



zCEEADM – IBM z/OS Connect Administration

A dive into Liberty and z/OS Connect
Administration

Mitch Johnson

mitchj@us.ibm.com

Washington Systems Center

mitchj@us.ibm.com



IBM
IBM Z
Wildfire Team –
Washington System Center

© 2018, 2022 IBM Corporation



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

- OMVS, Liberty, z/OS Connect 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**

First, 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 quick review of Unix permissions bits

Owner

Bit	Read	Write	Execute
Base-2 Value	1	1	1
[4]	[2]	[1]	
↓	↓	↓	
4 + 2 + 1 =			

7

The owner has READ, WRITE and EXECUTE



The **owner** of the file or directory

chmod -R * u+rwx zceesrv1

Group

Bit	Read	Write	Execute
Base-2 Value	1	0	1
[4]	[2]	[1]	
↓	↓	↓	
4 + 0 + 1 =			

5

The group has READ and EXECUTE, but not WRITE



IDs that are part of the **group** for the file or directory

chmod g+rwx server.xml

Other

Bit	Read	Write	Execute
Base-2 Value	0	0	0
[4]	[2]	[1]	
↓	↓	↓	
0 + 0 + 0 =			

0

Others have nothing



IDs that are not the owner and not part of the group; that is, **other**

chmod -R * o+rx resources
chmod -R * o-w resources/security

-R * indicates recursion



Using 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 for directories and files is a common problem.



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 ADMGRP
/zosconnect	751	LIBSERV ADMGRP
/apis	761	LIBSERV ADMGRP
/apiRequesters	761	LIBSERV ADMGRP
/rules	761	LIBSERV ADMGRP
/services	761	LIBSERV ADMGRP
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 user ID (UID) and group ID (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 utilities like ADRDSSU.

CWWKB0121I: The server process UMASK value is set to 0000

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

Tech/Tip: As an administrator 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 : Also 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 the power these commands provide carefully and only when necessary



Tech/Tip: z/OS : JCL examples 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'
//*****
///* Step ZCEESRVR - Use the zosconnect command to create a server
//*****
//ZCEESRVR EXEC PGM=IKJEFT01,REGION=0M
//SYSTSPRT DD SYSOUT=*
//SYSERR DD SYSOUT=*
//STDOUT DD SYSOUT=*
//SYSTSIN DD *,SYMBOLS=EXEC SYS
BPXBATCH SH +
export JAVA_HOME=&JAVAHOME; +
export WLP_USER_DIR=&WLPUSER; +
&ZCEEPATH/bin/zosconnect create &SERVER +
--template=&TEMPLATE
```

Using the SURROGAT RACF resources means there is no need to have access to 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.

```
//ZCEESRVR JOB 'ZCEE',CLASS=A,REGION=0M,NOTIFY=&SYSUID
//*****
///* 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
//SYSTSPRT DD SYSOUT=*
//SYSERR DD SYSOUT=*
//STDOUT DD SYSOUT=*
//SYSTSIN DD *,SYMBOLS=EXEC SYS
BPXBATCH SH +
export JAVA_HOME=&JAVAHOME; +
export WLP_USER_DIR=&WLPUSER; +
&ZCEEPATH/bin/zosconnect create &SERVER +
--template=&TEMPLATE
//SYSTSIN DD *,SYMBOLS=EXEC SYS
BPXBATCH SH +
export WLP_USER_DIR=&WLPUSER; +
export JAVA_HOME=&JAVAHOME; +
export WLP_USER_DIR=&WLPUSER; +
&ZCEEPATH/bin/zosconnect create &SERVER +
--template=&TEMPLATE; +
chown -R &USER:&GROUP $WLP_USER_DIR/servers/&SERVER
```

Alternatively, 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.



These are the LPAR specific Directories and Files created by zconsetup

The *zconsetup* script creates a symbolic link from the WLP *..v3r0/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
```

```
/var/zosconnect
  /servers
    /v3r0
      /extensions
        imsmobile.properties
        mqzosconnect.properties
        zosconnect.properties
```

```
com.ibm.websphere.productId=com.ibm.ims.mobile
com.ibm.websphere.productInstall=imsmobile/wlp-ext
```

```
com.ibm.websphere.productId=com.ibm.mq.zosconnect
com.ibm.websphere.productInstall=/usr/lpp/mqm/V9R1M1/zosconnect/v2.0
```

```
com.ibm.websphere.productId=com.ibm.zosconnect
com.ibm.websphere.productInstall=runtime
```

- 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 that 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      (see previous slide)
  ${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 multiple 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 Key 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.

Tech/Tip: Liberty Java Directives



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.file.name (messageFileName) - The message log has a default name of *messages.log*. This file always exists, and contains INFO and other (AUDIT, WARNING, ERROR, FAILURE) messages in addition to *System.out* and *System.err*. This log also contains time stamps and the issuing thread ID. If the log file is rolled over, the names of earlier log files have the format *messages_timestamp.log*.

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.

com.ibm.ws.logging.trace.file.name (traceFileName) - The *trace.log* file is only created if additional or detailed trace is enabled. *stdout* is recognized as a special value; and causes trace to be directed to the original standard out stream.

Example: `-Dcom.ibm.ws.logging.log.directory=/u/johnson/logs -Dcom.ibm.ws.logging.message.file.name=myMessages.log`

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 using Java directives.



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.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: The initial server.xml configuration file and how to modify it



Default server.xml configuration file

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="new server">
    <!-- 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="9080"
            httpsPort="9443" />
    <!-- add cors to allow cross origin access, e.g. when using swagger
        <cors id="defaultCORSConfig"
            domain="/"
            allowedOrigins="*"
            allowedMethods="GET, POST, PUT, DELETE, OPTIONS"
            allowedHeaders="Origin, Content-Type, Authorization, Cache-Control"
            allowCredentials="true"
            maxAge="3600"/>
    - - - - - 18 Line(s) not Displayed
    <!-- config requires updateTrigger="mbean" for REFRESH command support
    <config updateTrigger="mbean" monitorInterval="500"/>

    <zosconnect_zosConnectManager setUTF8ResponseEncoding="true"/>

    <!-- zosConnect APIs -->
    <zosconnect_zosConnectAPIs updateTrigger="disabled" pollingRate="5s"
        <!-- zosConnect Services -->
    <zosconnect_services updateTrigger="disabled" pollingRate="5s"/>

    <!-- applicationMonitor is not applicable for z/OS Connect EE servers -
    <applicationMonitor updateTrigger="disabled" dropinsEnabled="false"/>
</server>
```

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" />
```

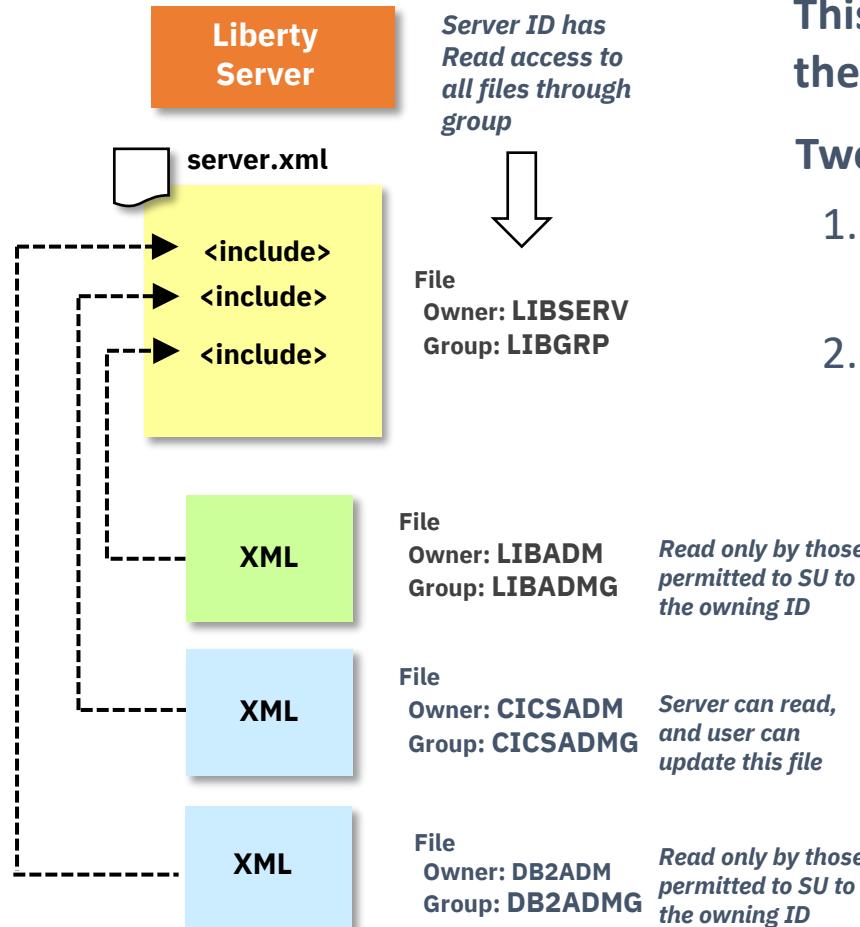
*Added in V3.0.48 with no HOLD information provided

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 support for 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.

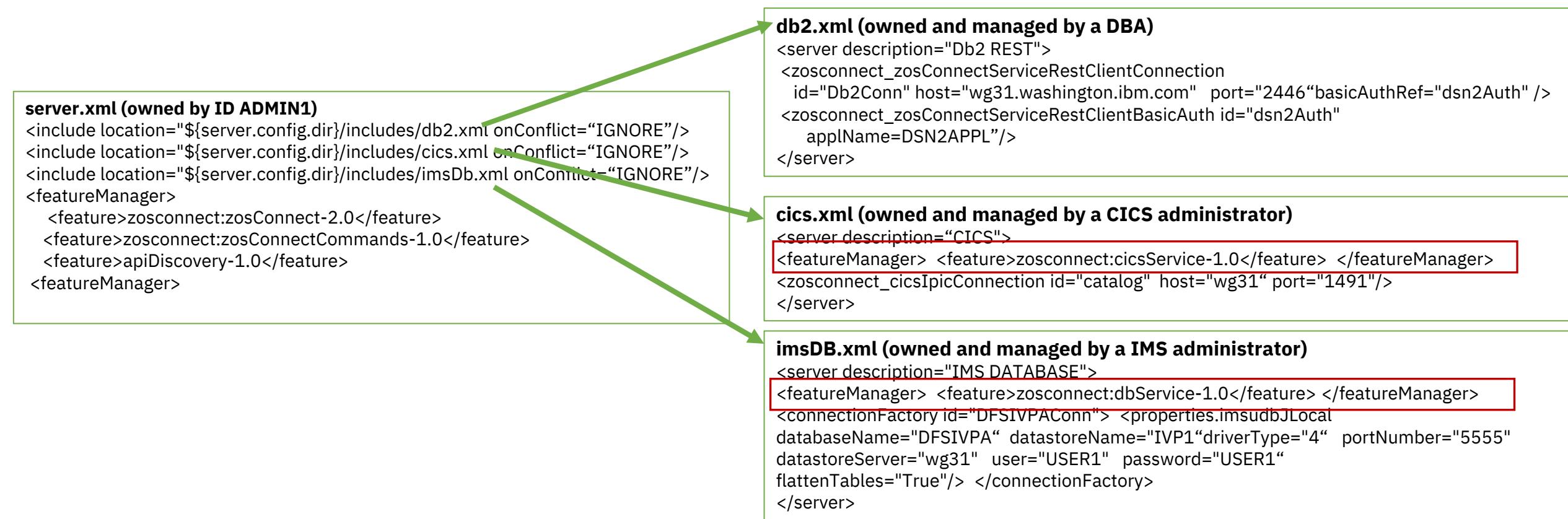
Nesting of an include file within a include file is possible



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





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.

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 zceeadm -> /var/ats/zosconnect/servers/zceeadm
lrwxrwxrwx  1 JOHNSON  SYS1      39 Aug 16 10:18 zceecics -> /var/cicsts/zosconnect/servers/zceecics
lrwxrwxrwx  1 JOHNSON  SYS1      35 Aug 16 10:31 zceedv -> /var/ats/zosconnect/servers/zceedv
lrwxrwxrwx  1 JOHNSON  SYS1      32 Jun 10 15:54 zceebasic -> /var/zosconnect/servers/zceebasic
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
```

Not all of these directories are for z/OS Connect servers, there are CICS Liberty servers, a MQ Web Console Liberty server, a zOSMF Liberty server, a HATS Liberty server and a couple of standard Liberty servers for Java applications.



Using the *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

Rather than creating an “includes” directory in each server configuration directory, create “includes” symbolic links

```
<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"/>
```

```
<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/zosconnect/servers/zceesrv1/includes



/var/zosconnect/servers/zceesrv2/includes



/var/zosconnect/servers/zceesrv3/includes

Contents of the these three “includes” directories

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

F BAQSTRT,REFRESH,CONFIG

But wait, 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"/>
```

```
BPXBATCH SH +  
export JAVA_HOME=&JAVAHOME; +  
export WLP_USER_DIR=&WLPUSER; +  
&ZCEEPATH/bin/zosconnect create &SERVER +  
--template=&TEMPLATE; +  
ln -s /var/shared/zosconnect/includes $WLP_USER_DIR/servers/&SERVER/includes; +  
ln -s $WLP_USER_DIR/servers/&SERVER /var/zcee/&SERVER
```



/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

Perhaps an extreme option, but consider creating an “include” file with just the desired include statements and then include this file in a server’s server.xml file. For example, an include that add CICS, SAF security and SSL and another file that adds CICS and SAF security (no SSL).



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

July 2020	
V3.0.35 (APAR PH26291) Server code update	<p>Enhancements</p> <ul style="list-style-type: none">The text of messages BAQR0417W and BAQR0418W has been updated. For more information, see z/OS Connect EE Runtime Messages. <p>Fixes</p> <ul style="list-style-type: none">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. <div style="background-color: #ffffcc; padding: 5px;"><p>Attention</p><p>When this fix is applied, additional CORS configuration is required in <code>server.xml</code> 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</p></div>

`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 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: Use Symbolic links to 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=EXECSYS  
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
```

Add exports to /u/johnson/.profile or /etc/profile

```
export serverName=defaultServer  
export sharedDir=/var/zcee/shared  
export WLP_USER_DIR=/var/zosconnect
```

Or

```
//ZCEELN EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
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 standard default directory location for these artifacts and then use a symbolic link to the actual real directory

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

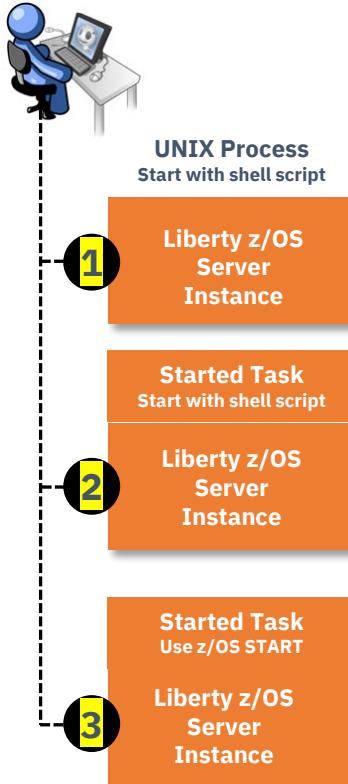
```
<zosconnect_apiRequesters location="/var/zcee/shared/apiRequesters">
</zosconnect_apiRequesters>
<zosconnect_zosConnectAPIs location="/var/zcee/shared/apis">
</zosconnect_zosConnectAPIs>
<zosconnect_services location="/var/zcee/shared/services">
</zosconnect_services>
```

This XML is now portable between servers in on LPARs in or not in a SYSPLEX.

z/OS : Starting Liberty Servers

All three options result in a Liberty z/OS server, and functionally there's very little difference.

When started as a UNIX process, the MODIFY command interface is not present. For production use, the best practice is to use a started task.



1. UNIX Process
 - Use the 'server' shell script in the installation /bin directory
 - Syntax: `server start zceesrv1`
 - ID of server will be based on ID that issued the command
2. Started Task using server shell script (server start zceesrv1)
 - Set **WLP_ZOS_PROCEDURE** environment variable in server.env file
 - Example: `WLP_ZOS_PROCEDURE=ZCEEPROC,JOBNAME=ZCEESVR1,PARMS='ZCEESVR1'`
 - ID of the server will be based on the SAF STARTED profile that takes effect
3. **Started Task using START command**
 - **Common procedure:** `START ZCEEPROC,JOBNAME=ZCEESVR1,PARMS='ZCEESVR1'`
 - **Dedicated proc:** `START ZCEEPROC`
 - **ID of the server will be based on the SAF STARTED profile that takes effect**

Expectation is for production servers #3 will be used

Liberty z/OS good practices:

<https://www.ibm.com/support/pages/node/6355605>

z/OS : Assigning ID to started tasks: SAF STARTED

The first question here is whether you wish to have a common started task ID that is shared among servers, or if you wish each server to have a unique ID

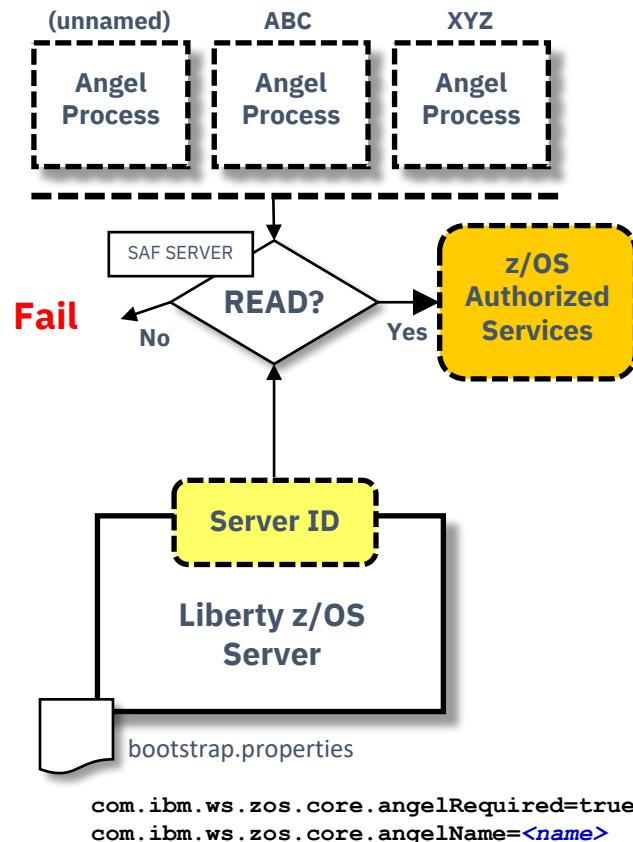
Then the second question is whether servers under a WLP_USER_DIR will share a common JCL start proc, or use unique start procs for each server

	<i>Common Identity per task</i>	<i>Unique Identities per task</i>
<i>Common JCL Procedure</i>	<pre>RDEFINE STARTED ZCEEPROC.* S ZCEEPROC,JOBNAM=server1,PARMS='server1' S ZCEEPROC,JOBNAM=server2,PARMS='server2'</pre>	<pre>RDEFINE STARTED ZCEEPROC.server1 RDEFINE STARTED ZCEEPROC.server2 S ZCEEPROC,JOBNAM=server1,PARMS='server1' S ZCEEPROC,JOBNAM=server2,PARMS='server2'</pre>
<i>Unique JCL Procedure per server</i>	<pre>RDEFINE STARTED ZCEE*.* S ZCEESRV1,JOBNAM=server1,PARMS='server1' S ZCEESRV2,JOBNAM=server2,PARMS='server2'</pre>	<pre>RDEFINE STARTED ZCEESRV1.* RDEFINE STARTED ZCEESRV2.* S ZCEESRV1,JOBNAM=server1,PARMS='server1' S ZCEESRV2,JOBNAM=server2,PARMS='server2'</pre>

Note: Using unique JCL procedure eliminates the need to specify PARMS on the start commands

It's possible to use a combination of the above, even under the same WLP_USER_DIR. So there's no "one best answer" here. What's best is what's best for you.

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>

Tech/Tip: Sample RACF Commands for SERVER resources

```
RDEFINE SERVER BBG.ANGEL UACC(NONE) OWNER(SYS1)
PERMIT BBG.ANGEL CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM UACC(NONE) OWNER(SYS1)
PERMIT BBG.AUTHMOD.BBGZSAFM CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM.SAFCRED UACC(NONE)
PERMIT BBG.AUTHMOD.BBGZSAFM.SAFCRED CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM.ZOSWLM UACC(NONE)
PERMIT BBG.AUTHMOD.BBGZSAFM.ZOSWLM CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM.TXRRS UACC(NONE)
PERMIT BBG.AUTHMOD.BBGZSAFM.TXRRS CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM.ZOSDUMP UACC(NONE)
PERMIT BBG.AUTHMOD.BBGZSAFM.ZOSDUMP CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.SECPFX.BBGZDFLT UACC(NONE)
PERMIT BBG.SECPFX.BBGZDFLT CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM.WOLA UACC(NONE) OWNER(SYS1)
PERMIT BBG.AUTHMOD.BBGZSAFM.WOLA CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM.LOCALCOM UACC(NONE) OWNER(SYS1)
PERMIT BBG.AUTHMOD.BBGZSAFM.LOCALCOM CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSCFM UACC(NONE) OWNER(SYS1)
PERMIT BBG.AUTHMOD.BBGZSCFM CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSCFM.WOLA UACC(NONE) OWNER(SYS1)
PERMIT BBG.AUTHMOD.BBGZSCFM.WOLA CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM.PRODMGR UACC(NONE) OWNER(SYS1)
PERMIT BBG.AUTHMOD.BBGZSAFM.PRODMGR CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
RDEFINE SERVER BBG.AUTHMOD.BBGZSAFM.ZOSAIO UACC(NONE) OWNER(SYS1)
PERMIT BBG.AUTHMOD.BBGZSAFM.ZOSAIO CLASS(SERVER) ACCESS(READ) ID(LIBSERV)
SETROPTS RACLIST(SERVER) REFRESH
```



SAF APPL and EJBRole Resources



Connect z/OS Connect users to a common group

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

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#, ZCEEUSR)

SETROPTS RACLST(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(ZCEEUSR) ACCESS(READ)**

Refresh the EJBROLE in storage profiles

SETROPTS RACLST(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 terminal windows side-by-side, illustrating the use of SURROGAT access.

Left Terminal (ISPF Shell):

- Window title: WG31# - 3270
- Menu bar: File, Edit, Settings, View, Communication, Actions, Window, Help
- Action bar: Directory, Special_file, Tools, File_systems, Options, Setup, Help
- Text area:
 - 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.
- Command line:

```
/var/zcee
```
- Output:

```
EUID=200042
```
- Bottom status bar:
 - MA B
 - Connected to remote server/host wg31a using lu/pool TCP00117 and port 23

Right Terminal (OMVS Shell):

- Window title: WG31# - 3270
- Menu bar: File, Edit, Settings, View, Communication, Actions, Window, Help
- Text area:

```
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.

