

ZADMIN – IBM z/OS Connect Administration

WebSphere Liberty Profile with
IBM z/OS Connect (OpenAPI 2) and/or
IBM z/OS Connect (OpenAPI 3)
Administration

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Notes and Disclaimers

- The information in this presentation was derived from various product documentation web sites.
- 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 WebSphere Application Server Liberty which is commonly called 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.
- **IBM z/OS Connect (OpenAPI 2)** refers to the z/OS Connect EE product prior to service level V3.0.55. **IBM z/OS Connect (OpenAPI 3)** refers to the additional functions and features added with service level V3.0.55. Important - servers configured for OpenAPI 2 can will continue to operate as is with service level V3.0.55 and later.
- A z/OS  or a Java  or a Liberty  or a z/OS Connect OpenAPI 2,  or a z/OS Connect OpenAPI 3  icon will appear on slides where the information is specific to these products. Don't hesitate to ask questions as to why the icon does or does not appear on certain slides.
- The examples, tips, etc. present in this material are based on firsthand experiences and are not necessarily sanctioned by Liberty or z/OS Connect development.

Agenda

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

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

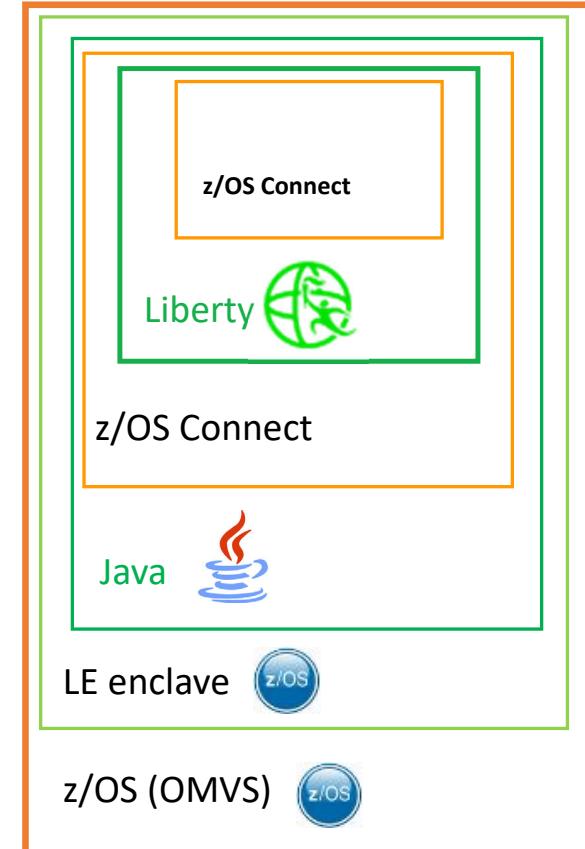


z/OS Connect consists of a stack of software

- z/OS Connect is a Liberty feature written in Java.
- Liberty provides shared access to basic z/OS functions, e.g., SAF security, WLM, RRS, SMF etc., for multiple Java applications running concurrently.
- z/OS Connect also provides Java code that initiates the Liberty process.*
- Started by an OMVS script that starts the Java environment (as an OMVS process).
- Under a Language Environment (LE) enclave configured to support OMVS and Java processes.
- On z/OS image with access z/OS services and facilities (e.g., SAF, WLM, RRS, SMF, JCL, started tasks, etc.)

Knowing the different layers and their relationship is important regarding

- Understanding which layer a configuration options, e.g., environment variables, etc., applies.
- Monitoring and understanding the health of the server
- Performing problem determination and performance tuning



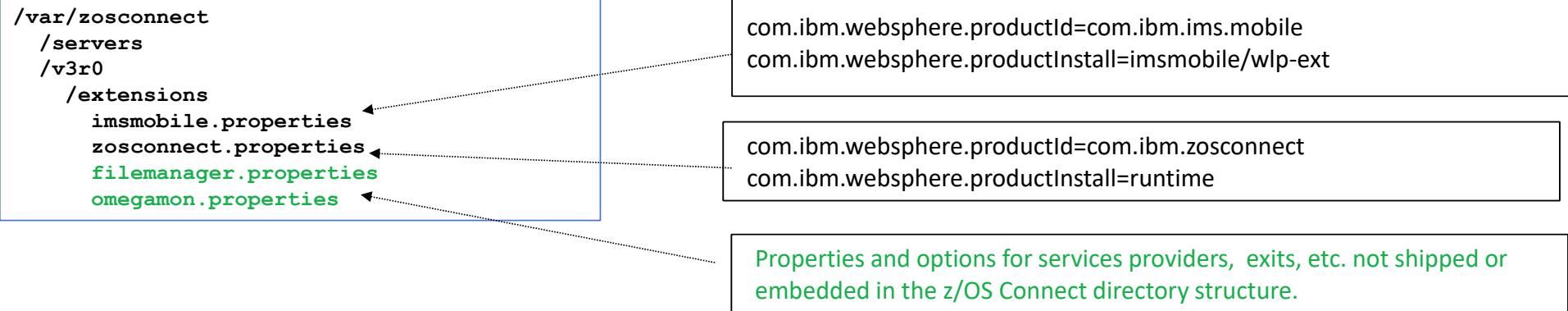
* z/OS Connect starts a Liberty process using a system programming interface (SPI).
See the Notes at URL <https://www.ibm.com/docs/en/was-liberty/zos?topic=liberty-embedding-server-in-your-applications> regarding restrictions in this environment.



Required LPAR customization – invoke the `zconsetup` command once per LPAR

The `zconsetup` script creates a symbolic link from the WLP `..v3r0/wlp/etc` directory (normally R/O) to a local R/W directory (creating a default configuration and local extension directories).

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



- This directory structure and contents is created by invoking the `zconsetup` script and **must be created on each LPAR** on which z/OS Connect will execute. This is how the z/OS Connect Liberty server locates service provider executables. Note: the `com.ibm.websphere.productInstall` directive value that is relative to directory `/usr/lpp/IBM/zosconnect/v3r0`.
- Not creating this link will cause messages `CWWKF0001E: A feature definition could not be found for zosconnect:....` or `CWWKE0054E: Unable to open /usr/lpp/IBM/zosconnect/v3r0/wlp/etc/extensions/zosconnect.properties`

OpenAPI 2 - Use the `zosconnect` command to create a z/OS Connect Liberty Server



To create an OpenAPI 2 server, use the `zosconnect` command using one of these templates, as in:

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

There are other templates, but they are useful only for samples of service provider configuration options.

- `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

Issues with permission bits and ownership and group access for directories and files is a common problem.

OpenAPI 3 - Use the `zosconnect` command to create a z/OS Connect Liberty Server



To create an OpenAPI 3 server, use the `zosconnect` command with the `zosconnect:openApi3` template:

```
zosconnect create serverName --template= zosconnect:openApi3
```

- This template installs feature **zosconnect:zosConnect-3.0**. z/OS Connect service provider features, e.g., `zosconnect:cics-1.0`, `zosconnect:mqService-1.0`, `zosconnect:dbService-1.0` and `imsmobile:imsmobile-2.0` have dependencies on feature **zosconnect:zosconnect-2.0** and are not compatible with feature **zosconnect:zosConnect-3.0**.
- z/OS Connect XML configuration attributes other than `zosconnect_cicsIpicConnection` and `zosconnect_db2Connection` are not recognized in an z/OS Connect OpenAPI 3 server.
- Where **serverName** is any value you wish, such as `zceeeApi3` or `zCEEopenAPI3`, and this value will be the name of the server instance. The templates can be found in directory `/usr/lpp/IBM/zosconnect/v3r0/runtime/templates/servers`.
- Environment variable **WLP_USER_DIR** will be used to set the location of the configuration directory and files created by this command, default location is `/var/zosconnect/servers` where `/var/zosconnect` is default value for **WLP_USER_DIR**.

Use multiple mount points and ZFS file systems for WLP_USER_DIR directories

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

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

SYS1.PARMLIB (BPXPRM##)

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

- Create a dedicated filesystem for the root z/OS Connect /var directory, e.g., /var/zosconnect/v3r0/extensions. This directory structure can not be changed. This provides portability for migrations and system upgrades. Note: MODE(READ) will apply to /var/zosconnect/servers.

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

df -P | grep /var/zosconnect

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

The default server configuration directories and files (OpenAPI 2)



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
/security	777	LIBSERV LIBGRP
server.xml	640	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.

* Only created when using the apiRequester template.



The default server configuration directories and files (OpenAPI 3)



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

```
export JAVA_HOME=<path_to_64_bit_Java>
export WLP_USER_DIR=/var/zosconnect
./zosconnect create zceeApi3
--template= zosconnect:openApi3

/var/zosconnect          750 LIBSERV LIBGRP
  /servers               750 LIBSERV LIBGRP
    /zceeApi3            750 LIBSERV LIBGRP
      /apps                750 LIBSERV LIBGRP
      /configDropins       750 LIBSERV LIBGRP
        /overrides          750 LIBSERV LIBGRP
      /logs                 777 LIBSERV LIBGRP
        messages.log         666 LIBSERV LIBGRP
      /resources             750 LIBSERV LIBGRP
        /security            777 LIBSERV LIBGRP
      server.xml             640 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

Note the differences from the OpenAPI 2 directory structure

- No **zosconnect** subdirectory in the **resources** directory. There are no API, services or API requester archive files.
- An **apps** directory where the Web Archive (WAR) files are deployed.
- A **configDropins/overrides** directory for server configuration XML files.

One suggestion for settings of the server configuration permission bits



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

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

/var/zosconnect	751	LIBSERV LIBGRP
/servers	751	LIBSERV LIBGRP
/zceesrvr	751	LIBSERV LIBGRP
/apps	761	LIBSERV LIBGRP
/configDropins	761	LIBSERV LIBGRP
/overrides	761	LIBSERV LIBGRP
/logs	771	LIBSERV LIBGRP
messages.log	644	LIBSERV LIBGRP
/resources	751	LIBSERV ADMGRP
/security	777	LIBSERV LIBGRP
/zosconnect	751	LIBSERV ADMGRP
/apis	761	LIBSERV ADMGRP
/apiRequesters	761	LIBSERV ADMGRP
/rules	761	LIBSERV ADMGRP
/services	761	LIBSERV ADMGRP
server.xml	460	LIBSERV ADMGRP

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

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

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

Use SURROGAT/UNIXPRIV SAF access to create a server



Example of using **SURROGAT** privileges

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

Example of using **UNIXPRIV** privileges

```
//ZCEESRVR JOB 'ZCEE',CLASS=A,REGION=0M,NOTIFY=&SYSUID
//*****
//** SET SYMBOLS
//*****
//EXPORT EXPORT SYMLIST=(*)
// SET JAVAHOME='/usr/lpp/java/J8.0_64'
// SET ZCEEPATH='/usr/lpp/IBM/zosconnect/v3r0'
// SET SERVER='zceesrvr'
// SET TEMPLATE='zosconnect:openApi3'
// SET WLPUSER='/var/zosconnect'
// SET USER='LIBSERV'
// SET GROUP='LIBGRP'
//*****
//** Step ZCEESRVR - Use the zosconnect command to create a server
//*****
//ZCEESRVR EXEC PGM=IKJEFT01,REGION=0M
//SYSTSPRT DD SYSOUT=*
//SYSERR DD SYSOUT=*
//STDOUT DD SYSOUT=*
//SYSTSIN DD *,SYMBOLS=EXECSYS
BPXBATCH SH +
export JAVA_HOME=&JAVAHOME; +
export WLP_USER_DIR=&WLPUSER; +
&ZCEEPATH/bin/zosconnect create &SERVER +
--template=&TEMPLATE; +
chown -R &USER:&GROUP $WLP_USER_DIR/servers/&SERVER
```

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

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

See the appendix for examples of the RACF commands to enable SURROGAT and UNIXPRIV access.

A Tour of a LPAR's and a server's directories and files



```
/var/zosconnect/v3r0<
  /extensions  (see previous slide)
```

```
 ${WLP_USER_DIR} <
  /servers      (details on next page)
    /serverName
```

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

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

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



A Tour of Key Server Configuration Directories and Files

A server's configuration structure looks like this (N.B. OpenAPI 2 and OpenAPI 3 servers do not coexist as shown here):

```
 ${WLP_USER_DIR}
  /servers
    /serverName
      /apps
      /configDropins
        /overrides
      /logs
        /ffdc
        messages.log
      /resources
        /security
          /zosconnect
            /apis
            /apiRequesters
            /rules
            /services
          server.xml
        /tranlog
        /workarea
```

The `/apps` directory is the location to where OpenAPI 3 Web Archive (WAR) files are deployed.

The `/configDropins/overrides` directory is the location where server XML configuration files are placed for OpenAPI 3 servers.

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

The `/security` directory contains files `ltpa.keys` and `key.p12`. `ltpa.keys` is the server specific LTPA token. `key.p12` is a self-signed certificate that expires in one year.

The `/zosconnect` directory is where the deployed APIs, services, and API requester files will be placed for an OpenAPI 2 server.

The `server.xml` file is the key configuration file. It is here that z/OS Connect definitions go which define the essential configuration of the server and backend connectivity.

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



The differences between the initial server.xml configuration files

```
default template - OpenAPI 2 server.xml configuration file
<?xml version="1.0" encoding="UTF-8"?>
<server description="new server">
    <!-- Enable features -->
    <featureManager>
        <feature>zosconnect:zosConnect-2.0</feature>
        <feature>zosconnect:zosConnectCommands-1.0</feature>
        <feature>apiDiscovery-1.0</feature> *
    </featureManager>

    <!-- To access this server from a remote client add a host attribute
        to fetch swagger doc from zOS Connect Enterprise Edition -->
    <httpEndpoint id="defaultHttpEndpoint"
        host="*"
        httpPort="9080"
        httpsPort="9443" />
    <!-- add cors to allow cross origin access, e.g. when using swagger UI
        to fetch swagger doc from zOS Connect Enterprise Edition -->
    <cors id="defaultCORSConfig" />
- - - - - 24 Line(s) not Displayed

    <!-- config requires updateTrigger="mbean" for REFRESH command support
-->
<config updateTrigger="mbean" monitorInterval="500"/>

    <zosconnect_zosConnectManager setUTF8ResponseEncoding="true"/>

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

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

</server>
```

* Include these features if not already present.

```
openApi3 template - OpenAPI 3 server.xml configuration file
<?xml version="1.0" encoding="UTF-8"?>
<server description="new server">
    <!-- Enable features -->
    <featureManager>
        <feature>zosconnect:zosConnect-3.0</feature>
        <feature>openapi-3.0</feature>
    </featureManager>

    <!-- To access this server from a remote client add a host attribute
        to fetch swagger doc from zOS Connect Enterprise Edition -->
    <httpEndpoint id="defaultHttpEndpoint"
        host="*"
        httpPort="9080"
        httpsPort="9443" />
- - - - - 12 Line(s) not Displayed
    <!-- config requires updateTrigger="mbean" for REFRESH command support
        config updateTrigger="mbean"/>

    <!-- applicationMonitor requires updateTrigger="mbean" for REFRESH command
        support -->
    <applicationMonitor updateTrigger="mbean" dropinsEnabled="false"/>

    <!-- Automatic expansion of WAR files is required for z/OS Connect native
        servers running the zosConnect-3.0 feature -->
    <applicationManager autoExpand="true" />

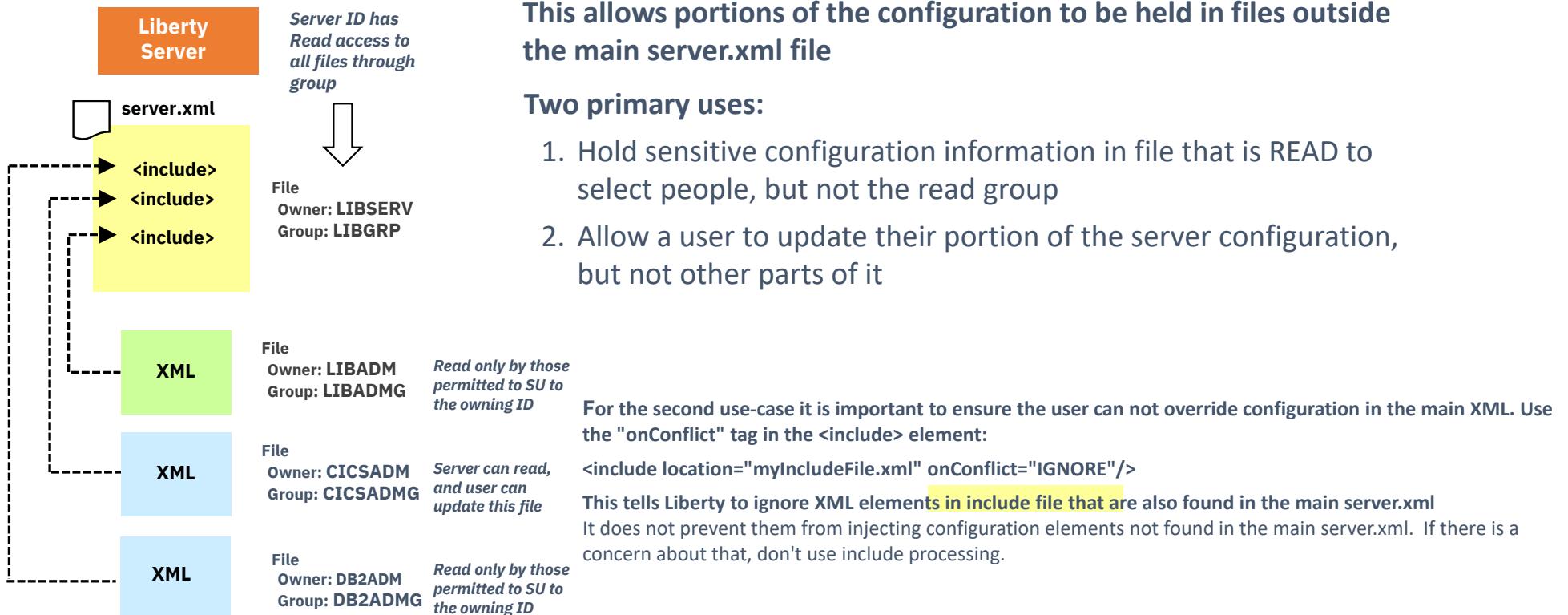
    <!-- APIs are deployed as WAR files and a webApplication element must be
        used to specify the location of the API WAR and optionally the name of the API
        -->
    <webApplication id="My API" location="${server.config.dir}/apps/api.war"
        name="MyAPI"/>

</server>
```

Note there are no *zosconnect* or *cors* configuration elements present with Open API 3.



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



Nesting of an include file within a include file is possible



Using “administration include” files to manage the server XML

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

https://www.ibm.com/support/knowledgecenter/en/SSAW57/liberty/com.ibm.websphere.wlp.nd.multiplatform.doc/ae/cwlp_config_include.html

server.xml (owned by ID ADMIN1)

```
<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"/>
<featureManager>
  <feature>zosconnect:zosConnect-2.0</feature>
  <feature>zosconnect:zosConnectCommands-1.0</feature>
  <feature>apiDiscovery-1.0</feature>
<featureManager>
```

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"/>
  <zosconnect_cicsIpicConnection id="cscvinc" host="wg31" port="1493"/>
</server>
```

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

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



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.



