

# **zOSSEC1 – IBM z/OS Connect Administration**

A dive into Liberty and z/OS Connect  
Administration

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# 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 z/OS Connect development.

# **Agenda**

- An overview of z/OS Connect
- Review OMVS, Liberty and RACF security/configuration
- Connecting to 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

# An overview of z/OS Connect

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# **z/OS Connect EE exposes z/OS resources to the “cloud” via RESTful APIs**



CICS
IMS/TM
IMS/DB
Db2
MQ
File Manager <sup>+</sup>
3270
DVM <sup>+</sup>
MVS
WAS
Custom*

+ HCL and Rocket Software

\*Other Vendors or your own implementation

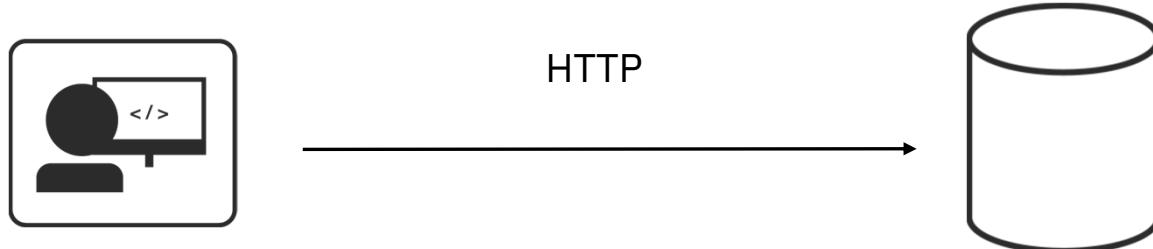
# REST is architectural programming style

**REST** stands for **R**epresentational **S**tate **T**ransfer.

An architectural programming style for **accessing** and **updating** data over the internet.

Typically using HTTP... but not all HTTP interfaces are “RESTful”.

Simple and intuitive for the end consumer (**the developer**).



Roy Fielding defined REST in his 2000 PhD dissertation "Architectural Styles and the Design of Network-based Software Architectures" at UC Irvine. He developed the REST architectural style in parallel with HTTP 1.1 of 1996-1999, based on the existing design of HTTP 1.0 of 1996.

# Key Principles of REST



Use HTTP verbs for Create, Read, Update, Delete (CRUD) operations

GET  
POST  
PUT  
DELETE

http://<host>:<port>/path/parameter?name=value&name=value

Use Path and Query parameters to refine the request

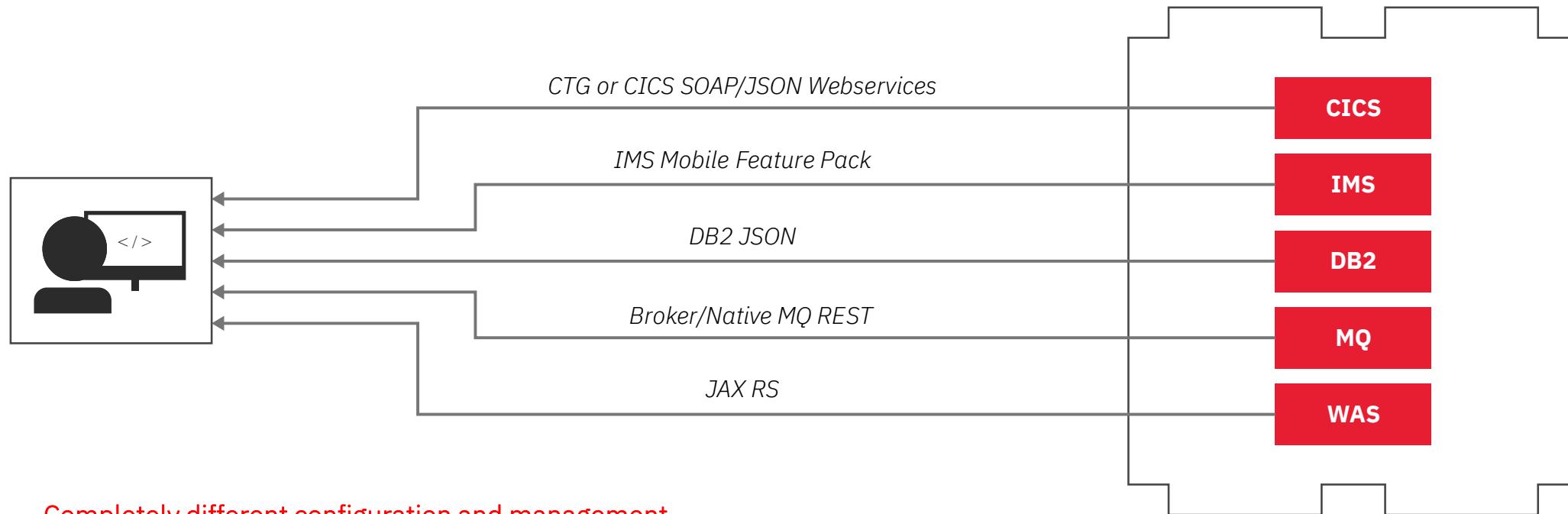
URI path identifies a resource (or lists of resources)

URL identifies the protocol, host and port and includes the URI Path

Request/Response Body is used to represent the data object

```
GET http://www.acme.com/customers/12345?personalDetails=true
RESPONSE: HTTP 200 OK
BODY { "id" : 12345
      "name" : "Joe Bloggs",
      "address" : "10 Old Street",
      "tel" : "01234 123456",
      "dateOfBirth" : "01/01/1980",
      "maritalStatus" : "married",
      "partner" : "http://www.acme.com/customers/12346" }
```

# REST APIs could access z/OS resources before z/OS Connect, but....



Completely different configuration and management.

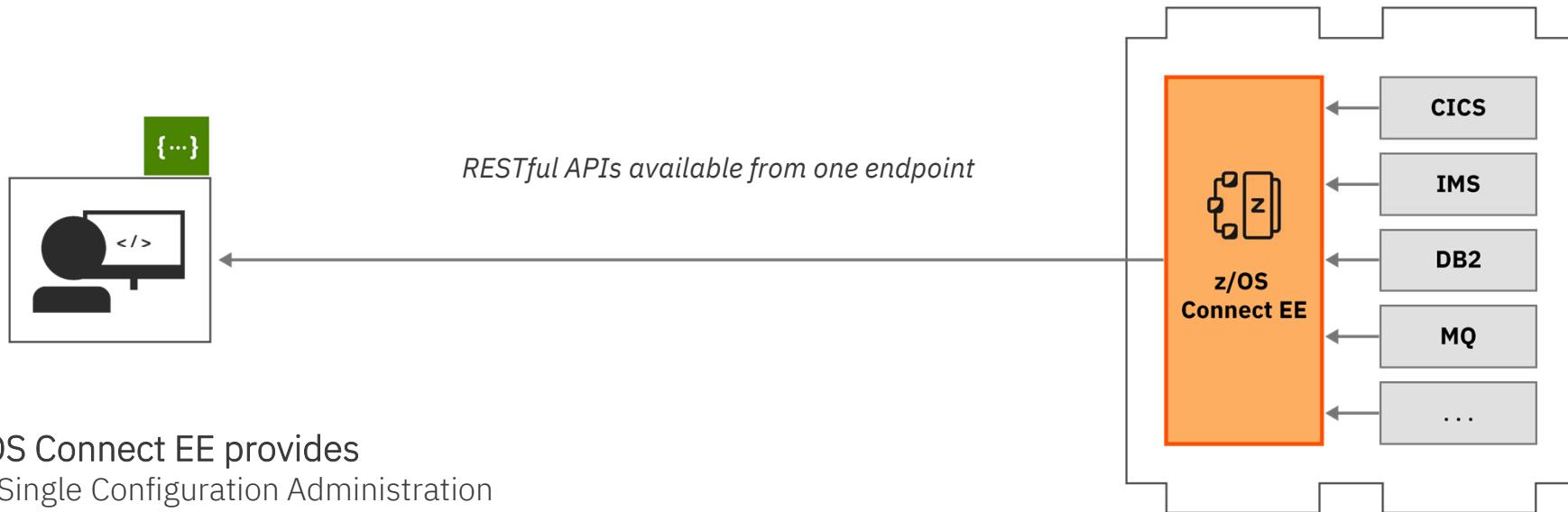
Multiple endpoints for developers to call/maintain access to.

These were typically not RESTful (solutions exposed z/OS as the back-end)



# A single-entry point

Expose z/OS resources without writing any code.

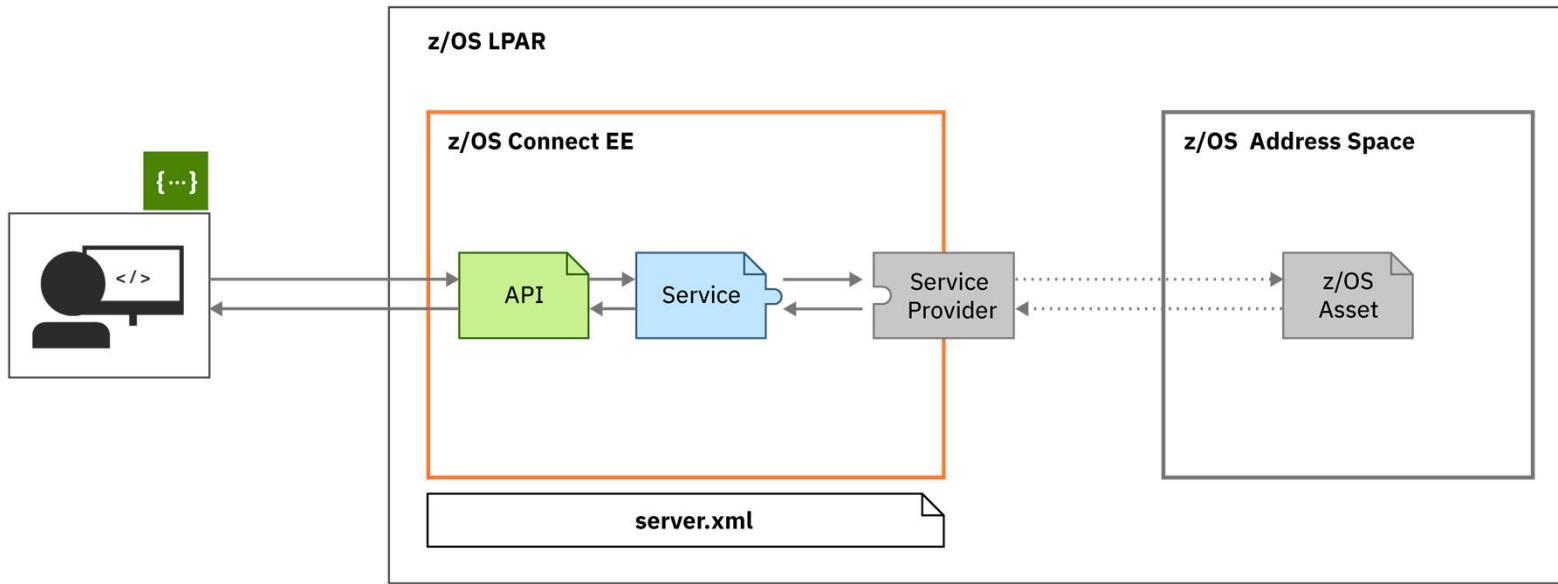


z/OS Connect EE provides

- Single Configuration Administration
- Single Security Administration
- With sophisticated mapping of truly RESTful APIs to existing mainframe and services data without writing any code.

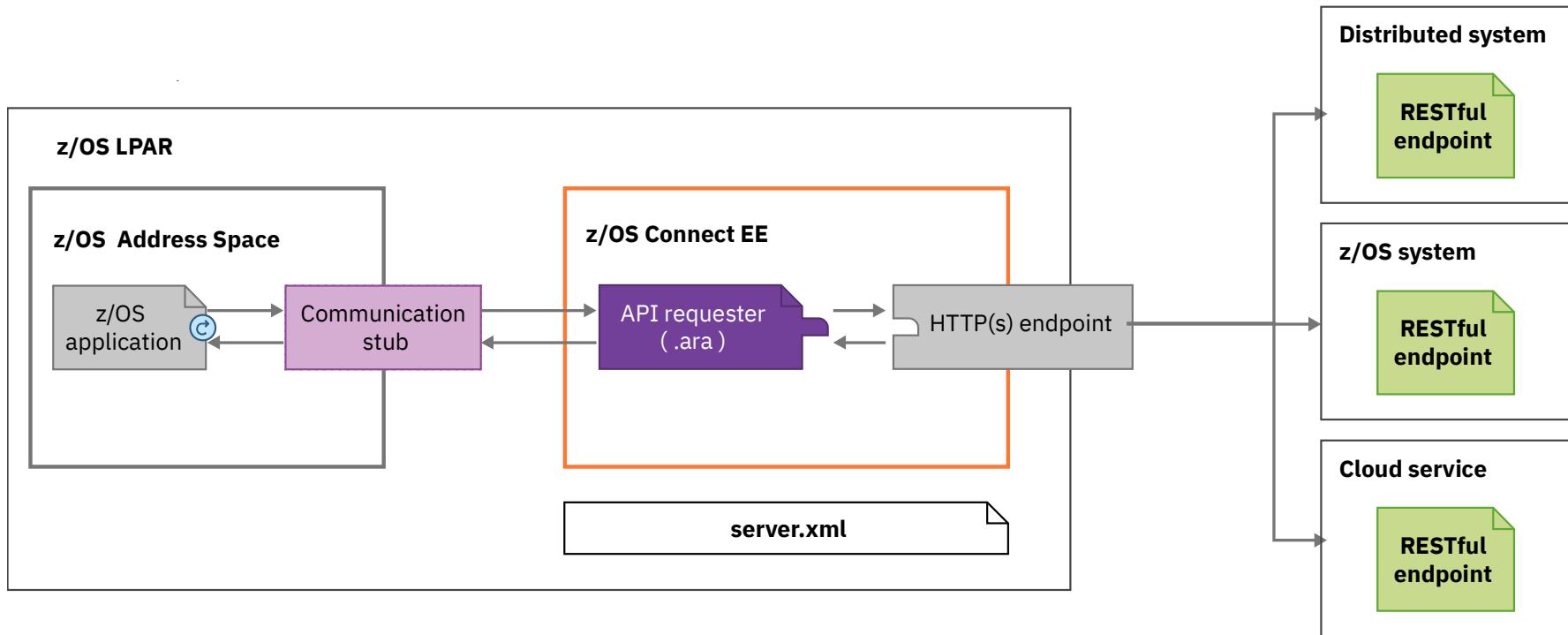


# Exposing a z/OS application/resource to a REST client



- The API is ready to be consumed and requires no knowledge that a z/OS resource is being accessed
- The Service provides meta data specific to the z/OS Asset (e.g., CICS program, MQ queue manager, etc.)
- The Service Provider is tightly coupled to a specific instance of a resource (e.g., host and port, security)

# Accessing an external REST API from a COBOL program



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



## Tech/Tip: Verify your OMVS environment\*

- Prevent out-of-memory or other storage issues:
  - Verify the Java runtime is not being limited by system parameters, e.g., *MAXASSIZE* (2 147 483 647), *MAXTHREADS*, etc., for details see *BPXPRM setting* at URL [https://www.ibm.com/docs/en/sdk-java-technology/8?topic=SSYKE2\\_8.0.0/com.ibm.java.vm.80.doc/docs/j9\\_configure\\_zos\\_bpxprm.html](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 can invoke Java.
- 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.



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

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

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

Where *templateName* can be:

- `zosconnect:apiRequester` for an API requester enabled z/OS Connect server
- `zosconnect:default` template for base z/OS Connect servers
- `zosconnect:sampleCicsIpicCatalogManager` for a sample CICS enabled z/OS Connect server
- `zosconnect:sampleDb2Project` for a sample Db2 enabled z/OS Connect server
- `zosconnect:sampleDatabase` for a sample IMS database enabled z/OS Connect server
- `zosconnect:samplePhonebook` for a sample IMS transaction enabled z/OS Connect server
- `zosconnect:sampleMQStockManager` for a sample MQ enabled z/OS Connect server
- `zosconnect:sampleWolaCatalogManager` for a sample WOLA enabled z/OS Connect server

Where *serverName* is any value you wish, such as `zceesrvr` and will be the name of the server instance. The templates can be found in directory `/usr/lpp/IBM/zosconnect/v3r0/runtime/templates/servers`

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

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

# Tec-Tip: OMVS security - Review Unix file permissions

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

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# 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 zceesrv1
```

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

*CWWKB0121I: The server process UMASK value is set to 0000*

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

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

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

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



## Tech/Tip: Use SAF SURROGAT Resources

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

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

*Define a SURROGAT profile for the server's SAF identity*

**RDEFINE SURROGAT BPX.SRV.*LIBSERV***

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

**RDEFINE SURROGAT *LIBSERV*.SUBMIT**

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

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

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

*Refresh the SURROGAT in storage profiles*

**SETROPTS RACLIST(SURROGAT) REFRESH**

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

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



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

- *Permit an administrative identity to write to any local directory or file*

**PERMIT SUPERUSER.FILESYS CLASS(UNIXPRIV)**

**ID(adminUser) ACC(CONTROL)**

- *Permit an administrative identity to change permission bit of any local directory or file*

**PERMIT SUPERUSER.FILESYS.CHANGEPERMS CLASS(UNIXPRIV)**

**ID(adminUser) ACC(READ)**

- *Permit an administrative identity to change the ownership of any directory or file*

**PERMIT SUPERUSER.FILESYS.CHOWN CLASS(UNIXPRIV)**

**ID(adminUser) ACC(READ)**

- *Permit an administrative identity switch to root (su -s root) or the Enable superuser mode(SU) Setup option in ISHELL*

**PERMIT BPX.SUPERUSER CLASS(FACILITY) ID(adminUser) ACC(READ)**

- *Refresh the UNIXPRIV and/or FACILITY instorage profiles*

**SETROPTS RACLIST(UNIXPRIV,FACILITY) REFRESH**

Use these commands only if you understand the implications.

[https://www.ibm.com/support/knowledgecenter/en/SSLTBW\\_2.4.0/com.ibm.zos.v2r4.bpxb200/usspriv.htm](https://www.ibm.com/support/knowledgecenter/en/SSLTBW_2.4.0/com.ibm.zos.v2r4.bpxb200/usspriv.htm)

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



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

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

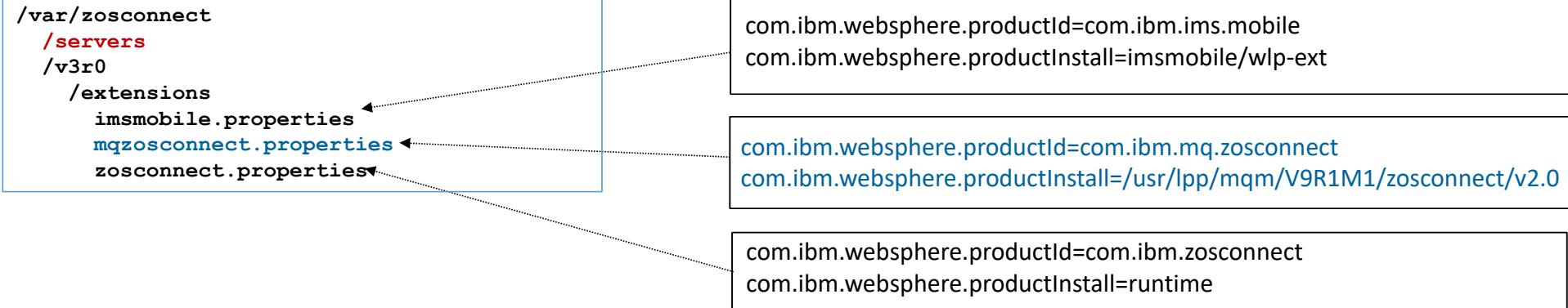
Alternatively, use the change ownership command, *chown*, to change the user and group attributes of the user associated with the STARTED task. This requires UNIXPRIV RACF access.



# A Tour of LPAR specific Directories and Files(zconsetup)

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

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



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



# A Tour of Server Configuration Directories and Files

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

```
/var/zosconnect
  /servers
    /zceesrv1
      /logs
        messages.log
  /resources
    /zosconnect
      /apis
      /apiRequesters
      /rules
      /services
    server.xml
    server.env
  /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.

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 variables sets the value of the root directory of the server's configuration files and directories, e.g.,  
*WLP\_USER\_DIR*=/var/zosconnect

-Dcom.ibm.ws.logging.log.directory=/u/johnson/logs



# 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: Initial server.xml configuration file



## Default server.xml configuration file

mitchj@us.ibm.com

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.