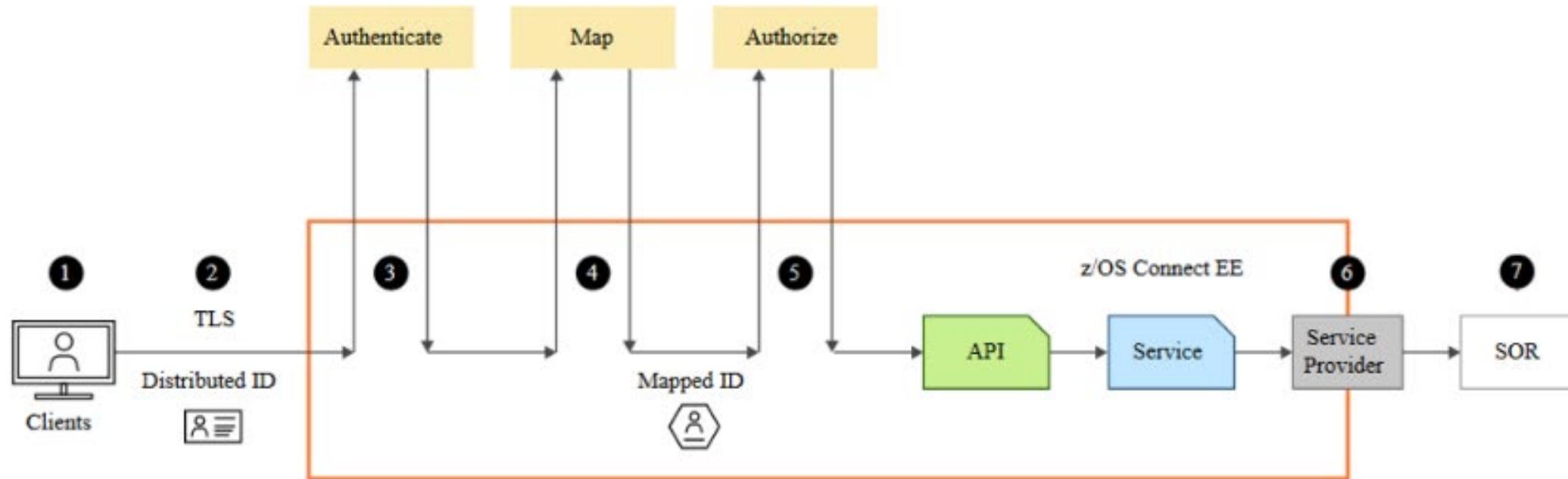
IBM is a registered trademark of the IBM Corp.

$ id
uid=5504(USER3) gid=2(SYS1)
$ su - libserv
$ id
uid=200042(LIBSERV) gid=200034(LIBGRP) groups=200033(GMINVOKE),200036(ZCEEUSRS)
$
```
- Bottom status bar:
 - ====> _
 - RUNNING
 - ESC=c 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
 - Connected to remote server/host wg31a using lu/pool TCP00108 and port 23
 - 29/007

Tech-Tip: Super user privilege is required to set the program control extended attribute (*extattr +p*) bit for the Java shared object ***ifaedjreg64.so***. This extended attribute must be set for identity assertion in certain situations. Also super user privilege access is required to use the ps –ef command



Details of a typical z/OS Connect EE API Provider security flow



1. The credentials provided by the client
2. Secure the connection to the Liberty server
3. Authenticate the client. This can be within the Liberty server or by requesting verification from a third-party server
4. Map the authenticated identity to a user ID in the user registry
5. Authorize the mapped user ID to connect to z/OS Connect EE and optionally authorize user to invoke actions on APIs
6. Secure the connection to the System of Record (SoR) and provide security credentials to be used to invoke the program or to access the data resource
7. The program or database request may run in the SoR under the mapped ID



- requireAuth - requires the client to provide credentials

```
<zosconnect_zosConnectManager  
      requireAuth="true|false"  
      requireSecure="true"/>  
  
<zosconnect_zosConnectAPIs>  
  <zosConnectAPI name="catalog"  
      requireAuth="true|false"  
      requireSecure="true"/>  
</zosconnect_zosConnectAPIs>  
  
<zosconnect_services>  
  <service id="selectByEmployee"  
      name="selectEmployee"  
      requireAuth="true|false"  
      requireSecure="true"/>  
</zosconnect_services>  
  
<zosconnect_apiRequesters>  
  requireAuth="true|false"  
  <apiRequester name="cscvincapi_1.0.0"  
      requireAuth="true|false"  
      requireSecure="true"/>  
</zosconnect_apiRequesters>
```

Globally, requires that users specify security credentials to be authenticated order to access APIs, services and API requesters, unless overridden on the specific resource definitions.

Requires that users specify security credentials to be authenticated in order to access the API.

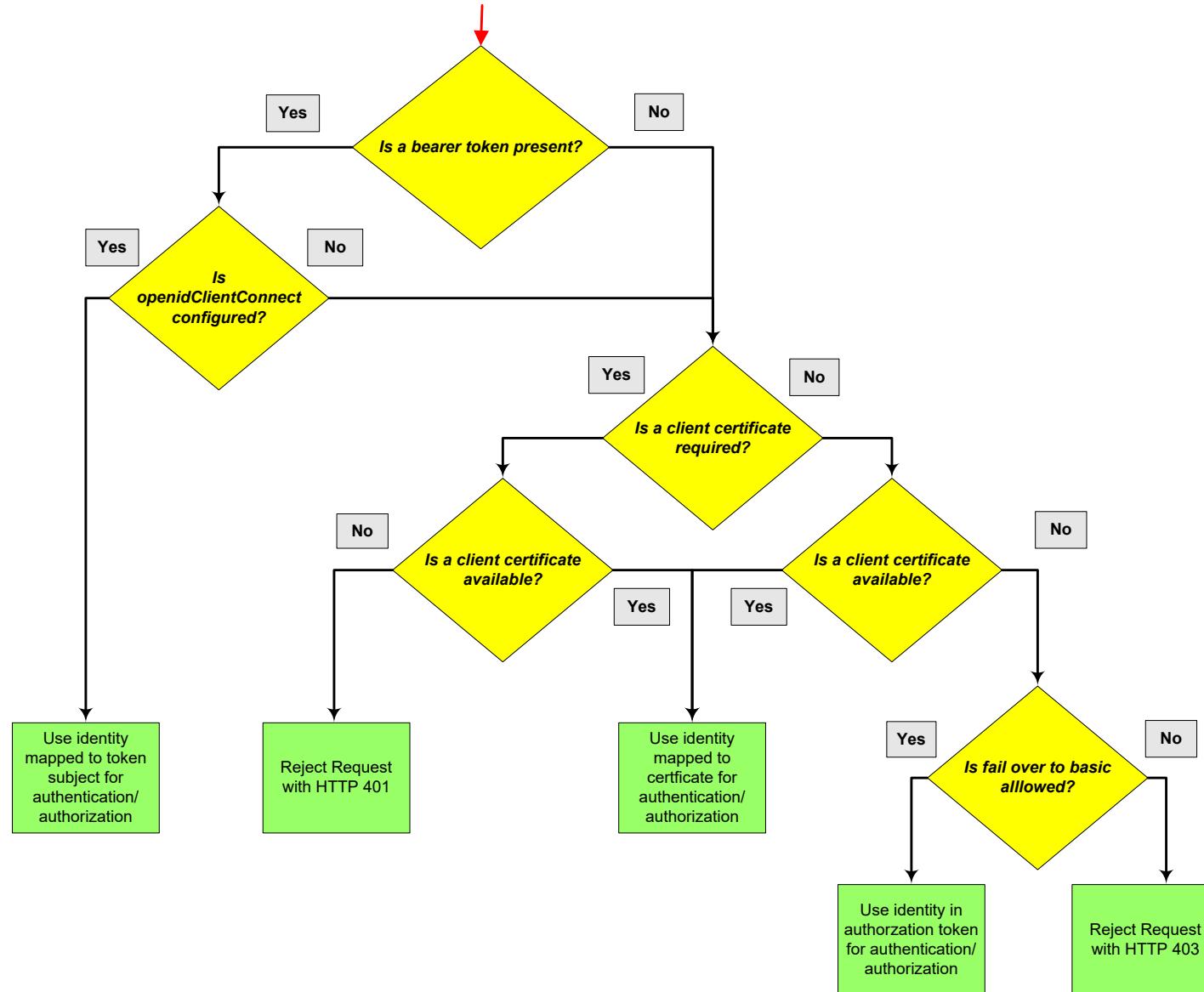
Requires that users specify security credentials to be authenticated in order to directly access the service. This attribute is ignored when the service is invoked from an API, then only the API requireAuth attribute is relevant.

Requires that users specify security credentials to be authenticated in order to access all API requesters. If the requireAuth attribute is not set, the global setting on the zosconnect_zosConnectManager element is used instead, unless the requireAuth attribute is overridden on the specific API requester.

The requireAuth attribute controls whether an inbound request must provide credentials using one of the three authentication methods, e.g., basic, client certificate, or third-party token.



Authentication Credential Precedence





z/OS Connect Security server XML Authentication Configuration



- requireSecure - requires the use of TLS (SSL) for communications

```
<zosconnect_zosConnectManager  
      requireAuth="true"  
      requireSecure="true|false"/>  
  
<zosconnect_zosConnectAPIs>  
  <zosConnectAPI name="catalog"  
      requireAuth="true"  
      requireSecure="true|false"/>  
</zosconnect_zosConnectAPIs>  
  
<zosconnect_services>  
  <service id="selectByEmployee"  
      name="selectEmployee"  
      requireAuth="true"  
      requireSecure="true|false"/>  
</zosconnect_services>  
  
<zosconnect_apiRequesters>  
  requireAuth="true"  
  <apiRequester name="cscvincapi_1.0.0"  
      requireAuth="true"  
      requireSecure="true|false"/>  
</zosconnect_apiRequesters>
```

Globally, requires that inbound request using HTTPS in order to access APIs, services and API requesters, unless overridden on the specific resource definitions.

Requires that inbound request use HTTPS in order to access the API.

Requires that inbound request use HTTPS when directly accessing this service.

Requires that all inbound request for this API requester use HTTPS.

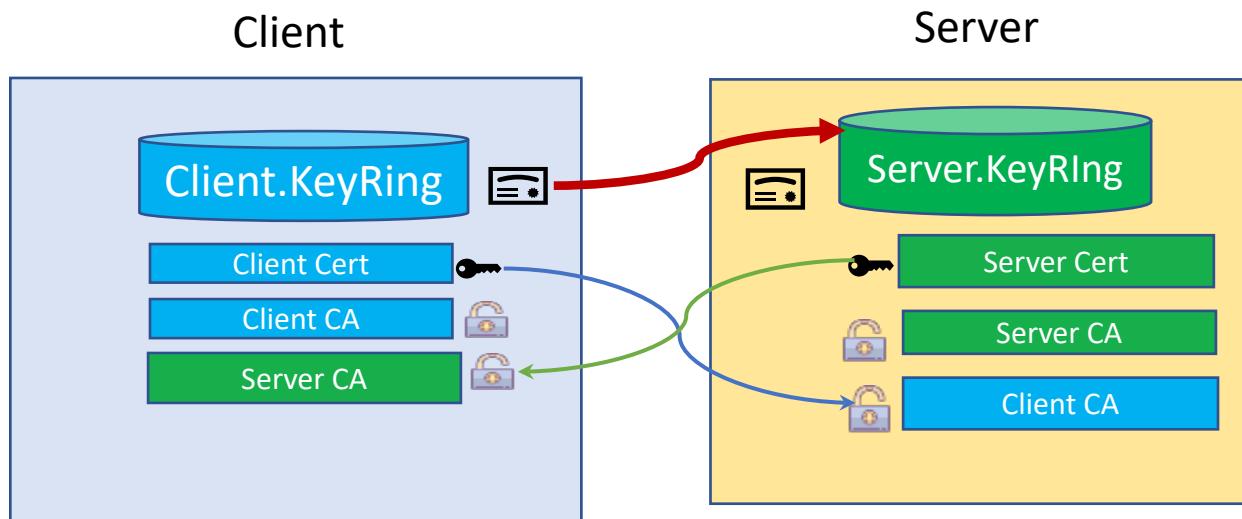
requireSecure controls inbound TLS connections

Let's review the basic TLS Handshake Flow

TLS handshake –

Server Authentication

Mutual Authentication (optional)



safkeyring:///KeyRing v safkeyring://owner/KeyRing

RACF FACILITY resources

- IRR.DIGTCERT.LISTRING
 - READ to list your own key ring
 - UPDATE to list another user's key ring
- IRR.DIGTCERT.LIST
 - READ to list your own certificate
 - UPDATE to list another user's certificate
 - CONTROL to list SITE of CERTAUTH certificates

🔑 Certificate with a private key*

🔒 Certificate Authority (CA) certificate chain#

*For server and/or mutual authentication to work, the endpoint sending its server or client certificate must use a personal certificate with a private key. The private key is required to decrypt (or encrypt) a message digest that is sent from the other endpoint during the handshake flow. Generation of a message digest also requires access to the CA certificate used to sign the certificate.

#Refers to the set or of certificates used to issue the server or client personal certificate including any intermediate certificates all the way to the root CA.



Using this Liberty JSSE server XML configuration



```
<!-- Enable features -->
<featureManager>
    <feature>transportSecurity-1.0</feature>
</featureManager>

<sslDefault sslRef="DefaultSSLSettings"
    outboundSSLRef="OutboundSSLSettings" />

<ssl id="DefaultSSLSettings"
    keyStoreRef="CellDefaultKeyStore"
    trustStoreRef="CellDefaultKeyStore"
    clientAuthenticationSupported="true"
    clientAuthentication="true"
    serverKeyAlias="Liberty Server Cert"/>

<keyStore id="CellDefaultKeyStore"
    location="safkeyring:///Liberty.KeyRing"
    password="password" type="JCERACFKS"
    fileBased="false" readOnly="true" />

<ssl id="OutboundSSLSettings"
    keyStoreRef="OutboundKeyStore"
    trustStoreRef="OutboundKeyStore"/>

<keyStore id="OutboundKeyStore"
    location="safkeyring:///zCEE.KeyRing"
    password="password" type="JCERACFKS"
    clientKeyAlias="Liberty Client Cert"
    fileBased="false" readOnly="true" />
```

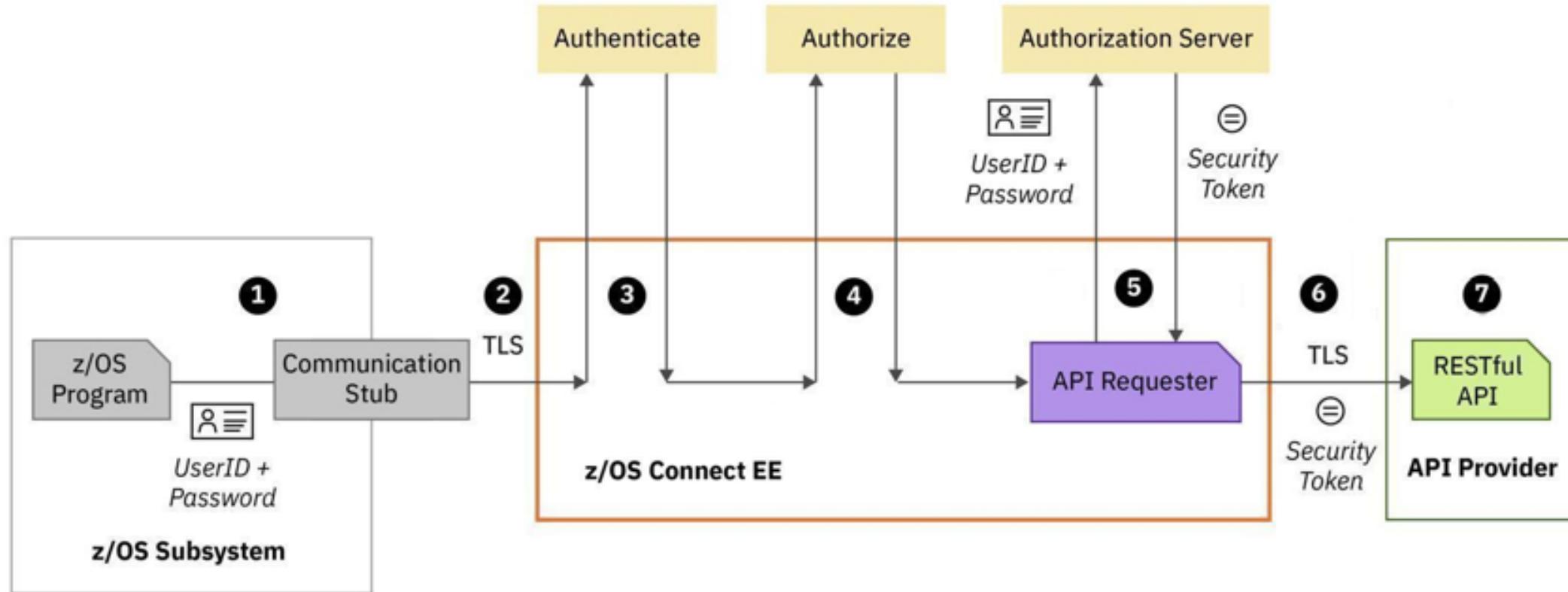
SSL repertoires

```
<zosconnect_authorizationServer sslCertsRef="SSL repertoire"/>
<zosconnect_cicsIpicConnection sslCertsRef="SSL repertoire"/>
<zosconnect_endpointConnect sslCertsRef="SSL repertoire"/>
<zosconnect_zosConnectRestClient sslCertsRef="SSL repertoire"/>
<zosconnect_zosConnectServiceRestClientConnection sslCertsRef="SSL repertoire"/>
```

Tech-Tip: when more than one personal certificate is connected to a key ring. Use the SSL repertoire *serverKeyAlias* or *clientKeyAlias* attributes to select the personal certificate to be used in a handshake.



Details of a typical z/OS Connect EE API Requester security flow



1. A user ID and password can be used for basic authentication by the Liberty EE server
2. Connection between the CICS, IMS, or z/OS application and the Liberty server can use TLS
3. Authenticate the CICS, IMS, or z/OS application.
4. Authorize the authenticated user ID to connect to Liberty and to perform specific actions on z/OS Connect EE API requesters
5. If required, pass the user ID and password credentials to an authorization server to obtain a security token.
6. Secure the connection to the external API provider, and provide security credentials such as a security token to be used to invoke the API
7. The API runs in the external API provider

Connecting z/OS Connect servers to z/OS subsystems



Tech-Tip: Liberty's “adminCenter” Feature

- The Web browser interface feature “adminCenter” was used to display the server’s configuration files

Server Config

server.xml

Save

Design Source

Server

Select an element on the left hand side tree to view its configuration.

Add child Remove

Description

new server

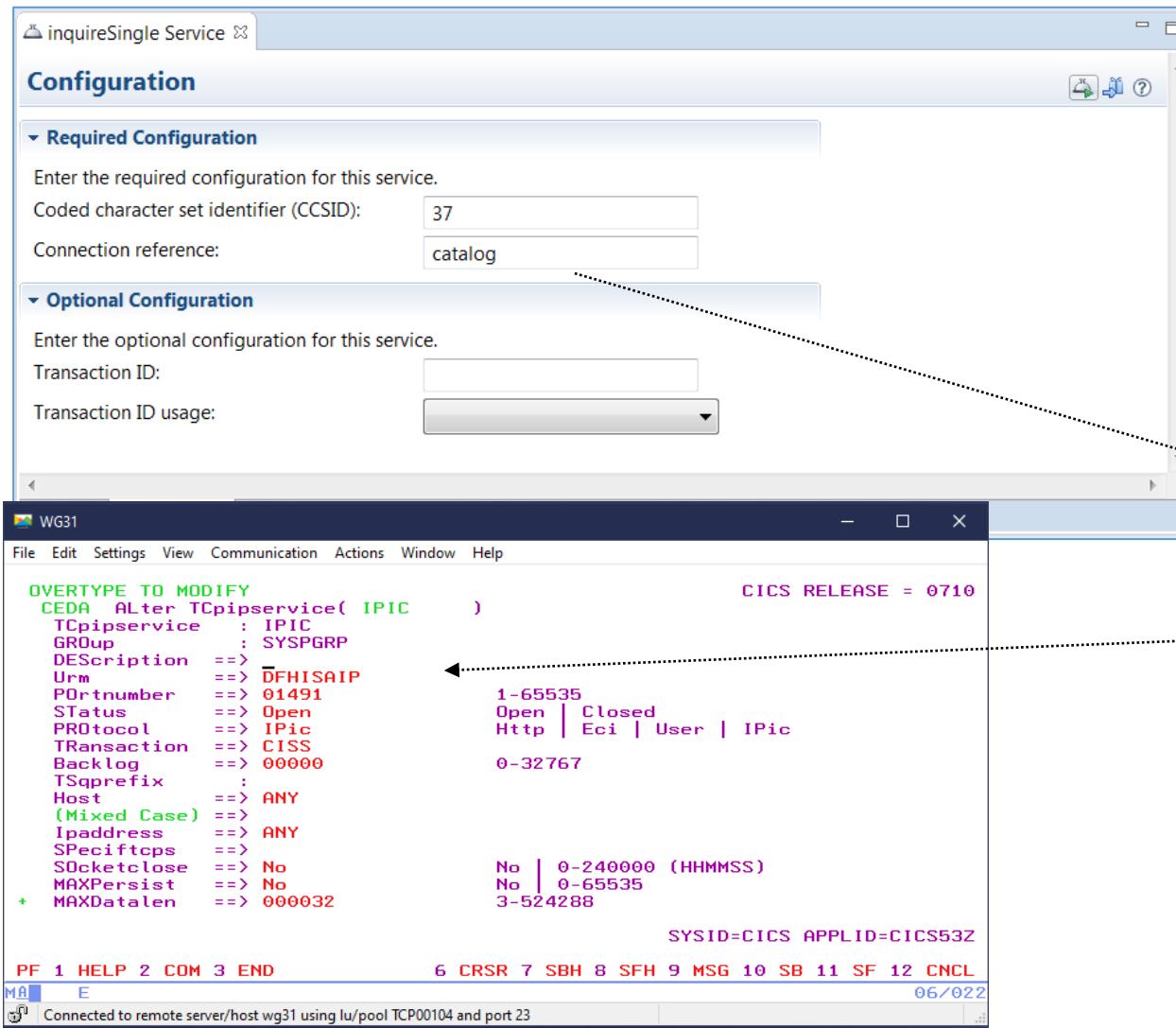
```
1 <server description="new server">
2 <include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/services/ims-services.xml" optional="true"/>
3 <include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/interactions/ims-interactions.xml" optional="true"/>
4 <include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/connections/ims-connections.xml" optional="true"/>
5 <include location="/var/zosconnect/servers/myServer/ims-admin-services.xml" optional="true"/>
6 <include location="${server.config.dir}/includes/safSecurity.xml"/>
7 <include location="${server.config.dir}/includes/safTrace.xml"/>
8 <include location="${server.config.dir}/includes/ipic.xml"/>
9 <include location="${server.config.dir}/includes/keyring.xml"/>
10 <include location="${server.config.dir}/includes/apiRequesterHTTPS.xml"/>
11 <include location="${server.config.dir}/includes/shared.xml"/>
12 <include location="${server.config.dir}/includes/oauth.xml"/>
13 <include location="${server.config.dir}/includes/audit.xml"/>
14 <include location="${server.config.dir}/includes/mq.xml"/>
15 <include location="${server.config.dir}/includes/db2.xml"/>
16 <include location="${server.config.dir}/includes/wlm.xml"/>
17 <include location="${server.config.dir}/includes/restConnector.xml"/>
18 <include location="${server.config.dir}/includes/smf.xml"/>
19 <include location="${server.config.dir}/includes/adminCenter.xml" />
20
21     <!-- Enable features -->
22     <featureManager>
23         <feature>apiDiscovery-1.0</feature>
24         <feature>zosconnect:zosConnect-2.0</feature>
25         <feature>zosconnect:zosConnectCommands-1.0</feature>
26         <feature>imsmobile:imsmobile-2.0</feature>
27     </featureManager>
28
29     <!-- To access this server from a remote client add a host attribute to the following element, e.g. host="*" -->
30     <httpEndpoint host="*" httpPort="9080" httpsPort="9443" id="defaultHttpEndpoint"/>
31
32 </server>
```



Server XML - Accessing a CICS program using IPIC



The server.xml file is the key configuration file:



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

catalog.xml

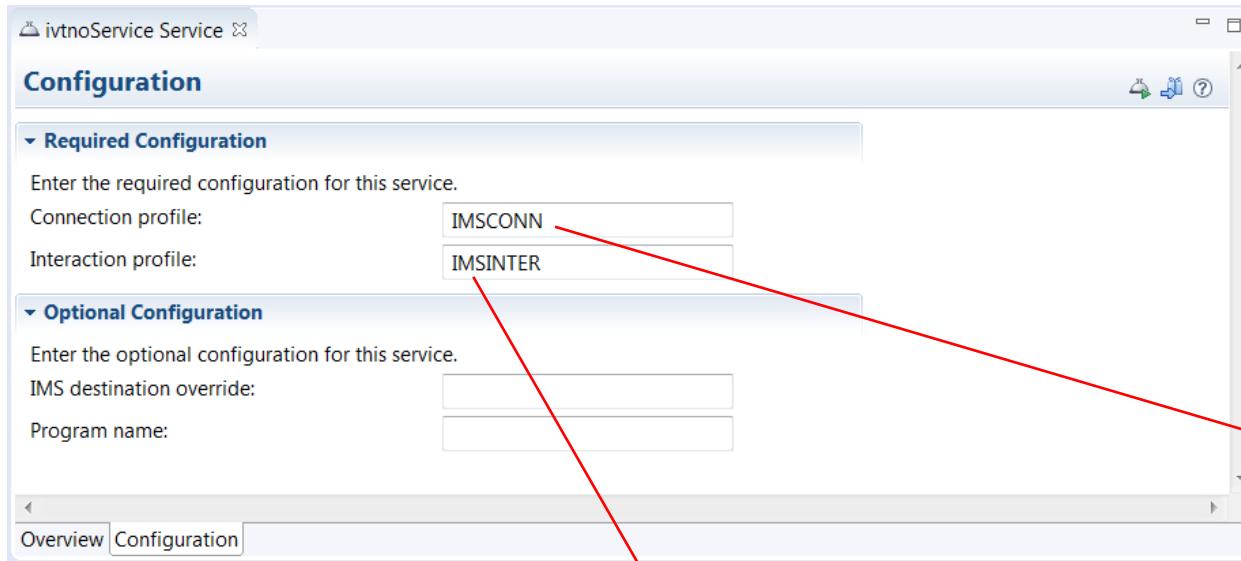
Design Source