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

zceesrv1's bootstrap.properties

```
httpPort=9080
httpsPort=9443
ipicPort=1491
host=*
cicsHost=wg31.washington.ibm.com
network=ZOSCONN1
applid=ZOSCONN1
com.ibm.ws.zos.core.angelName=namedAngel
```

zceesrv2's bootstrap.properties

```
httpPort=9090
httpsPort=9453
ipicPort=1492
host=wg31.washington.ibm.com
cicsHost=wg31.washington.ibm.com
network=ZOSCONN2
applid=ZOSCONN2
com.ibm.ws.zos.core.angelName=namedAngel
```

Java directives can also be provided.

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="${host}"
    httpPort ="${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} and uses
EBCDIC encoding

A suggestion for modifying the initial server.xml configuration file ([OpenAPI 2](#))



Default server.xml configuration file

Modified server.xml configuration file

The simplifies administration by :

- Use a *bootstrap.properties* file to customize the ports in the *server.xml* file.
 - 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.

A suggestion for modifying the initial server.xml configuration file (OpenAPI 3)



Default server.xml configuration file

Modified server.xml configuration file

The simplifies administration by :

- Use a `bootstrap.properties` file to customize the ports in the `server.xml` file.
 - Add configuration elements by placing server XML files in the `.../configDropins/original` subdirectory.

A suggestion for modifying the initial server.xml configuration file (OpenAPI 3)



Default server.xml configuration file

Modified server.xml configuration file

```
<server description="zCEE Server">
<include location="${server.config.dir}/includes/safSecurity.xml"/>
<include location="${server.config.dir}/includes/ipicIDProp.xml"/>
<include location="${server.config.dir}/includes/keyring.xml"/>
<include location="${server.config.dir}/includes/groupAccess.xml"/>
<include location="${server.config.dir}/includes/shared.xml"/>
<include location="${server.config.dir}/includes/apiRequesterHTTPS.xml"/>
<include location="${server.config.dir}/includes/imsDatabase.xml"/>
<!-- Enable features -->
    <featureManager>
        <feature>zosconnect:zosConnect-3.0</feature>
        <feature>openapi-3.0</feature>
    </featureManager>
<!-- To access this server from a remote client add a host attribute
    <httpEndpoint id="defaultHttpEndpoint"
                  host ="${host}"
                  httpPort ="${httpPort}"
                  httpsPort ="${httpsPort}" />
```

The simplifies administration by :

- Use a bootstrap.properties file to customize the ports in the server.xml file.
 - Add configuration elements by placing server XML files in the .../configDropins/original subdirectory.
 - The use of <include> statements is also available.

The z/OS Connect started task JCL procedure

```
//ZCEESRVR PROC PARM='zceesrvr'  
//  
// SET ZCONHOME='/usr/lpp/IBM/zosconnect/v3r0'  
//  
//ZCON      EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,  
//                  PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS. --clean '  
//STDOUT    DD     SYSOUT=*  
//STDERR    DD     SYSOUT=*  
//STDIN     DD     DUMMY  
//STDENV    DD     *  
_BPX_SHAREAS=YES  
_CEE_RUNOPTS=HEAPPOOLS (ON) ,HEAPPOOLS64 (ON)  
JAVA_HOME=/usr/lpp/java/J8.0_64  
WLP_USER_DIR=/var/zosconnect  
JVM_OPTIONS=-Dcom.ibm.ws.zos.core.angelName=ZCEE -Xmx512m  
OPENJ9_JAVA_OPTIONS=-Xoptionsfile=/var/zcee/properties/myServer.property
```

OMVS
LE
JAVA
LIBERTY
z/OS Connect



Liberty and Java environment variables and z/OS Connect

A subset of Liberty environment variables are available in a z/OS Connect environment.

- **WLP_USER_DIR** – The environment variable informs the runtime environment where to look for shared resources and server definitions (e.g., server.xml).

Java related environment variables are also available in a z/OS Connect environment.

- **JAVA_HOME** – The OMVS directory where the Java executables (*/bin* directory) can be located.
- **JVM_OPTIONS** – A z/OS Connect environment variables that provides Java options and/or system properties. The contents of *JVM_OPTIONS* is added to the **java** command line in the *zosconnect* startup script.
- **IBM_JAVA_OPTIONS** – An IBM JAVA environment variable (deprecated and eventually will be replaced by *environment variable OPENJ9_JAVA_OPTIONS*). Environment variable *IBM_JAVA_OPTIONS* variable can be used to provide Java options and/or system properties.
- **OPENJ9_JAVA_OPTIONS** – An OpenJ9 environment variable (eventually will replace the deprecated environment variable *IBM_JAVA_OPTIONS*). Environment variable *OPENJ9_JAVA_OPTIONS* variable can be used to provide Java options and/or system properties.

Note: Any Java option or system property using *JVM_OPTIONS* supersedes the same Java non-standard options or system property when provided by *IBM_JAVA_OPTIONS* or *OPENJ9_JAVA_OPTIONS*. Java options and system properties and directives provided by *IBM_JAVA_OPTIONS* supersede the same property when provided by the *OPENJ9_JAVA_OPTIONS* environment variable.

The following environment variables are automatically set in a Liberty server and be used as variables in the server XML configuration files.

- **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: Java standard options are common across all JVM implementations (e.g., *-verbose* and *-classpath*) Non-standard options are unique to a JVM implementation and are identified using *-X*. System properties (*-D*) are passed on to the Java application for the Java application's use.



An example of using STDENV in a z/OS Connect JCL Procedure

Use the STDENV DD statement to scale servers and share configuration properties horizontally

```
//ZCON      EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,  
//                  PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS. --clean'  
//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 PATH='/var/zcee/properties/&PARMS..property',  
//                  PATHOPTS=ORDONLY  
  
//  
// or  
//STDENV      DD DISP=SHR,DSN=JOHNSON.ZCEE.STDENV(COMMON)  
//                  DD DISP=SHR,DSN=JOHNSON.ZCEE.STDENV(OPENJ9)  
//                  DD DISP=SHR,DSN=JOHNSON.ZCEE.STDENV(IBMOPTS)  
//                  DD DISP=SHR,DSN=JOHNSON.ZCEE.STDENV(JVMOPTHC)  
//                  DD DISP=SHR,DSN=JOHNSON.ZCEE.STDENV(JAVAHOME)  
//                  DD DISP=SHR,DSN=JOHNSON.ZCEE.STDENV(ZCEEANGL)  
//                  DD DISP=SHR,DSN=JOHNSON.ZCEE.STDENV(WLPUSER)
```

Either one OMVS property file or multiple PDS members.

The last occurrence environment variable encountered determines the value of the environment variable.

Which value used for a Java option or property depends on which environment variable is used to specify the option or property.

Trailing blanks are truncated for in-stream data sets, but not for other data sets.

BTW, the DCB characteristics the STDENV PDS/PDSE data set were (LRECL=400,BLKSIZE=32400).



z/OS Connect JCL STDENV PDS concatenation observations

Member COMMON

```
_BPX_SHAREAS=YES  
_CEE_RUNOPTS=HEAPPOOLS (ON) ,HEAPPOOLS64 (ON)  
JAVA_HOME=/usr/lpp/java/J8.0_64  
ZCON_ENV_DEBUG=TRUE  
WLP_USER_DIR=/var/alt/zosconnect
```

Green indicated the environment variable, Java option(-X) or system property(-D) that are used.
Red indicates the environment variable, Java option(-X) or system property(-D) that are ignored.

Member OPENJ9

```
OPENJ9_JAVA_OPTIONS=-verbose:sizes -Xms75m -Dcom.ibm.ws.zos.core.angelName=OPENJ9  
-Dcom.ibm.ws.logging.message.file.name=openj9.log #
```

Member IBMOPTS

```
IBM_JAVA_OPTIONS=-verbose:jni -Xms80m -Dcom.ibm.ws.logging.message.file.name=ibmopts.log  
-Dcom.ibm.ws.zos.core.angelName=IBMOPTS #
```

Member JVMOPTHC

```
JVM_OPTIONS=-Xoptionsfile=/var/zcee/properties/javaHCD.property -Dcom.ibm.ws.zos.core.angelName= -Xmx256m -verbose:sizes
```

Member JAVAHOME

```
JAVA_HOME=/u/johnson/java/J8.0_64
```

Member ZCEEANGL

```
OPENJ9_JAVA_OPTIONS=-Dcom.ibm.ws.zos.core.angelName=ZCEEANGL -Dcom.ibm.ws.logging.message.file.name=zceean gl.log -Xmx16m -Xms60m  
-verbose:gc #
```

Member WLPUSER

```
WLP_USE_DIR=/var/zosconnect
```

Default settings for the OpenJ9 VM <https://www.ibm.com/docs/en/sdk-java-technology/8?topic=reference-default-settings>

mitchj@us.ibm.com

These entries do not span multiple lines in the PDS member(the contents are continuous on one line).

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Consider using 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 CSCWLW -> /var/wlp/cics/CICS53Z/CSCWLW/wlp/usr/servers/defaultServer
lrwxrwxrwx 1 JOHNSON SYS1          57 Aug 16 12:22 CICSWLW -> /var/wlp/cics/CICS53Z/CICSWLW/wlp/usr/servers/cicswlw
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 wazz34a -> /var/zosconnect/servers/wazz34a
lrwxrwxrwx 1 JOHNSON SYS1          24 Aug 16 10:32 wlphats -> /var/wlp/servers/wlphats
lrwxrwxrwx 1 JOHNSON SYS1          36 Aug 16 10:31 zceeapir -> /var/ats/zosconnect/servers/zceeapir
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 zceeoipid -> /var/zosconnect/servers/zceeoipid
lrwxrwxrwx 1 JOHNSON SYS1          36 Aug 16 10:14 zceesrvr -> /var/ats/zosconnect/servers/zceesrvr
lrwxrwxrwx 1 JOHNSON SYS1          44 Aug 16 11:57 zosmfServer -> /var/zosmf/configuration/servers/zosmfServer
```

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

One administration directory to manage them all!

Administrative – Again use dedicated ZFS filesystem at the mount points

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

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



Sharing XML configuration files between servers across an LPAR or Sysplex

Add an *includes* subdirectories {server.config.dir} with a symbolic links to a common location. This common directory can be accessed from multiple servers on a single or from multiple LPARs. Additions and updates to the “include” files are then made in one single administrative directory.

OMVS commands

Symbolic links to a shared local LPAR directory

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

*Symbolic links to a shared Sysplex directory **

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

The server.xml file contains these “include” statements

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

Consider adding the “In” commands to the JCL used to create a new server

```
BPXEATCH SH +
export JAVA_HOME=&JAVAHOME; +
export WLP_USER_DIR=&WLPUSER; +
&ZCEEPATH/bin/zosconnect create &SERVER +
--template=&TEMPLATE; +
In -s /var/shared/zosconnect/includes $WLP_USER_DIR/servers/&SERVER/includes; +
In -s $WLP_USER_DIR/servers/&SERVER /var/zceesrv1/&SERVER
```



/var/shared/zosconnect/includes

Contents of the common “includes” directory

basicSecurity.xml

db2.xml

db2TLS.xml

groupAccess.xml

ipic.xml

ipicIDProp.xml

keyringInbound.xml

keystore.xml

keyringMutual.xml

keyringOutboundMutual.xml

safSecurity.xml

F ZCEESRV1,REFRESH,CONFIG

F ZCEESRV2,REFRESH,CONFIG

F ZCEESRV3,REFRESH,CONFIG



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

July 2020

V3.0.35 (APAR PH26291)
Server code update

Enhancements

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

Fixes

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

Attention

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

`cors.xml`

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

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

</server>
```

`server.xml`

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



Sharing XML configuration files – using '*variables*' files

“variables” files whose names are based on the name of the server

myServer.xml

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

zceoepid.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>
```



Use symbolic links to share z/OS Connect artifacts in a default location

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

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

Contents of each of the "resources/zosconnect" directory

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

Specify a standard default directory location for these artifacts and then use a symbolic link to the actual real directory

OMVS commands

Symbolic links to a local file system

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

Or a symbolic links to a shared file system

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

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

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

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

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



Consider simplifying administration by combining include files and using custom variables

Default server.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="new server">
<include location="${server.config.dir}/includes/${wlp.server.name}.xml"/>

    <!-- Enable features -->
    <featureManager>
        <feature>zosconnect:zosConnect-3.0</feature>
        <feature>openapi-3.0</feature>
    </featureManager>

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

\${server.config.dir}/includes/httpEndpoint.xml

```
<server description="basic security">
    <httpEndpoint id="defaultHttpEndpoint"
        host="${hostName}"
        httpPort="${httpPort}"
        httpsPort="${httpsPort}" />
</server>
```

\${server.config.dir}/includes/cics.xml

```
<server description="CICS IPIC connections">
    <!-- Enable features -->
    <featureManager>
        <feature>zosconnect:cics-1.0</feature>
    </featureManager>
    <zosconnect_cicsIpicConnection id="cicsConn" host="${CICS_HOST}"
        port="${CICS_PORT}" />
</server>
```

\${server.config.dir}/includes/\${wlp.server.name}.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="new server">
    <variable name="httpPort" value="9081"/>
    <variable name="httpsPort" value="9445"/>
    <variable name="hostName" value="*"/>
    <variable name="CICS_HOST" value="wg31.washington.ibm.com"/>
    <variable name="CICS_PORT" value="1491"/>
    <variable name="DB2_HOST" value="wg31.washington.ibm.com"/>
    <variable name="DB2_PORT" value="2446"/>
    <variable name="DB2_USERNAME" value="USER2"/>
    <variable name="DB2_PASSWORD" value="USER2"/>
    <include location="${server.config.dir}/includes/safSecurity.xml"/>
    <include location="${server.config.dir}/includes/cics.xml"/>
    <include location="${server.config.dir}/includes/features.xml"/>
    <include location="${server.config.dir}/includes/keystore.xml"/>
    <include location="${server.config.dir}/includes/db2.xml"/>
    <include location="${server.config.dir}/includes/httpEndpoint.xml"/>
</server>
```

\${server.config.dir}/includes/db2.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<server description="Default server">
    <featureManager>
        <feature>zosconnect:db2-1.0</feature>
    </featureManager>
    <zosconnect_credential user="${DB2_USERNAME}"
        password="${DB2_PASSWORD}" id="commonCredentials" />
    <zosconnect_db2Connection id="db2Conn" host="${DB2_HOST}"
        port="${DB2_PORT}" credentialRef="commonCredentials" />
</server>
```

Use Symbolic links to simplify commands used in OMVS 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
```

Will change these OMVS commands from:

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

To simpler (and shorter) OMVS commands:

```
ln -s /var/zcee/includes /var/zcee/zceesrv1/includes
ln -s /var/zcee/includes /var/zcee/zceesrv2/includes
```

Directory Shortcuts

- Create a shortcut from the shared administrative *include* directory to the Sysplex or LPAR shared directory
- Create shortcuts from the server's administrative directories to each server's configuration directory.