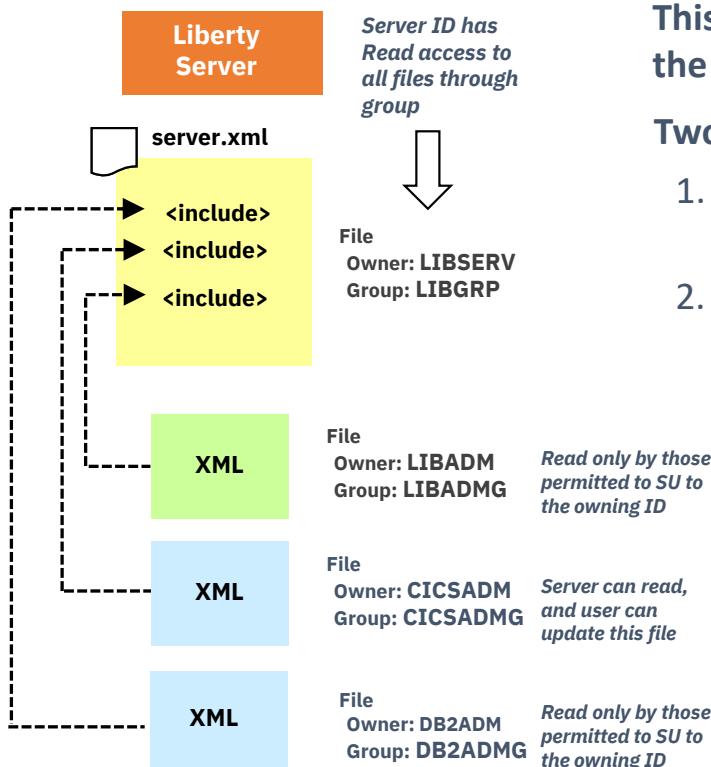
## Modified server.xml configuration file

```
<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



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



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

Two primary uses:

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

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

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

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

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

**Nesting of an include file within a include file is possible**

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

## server.xml (owned by ID ADMIN1)

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

## db2.xml (owned and managed by a DBA)

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

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

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

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

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



## Tech-Tip: Review configuration conflicts

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

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

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

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



# Using a bootstrap.properties file to customize the server's configuration XML<sup>#</sup>

## **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}

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## Consider sharing XML configuration files between servers

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

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

### F BAQSTRT,REFRESH,CONFIG

But wait, let’s take this a step further

#### 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
```



# Sharing XML configuration files between servers

Starting with the server.xml file contains these “include” statements

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

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

## OMVS commands

### **Symbolic links to a local file system**

```
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 file system (Sysplex) \***

```
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
```

**F ZCEESRV1,REFRESH,CONFIG**

**F ZCEESRV2,REFRESH,CONFIG**

**F ZCEESRV3,REFRESH,CONFIG**

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.

 /var/shared/zosconnect/includes

### **Contents of the “includes” directory**

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



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

**July 2020**

V3.0.35 (APAR PH26291)  
Server code update

**Enhancements**

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

**Fixes**

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

**Attention**

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

## cors.xml

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

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

</server>
```

## server.xml

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



# Sharing security XML configuration files – 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>
```

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

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

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



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

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

```
SYS1.PARMLIB(BPXPRM##)
MOUNT FILESYSTEM('OMVS.ZCEEVAR.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 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
```

Which leads to shorter OMVS commands:

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

OR

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

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



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

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

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

**Contents of each of the "resources/zosconnect" directory**

- /apis
- /apiRequesters
- /services

Or just specify shared alternative location for these artifacts using symbolic links.

## OMVS commands

### *Symbolic links to a local file system*

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

### *Or a symbolic links to a shared file system*

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

- /var/shared/zosconnect/resources/zosconnect/....
- /global/zosconnect/sources/....

Or better yet, use the location attribute to override the default directories.

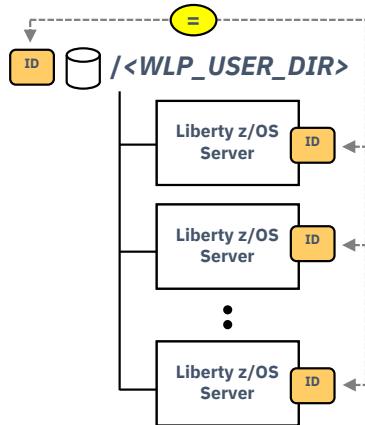
```
shared.xml
<zosconnect_apiRequesters location="/var/zcee/shared/apiRequesters">
</zosconnect_apiRequesters>
<zosconnect_zosConnectAPIs location="/var/zcee/shared/apis">
</zosconnect_zosConnectAPIs>
<zosconnect_services location="/var/zcee/shared/services">
</zosconnect_services>
```

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

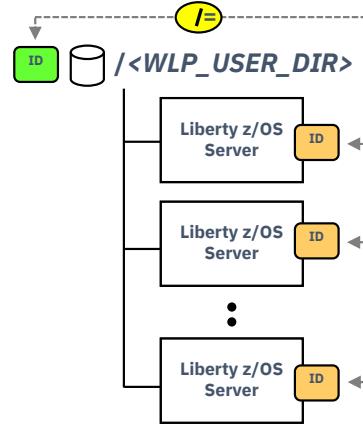
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# z/OS Security – Range of options – Started Task IDs

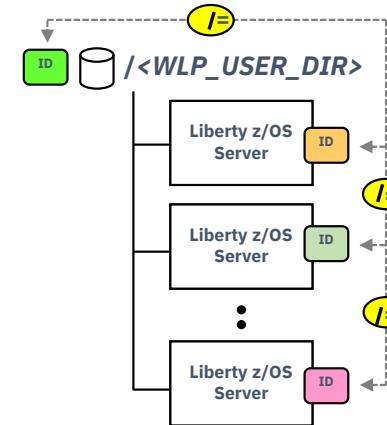
On z/OS, the best practice for Liberty servers in production is that they run as ‘Started Tasks’ (STCs).



- Multiple servers
- All have same STC ID
- STC ID = File Owner ID



- Multiple servers
- All have same STC ID
- STC ID ≠ File Owner ID



- Multiple servers
- Different STC IDs
- STC IDs ≠ File Owner ID

**Should all servers sharing WLP\_USER\_DIR share the same STC ID?  
It is a matter of the degree of identity isolation that is required**

# 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

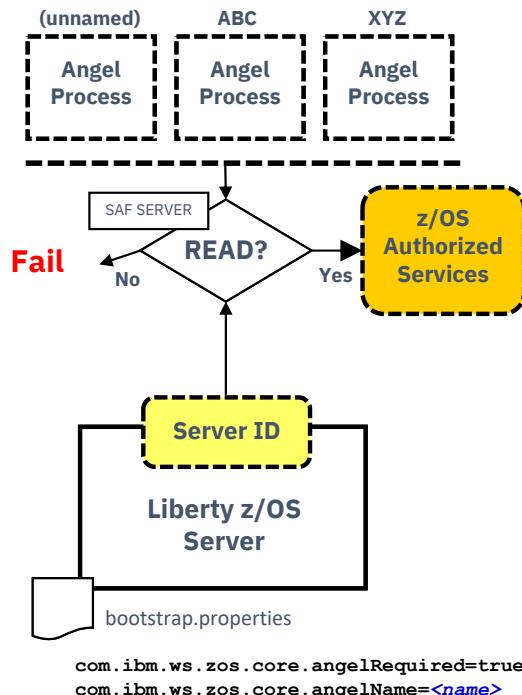
Then the second question is whether servers under a `WLP_USER_DIR` will share a common JCL start proc, or use unique start procs for each server

	<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

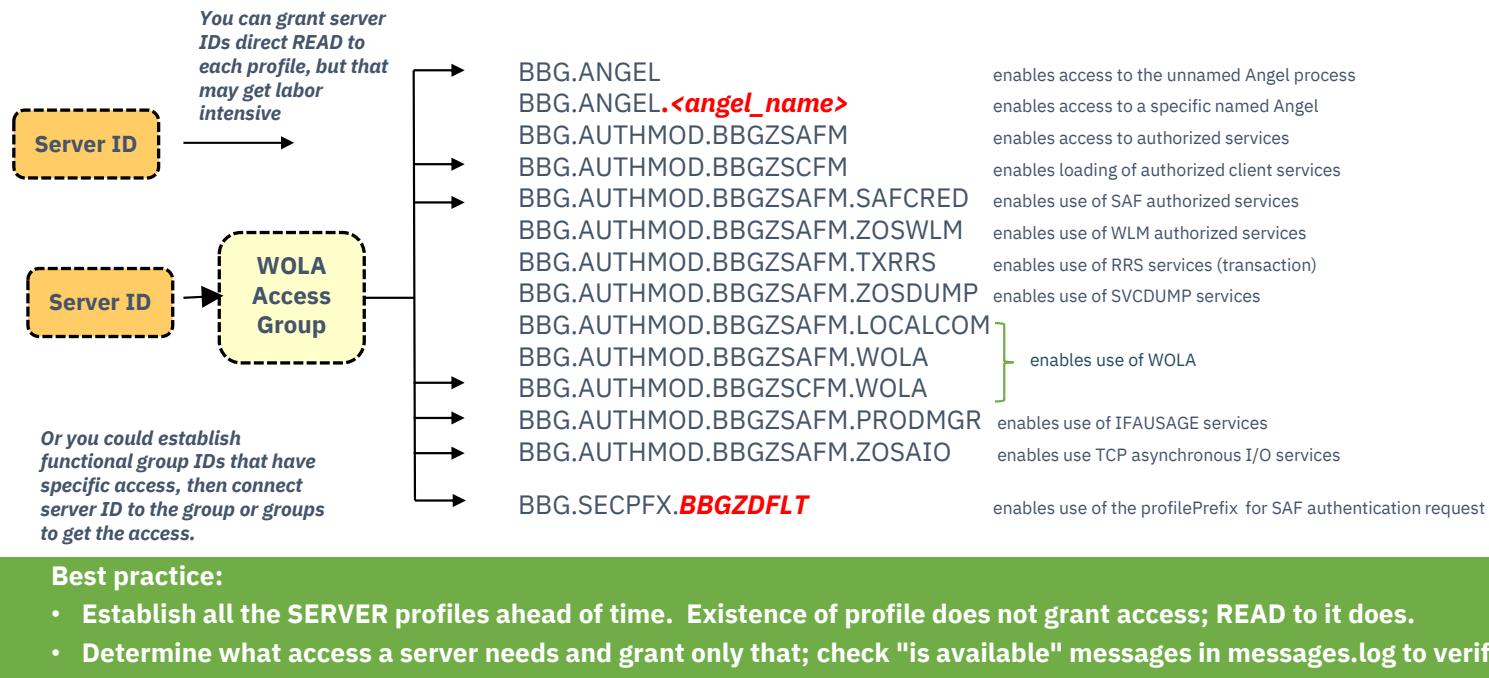
## Best practice:

- 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](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



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

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

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



# SAF APPL and EJBRole Resources

*Connect z/OS Connect users to a common group*

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

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

**RDEFINE APPL BBGZDFLT UACC(NONE) OWNER(SYS1)**

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

**SETROPTS RACLIST(APPL) REFRESH**

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

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

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

*Refresh the EJBROLE in storage profiles*

**SETROPTS RACLIST(EJBROLE) REFRESH**

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

- # [https://www.ibm.com/support/knowledgecenter/SS7K4U/liberty/com.ibm.websphere.wlp.zseries.doc/ae/twlp\\_config\\_security\\_saf.html](https://www.ibm.com/support/knowledgecenter/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](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 side-by-side screenshots of the z/OS ISPF/OMVS interface. Both screenshots show a terminal window titled 'WG31# - 3270'.

**Screenshot 1 (Left):** This screenshot shows the ISPF Shell menu bar. The 'Setup' option is highlighted with a red oval. Below the menu bar, the text 'Enter a pathname and do one of these:' is displayed, followed by three bullet points: '- Press Enter.', '- Select an action bar choice.', and '- Specify an action code or command on the command line.' A red oval highlights the text 'EUID=200042' in the terminal window.

**Screenshot 2 (Right):** This screenshot shows the terminal window displaying a series of commands and their outputs. The commands shown are:

```
s id  
uid=5504(USER3) gid=2(SYS1)  
su -s libserv  
$ id  
uid=200042(LIBSERV) gid=200034(LIBGRP) groups=200033(GMINVOKE),200036(ZCEEUSRS)  
$
```

Below the terminal window, a command line prompt shows '====> -' followed by a key mapping legend:

ESC=<	1=Help	2=SubCmd	3=HlpRetrn	4=Top	5=Bottom	6=TSO
MN	7=BackScr	8=Scroll	9=NextSess	10=Refresh	11=FwdRetr	12=Retrieve

The status bar at the bottom of the terminal window indicates 'Connected to remote server/host wg31a using lu/pool TCP00117 and port 23'.

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

# **Connecting to z/OS subsystems**



## Tech-Tip: Liberty's “adminCenter” Feature

- Web browser interface to the server's configuration files

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

**Left View (Design Tab):**

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

**Right View (Source Tab):**

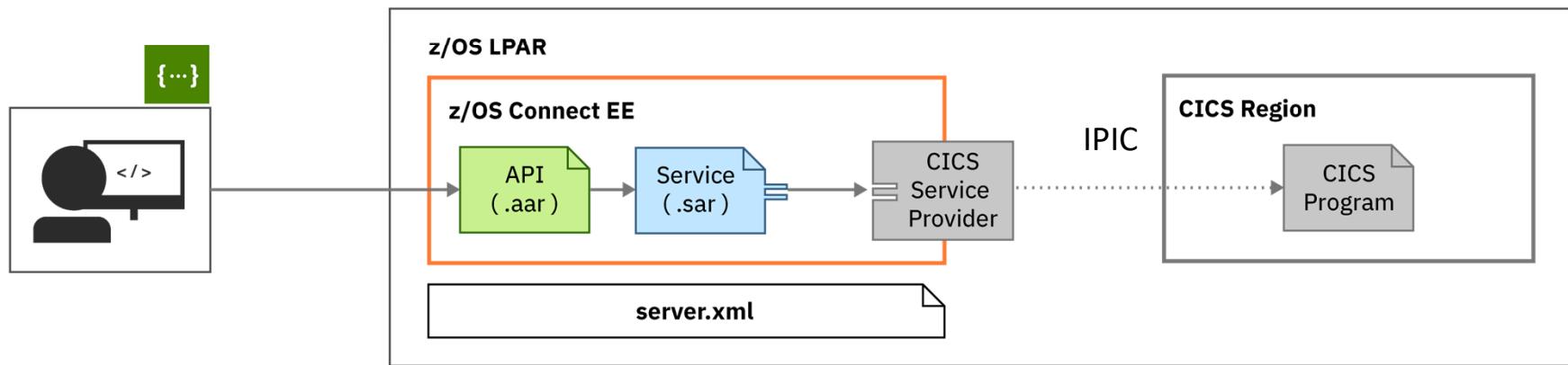
- The title bar says "Server Config".
- The file name is "server.xml".
- The tab bar has "Design" and "Source" (highlighted with a red circle).
- The main area displays the XML code for the `server.xml` file, starting with:

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



# Accessing a CICS program

## Topology



Connection to CICS is configured in `server.xml`.

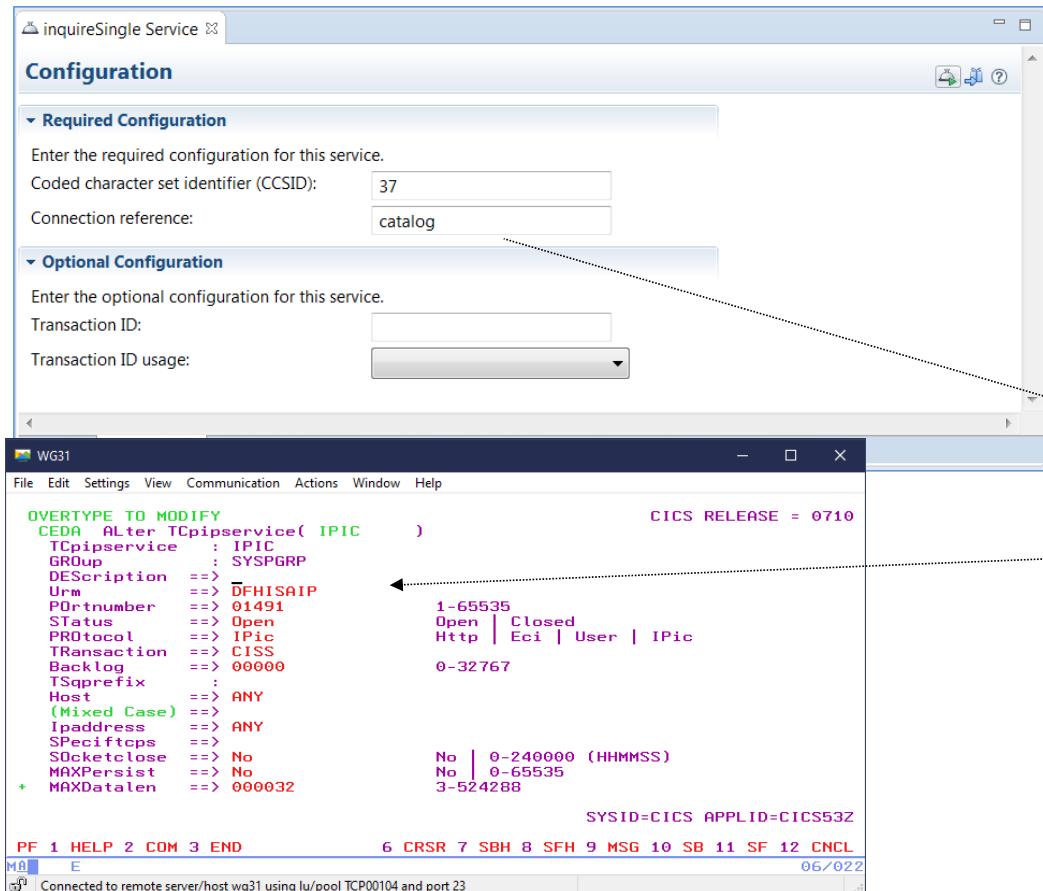
An IPIC connection must be configured in CICS.

i [ibm.biz/zosconnect-scenarios](http://ibm.biz/zosconnect-scenarios)

# 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

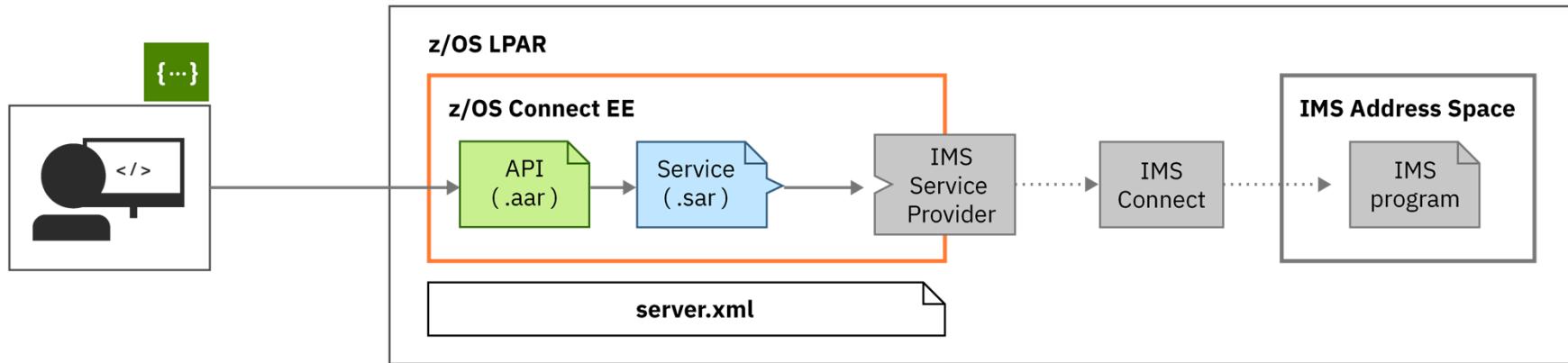
```
1<server description="CICS IPIC - catalog">
2
3<!-- Enable features -->
4<featureManager>
5  <feature>zosconnect:cicsService-1.0</feature>
6</featureManager>
7
8<zosconnect_cicsIpicConnection id="catalog">
9  host="wg31.washington.ibm.com"
10 port="1491"
11 transid="CSMI"
12 transidUsage="EIB_AND_MIRROR"/>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

Define IPIC connection to CICS



# Accessing an IMS transaction

## Topology



Configure the connection to IMS through `ims-connections.xml` and `ims-interactions.xml` in the IMS service registry.

[ibm.biz/zosconnect-scenarios](http://ibm.biz/zosconnect-scenarios)

# Server XML – Accessing an IMS Transaction using OTMA



ivtnoService Service Configuration

**Required Configuration**

Enter the required configuration for this service.

Connection profile: **IMSCONN**

Interaction profile: **IMSINTER**

**Optional Configuration**

Enter the optional configuration for this service.