```
1 <server description="CICS IPIC - catalog">
2
3 <!-- Enable features -->
4 <featureManager>
5   <feature>zosconnect:cicsService-1.0</feature>
6 </featureManager>
7
8 <zosconnect_cicsIpicConnection id="catalog">
9   host="wg31.washington.ibm.com"
10  port="1491"
11  transid="CSMI"
12  transidUsage="EIB_AND_MIRROR"/>
13
14 </server>
15
```

Define IPIC connection to CICS



Server XML – Accessing an IMS Transaction using OTMA



IMS Connect HWSCFG

```
HWS= (ID=IMS14HWS, XIBAREA=100, RACF=Y, RRS=N)
TCPPIP= (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)
```

connections/ims-connection.xml#

```
<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>
```

interactions/ims-interactions.xml#

```
<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:

DFSIIVPAConn

ConnectionFactory

```
<connectionFactory id="DFSIIVPAConn">  
<properties.imsldbJLocal  
    databaseName="DFSIIVPA"  
    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,RACF=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

*selectEmployee Service X

Service Project Editor: Configuration

Required Configuration

Enter the required configuration for this service.

Connection reference: db2conn

DSNL004I -DSN2 DDF START
COMPLETE
LOCATION DSN2LOC
LU
USIBMWZ.DSN2APPL
GENERICLU -NONE
DOMAIN
WG31.WASHINGTON.IBM.COM
TCPPORT 2446
SECPORT 2445
RESPORT 2447

db2pass.xml

Design Source

```
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
```



Server XML - Using JMS to access MQ

*twoWay Service

Service Project Editor: Configuration

Required Configuration

Enter the required configuration for this service.

Connection factory JNDI name: jms/qmgrCf

Request destination JNDI name: jms/requestQueue

Reply destination JNDI name: jms/replyQueue

Wait interval: 3000

MQMD format: MQSTR

Coded character set identifier (CCSID): 37

Is message persistent:

Reply selection: msgIDToCorrelID

Expiry: -1

Definition Configuration

mq.xml

Read only Close

Design Source

```
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.MQZEE.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
```

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

Server Config

hats.xml Read only Close

Design Source

```
<server description="HATS">
  <zosconnect_zosConnectServiceRestClientConnection id="HatsConn"
    host="wg31.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=ATSFFILEA
register=FILEAZCON
connectionRef=wolaCF
requestStructure=./fileareq.cpy
responseStructure=./filearsp.cpy
Ln 1, Col 1 100% Windows (CRLF) UTF-8
```

Server Config

wola.xml

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 'ATSFFILEA'          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"
      max_timeout="1800"/>
  </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
///* Common component authorised library
//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.(IPVCONFG)
```



Server XML – API Requester = Accessing an 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

server.xml

Save Close

Design Source

Press Ctrl+space for content assist.

```
<!-- 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"
              id="defaultHttpEndpoint"/>
```

Server Config

apiRequesterHTTPS.xml

Read only Close

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">
    <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" />

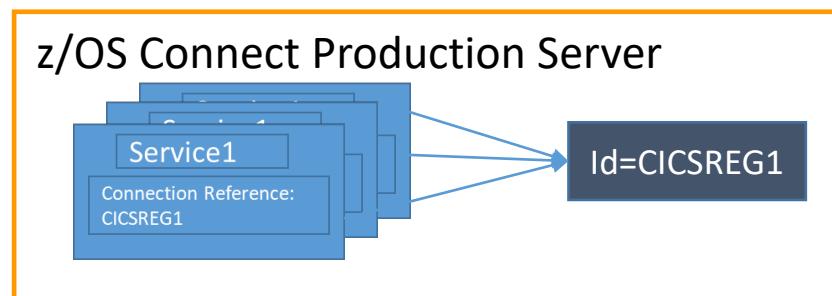
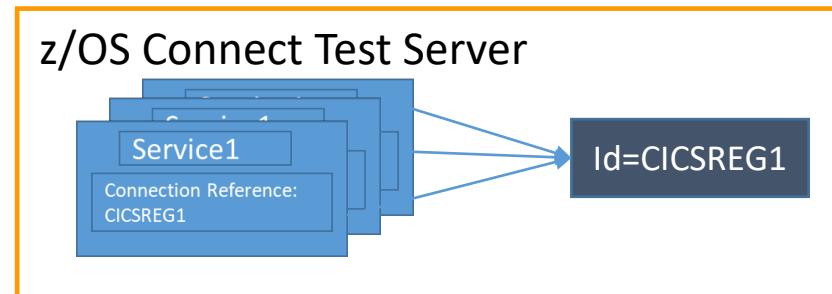
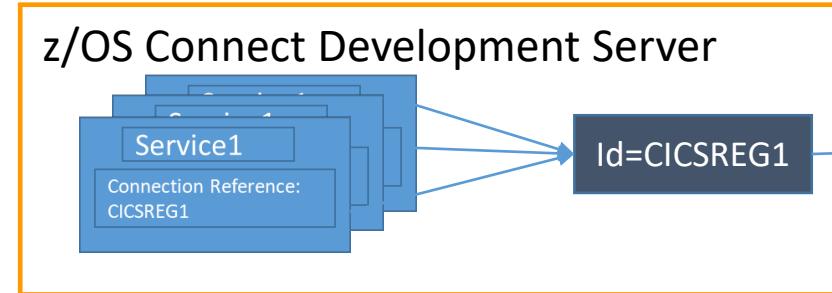
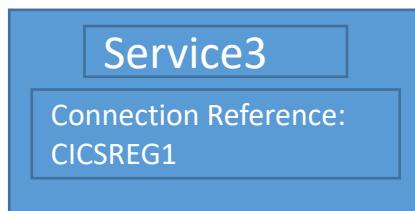
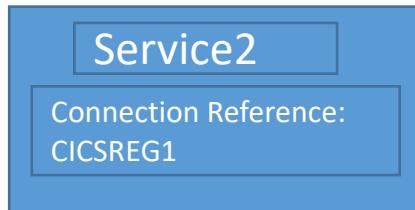
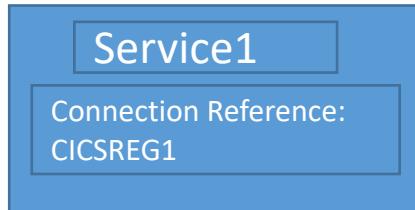
  <zosconnect_authData id="mySAFAuth"
    user="USER1"
    password="user1" />
</server>
```



Use naming conventions for service and endpoint connection references



Don't couple service and API requester connection names to specific systems or endpoints



?

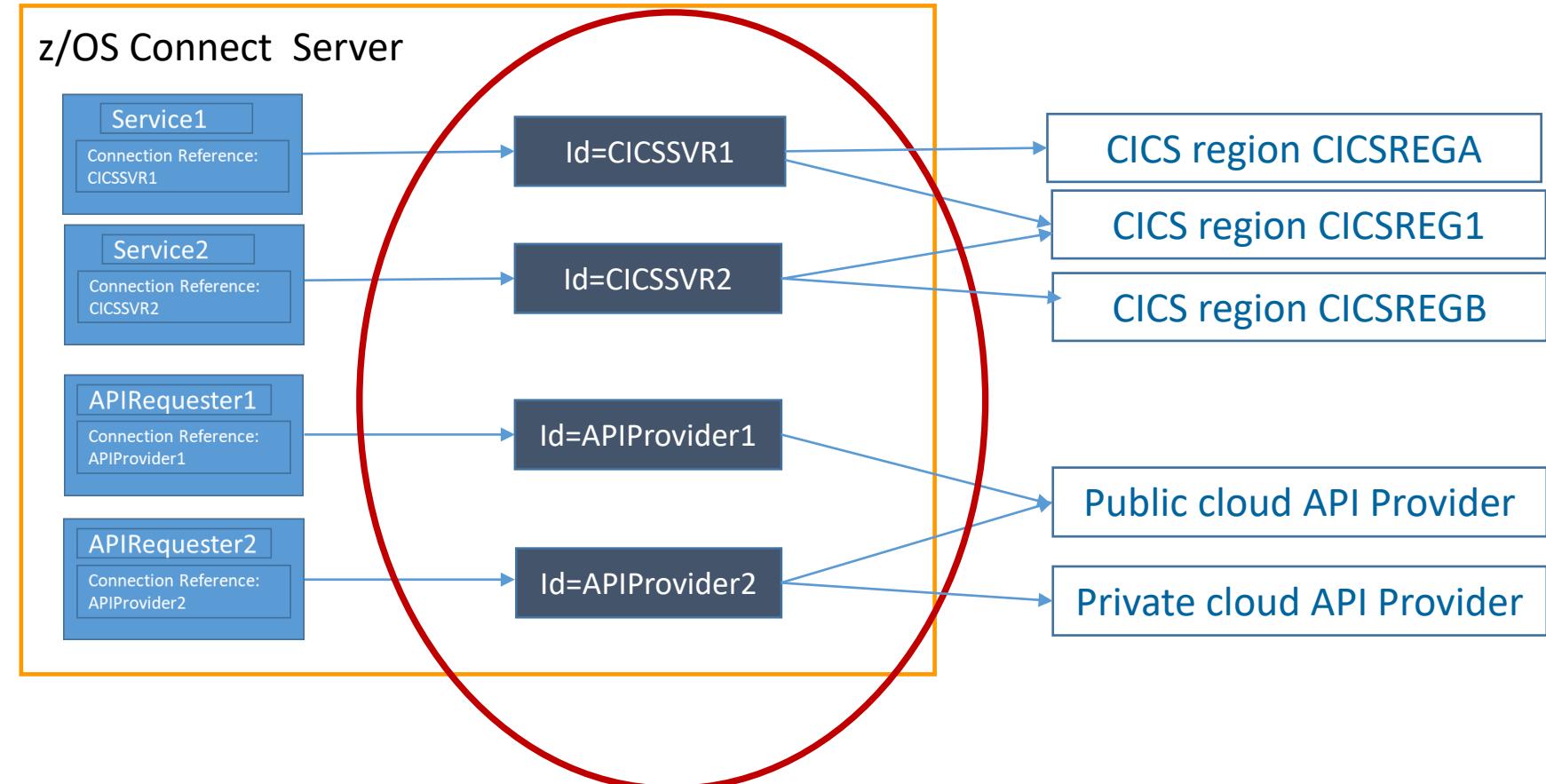
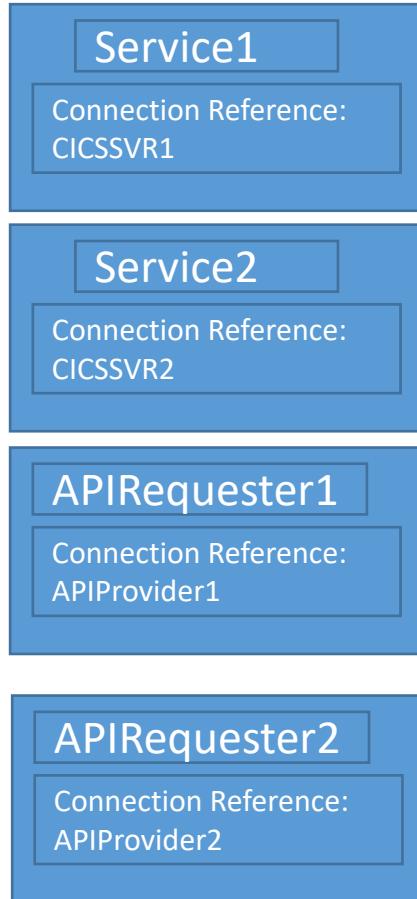
CICS region CICSTST1
CICS region CICSTST2

CICS region CICSPRD1
CICS region CICSPRD2
CICS region CICSPRD3



Use naming conventions for connection references

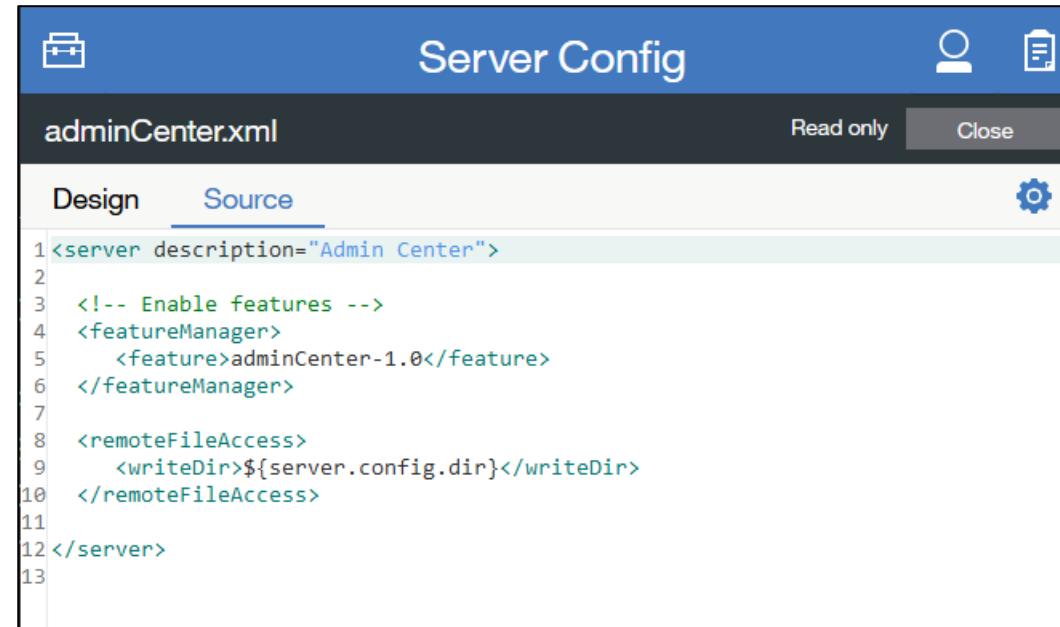
Use application meaningful names or an extendable convention for connection reference names



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.



```
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 two instances of the "Server Config" interface for the file "server.xml".

Left Window (Design View):

- Require request authentication:** Set to "false".
- Preserve JSON object payload order:** Set to "false (default)".
- Preserve JSON payload character format:** A modal dialog is open, showing options "true" and "false (default)".
- Set response encoding to:** Set to "false (default)".
- Return all errors in JSON:** Set to "true (default)".

Right Window (Source View):

- The XML configuration code is visible.
- A tooltip at the top right says "Press Ctrl+space for content assist." with a red oval highlight.
- A dropdown menu is open over the XML code, showing suggestions like "zosconnect_apiRequester", "zosconnect_apiRequesters", etc.

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.



The screenshot shows the 'Server Config' interface with the title 'restConnector.xml'. It has tabs for 'Design' and 'Source'. The 'Source' tab is selected, displaying XML code. The XML includes a 'server' element with a 'featureManager' containing a 'feature' named 'restConnector-2.0'. Below the XML, a list of URLs is shown, each starting with 'https://mpz3.washington.ibm.com:9443/ibm/api/config/' followed by a specific configuration path. At the bottom of the slide, there is a box containing RACF commands to define roles and permissions for the 'BBGZDFLT' role.

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

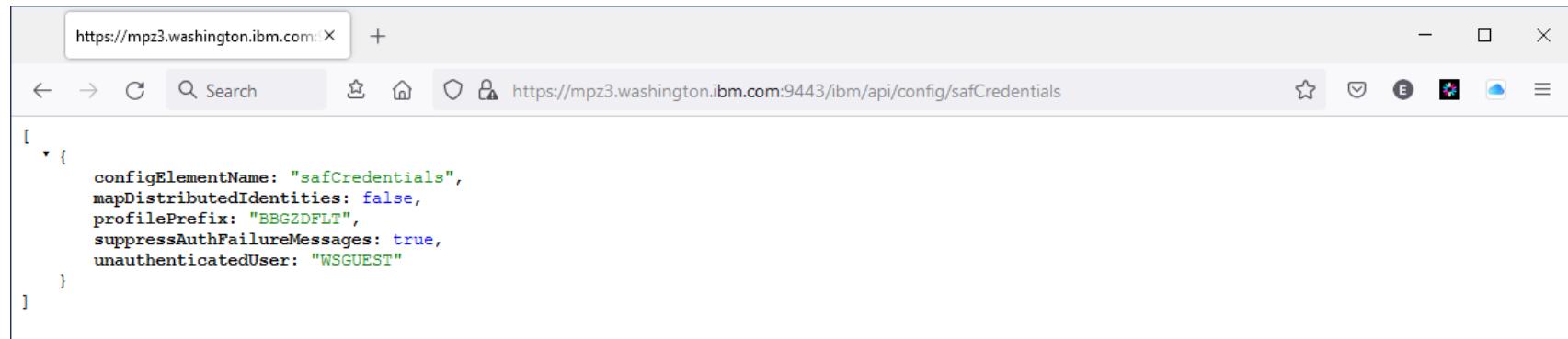
```
1<?xml version="1.0" encoding="UTF-8"?>
2<server description="REST Connector">
3  <featureManager>
4    <feature>restConnector-2.0</feature>
5  </featureManager>
6</server>
7
8</server>
9
```

<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>



A screenshot of a web browser window displaying a JSON configuration object. The URL in the address bar is <https://mpz3.washington.ibm.com:9443/ibm/api/config/safCredentials>. The JSON content is:

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

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

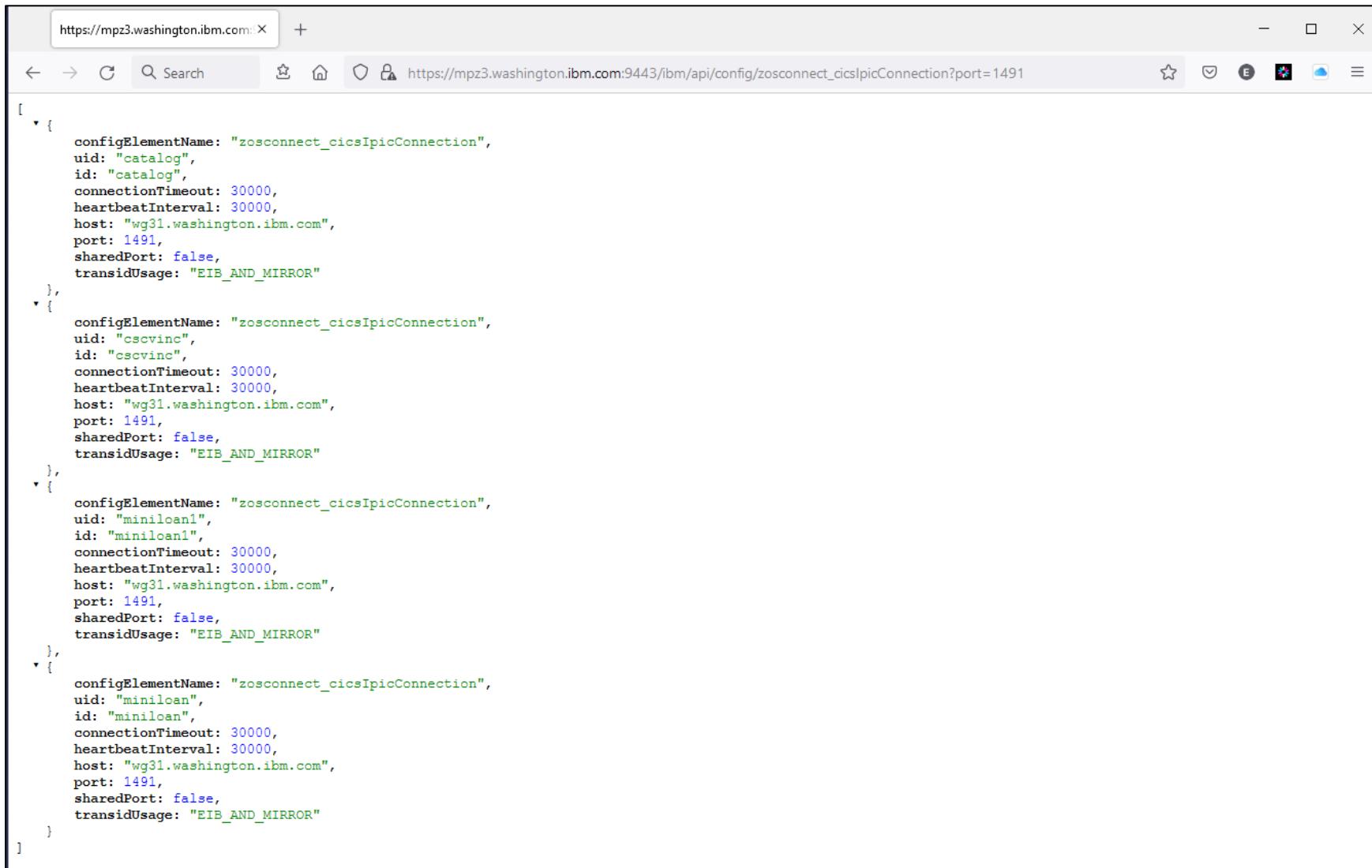


A screenshot of a web browser window displaying a JSON configuration object. The URL in the address bar is https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectServiceRestClientConnection?port=2446. The JSON content is:

```
[{"configElementName": "zosconnect_zosConnectServiceRestClientConnection", "uid": "Db2Conn", "id": "Db2Conn", "allowChunking": true, "basicAuthRef": {"configElementName": "zosconnect_zosConnectServiceRestClientBasicAuth", "uid": "dsn2Auth", "id": "dsn2Auth", "password": "*****", "userName": "USER1"}, "connectionTimeout": 30000, "host": "vg31.washington.ibm.com", "port": "2446", "receiveTimeout": 60000} ]
```