N.B. These are symbolic links to symbolic links.

ln -s oldname newname

These symbolic links can be used as JCL symbols

```
//EXPORT EXPORT SYMLIST=(*)
// SET SERVER= 'zceesrv1'
// SET SHARED='/var/zcee/includes'
// SET WLPUSER='var/zosconnect'
//ZCEELN EXEC PGM=IKJEFT01,REGION=0M
//SYSTSPRT DD SYSOUT=*
//SYSERR DD SYSOUT=*
//STDOUT DD SYSOUT=*
//SYSTSIN DD *,SYMBOLS=EXECSYS
BPXBATCH SH +
ln -s &SHARED /var/zcee/&SERVER/includes
instead of entering the full directory names as in
ln -s /global/zosconnect/includes +
&WLPUSER/servers/&SERVER/includes
```

And added as exports to /u/home/.profile or /etc/profile files

```
export serverName=zceesrv1
export shared=/var/zcee/includes
export WLP_USER_DIR=/var/zosconnect
```

```
//ZCEELN EXEC PGM=IKJEFT01,REGION=0M
//SYSTSPRT DD SYSOUT=*
//SYSERR DD SYSOUT=*
//STDOUT DD SYSOUT=*
//SYSTSIN DD *
BPXBATCH SH +
ln -s $shared /var/zcee/$serverName/includes
instead of entering the full directory names as in
ln -s /global/zosconnect/includes +
$WLPUSER/servers/$serverName/includes
```



Use JCL to make the creation and configuration of servers repeatable and portable

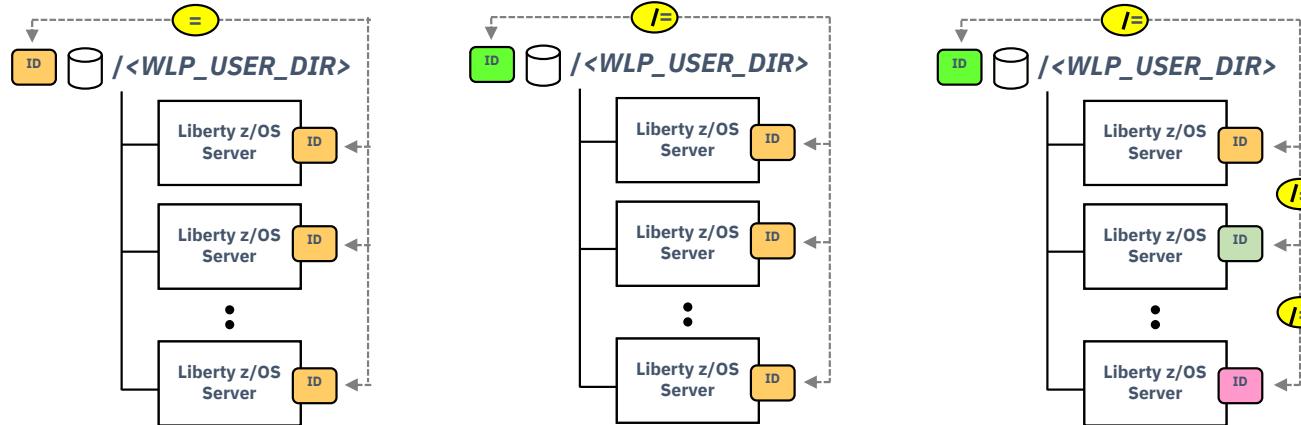
```
*****  
/* SET SYMBOLS  
*****  
//EXPORT EXPORT SYMLIST=(*  
// SET JAVAHOME='/usr/lpp/java/J8.0_64'  
// SET ZCEEPATH='/usr/lpp/IBM/zosconnect/v3r0'  
// SET SERVER='zceesrvr'  
// SET TEMPLATE='zosconnect:default'  
// SET WLPUSER='/var/ats/zosconnect'  
// SET USER='ATSSERV'  
// SET GROUP='ATSGRP'  
*****  
/* Step ZCEESRVR - Use the zosconnect command to create a server  
*****  
//ZCEESRVR EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH +  
export JAVA_HOME=&JAVAHOME; +  
export WLP_USER_DIR=&WLPUSER; +  
&ZCEEPATH/bin/zosconnect create &SERVER +  
--template=&TEMPLATE; +  
ln -s $WLP_USER_DIR/servers/&SERVER /var/zcee/&SERVER; +  
ln -s /var/zcee/includes/ +  
/var/zcee/&SERVER/includes; +  
cp /var/zcee/properties/bootstrap.properties +  
/var/zcee/&SERVER; +  
cp /var/zcee/properties/server.xml +  
/var/zcee/&SERVER; +  
chown -R &USER:&GROUP $WLP_USER_DIR/servers/&SERVER
```

```
*****  
/* SET SYMBOLS  
*****  
//EXPORT EXPORT SYMLIST=(*  
// SET JAVAHOME='/usr/lpp/java/J8.0_64'  
// SET ZCEEPATH='/usr/lpp/IBM/zosconnect/v3r0'  
// SET SERVER='openApi3'  
// SET TEMPLATE='zosconnect:openApi3'  
// SET WLPUSER='/var/ats/zosconnect'  
// SET CONFIG='configDropins/overrides'  
// SET USER='ATSSERV'  
// SET GROUP='ATSGRP'  
*****  
/* Step ZCEEAPI3 - Use the zosconnect command to create a server  
*****  
//ZCEEAPI3 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 WLP_USER_DIR=&WLPUSER; +  
&ZCEEPATH/bin/zosconnect create &SERVER +  
--template=&TEMPLATE; +  
ln -s $WLP_USER_DIR/servers/&SERVER /var/zcee/&SERVER; +  
ln -s /var/zcee/includes/safSecurity.xml +  
/var/zcee/&SERVER/&CONFIG/safSecurity.xml; +  
ln -s /var/zcee/includes/cicsIpic.xml +  
/var/zcee/&SERVER/&CONFIG/cicsIpic.xml; +  
ln -s /var/zcee/includes/keystore.xml +  
/var/zcee/&SERVER/&CONFIG/keystore.xml; +  
ln -s /var/zcee/includes/features.xml +  
/var/zcee/&SERVER/&CONFIG/features.xml; +  
cp /var/zcee/properties/bootstrap.properties +  
/var/zcee/&SERVER; +  
cp /var/zcee/properties/server.xml +  
/var/zcee/&SERVER; +  
chown -R &USER:&GROUP $WLP_USER_DIR/servers/&SERVER
```

RACF, Liberty and z/OS Connect Security Details and Options

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 Security: Assigning ID to started tasks: SAF STARTED class

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

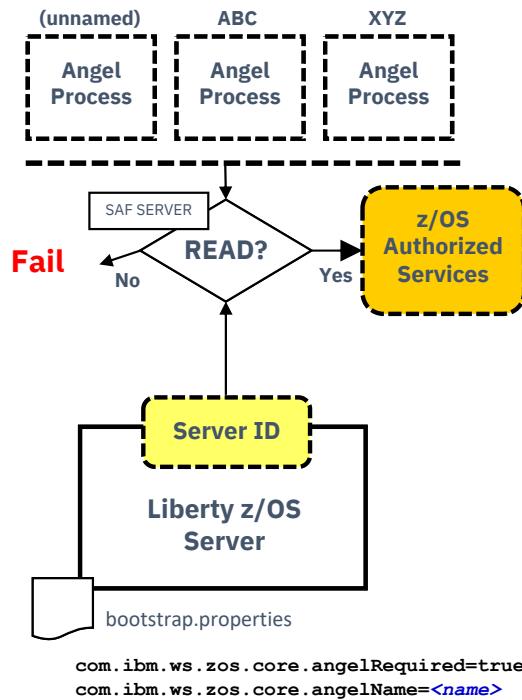
	<i>Common Identity per task</i>	<i>Unique Identities per task</i>
<i>Common JCL Procedure</i>	<pre>RDEFINE STARTED ZCEEPROC.* S ZCEEPROC, JOBNAME=<i>server1</i>, PARMs='<i>server1</i>' S ZCEEPROC, JOBNAME=<i>server2</i>, PARMs='<i>server2</i>'</pre>	<pre>RDEFINE STARTED ZCEEPROC.<i>server1</i> RDEFINE STARTED ZCEEPROC.<i>server2</i> S ZCEEPROC, JOBNAME=<i>server1</i>, PARMs='<i>server1</i>' S ZCEEPROC, JOBNAME=<i>server2</i>, PARMs='<i>server2</i>'</pre>
<i>Unique JCL Procedure per server</i>	<pre>RDEFINE STARTED ZCEE*.* S ZCEESRV1, JOBNAME=<i>server1</i>, PARMs='<i>server1</i>' S ZCEESRV2, JOBNAME=<i>server2</i>, PARMs='<i>server2</i>'</pre>	<pre>RDEFINE STARTED ZCEESRV1.* RDEFINE STARTED ZCEESRV2.* S ZCEESRV1, JOBNAME=<i>server1</i>, PARMs='<i>server1</i>' S ZCEESRV2, JOBNAME=<i>server2</i>, PARMs='<i>server2</i>'</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 Security: The Angel process – what is this about?



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

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

Best practice:

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

List of current Liberty Features

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

z/OS Security: SAF SERVER profiles related to the Angel



Best practice:

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

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

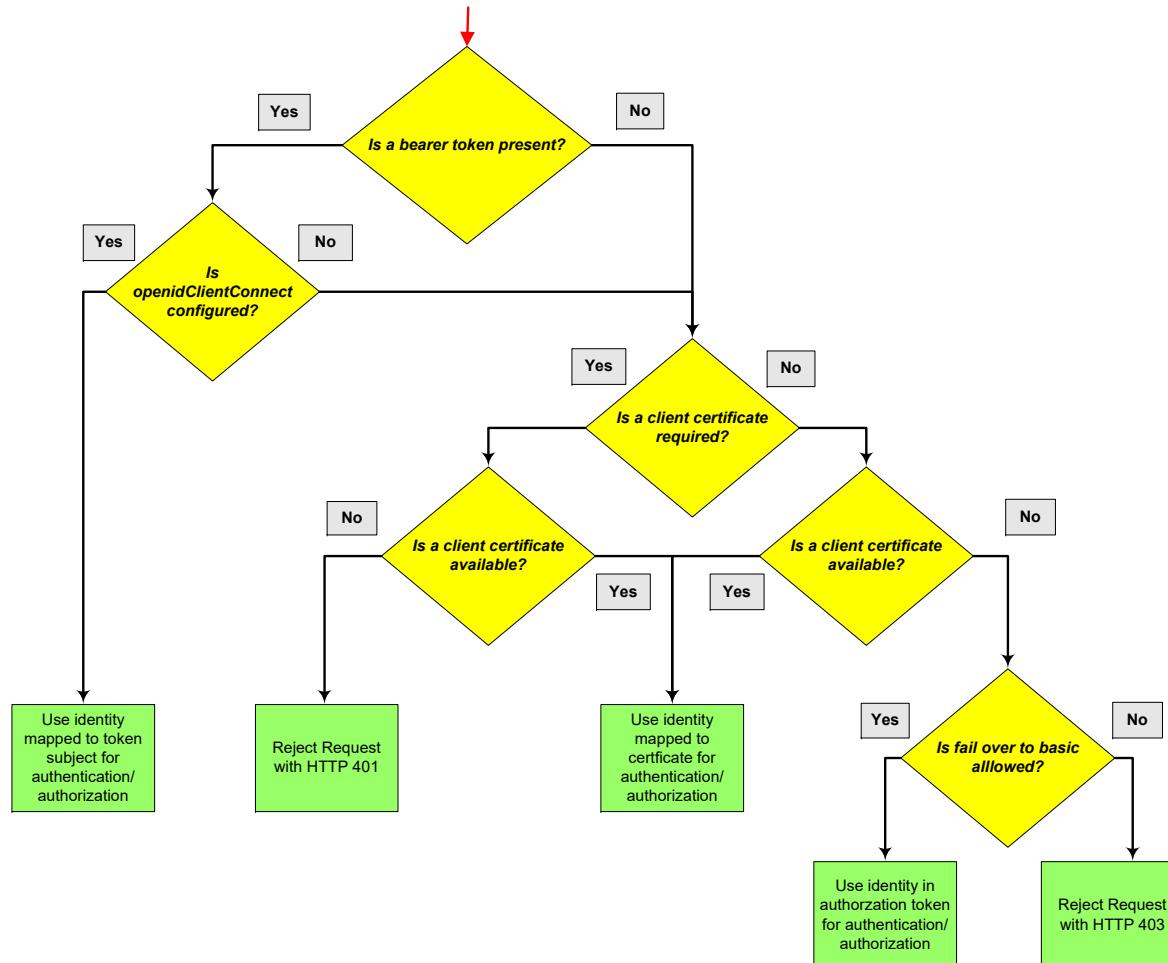
https://www.ibm.com/support/knowledgecenter/SS7K4U_liberty/com.ibm.websphere.wlp.zseries.doc/ae/rwlp_newinrelease.html

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

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



Liberty authentication credential precedence to determine authorization identity





Basic authentication – Where the client provides an identity and password

- ❑ server XML security configuration:

```
<featureManager>
    <feature>appSecurity-2.0</feature>
    <feature>zosSecurity-1.0</feature>
</featureManager>

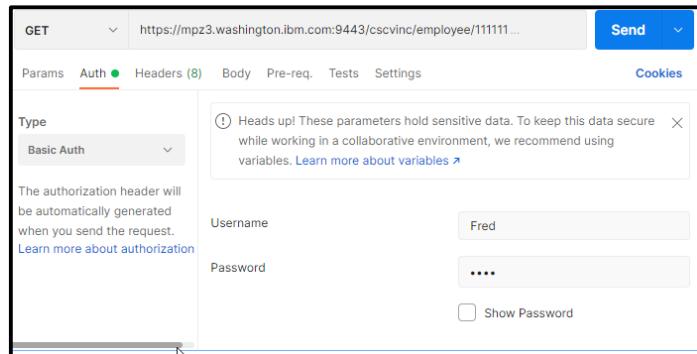
<webAppSecurity allowFailOverToBasicAuth="true" />

<safRegistry id="saf" />
<safAuthorization racRouteLog="ASIS" />
<safCredentials unauthenticatedUser="WSGUEST"
    profilePrefix="BBGZDFLT" />
```

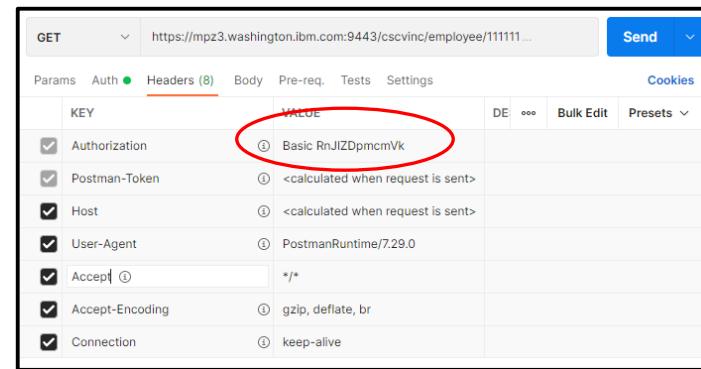
Note that these are Liberty configuration elements documented in the Liberty KC, i.e., no `zosconnect_` prefix.

- ❑ When sending a request to a Liberty server running z/OS Connect, basic authentication information (identity and password) is provided in the HTTP header in a Basic *Authorization* token with the identity and password encoded or formatted using Base64.

- An example with Postman:



The screenshot shows the Postman interface for a GET request to `https://mpz3.washington.ibm.com:9443/cscvinc/employee/111111...`. The 'Auth' tab is selected. Under 'Type', 'Basic Auth' is chosen. A note says: 'The authorization header will be automatically generated when you send the request.' Below it, 'Username' is set to 'Fred' and 'Password' is set to '****'. There is a 'Show Password' checkbox.