IMS destination override:

Program name:

Overview Configuration

## IMS Connect HWSCFG

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

## Connection

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

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

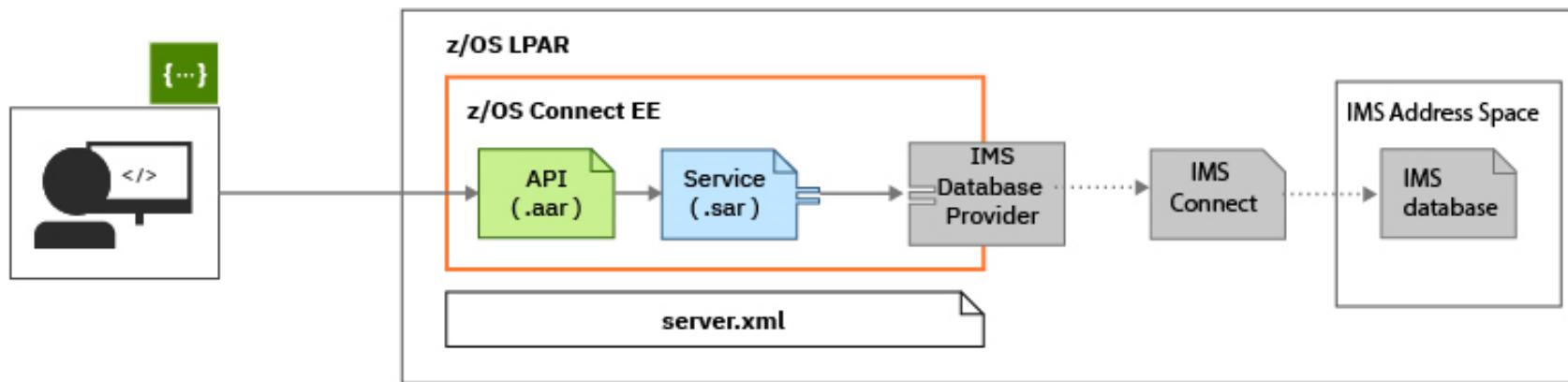
## Interaction

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



# Accessing an IMS data base

## Topology



Configure the connection to IMS using a Connection Factory in server.xml

Use the **API toolkit** to configure the service.

# Server XML – Accessing an IMS Database using ODBA



Service Project Editor: Configuration

Required Configuration

Enter the required configuration for this service.

Connection profile: DFSIVPACConn

## ConnectionFactory

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

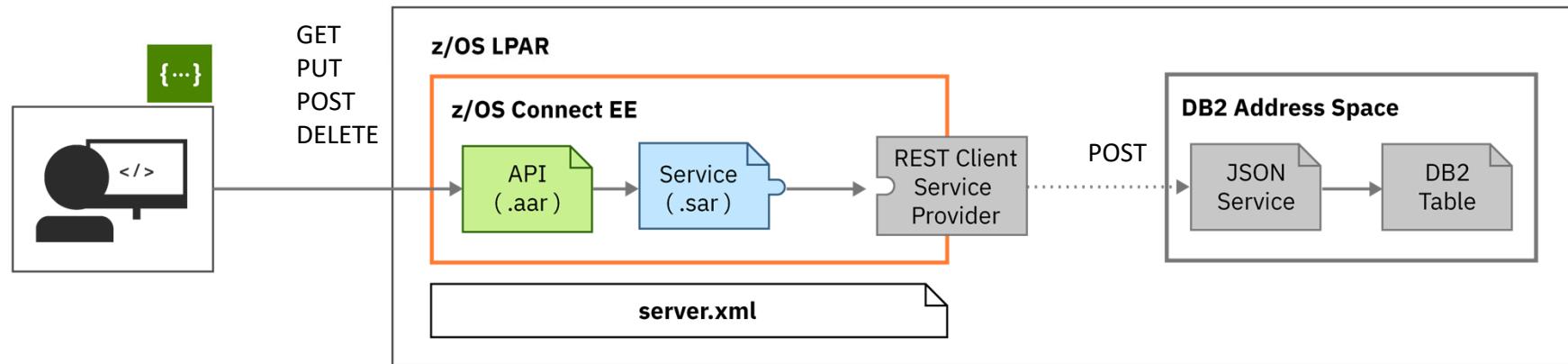
## IMS Connect HWSCFG

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



# Accessing a Db2 resources

## Topology



Connection to the JSON Service is configured in **server.xml**.

A Db2 REST Service must be configured in DB2.

# 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

Definition Configuration

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

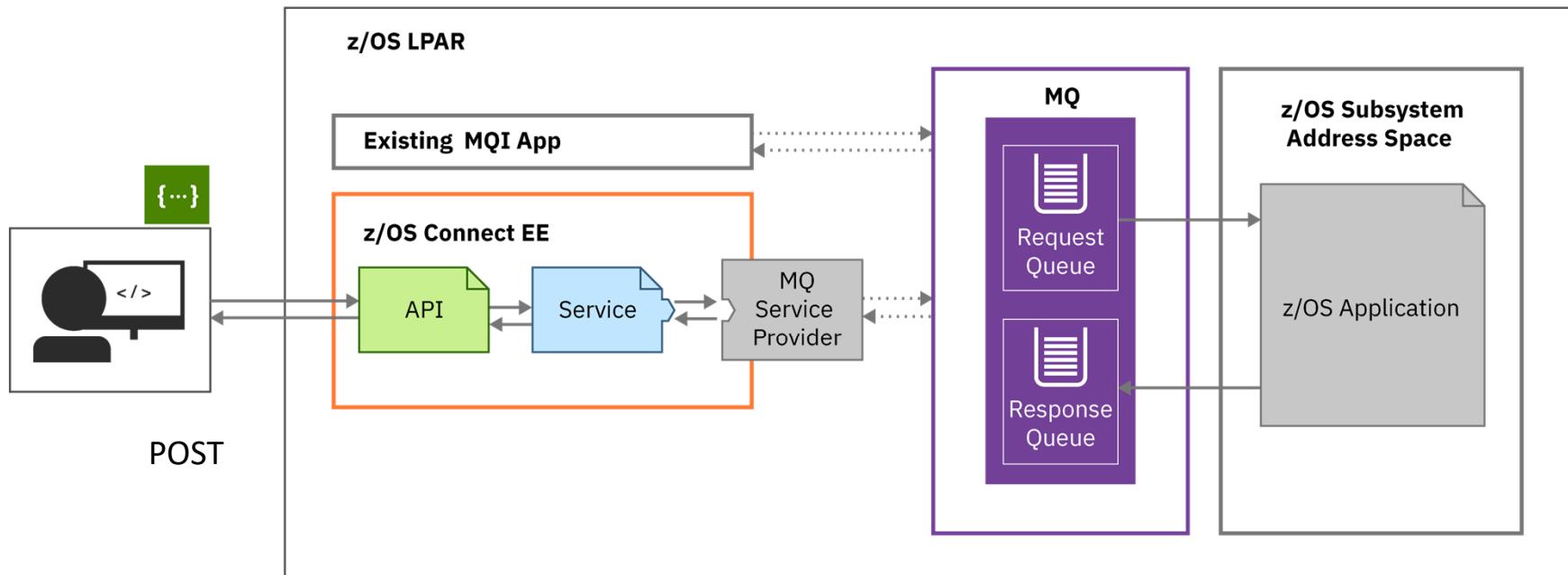
Design Source

```
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
```



# Accessing a MQ queue manager and request/reply queues

Topology (Two-way service example)

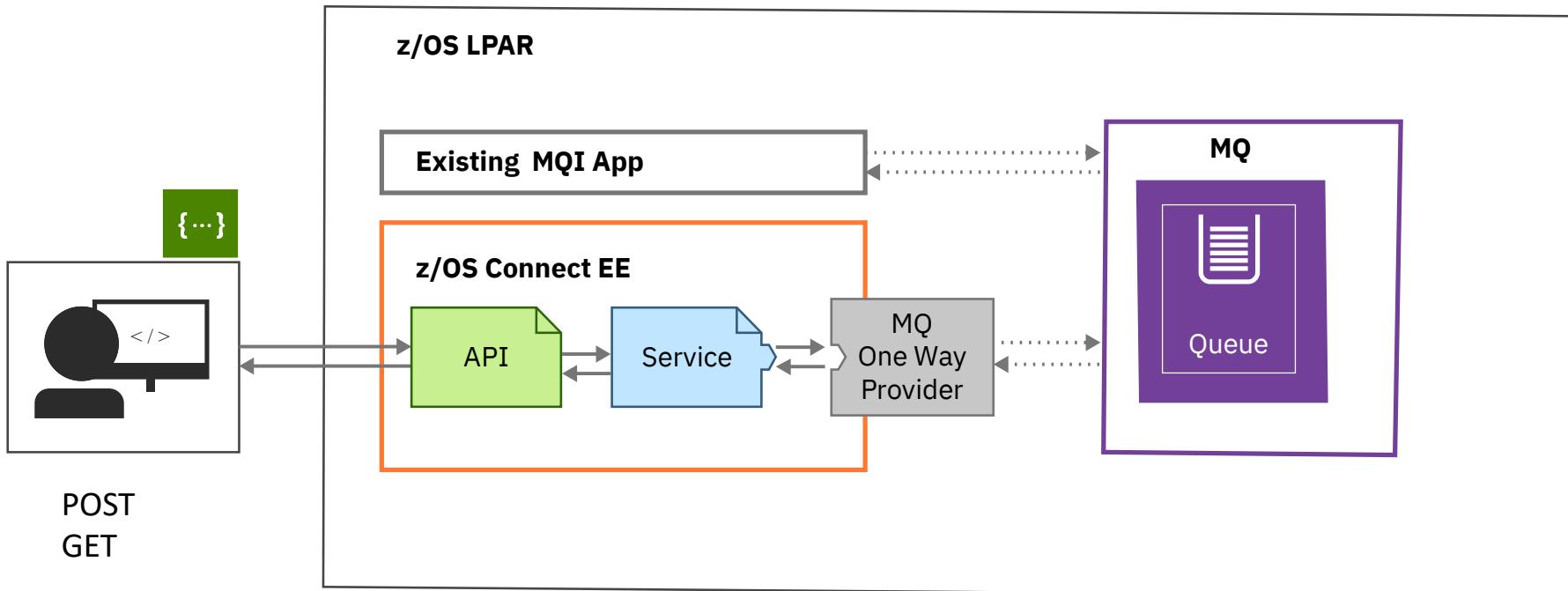


You can also configure one-way services.



# Accessing a MQ queue

Topology (One-way service example)



# Server XML - Using JMS to access MQ

\*twoWay Service X

## 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

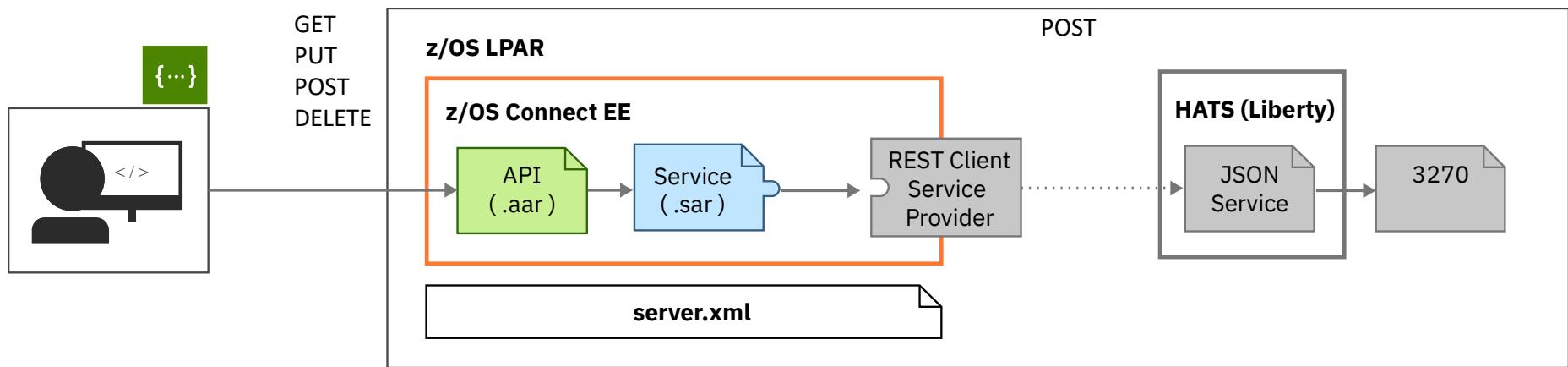
Design Source

```
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.MQZCEE.QUEUE"
30     CCSID="37"/>
31 </jmsQueue>
32
33 <jmsQueue id="requestQueue" jndiName="jms/request">
34   <properties.wmqJms
35     baseQueueName="ZCONN2.TRIGGER.REQUEST"
36     targetClient="MQ"
37     CCSID="37"/>
38 </jmsQueue>
39
40 <jmsQueue id="replyQueue" jndiName="jms/replyQueue">
41   <properties.wmqJms
42     baseQueueName="ZCONN2.TRIGGER.RESPONSE"
43     targetClient="MQ"
44     CCSID="37"/>
45 </jmsQueue>
46
47
```



# Accessing a HATS server

## Topology



Connection to the HATS REST Service is configured in `server.xml`.

# Server XML – Accessing a HATS REST service



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

Server Config

hats.xml

Read only Close

Design Source

```
<server description="HATS">
  <zosconnect_zosConnectServiceRestClientConnection id="HatsConn">
    host="wg31.washington.ibm.com"
    port="29080" />
</server>
```

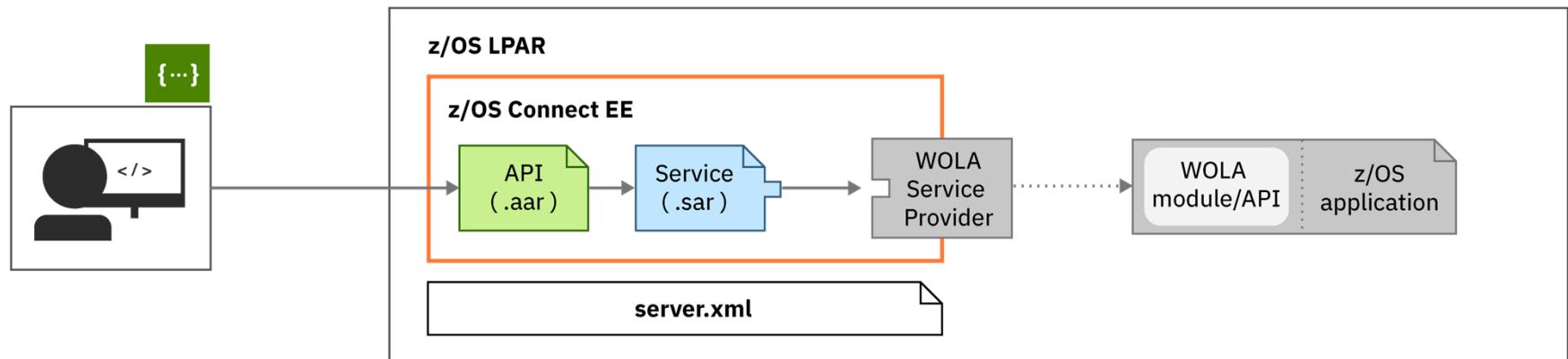
## HATS Liberty server.xml

```
<!-- 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" />
```



# Accessing a MVS batch application

## Topology



Connection to WOLA is configured in `server.xml`.

The z/OS application must be WOLA-enabled.

# Server XML- Accessing an MVS application using WOLA



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

Server Config

wola.xml

Read only Close

Design Source

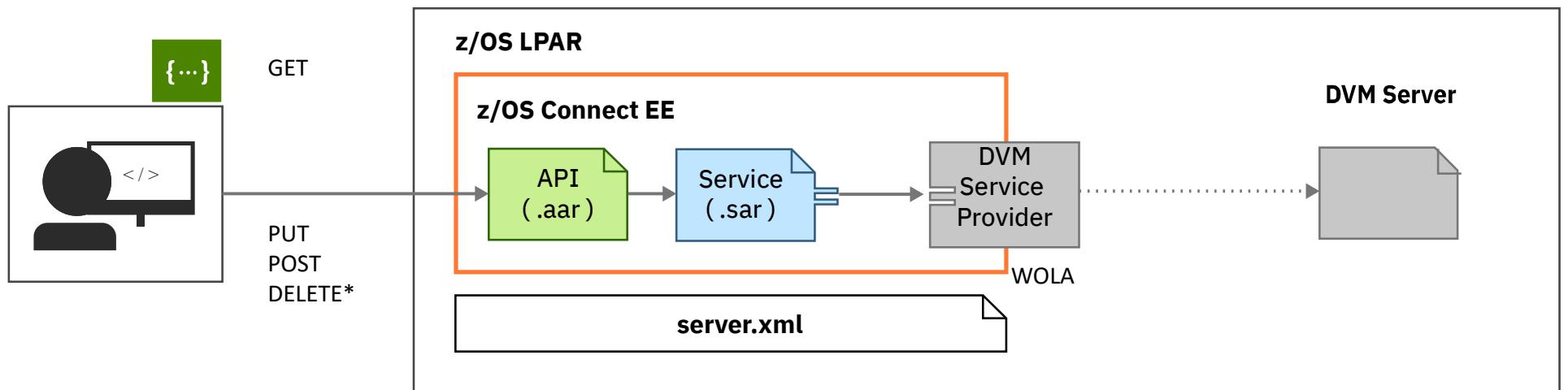
```
<server description="WOLA">
  <featureManager>
    <feature>zosLocalAdapters-1.0</feature>
  </featureManager>
  <zosLocalAdapters wolaGroup="ZCEESRVR"
    wolaName2="ZCEESRVR"
    wolaName3="ZCEESRVR"/>
  <connectionFactory id="wolaCF"
    jndiName="eis/ola">
    <properties.ola/>
  </connectionFactory>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

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



# Accessing a DVM server

## Topology



The DVM service provider uses WOLA

\* Requires a resource manager (e.g., RLS, VSAMCICS, etc.)

# 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>
```

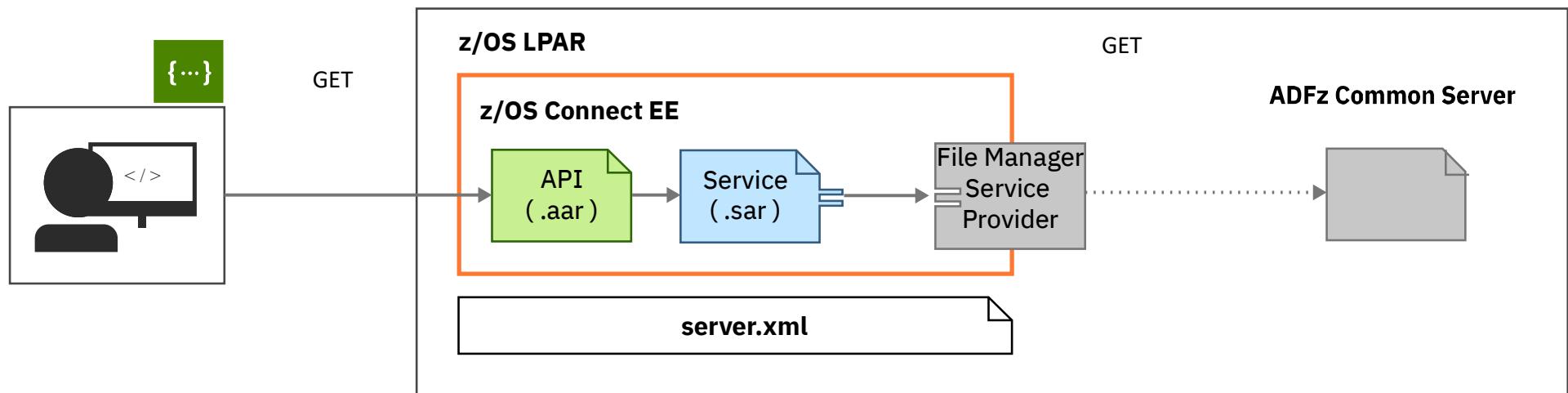
## DVS.AVZS.SAVZEXEC (AVZSIN00)

```
/*
 * 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
```



# Accessing a File Manager server

## Topology



Connection to the Application Delivery Foundation for z (ADFz) common server is over TCP/IP

A File Manager Template is required .

# Server XML – Accessing a File Manager



```
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"/>
</server>
```

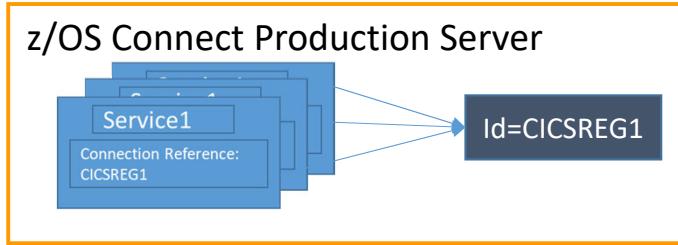
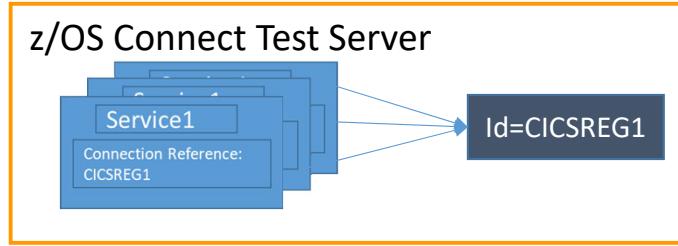
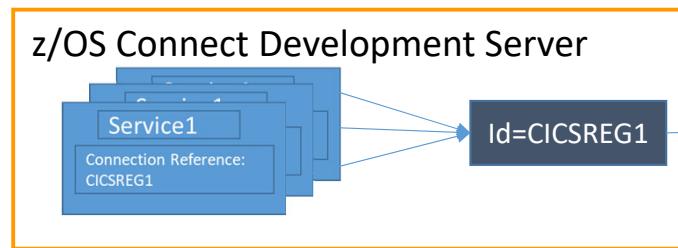
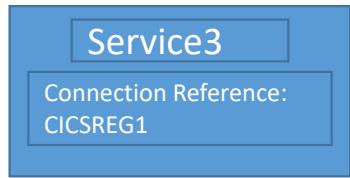
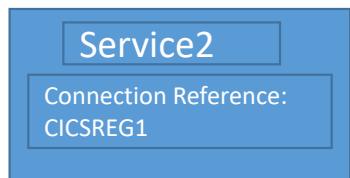
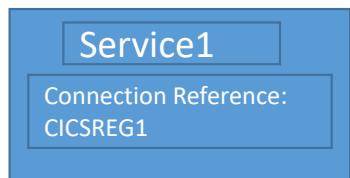
SYS1.PROCLIB(IPVSRV1)

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



# Use naming conventions for service connection references

Don't couple connection names to specific systems



?