restConnector-2.0 feature

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

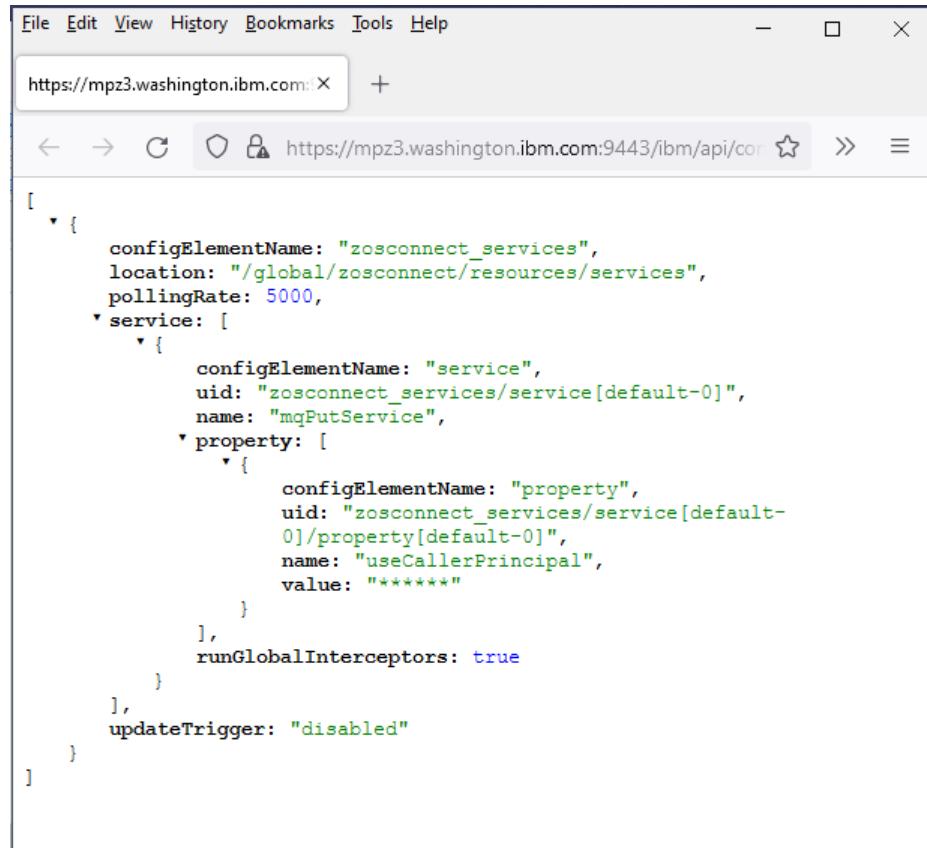


The screenshot shows a browser window with the URL https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491. The page displays a JSON array containing four objects, each representing a configuration element for a CICS IPIC connection. The objects have the following properties:

```
[{"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": "miniloan", "id": "miniloan", "connectionTimeout": 30000, "heartbeatInterval": 30000, "host": "wg31.washington.ibm.com", "port": 1491, "sharedPort": false, "transidUsage": "EIB_AND_MIRROR"}]
```

restConnector-2.0 feature

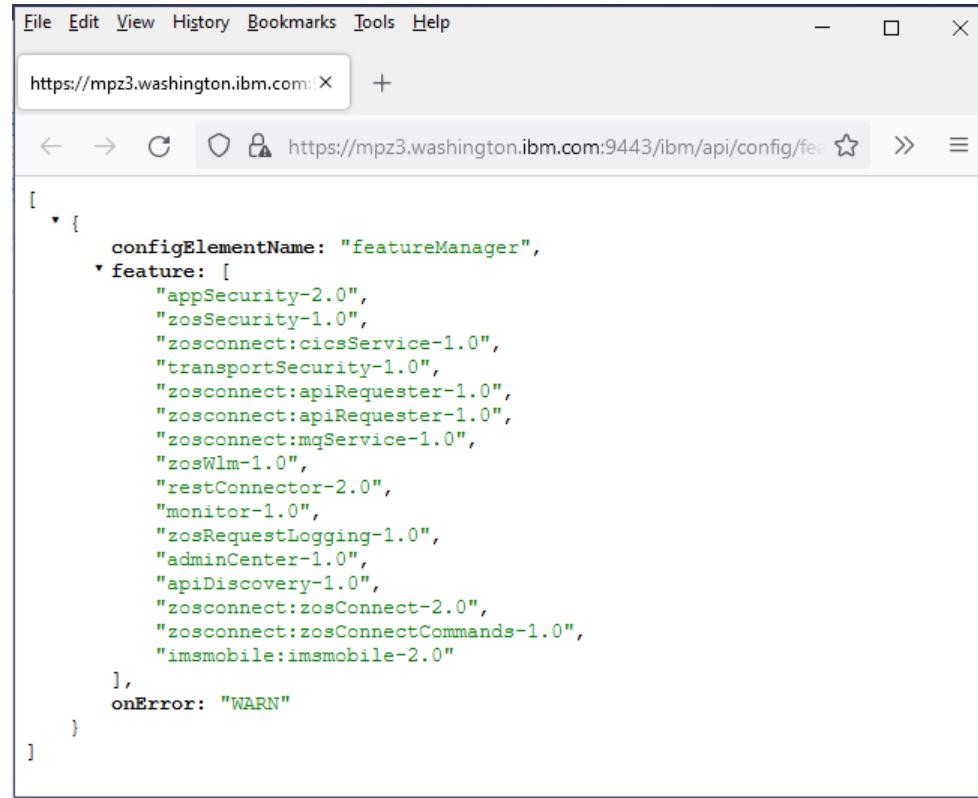
https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_services



The screenshot shows a browser window with the URL `https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_services`. The page displays a JSON object representing the configuration for the `zosconnect_services` element. The configuration includes a `location` of `/global/zosconnect/resources/services`, a `pollingRate` of 5000, a `service` array containing one item, and a `property` array containing one item. The `value` field for the property is set to `*****`.

```
[{"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



The screenshot shows a browser window with the URL `https://mpz3.washington.ibm.com:9443/ibm/api/config/featureManager`. The page displays a JSON object representing the configuration for the `featureManager` element. The configuration includes a `feature` array containing multiple items, such as `appSecurity-2.0`, `zosSecurity-1.0`, `zosconnect:cicsService-1.0`, and `restConnector-2.0`.

```
[{"configElementName": "featureManager", "feature": [{"name": "appSecurity-2.0"}, {"name": "zosSecurity-1.0"}, {"name": "zosconnect:cicsService-1.0"}, {"name": "transportSecurity-1.0"}, {"name": "zosconnect:apiRequester-1.0"}, {"name": "zosconnect:apiRequester-1.0"}, {"name": "zosconnect:mqService-1.0"}, {"name": "zosWlm-1.0"}, {"name": "restConnector-2.0"}, {"name": "monitor-1.0"}, {"name": "zosRequestLogging-1.0"}, {"name": "adminCenter-1.0"}, {"name": "apiDiscovery-1.0"}, {"name": "zosconnect:zosConnect-2.0"}, {"name": "zosconnect:zosConnectCommands-1.0"}, {"name": "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" with the URL <https://mpz3.washington.ibm.com:9443/api/explorer/#/cscvinc>. The page displays the "Liberty REST APIs" section, specifically the "cscvinc" API. It lists four operations: POST /cscvinc/employee, DELETE /cscvinc/employee/{employee}, GET /cscvinc/employee/{employee}, and PUT /cscvinc/employee/{employee}. Each operation is represented by a colored button (green for POST, red for DELETE, blue for GET, brown for PUT) followed by its path. Below the "cscvinc" section, there are links to other APIs: db2employee, filemgr, imsPhoneBook, jwtIvpDemoApi, miniloancics, mqapi, and phonebook, each with their own "Show/Hide", "List Operations", and "Expand Operations" buttons.

*V3.0.48

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 JOBNAME ZCEEAPIR PID 16777398
CWWKB0080I ACTIVE SERVER ASID 4b JOBNAME ZCEEDVM PID 50331780
CWWKB0080I ACTIVE SERVER ASID 4f JOBNAME WLPRPSRV PID 138
CWWKB0080I ACTIVE SERVER ASID 4a JOBNAME ZCEESRVR PID 50331815
CWWKB0080I ACTIVE SERVER ASID 50 JOBNAME ZCEEOPID PID 33554605
CWWKB0080I ACTIVE SERVER ASID 4c JOBNAME ZCEEHATS PID 143
CWWKB0080I ACTIVE SERVER ASID 4e JOBNAME WLPOPSRV PID 33554565
CWWKB0080I ACTIVE SERVER ASID 58 JOBNAME 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?

Where to find information when a problem occurs.



messages.log

```
mpz3
File Edit Settings View Communication Actions Window Help
File Edit Settings Menu Utilities Compilers Test Help
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/messages.log Columns 00100 00223
Command ==> Scroll ==> PAGE
000228 System Property com.ibm.lms.jdbcenvironment set to 'WAS' 000228
000229 Application serverConfig successfully installed in 5.685 seconds. 000229
000230 CWWKZ00140I: The application resources could not be started as it could not be found at location /var/zosconnect/servers/mySe 000230
000231 CWWKZ00130I: Starting application serverConfig. 000231
000232 CWWKZ00130I: The serverConfig application is using the expanded directory at the /var/zosconnect/servers/myServer location. 000232
000233 CWWKZ00130I: The serverConfig application is using the expanded directory at the /var/zosconnect/servers/myServer location. 000233
000234 CWWKZ00130I: Web Module myServer has been bound to default-host. 000234
000235 CWWKZ00162I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/server/config/ 000235
000236 CWWKZ00162I: A new session context will be created for application key default-host/server/config 000236
000237 CWWKZ00162I: Creating the session ID using the sessionRandom element definition for session ID generation. 000237
000238 SERVE91603I: A configuration file for a web server plugin was automatically generated for this server at /var/zosconnect/serv 000238
000239 SERVE91601I: Application serverConfig started in 0.036 seconds. 000239
000240 SERVE91601I: A configuration file for a web server plugin was automatically generated for this server at /var/zosconnect/serv 000240
000241 SERVE91601I: Application serverConfig started in 0.036 seconds. 000241
000242 CWWKZ00219I: TCP Channel defaulthttpPEndpoint-ssl has been started and is now listening for requests on host * (IPv6) port 94 000242
000243 CWWKF00121I: The server installed the following features: {adminCenter=1.0, apidiscovery=1.0, appsecurity=2.0, distributedMap 000243
000244 CWWKZ00111I: The myServer server is ready to run. Smarter planet. 000244
000245 CWWKZ00111I: The myServer server is ready to run. Smarter planet. The myServer server started in 17.991 seconds. 000245
000246 CWWKZ00111I: The authorized version of the SAF user registry is activated. Authentication will proceed using authorized nativ 000246
000247 CWWKZ00100A1: Authentication did not succeed for user ID user1. An invalid user ID or password was specified. 000247
000248 CWWKZ00100A1: Authentication did not succeed for user ID user1. An invalid user ID or password was specified. 000248
***** Bottom Of Data *****
Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23
```

First Failure Data Collection (FFDC) dumps

```
mpz3
File Edit Settings View Communication Actions Window Help
File Edit Settings Menu Utilities Compilers Test Help
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/ffdc/ffdcl_21.06.30_15.05.58.0.log Columns 00001 00124
Command ==> Scroll ==> PAGE
====+***** Top of Data *****+====+
==MSO* -Warning- The UNDO command is not available until you change
==MSO* your edit profile using the command RECOVERY ON.
000001 ---- Start of trace at 2021-06-30T15:05:58.000Z (IST0558+05 GMT)
000002 Exception = javax.net.ssl.SSLHandshakeException
000003 Source = com.ibm.ws.channel.ssl.internal.SSLReadServiceContext$SSLReadCompletedCallback
000004 ProbeId = 798
000005 StackTrace = at com.ibm.jss2.g.a(g.java:29)
000006 at com.ibm.jss2.bb.a(bb.java:35)
000007 at com.ibm.jss2.bb.bb(bb.java:29)
000008 at com.ibm.jss2.bb.bb(bb.java:29)
000009 at com.ibm.jss2.bb.bb(bb.java:29)
000010 at com.ibm.jss2.bb.bb(bb.java:71)
000011 at com.ibm.jss2.bb.bb(bb.java:45)
000012 at com.ibm.jss2.bb.bb(bb.java:31)
000013 at com.ibm.jss2.bb.bb(bb.java:64)
000014 at com.ibm.jss2.bb.bb(bb.java:199)
000015 at com.ibm.jss2.bb.unwrap(bb.java:106)
000016 at com.ibm.jss2.bb.unwrap(bb.java:21)
000017 at com.ibm.ws.channel.ssl.internal.SSLReadServiceContext.decryptMessage(SSLReadServiceContext.java:1212)
000018 at com.ibm.ws.channel.ssl.internal.SSLReadCompletedCallback.complete(SSLReadServiceContext.java:1600)
000019 at com.ibm.ws.tcpchannel.internal.AioReadCompletionListener.futureCompleted(AioReadCompletionListener.java:138)
***** Bottom Of Data *****
Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23
```

trace.out

```
mpz3
File Edit Settings View Communication Actions Window Help
File Edit Settings Menu Utilities Compilers Test Help
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/trace.log Columns 00001 00124
Command ==> Scroll ==> PAGE
====+***** Top of Data *****+====+
==MSO* -Warning- The UNDO command is not available until you change
==MSO* your edit profile using the command RECOVERY ON.
000001 ****+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
000002 -----| WIP FOR ZOSCONNECT |-----| OMEGACORE |-----| 00.48 (Wip-1.v0.53.c(210620210527-1900)
000003 Wip.InstallDir=/shared/IBM/zosconnect/v3r0/wip
000004 server.config.dir = /var/zosconnect/servers/myServer/
000005 java.home = /MARSH1/usr/PPC/java/j8_0_64
000006 os.name = Linux
000007 java.runtime = Java(TM) SE Runtime Environment (8.0_6.35 - pmz6480sr6fp05-20210714_01(SR6 FP35))
000008 os.version = 02.04.00; z390X (en_US)
000009 process = 16000000MPZ3
000010 traceSpecification=info:com.ibm.zosconnect.wv*FINEST:zosConnectAll|zosConnectServiceCicsAll
000011 ****+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
000012 [8/30/21 15:34:58:201 GMT] 000000064 id=e8994258 com.ibm.zosconnect.service.cics.internal.com.isc.connection < getVersion Ent
000013 [8/30/21 15:34:58:203 GMT] 000000064 id=e8994258 com.ibm.zosconnect.service.cics.internal.com.isc.connection < getVersion Ex
000014 [8/30/21 15:34:58:203 GMT] 000000064 connect.service.cics.internal.com.isc.headers.ISCHTTPHeader < init Entry
000015 [8/30/21 15:34:58:203 GMT] 000000064 id=00000000 connect.service.cics.internal.com.isc.headers.ISCHTTPHeader < init Header Ent
000016 [8/30/21 15:34:58:203 GMT] 000000064 id=00000000 connect.service.cics.internal.com.isc.headers.ISCHTTPHeader < init Header Ex
000017 [8/30/21 15:34:58:203 GMT] 000000064 id=438677cd connect.service.cics.internal.com.isc.headers.ISCV2HTTPHeader < init Entry
000018 [8/30/21 15:34:58:203 GMT] 000000064 id=438677cd connect.service.cics.internal.com.isc.headers.ISCV2HTTPHeader < init Exit
000019
***** Bottom Of Data *****
Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23
```

SYSLOG/STC JESMSGLG DD

```
mpz3
File Edit Settings View Communication Actions Window Help
Display Elter View Print Options Search Help
SDSF OPERLOG MPZ3 06/30/2021 @W
COMMAND INPUT ==> SDSSF OUTPUT DISPLAY BAQSTRT STC10771 DSD 103 LINE 84 COLS 02-133
SDSF OPERLOG MPZ3 06/30/2021 @W
COMMAND INPUT ==> SDSSF OUTPUT DISPLAY BAQSTRT STC10771 DSD 103 LINE 84 COLS 02-133
CWWKZ00131I: Resource manager BBG.DEFAULT.DA38C9E1985D0C11.IBM with 337
00200000 MPZ3 21242 13:20:25.35 STC10771 000000290 +CWWKZ00131I: Resource manager BBG.DEFAULT.DA38C9E1985D0C11.IBM with 337
00000000 MPZ3 21242 13:20:25.36 STC10771 000000290 the corresponding token ID of 01000001023805f80000000900000007 has
00000000 MPZ3 21242 13:20:25.36 STC10771 000000290 successfully restarted with Resource Recovery Services (RRS). Number
00000000 MPZ3 21242 13:20:25.36 STC10771 000000290 of resource manager 339
00000000 MPZ3 21242 13:20:25.36 STC10771 000000290 +CWWKZ00131I: Resource manager BBG.DEFAULT.DA38C9E1985D0C11.IBM with 337
00000000 MPZ3 21242 13:20:25.41 STC04167 000000090 +CWWKZ00131I: Resource manager BBG.DEFAULT.DA38C9E1985D0C11.IBM with 337
00000000 MPZ3 21242 13:20:25.41 STC04167 000000090 DSNI133I: -DSNB DSNMVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
00000000 MPZ3 21242 13:20:25.44 STC10771 000000290 +CWWKZ00131I: Application serverConfig started in 0.056 seconds.
00000000 MPZ3 21242 13:20:25.92 STC10771 000000090 DSNI133I: -DSNB DSNMVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
00000000 MPZ3 21242 13:20:25.92 STC10771 000000090 +CWWKZ00131I: The myServer server is ready to run a smarter Planet. The
00000000 MPZ3 21242 13:20:30.95 STC10771 000000090 341
00000000 MPZ3 21242 13:20:30.95 STC10771 000000090 MServer server started in 17.991 seconds.
00000000 MPZ3 21242 13:20:30.95 STC10771 000000090 ICH408I USER1 GROUP(SYS1) NAME( ) GROUP(SYS1) NAME( ) 342
00000000 MPZ3 21242 13:20:30.95 STC10771 000000090 ICH408I USER1 GROUP(SYS1) NAME( ) GROUP(SYS1) NAME( ) 343
00000000 MPZ3 21242 13:20:35.53 STC04167 000000090 DSNI133I: -DSNB DSNMVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
00000000 MPZ3 21242 13:21:00.13 STC04167 000000090 DSNI133I: -DSNB DSNMVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
00000000 MPZ3 21242 13:21:00.56 STC04190 000000090 +CSQX251I ZMQA CSQXSTRL Listener started, TRPTYPE=TCP INDISP=QMGR
00000000 MPZ3 21242 13:21:00.56 STC04190 000000090 +CSQX218E ZMQA CSQXLST Listener not started - unable to bind, 245
***** Bottom Of Data *****
Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23
```

STC STDOUT DD

```
mpz3
File Edit Settings View Communication Actions Window Help
Display Elter View Print Options Search Help
SDSF OUTPUT DISPLAY BAQSTRT STC10771 DSD 103 LINE 84 COLS 02-133
COMMAND INPUT ==> SDSSF OUTPUT DISPLAY BAQSTRT STC10771 DSD 103 LINE 84 COLS 02-133
YAUDIT **BADR7130I: z/OS Connect EE API miniapicnics was registered successfully for API Discovery.
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/ibm/api/explorer/
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/api/docs/
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/api/explorer/
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/ibm/api/
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/IBMIMXConnectorREST/
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/adminCenter/serverConfig-i
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/adminCenter/explore-1.0/
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/adminCenter/
YAUDIT **CWWKZ00161I: Web application available (default-host): http://dvipa.washington.ibm.com:9080/adminCenter/
YAUDIT **J2CA7001II: Resource adapter qmoxa installed in 4.766 seconds.
YAUDIT **J2CA7001II: Resource adapter imsdbJLocal installed in 5.685 seconds.
YAUDIT **J2CA7001II: The application resource could not be started as it could not be found at location /var/zosconnect/servers/m
YAUDIT **CWWKZ00111I: Application serverConfig started in 0.036 seconds.
YAUDIT **CWWKZ00121I: The server installed the following features: {adminCenter=1.0, apidiscovery=1.0, appsecurity=2.0, distributed
YAUDIT **CWWKZ00121I: The myServer server is ready to run. Smarter planet. The myServer server started in 17.991 seconds.
YAUDIT **CWWKZ00100A1: Authentication did not succeed for user ID user1. An invalid user ID or password was specified.
YAUDIT **CWWKZ00100A1: Authentication did not succeed for user ID user1. An invalid user ID or password was specified.
***** Bottom Of Data *****
Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23
```



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 file



```
*****
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.TCPPort
[9/3/21 13:38:42:431 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPPort
[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
I 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 CWK00219I: TCP Channel defaultHttpEndpoint has been s
I CWK00219I: 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  
-----  
SDFS 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 server config started in 0.086 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 //BAQSTRT 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 – Sometimes you must 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:

The screenshot shows a terminal window titled "WG31". The menu bar includes File, Edit, Settings, View, Communication, Actions, Window, Help, and a bottom row of File, Edit, Edit_Settings, Menu, Utilities, Compilers, Test, Help. The main pane displays the contents of the file "/MPZ3/var/zosconnect/servers/myServer/logs/messages.log". The log entries are in green text. The window has standard OS X-style controls at the top right.