The screenshot shows the 'Headers' tab in Postman with 8 items. The 'Authorization' header is circled in red. The table shows:

KEY	VALUE
Authorization	Basic RnJIZDpmcmVk
Postman-Token	<calculated when request is sent>
Host	<calculated when request is sent>
User-Agent	PostmanRuntime/7.29.0
Accept	*
Accept-Encoding	gzip, deflate, br
Connection	keep-alive



Liberty JSSE server XML configuration (default inbound/outbound TLS connections)

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

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

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

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

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

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

SSL repertoires

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

Using this Liberty JSSE server XML configuration (outbound connections)



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

<ssl id="cicsTLSSettings"
    keyStoreRef="CellDefaultKeyStore"
    trustStoreRef="CellDefaultKeyStore"
    clientKeyAlias="Liberty Client Cert"/>

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

<ssl id="db2TLSSettings"
    keyStoreRef="OutboundKeyStore"
    trustStoreRef="OutboundKeyStore"
    clientKeyAlias="Liberty Client Cert"/>

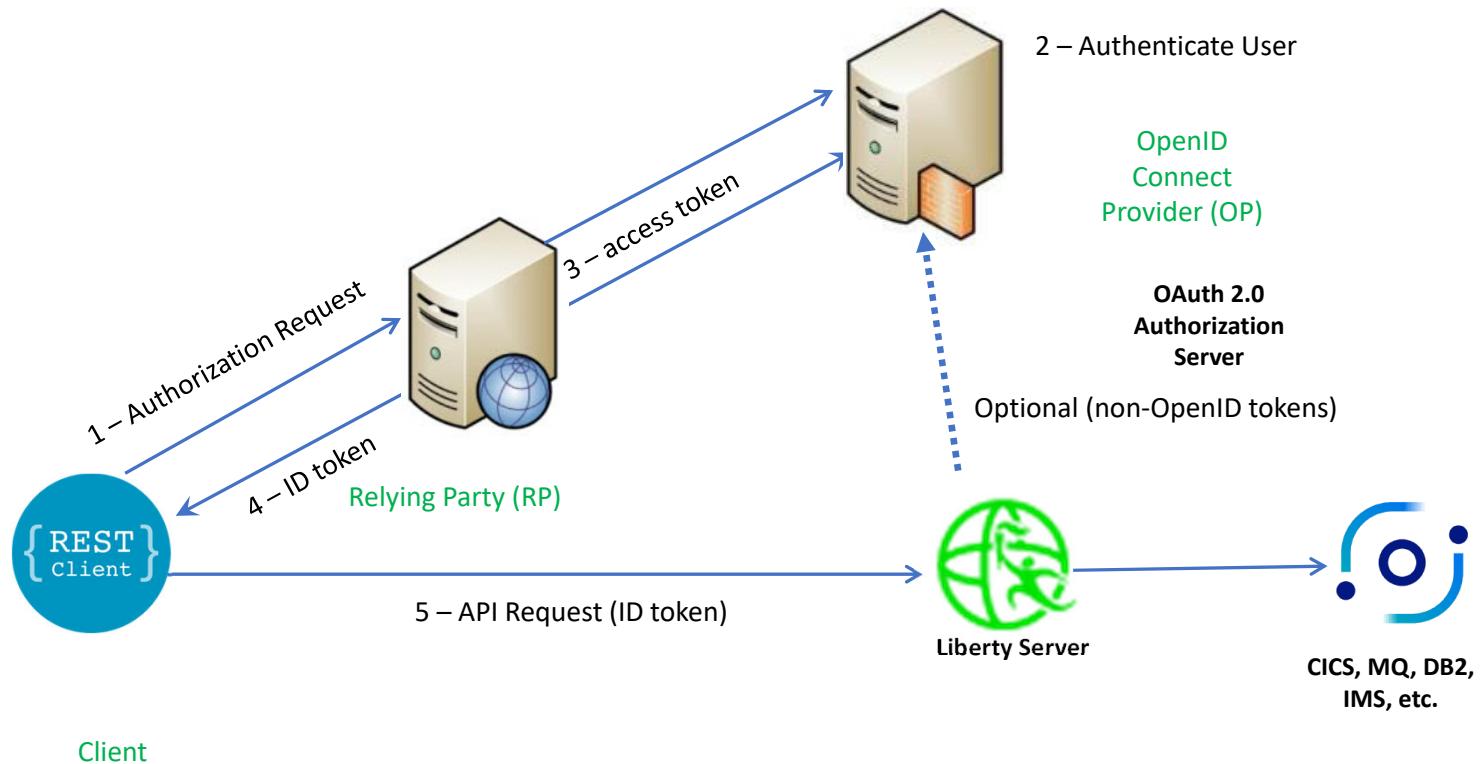
<keyStore id="Db2KeyStore"
    location="safkeyring:///Liberty.Db2.KeyRing"
    password="password" type="JCERACFKS"
    fileBased="false" readOnly="true" />
```

```
<zosconnect_authorizationServer sslCertsRef="SSL repertoire"/>
<zosconnect_cicsIpicConnection sslCertsRef="cicsTLSSettings"/>
<zosconnect_db2Connection sslCertsRef="db2TLSSettings"> * 
<zosconnect_endpointConnect sslCertsRef= "SSL repertoire"/>
<zosconnect_zosConnectRestClient sslCertsRef="SSL repertoire"/>
<zosconnect_zosConnectServiceRestClientConnection sslCertsRef="SSL repertoire"/>
```

F BAQSTRT,REFRESH,KEYSTORE
F BAQSTRT,REFRESH,KEYSTORE,ID=CICSKeyStore
F BAQSTRT,REFRESH,KEYSTORE,ID=Db2KeyStore



Typical Authorization Flow for an OpenID Connect token to a z/OS Connect API Provider





Liberty OpenID Client identity mapping configuration attributes

Decoded EDIT THE PAYLOAD AND SECRET

```
HEADER: ALGORITHM & TOKEN TYPE

{
  "kid": "kvjtqdlMjOTWiJrjOr73fu2MMt-FjiQrxU0YBzJLR4o",
  "alg": "RS256"
}

PAYLOAD: DATA

{
  "sub": "auser",
  "token_type": "Bearer",
  "scope": [
    "openid",
    "profile",
    "email"
  ],
  "azp": "rpSsl",
  "iss": "https://wg31.washington.ibm.com:26213/oidc/endpoint/OP",
  "aud": "myZcee",
  "exp": 1646761228,
  "iat": 1646760928,
  "realmName": "zCEERealm",
  "uniqueSecurityName": "auser"
}
```

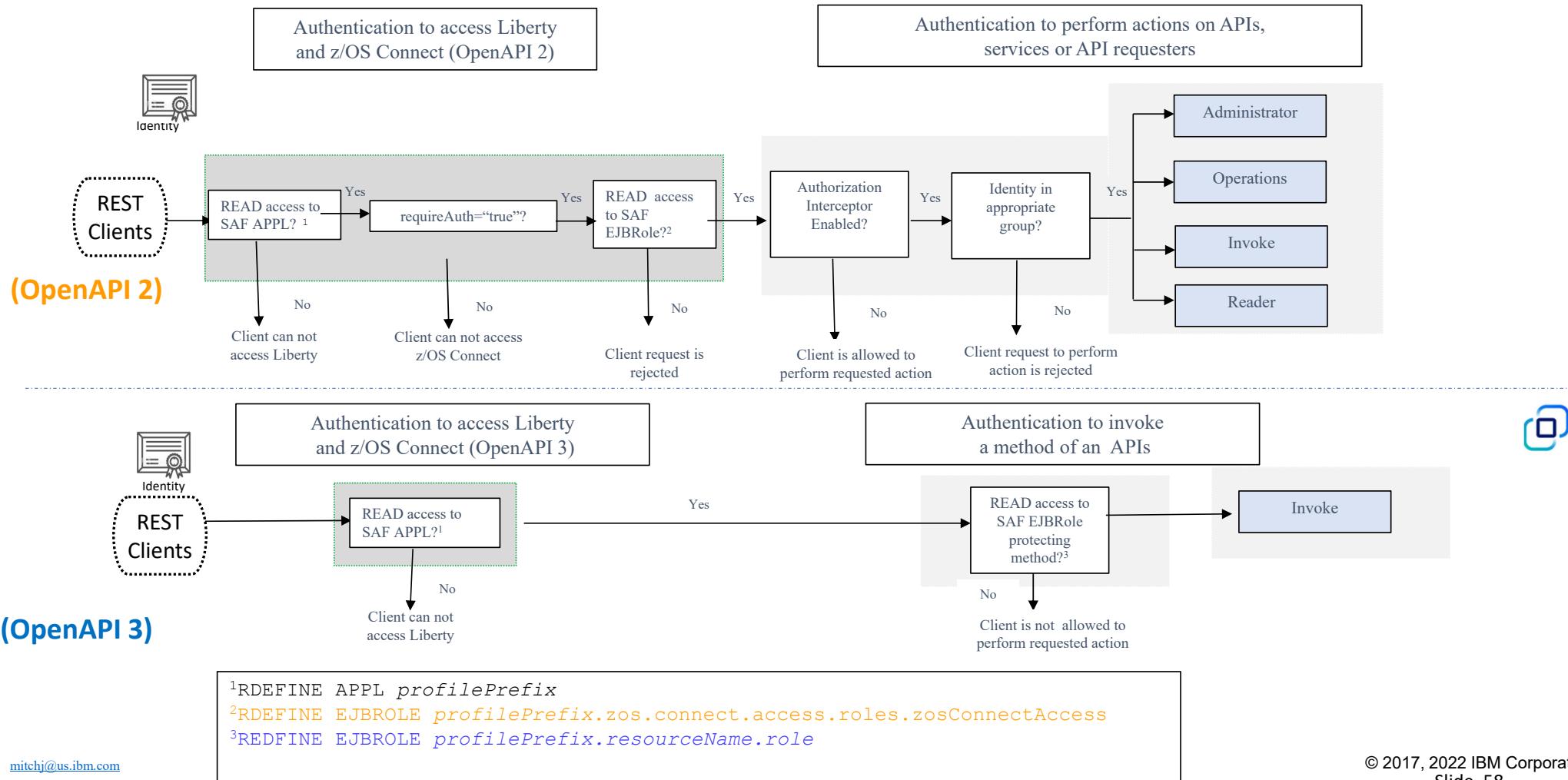
```
<safRegistry id="saf" />
<safAuthorization racRouteLog="ASIS" />
<safCredentials unauthenticatedUser="WSGUEST"
  mapDistributedIdentities="true" ←
  profilePrefix="BBGZDFLT" />
```

Use distributed identity filters to map the distributed identities to SAF user IDs, using IDIDMAP resources and the RACMAP command.

```
<authFilter id="ATSAuthFilter">
  <requestUrl id="ATSDemoUrl"
    name="ATSRefererUri"
    matchType="contains"
    urlPattern="/cscvinc/employee|/db2/employee|/mqapi/loan"/>
</authFilter>
<openidConnectClient id="ATS"
  httpsRequired="true"
  authFilterRef="ATSAuthFilter"
  inboundPropagation="required"
  scope="openid profile email"
  audiences="myZcee"
  issuerIdentifier="https://wg31.washington.ibm.com:26213/oidc/endpoint/OP"
  mapIdentityToRegistryUser="false" ←
  signatureAlgorithm="RS256"
  userIdentityToCreateSubject="sub"
  trustAliasName="JWT-Signer-Certificate"
  trustStoreRef="jwtTrustStore"
  authnSessionDisabled="true"
  disableLtpaCookie="true">
</openidConnectClient>
<keyStore fileBased="false" id="jwtTrustStore"
  location="safkeyring:///JWT.KeyRing"
  password="password" readOnly="true" type="JCERACFKS"/>
```

Specifies whether to map the identity to a registry user. If this is set to false, then the user registry (SAF) is not used to create the user subject.

Authorization security flow within z/OS Connect





z/OS Connect Security server XML Authentication Configuration (OpenAPI 2)

- requireAuth - requires the client to provide credentials

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

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

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

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

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

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



z/OS Connect Security server XML Authentication Configuration (OpenAPI 2)

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

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

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

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

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

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

requireSecure controls inbound TLS connections



RESTful Administrative APIs (OpenAPI 2)

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		
GET	/apis	Show/Hide List Operations Expand Operations 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		
GET	/services	Show/Hide List Operations Expand Operations 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.		
GET	/apiRequesters	Show/Hide List Operations Expand Operations 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

z/OS Connect Authorization Functions (OpenAPI 2)



Operations - Ability to perform all z/OS Connect EE operations and actions except for function *Invoke*. The following operations/actions are allowed:

APIs:

- *To obtain a list of all APIs (GET).**
- For a specific API, get its details and API Swagger document (GET) and *deploy (POST)**, update (PUT), start(PUT), stop(PUT), and delete(DELETE) it.

Services:

- *To obtain a list of all services or statistics for all services (GET).**
- For a specific service, get its details, request and response schemas, statistics (GET) and *deploy(POST)**, update(PUT), start(PUT), stop(PUT), and delete(DELETE) it.

API Requesters:

- *To obtain a list of all API requesters (GET).**
- For a specific API requester, get its details (GET) and *deploy (POST)**, update(PUT), start(PUT), stop(PUT), and delete(DELETE) it.

*These APIs use either the POST or GET method to invoke the REST APIs whose URIs have no path parameter. Therefore, the name of the API, or service or API Requester is ignored. For authorization, only the default or global groups list can be used since no specific group list can be determined (for deployment, the name is embedded in the archive file).



z/OS Connect Authorization Levels (OpenAPI 2)

Reader - Ability for:

APIs:

- *To obtain a list of all APIs (GET) . **
- For a specific API, get its details and API Swagger document (GET).

Services:

- *To obtain a list of all services (GET). **
- For a specific service, get its details and request and response schemas (GET).

API Requesters:

- *To obtain a list of all API requesters (GET). **
- For a specific API requester, get its details (GET) .

Invoke - Ability to invoke user APIs, services and/or API requesters (POST,PUT,GET,DELETE,+).

Admin - All z/OS Connect EE actions are allowed, including all corresponding *Operations*, *Invoke*, and *Reader* actions configured for the same z/OS Connect resource.

*These APIs use either the POST or GET method to invoke the REST APIs whose URIs have no path parameter. Therefore, the name of the API, service or API Requester is not available. For authorization, only the default or global groups list since no specific group list can be determined (for deployment, the name is embedded in the archive file).

z/OS Connect RESTful Administrative APIs Security (OpenAPI 2)



z/OS Connect uses group security for controlling authorization for accessing APIs. There are sets of default global groups for functional roles are configured in a `zosConnectManager` configuration element as shown below:

```
<zosconnect_zosConnectManager  
    globalInterceptorsRef="interceptorList_g"  
    globalAdminGroup="SYSPGRP" globalOperationsGroup="GBLOPERS"  
    globalInvokeGroup="GBLINVKE" globalReaderGroup="GBLRDR"/>
```

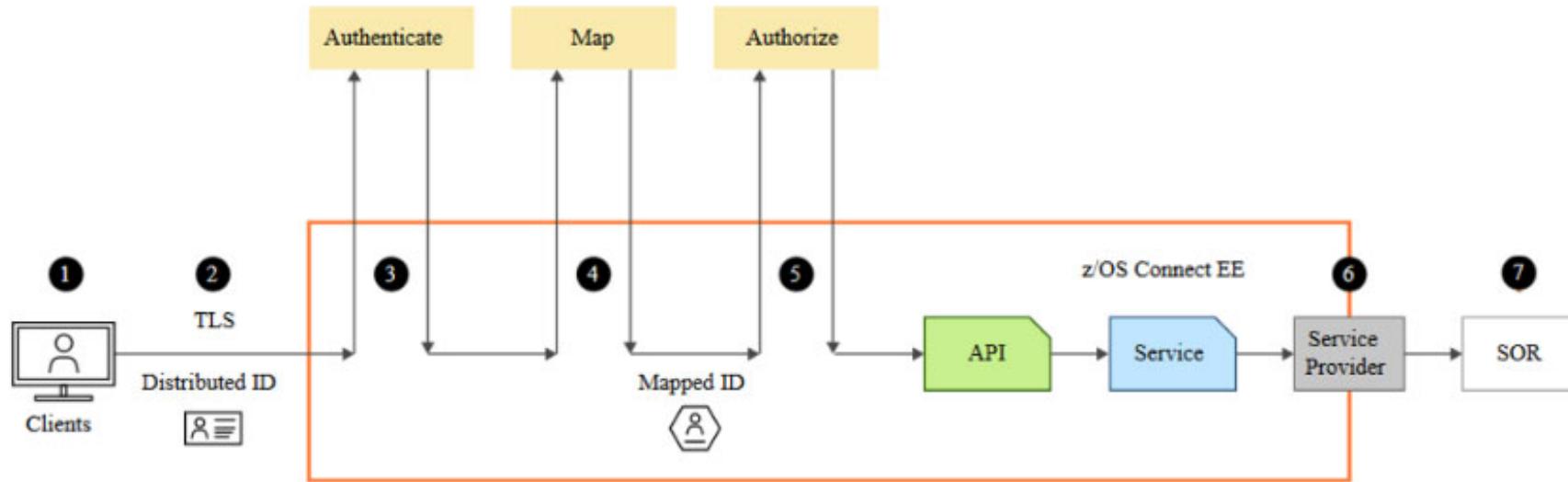
There are four classes of groups available controlling z/OS Connect functions, administration, operations, invoking and reader in our server. An authenticated identity membership in one or more of these groups provides access to the corresponding function to that identity.

There is also a way to provide an alternative set of groups for functional roles for specific APIs, services, and API requesters in subordinate configuration elements in our server.