CICS region CICSREG1

CICS region CICSTST1

CICS region CICSTST2

CICS region CICSPRD1

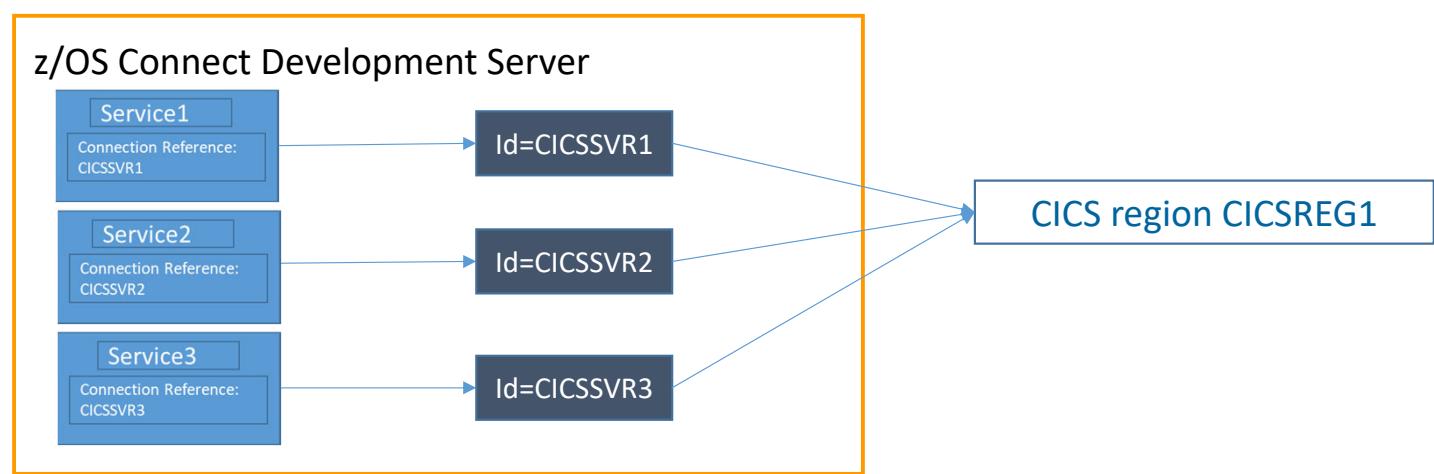
CICS region CICSPRD2

CICS region CICSPRD3



# Use naming conventions for service connection references

Use application meaningful names for connection references



# **Useful Liberty features and MVS commands**



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

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



```
Server Config
adminCenter.xml
Read only Close

Design Source

<server description="Admin Center">
  <!-- Enable features -->
  <featureManager>
    <feature>adminCenter-1.0</feature>
  </featureManager>
  <remoteFileAccess>
    <writeDir>${server.config.dir}</writeDir>
  </remoteFileAccess>
</server>
```

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



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

- Web browser interface to the server's configuration files

The screenshot shows the IBM Liberty adminCenter interface for managing server configuration files. The left sidebar lists various configuration sections like z/OS Connect Manager, z/OS Logging, and Application Monitoring. The main area is titled 'Server Config' and shows the 'server.xml' file. The 'Source' tab is active, displaying the XML code for the server configuration. A content assist dropdown is open over the 'zosconnect\_apiRequester' element, listing several options including 'zosconnect\_zosConnectServiceRestClientBasicAuth'. A red oval highlights the status bar message 'Press Ctrl+space for content assist'.

# 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, showing the XML configuration code. A tooltip explains that the URI Path is the concatenation of the path /ibm/api/config with the server XML configuration element and any optional query strings. Below the code, a list of URLs is displayed, each starting with <https://mpz3.washington.ibm.com:9443/ibm/api/config/jmsQueue>.

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="REST Connector">
    <featureManager>
        <feature>restConnector-2.0</feature>
    </featureManager>
</server>
```

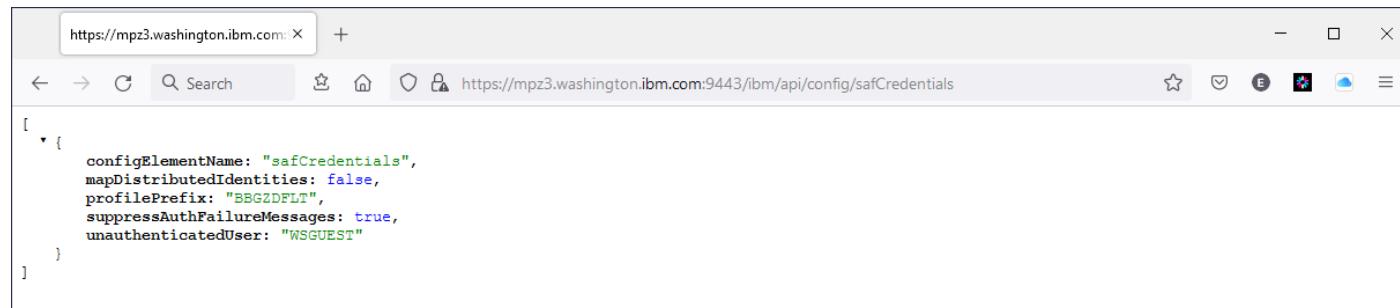
URI Path is the concatenation of the path `/ibm/api/config` with the server XML configuration element and any optional query strings.

<https://mpz3.washington.ibm.com:9443/ibm/api/config/jmsQueue>  
[https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect\\_cicsIpicConnection?port=1491](https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491)  
[https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect\\_zosConnectServiceRestClientConnection](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/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/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_zosConnectManager)  
[https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect\\_zosConnectAPIs](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_services)  
[https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect\\_apiRequesters](https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_apiRequesters)



# restConnector-2.0 feature examples

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



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

[https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect\\_zosConnectServiceRestClientConnection?port=2446](https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectServiceRestClientConnection?port=2446)

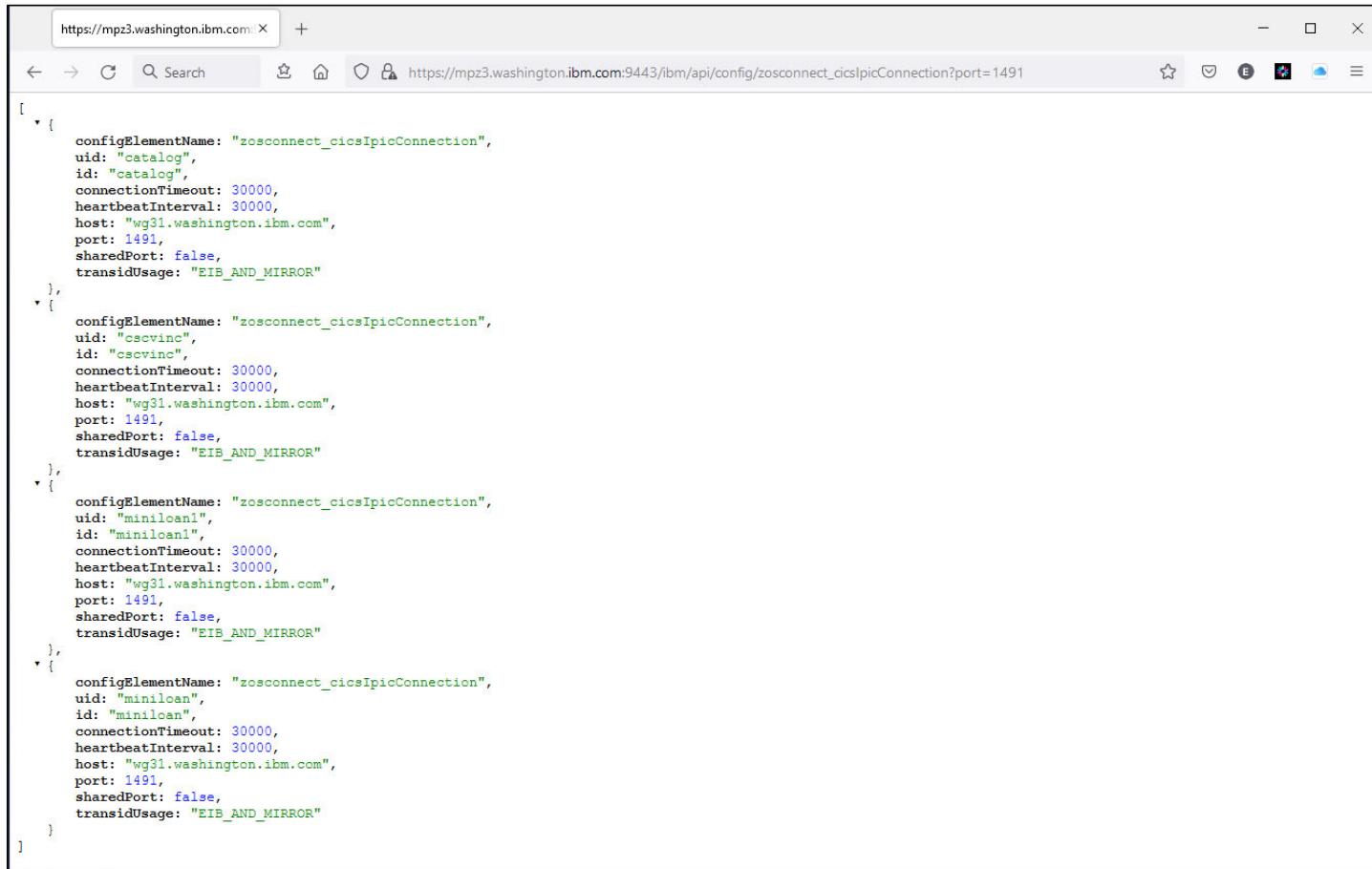


```
[{"configElementName": "zosconnect_zosConnectServiceRestClientConnection", "uid": "Db2Conn", "id": "Db2Conn", "allowChunking": true, "basicAuthRef": {"configElementName": "zosconnect_zosConnectServiceRestClientBasicAuth", "uid": "dns2Auth", "id": "dns2Auth", "password": "*****", "userName": "USER1"},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



# restConnector-2.0 feature

[https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect\\_cicsIpicConnection?port=1491](https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491)



The screenshot shows a web browser window displaying a JSON array of configuration elements. The URL in the address bar is [https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect\\_cicsIpicConnection?port=1491](https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491). The JSON data lists five connection configurations:

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

## **restConnector-2.0 feature**



[https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect\\_services](https://mpz3.washington.ibm.com:9443/ibm/api/config/zosconnect_services)

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

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

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

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



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

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

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

\*V3.0.48

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# Liberty MVS Commands

## F BAQSTRT,REFRESH,CONFIG

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

## F BAQSTRT,REFRESH,KEYSTORE

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

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

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

## F BAQSTRT,CACHE,CLEAR,AUTH

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

## F BAQZANGL,DISPLAY,SERVERS

Displays a list of servers currently connected to the angel

## F BAQZANGL,DISPLAY,SERVERS,PID

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

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

## F BAQZANGL,VERSION

Displays the version level of the angel

# **z/OS Connect MVS Commands**



## **F BAQSTRT,ZCON,REFRESH**

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

## **F BAQSTRT,ZCON,CLEARTOKENCACHE**

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

## **F BAQSTRT,ZCON,CLEARSAFCACHE**

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

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

# **Where do I look when things go wrong?**

# Where to find information when a problem occurs.



messages.log

```
mpz3
File Edit Settings View Communication Actions Window Help
File Edit Edit... Settings Menu Utilities Compilers Test Help
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/messages.log Columns 00100 00223
SCROLL ==> PAGE
000222 SYSTEM:Property com.ibm.lms.jdbenvironment set to 'JMS'
000223 JZCA7081I: Resource adapter imdbsLocal installed in 5.685 seconds,
000224 The resource adapter could not be started as it could not be found at location /var/zosconnect/servers/mySe
000231 CMKXZ081I: Starting application serverConfig.
000232 SRVE0169I: The server configuration file is using the expanded directory at the /var/zosconnect/servers/myServer location.
000233 SRVE0169I: Web Module myServer has been bound to defaultHost.
000234 SRVE0169I: The session configuration file for the Web Server plugin was automatically generated for this server at /var/zosconnect/servers/myServer/config.
000235 SRVE0169I: The session configuration file for the Web Server plugin was automatically generated for this server at /var/zosconnect/servers/myServer/config.
000236 SESN0176I: A new session context will be created for application key defaultHost/serverConfig.
000237 CMKXZ081I: Application serverConfig started in 0.636 seconds.
000238 CMKXZ081I: Application serverConfig started in 0.636 seconds.
000239 CMKXZ081I: Application serverConfig started in 0.636 seconds.
000241 CMKXZ0219I: TCP Channel defaultHTTPEndpoint has been started and is now listening for requests on host * (IPv6) port 9989.
000242 CMKXZ0219I: The server installed the following features: AdminCenter-1.0, appDiscovery-v2.0, distributedRedis
000243 CMKXZ0808I: Feature update completed in 17.917 seconds.
000246 CMKXZ2952I: The authorized version of the SAF user registry is activated. Authentication will proceed using authorized native
000247 CMKXZ1109I: 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
```

First Failure Data Collection (FFDC) dumps

```
mpz3
File Edit Settings View Communication Actions Window Help
File Edit Edit... Settings Menu Utilities Compilers Test Help
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/ffdc/ffdc.21.08.30_15.05.55.6.109 Columns 00001 00124
SCROLL ==> PAGE
=====
***** Top of Data *****
====MSG01====Warning: The UNDO command is not available until you Change your edit Profile using the command RECOVERY ON
====MSG02====Start Date: 2021-08-30 15:05:55.6109 (GMT)
000001 Exception = javax.net.ssl.SSLHandshakeException
000002 Stack Trace: java.net.ssl.SSLHandshakeException Received fatal alert: unknown_ca
at com.ibm.Jsse2.b.a(Unknown Source)
000003 at com.ibm.Jsse2.b.b.a(Unknown Source)
000004 at com.ibm.Jsse2.b.b.c.b(Unknown Source)
000005 at com.ibm.Jsse2.b.b.e.b(Unknown Source)
000006 at com.ibm.Jsse2.b.b.f.b(Unknown Source)
000007 at com.ibm.Jsse2.b.b.g.b(Unknown Source)
000008 at com.ibm.Jsse2.b.b.h.b(Unknown Source)
000009 at com.ibm.Jsse2.b.b.i.b(Unknown Source)
000010 at com.ibm.Jsse2.b.b.j.b(Unknown Source)
000011 at com.ibm.Jsse2.b.b.k.b(Unknown Source)
000012 at com.ibm.Jsse2.b.b.l.b(Unknown Source)
000013 at com.ibm.Jsse2.b.b.m.b(Unknown Source)
000014 at com.ibm.Jsse2.b.b.o.b(Unknown Source)
000015 at com.ibm.Jsse2.b.b.p.b(Unknown Source)
000016 at com.ibm.ws.channel.ssl.internal.SSLReadServiceContext.decryptMessage(SSLReadServiceContext.java:121)
000017 at com.ibm.ws.channel.ssl.internal.SSLReadServiceContext.decrypt(SSLReadServiceContext.java:1000)
000018 at com.ibm.ws.channel.ssl.internal.SSLReadServiceContext.decrypt(SSLReadServiceContext.java:1000)
000019 at com.ibm.ws.channel.ssl.internal.SSLReadServiceContext.decrypt(SSLReadServiceContext.java:1000)
***** 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 Edit... Settings Menu Utilities Compilers Test Help
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/trace.log Columns 00001 00124
SCROLL ==> PAGE
=====
***** Top of Data *****
====MSG01====Warning: The UNDO command is not available until you Change your edit Profile using the command RECOVERY ON
====MSG02====Start Date: 2021-08-30 15:05:55.6109 (GMT)
000001 PRINTER LOG FOR ZOSCONNECT SERVERS MYSEVER
000002 PREVIOUS LOG FOR ZOSCONNECT SERVERS MYSEVER
000003 PREVIOUS LOG FOR ZOSCONNECT SERVERS MYSEVER
000004 server.config.dir = /var/zosconnect/servers/myServer/
000005 Java.version = 1.8.0_311
000006 Java.runtime = Java(TM) SE Runtime Environment (8.0_65-b14-164)
000007 Java.runtime = Java(TM) SE Runtime Environment (8.0_65-b14-164)
000008 process = 168439936P23
000009 process = 168439936P23
000010 process = 168439936P23
000011 **** Bottom of Data *****
000012 [8/30/21 15:34:58:201 GMT] 000000054 id=8994258 com.ibm.zosconnect.service.cics.internal.com.isc.Connection > setVersion Entry
000013 [8/30/21 15:34:58:201 GMT] 000000054 id=8994258 com.ibm.zosconnect.service.cics.internal.com.isc.Connection < setVersion Exit
000014 [8/30/21 15:34:58:203 GMT] 000000054 id=8994258 com.ibm.zosconnect.service.cics.internal.com.isc.Connection > getHeader Entry
000015 [8/30/21 15:34:58:203 GMT] 000000054 id=8994258 com.ibm.zosconnect.service.cics.internal.com.isc.Connection < getHeader Exit
000016 [8/30/21 15:34:58:203 GMT] 000000054 id=8994258 com.ibm.zosconnect.service.cics.internal.com.isc.Connection > init Entry
000017 [8/30/21 15:34:58:203 GMT] 000000054 id=8994258 com.ibm.zosconnect.service.cics.internal.com.isc.Connection < init Exit
000018 [8/30/21 15:34:58:203 GMT] 000000054 id=8994258 com.ibm.zosconnect.service.cics.internal.com.isc.Connection > destroy Entry
000019 [8/30/21 15:34:58:203 GMT] 000000054 id=8994258 com.ibm.zosconnect.service.cics.internal.com.isc.Connection < destroy Exit
***** 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
File Edit Display Filter View Print Options Search Help
SDSF OPERLOG_MPZ3 08/30/2021 04 COLUMNS 02* 133
COMMAND INPUT ==>
00000000 MPZ3 21242 13:20:25.35 STC10771 00000000
337 00000000
00000000 MPZ3 21242 13:20:25.36 STC10771 00000000
338 00000000
00000000 MPZ3 21242 13:20:25.36 STC10771 00000000
339 00000000
00000000 MPZ3 21242 13:20:25.41 STC04167 00000000
DSNI1331 - DSNE DSNUVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
00000000 MPZ3 21242 13:20:25.41 STC04167 00000000
DSNI1331 - DSNE DSNUVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
00000000 MPZ3 21242 13:20:25.92 STC10771 00000000
+CMKFB00111: The myServer server is ready to run a smarter Planet. The
00000000 MPZ3 21242 13:20:25.92 STC10771 00000000
+CMKFB00111: The myServer server is ready to run a smarter Planet. The
00000000 MPZ3 21242 13:20:30.98 STC10771 00000000
+CMKFB00111: The myServer server is ready to run a smarter Planet. The
00000000 MPZ3 21242 13:20:30.98 STC10771 00000000
+CMKFB00111: The myServer server is ready to run a smarter Planet. The
00000000 MPZ3 21242 13:20:35.53 STC04167 00000000
DSNI1331 - DSNE DSNUVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
00000000 MPZ3 21242 13:21:00.19 STC04167 00000000
+CSX2511 ZMQ CSQXSTL Listener started, TRPTYPE=TCP INDISPQNR
00000000 MPZ3 21242 13:21:00.19 STC04167 00000000
+CSX2511 ZMQ CSQXSTL Listener not started, unable to bind, 245
21/099
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
File Edit Display Filter View Print Options Search Help
SDSF OUTPUT DISPLAY BAQ01771 DSID 103 LINE 84 COLS 02* 133
COMMAND INPUT ==>
00000000 MPZ713017 Z/OS Connect EE API miniloanics was requested successfully for API Discovery.
YAUDIT -- CMKXZ081I: Web application available (defaultHost) : https://drvpis.washington.ibm.com:9880/api/explorer/
YAUDIT -- CMKXZ081I: Web application available (defaultHost) : https://drvpis.washington.ibm.com:9880/api/docstore/
YAUDIT -- CMKXZ081I: Web application available (defaultHost) : https://drvpis.washington.ibm.com:9880/ibmIVRConnectorREST/
YAUDIT -- CMKXZ081I: Web application available (defaultHost) : https://drvpis.washington.ibm.com:9880/ibm-adminCenter/serverConfig-i/
YAUDIT -- CMKXZ081I: Web application available (defaultHost) : https://drvpis.washington.ibm.com:9880/ibm-adminCenter/explore-i/
YAUDIT -- CMKXZ081I: Web application available (defaultHost) : https://drvpis.washington.ibm.com:9880/ibm-adminCenter/
YAUDIT -- CMKXZ081I: Web application available (defaultHost) : https://drvpis.washington.ibm.com:9880/zosconnect/apiRequesters/
YAUDIT -- CMKXZ081I: Web application available (defaultHost) : https://drvpis.washington.ibm.com:9880/zosconnect/apiRequesters/
YAUDIT -- CMKXZ081I: Resource adapter imdbsLocal installed in 5.685 seconds.
YAUDIT -- CMKXZ081I: Resource adapter imdbsLocal did not start as it could not be found at location /var/zosconnect/servers/myServer/
YAUDIT -- CMKXZ081I: Application serverConfig started in 0.636 seconds.
YAUDIT -- CMKXZ081I: Application serverConfig started in 0.636 seconds.
YAUDIT -- CMKXZ081I: The myServer server is ready to run a smarter Planet. The myServer server started in 17.991 seconds.
YAUDIT -- CMKXZ1109I: Authentication did not succeed for user ID user1. An invalid user ID or password was specified.
00000000 MPZ3 21242 13:21:00.19 STC04167 00000000
+CMKFB00111: The myServer server is ready to run a smarter Planet. The myServer server started in 17.991 seconds.
***** 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 token validation.
- **z/OS Connect XML Configuration issues**
  - Missing or misspelled configuration attributes (remember the Liberty XML parser is too forgiving)
- **External resource Issues**
  - Service provider configuration issues.
  - Timeouts
  - Network Firewalls
  - Resource Security
  - Other resource errors

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

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



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

[9/3/21 13:38:02:831 GMT] 00000013 com.ibm.ws.kernel.launch.internal.FrameworkManager

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 CWWKO0219I: TCP Channel defaultHttpEndpoint has been s

I CWWKO0219I: TCP Channel defaultHttpEndpoint-ssl has be

I SRVE9103I: A configuration file for a web server plugi

A CWWKF0012I: The server installed the following feature

I CWWKF0008I: Feature update completed in 37.484 seconds

A CWWKF0011I: The zceepid server is ready to run a smar

I CWWKS1700I: OpenID Connect client ATS configuration su

I CWWKS4358I: The authentication filter ATSAuthFilter co

I BAQR0680I: CICS connection cscvinc established with 10

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



# Basic security issues – Sometimes you are lucky

The STDOUT may show:

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

And the messages.log displays:

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

But the JESMSGGLG and SYSLOG displays:

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

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

MA B 16/074
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
```



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

The STDOUT may show:

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

But there are no SAF messages in the SYSLOG:

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

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

CWWKS2907E: SAF Service IRRSIA00\_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZDFLT. SAF return code 0x00000008. RACF return code 0x00000008. RACF reason code 0x00000020.