```
VIEW      /MPZ3/var/zosconnect/servers/myServer/logs/messages.log          Columns 00100 00223  
Command ==> _  
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 *****  
MA B 04/015  
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
```

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	K 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



Basic security issues – Sometimes there is misdirection



The STDOUT may show:

```
WG31
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
-----  
SDSF OUTPUT DISPLAY BAQSTRT STC12844 DSID 103 LINE 98 COLS 02- 133  
COMMAND INPUT ==> SCROLL ==> PAGE  
YAUDIT " CWWKZ0001I: Application serverConfig started in 4.006 seconds.  
YAUDIT " CWWKZ0001I: Application resources started in 4.007 seconds.  
YAUDIT " CWWKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/zosConnect/apiRequesters/  
YAUDIT " CWWKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/  
YAUDIT " CWWKF0012I: The server installed the following features: YadminCenter-1.0, apiDiscovery-1.0, appSecurity-2.0, distributed  
YAUDIT " CWWKF0011I: The myServer server is ready to run a smarter planet. The myServer server started in 66.646 seconds.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
***** BOTTOM OF DATA *****
```

MA B
Connected to remote server/host mpz3 using lu/pool MPZ30019 and port 23 04/021



Basis security issues - Use the SYSLOG/JESMSGLG 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
COMMAND INPUT ==>
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
E 422 00000090 RC=00000024
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
E 424 00000090 RC=00000024
N 4000000 MPZ3 21259 16:50:19.10 STC11010 00000090 +CSQX125I ZMQ3 CSQXSMFT SMF data incomplete
N 0000000 MPZ3 21259 16:50:20.66 00000281 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 DSNW123I -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
MA B
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
04/021
```

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 +CWJWKE0001I: The server myServer has been launched.
16.32.20 STC12862 BPXM023I (LIBSERV) 282
282 GMOIG7777I: IMS service provider (20210816-0926) for z/OS Connect
282 Enterprise Edition initialized successfully.
16.32.50 STC12862 +CWJWKZ0001I: Application resources started in 14.912 seconds.
16.32.50 STC12862 +CWJWKZ0001I: Application serverConfig started in 14.910 seconds.
16.32.55 STC12862 +CWJWF0011I: 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 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/shared.xml
000022 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/oauth.xml
000023 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/audit.xml
000024 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/mq.xml
000025 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/db2.xml
000026 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/wlm.xml
000027 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/restConnector.xml
000028 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/smf.xml
000029 CWWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/adminCenter.xml
000030 CWWKB0125I: This server requested a REGION size of 0KB. The below-the-line storage limit is 8MB and the above-the-line storag
000031 CWWKB0126T: MEM1 TMTT=2AAA. MEM1 TMTT CONFIGURATION SOURCE=TCI
000032 CWWKB0101I: The angel process is not available. No authorized services will be loaded. The reason code is 4.
000033 CWWKB0104I: Authorized service group KERNEL is not available.
000034 CWWKB0104I: Authorized service group LOCALCOM is not available.
000035 CWWKB0104I: Authorized service group PRODMGR is not available.
000036 CWWKB0104I: Authorized service group SAFCREC is not available.
000037 CWWKB0104I: Authorized service group TXRRS is not available.
000038 CWWKB0104I: Authorized service group WOLA is not available.
000039 CWWKB0104I: Authorized service group ZOSAIO is not available.
000040 CWWKB0104I: Authorized service group ZOSDUMP is not available.
000041 CWWKB0104I: Authorized service group ZOSWLM is not available.
000042 CWWKB0104I: Authorized service group CLIENT.WOLA is not available.
000043 CWWKB0108I: 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:

```
WARNING -- 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 – look somewhere else

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 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)
```

A J2CA0056I: The Connection Manager received

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 14:19:29:291 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



```
-----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.proxy.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"
```

z/OS Connect Java classes

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
BPX1CLO: RetVal = 0, RC = 0, Reason = 0x00000000
GetAddrInfo Failed: RetVal = -1, RC = 1, Reason = 0x78AE1004
GetAddrInfo Ended: 2021/09/12 12:55:32.364732
*****
EZZ3111I 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



The messages.log states a First Failure Data Collection dump of the issues has been created.

```
[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.'
```



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.createManagedJMSSConnection(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



A FFDC dump showing an 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.

Tech-Tip: Use the Java JSSE debugging utility to enable SSL tracing at the Java level.

Use the Java runtime directive `-Djavax.net.debug` to enable this tracing by setting this directive value to `ssl`, e.g. **`-Djavax.net.debug=ssl`**. For more options regarding additional trace options SSL tracing available, see URL <https://www.ibm.com/docs/en/sdk-java-technology/8?topic=troubleshooting-debugging-utilities>

Using this directive requires the Java SDK be at Version 8, service release 6, fix pack 36 or later release level.



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.SSLException: Received fatal alert: bad_certificate error (handshake), vc=1083934466
Caught exception during unwrap, javax.net.ssl.SSLException: 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. Of 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.

Tech/Tip: Use the Java directive `javax.net.debug=ssl,handshake` to enable Java SSL tracing

Add this directive to the JVM properties `-Djavax.net.debug=ssl,handshake`

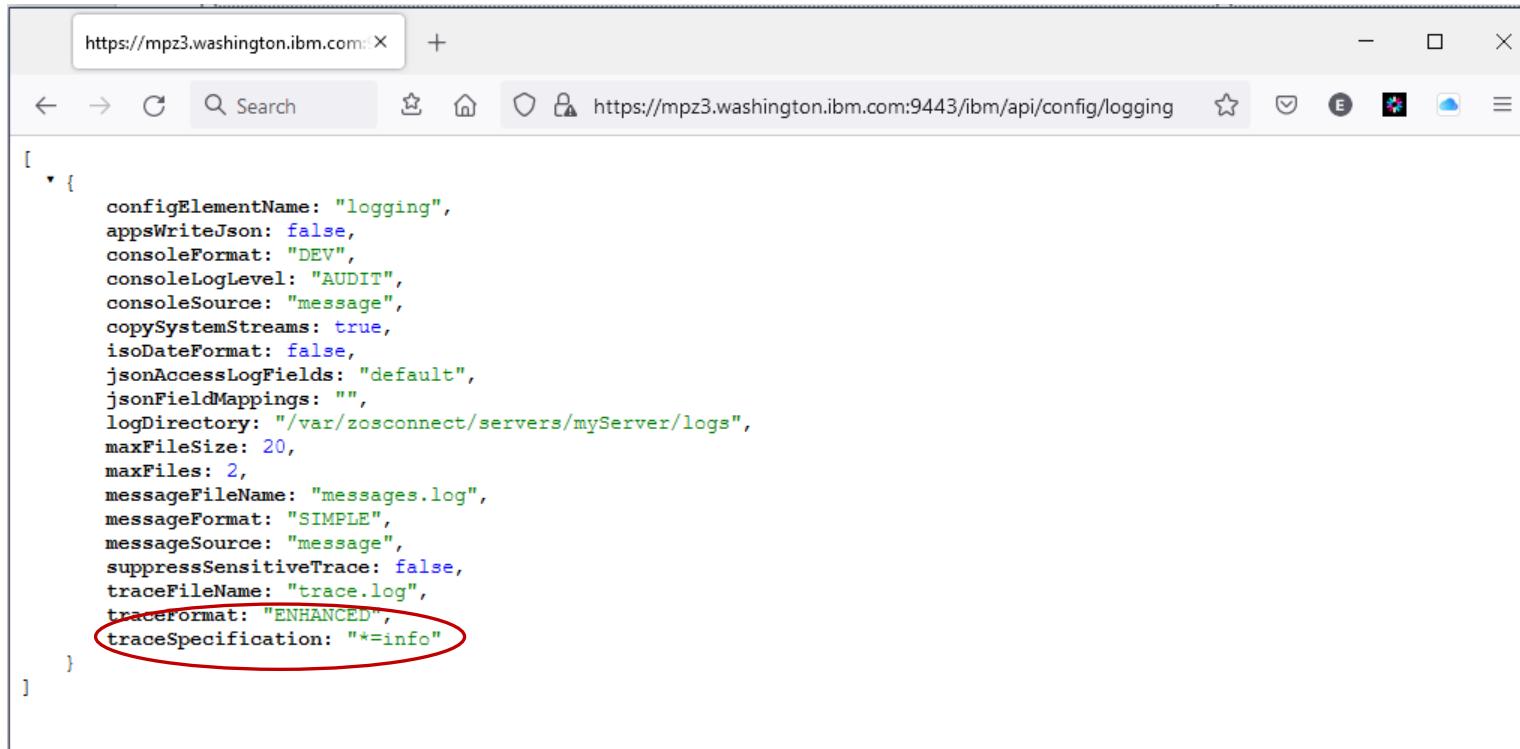
```
.java:1168|JsseJCE: Using cipher DES/CBC/NoPadding from provider TBD via init
.java:1168|JsseJCE: Using cipher RC4 from provider TBD via init
.java:1168|JsseJCE: Using cipher DES/CBC/NoPadding from provider TBD via init
.java:1168|JsseJCE: Using cipher DESede/CBC/NoPadding from provider TBD via init
-
-
-
.java:1168|JsseJCE: Using cipher AES/GCM/NoPadding from provider TBD via init
.java:1168|JsseJCE: Using cipher ChaCha20-Poly1305 from provider TBD via init
-
-
-
.java:1168|JsseJCE: Using KeyGenerator IbmTlsExtendedMasterSecret from provider TBD via init
.java:1168|JsseJCE: Using signature SHA1withECDSA from provider TBD via init
.java:1168|JsseJCE: Using signature NONEwithECDSA from provider TBD via init
-
-
-
.java:1168|Consuming ClientHello handshake message (
-
-
-
.java:1168|Consumed extension: supported_versions
.java:1168|Negotiated protocol version: TLSv1.2
-
-
-
.java:1168|Produced ServerHello handshake message (
-
-
-
.java:1168|Produced server Certificate handshake message (
-
-
-
.java:1168|Produced ECDH ServerKeyExchange handshake message (
-
-
-
.java:1168|Produced ServerHelloDone handshake message (
-
-
-
.java:1168|Consuming ECDHE ClientKeyExchange handshake message (
-
-
-
.java:1168|Consuming ChangeCipherSpec message
-
-
-
.java:1168|Consuming client Finished handshake message (
-
-
-
.java:1168|Produced ChangeCipherSpec message
.java:1168|Produced server Finished handshake message (
-
-
-
```

For more details, see URL <https://www.ibm.com/docs/en/sdk-java-technology/8?topic=troubleshooting-debugging-utilities>

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

First, the current active trace specification settings can be display 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 specifications

- 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/var/zosconnect/servers/myServer/logs/trace.log Columns 00101 00252
Command <=> PAGE

003637 > getSSLConfig: DefaultSSLSettings Entry - 4 Line(s) not Displayed
003638 < getSSLConfig Exit
003639 SSLConfig.toString() {
003683 > determineIfCSIV2SettingsApply Entry - 43 Line(s) not Displayed
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 - 44 Line(s) not Displayed
003731 3 trustStoreType: JCERACFKS
003734 3 keyStore: safkeyring:///Liberty.KeyRing - 2 Line(s) not Displayed
003735 3 keyStoreName: CellDefaultKeyStore
003736 3 keyStorePassword: *****
003737 3 trustStore: safkeyring:///Liberty.KeyRing - 1 Line(s) not Displayed
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) - 1 Line(s) not Displayed
004117 K 3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain - 375 Line(s) not Displayed
004119 3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain - 1 Line(s) not Displayed
004142 (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl) - 22 Line(s) not Displayed
004144 > isTransportSecurityEnabled Entry - 1 Line(s) not Displayed
004145 < isTransportSecurityEnabled true Exit
004150 > getSSLConfig: DefaultSSLSettings Entry - 4 Line(s) not Displayed
004151 < getSSLConfig Exit
004152 SSLConfig.toString() {
004196 > determineIfCSIV2SettingsApply Entry - 43 Line(s) not Displayed
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 - 44 Line(s) not Displayed
004243 3 keyStoreType: JCERACFKS - 2 Line(s) not Displayed
004244 3 trustStoreType: JCERACFVK
004247 3 keyStore: safkeyring:///Liberty.KeyRing - 1 Line(s) not Displayed
004248 3 keyStoreName: CellDefaultKeyStore
004249 3 keyStorePassword: *****
004250 3 trustStore: safkeyring:///Liberty.KeyRing - 375 Line(s) not Displayed
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) - 1 Line(s) not Displayed
004630 K 3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain - 1 Line(s) not Displayed
004632 3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain - 22 Line(s) not Displayed
004655 (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl) - 1 Line(s) not Displayed
004657 > isTransportSecurityEnabled Entry - 1 Line(s) not Displayed
004658 < isTransportSecurityEnabled true Exit

MA A 03/019

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

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
 - Dcom.ibm.java.diagnostics.healthcenter.socket.readwrite=on
 - Dcom.ibm.java.diagnostics.healthcenter.headless.files.to.keep=2
 - Dcom.ibm.java.diagnostics.healthcenter.headless.delay.start=value=0
 - Dcom.ibm.java.diagnostics.healthcenter.headless.run.pause.duration=0
 - Dcom.ibm.java.diagnostics.healthcenter.headless.run.duration=0
 - Dcom.ibm.java.diagnostics.healthcenter.headless.run.number.of.runs=0
 - Dcom.ibm.diagnostics.healthcenter.readonly=on
- run without a client
directory where HCD will be stored
collect socket sent/receive data
number of HCD files to retain
delay start value in minutes
pause between runs, in minutes
run duration, in minutes
number of runs
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

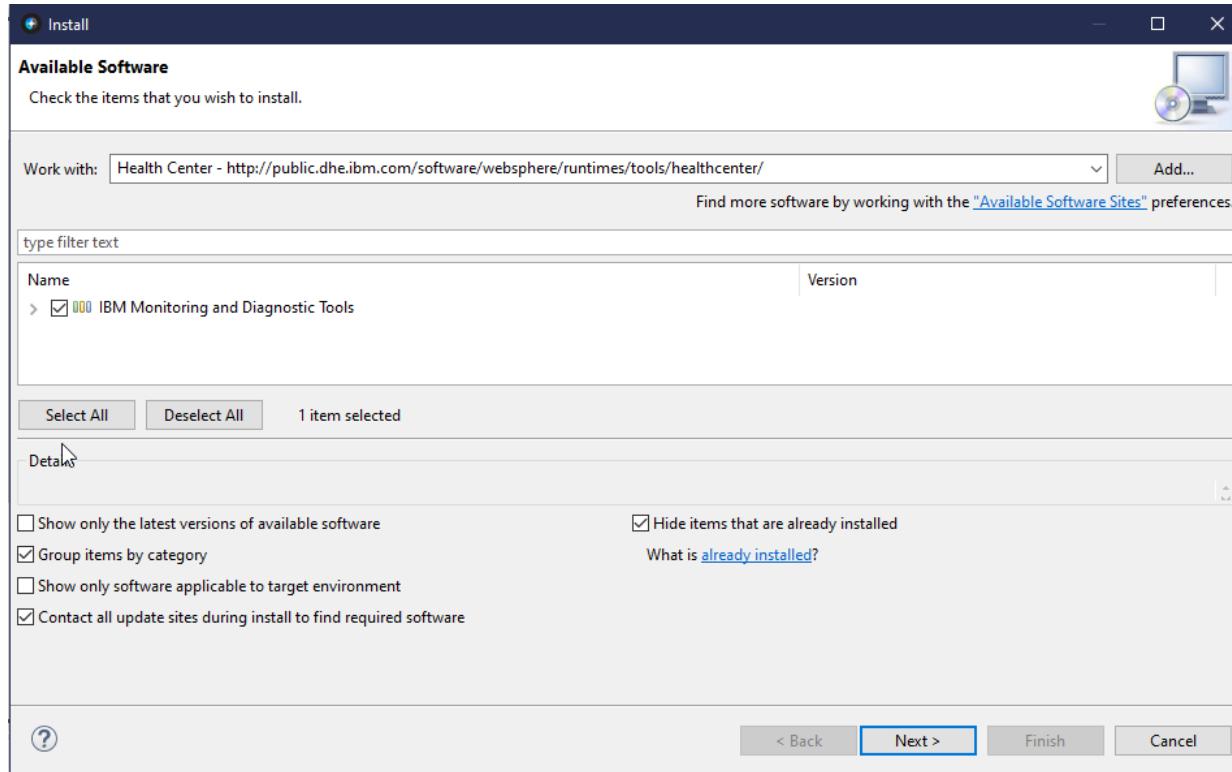
SYS1.PROCLIB (BAQSTRT)

```
//BAQSTRT PROC PARMS='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



The screenshot shows the Java Health Center interface in Eclipse, specifically the Garbage Collection perspective.

Left Sidebar: A tree view of monitoring categories: CPU, Classes, Environment, Events, Garbage Collection, I/O, Locking, Method Profiling, Method Trace, Native Memory, Network, and Threads. Most categories have a green checkmark icon.

Top Center: A graph titled "Heap and pause times" showing "Used heap (after collection)" (solid purple line), "Heap size" (dashed green line), and "Pause time" (dotted blue line) over "elapsed time (minutes)". The x-axis ranges from 0:00 to 0:36, and the y-axis has two scales: "size (MB)" (0 to 100) and "time (ms)" (0.0 to 50.0). The graph shows a general upward trend in heap usage, with several sharp spikes in pause times between 0:12 and 0:30.

Middle Left: A table titled "Analysis and Recommendations" containing various garbage collection metrics. Some rows have a small error icon (red exclamation mark).

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

Middle Right: A summary table titled "Tool: IBM Monitoring and Diagnostic Tools - Health Center > IBM Monitoring and Diagnostic Tools - Health Center > Viewing the data collected > Garbage collection perspective". It lists sections like "Using the garbage collection perspective", "Views for basic garbage collection information", and "Views for detailed garbage collection information".

Bottom Right: Copyright notice: © 2017, 2022 IBM Corporation

Java Health Center – Network analysis example



smf - Eclipse

File Edit Navigate Search Project Data Run Monitored System Window Help

Status Connection Sockets

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

Socket ID filter: Apply Clear

ID	Type	IP Address	Port	Data sent	Data received	State	Thread [ID] Name
102	Client	0:0:0:0:ffff:c0a8:11c9	1491	116043 bytes	42284 bytes	Closed	[0x29d2fa00] Equino...
103	Client	0:0:0:0:ffff:c0a8:11c9	1491	116043 bytes	42284 bytes	Open	[0x2a00aa00] Default...
112	Server	0:0:0:0:ffff:c0a8:3c	65470	32953 bytes	38334 bytes	Open	[0x2a253d00] Shared...
127	Server	0:0:0:0:ffff:c0a8:3c	59411	116043 bytes	42284 bytes	Closed	[0x2a019f00] Default...
136	Server	0:0:0:0:ffff:c0a8:11c9	2446	87343 bytes	98768 bytes	Open	[0x2b38c800] Default...
138	ServerS...	0:0:0:0:0:0	9080	116043 bytes	42284 bytes	Open	[0x2a253d00] Shared...
144	Server	0:0:0:0:ffff:c0a8:3c	59412	4248 bytes	8818 bytes	Open	[0x2a019f00] Default...
164	ServerS...	0:0:0:0:0:0	9443	116043 bytes	42284 bytes	Open	[0x2a253d00] Shared...
176	Client	0:0:0:0:ffff:c0a8:11c9	4000	182558 bytes	186691 bytes	Closed	[0x2a00aa00] Default...
183	Client	0:0:0:0:ffff:c0a8:11c9	4000	182558 bytes	186691 bytes	Open	[0x2a14f400] Default...
186	Server	0:0:0:0:ffff:c0a8:11f3	7883	116043 bytes	42284 bytes	Open	[0x2a253d00] Shared...
196	Server	0:0:0:0:ffff:c0a8:3c	61723	116043 bytes	42284 bytes	Closed	[0x29fcbb00] Default...
204	Server	0:0:0:0:ffff:c0a8:11f3	7880	1428 bytes	602 bytes	Open	[0x2a253d00] Shared...
215	Client	0:0:0:0:ffff:c0a8:11c9	1491	116825 bytes	62048 bytes	Open	[0x2b38c800] Default...
226	Server	0:0:0:0:ffff:c0a8:11f3	7863	2447 bytes	1059 bytes	Closed	[0x2a00aa00] Default...
227	Server	0:0:0:0:ffff:c0a8:11f3	9463	9892 bytes	8675 bytes	Open	[0x2aa3c100] Default...
228	Server	0:0:0:0:ffff:c0a8:11f3	7849	116043 bytes	42284 bytes	Closed	[0x29fcbb00] Default...
230	Server	0:0:0:0:ffff:c0a8:11f3	7850	39936 bytes	54048 bytes	Open	[0x2a00aa00] Default...
231	Server	0:0:0:0:ffff:c0a8:11f3	9463	10868 bytes	7460 bytes	Open	[0x2a14f400] Default...
233	Server	0:0:0:0:ffff:c0a8:11f3	9463	22059 bytes	11436 bytes	Open	[0x2a00aa00] Default...
224	Server	0:0:0:0:ffff:c0a8:11f3	7810	116043 bytes	42284 bytes	Closed	[0x2b38c800] Default...

Sockets open Network I/O

number (amount)

elapsed time (minutes)

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:

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.logging...)
264	2.56	■	2.56	■	java.math.Division.monReduction(int[], java.math.BigInteger, int)
183	1.77	■	1.79	■	java.math.Multiplication.monReduction(int[], java.math.BigInteger, int)
172	1.67	■	2.32	■	javax.security.auth.Subject.toString(boolean)
150	1.45	■	1.47	■	java.math.DivisionLong.monReduceSq(long[], long[], 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.DivisionLong.monMulSq(long[], int, long[])
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.logging...)
92	0.89	■	1.31	■	org.eclipse.osgi.internal.loader.BundleActivator.start(BundleContext)

Sample based profile

Filter methods:

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.logging...)
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.DivisionLong.monReduceSq(long[], long[], long, int, long[])
54	1.39	■	1.94	■	javax.security.auth.Subject.toString(boolean)
53	1.37	■	1.45	■	java.math.DivisionLong.monMulSq(long[], int, long[])
51	1.32	■	1.63	■	com.ibm.crypto.provider.P256PrimeField.a(int[])
43	1.11	■	3.59	■	java.math.Multiplication.multPAP(int[], int[], int[], int, int)
39	1.01	■	5.01	■	com.ibm.ws.logging.internal.impl.BaseTraceFormatter.formatObj(java.lang.Object)
27	0.7	■	1.47	■	com.ibm.ws.logging.internal.impl.BaseTraceFormatter.createFormattedMessage(java.util.logging...

Sample based profile

Invocation paths Called methods Timeline Method trace summary

number (#) elapsed time (minutes)

2:30 5:00

elapsed time (minutes)

number (#) elapsed time (minutes)

1:48 1:54 2:00 2:06 2:12 2:18 2:24

elapsed time (minutes)

Liberty Admin Center feature provides real time monitoring



Liberty Admin Center x +

Search Search Home Lock https://mpz3.washington.ibm.com:9443/adminCenter/#explore/monitor

Explore

myServer

Overview Applications Monitor Configure

Used Heap Memory
Used: 86.2 MB Committed: 125.5 MB Max: 512.0 MB
This chart has no historical data. It will continue to show the most recent 10 minutes of data.

Loaded Classes
Loaded: 13,495 Unloaded: 0 Total: 13,495

Active JVM Threads
Live: 54 Total: 87 Peak: 67

CPU Usage
CPU Usage: 1.5%
This chart has no historical data. It will continue to show the most recent 10 minutes of data.

Active Sessions
Showing live data

Active Liberty Threads
Showing live data

mitchj@us.ibm.com



Workload Manager - Definitions



WLM Report Classes

```
mpz3
File Edit Settings View Communication Actions Window Help
Report-Class View Notes Options Help
Report Class Selection List Row 1 to 12 of 12
Command ===> _____
Action Codes: 1=Create, 2=Copy, 3=Modify, 4=Browse, 5=Print, 6=Delete,
              /=Menu Bar
Action Name Description
User Date
--- Last Change ---
BAQSTC
WMQFTE
WMQFTER
WMQFTEZ
ZCEEADM
ZCEEAPIR
ZEECICS
ZEEDB2
ZEEIMS
ZCEEMQ
ZEEOTHR
ZCEESTC
JOHNSON 2021/09/04
JOHNSON 2011/08/31
JOHNSON 2011/08/31
JOHNSON 2011/08/31
JOHNSON 2021/08/02
JOHNSON 2021/08/05
JOHNSON 2021/08/05
JOHNSON 2021/08/05
JOHNSON 2021/08/05
JOHNSON 2021/08/05
JOHNSON 2021/08/02
JOHNSON 2021/09/02
***** Bottom of data *****
M A 10/004
Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23
```

WLM Service Classes

```
mpz3
File Edit Settings View Communication Actions Window Help
Service-Class Xref Notes Options Help
Modify a Service Class Row 1 to 2 of 2
Command ===> _____
Service Class Name . . . . . : OPS_HIGH
Description . . . . . : System Tasks Velocity 70
Workload Name . . . . . : STC_WKL (name or ?)
Base Resource Group . . . . . : (name or ?)
Cpu Critical . . . . . : NO (YES or NO)
I/O Priority Group . . . . . : NORMAL (NORMAL or HIGH)
Honor Priority . . . . . : DEFAULT (DEFAULT or NO)