```
<zosConnectAPI name="cscvinc"  
    adminGroup="CSCADMIN" operationsGroup="CSCOPERS"  
    invokeGroup="CSCINVKE" readerGroup="CSCREADR"/>  
  
<service name="cscvincSelectService"  
    adminGroup="CSCADMIN" operationsGroup="CSCOPERS"  
    invokeGroup="CSCINVKE" readerGroup="CSCREADR"/>  
  
<apiRequester name="cscvinc_1.0.0"  
    adminGroup="CSCADMIN" operationsGroup="CSCOPERS"  
    invokeGroup="CSCINVKE" readerGroup="CSCREADR"/>
```



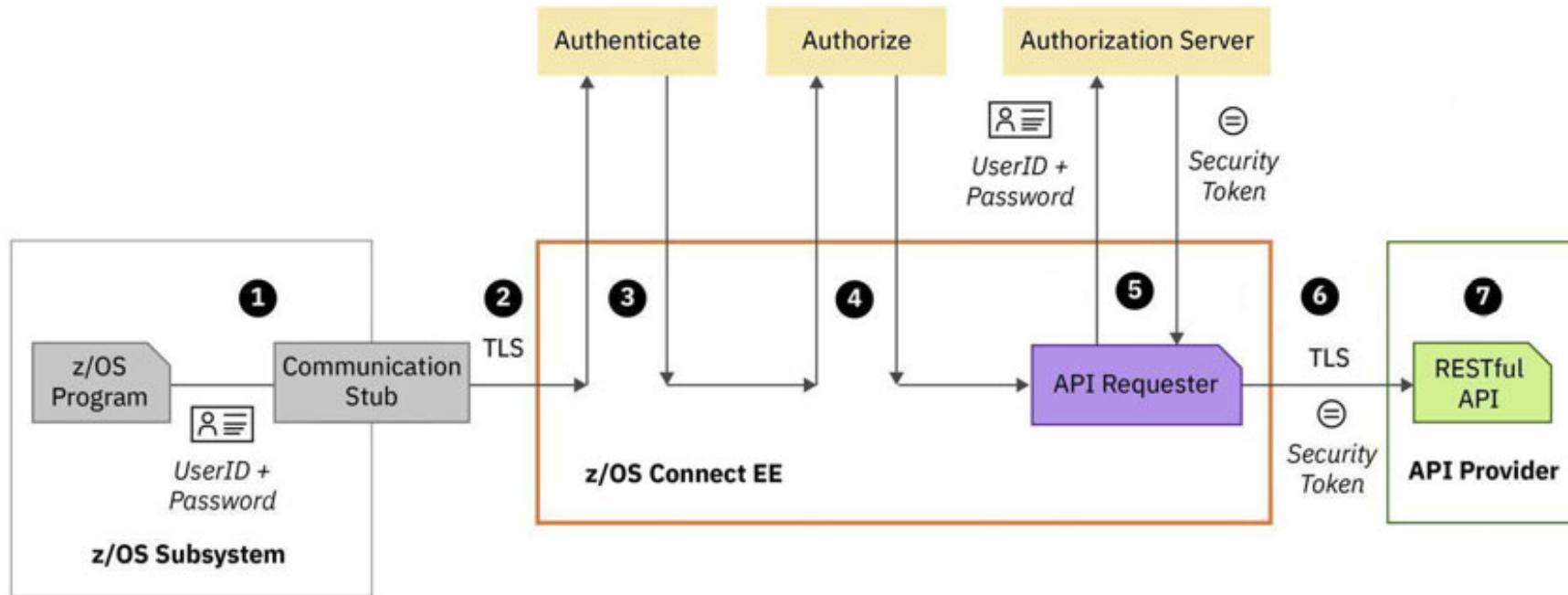
Details of a typical z/OS Connect EE API Provider security flow (OpenAPI 2)



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

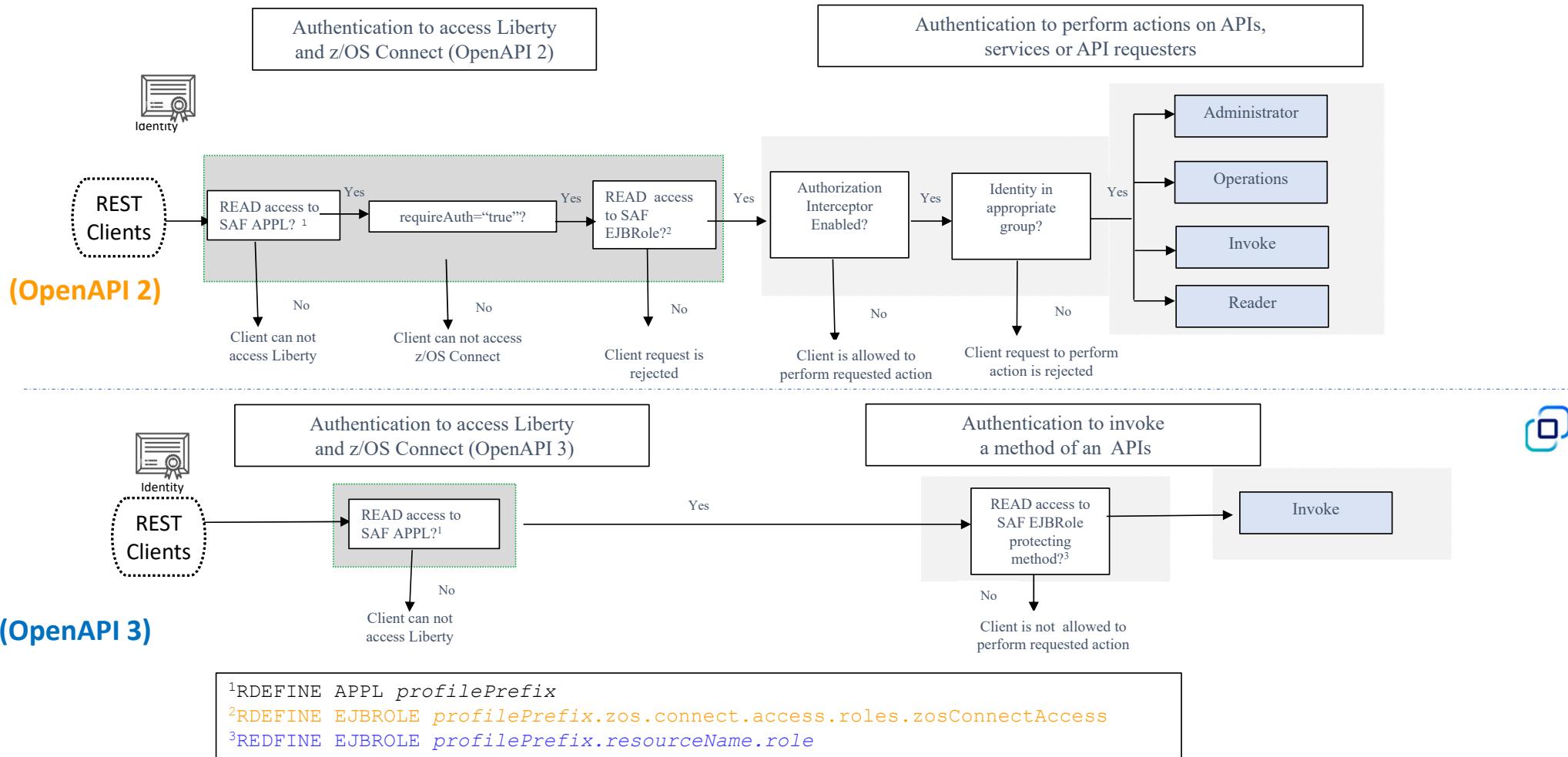


Details of a typical z/OS Connect EE API Requester security flow (OpenAPI 2)



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

Authorization security flow with z/OS Connect





EJB roles for z/OS Connect (OpenAPI 3)

```
<safCredentials unauthenticatedUser="WSGUEST" profilePrefix="BBGZDFLT" />  
  
<webApplication id="CatalogManager" location="${server.config.dir}/apps/api.war" name="CatalogManager"/>  
  
<safRoleMapper profilePattern=%profilePrefix%.%resourceName%.%role%
```

```
openapi: 3.0.0  
...  
servers:  
- url: /  
x-ibm-zcon-roles-allowed:  
- Manager  
...  
paths:  
/items:  
  get:  
    operationId: itemsGet  
    ...  
/items/{id}:  
  get:  
    ...  
    operationId: itemsIdGet  
    x-ibm-zcon-roles-allowed:  
      - Staff  
/orders:  
  post:  
    ...  
    operationId: ordersPost  
    x-ibm-zcon-roles-allowed:  
      - Staff
```

From the OpenApi document, the value for %role% would be either Manager or Staff.

So, the required SAF EJB roles to be defined would be:

- *BBGZDFLT.CatalogManager.Manager*
- *BBGZDFLT.CatalogManager.Staff*

*REDFINE EJBRULE BBGZDFLT.CatalogManager.Manager
REDFINE EJBRULE BBGZDFLT.CatalogManager.Staff*

Access to use the GET method to invoke /items would require read access to EJB role *BBGZDFLT.CatalogManager.Manager*.

Access to use the GET method to invoke /items/{id} and the POST method to invoke /orders would require read access to EJB role *BBGZDFLT.CatalogManager.Staff*.

A Review of connecting z/OS Connect servers to to z/OS subsystems



Server XML - Accessing a CICS program using IPIC (OpenAPI 2)

The server.xml file is the key configuration file:

inquireSingle Service

Configuration

Required Configuration

Coded character set identifier (CCSID): 37

Connection reference: catalog

Optional Configuration

Enter the optional configuration for this service.

Transaction ID:

Transaction ID usage:

WG31

File Edit Settings View Communication Actions Window Help

OVERTYPE TO MODIFY

```
CEDA ALTER TCpipservice( IPIC      )          CICS RELEASE = 0710
TCpipservice  : IPIC
GROup        : SYSPGRP
DEscription   ==> DFHISAIPI
Urm          ==> 01491
PDrnumber    ==> 1-65535
Status        ==> Open
PROtocol     ==> IPic
TRansaction  ==> CISS
Backlog       ==> 00000
TSqprefix    :
Host          ==> ANY
(Mixed Case) ==>
Ipadress      ==> ANY
SPEcificTcps ==>
SOcketclose  ==> No
MAXPersist   ==> No
MAXDatalen   ==> 000032
                           No | 0-240000 (HHMMSS)
                           No | 0-65535
                           3-524288
SYSID=CICS APPLID=CICS53Z
PF 1 HELP 2 COM 3 END          6 CRSR 7 SBH 8 SFH 9 MSG 10 SB 11 SF 12 CNCL
M8 E
Connected to remote server/host wg31 using lu/pool TCP00104 and port 23          06/022
```

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

catalog.xml

Design Source

```
<server description="CICS IPIC - catalog">
<!-- Enable features -->
<featureManager>
<feature>zosconnect:cicsService-1.0</feature>
</featureManager>
<zosconnect_cicsIpicConnection id="catalog">
<host>wg31.washington.ibm.com</host>
<port>1491</port>
<transid>CSMI</transid>
<transidUsage>EIB_AND_MIRROR</transidUsage>
</zosconnect_cicsIpicConnection>
</server>
```

Define IPIC connection to CICS



Server XML – Accessing an IMS Transaction using OTMA (OpenAPI 2)

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, T MEMBER=OTMAMEM)
IMSPLEX=(MEMBER=IMS14HWS, T MEMBER=PLEX1)
ODACCESS=(ODBMAUTOCONN=Y,
DRDAPORT=(ID=5555,PORTTMOT=6000), ODBMTMOT=6000)
```

connections/ims-connection.xml#

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

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

interactions/ims-interactions.xml#

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



Server XML – Accessing an IMS Database using ODBA (OpenAPI 2)

Service Project Editor: Configuration

Required Configuration

Enter the required configuration for this service.

Connection profile: DFSIVPACConn

ConnectionFactory

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

IMS Connect HWSCFG

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

Server XML - Accessing a Db2 REST service (OpenAPI 2)



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
```

mitchj@us.ibm.com

Server XML - Using JMS to access MQ (OpenAPI 2)

*twoWay Service

Service Project Editor: Configuration

Required Configuration

Enter the required configuration for this service.

Connection factory JNDI name:

Request destination JNDI name:

Reply destination JNDI name:

Wait interval:

MQMD format:

Coded character set identifier (CCSID):

Is message persistent:

Reply selection:

Expiry:

Definition **Configuration**

mq.xml

Read only Close

Design Source

```
2 <featureManager>
3   <feature>zosconnect:mqService-1.0</feature>
4 </featureManager>
5
6 <variable name="wmqJmsClient.rar.location"
7   value="/usr/lpp/mqm/V9R1M1/java/lib/jca/wmq.jmsra.rar"/>
8 <wmqJmsClient nativeLibraryPath="/usr/lpp/mqm/V9R1M1/java/lib"/>
9
10 <connectionManager id="ConMgr1" maxPoolSize="5"/>
11
12 <jmsConnectionFactory id="qmgrCf" jndiName="jms/qmgrCf">
13   connectionManagerRef="ConMgr1">
14   <properties.wmqJMS transportType="BINDINGS"
15     queueManager="QMZ1" />
16 </jmsConnectionFactory>
17
18 <jmsConnectionFactory id="qmgrCf2" jndiName="jms/qmgrCf2">
19   connectionManagerRef="ConMgr1">
20   <properties.wmqJMS transportType="CLIENT"
21     queueManager="ZMQ1"
22     channel="LIBERTY.DEF.SVRCONN"
23     hostName="wg31.washington.ibm.com"
24     port="1422" />
25 </jmsConnectionFactory>
26
27 <jmsQueue id="q1" jndiName="jms/default">
28   <properties.wmqJMS
29     baseQueueName="ZCONN2.DEFAULT.MQZCEE.QUEUE"
30     CCSID="37"/>
31 </jmsQueue>
32
33 <jmsQueue id="requestQueue" jndiName="jms/request">
34   <properties.wmqJMS
35     baseQueueName="ZCONN2.TRIGGER.REQUEST"
36     targetClient="MQ"
37     CCSID="37"/>
38 </jmsQueue>
39
40 <jmsQueue id="replyQueue" jndiName="jms/replyQueue">
41   <properties.wmqJMS
42     baseQueueName="ZCONN2.TRIGGER.RESPONSE"
43     targetClient="MQ"
44     CCSID="37"/>
45 </jmsQueue>
46
47
```



Server XML – API Requester - Accessing an API Provider (OpenAPI 2)

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

Server Config

apiRequesterHTTPS.xml

Design Source

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

Server Config

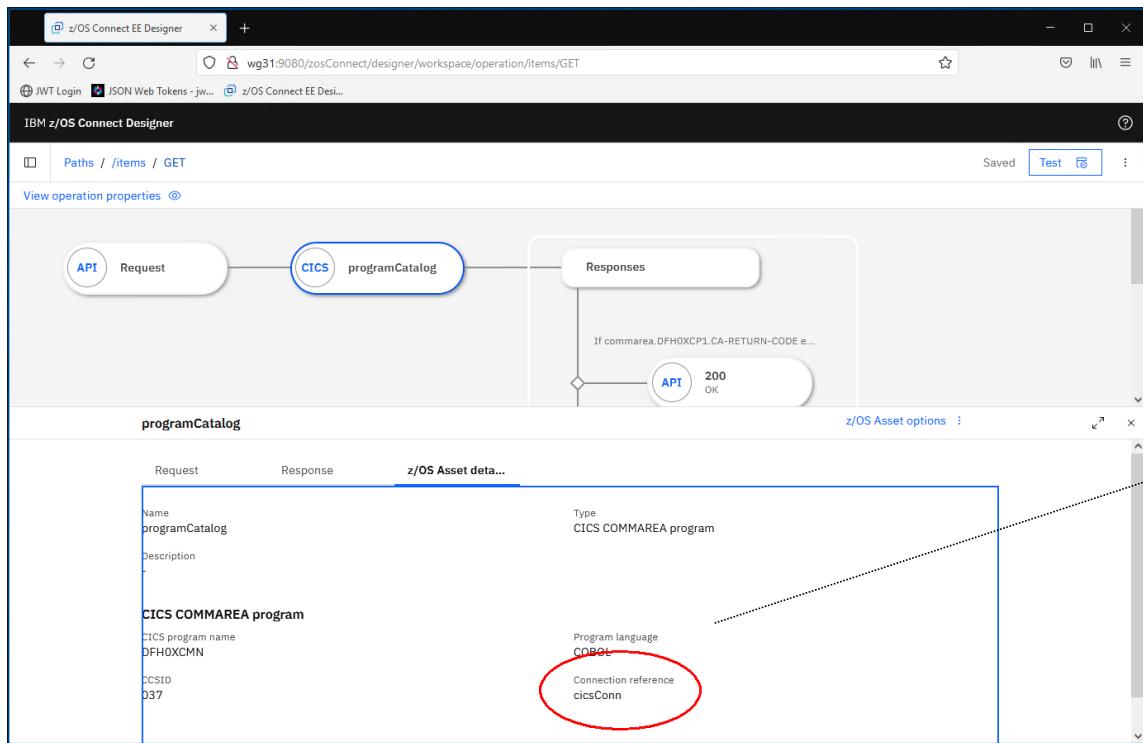
server.xml

Design Source

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



Server XML - Accessing a CICS program using IPIC (OpenAPI 3)



The screenshot shows the 'Server Config' interface with the 'cics.xml' configuration file open. The 'Source' tab is selected, displaying the XML code:

```
1<server description="CICS IPIC connections">
2
3<!-- Enable features -->
4<featureManager>
5  <feature>zosconnect:cics-1.0</feature>
6</featureManager>
7
8<zosconnect_cicsIpicConnection id="cicsConn" host="${CICS_HOST}">
9  port="${CICS_PORT}" />
10
11</server>
12
```

A callout box points to the 'zosconnect_cicsIpicConnection' element with the text: 'Define IPIC connection to CICS using variables defined in bootstrap.properties file'.

The connection references identifies a `zosconnect_cicsIpicConnection` configuration element. Which provides the connection details to a CICS region.



Server XML - Accessing a Db2 REST service (OpenAPI 3)

The screenshot shows the IBM z/OS Connect Designer interface. A flow diagram illustrates the interaction between an API request and a DB2 service. The API request leads to a 'getEmployee-V1' step, which then connects to a 'Responses' block. This block contains a condition: 'If commarea.DFH0XCP1.CA-RETURN-CODE e...'. If true, it leads to an 'API OK' response (status 200). The 'getEmployee-V1' step is detailed below:

- Name:** getEmployee-V1
- Description:** Get the details of all employees
- Type:** Db2 native REST service
- Version:** V1
- Connection reference:** db2Conn (circled in red)

The screenshot shows the 'Server Config' interface with the 'db2.xml' configuration file open. The 'Source' tab displays the XML code:

```

<?xml version="1.0" encoding="UTF-8"?>
<server description="Db2 Connections">
  <featureManager>
    <feature>zosconnect:db2-1.0</feature>
  </featureManager>
  <zosconnect_credential user="${DB2_USERNAME}" password="${DB2_PASSWORD}" id="commonCredentials" />
  <zosconnect_db2Connection id="db2Conn" host="${DB2_HOST}" port="${DB2_PORT}" credentialRef="commonCredentials" />
</server>

```

A callout box with a red arrow points from the 'Connection reference' in the 'getEmployee-V1' step of the z/OS Connect Designer to the 'zosconnect_db2Connection' element in the db2.xml file.

Define connections to Db2 using variables defined in bootstrap.properties file

```

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

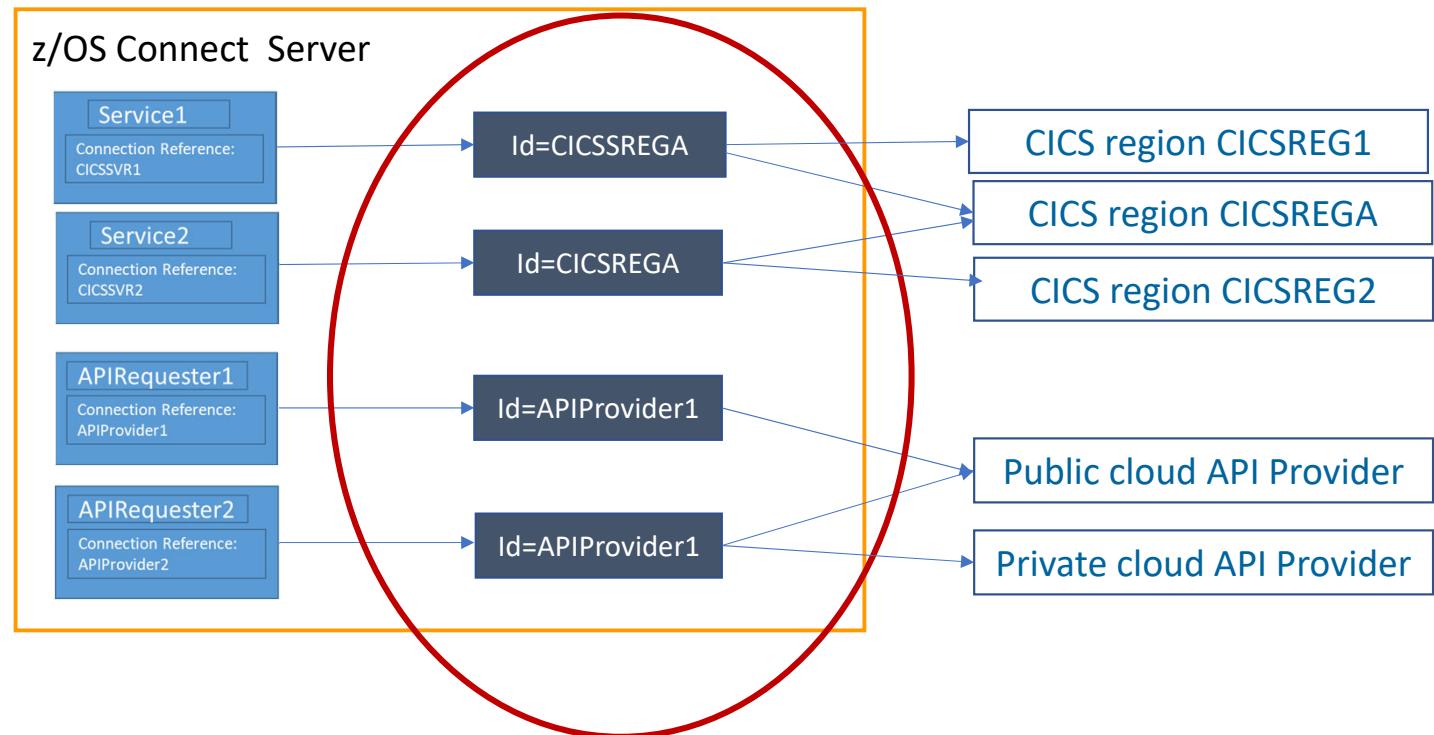
```

The connection references identifies a `zosconnect_db2Connection` configuration element. Which provides the connection details to a DB2 DDF task.



Use naming conventions for connection references

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

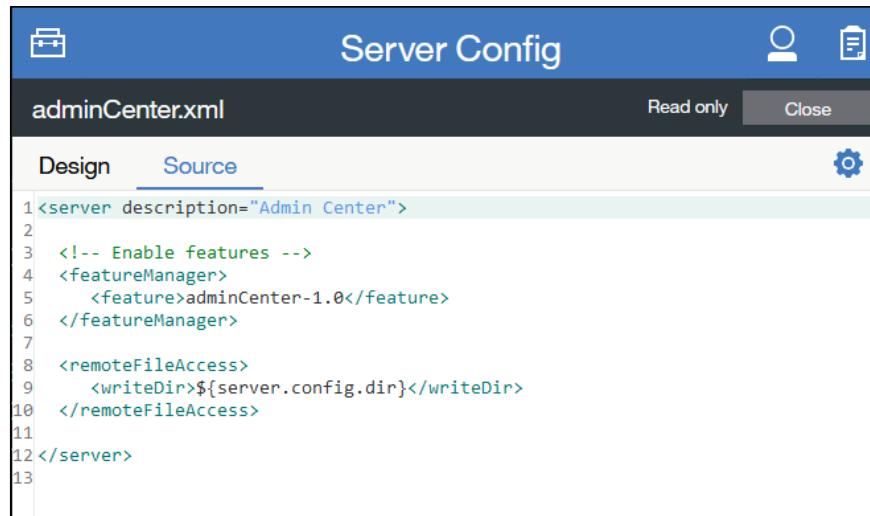


Useful Liberty functions/features and MVS commands



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

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



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

```
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Administrator OWNER(SYS1) UACC(NONE)
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Viewer OWNER(SYS1) UACC(NONE)
```

```
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.Administrator CLASS(EJBROLE) ID(FRED) ACCESS(READ)
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.Viewer CLASS(EJBROLE) ID(FRED) ACCESS(READ)
```

```
SETR RACLIST(EJBROLE) REFRESH
```



Use 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 main window title is "Server Config" and the file being edited is "server.xml". The interface has two tabs: "Design" and "Source". The "Source" tab is currently active, showing the XML configuration of the server.

In the XML code, the "zosconnect_apiRequester" element is selected, and a content assist dropdown is displayed, listing various z/OS Connect API Requester-related elements. One specific element, "zosconnect_zosConnectServiceRestClientBasicAuth", is highlighted in the dropdown.

The top right corner of the interface includes a status message: "Press Ctrl+space for content assist".

```
<server description="new server">
<include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/services/ims-services.xml" optional="true"/>
<include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/interactions/ims-interactions.xml" optional="true"/>
<include location="/var/zosconnect/servers/myServer/resources/imsmobile-config/connections/ims-connections.xml" optional="true"/>
<include location="${server.config.dir}/includes/safSecurity.xml"/>
<include location="${server.config.dir}/includes/safTrace.xml"/>
<include location="${server.config.dir}/includes/ipic.xml"/>
<include location="${server.config.dir}/includes/keyring.xml"/>
<include location="${server.config.dir}/includes/apiRequesterHTTPS.xml"/>
<include location="${server.config.dir}/includes/shared.xml"/>
<include location="${server.config.dir}/includes/oauth.xml"/>
<include location="${server.config.dir}/includes/audit.xml"/>
<include location="${server.config.dir}/includes/mq.xml"/>
<include location="${server.config.dir}/includes/db2.xml"/>
<include location="${server.config.dir}/includes/wlm.xml"/>
<include location="${server.config.dir}/includes/restConnector.xml"/>
<wsSecurityProvider>
<zosconnect_apiRequester>
<zosconnect_apiRequesters>
Required z/OS Connect API Requester.
<zosconnect_auditInterceptor>
<zosconnect_authData>
<zosconnect_authorizationInterceptor>
<zosconnect_authorizationServer>
<zosconnect_authToken>
<zosconnect_zosConnectServiceRestClientBasicAuth />
<!-- To access this server from a remote client add a host attribute to the following element, e.g. host="*" --&gt;
&lt;httpEndpoint host="*" httpPort="9080" httpsPort="9443" id="defaultHttpEndpoint"/&gt;
<!-- add cors to allow cross origin access, e.g. when using swagger UI to fetch swagger doc from z/OS Connect Enterprise Edition --&gt;
&lt;cors allowCredentials="true" allowedHeaders="Origin, Content-Type, Authorization, Cache-Control, Expires, Pragma" allowedMethods="GET, POST, PUT, PATCH, DELETE, HEAD, OPTIONS" maxAge="1728000" /&gt;</pre>
```



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

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

Server Config

restConnector.xml

Read only

Close

Design Source

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

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

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

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



restConnector-2.0 feature

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

```
[{"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"}]
```



Use the **apiDiscovery-1.0** or **OpenAPI-3.0** features 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 include "db2employee", "filemgr", "imsPhoneBook", "jwtIvpDemoApi", "miniloancics", "mqapi", and "phonebook", each with their own "Show/Hide", "List Operations", and "Expand Operations" links.

*V3.0.48

Provide remote access to configuration/log information



```
<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>
```

```
-----  
41 (wlp-1.0.41.c1200620200528-0414)  
  
r/  
  
.6.15 - pmx6480sr6fp15-20200724_01(SR6 FP15)  
  
-----
```

```
*****  
product = WAS FOR z/OS 21.0.0.1, z/OS Connect 03.00.42 (wlp-1.0.45.c1210120210113-1459)  
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/  
server.config.dir = /shared/IBM/zosconnect/servers/myServer/  
java.home = /shared/java/J8_0_64  
java.version = 1.8.0_261  
java.runtime = Java(TM) SE Runtime Environment (8.0.6.15 - pmz6480sr6fp15-20200724_01(SR6 FP15))  
os = z/OS (02-00-00; s990x) (en_US)  
process = 0779822@wg31  
trace.specific=*****  
*****  
[2/25/21 17:27:54+487 GMT] 0000001b id=00000000 com.ibm.ws.logging.internal.TraceSpecification I TRAS0018I: The trace state has been  
changed. The new trace state is  
*****  
[2/25/21 17:27:54+491 GMT] 0000001d id=078ec277 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry  
org/apache/felix/scr/impl/manager  
/DependencyManager$SingleDynamicCustomizer.class  
[2/25/21 17:27:54+493 GMT] 0000001d id=078ec277 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper < getEntry Exit  
org/apache/felix/scr/impl/manager  
/DependencyManager$SingleDynamicCustomizer.class  
[2/25/21 17:27:54+494 GMT] 00000017 id=00000000 com.ibm.ws.zos.core.internal.CoreBundleActivator I CNWK8012I: The server process UMASK  
value is set to 0000.  
[2/25/21 17:27:54+494 GMT] 00000017 id=52c3d2ff 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=52c3d2ff ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper < getEntry Exit  
OSGI-  
INF/com.ibm.ws.logging.config.xml  
[2/25/21 17:27:54+494 GMT] 0000001b id=459954a0 tv.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry
```



Provide remote access to z/OS Connect OPENAPI 2 archives files

Index of /resources/zosConnect/

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

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

Index of /resources/zosConnect/services/

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

Opening cscvincSelectService.sar

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

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

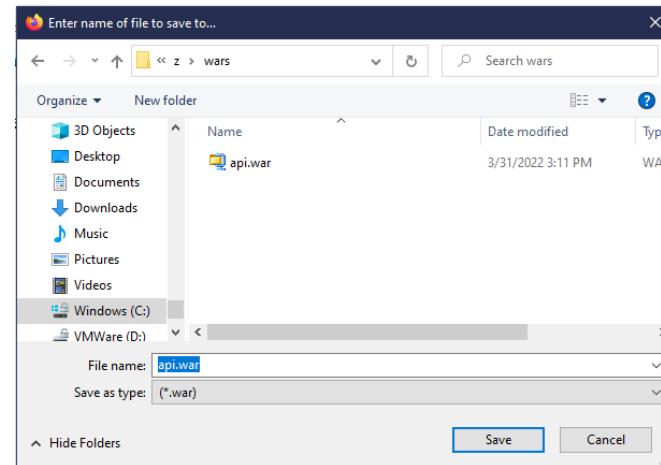
OK Cancel

Provide remote access to z/OS Connect Designer OPENAPI 3 web archives files

The screenshot shows a web browser window with the URL <https://localhost:9445/dropins/>. The title bar says "Index of /dropins/". The page content is titled "Index of /dropins/" and contains a table with two rows:

Name	Last Modified	Size	Description
EmployeesApi.war	Tue May 03 22:36:07 UTC 2022	26394	File
api.war	Wed May 04 12:33:45 UTC 2022	15227	File

```
<webApplication id="resources-location" name="resources"
location="/opt/ibm/wlp/usr/servers/defaultServer/dropins">
<web-ext context-root="dropins"
enable-file-serving="true" enable-directory-browsing="true">
<file-servering-attribute name="extendDocumentRoot"
value="/opt/ibm/wlp/usr/servers/defaultServer/dropins" />
</web-ext>
</webApplication> >
```





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,APPS

Process pending application updates. ([Applicable to OpenAPI 3 servers only](#))

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 (OpenAPI 2)

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

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.

F BAQSTRT,REFRESH,APPS

Where do I look when things go wrong?

Where to find information when a problem occurs.



messages.log

First Failure Data Collection (FFDC) dumps

trace.out

SYSLOG/STC JESMSG LG DD

STC STDOUT DD



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 these categories.

- **Basic Security issues**
 - Insufficient access to local SAF resources, e.g., APPL, EJBROLE, SERVER resources
 - Security issues related to XML configuration elements, safCredentials, sslDefault, keystore, etc.

- **Advanced Security issues**
 - Key ring access, e.g., FACILITY resources IRR.DIGTCERT or RDATALIB or IDIDMAP resources.
 - Key ring contents, e.g., missing certificates, key usage, personal and certificate authorities, private keys versus public keys.
 - Incorrect use of certificates in a TLS handshakes versus certificates used for token validation.

- **z/OS Connect XML Configuration issues**
 - Missing or misspelled configuration attributes (remember the Liberty XML parser is too forgiving)

- **External resource Issues**
 - Service provider configuration issues.
 - Timeouts
 - Network Firewalls
 - Resource Security
 - Other resource errors

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



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

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

A CWWKE0001I: The server zceepid has been launched.

A CWWKG0028A: Processing included configuration resource

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 the problem is easy to find

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 – Sometimes you must dig a little more

The STDOUT may show:

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

But there are no SAF messages in the SYSLOG:

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

```
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.