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



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

Table 1. initACEE create return codes

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

Hex '20' = Dec '32'

Root cause – No READ access to APPL resource BBGZDFLT

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

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# Basic security issues – Sometimes there is misdirection

The STDOUT may show:

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

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



# Basis security issues - Use the SYSLOG/JESMSGGLG output

The SYSLOG shows a ICH408I message:

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

SDSF OPERLOG MPZ3 09/16/2021 0W
COMMAND INPUT ===> -
M 8000000 MPZ1 21259 16:50:10.13 STC11092 00000090 COLUMNS 01- 132
E 057 00000090 SCROLL ==> PAGE
M 8000000 MPZ1 21259 16:50:18.77 STC11094 00000090 CSQY220I ZMQ1 CSQSCTL Queue manager storage usage: 057
E 058 00000090 local storage: used 607MB, free 787MB; above bar: used 256MB, free 1GB
M 4000000 MPZ3 21259 16:50:19.01 STC11011 00000090 CSQY220I ZMQA CSQSCTL Queue manager storage usage: 058
S +CSQX123E ZMQC CSQXSMFT Failed to process channel initiator statistics,
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 00000090 RC=00000024
E 424 00000090 +CSQX125I ZMQ3 CSQXSMFT SMF data incomplete
N 4000000 MPZ3 21259 16:50:19.10 STC11010 00000090 IEA989I SLIP TRAP ID=X13E MATCHED.  JOBNAME=JOHNSON , ASID=004D.
N 0000000 MPZ3 21259 16:50:20.66 00000281 DSNW133I -DSNA DSNWVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
N 8000000 MPZ1 21259 16:50:30.89 STC11087 00000090 DSNW133I -DSNC DSNWVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
N 8000000 MPZ3 21259 16:50:31.08 STC11002 00000090 DSNW123T -DSNC DSNWVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
N 8000000 MPZ3 21259 16:50:47.01 STC11002 00000090
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 04/021
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
```

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

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



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

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

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

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

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

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

```
VIEW      /MPZ3/var/zosconnect/servers/myServer/logs/messages.log          Columns 00100 00223
Command ==>
000021 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/shared.xml
000022 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/oauth.xml
000023 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/audit.xml
000024 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/mq.xml
000025 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/db2.xml
000026 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/wlm.xml
000027 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/restConnector.xml
000028 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/smf.xml
000029 CUWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/adminCenter.xml
000030 CUWKB0125I: This server requested a REGION size of 8KB. The below-the-line storage limit is 8MB and the above-the-line stor
000031 CUWKB0126I: MEM1 TMIT=2000... MEM1 TMIT CONFIGURATION SOURCE=TCI
000032 CUWKB0101I: The angel process is not available. No authorized services will be loaded. The reason code is 4.
000033 CUWKB0104I: Authorized service group KERNEL is not available.
000034 CUWKB0104I: Authorized service group LOCALCOM is not available.
000035 CUWKB0104I: Authorized service group PRODMGR is not available.
000036 CUWKB0104I: Authorized service group SAFCRED is not available.
000037 CUWKB0104I: Authorized service group TXRRS is not available.
000038 CUWKB0104I: Authorized service group WOLA is not available.
000039 CUWKB0104I: Authorized service group ZOSAIO is not available.
000040 CUWKB0104I: Authorized service group ZOSDUMP is not available.
000041 CUWKB0104I: Authorized service group ZOSWLM is not available.
000042 CUWKB0104I: Authorized service group CLIENT.WOLA is not available.
000043 CUWKB0108I: IBM Corp product z/OS Connect version 03.00 successfully registered with z/OS.
MA      B                                         14/809
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
```



# External resource issues (HTTP 500) - CICS

The client sees:

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

The STDOUT may show:

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

While the messages.log display

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



# External resource issues (HTTP 500) – Db2

The client sees:

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

The STDOUT may show:

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

The messages.log displays:

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

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

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

## Tech-Tip: An HTTP 500 shortcut

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

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

# What is a Java stack trace?



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

IMS service provider classes  
z/OS Connect Java classes

A Google search of ICO0001E 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

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# 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

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# The FFDC dump is more than a Java stack trace

z/OS Connect Java classes

```
-----Start of DE processing----- = [9/7/21 20:26:12:394 GMT]
Exception = com.ibm.zosconnect.endpoint.connection.TokenConfigException
Source = com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl
probeid = 265
Stack Dump = com.ibm.zosconnect.endpoint.connection.TokenConfigException: BAQR1006E: An error occurred when z/OS Connect EE attempted to
access the authentication/authorization server. Error: javax.net.ssl.SSLHandshakeException: SSLHandshakeException invoking
https://wg31.washington.ibm.com:26213/oidc/endpoint/OP/token: com.ibm.jsse2.util.j: PKIX path building failed:
com.ibm.security.cert.IBMCertPathBuilderException: unable to find valid certification path to requested target
at com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl.requestAuthorizationServer(Unknown Source)
at com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl.getAuthData(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.restclient.RestClientImpl.handleAuthConfig(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.restclient.RestClientImpl.invoke(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.ARInvokeHandler.handle(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.ApiRequesterManagerImpl.invoke(Unknown Source)
at com.ibm.zosconnect.apirequester.internal.ApiRequesterManagerProxyImpl$1.run(Unknown Source)
.
.
.
Dump of callerThis
Object type = com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl
copyright_notice = "Licensed Materials - Property of IBM 5655-CE3 (c) Copyright IBM Corp. 2017, 2021 All Rights Reserved
tc = class com.ibm.websphere.ras.TraceComponent@2d85bcc
strings[0] = "TraceComponent[com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl,class
com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl,[zosConnectApiRequesterToken],com.ibm.zosconnect.endpoint
.connection.internal.resources.ZosConnectEndpointConnection,null]"
CFG_ELEMENT_ID = "id"
CFG_GRANTTYPE = "grantType"
id = "myoAuthConfig"
grantType = "password"
authServer = class com.ibm.zosconnect.endpoint.connection.internal.AuthorizationServerImpl@ed6c1e8c
.
.
.
sslCertsRef = "OutboundSSLSettings"
connectionTimeout = 30000
receiveTimeout = 60000
id = "myoAuthServer"
```



# The FFDC dump for a network issue

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

Base Java classes  
z/OS Connect Java classes

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

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

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

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

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

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# Use the messages.log and FFDC log together

```
[9/12/21 14:56:45:613 GMT] 00000045 com.ibm.ws.logging.internal.impl.IncidentImpl           I FFDC1015I: An FFDC Incident has been  
created: "com.ibm.mq.connector.DetailedResourceException: MQJCA1011: Failed to allocate a JMS connection., error code: MQJCA1011 An internal  
error caused an attempt to allocate a connection to fail. See the linked exception for details of the failure.  
com.ibm.ejs.j2c.poolmanager.FreePool.createManagedConnectionWithMCWrapper 199" at ffdc_21.09.12_14.56.45.0.log

[9/12/21 14:56:45:652 GMT] 00000045 com.ibm.ws.logging.internal.impl.IncidentImpl           I FFDC1015I: An FFDC Incident has been  
created: "com.ibm.msg.client.jms.DetailedJMSEException: MQJCA1011: Failed to allocate a JMS connection.

An internal error caused an attempt to allocate a connection to fail.

See the linked exception for details of the failure. com.ibm.zosconnect.service.mq.OneWayMQServiceInvocation 0004" at  
ffdc_21.09.12_14.56.45.1.log

[9/12/21 14:56:45:652 GMT] 00000045 com.ibm.zosconnect.service.mq.MQServiceInvocation          E BAQM0056E: An unexpectedJMSEException  
occurred while processing a request for service 'mqGetService'. The exception message was 'MQJCA1011: Failed to allocate a JMS connection.'.
```

Spacing added between lines to improve readability

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# The FFDC dump showing additional JMS information



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

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

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# A FFDC dump showing a SSL Handshake issue

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

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

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# Other common TLS handshake issues

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

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

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

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

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

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

The first FACILITY resource gives the identity access to their own key ring and the second allows access to the certificates. 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.



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

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

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

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

## Enabling trace in z/OS Connect EE server

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



# Managing trace specification

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

## **server.xml**

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

## **safTrace.xml**

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

## **cicsTrace.xml**

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

## **imsTrace.xml**

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

## **Enables enhanced tracing**

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

## **Disable enhanced tracing**

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

# trace.out file



mpz3

File Edit Settings View Communication Actions Window Help

File Edit Settings Menu Utilities Compilers Test Help

EDIT /MPZ3/var/zosconnect/servers/myServer/logs/trace.log Columns 00101 00252

Command ==> Scroll ==> PAGE

```
003637 > getSSLConfig: DefaultSSLSettings Entry
003638 < getSSLConfig Exit
003639   SSLConfig.toString() (
003683 > determineIfCSIV2SettingsApply Entry
003684   (com.ibm.ssl.RemoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
003685 < determineIfCSIV2SettingsApply (original settings) Exit
003730   3 keyStoreType: JCERACFKS
003731   3 trustStoreType: JCERACFKS
003734   3 keyStore: saferouting://Liberty.KeyRing
003735   3 keyStoreName: CellDefaultKeyStore
003736   3 keyStorePassword: *****
003737   3 trustStore: saferouting://Liberty.KeyRing
003738   3 trustStoreName: CellDefaultKeyStore
003739   3 trustStorePassword: *****

003741   (com.ibm.ssl.RemoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004117 K 3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004119   3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004142   (com.ibm.ssl.RemoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004144 > isTransportSecurityEnabled Entry
004145 < isTransportSecurityEnabled true Exit
004150   > getSSLConfig: DefaultSSLSettings Entry
004151   < getSSLConfig Exit
004152     SSLConfig.toString() (
004196 > determineIfCSIV2SettingsApply Entry
004197   (com.ibm.ssl.RemoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004198 < determineIfCSIV2SettingsApply (original settings) Exit
004243   3 keyStoreType: JCERACFKS
004244   3 trustStoreType: JCERACFKS
004247   3 keyStore: saferouting://Liberty.KeyRing
004248   3 keyStoreName: CellDefaultKeyStore
004249   3 keyStorePassword: *****
004250   3 trustStore: saferouting://Liberty.KeyRing
004251   3 trustStoreName: CellDefaultKeyStore
004252   3 trustStorePassword: *****

004254   (com.ibm.ssl.RemoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004630 K 3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004632   3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004655   (com.ibm.ssl.RemoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004657 > isTransportSecurityEnabled Entry
004658 < isTransportSecurityEnabled true Exit
```

03/019

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

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

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

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

# All the health center directives should be on one line.

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

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

# Java Health Center – Monitoring Agent Configuration



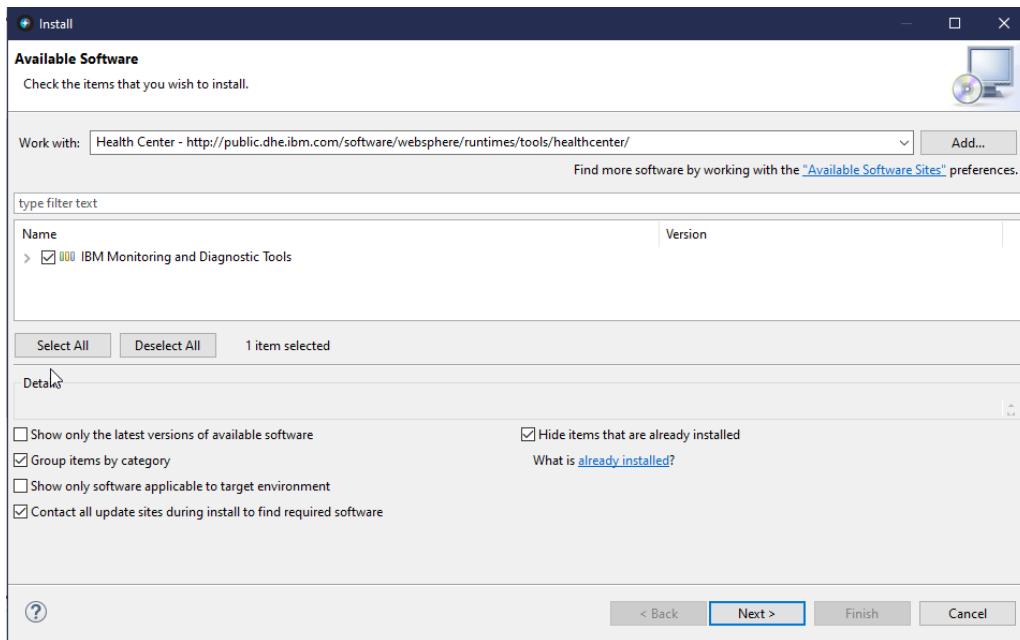
Set the JVM\_OPTIONS environment variable to the properties file containing the health center directives

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

# Java Health Center – Client Configuration



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



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

# Java Health Center – HEAP analysis example



The screenshot shows the Java Health Center interface in Eclipse, specifically the Garbage Collection perspective. The main window displays a graph of heap usage, pause times, and object allocations over time.

**Graph View:** The graph shows three metrics over a 36-minute period:

- Used heap (after collection):** Represented by a solid purple line, showing a steady increase from ~10MB to ~40MB.
- Heap size:** Represented by a dashed green line, showing a step-up to ~90MB around 0:24.
- Pause time:** Represented by a dotted blue line, showing several spikes reaching up to 50ms.

**Summary View:** A table providing detailed garbage collection statistics:

Metric	Value
Concurrent collection count	10
GC Mode	Default (gencon)
Global collections - Mean garbage collection pause	6.29 ms
Global collections - Mean interval between collections	2110 ms
Global collections - Number of collections	12
Largest memory request	199 KB
Mean garbage collection pause	3.5 ms
Mean interval between collections	129 ms
Minor collections - Mean garbage collection pause	3.39 ms
Minor collections - Mean interval between collections	134 ms
Minor collections - Number of collections	310
Minor collections - Total amount flipped	338073 KB
Minor collections - Total amount tenured	52.64 MB
Number of collections	322
Number of collections triggered by allocation failure	312
Proportion of time spent in garbage collection pauses (%)	2.71%
Proportion of time spent unpause (%)	97.29%
Rate of garbage collection	2643 MB/minute
Total amount flipped	338073 KB

**Help View:** A sidebar containing links to help topics, including "Using the garbage collection perspective".

**Using the garbage collection perspective**

View data such as heap usage, pause times, summary table, object allocations, and tuning recommendation sections in the Health Center garbage collection perspective. Some data is not available for non-Java™ applications.

The Health Center garbage collection perspective has the following views:

**Views for basic garbage collection information**

These views are available for all application types:

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

**Views for detailed garbage collection information**

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

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

# Java Health Center – Network analysis example



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

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

Sockets

Socket ID filter:

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	65470	32953 bytes	38334 bytes	Open	[0x2a00aa00] Default...
112	Server	0:0:0:0:ffff:c0a8:3c	59411			Open	[0x2a253d00] Shared...
127	Server	0:0:0:0:ffff:c0a8:3c	2446	87343 bytes	98768 bytes	Open	[0x2b38c800] Default...
136	Server	0:0:0:0:ffff:c0a8:11c9	9080			Open	[0x2a253d00] Shared...
138	ServerS...	0:0:0:0:0	59412	4248 bytes	8818 bytes	Open	[0x2a019f00] Default...
144	Server	0:0:0:0:ffff:c0a8:3c	9443			Open	[0x2a253d00] Shared...
164	ServerS...	0:0:0:0:0	176			Closed	[0x2a253d00] Shared...
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			Open	[0x2a253d00] Shared...
196	Server	0:0:0:0:ffff:c0a8:3c	61723			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			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	7810	22059 bytes	11436 bytes	Open	[0x2a00aa00] Default...
234	Server	0:0:0:0:ffff:c0a8:11f3				Closed	[0x2a14f400] Default...

Sockets open Network I/O

number (amount)

elapsed time (minutes)

c0a8:11c9 = 192.168.17.201

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# 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.loggii
264	2.56	██████	2.56	██████	java.math.Division.monReduction(int[], java.math.BigInteger, int)
183	1.77	██████	1.79	██████	java.math.Multiplication.square(int[], int, int)
172	1.67	██████	2.32	██████	javax.security.auth.Subject.toString(boolean)
150	1.45	██████	1.47	██████	java.math.Division.longMonReduction(int[], long[], int, long)
130	1.26	██████	1.83	██████	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
128	1.24	██████	1.55	██████	com.ibm.crypto.provider.P256PrimeField.a(int[])
115	1.11	██████	1.14	██████	java.math.Division.longMonReduceSqr(long[], long[], long, long, int, int)
102	0.99	██████	5.32	██████	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
97	0.94	██████	1.91	██████	com.ibm.ws.logging.internal.impl.BaseTraceService.publishTraceLogRecord(com.ibm.ws.loggii
92	0.89	██████	1.21	██████	java.util.concurrent.ConcurrentHashMap\$Node.getEntryCount()

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.loggii
111	2.86	██████	2.86	██████	java.math.Division.monReduction(int[], java.math.BigInteger, int)
96	2.48	██████	2.48	██████	java.math.Multiplication.square(int[], int, int)
56	1.45	██████	2.04	██████	com.ibm.crypto.provider.x.add(com.ibm.crypto.provider.EllipticPoint)
54	1.39	██████	1.45	██████	java.math.Division.long.monReduceSqr(long[], long[], long, long, int, int)
54	1.39	██████	1.94	██████	javax.security.auth.Subject.toString(boolean)
53	1.37	██████	1.45	██████	java.math.Division.long.monMulSq(long[], int, long)
51	1.32	██████	1.63	██████	com.ibm.crypto.provider.P256PrimeField.a(int[])
43	1.11	██████	3.59	██████	java.math.Multiplication.multiply(int[], int[], int[], int, int)
39	1.01	██████	5.01	██████	com.ibm.ws.logging.internal.impl.BaseTraceFormatter.formatObj(java.lang.Object)
27	0.7	██████	1.42	██████	com.ibm.ws.logging.internal.impl.BaseTraceFormatter.createFormattedMessage(java.util.LoggingEvent)

Sample based profile

Invocation paths Called methods Timeline Method trace summary

Samples over time

Invocation paths Called methods Timeline Method trace summary

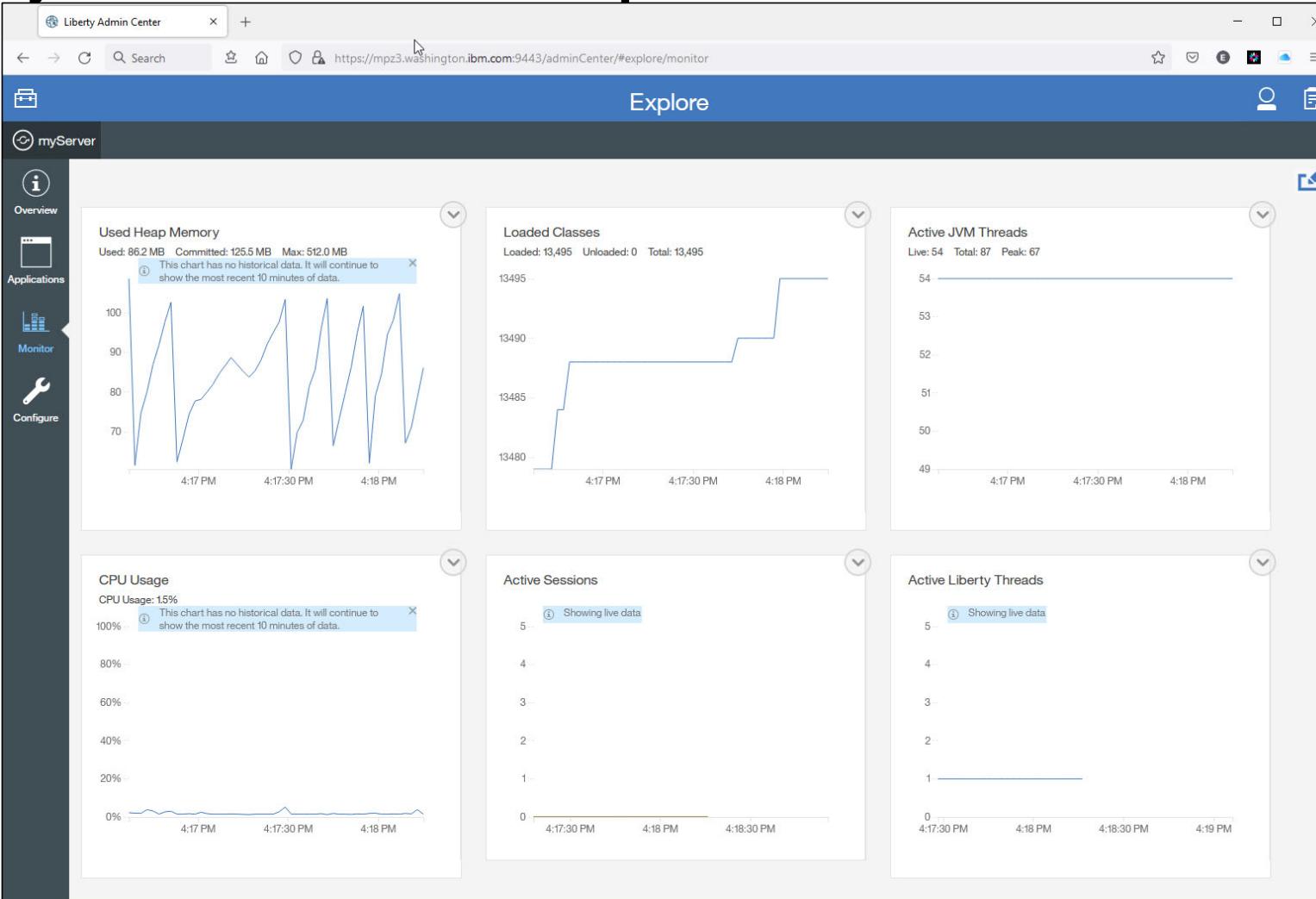
number (#) elapsed time (minutes)

number (#) elapsed time (minutes)

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# Liberty Admin Center feature provides real time monitoring



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# 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
----- Last Change -----
Action Name Description User Date
BAOSTC _____ JOHNSON 2021/09/04
WMQFTE _____ JOHNSON 2011/08/31
WMQFTER _____ JOHNSON 2011/08/31
WMQFTEZ _____ JOHNSON 2011/08/31
ZCEEADM _____ JOHNSON 2021/08/02
ZEEAPIR _____ JOHNSON 2021/08/05
ZEECICS _____ JOHNSON 2021/08/05
ZEEDB2 _____ JOHNSON 2021/08/05
ZEEIMS _____ JOHNSON 2021/08/05
ZEEEMQ _____ JOHNSON 2021/08/05
ZEEOTHR _____ JOHNSON 2021/08/02
ZEEESTC _____ 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
mitchj@us.ibm.com
```

