN=JOHNSON.ZCEE30.BKUP349  
//SYSIN DD *  
    RESTORE DATASET(INCLUDE(**)) -  
    INDDNAME(DUMPDD) OUTDYNAM(WAS004) -  
    NULLSTORCLAS -  
    REPLACE CATALOG TOLERATE(ENQF)
```



Sample JCL – Define and format a ZFS data set using IOEAGFMT

```
ZFS
//DEFINE EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//AMSDUMP DD SYSOUT=*
//SYSIN DD *
      SET MAXCC=0
      DEFINE CLUSTER (NAME(OMVS.ZCEE.GROUP1.ZFS) -
                      LINEAR CYLINDERS(100 100) SHAREOPTIONS(3))
//CREATE EXEC PGM=IOEAGFMT,REGION=0M,
// PARM=(-aggregate OMVS.ZCEE.GROUP1.ZFS -compat')
//SYSPRINT DD SYSOUT=*
//STDOUT DD SYSOUT=*
//STDERR DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//CEEDUMP DD SYSOUT=*
```

Sample JCL – Generate WLM Workload Activity Reports

```
//JOHNSONS JOB (ACCOUNT),NOTIFY=&SYSUID,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)  
//DELETE EXEC PGM=IDCAMS  
//SYSPRINT DD SYSOUT=*  
//SYSIN DD *  
    DELETE JOHNSON.DUMPSSMF.SORT  
//RMFSORT EXEC PGM=SORT,REGION=0M  
//SORTIN DD DISP=SHR,DSN=MPZ3.DUMPSSMF  
//SORTOUT DD DISP=(,CATLG),DSN=JOHNSON.DUMPSSMF.SORT,  
//           SPACE=(CYL,(100,50),RLSE),UNIT=SYSDA  
//SORTWK01 DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,(100))  
//SORTWK02 DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,(100))  
//SORTWK03 DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,(100))  
//SORTWK04 DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,(100))  
//SORTWK05 DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,(100))  
//SORTWK06 DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,(100))  
//SORTWK07 DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,(100))  
//SYSPRINT DD SYSOUT=(,)  
//SYSOUT DD SYSOUT=(,)  
//SYSIN DD *  
    SORT FIELDS=(11,4,CH,A,7,4,CH,A),EQUALS  
    MODS E15=(ERBPPE15,36000,,N),E35=(ERBPPE35,3000,,N)  
//RMFPP EXEC PGM=ERBRMFPP,REGION=0M  
//SYSUDUMP DD SYSOUT=*  
//STEPLIB DD DSN=SYS1.COMBINED.LINKLIB,DISP=SHR  
//MFPIINPUT DD DISP=SHR,DSN=JOHNSON.DUMPSSMF.SORT  
//MFPMMSGDS DD SYSOUT=*  
//SYSIN DD *  
    SYSOUT(O)  
    SYSRPTS(WLMGL(RCPER)) /*WORKLOAD ACTIVITY REPORT */
```

Sample JCL - Restarting the Java Health Center collection

SDSF PROCESS DISPLAY MPZ3 ALL		LINE 1-5 (5) SCROLL ===> CSR									
NP	JOBNAME	tatus	Owner	State	CPU-Time	PID	PPID	ASID	ASIDX	LatchWaitPID	Command
	BAQSTRT	AITING FOR CHILD	LIBSERV	1W	40.01	69050	83955129	42	002A		/bin/sh /usr/l
	BAQSTRT	THER KERNEL WAIT	LIBSERV	HK	40.01	16846267	69050	42	002A		/usr/lpp/java/
	BAQZANGL	WAPPED, RUNNING	LIBANGE	1RI	0.01	50399398	83953829	77	004D		/usr/lpp/IBM/z
	BAQZANGL	WAPPED, FILE SYS KERNEL WAIT	LIBANGE	1FI	0.01	83953829		1	77	004D	BPXBATA2
	BAQSTRT	ILE SYS KERNEL WAIT	LIBSERV	1F	40.01	83955129		1	42	002A	BPXBATSL

```
//JOHNSONS JOB (ACCOUNT),NOTIFY=&SYSUID,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1),USER=LIBSERV  
//JAVA      EXEC PGM=IKJEFT01,REGION=0M  
//SYSERR   DD  SYSOUT=*<br/>  
//STDOUT    DD  SYSOUT=*<br/>  
//SYSTSPRT  DD  SYSOUT=*<br/>  
//SYSTSIN   DD  *  
BPXBATCH SH +  
java -jar /usr/lpp/java/J8.0_64/lib/ext/healthcenter.jar +  
ID=16846267 level=headless +  
-Dcom.ibm.java.diagnostics.healthcenter.headless.run.number.of.runs=1
```

The job must be executed under the same identity under which the server is running.