Basic security issues – Sometimes there is misdirection

The STDOUT may show:

WG31

File Edit Settings View Communication Actions Window Help

Display Filter View Print Options Search Help

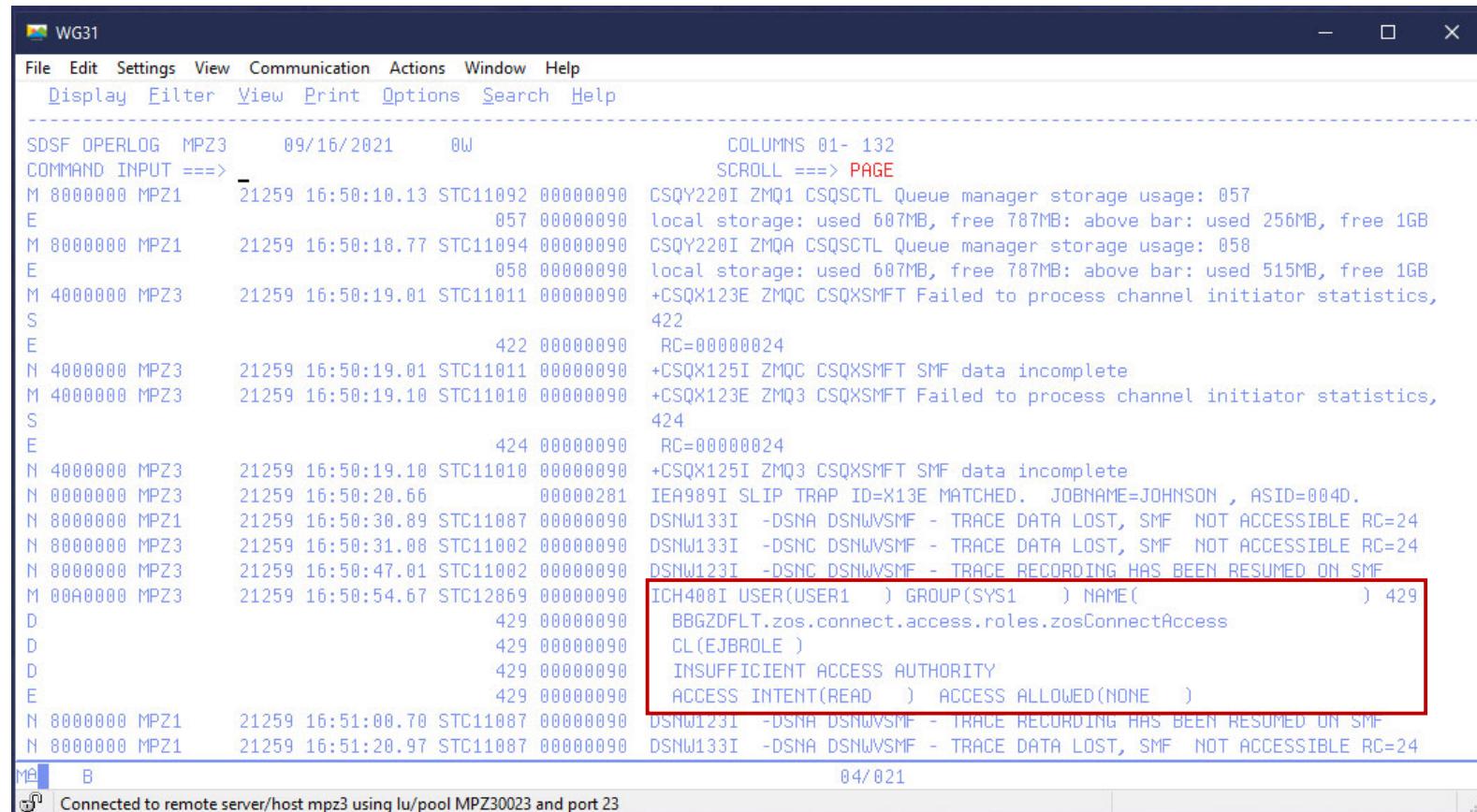
```
SDSF OUTPUT DISPLAY BAQSTRT STC12844 DSID 103 LINE 98      COLS 02- 133
COMMAND INPUT ===> SCROLL ==> PAGE
AUDIT  " CWWKZ0001I: Application serverConfig started in 4.006 seconds.
AUDIT  " CWWKZ0001I: Application resources started in 4.007 seconds.
AUDIT  " CWWKT0016I: Web application available (default_host): 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: YadimCenter-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 04/021

Connected to remote server/host mpz3 using lu/pool MPZ30019 and port 23

Basis security issues - Use the SYSLOG/JESMSGGLG output

The SYSLOG shows a ICH408I message:



```

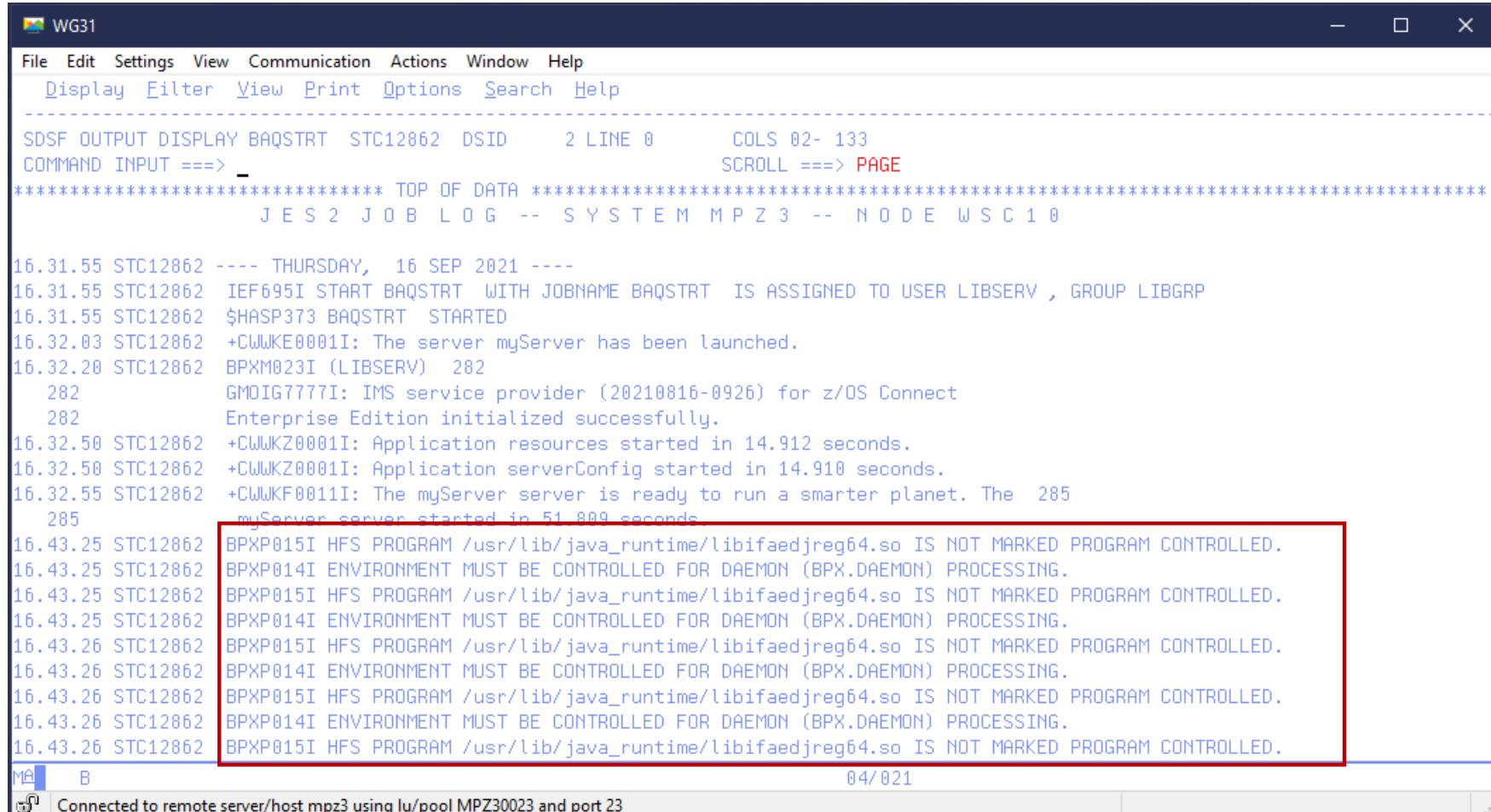
WG31
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF OPERLOG MPZ3 09/16/2021 0W
COMMAND INPUT ===> -
M 8000000 MPZ1 21259 16:50:10.13 STC11092 00000090 COLUMNS 01- 132
E 057 00000090 SCROLL ==> PAGE
M 8000000 MPZ1 21259 16:50:18.77 STC11094 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 000000281 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

```

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     GMODIG7777I: IMS service provider (20210816-0926) for z/OS Connect
    282     Enterprise Edition initialized successfully.
16.32.50 STC12862 +CLWJKZ0001I: Application resources started in 14.912 seconds.
16.32.50 STC12862 +CLWJKZ0001I: Application serverConfig started in 14.910 seconds.
16.32.55 STC12862 +CLWJKF0011I: The myServer server is ready to run a smarter planet. The 285
    285     myServer server started in 51.809 seconds
16.43.25 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.25 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.25 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.25 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.26 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.26 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.

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

```

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



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

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

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



External resource issues (HTTP 500)

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.
```

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"}  
}
```



Tech-Tip: An HTTP 500 shortcut – look elsewhere

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

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



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

```
[9/6/21 22:51:19:981 GMT] 00000039 com.ibm.ejs.j2c.ConnectionEventListener
A J2CA0056I: The Connection Manager received
a fatal connection error from the Resource Adapter for resource null. The exception is: javax.resource.spi.EISSystemException: ICO0001E:
com.ibm.connector2.ims.ico.IMSTCIPManagedConnection@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.IMSTCIPManagedConnection.callSendRecv(IMSTCIPManagedConnection.java:241)
at com.ibm.connector2.ims.ico.IMSManagedConnection.call(IMSManagedConnection.java:1625)
at com.ibm.connector2.ims.ico.IMSConnection.call(IMSConnection.java:213)
at com.ibm.connector2.ims.ico.IMSInteraction.execute(IMSInteraction.java:586)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.executeTransServiceInputTMRA(Unknown Source)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.invokeTransactionService(Unknown Source)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.invoke(Unknown Source)
at com.ibm.ims.zconnect.provider.clients.GatewayServiceClient.doPost(Unknown Source)
at com.ibm.ims.zconnect.provider.clients.IMSClient.doInvoke(Unknown Source)
at com.ibm.ims.gateway.config.services.IMSZServiceHandlerImpl.invoke(Unknown Source)
at com.ibm.ims.gateway.config.services.IMSZServiceImpl.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ZosConnectServiceImpl.apiInvoke(Unknown Source)
at com.ibm.zosconnect.internal.ServiceManagerImpl.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ApiManagerImpl.invokeApi(Unknown Source)
at com.ibm.zosconnect.internal.web.ServiceProxyServlet$3.run(Unknown Source)
at com.ibm.ws.webcontainer.async.ServiceWrapper.wrapAndRun(ServiceWrapper.java:236)
at com.ibm.ws.webcontainer.async.ContextWrapper.run(ContextWrapper.java:28)
at com.ibm.ws.webcontainer.async.WrapperRunnableImpl.run(WrapperRunnableImpl.java:89)
at com.ibm.ws.threading.internal.ExecutorServiceImpl$RunnableWrapper.run(ExecutorServiceImpl.java:238)
at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1160)
at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:635)
at java.lang.Thread.run(Thread.java:825)
```

IMS service provider classes
z/OS Connect Java classes

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

Root cause – Datastore mistyped in the interaction configuration

First Failure Data Collection (FFDC)



```
-----Start of DE processing----- = [9/7/21 14:19:29:291 GMT]
Exception = com.ibm.msg.client.jms.DetailedIllegalStateException
Source = com.ibm.zosconnect.service.mq.OneWayMQServiceInvocation
probeid = 0004
Stack Dump = com.ibm.msg.client.jms.DetailedIllegalStateException: JMSWMQ2002: Failed to get a message from destination 'ZCONN2.DEFAULT.MQZCEE.QUEUE'.
IBM MQ classes for JMS attempted to perform an MQGET; however IBM MQ reported an error.
Use the linked exception to determine the cause of this error.
at com.ibm.msg.client.wmq.common.internal.Reason.reasonToException(Reason.java:489)
at com.ibm.msg.client.wmq.common.internal.Reason.createException(Reason.java:215)
.
.
.
at com.ibm.zosconnect.service.mq.MQService.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ZosConnectServiceImpl.apiInvoke(Unknown Source)
at com.ibm.zosconnect.internal.ServiceManagerImpl.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ApiManagerImpl.invokeApi(Unknown Source)
at com.ibm.zosconnect.internal.web.ServiceProxyServlet$3.run(Unknown Source)
at com.ibm.ws.webcontainer.async.ServiceWrapper.wrapAndRun(ServiceWrapper.java:236)
at com.ibm.ws.webcontainer.async.ContextWrapper.run(ContextWrapper.java:28)
at com.ibm.ws.webcontainer.async.WrapperRunnableImpl.run(WrapperRunnableImpl.java:89)
at com.ibm.ws.threading.internal.ExecutorServiceImpl$RunnableWrapper.run(ExecutorServiceImpl.java:238)
at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1160)
at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:635)
at java.lang.Thread.run(Thread.java:825)
Caused by: com.ibm.mq.MQException: JMSCMQ0001: IBM MQ call failed with compcode '2' ('MQCC_FAILED') reason '2016' ('MQRC_GET_INHIBITED').
at com.ibm.msg.client.wmq.common.internal.Reason.createException(Reason.java:203)
... 25 more
```

MQ service provider classes

Root cause – Queue was configured to disable the MQPUT request

The FFDC dump is more than just 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.proxy.ApiRequesterManagerProxyImpl$1.run(Unknown Source)
.
.
Dump of callerThis
Object type = com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl
copyright_notice = "Licensed Materials - Property of IBM 5655-CE3 (c) Copyright IBM Corp. 2017, 2021 All Rights Reserved
tc = class com.ibm.websphere.ras.TraceComponent@2d85bcc
strings[0] = "TraceComponent[com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl,class
com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl,[zosConnectApiRequesterToken],com.ibm.zosconnect.endpoint
.connection.internal.resources.ZosConnectEndpointConnection,null]"
CFG_ELEMENT_ID = "id"
CFG_GRANTTYPE = "grantType"
id = "myoAuthConfig"
grantType = "password"
authServer = class com.ibm.zosconnect.endpoint.connection.internal.AuthorizationServerImpl@ed6c1e8c
.
.
sslCertsRef = "OutboundSSLSettings"
connectionTimeout = 30000
receiveTimeout = 60000
id = "myoAuthServer"
```



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.CicsIpccConnection.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



Use the messages.log and FFDC log together

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

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