## 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 ==> _____
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 ==>
-----Qualifier----- -----Class-----
Action Type Name Start DEFAULTS: Service Report
1 CN myServer _____ OPS_HIGH ZCEEOTHR
2 TC TCADM _____ OPS_HIGH BAOSTC
2 TC TCAPIR _____ OPS_HIGH ZEEAPIR
2 TC TCCICS _____ OPS_HIGH ZEECICS
2 TC TCDB2 _____ OPS_HIGH ZEEDB2
2 TC TCIMS _____ OPS_HILO ZEEIMS
2 TC TCMQ _____ OPS_MED ZEEEMQ
2 TC TCOTHR _____ OPS_LOW ZCEEOTHR
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 ==> _____
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 ==>
-----Qualifier----- -----Class-----
Action Type Name Start DEFAULTS: Service Report
1 CN zceex TCADM _____ OPS_HIGH ZCEEESTC
2 TC TCAPIR _____ OPS_HIGH ZCEEADM
2 TC TCDB2 _____ OPS_HIGH ZEEEDB2
2 TC TCCICS _____ OPS_HILO ZEEECICS
2 TC TCIMS _____ OPS_HILO ZEEIMS
2 TC TCMQ _____ OPS_MED ZEEEMQ
2 TC TCOTHR _____ OPS_HILO ZCEEOTHR
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="/mqapi/\*" METHOD="POST"/>  
19 <httpClassification transactionClass="TCMQ"  
20 resource="/mqapi/\*" METHOD="GET"/>  
21 <httpClassification transactionClass="TCAPIR" resource="/zosConnect/apiRequesters/\*"/>  
22 <httpClassification transactionClass="TCADM" resource="/zosConnect/\*\*/\*"/>  
23 <httpClassification transactionClass="TCOTHR" />  
24 </wlmClassification>  
25  
26 <osWorkloadManager collectionName="\${wlp.server.name}" />  
27  
28 <zosWlmHealth interval="30" increment="15"/>  
29  
30 </server>  
31

Related to WLM CN name.



# Workload Manager – Active HTTP Classification

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

The screenshot shows a web browser window displaying a JSON array of configuration elements for "httpClassification". Each element has a unique identifier (uid), host, method, port, resource, and transaction class. The transaction classes listed are TCMQ, TCMQ, TCAPIR, TCADM, and 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"}]
```

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# 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 ==> SCROLL ==> PAGE
POLICY=WSCPOL REPORT CLASS=ZCEECICS PERIOD=1

-TRANSACTIONS-- TRANS-TIME HHH.MM.SS.FFFFFF TRANS-APPL%----CP-IIPCP/AAPCP-IIP/AAP ---ENCLAVES---
AVG      0.02 ACTUAL          108891 TOTAL      0.02      0.02 0.31 AVG ENC  0.02
MPL      0.02 EXECUTION       108856 MOBILE    0.00      0.00 0.00 REM ENC  0.00
ENDED    96 QUEUED           34 CATEGORYA   0.00      0.00 0.00 MS ENC   0.00
END/S    0.16 R/S AFFIN      0 CATEGORYB   0.00
#SWAPS   0 INELIGIBLE       0
EXCTD   0 CONVERSION        0
STD DEV 762583

---SERVICE---- SERVICE TIME ---APPL %--- --PROMOTED-- --DASD I/O
IOC      0 CPU    1.967 CP    0.02 BLK    0.000 SSCHRT
CPU     1739K SRB    0.000 IIPCP  0.02 ENQ    0.000 RESP
MSO      0 RCT    0.000 IIP    0.31 CRM    0.000 CONN
SRB      0 IIT    0.000 AAPCP  0.00 LCK    0.000 DISC
TOT     1739K HST    0.000 AAP    N/A SUP    0.000 Q+PEND
/SEC    2898 IIP    1.844                   IOSQ

MP A
Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23

```

```

mpz3
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF OUTPUT DISPLAY JOHNSONR JOB12740 DSID 112 LINE CHARS 'APIR' FOUND
COMMAND INPUT ==> SCROLL ==> PAGE
POLICY=WSCPOL REPORT CLASS=ZCEEAPIR PERIOD=1

-TRANSACTIONS-- TRANS-TIME HHH.MM.SS.FFFFFF TRANS-APPL%----CP-IIPCP/AAPCP-IIP/AAP ---ENCLAVES---
AVG      0.14 ACTUAL          424835 TOTAL      0.12      0.12 0.73 AVG ENC  0.14
MPL      0.14 EXECUTION       424707 MOBILE    0.00      0.00 0.00 REM ENC  0.00
ENDED    200 QUEUED          126 CATEGORYA   0.00      0.00 0.00 MS ENC   0.00
END/S    0.33 R/S AFFIN      0 CATEGORYB   0.00      0.00 0.00
#SWAPS   0 INELIGIBLE       0
EXCTD   0 CONVERSION        0
STD DEV 1.381943

---SERVICE---- SERVICE TIME ---APPL %--- --PROMOTED-- --DASD I/O--- ----STORAGE--- -PAGE-IN RATES-
IOC      0 CPU    5.073 CP    0.12 BLK    0.000 SSCHRT  2.4 AVG    0.00 SINGLE   0.0
CPU     4485K SRB    0.000 IIPCP  0.12 ENQ    0.000 RESP    0.4 TOTAL   0.00 BLOCK   0.0
MSO      0 RCT    0.000 IIP    0.73 CRM    0.000 CONN   0.3 SHARED  0.00 SHARED  0.0
SRB      0 IIT    0.000 AAPCP  0.00 LCK    0.000 DISC    0.0                   HSP    0.0
TOT     4485K HST    0.000 AAP    N/A SUP    0.000 Q+PEND  0.0
/SEC    7474 IIP    4.363                   IOSQ    0.0
ABSRPTN 53K AAP    N/A
TRX SERV 53K

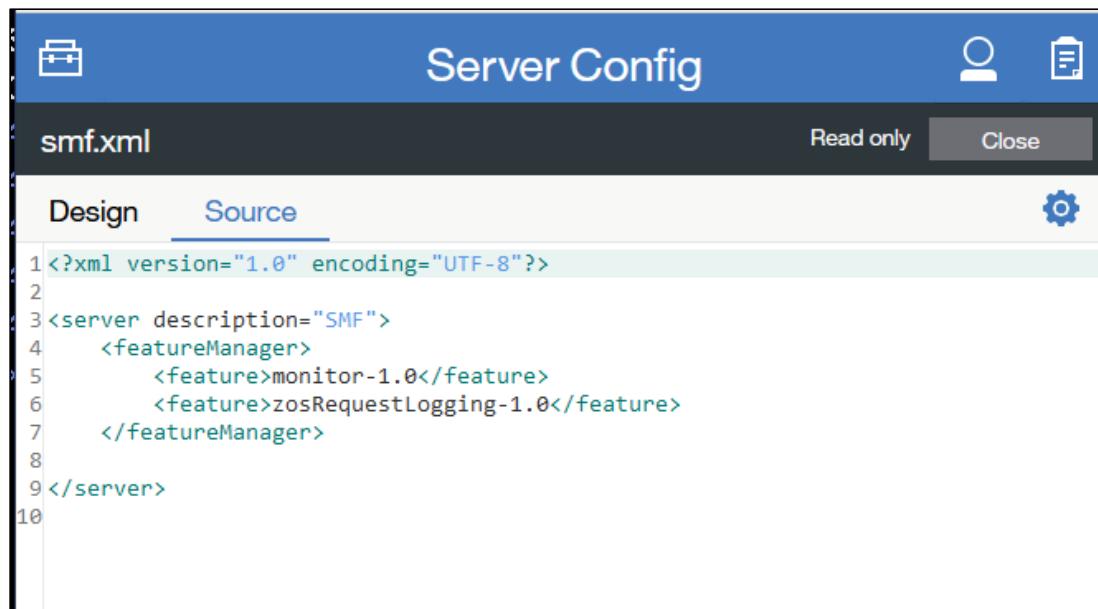
MP A
Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23
05/057

```



# Liberty SMF 120 Subtype 11

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



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

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

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

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

# Liberty SMF 120 Subtype 11 – WP102312 Plugin



LibertyExport.csv

Mitch Johnson M

File Home Insert Page Layout Formulas Data Review View Help ACROBAT

Cut Copy Format Painter

Font Alignment Number Styles

Clipboard

AS9 : 166

SystemName JobName StartTime StartTime EndTime EndTime(EndTime) Response TranClass TotalCPU Start TotalCPU EndTotalCPU TotalGPP(ms) TotalOffload(ms) userid mappedUser requestUser host port uri response targetPort remotePort remoteAddr

	B	C	E	P	Q	R	S	T	U	V	W	Z	AA	AB	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
1	SystemName	SysNx	JobName	StartTime	StartTime	EndTime	EndTime(EndTime)	Response	TranClass	TotalCPU	Start	TotalCPU	EndTotalCPU	TotalGPP(ms)	TotalOffload(ms)	userid	mappedUser	requestUser	host	port	uri	response	targetPort	remotePort	remoteAddr
2	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	6080	TCAPIR	3314772936	4.32E+09	245.5195	5.0110927	240.50838	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4283	192.168.17.243	
3	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7030	TCAPIR	178821759	471750165	71.51572	2.334169	69.18156	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4286	192.168.17.243	
4	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	374	TCAPIR	4327455460	4.469E+09	34.44008	0.10757129	34.332504	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4301	192.168.17.243	
5	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	495	TCAPIR	2762287407	2.9E+09	33.65053	0.057430662	33.5931	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4304	192.168.17.243	
6	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	500	TCAPIR	4484655211	4.629E+09	35.15451	0.12540185	35.020004	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4303	192.168.17.243	
7	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	262	TCAPIR	4637789017	4.777E+09	34.10283	0.42818993	33.680042	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4305	192.168.17.243	
8	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	293	TCAPIR	542458283	668050357	30.666213	0.053870115	30.608257	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4306	192.168.17.243	
9	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	10493	TCAPIR	3802597962	5.38E+09	385.0374	5.576215	379.46115	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4285	192.168.17.243	
10	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	185	TCAPIR	5384541333	5.446E+09	15.04486	0.15656103	14.888303	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4308	192.168.17.243	
11	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	282	TCAPIR	1028119195	1.153E+09	30.38298	0.04661279	30.336363	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4309	192.168.17.243	
12	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	163	TCAPIR	901260513	962209631	14.88016	0	14.880165	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4310	192.168.17.243	
13	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	5126	TCAPIR	3137255105	3.284E+09	35.92899	0.33009765	35.598892	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4313	192.168.17.243	
14	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	5122	TCAPIR	4890213483	5.128E+09	58.01673	0.61064285	57.40609	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4314	192.168.17.243	
15	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	24315	TCAPIR	13036032356	1.393E+10	217.4406	4.0119	213.4287	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4282	192.168.17.243	
16	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	24338	TCAPIR	1463812131	2.41E+09	290.9845	3.1036336	272.8809	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4284	192.168.17.243	
17	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	12587	TCAPIR	1160912461	1.967E+09	196.8579	0.7669092	196.09096	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4315	192.168.17.243	
18	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	6599	TCAPIR	5303866625	5.467E+09	39.79177	0.020269532	39.761494	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4316	192.168.17.243	
19	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	6565	TCAPIR	6143860672	6.315E+09	41.86705	0.16208105	41.704967	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4317	192.168.17.243	
20	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	25052	TCAPIR	2622790027	3.928E+09	318.7149	5.498493	313.22546	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4281	192.168.17.243	
21	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7709	TCAPIR	4477460136	4.615E+09	33.52233	0.35891944	33.163406	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4322	192.168.17.243	
22	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7682	TCAPIR	197302107	2.112E+09	33.81701	0.19548193	33.621525	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4321	192.168.17.243	
23	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	14950	TCAPIR	458083506	590213570	32.25832	0.0489917	32.209324	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4323	192.168.17.243	
24	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	14016	TCAPIR	61401222	178390269	28.56178	0.2347461	28.327032	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4325	192.168.17.243	
25	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	14088	TCAPIR	86069626	148846164	15.32625	0.0541626	15.272091	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4326	192.168.17.243	
26	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	14097	TCAPIR	5471350509	5.535E+09	15.43587	0.21740967	15.218459	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4324	192.168.17.243	
27	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7051	TCAPIR	5358173556	5.482E+09	30.16547	0.001757324	30.163715	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4328	192.168.17.243	
28	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7029	TCAPIR	2281578411	2.336E+09	13.27289	0	13.272889	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4327	192.168.17.243	
29	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	379	TCAPIR	1054429318	1.188E+09	32.66632	0.067269534	32.599052	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4329	192.168.17.243	
30	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	347	TCAPIR	644045567	759168227	28.10612	0.16462207	27.941496	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4330	192.168.17.243	
31	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	18550	TCAPIR	764059849	891747729	31.1738	0.4028291	30.770971	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4336	192.168.17.243	
32	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	18551	TCAPIR	5678912186	5.811E+09	32.35731	0.39294335	31.964365	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4332	192.168.17.243	
33	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	18557	TCAPIR	260836676	390012335	31.53703	0.6369346	30.90091	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4331	192.168.17.243	
34	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	18568	TCAPIR	252264630	387487083	33.01329	0.4126411	32.600655	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4333	192.168.17.243	
35	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	18571	TCAPIR	6167008451	6.311E+09	35.09796	0.69125974	34.406696	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4334	192.168.17.243	

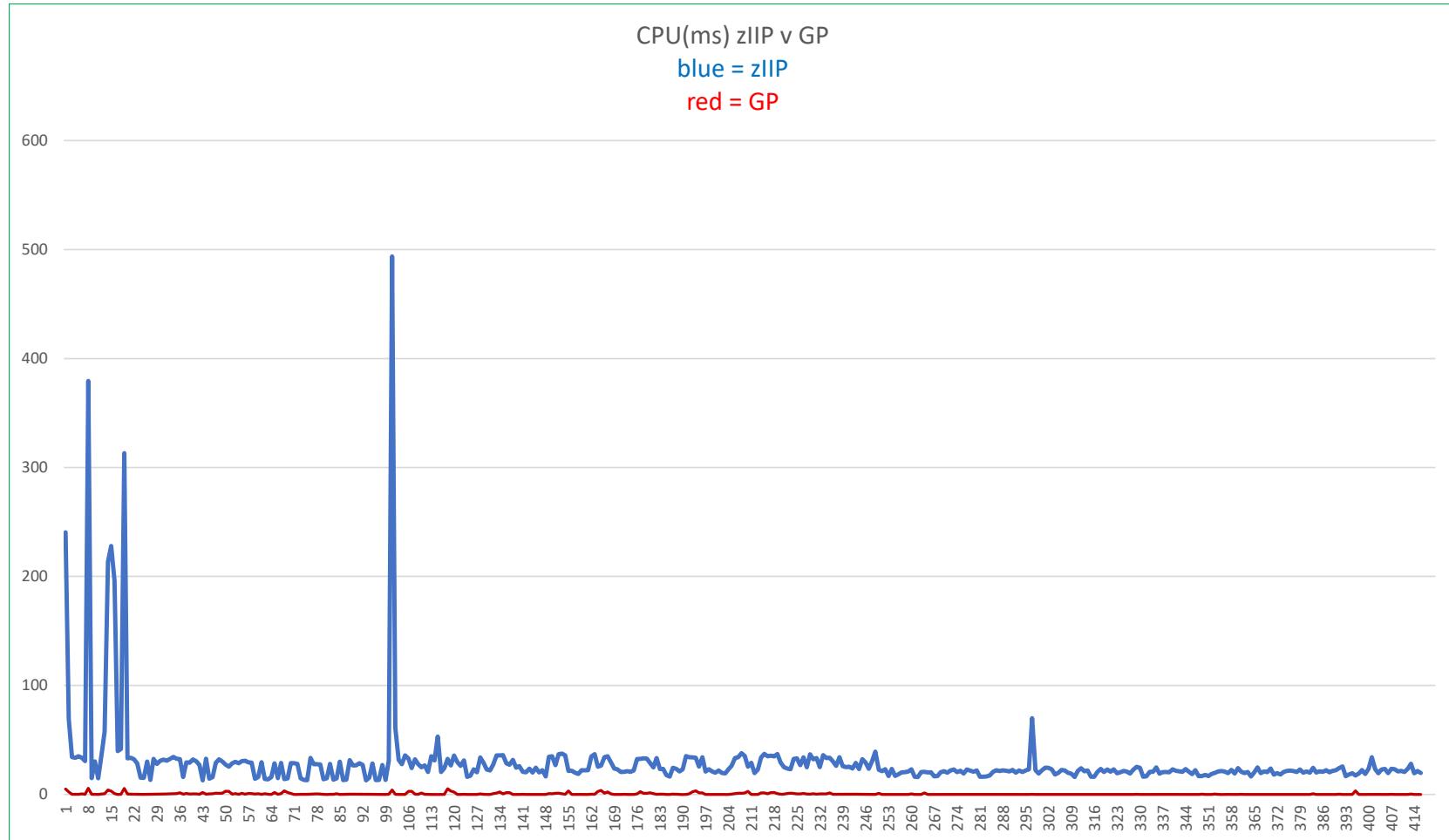
Select destination and press ENTER or choose Paste