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 *****

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

WLM "CB" Classification Rules

```
mpz3
File Edit Settings View Communication Actions Window Help
Subsystem-Type Xref Notes Options Help
Modify Rules for the Subsystem Type Row 1 to 8 of 16
Command ===> _____ Scroll ==> PAGE
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
-----Qualifier----- -----Class-----
1 CN myServer
2 TC TCADM
2 TC TCAPIR
2 TC TCCICS
2 TC TCDB2
2 TC TCIMS
2 TC TCMQ
2 TC TCOTHR
DEFAULTS: OPS_HIGH ZCEEOTHR
OPS_HIGH BAQSTC
OPS_HIGH ZCEEADM
OPS_HIGH ZCEEAPIR
OPS_HIGH ZEECICS
OPS_HIGH ZEEDB2
OPS_HILO ZEEIMS
OPS_MED ZCEEMQ
OPS_LOW ZEEOTHR
M A 07/021
Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23
```

```
mpz3
File Edit Settings View Communication Actions Window Help
Subsystem-Type Xref Notes Options Help
Modify Rules for the Subsystem Type Row 9 to 16 of 16
Command ===> _____ Scroll ==> PAGE
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
-----Qualifier----- -----Class-----
1 CN zceex
2 TC TCADM
2 TC TCAPIR
2 TC TCCICS
2 TC TCDB2
2 TC TCIMS
2 TC TCMQ
2 TC TCOTHR
DEFAULTS: OPS_HIGH ZCEEOTHR
OPS_HIGH ZCEESTC
OPS_HIGH ZCEEADM
OPS_HIGH ZCEEAPIR
OPS_HIGH ZEEDB2
OPS_HILO ZEECICS
OPS_HILO ZEEIMS
OPS_MED ZCEEMQ
OPS_HILO ZEEOTHR
M A 07/021
Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23
```

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"
10    resource="/cscvinc/employee/*" method="GET"/>
11  <httpClassification transactionClass="TCDB2"
12    resource="/db2/employee/*" method="GET"/>
13  <httpClassification transactionClass="TCIMS"
14    resource="/phonebook/contacts/*"/>
15  <httpClassification transactionClass="TCIMS"
16    resource="/phonebook/contacts" METHOD="POST"/>
17  <httpClassification transactionClass="TCMQ"
18    resource="/mapapi/*" METHOD="POST"/>
19  <httpClassification transactionClass="TCMQ"
20    resource="/mapapi/*" METHOD="GET"/>
21  <httpClassification transactionClass="TCAPIR" resource="/zosConnect/apiRequesters/**/*"/>
22  <httpClassification transactionClass="TCADM" resource="/zosConnect/**/*"/>
23  <httpClassification transactionClass="TCOTHR" />
24</wlmClassification>
25
26<zosWorkloadManager collectionName="${wlp.server.name}"/>
27
28<zosWlmHealth interval="30" increment="15"/>
29
30</server>
31
```

Related to WLM CN name.

mpz3

File Edit Settings View Communication Actions Window Help

Subsystem-Type Xref Notes Options Help

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

Command ==> Scroll ==> PAGE

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 S=Insert Sub-rule More ==>

Action	Type	Name	Start	Service	Report
1	CN	zceex*		OPSLHIGH	ZCEEOTHR
2	TC	TCADM		OPSLHIGH	ZCEEADM
2	TC	TCAPIR		OPSLHIGH	ZCEEAPIR
2	TC	TCCICS		OPSLHIGH	ZCEEBCS
2	TC	TCIMS		OPSLHIGH	ZCEEIMS
2	TC	TCMQ		OPSMED	ZCEEMQ
2	TC	TCOTHR		OPSLHIGH	ZCEEOTHR

MA B 07/02/21

Connected to remote server/host mpz3 using lu/pool MPZ30048 and port 23

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 the following fields:

- configElementName: "httpClassification"
- uid: "wlmClassification[default-0]/httpClassification[default-4]" (or similar for other indices)
- host: "*"
- method: "POST", "GET", or others
- port: "*"
- resource: "/mqapi/*", "/zosConnect/apiRequesters/*", or others
- transactionClass: "TCMQ", "TCAPIR", "TCADM", or "TCOTHR"

```
[{"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.FFFFFFF TRA

	Avg	Actual	Total	Mobile	Cat	
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	CPU	1.967	CP	0.02	BLK	
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.FFFFFFF TRANS-APPL%----CP-IIPCP/AAPCP-IIP/AAP ---ENCLAVES---

	Avg	Actual	Total	0.12	0.12	0.73	Avg Enc	0.14
Avg	0.14	ACTUAL	424835	TOTAL	0.12	0.12	0.73	0.14
MPL	0.14	EXECUTION	424707	MOBILE	0.00	0.00	0.00	0.00
ENDED	200	QUEUED	126	CATEGORYA	0.00	0.00	0.00	0.00
END/S	0.33	R/S AFFIN	0	CATEGORYB	0.00	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	CPU	5.073	CP	0.12	BLK	0.000	SSCHRT	2.4	Avg	0.00	SINGLE	0.0
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>

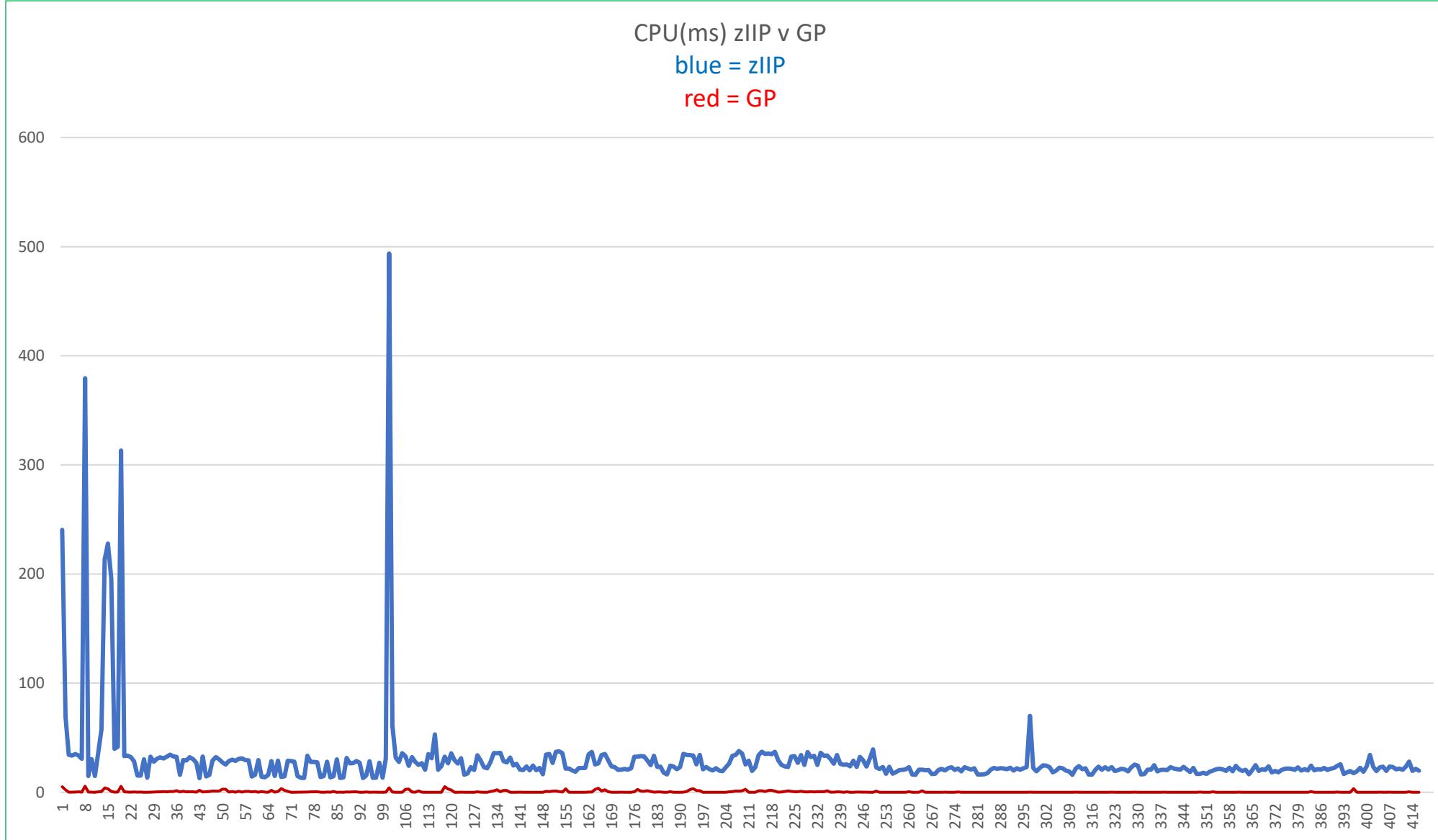
The screenshot shows the 'Server Config' interface with a blue header bar. On the left is a briefcase icon, in the center is the title 'Server Config', and on the right are icons for user profile and save. Below the header is a dark navigation bar with the text 'smf.xml' on the left and 'Read only' and 'Close' buttons on the right. Underneath is a toolbar with 'Design' and 'Source' tabs, where 'Source' is currently selected. To the right of the tabs is a gear icon. The main area contains the XML configuration code:

```
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>

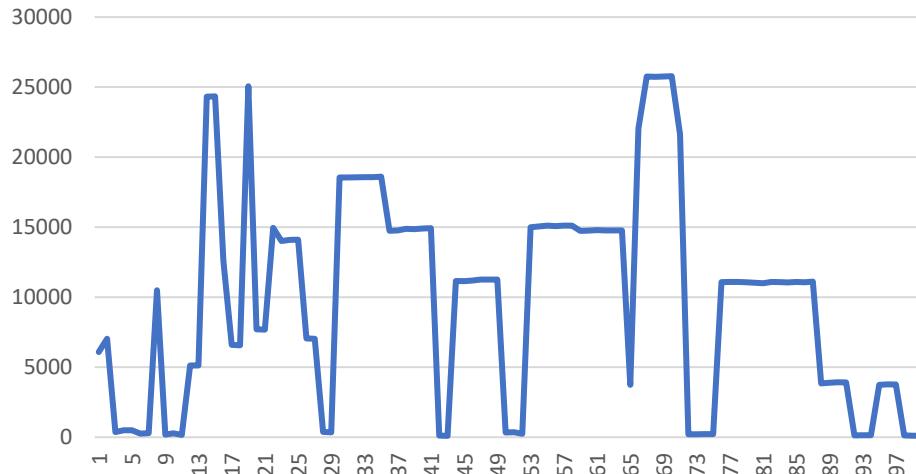
Liberty SMF 120 type 11 – GP v zIPP comparison example



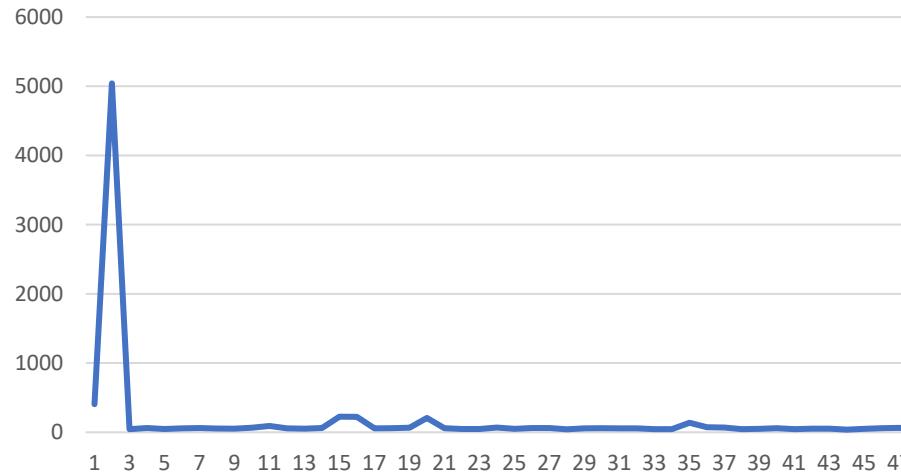
Liberty SMF 120 type 11 – Response times comparisons example



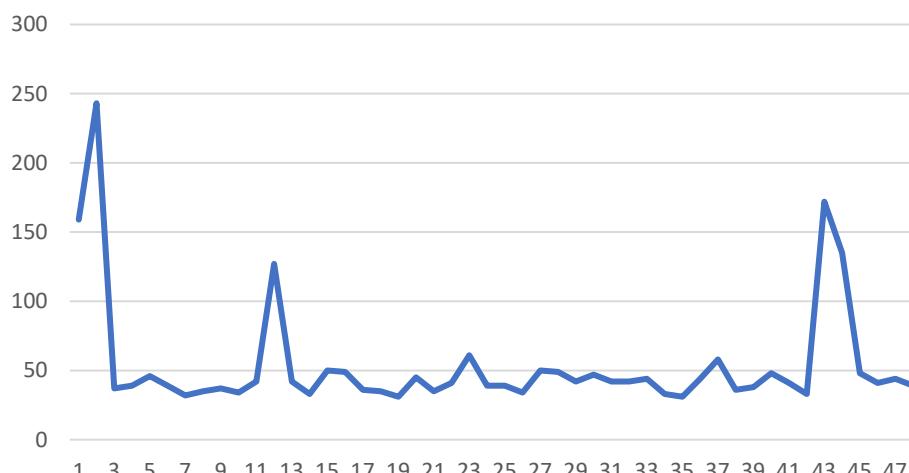
TCAPI Response Times(ms)



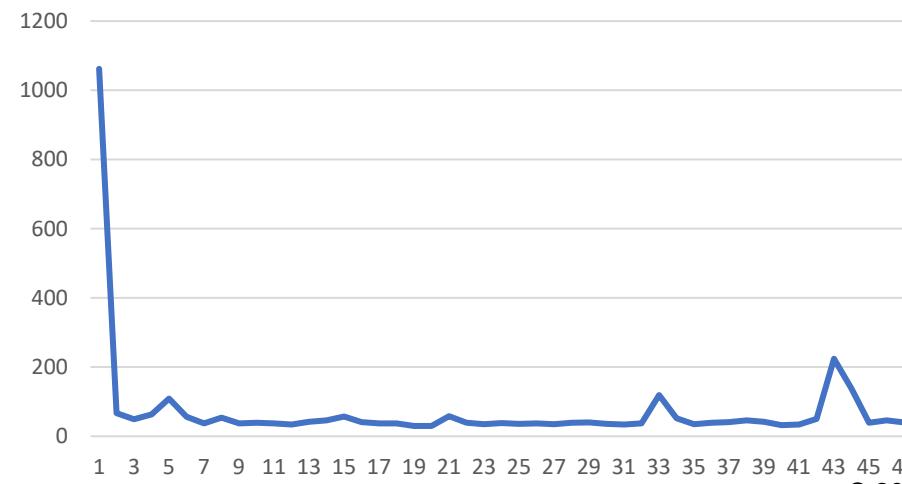
TCCICS Response Times(ms)



TCDB2 Response Times (ms)



TCIMS Response Times(ms)



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

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <server description="SMF reporting">
3
4   <zosconnect_zosConnectManager
5     globalInterceptorsRef="interceptorList_g"/>
6
7   <zosconnect_authorizationInterceptor id="auth"
8     safCacheTimeout="600"/>
9
10  <zosconnect_auditInterceptor id="audit"
11    apiRequesterSmfVersion="2"
12    apiProviderSmfVersion="2"/>
13
14  <zosconnect_zosConnectInterceptors id="interceptorList_g"
15    interceptorRef="audit"/>
16
17 </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 *



AutoSave Off

smfout.csv Search Mitch Johnson Share Comments

File Home Insert Page Layout Formulas Data Review View ACROBAT

Cut Copy Format Painter

Calibri 11 A A Wrap Text General

Font Alignment Number Conditional Format as Table Normal Bad Good Neutral Calculation Check Cell

Clipboard Insert Delete Format Cells Editing Ideas Sensitivity

Sort & Filter Clear Ideas Sensitivity

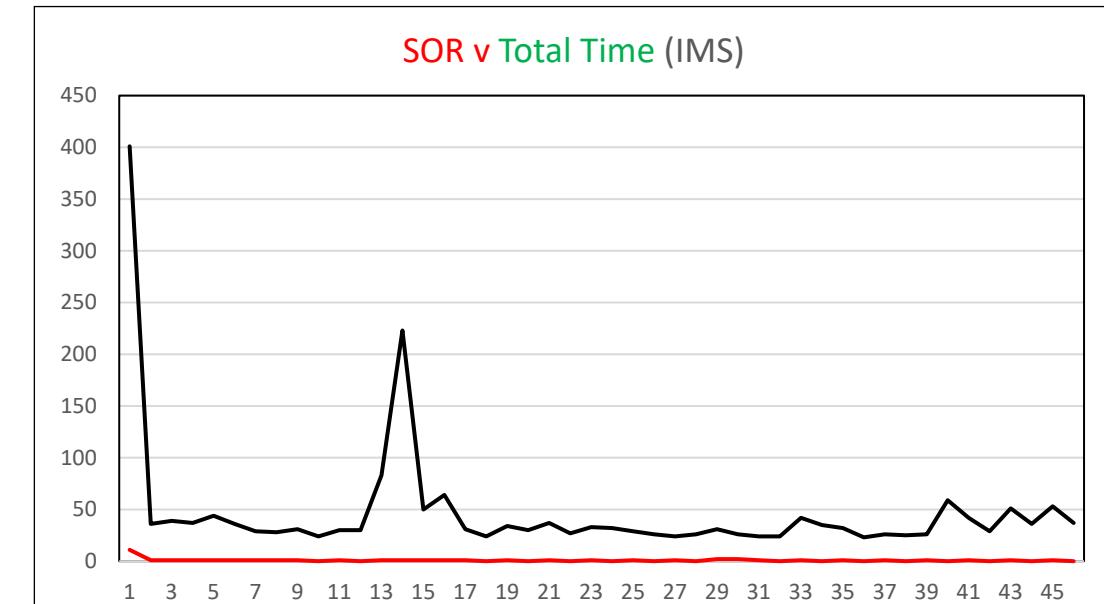
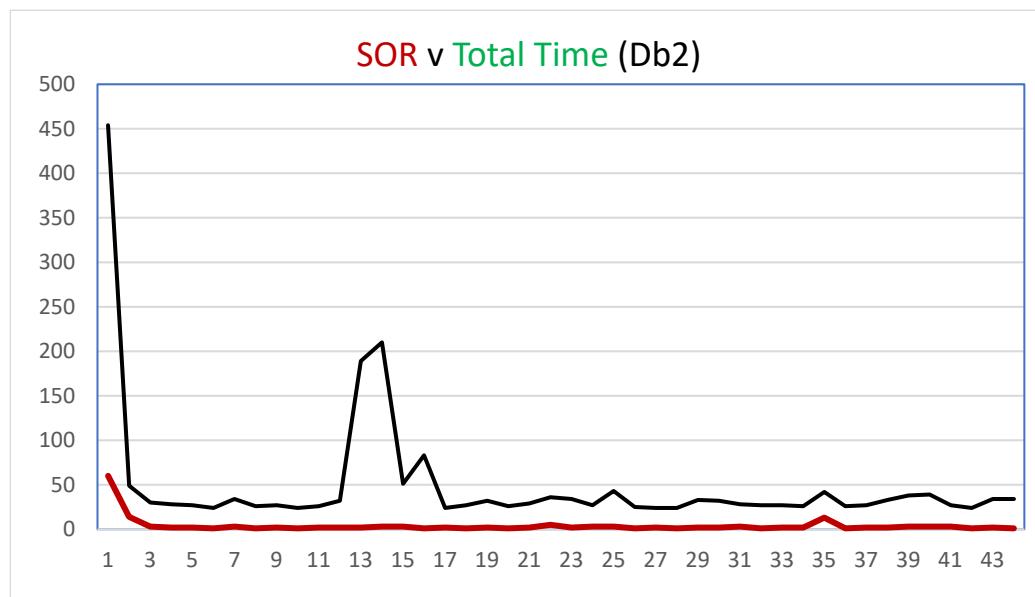
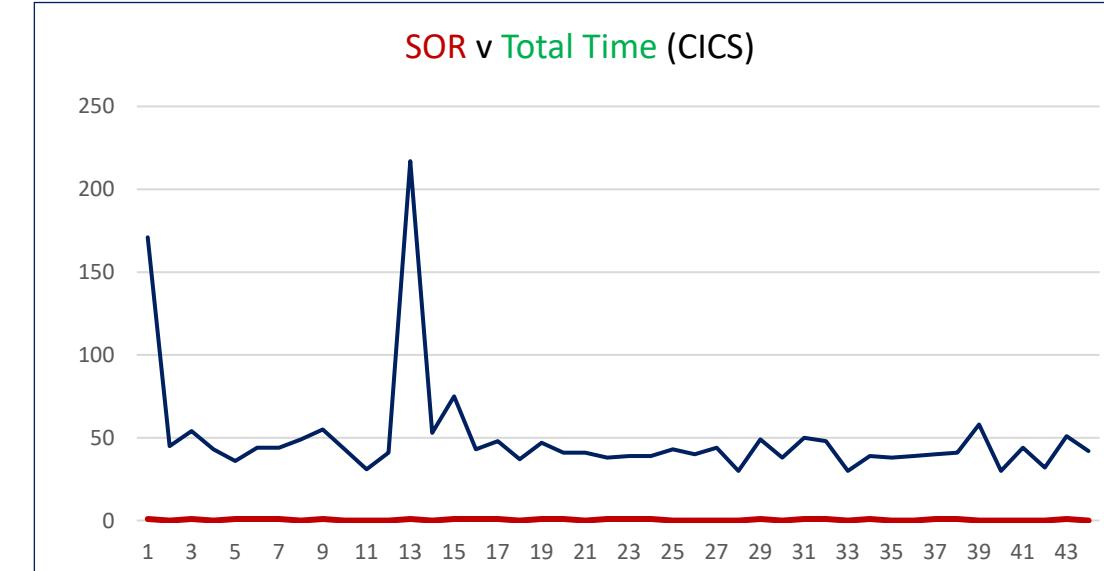
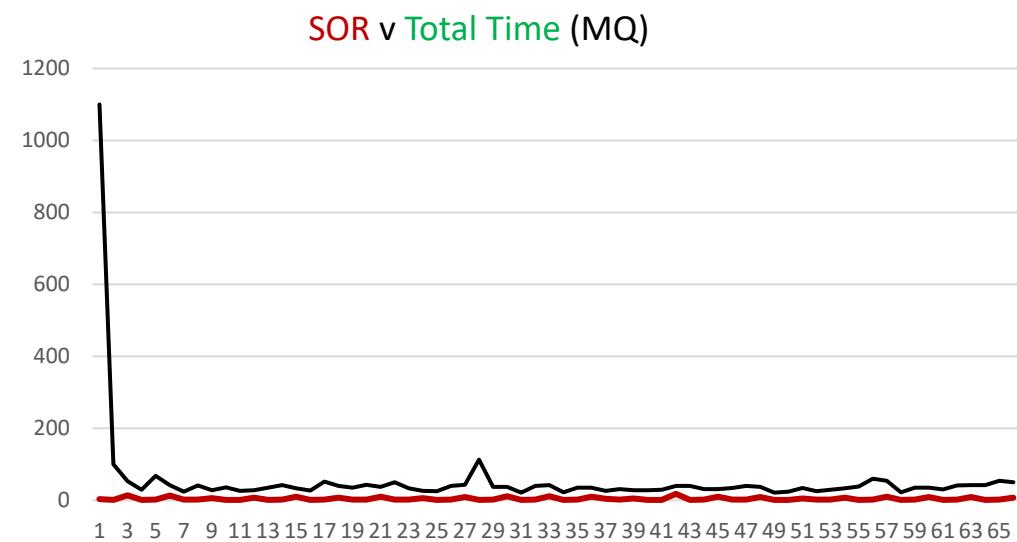
AM1 X ✓ fx

A	B	C	D	U	V	W	X	Y	Z	AA	A	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV
1	REC_TYPE	SUBTYPE	SUBTYPE_VERSION																						
2	123	1	2																						
3																									
4																									
5	SID	SSI	TRIPLET_C	TRIPLET_C	HTTP_RES	REQ_TIME	USER_NAM	USER_NA	CLIENT_IP	API_NAM	API_VERS	TIME_ZC_EN	TIME_ZC	TIME_SOFTIME	ZCI inbound Time(us)	SORTIME(us)	ZC Outbound Time(us)	TotalTime(us)	TotalTime(s)	SP_NAME	SOR_REF	SOR_IDEN	SOR_RESOURCE	REQ_I	
6	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/21 1	2021/08/21 08:2021/08/21 0:	2021/08/21 08:2021/08/21 0:	41355	913	9306	51575	0.0516	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
7	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/21 1	2021/08/21 08:2021/08/21 0:	2021/08/21 08:2021/08/21 0:	25471	756	3442	29669	0.0297	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
8	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	33757	1072	7176	42007	0.042	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
9	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	22424	1683	3430	27538	0.0275	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
10	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	24569	835	6861	32266	0.0323	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
11	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	23687	894	6740	31321	0.0313	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
12	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	39183	813	5873	45869	0.0459	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
13	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	28666	442	3328	32437	0.0324	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
14	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	62785	1454	14099	78338	0.0783	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
15	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	63645	720	10646	75013	0.075	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
16	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	32949	956	7546	41452	0.0415	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
17	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	35064	774	7185	43023	0.043	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
18	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	29211	577	3953	33743	0.0337	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
19	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	19984	764	7056	27805	0.0278	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
20	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	70534	834	18331	89700	0.0897	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
21	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	59928	1413	8672	70014	0.07	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
22	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	34807	561	5141	40510	0.0405	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
23	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	103793	5375	15872	125041	0.125	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
24	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	103356	1792	12380	117530	0.1175	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
25	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/23 08:2021/08/23 0:	2021/08/23 08:2021/08/23 0:	97134	987	14433	112554	0.1126	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC		
26																									

Average: 3260805.85 Count: 210 Sum: 326080585

Edit

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



z/OS Connect SMF 123 subtype 2 version 2 *



AutoSave Off

smfout.csv Search

Mitch Johnson MJ

File Home Insert Page Layout Formulas Data Review View ACROBAT

Cut Copy Format Painter

Font Alignment Number Styles Cells Editing Ideas Sensitivity

AP31 2021/08/23 18:16:02.725340 UTC

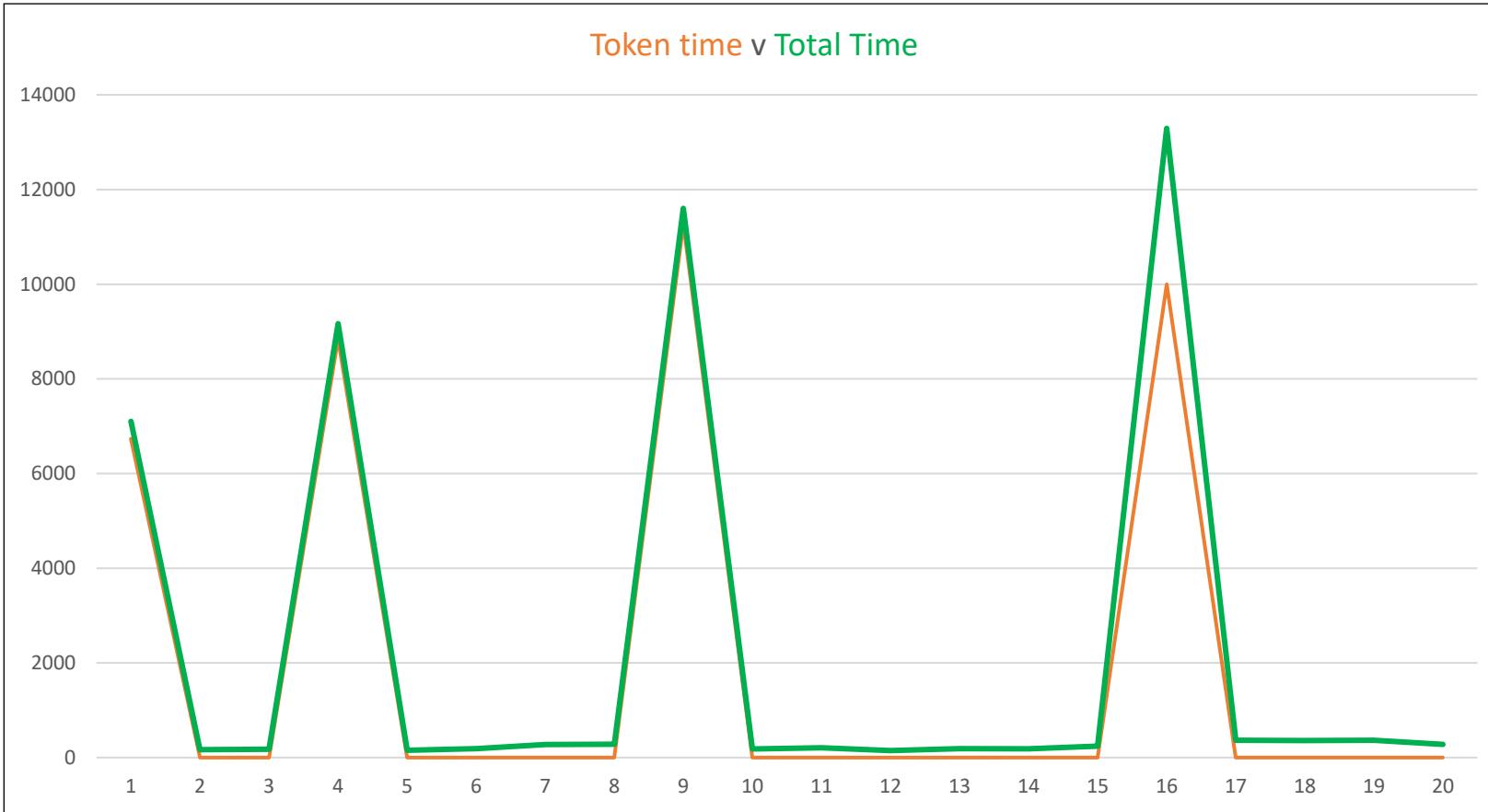
	A	B	C	D	U	V	W	X	Y	Z	AA	AI	AJ	AK	AL	AM	AAC	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY
27	SMF123_R	SMF123_S	SMF123_SUBTYPE_VERSION																								
28	123	2	2																								
29																											
30	SID	SSI	TRIPLET_C	TRIPLET_C	HTTP_REQ_STAT	REQ_REQT	REQ_PAYL	RESP_PA1	USER_NA	USER_NA	ENDPOINT_I	ENDPOINT_I	TIME_STI	TIME_TII	TIME_ENDPOI	StubTime	ZCInboun	TokenTim	EndPointTime	ZCOutbou	TotalTime(us)	TotalTime(s)	MVS_JOB	M			
31	MPZ3	ZCON	2	40	200	200	NO	0	272	USER1	IGET		2021/08/2021/02202021/08/2318:	95384	108577	6734453	131423	25653		7103301	7.1032	USER1GE5	JC				
32	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	114313	7707	318	40583	2105		166276	0.1663	USER1GE5	JC				
33	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	112903	7193	130	51158	1905		175644	0.1756	USER1GE5	JC				
34	MPZ3	ZCON	2	40	200	200	NO	0	271	USER1	IGET		2021/08/2021/02202021/08/2318:	103999	102634	8843582	110850	3497		9166156	9.1662	USER1GE4	JC				
35	MPZ3	ZCON	2	40	200	200	NO	0	271	USER1	IGET		2021/08/2021/02202021/08/2318:	82840	4956	128	65685	1900		156097	0.1561	USER1GE4	JC				
36	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	116458	10778	288	58698	1778		189030	0.189	USER1GE5	JC				
37	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	149159	20483	614	102698	1760		277114	0.2771	USER1GE5	JC				
38	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	153803	23181	285	101022	1775		281176	0.2812	USER1GE4	JC				
39	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	140685	70595	11275606	113382	1920		11603168	11.6032	USER1GE1	JC				
40	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	108088	7624	222	65726	1746		184303	0.1843	USER1GE5	JC				
41	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	119784	9945	282	76225	1773		209052	0.2091	USER1GE4	JC				
42	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	94511	5061	132	44576	2427		147407	0.1474	USER1GE1	JC				
43	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	56951	10497	126	118293	1703		189186	0.1892	USER1GE5	JC				
44	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	55110	7646	210	122479	1616		187974	0.188	USER1GE4	JC				
45	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	119104	10588	354	109467	1604		242675	0.2427	USER1GE1	JC				
46	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	3051028	17103	9999318	222997	1770		13292831	13.2928	USER1GET	JC				
47	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	129965	20381	121	212563	1870		366316	0.3663	USER1GE5	JC				
48	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	117036	17792	768	221666	1796		360790	0.3608	USER1GE4	JC				
49	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	121667	23095	468	217285	1673		366393	0.3664	USER1GE1	JC				
50	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1	IGET		2021/08/2021/02202021/08/2318:	115629	13252	685	146376	1659		279825	0.2798	USER1GE1	JC				
51	REC	TYPE	SUBTYPE	SUBTYPE	VERSION																						
52	REC	TYPE	SUBTYPE	SUBTYPE	VERSION																						

Some fields have been hidden

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

mitchj@us.ibm.com

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 = 0x00DA2FB8 38ED5494 04000000 08880001
UTC_CONV_TIME_ZC_ENTRY = 2021/08/19 15:30:24.905545 UTC
SMF123S1_TIME_ZC_EXIT = 0x00DA2FB8 38F3883F A8000000 08880001
UTC_CONV_TIME_ZC_EXIT = 2021/08/19 15:30:24.930947 UTC
SMF123S1_TIME_SOR_SENT = 0x00DA2FB8 38F232A9 76000000 08A00001
UTC_CONV_TIME_SOR_SENT = 2021/08/19 15:30:24.925482 UTC
SMF123S1_TIME_SOR_RECV = 0x00DA2FB8 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 = 0x00DA2FC1 7D34CE8B 4A000000 084C0001
UTC_CONV_TIME_STUB_SENT = 2021/08/19 16:11:52.420584 UTC
SMF123S2_TIME_ZC_ENTRY = 0x00DA2FC1 7D58AEE0 0E000000 08A00001
UTC_CONV_TIME_ZC_ENTRY = 2021/08/19 16:11:52.567534 UTC
SMF123S2_TIME_ZC_EXIT = 0x00DA2FC1 87DCB806 E6000000 08880001
UTC_CONV_TIME_ZC_EXIT = 2021/08/19 16:12:03.594112 UTC
SMF123S2_TIME_TOKEN_GET_START = 0x00DA2FC1 7D59D3A6 E6000000 08A00001
UTC_CONV_TIME_TOKEN_GET_START = 2021/08/19 16:11:52.572218 UTC
SMF123S2_TIME_TOKEN_GET_FINISH = 0x00DA2FC1 7D59DF85 CC000000 088C0001
UTC_CONV_TIME_TOKEN_GET_FINISH = 2021/08/19 16:11:52.572408 UTC
SMF123S2_TIME_ENDPOINT_SENT = 0x00DA2FC1 7D5A0328 04000000 088C0001
UTC_CONV_TIME_ENDPOINT_SENT = 2021/08/19 16:11:52.572978 UTC
SMF123S2_TIME_ENDPOINT_RECEIVED = 0x00DA2FC1 87DC8216 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

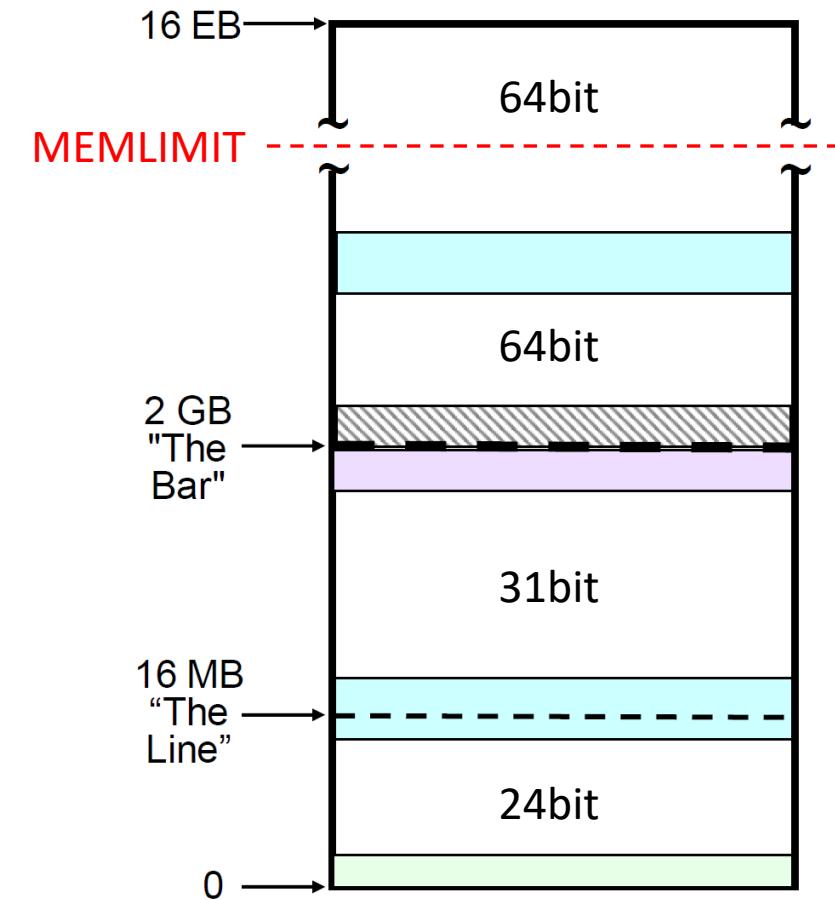
V5R4M0		CICS Performance Analyzer z/OS Connect Summary													
ZCEE0001 Printed at 13:35:01 8/21/2021		Data from 11:30:24 8/19/2021 to 12:11:24 8/19/2021						Page	1						
Initial CICS PA report															
JOBNAME : BAQSTRT SPNAME : imsmobile-2.0															
Request: 49 Fail: 0 Timed out: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



MEMLIMIT



- Limits the amount of 64-bit storage
 - Only a limit, not pre-allocated
- Java
 - Heap
 - Caches
- z/OS
 - Native thread stack storage
 - 3MB for each thread





MEMLIMIT



- OMVS display
 - Monitor periodically
 - Track high water mark
 - /D OMVS,LIMITS,PID=<server pid>