Some fields have been hidden

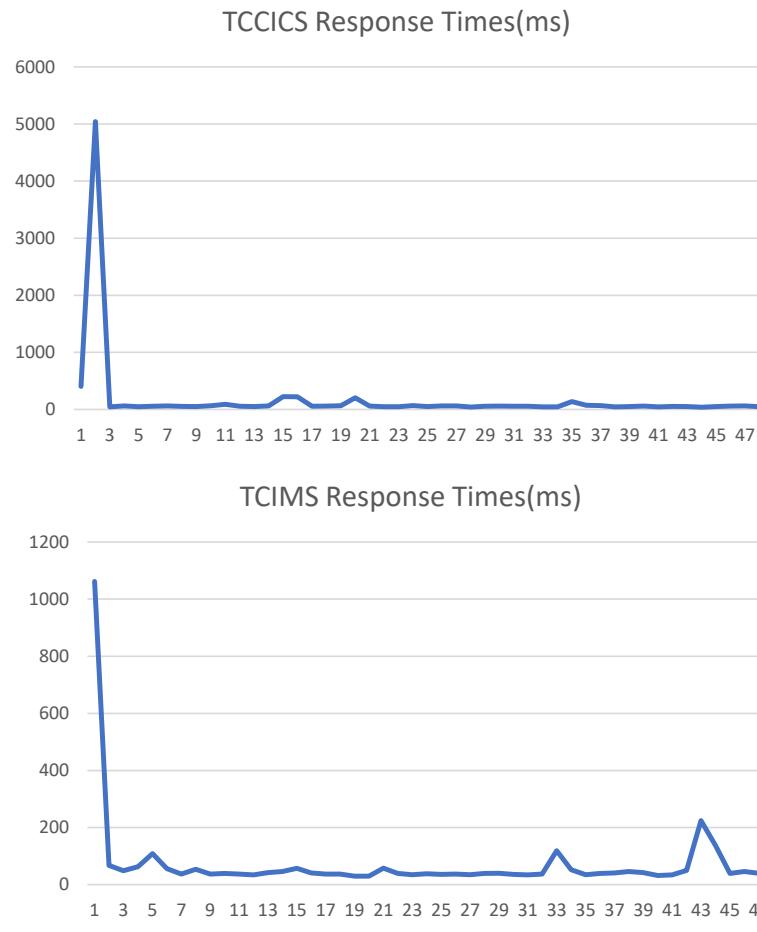
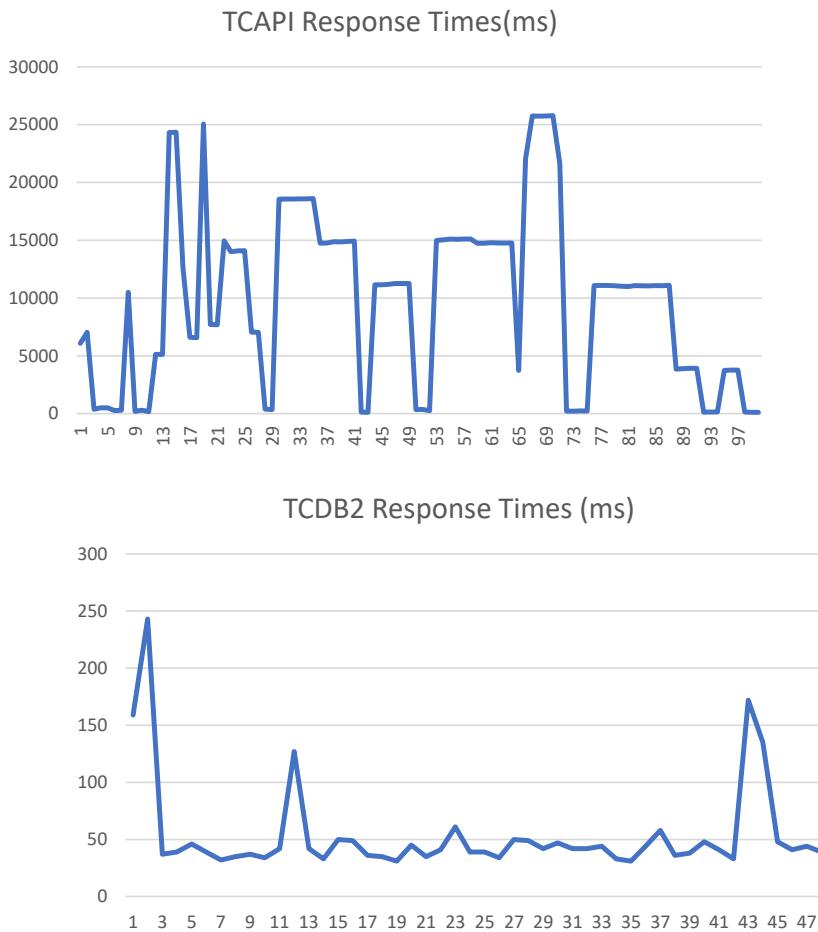
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# Liberty SMF 120 type 11 – GP v zIPP comparison example



# Liberty SMF 120 type 11 – Response times comparisons example



# z/OS Connect SMF 123 server XML configuration



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

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

Server Config

audit.xml

Read only Close

Design Source

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

Server Config

audit.xml

Read only Close

Design Source

Server

z/OS Connect Manager

z/OS Connect Authorization Interceptor auth

z/OS Connect EE SMF Audit Interceptor audit

z/OS Connect Interceptors interceptorList\_g

Sequence

0 (default)

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

API provider SMF Version

2

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

auditApiProviderRequestHeaders.name

(no value)

auditApiProviderRequestHeaders.desc

auditApiProviderResponseHeaders.name

(no value)

auditApiProviderResponseHeaders.desc

API requester SMF Version

2

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

# **z/OS Connect SMF 123 subtype 1 version 2 \***

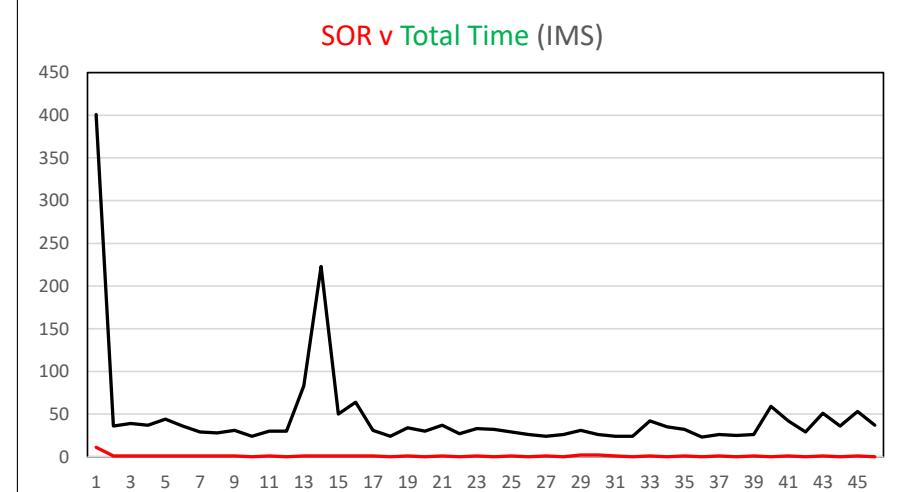
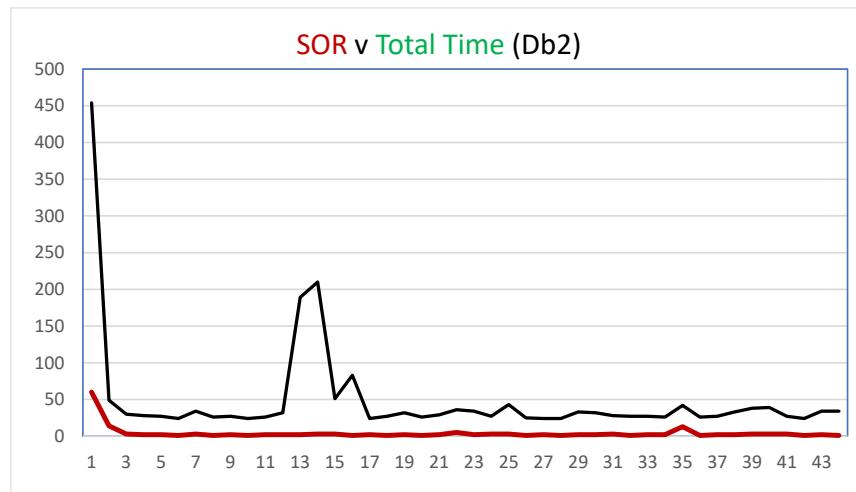
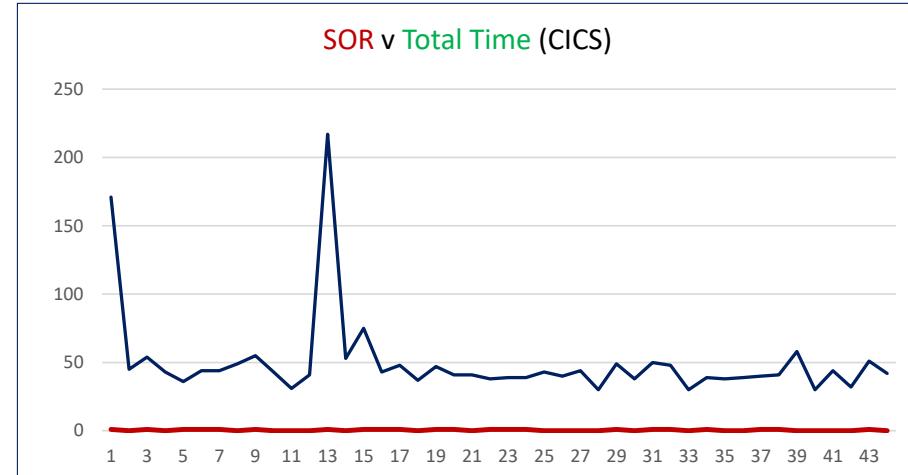
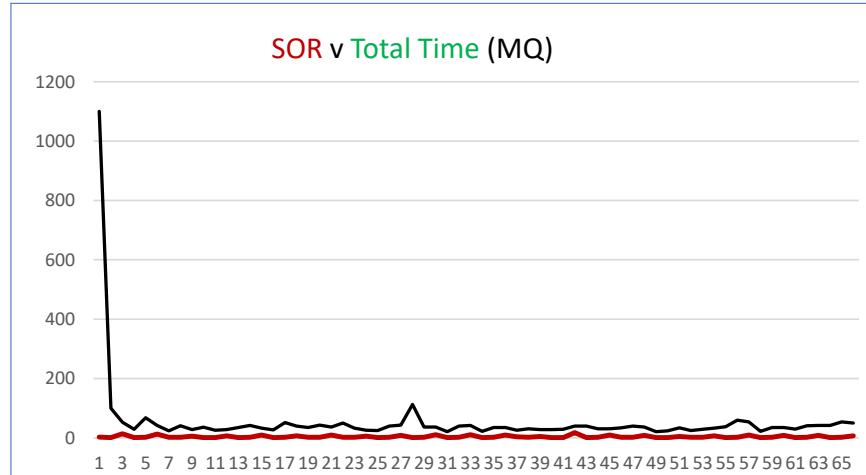


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\* Generated by using a modified version of the BAQSMFX sample program.

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



# z/OS Connect SMF 123 subtype 2 version 2 \*



smfout.csv

File Home Insert Page Layout Formulas Data Review View Help ACROBAT

Font Alignment Number Styles Cells Editing Ideas Sensitivity

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

27 SMF123\_RSMF123\_S SMF123\_SUBTYPE\_VERSION

28 123 2 2

29

30 SID SSI TRIPLET\_C TRIPLET\_U HTTP\_REQ\_STAT REQ\_RETREQ\_PAYL RESP\_PA1 USER\_NA USER\_NA | ENDPOINT\_I ENDPOINT TIME\_ST TIME\_TIME\_ TII TIM 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 | GET 2021/08/2021/02202021/08/2318: 95384 108577 6734453 131423 25653 7103301 7.103301 USER1GE5JC

32 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 114313 7767 318 40583 2105 166276 0.1663 USER1GE5JC

33 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 112903 7193 130 51158 1905 175644 0.1756 USER1GE5JC

34 MPZ3 ZCON 2 40 200 200 NO 0 271 USER1 | GET 2021/08/2021/02202021/08/2318: 103999 102634 8843582 110850 3497 9166156 9.1662 USER1GE4JC

35 MPZ3 ZCON 2 40 200 200 NO 0 271 USER1 | GET 2021/08/2021/02202021/08/2318: 82840 4956 128 65685 1900 156097 0.1561 USER1GE4JC

36 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 116458 10778 288 58698 1778 189030 0.189 USER1GE5JC

37 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 149159 20483 614 102698 1760 277114 0.2771 USER1GE5JC

38 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 153803 23181 285 101022 1775 281176 0.2812 USER1GE4JC

39 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 140685 70595 11275606 113382 1920 11603168 11.6032 USER1GE1JC

40 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 108088 7624 222 65726 1746 184303 0.1843 USER1GE5JC

41 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 119784 9945 282 76225 1773 209052 0.2091 USER1GE4JC

42 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 94511 5061 132 44576 2427 147407 0.1474 USER1GE1JC

43 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 56951 10497 126 118293 1703 189186 0.1892 USER1GE5JC

44 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 55110 7646 210 122479 1616 187974 0.188 USER1GE4JC

45 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 119104 10588 354 109467 1604 242675 0.2427 USER1GE1JC

46 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 3051028 17103 9999318 222997 1770 13292831 13.2928 USER1GETJC

47 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 129965 20381 121 212563 1870 366316 0.3663 USER1GE5JC

48 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 117036 17792 768 221666 1796 360790 0.3608 USER1GE4JC

49 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 121667 23095 468 217285 1673 366393 0.3664 USER1GE1JC

50 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 | GET 2021/08/2021/02202021/08/2318: 115629 13252 685 146376 1659 279825 0.2798 USER1GE1JC

51

52 REC\_TYPE SUBTYPE SUBTYPE VERSION

smfout

Ready

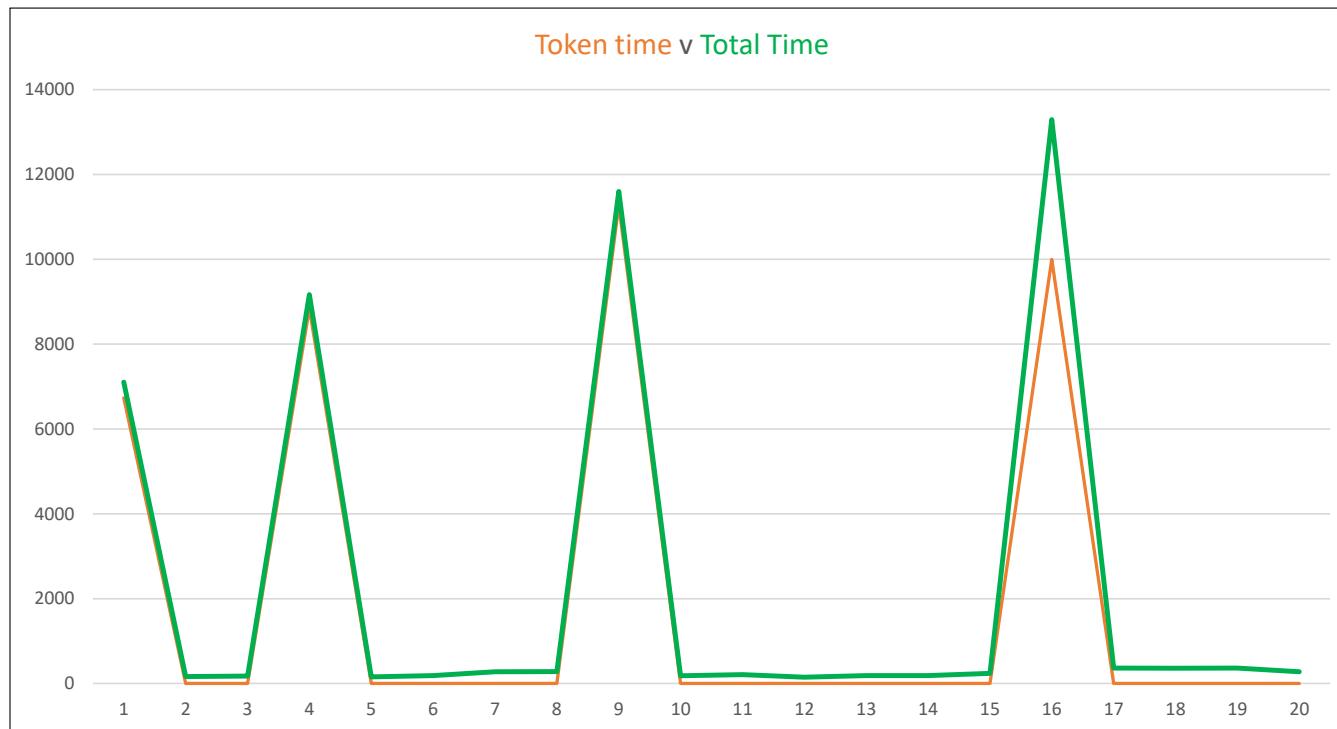
Some fields have been hidden

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



# BAQSMFP output



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

```
*****
* SMF123.2 V2 Request Data Section *
*****
SMF123S2_REQ_APP_TYPE = ZOS (3)
SMF123S2_HTTP_RESP_CODE = 200
SMF123S2_REQ_STATUS_CODE = 200
SMF123S2_REQ_RETRY = NO
SMF123S2_REQ_PAYLOAD_LEN = 0
SMF123S2_RESP_PAYLOAD_LEN = 269
SMF123S2_USER_NAME = USER1
SMF123S2_USER_NAME_MAPPED =
SMF123S2_USER_NAME_ASSERTED = USER1
SMF123S2_API_REQ_NAME = cscvinc_1.0.0
SMF123S2_API_REQ_VERSION = 1.0.0
SMF123S2_ENDPOINT_REFERENCE = cscvincAPI
SMF123S2_ENDPOINT_HOST = https://mpz3.washington.ibm.com
SMF123S2_ENDPOINT_PORT = 9463
SMF123S2_ENDPOINT_FULL_PATH = /cscvinc/employee/111111
SMF123S2_ENDPOINT_METHOD = GET
SMF123S2_ENDPOINT_QUERY_STR =
SMF123S2_TIME_STUB_SENT = 0x000DA2FC1 7D34CE8B 4A000000 084C0001
UTC_CONV_TIME_STUB_SENT = 2021/08/19 16:11:52.420584 UTC
SMF123S2_TIME_ZC_ENTRY = 0x000DA2FC1 7D58AE00 0E000000 08A00001
UTC_CONV_TIME_ZC_ENTRY = 2021/08/19 16:11:52.567534 UTC
SMF123S2_TIME_ZC_EXIT = 0x000DA2FC1 87DCB806 E6000000 08880001
UTC_CONV_TIME_ZC_EXIT = 2021/08/19 16:12:03.594112 UTC
SMF123S2_TIME_TOKEN_GET_START = 0x000DA2FC1 7D59D3A6 E6000000 08A00001
UTC_CONV_TIME_TOKEN_GET_START = 2021/08/19 16:11:52.572218 UTC
SMF123S2_TIME_TOKEN_GET_FINISH = 0x000DA2FC1 7D59DF85 CC000000 088C0001
UTC_CONV_TIME_TOKEN_GET_FINISH = 2021/08/19 16:11:52.572408 UTC
SMF123S2_TIME_ENDPOINT_SENT = 0x000DA2FC1 7D5A0328 04000000 088C0001
UTC_CONV_TIME_ENDPOINT_SENT = 2021/08/19 16:11:52.572978 UTC
SMF123S2_TIME_ENDPOINT RECEIVED = 0x000DA2FC1 87DCB216 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 =
```

# IBM z Omegamon for JVM

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

- WG31 - 3270**: Shows the "z/OS Connect Request Summary". It includes a table for API requests and a list of available APIs.
- WG31 - 3270**: Shows the "Requests by Service Name". It includes a table for service requests and a list of available services.
- WG31 - 3270**: Shows the "z/OS Connect Request Detail" for a specific request. The details include event time, request type, API name, request URI, query string, method, port, HTTP code, timeout, service name, total request time, z/OS connection time, SoR response time, SoR ID, SoR ref, SoR resource, remote address, request length, response length, correlator, operation, provider, and user ID.
- CMS on platform WG31(z/OS)**: A terminal window showing the command "tel TCP00109 and port 23".