```
zVA
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF PROCESS DISPLAY S0W1 ALL
COMMAND INPUT ===> -
RESPONSE=S0W1
BPX0051I 13.48.35 DISPLAY OMVS 872
OMVS 000F ACTIVE OMVS=(00,01,BP,IZ,DB,BB,MJ,IM,RZ)
USER JOBNAM ASID PID PPID STATE START CT_SECS
ATSSERV ZCEESRVR 0062 67174611 65734 HK----- 13.25.24 881.7
LATCHWAITPID= 0 CMD=/usr/lpp/java/J8.0_64/bin/java -javaagen
PROCESS LIMITS: LIMMSG=NONE
                CURRENT HIGHWATER PROCESS
                USAGE   USAGE   LIMIT
MAXFILEPROC      205      209      65535
MAXFILESIZE     ---      ---      NOLIMIT
MAXPROCUSER      9       13      32767
MAXQUEUEDSIGS    0        1      1000
MAXTHREADS       44      54      20000
MAXTHREADTASKS   47      54      32768
IPCSHMNSEGS      0        0      500
MAXCORESIZE     ---      ---      4194304
MAXMEMLIMIT      1099M    1114M    4096M
```

Connected to remote server/host zva using lu/pool TCP00001 and port 23 Adobe PDF on Documents*.pdf



MEMLIMIT Recommendations



- Don't reach the maximum!
 - Results in Java Out Of Memory errors and system abends
 - z/OS Connect EE will stop processing API requests
- Ensure this doesn't happen
 - Limit the Liberty Default Executor thread pool
 - `maxThreads` default value is `-1` No Limit!
 - **MEMLIMIT** =
 - Maximum JVM Heap Size (`-Xmx`)
 - + 20% of the Maximum Heap Size (for JIT caches and other JVM requirements)
 - + Default Executor pool `maxThreads` * 3MB

`<executor maxThreads="300"/>`



MEMLIMIT Recommendations



- Monitor thread usage for the address space
 - `/D OMVS,LIMITS,PID=<server pid>`

- Ensure SOR connections
 - IPIC Send Sessions, etc.
- Take action when usage reaches limits

```
OMVS      0011 ACTIVE          OMVS=(22,DB,JV,00,US)
USER      JOBNAME ASID          PID      PPID STATE START  CT_SECS
ZOSPERF   ZOSCONN 00B4          16843242  66037 HK----- 11.12.37  85.8
          LATCHWAITPID=    0 CMD=/java/J64/bin/java -javaagent:/u/zosperf
PROCESS LIMITS:  LIMMSG=NONE
                  CURRENT HIGHWATER  PROCESS
                           USAGE     USAGE     LIMIT
MAXTHREADS           78          81        15000
MAXTHREADTASKS       79          81 maxThreads 60000
```

IBM z Omegamon for JVM

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

- WG31 - 3270**: A window titled "z/OS Connect Request Summary". It shows a summary table with columns: APIName, Service, SoR ID, Reference, Resource. The summary table contains three rows: 1. Last 30 Minute(s), 2. Last 1 Hour(s), and 3. Date/Time Range. Below the summary is a detailed table with columns: ΔAPI, ΔHTTP, ΔRequest, ΔError, ΔTimeout, ΔResp Time, ΔService, and ΔzOS Conn. The detailed table lists various service names and their corresponding metrics.
- WG31 - 3270**: A window titled "Requests by Service Name". It shows a table with columns: APIName, Service, SoR ID, Reference, Resource. The table contains three rows: 1. Last 30 Minute(s), 2. Last 1 Hour(s), and 3. Date/Time Range. Below the table is a detailed table with columns: ΔService, ΔRequest, ΔError, ΔTimeout, ΔResp Time, and ΔzOS Conn. The detailed table lists specific service requests like inquireSingle, cscvincService, and selectEmployee.
- WG31 - 3270**: A window titled "z/OS Connect Request Detail". It shows a detailed log of a single request. The log includes fields such as Event time, Request Type, API name, Request URI, Method, Port, HTTP code, Timeout, Service Name, Total Req Time, z/OS Conn Time, SoR Resp Time, SoR ID, SoR Ref, SoR Resource, Remote Address, Request Length, Response Length, Correlator, Operation, Provider, and User ID. The log entry for the request is as follows:

```

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.. 0.008006s
z/OS Conn Time.. 0.005515s
SoR Resp Time.. 0.002491s
SoR ID..... USIBMWZ.CICS53Z
SoR Ref.... cscvinc
SoR Resource... CSMI.CSCVINC
Remote Address.. 192.168.0.141
Request Length... 0
Response Length.. 302
Correlator.... e6e2d3d7d8c5e7400011000010d5ea50
Operation.... getCscvincService
Provider..... CICS-1.0
User ID..... Fred
  
```

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

KJJZCDD

```
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... FileQueue
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

KJJZCDD

```
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.. 0.008006s
z/OS Conn Time.. 0.005515s
SoR Resp Time.. 0.002491s
SoR ID..... USIBMWZ.CICS53Z
SoR Ref..... cscvinc
SoR Resource.... CSM1,CSCVINC
Remote Address.. 192.168.0.141
Request Length.. 0
Response Length.. 302
Correlator..... e6e2d3d7d3c5e7400011000010d5ea50
Operation..... getCscvincService
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

Event time..... 04/02/19 19:07:04.090
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..... IMSCCONN
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

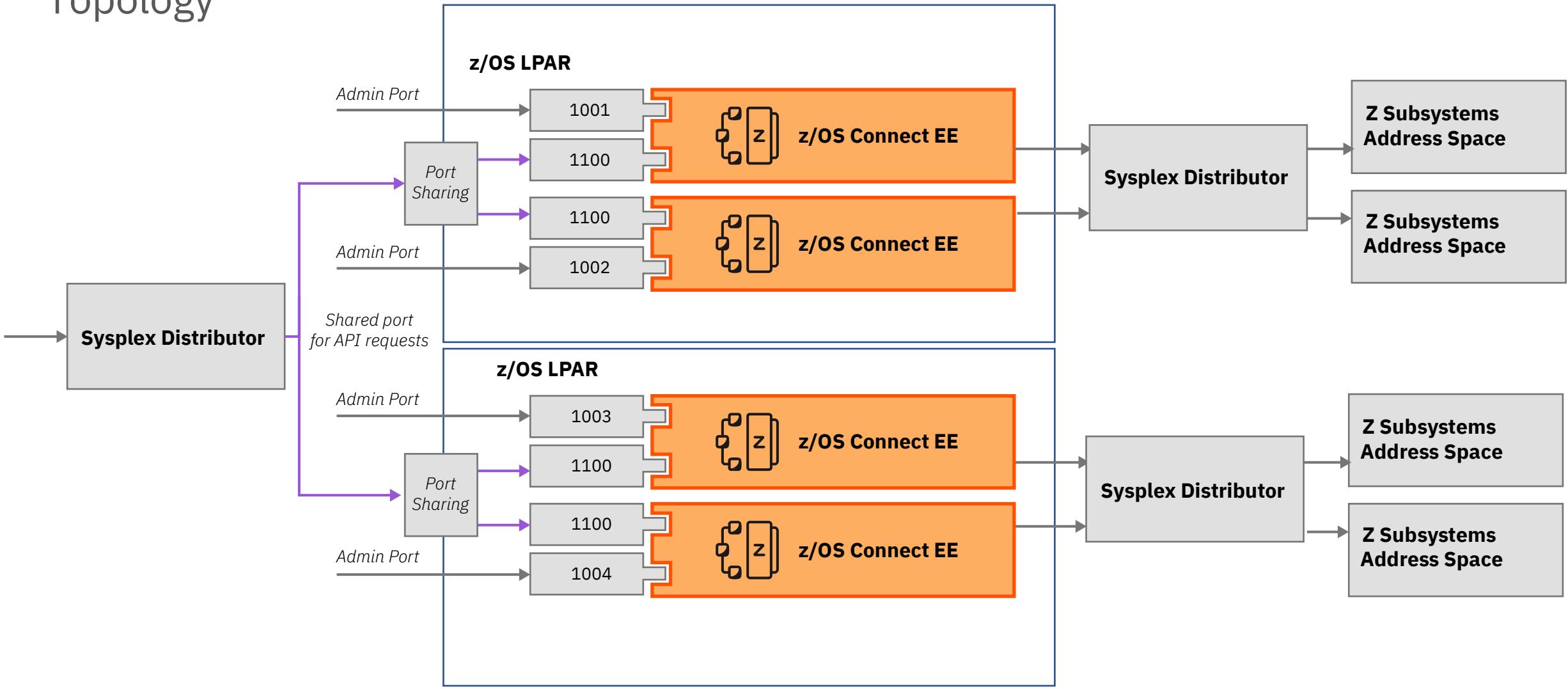
API Requesters : Operations that work with API Requesters.

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!
```

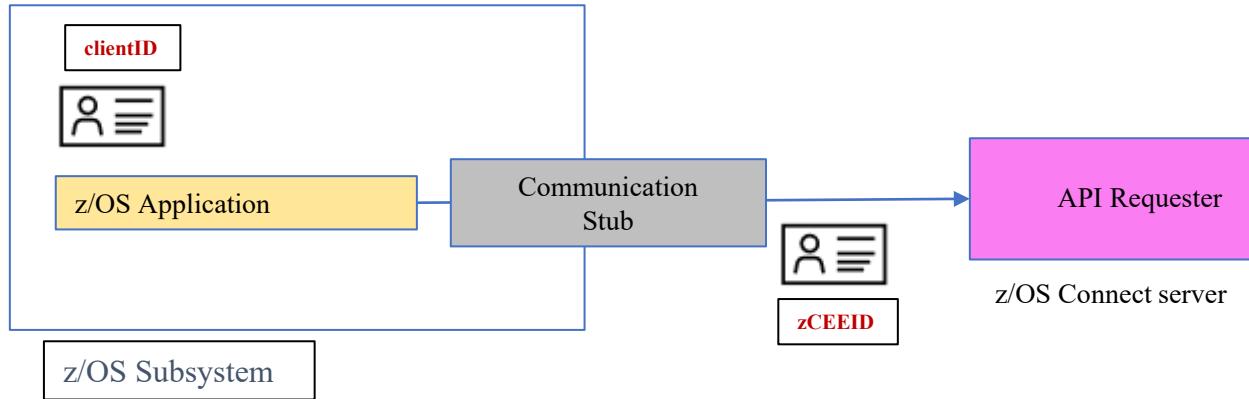
```
<zosconnect_cicsIpicConnection id="cscvinc"
  host="dvipa.washington.ibm.com"
  port="1491"/>
<zosconnect_endpointConnection id="mqapi"
  host="http://dvipa.washington.ibm.com"
  port="9453"
  basicAuthRef="myBasicAuth"
  connectionTimeout="10s"
  receiveTimeout="20s" />
```

The screenshot shows a browser window titled "IBM REST API Documentation" displaying the Liberty REST API Explorer. The URL <https://dvipa.washington.ibm.com:9443/api/explorer/> is visible in the address bar. The page lists several RESTful endpoints under the heading "Liberty REST APIs". Each endpoint is shown with its name, a color-coded button for the method (e.g., green for POST), and the URL path. Buttons for "Show/Hide", "List Operations", and "Expand Operations" are also present.