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# IBM z Omegamon for JVM

WG31 - 3270

File Edit View Communication Actions Window Help

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

Command ==> z/OS Connect Request Detail

```

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

```

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

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

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

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

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

WG31 - 3270

File Edit View Communication Actions Window Help

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

Command ==> z/OS Connect Request Detail

```

Event time..... 04/02/19 18:47:54.267
Request Type... API
API name..... cscvinc
Request URI... /cscvinc/employee/444444
Query String...
Method..... GET
Port..... 9453
HTTP code.... 200 (OK)
Timeout..... No
Service Name... cscvincService
Total Req Time. 0.000006s
z/OS Conn Time. 0.005515s
SoR Resp Time. 0.002491s
SoR ID..... USIBMWZ.CICS53Z
SoR Ref... cscvinc
SoR Resource... CSM1,CSCVINC
Remote Address.. 192.168.0.141
Request Length.. 0
Response Length. 302
Correlator.... e6e2d3d7d3c5e7400011000010d5ea50
Operation.... getGscvincService
Provider..... CICS-1.0
User ID..... Fred

```

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

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

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

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

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

## **Miscellaneous Odds and Ends**



## z/OS Connect administration API

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

### APIs : Operations for working with APIs

Show/Hide | List Operations | Expand Operations

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

### Services : Operations for working with services

Show/Hide | List Operations | Expand Operations

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

### API Requesters : Operations that work with API Requesters.

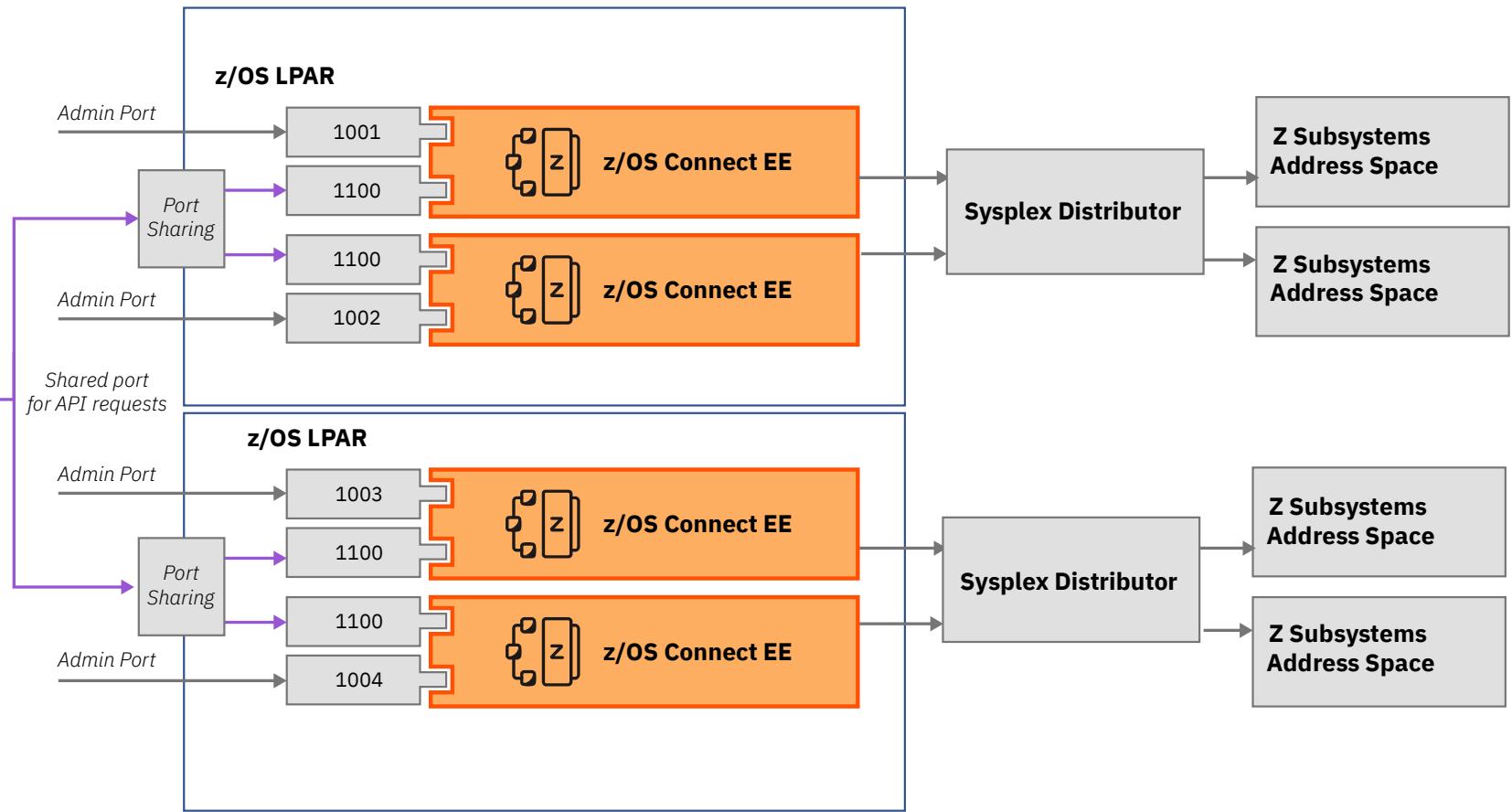
Show/Hide | List Operations | Expand Operations

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

# High Availability



## Topology



**i** [ibm.biz/zosconnect-ha-concepts](http://ibm.biz/zosconnect-ha-concepts)

**i** [ibm.biz/zosconnect-scenarios](http://ibm.biz/zosconnect-scenarios)

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# 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 (PROFMPZ1)

IPCONFIG SYSPLEXROUTING

DYNAMICXCF 172.1.1.241 255.255.255.0 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!

mitchj@us.ibm.com

BASEWLM uses the Target Server Responsiveness (TSR) value to select image (tso netstat vdpt detail)

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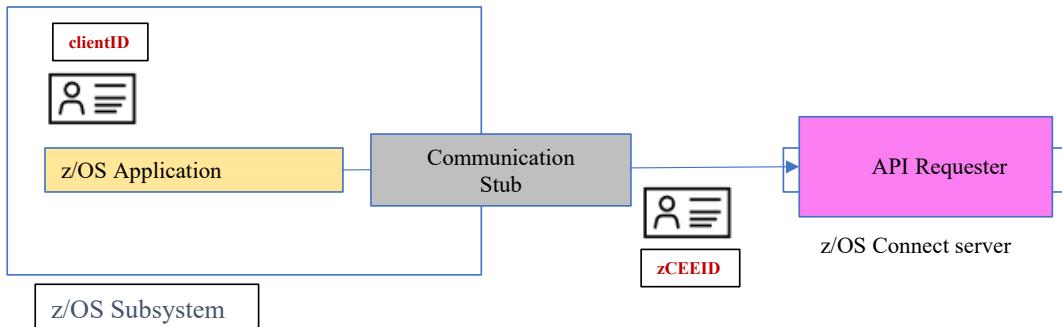
```
<zosconnect_cicsIpicConnection id="cscvinc"
host="dvipa.washington.ibm.com"
port="1491"/>
<zosconnect_endpointConnection id="mqapi"
host="http://dvipa.washington.ibm.com"
port="9453"
basicAuthRef="myBasicAuth"
connectionTimeout="10s"
receiveTimeout="20s" />
```

The screenshot shows a browser window titled "REST API Documentation". The address bar contains the URL <https://dvipa.washington.ibm.com:9443/api/explorer/>. The page itself is titled "Liberty REST APIs" and displays a list of available APIs under the "cscvinc" category. The listed operations are:

- cscvinc**
  - POST** /cscvinc/employee
  - 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
- jwtpDemoApi**
  - 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 and identity assertion



***zCECID*** – 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

requireAuth	idAssertion	Actions performed by z/OS Connect
true	OFF	Identity assertion is disabled. The zCEE server authenticates <b><i>zCECID</i></b> and checks whether <b><i>zCECID</i></b> has the authority to invoke an API requester.
	ASSERT_SURROGATE	Identity assertion is enabled. The zCEE server authenticates <b><i>zCECID</i></b> and checks whether <b><i>zCECID</i></b> is a surrogate of <b><i>clientID</i></b> . If <b><i>zCECID</i></b> is a surrogate of <b><i>clientID</i></b> , the server further checks whether <b><i>clientID</i></b> has the authority to invoke an API requester; otherwise, a BAQR7114E message occurs.
	ASSERT_ONLY	Identity assertion is enabled. The zCEE server authenticates <b><i>zCECID</i></b> and directly checks whether <b><i>clientID</i></b> has the authority to invoke an API requester.
false	OFF	Identity assertion is disabled. A BAQR0407W message occurs.
	ASSERT_SURROGATE	Identity assertion is enabled. The zCEE server checks whether <b><i>clientID</i></b> has the authority to invoke an API requester, and a warning message occurs to indicate that the ASSERT_ONLY value is used instead of the ASSERT_SURROGATE value.
	ASSERT_ONLY	Identity assertion is enabled. The zCEE server checks whether <b><i>clientID</i></b> has the authority to invoke an API requester.

```

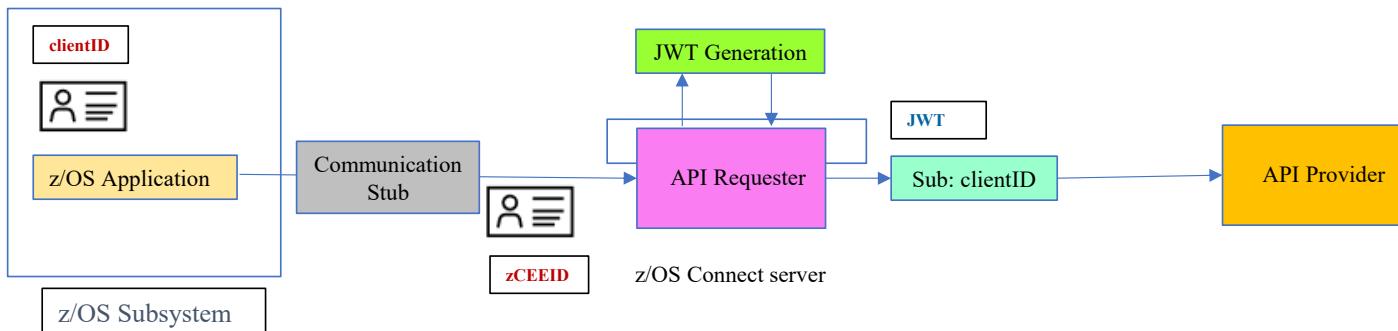
<zosconnect_apiRequesters idAssertion="ASSERT_ONLY">
</zosconnect_apiRequesters>

```

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# API Requester – 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

requireAuth	idAssertion	Actions performed by z/OS Connect
true	ASSERT_SURROGATE	Identity assertion is enabled. The zCEE server authenticates <b><i>zCEEID</i></b> and checks whether <b><i>zCEEID</i></b> is a surrogate of <b><i>clientID</i></b> . If <b><i>zCEEID</i></b> is a surrogate of <b><i>clientID</i></b> , the server further checks whether <b><i>clientID</i></b> has the authority to invoke an API requester; otherwise, a BAQR7114E message occurs.
	ASSERT_ONLY	Identity assertion is enabled. The zCEE server authenticates <b><i>zCEEID</i></b> and directly checks whether <b><i>clientID</i></b> has the authority to invoke an API requester
false	ASSERT_SURROGATE	Identity assertion is enabled. The zCEE server checks whether <b><i>clientID</i></b> has the authority to invoke an API requester, and a warning message occurs to indicate that the ASSERT_ONLY value is used instead of the ASSERT_SURROGATE value.
	ASSERT_ONLY	Identity assertion is enabled. The zCEE server checks whether <b><i>clientID</i></b> has the authority to invoke an API requester



# SAF SURROGAT Resources for identity assertion and/or JWT generation

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

*su*

*cd /usr/lib/java\_runtime  
extattr +p libifaedjreg64.so*

The *extattr* command must be entered as root or superuser.

- *Permit the server 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**



# Use z/OS Connect API Policies to change runtime behavior

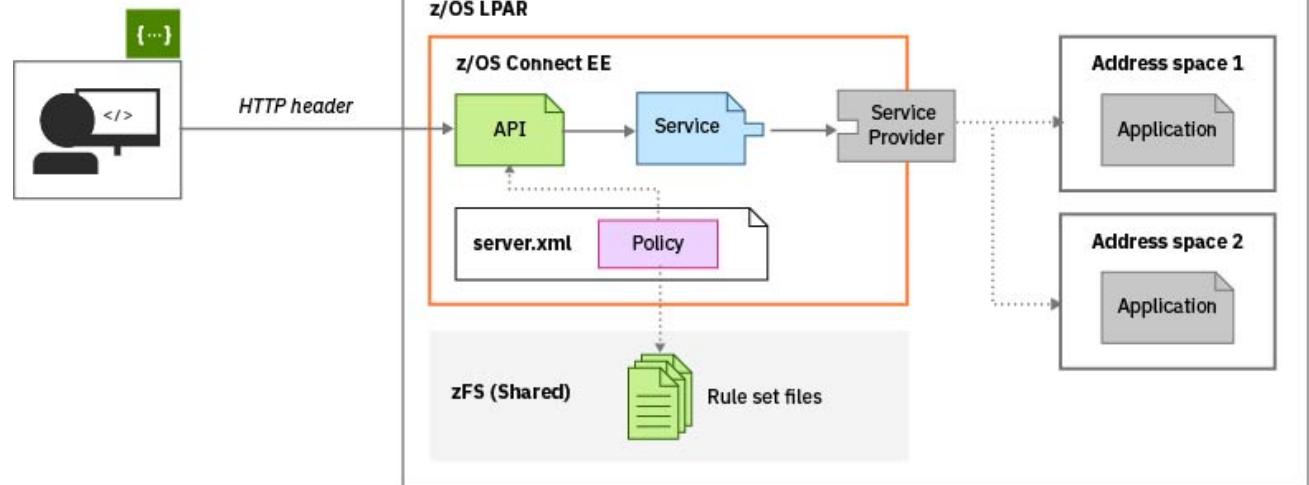
- HTTP header properties can be used to select alternative for IMS (V3.0.4) , CICS (V3.0.10), Db2 (V3.0.36) or MQ (V3.0.39)
- Policies can be configured globally for every API in the server or for individual APIs (V3.0.11)

CICS attributes  
• cicsCcsid  
• cicsConnectionRef  
• cicsTransId

IMS attributes  
• imsConnectionRef  
• imsInteractionRef  
• imsInteractionTimeout  
• imsLtermOverrideName  
• 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>
```

The screenshot shows the API Policy Editor interface. A red oval highlights the 'HTTP Headers' section, which contains two entries: 'cicsMirror' (optional string) and 'cicsConnection' (optional string). Another red oval highlights the 'Path Parameters' section, specifically the '{numb}' entry, which is defined as a required string.

## 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

wg31.washington.ibm.com:9443/x

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

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

```

```
<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>
```

wg31.washington.ibm.com:9443/x

product = WAS FOR z/OS 20.0.0.6, z/OS Connect 03.00.41 (wlp-1.0.41.c120620200528-0414)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home.dir = /shared/java/J8.0\_64
os = z/OS (02.03.00. s390x) (en\_US)
process = 16778878@wg31

[2/19/21 15:48:18+901 GMT] 00000017 com.ibm.ws.kernel
[2/19/21 15:48:18+1869 GMT] 00000017 com.ibm.ws.config
</var/zosconnect/servers/myServer/includes/safSecurity.xml>
[2/19/21 15:48:18+1992 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+998 GMT] 00000016 com.ibm.ws.zos
below-the-line storage limit is 1MB and the above
the-line storage limit is 1GB
[2/19/21 15:48:19+997 GMT] 00000016 com.ibm.ws.zos
[2/19/21 15:48:20+012 GMT] 00000016 com.ibm.ws.zos
process
[2/19/21 15:48:20+088 GMT] 00000016 com.ibm.ws.zos
[2/19/21 15:48:20+090 GMT] 00000016 com.ibm.ws.zos

\*\*\*\*\*

```
product = WAS FOR z/OS 21.0.0.1, z/OS Connect 03.00.42 (wlp-1.0.48.c1210120210113-1459)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home.dir = /shared/java/J8.0_64
java.version = 1.8_0_261
java.runtime = Java(TM) SE Runtime Environment (8.0.0.15 - pmz6480sr6fp15-20200724_01(SR6 FP15))
os = z/OS (02.03.00. s390x) (en_US)
process = 16779882@wg31
trace.spaces=0

Info:Credentials=>all:SSL=>all:SSLCChannel=>all:Security.Authorization=>all:UserRegistry=>all:com.ibm.ws.security.*=>all:com.ibm.ws.webcontainer.*=>all:com.ibm.ws.wim.*=>all:org.apache.http.client.>=>all:zosConnect=>all:zosConnectSaf=>all:
[2/25/21 17:27:54+497 GMT] 00000016 id=00000000 com.ibm.ws.logging.internal.TraceSpecification I TRAS0018I: The trace state has been changed. The new trace state is
*info:Credentials=>all:SSL=>all:SSLCChannel=>all:Security.Authorization=>all:UserRegistry=>all:com.ibm.ws.security.*=>all:com.ibm.ws.webcontainer.*=>all:com.ibm.ws.wim.*=>all:org.apache.http.client.*=>all:zosConnect=>all:zosConnectSaf=>all:
[2/25/21 17:27:54+492 GMT] 00000016 id=078ec277 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry org/apache/felix/scr/impl/manager
/DependencyManager=>SingleDynamicCustomizer.class
[2/25/21 17:27:54+493 GMT] 00000016 id=078ec277 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper < getEntry Exit org/apache/felix/scr/impl/manager
/DependencyManager=>SingleDynamicCustomizer.class
[2/25/21 17:27:54+491 GMT] 00000017 id=00000000 com.ibm.ws.zos.core.internal.CoreBundleActivator I CNWK0012I: The server process UMASK value is set to 0000.
[2/25/21 17:27:54+494 GMT] 00000017 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] 0000001b id=459954a0 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry com.ibm.ws.zos.logging.config.xml
```



# Provide remote access to z/OS Connect archives files

Index of /resources/zosConnect/

Name	Last Modified	Size	Description
<a href="#">apis</a>	Fri Feb 19 13:46:13 GMT 2021	-	Directory
<a href="#">services</a>	Sat Feb 20 20:54:41 GMT 2021	-	Directory
<a href="#">apiRequesters</a>	Wed Feb 07 17:59:04 GMT 2018	-	Directory
<a href="#">rules</a>	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
<a href="#">cscvincDeleteService.sar</a>	Thu Feb 18 18:02:19 GMT 2021	4362	File
<a href="#">cscvincInsertService.sar</a>	Thu Feb 18 18:02:19 GMT 2021	4491	File
<a href="#">cscvincSelectService.sar</a>	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

# **Additional Material**

## **Sample Administrative JCL**

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# Sample JCL - Check Java installation by display Java version information

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

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

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

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

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

## cscvinc.properties

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

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

# Sample JCL - Executing multiple OMVS commands in one step

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

Always be aware of the beginning and trailing spaces.

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

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# Sample JCL - Executing the Liberty *productInfo* command

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

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

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

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

# Sample JCL - Copy WOLA executables from OMVS to a PDSE

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

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

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

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

# Sample JCL – Generate WLM Workload Activity Reports

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

# Sample JCL - Restarting the Java Health Center collection

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

```
//JOHNSONS JOB (ACCOUNT),NOTIFY=&SYSUID,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1),USER=LIBSERV  
//JAVA      EXEC PGM=IKJEFT01,REGION=0M  
//SYSERR   DD  SYSOUT=*  
//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.

## **Today we covered**

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

# z/OS Connect Wildfire Github Site

<https://ibm.biz/Bdf8BZ>

A screenshot of two separate browser windows side-by-side, both displaying GitHub interfaces. The left window shows the repository 'ibm-wsc/zCONNEE-Wildfire-Workshop' with a single commit from user 'emitchj'. The right window shows the repository 'zCONNEE-Wildfire-Workshop' with multiple commits from the same user, all dated 21 days ago. Both windows show standard GitHub navigation and file listing features.

The screenshot displays two GitHub repository pages:

**Left Window (ibm-wsc/zCONNEE-Wildfire-Workshop):**

- Commits: 1
- Pull requests: 0
- Actions: 0
- Projects: 0
- Wiki: 0
- Security: 0
- Insights: 0
- Settings: 0

**Right Window (zCONNEE-Wildfire-Workshop):**

- Commits: 12
- Starred: 13
- Forks: 8
- Unwatched: 12
- Issues: 1
- Pull requests: 0
- Actions: 0
- Projects: 0
- Wiki: 0
- Security: 0
- Insights: 0
- Settings: 0

**Commit History (Right Window):**

Commit	Author	Date	Message
6acb786	emitchj	21 days ago	Add files via upload
...			
adminCenter.xml		14 months ago	Add files via upload
apiRequester.xml		14 months ago	Add files via upload
apiRequesterHTTPS.xml		14 months ago	Add files via upload
apiRequesterTrace.xml		14 months ago	Add files via upload
atssaf.xml		4 months ago	Add files via upload
basicSecurity.xml		14 months ago	Add files via upload
cicsTrace.xml		14 months ago	Add files via upload
cors.xml		11 months ago	Add files via upload
db2.xml		14 months ago	Add files via upload
db2TLS.xml		14 months ago	Add files via upload

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