Endpoint	Method	URL Path	Operations
cscvinc	POST	/cscvinc/employee	Show/Hide List Operations Expand Operations
	DELETE	/cscvinc/employee/{employee}	
	GET	/cscvinc/employee/{employee}	
	PUT	/cscvinc/employee/{employee}	
db2employee			Show/Hide List Operations Expand Operations
filemgr			Show/Hide List Operations Expand Operations
imsPhoneBook			Show/Hide List Operations Expand Operations
jwttlvDemoApi			Show/Hide List Operations Expand Operations
miniloancics			Show/Hide List Operations Expand Operations
mqapi			Show/Hide List Operations Expand Operations
phonebook			Show/Hide List Operations Expand Operations



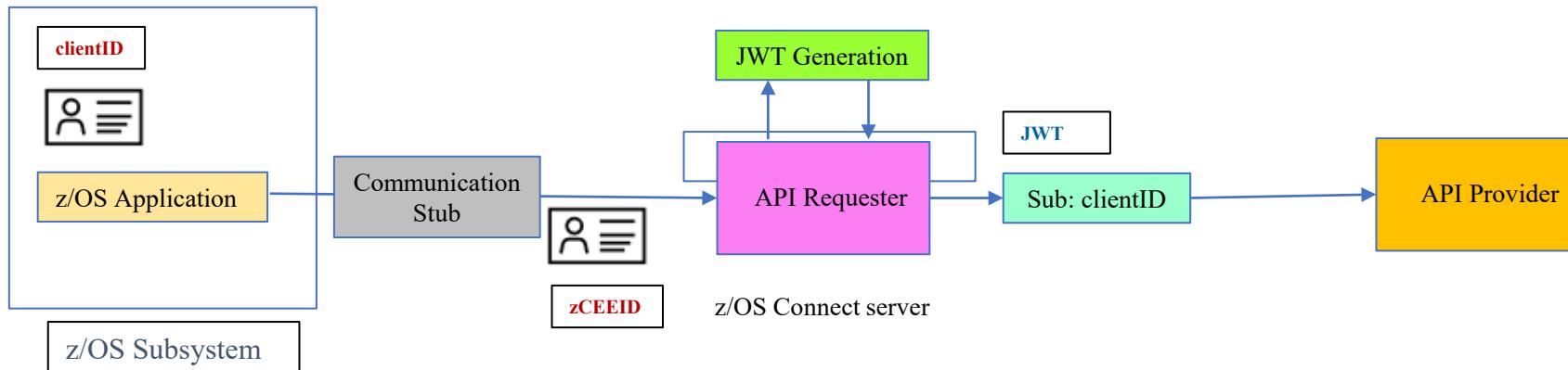
API Requester - authentication with identity assertion and JWT generation



zCEEID – The identity that is used for authenticating connectivity the z/OS subsystem to the zCEE server. It is configured using basic authentication or for CICS, TLS client authentication.

clientID – the identity under which the z/OS application is executing.

- For CICS, the task owner
- For IMS, the transaction owner
- For batch, the job owner



```
<zosconnect_apiRequesters idAssertion="ASSERT_ONLY">  
</zosconnect_apiRequesters>
```

Identity assertion and/or JWT generation Extended Attribute Requirement

As root or superuser, set the *libifaedjreg64.so* program control extended attribute bit

- *Permit the server's identity to the required FACILITY resource*

**PERMIT BPX.SERVER CLASS(FACILITY) ID(*LIBSERV*) ACCESS(READ)
SETROPTS RACLIST(FACILITY) REFRESH**

- *Define a SURROGAT profile for the asserted identity and permit access to connection identity*

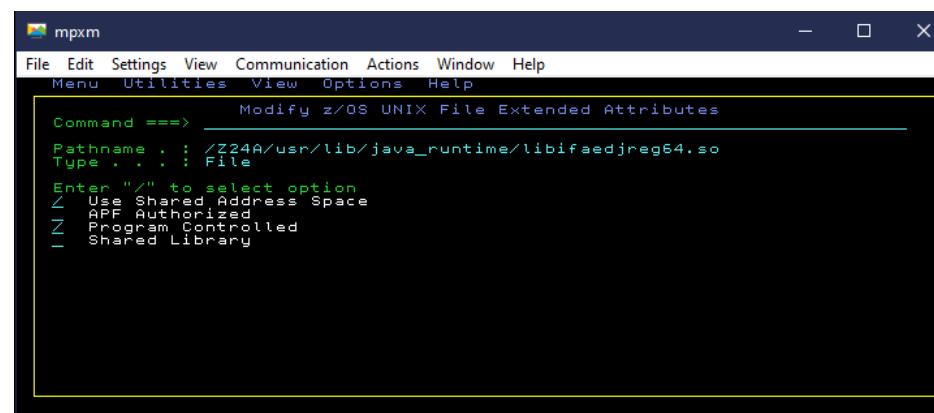
RDEFINE SURROGAT **clientID.BAQASSRT UACC(NONE) OWNER(SYS1)**
PERMIT clientID.BAQASSRT CLASS(SURROGAT) ACCESS(READ) ID(*zCEEID*)

OR

RDEFINE SURROGAT ***.BAQASSRT UACC(NONE) OWNER(SYS1)**
PERMIT *.BAQASSRT CLASS(SURROGAT) ACCESS(READ) ID(*zCEEID*)
SETROPTS RACLIST(SURROGAT) REFRESH

- *Enable the program control bit for Java shared object ifaedjreg64*

```
su  
cd /usr/lib/java_runtime  
extattr +p libifaedjreg64.so
```





Tech/Tip: z/OS : Switching to root authority



The image displays two side-by-side terminal windows from the z/OS environment.

WG31 - 3270 Window:

- File menu:** File, Edit, Settings, View, Communication, Actions, Window, Help.
- Action bar:** File, Directory, Special_file, Tools, File_systems, Options, **Setup** (circled in red), Help.
- Submenu for Options:** 1. *User..., 2. *User list..., 3. *All users..., 4. *All groups..., 5. *Permit field access..., 6. *Character Special... (circled in red), 7. Enable superuser mode(SU), 8. *Group list... (circled in red).
- Text area:** Enter a pathname and do one of these:
 - Press Enter.
 - Select an action bar choice.
 - Specify an action code or command onReturn to this panel to work with a differ
- Input field:** /u/johnson
- Note box:** Some choices (*) require superuser or the "special" attribute for full function, or both
- Status:** EUID=200000
- Command line:** Command ==> **M A B** 03/047
- Bottom status:** Connected to remote server/host wg31a using lu/pool TCP00110 Adobe PDF on Documents*.pdf

mpxm Window:

- File menu:** File, Edit, Settings, View, Communication, Actions, Window, Help.
- Text area:** IBM Licensed Material - Property of IBM 5650-ZDS 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.
- Text area:** IBM is a registered trademark of the IBM Corp.
- Text area:** JOHNSTON:/u/johnson: >id
uid=990016(JOHNSON) gid=0(SYS1)
JOHNSTON:/u/johnson: >su
JOHNSTON:/u/johnson: >id
uid=0(OMVSKERN) gid=0(SYS1)
JOHNSTON:/u/johnson: >
- Bottom status:** Connected to remote server/host mprixm using lu/pool TCP00027 Adobe PDF on Documents*.pdf

Tech-Tip: Super user is required to set the program control extended attribute (`extattr +p`) bit for the Java shared object ***ifaedjreg64.so***. This extended attribute must be set for identity assertion in certain situations.

Use z/OS Connect API Policies to change runtime behavior

- HTTP header properties can be used to select alternative for IMS (V3.0.4) , CICS (V3.0.10), Db2 (V3.0.36) or MQ (V3.0.39)
- Policies can be configured globally for every API in the server or for individual APIs (V3.0.11)

CICS attributes

- cicsCcsid
- cicsConnectionRef
- cicsTransId

IMS attributes

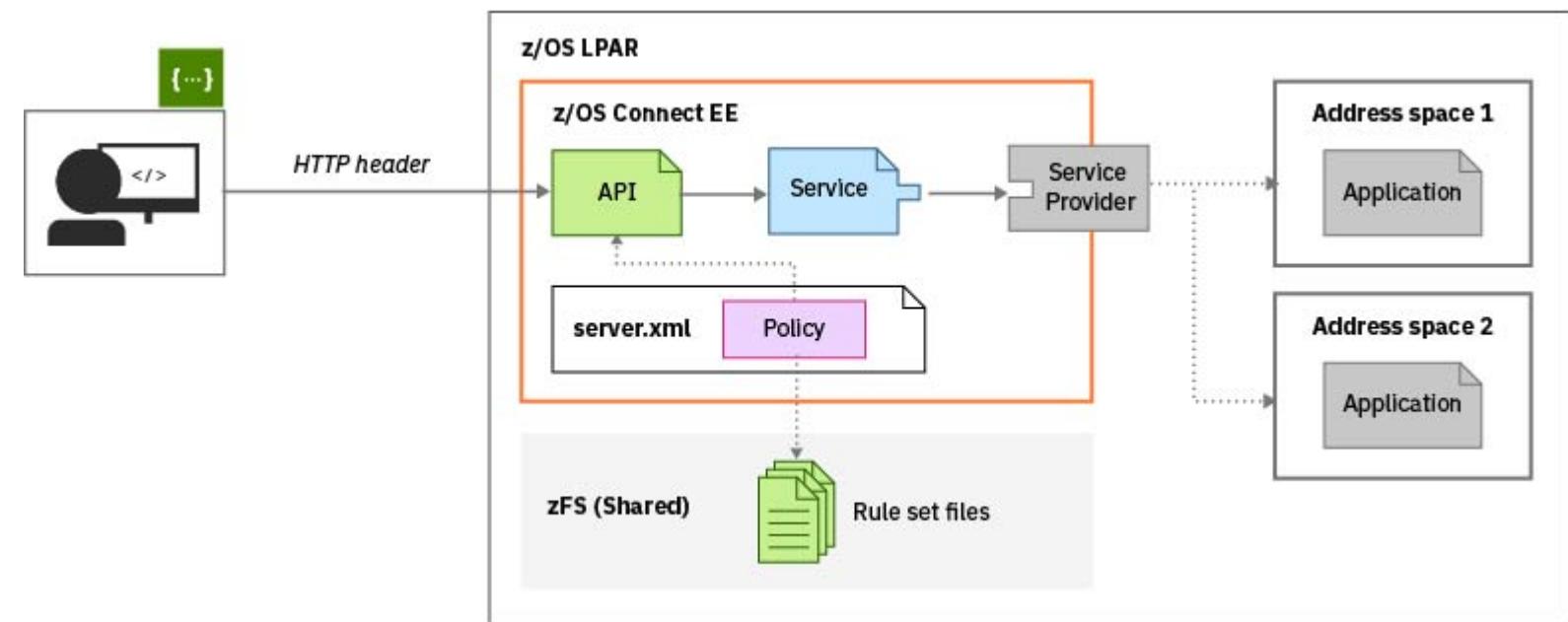
- imsConnectionRef
- imsInteractionRef
- imsInteractionTimeout
- imsItermOverrideName
- imsTranCode
- imsTranExpiration

Db2 attributes

- db2ConnectionRef
- db2CollectionID

MQ attributes

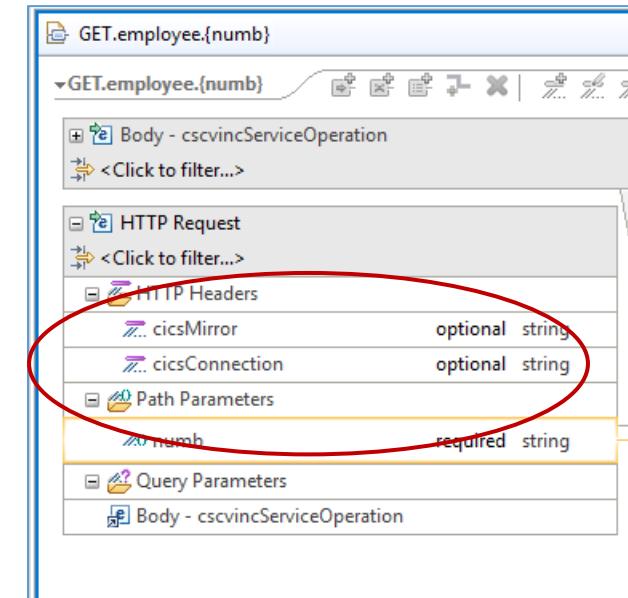
- mqConnectionFactory
- mqDestination
- mqReplyDestination





A sample API Policies for CICS

```
<ruleset name="CICS rules">
    <rule name="csmi-rule">
        <conditions>
            <header name="cicsMirror" value="CSMI,MIJO"/> *
        </conditions>
        <actions>
            <set property="cicsTransId" value="${cicsMirror}"/>
        </actions>
    </rule>
    <rule name="connection-rule">
        <conditions>
            <header name="cicsConnection"
                   value="cscvinc,cics92,cics93"/>
        </conditions>
        <actions>
            <set property="cicsConnectionRef" value="${cicsConnection}">
        </actions>
    </rule>
</ruleset>
```



Curl

```
curl -X GET --header 'Accept: application/json' --header 'cicsMirror: MIJO' --header 'cicsConnection: cscvinc' 'https://m...
```

*Transaction MIJO needs to be a clone of CSMI (e.g., invoke program DFHMIRS)

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



```
<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}>
<include location="${server.config}
<!-- Enable features -->
<featureManager>
<feature>zosconnect:zosConnect
<feature>zosconnect:zosConnect
</featureManager>
<!--
To access this server from
-->
<httpEndpoint id="defaultHttpEnd
<!--
add cors to allow cross or
-->
```

```
*****
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/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/J8_0_64
java.version = 1.8.0_261
java.runtime = Java(TM) SE Runtime Environment (8.0.6.15 - pmz6480sr6fp15-20200724_01(SR6 FP15))
os = z/OS (02.03.00; s390x) (en_US)
process = 16778879@wg31
*****
[2/19/21 15:48:18:901 GMT] 0000000b com.ibm.ws.kernel
[2/19/21 15:48:19:869 GMT] 00000017 com.ibm.ws.config
/var/zosconnect/servers/myServer/includes/safSecurity
[2/19/21 15:48:19:892 GMT] 00000017 com.ibm.ws.config
/var/zosconnect/servers/myServer/includes/ipicIDProp
[2/19/21 15:48:19:894 GMT] 00000017 com.ibm.ws.config
/var/zosconnect/servers/myServer/includes/keyringOut
[2/19/21 15:48:19:904 GMT] 00000017 com.ibm.ws.config
[2/19/21 15:48:19:905 GMT] 00000017 com.ibm.ws.config
/var/zosconnect/servers/myServer/includes/groupAccess
[2/19/21 15:48:19:906 GMT] 00000017 com.ibm.ws.config
/var/zosconnect/servers/myServer/includes/shared.xml
[2/19/21 15:48:19:907 GMT] 00000017 com.ibm.ws.config
/var/zosconnect/servers/myServer/includes/oauth.xml
[2/19/21 15:48:19:910 GMT] 00000017 com.ibm.ws.config
/var/zosconnect/servers/myServer/includes/test.xml
[2/19/21 15:48:19:996 GMT] 00000016 com.ibm.ws.zos.co
below-the-line storage limit is 8MB and the above-th
[2/19/21 15:48:19:997 GMT] 00000016 com.ibm.ws.zos.co
[2/19/21 15:48:20:012 GMT] 00000016 com.ibm.ws.zos.co
process.
[2/19/21 15:48:20:089 GMT] 00000016 com.ibm.ws.zos.co
[2/19/21 15:48:20:090 GMT] 00000016 com.ibm.ws.zos.co
```

```
<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>
```

```
*****
Product = WAS FOR z/OS 21.0.0.1, z/OS Connect 03.00.42 (wlp-1.0.48.c121012010113-1459)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/J8_0_64
java.version = 1.8.0_261
java.runtime = Java(TM) SE Runtime Environment (8.0.6.15 - pmz6480sr6fp15-20200724_01(SR6 FP15))
os = z/OS (02.03.00; s390x) (en_US)
process = 16779882@wg31
traceSpecification =
*****[2/25/21 17:27:54:487 GMT] 00000016 id=00000001 com.ibm.ws.logging.internal.TraceSpecification
*****[2/25/21 17:27:54:487 GMT] 00000016 id=00000001 com.ibm.ws.logging.internal.TraceSpecification
I TRAS0018I: The trace state has been
changed. The new trace state is
*****[2/25/21 17:27:54:491 GMT] 00000016 id=00000001 com.ibm.ws.logging.internal.TraceSpecification
*****[2/25/21 17:27:54:491 GMT] 00000016 id=00000001 com.ibm.ws.logging.internal.TraceSpecification
I CWWKBO121I: The server process UMASK
value is set to 0000.
*****[2/25/21 17:27:54:494 GMT] 00000016 id=32c3d2ff ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry
OSGI-
INF/com.ibm.ws.zos.logging.config.xml
*****[2/25/21 17:27:54:494 GMT] 00000017 id=32c3d2ff ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Exit
OSGI-
INF/com.ibm.ws.zos.logging.config.xml
*****[2/25/21 17:27:54:494 GMT] 00000017 id=459954a0 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry
OSGI-
```



Provide remote access to z/OS Connect archives files



Index of /resources/zosConnect/

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

```
<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>
```

Index of /resources/zosConnect/services/

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

Opening cscvincSelectService.sar

You have chosen to open:
[cscvincSelectService.sar](#)
which is: SAR file (4.5 KB)
from: https://wg31.washington.ibm.com:9453

What should Firefox do with this file?
 Open with Applications\WINZIP32.EXE (default)
 Save File

OK Cancel



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>



The image shows two side-by-side browser windows displaying GitHub repository pages. Both windows have a dark theme.

Left Window: The URL is <https://github.com/ibm-wsc/zCONNEE-Wildfire-Workshop>. The repository is public and has 1 issue. It contains several branches and files, including ZCONNEE, cobol, exercises, security, xml, README.md, WSC Wildfire zOS Primer.pdf, ZCONNEE - Introduction to zOS Conn..., ZOSSEC1 - zOS Connect Security.pdf, zOS Connect EE V3 Advanced Topics ..., and zOS Connect EE V3 Getting Started.pdf.

Right Window: The URL is <https://github.com/ibm-wsc/zCONNEE-Wildfire-Workshop/tree/master/xml>. This is a subdirectory of the main repository. It has 12 issues, 13 stars, and 8 forks. It contains XML configuration files: adminCenter.xml, apiRequester.xml, apiRequesterHTTPS.xml, apiRequesterTrace.xml, atssaf.xml, basicSecurity.xml, cicsTrace.xml, cors.xml, db2.xml, db2TLS.xml, and others.



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

```
//JOHNSONS JOB (ACCOUNT),JOHNSON,NOTIFY=JOHNSON,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)  
//*****  
///* Set symbols  
//*****  
//EXPORT EXPORT SYMLIST=(*)  
// SET JAVAHOME='/usr/lpp/java/J8.0_64'  
// SET ZCEEPATH='/usr/lpp/IBM/zosconnect/v3r0'  
//*****  
///* Step ZCSETUP - Invoke the zconsetup script  
//*****  
//ZCSETUP EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH +  
  export JAVA_HOME=&JAVAHOME; +  
  &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  
//SYSTSPRT 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)

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 +  
Export WLPDIR=&WLPDIR; +  
$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'
```

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

```
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.
```

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)

```
//JOHNONS 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 EXPORT SYMLIST=(*)
// SET ZCEELVL=349
//DELETE EXEC PGM=IDCAMS
//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  
//MFPINPUT DD DISP=SHR,DSN=JOHNSON.DUMPSSMF.SORT  
//MFPMSGDS 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	Status	Owner	State	CPU-Time	PID	PPID	ASID	ASIDX	LatchWaitPID	Command
	BAQSTRT	WAITING FOR CHILD	LIBSERV	1W	40.01	69050	83955129	42	002A		/bin/sh /usr/lpp/IBM/zosconnect/v3r0/bin
	BAQSTRT	OTHER KERNEL WAIT	LIBSERV	HK	40.01	16846267	69050	42	002A		/usr/lpp/java/J8.0_64/bin/java -javagen
	BAQZANGL	SWAPPED, RUNNING	LIBANGE	1RI	0.01	50399398	83953829	77	004D		/usr/lpp/IBM/zosconnect/v3r0/wplib/nat
	BAQZANGL	SWAPPED, FILE SYS KERNEL WAIT	LIBANGE	1FI	0.01	83953829		1	77 004D		BPXBATA2
	BAQSTRT	FILE SYS KERNEL WAIT	LIBSERV	1F	40.01	83955129		1	42 002A		BPXBATSL

```
*****
product = WAS FOR z/OS 21.0.0.9, z/OS Connect 03.00.52 (wlp-1.0.56.c1210920210909-1618)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/J8.0_64
java.version = 1.8.0_301
java.runtime = Java(TM) SE Runtime Environment (8.0.6.36 - pmz6480sr6fp36-20210913_01(SR6 FP36))
os = z/OS (02.03.00; s390x) (en_US)
process = 16780584@wg31
*****
```

```
//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=*
//STDOUT    DD  SYSOUT=*
//SYSTSPRT DD  SYSOUT=*
//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.