```
[9/12/21 14:56:45:652 GMT] 00000045 com.ibm.ws.logging.internal.impl.IncidentImpl           I FFDC1015I: An FFDC Incident has been  
created: "com.ibm.msg.client.jms.DetailedJMSEception: 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 unexpectedJMSEception  
occurred while processing a request for service 'mq.GetService'. The exception message was 'MQJCA1011: Failed to allocate a JMS  
connection.'.
```

Spacing added between lines to improve readability



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.ManagedConnectionFactoryImpl.<init>(ManagedConnectionFactoryImpl.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.createManagedJMSSession(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 an SSL Handshake issue

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

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

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

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

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



Tech/Tip: Use the Java directive javax.net.debug to enable Java SSL tracing

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

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

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



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 certificate authority(CA) certificate for the CA that signed 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.

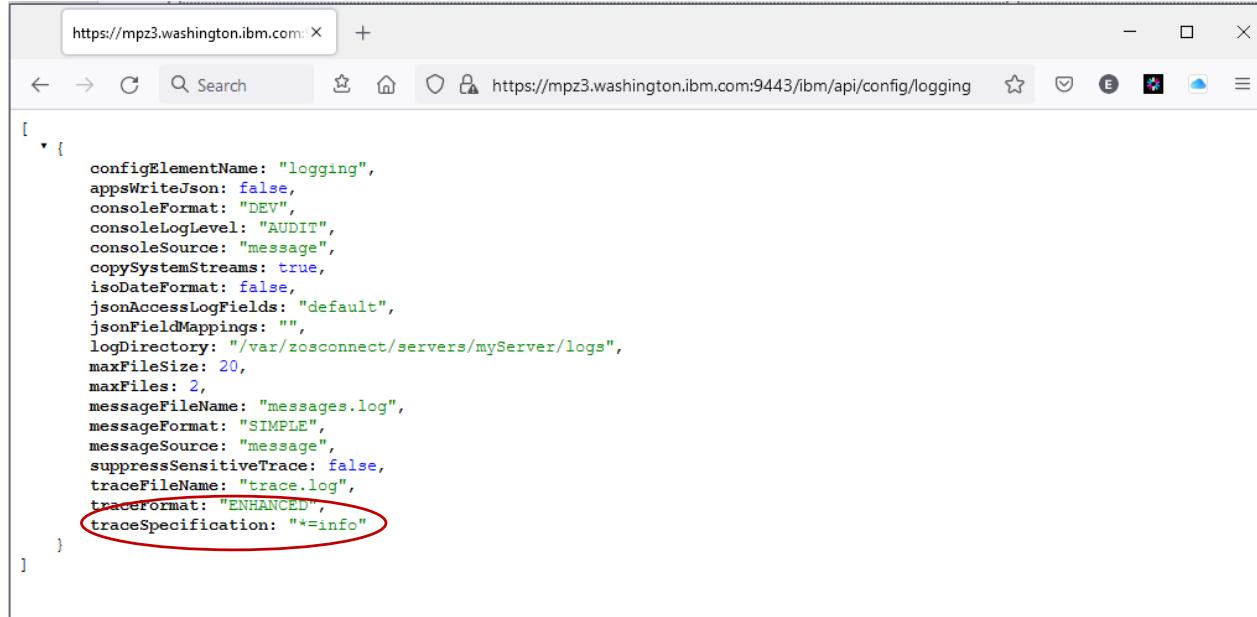
- Another possibility is that the TLS handshake the negotiations between the client and server failed, e.g., `javax.net.ssl.SSLHandshakeException: Client requested protocol SSLv3 is not enabled or supported in server context`



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 specifications

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

server.xml

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

safTrace.xml

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

cicsTrace.xml

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

imsTrace.xml

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

Enables enhanced tracing

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

Disable enhanced tracing

F BAQSTRT,LOGGING='*=INFO'

Or

F BAQSTRT,REFRESH,CONFIG
(after removing the “include” file)



trace.out file

mpz3

File Edit Settings View Communication Actions Window Help

File Edit Edit_Settings Menu Utilities Compilers Test Help

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

Command ==>

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

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

003730 3 keyStoreType: JCERACFKS
003731 3 trustStoreType: JCERACFKS

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

003741 (com.ibm.ssl.remoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004117 K 3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004119 3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004142 (com.ibm.ssl.remoteHost:*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004144 > isTransportSecurityEnabled Entry
004145 < isTransportSecurityEnabled true Exit

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

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

004243 3 keyStoreType: JCERACFKS
004244 3 trustStoreType: JCERACFKS

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

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

Columns 00101 00252
Scroll ==> PAGE

- 4 Line(s) not Displayed
- 43 Line(s) not Displayed
- 44 Line(s) not Displayed
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- 1 Line(s) not Displayed
- 4 Line(s) not Displayed
- 43 Line(s) not Displayed
- 44 Line(s) not Displayed
- 2 Line(s) not Displayed
- 1 Line(s) not Displayed
- 375 Line(s) not Displayed
- 1 Line(s) not Displayed
- 22 Line(s) not Displayed
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- 1 Line(s) not Displayed
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Connected to remote server/host mpz3 using lu/pool MPZ30006 and port 23

Monitoring Java, Liberty and z/OS Connect



Java Health Center – Monitors the Java environment

Configuring the Monitoring Agent using JVM directives

Java Directives

- Xhealthcenter:level=headless 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 bootstrap.properties or a JVM properties file, e.g.,

/var/zcee/properties/zceeHCD.properties

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

All the health center directives should be on one line.

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

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

Java Health Center – Monitoring Agent Configuration



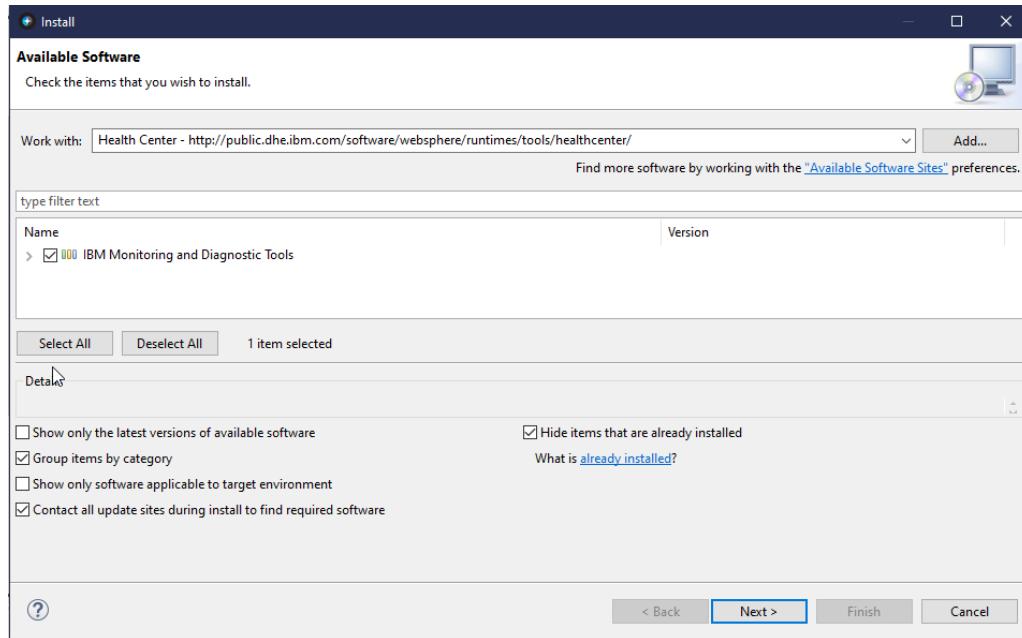
Set the JVM_OPTIONS environment variable to the properties file containing the health center directives

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

Java Health Center – Client Configuration



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



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

Java Health Center – HEAP analysis example



The screenshot shows the IBM Java Health Center interface within the Eclipse IDE. The main window displays a graph of Heap and pause times over time, showing Used heap (after collection), Heap size, and Pause time. Below the graph is a summary table of garbage collection metrics. To the right, a help panel provides information on using the garbage collection perspective.

Graph Legend:

- Used heap (after collection)
- Heap size
- Pause time

Summary Table Metrics:

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 Panel Content:

- Tool: IBM Monitoring and Diagnostic Tools - Health Center > IBM Monitoring and Diagnostic Tools - Health Center > Viewing the data collected > 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
 - Views for detailed garbage collection information
- Views for basic garbage collection information
- Views for detailed garbage collection information

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

Sockets open Network I/O

number (amount)

elapsed time (minutes)

c0a8:11c9 = 192.168.17.201

Java Health Center – Method Profiling



The screenshot shows the Java Health Center interface in Eclipse, specifically the Method Profiling section.

Left Sidebar: Contains links for CPU, Classes, Environment, Events, Garbage Collection, I/O, Locking, Method Profiling (highlighted), Method Trace, Native Memory, Network, Threads, and WebSphere Real Time. It also includes Analysis and Recommendations with a note about the MD5.a() method being a candidate for optimization.

Main Area: Features three main windows:

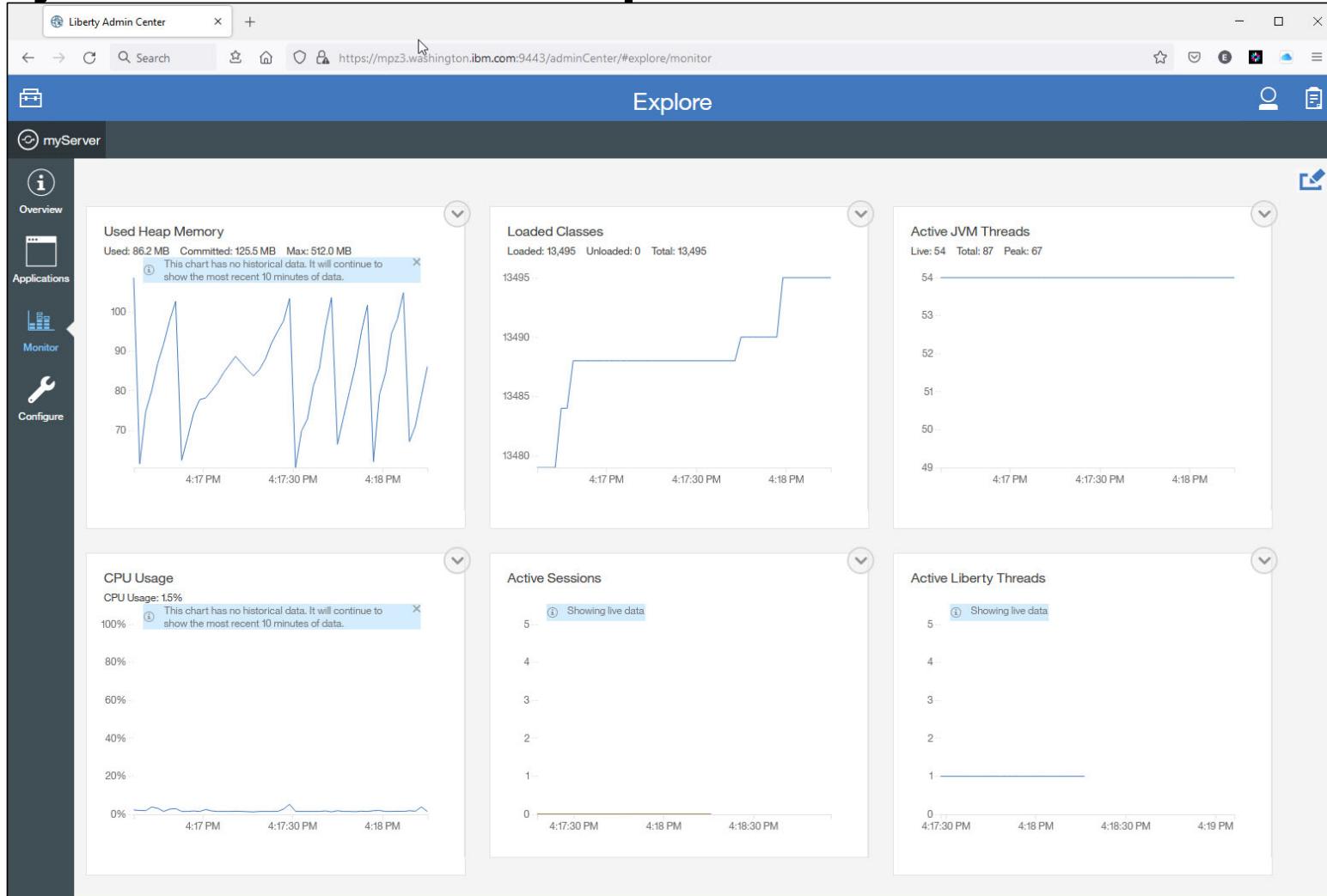
- Sample based profile:** A table showing method samples and their percentages. The top row shows:

Samples	Self (%)	Self	Tree (%)	Tree	Method
2806	27.17	██████	27.28	██████	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
- Samples over time:** A graph showing the number of samples over time. A red circle highlights a peak around 2:30, and a blue arrow points from this area to the timeline graph below.
- Invocation paths / Called methods / Timeline / Method trace summary:** A detailed timeline graph showing the evolution of samples over time, with a focus on the period between 2:00 and 5:00.

Bottom Right Window: A detailed view of the timeline graph, showing the number of samples (0 to 400) versus elapsed time in minutes (1:48 to 2:24). The graph shows a significant drop in sample count starting around 2:06.



Liberty Admin Center feature provides real time monitoring



Workload Manager - Definitions

WLM Report Classes

Report Class Selection List Row 1 to 12 of 12

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

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

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

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.

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

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

mitchj@us.ibm.com 19/004
 Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23

WLM "CB" Classification Rules

SubSystem-Type Xref Notes Options Help

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

Command ==>

Subsystem Type . . . : CB Fold qualifier names? N Y or N
 Description : WLP/zCEE Transactions

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

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

-----Class-----

Defaults: OPS_HIGH ZCEEOTHR
 OPS_HIGH ZCEESTC
 OPS_HIGH ZCEEADM
 OPS_HIGH ZCEEAPIR
 OPS_HIGH ZEECICS
 OPS_HILO ZCEEIMS
 OPS_MED ZCEEMQ
 OPS_LOW ZCEEOTHR

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SubSystem-Type Xref Notes Options Help

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

Command ==>

Subsystem Type . . . : CB Fold qualifier names? N Y or N
 Description : WLP/zCEE Transactions

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

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

-----Class-----

Defaults: OPS_HIGH ZCEEOTHR
 OPS_HIGH ZCEESTC
 OPS_HIGH ZCEEADM
 OPS_HIGH ZCEEAPIR
 OPS_HIGH ZEECICS
 OPS_HILO ZEEIMS
 OPS_MED ZCEEMQ
 OPS_HILO ZCEEOTHR

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SubSystem-Type Xref Notes Options Help

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

Command ==>

Subsystem Type . . . : CB Fold qualifier names? N Y or N
 Description : WLP/zCEE Transactions

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

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

-----Class-----

Defaults: OPS_HIGH ZCEEOTHR
 OPS_HIGH ZCEESTC
 OPS_HIGH ZCEEADM
 OPS_HIGH ZCEEAPIR
 OPS_HIGH ZEECICS
 OPS_HILO ZEEIMS
 OPS_MED ZCEEMQ
 OPS_HILO ZCEEOTHR

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

```

<?xml version="1.0" encoding="UTF-8"?>
<server description="wlm">
<featureManager>
<feature>zosWlm-1.0</feature>
</featureManager>
<wlmClassification>
<httpClassification transactionClass="TCCICS"
  resource="/cscvinc/employee/*" method="GET"/>
<httpClassification transactionClass="TCDB2"
  resource="/db2/employee/*" method="GET"/>
<httpClassification transactionClass="TCIMS"
  resource="/phonebook/contacts/*"/>
<httpClassification transactionClass="TCIMS"
  resource="/phonebook/contacts" METHOD="POST"/>
<httpClassification transactionClass="TCMQ"
  resource="/mqapi/*" METHOD="POST"/>
<httpClassification transactionClass="TCMQ"
  resource="/mqapi/*" METHOD="GET"/>
<httpClassification transactionClass="TCAPIR" resource="/zosConnect/apiRequesters/*"/>
<httpClassification transactionClass="TCADM" resource="/zosConnect/**/*"/>
<httpClassification transactionClass="TCOTHR" />
</wlmClassification>
<zosWorkloadManager collectionName="${wlp.server.name}"/>
<zosWlmHealth interval="30" increment="15"/>
</server>

```

Related to WLM CN name.

mpz3

File Edit Settings View Communication Actions Window Help

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

Description . . . WLP/zCEE Transactions

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

More ==>

Action	Type	Name	Start	Service	Report
1	CN	zcee*		OPSLHIGH	ZCEEOTHR
2	TC	TCADM		OPSLHIGH	ZCEESTC
2	TC	TCDB2		OPSLHIGH	ZCEEADM
2	TC	TCCICS		OPSLHIGH	ZCEEAPTR
2	TC	TCIMS		OPSLHILO	ZCEEBC2
2	TC	TCMQ		OPSLHILO	ZCEEICMS
2	TC	TCOTHR		OPSLMED	ZCEEMQ
				OPSLHILO	ZCEEOTHR

Row 9 to 16 of 16

Scroll ==> PAGE

Command ==> Modify Rules for the Subsystem Type

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



Workload Manager – Active HTTP Classification

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

The screenshot shows a web browser window displaying a JSON array of configuration elements. Each element represents an 'httpClassification' rule with the following fields:

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

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

RMF SMF Type 72 Service Class Reports

mpz3

File Edit Settings View Communication Actions Window Help

Display Filter View Print Options Search Help

SDSF OUTPUT DISPLAY JOHNSONR JOB12740 DSID 112 LINE CHARS 'CICS' FOUND

COMMAND INPUT ==>

POLICY=WSCPOL REPORT CLAS

-TRANSACTIONS--		TRANS-TIME	HHH.MM.SS.FFFFFF	TRA
AVG	0.02	ACTUAL	108891	TOT
MPL	0.02	EXECUTION	108856	MOB
ENDED	96	QUEUED	34	CAT
END/S	0.16	R/S AFFIN	0	CAT
#SWAPS	0	INELIGIBLE	0	
EXCTD	0	CONVERSION	0	
		STD DEV	762583	

----SERVICE---- SERVICE TIME ---APPL %--- --P

IOC	0	CPU	1.967	CP	0.02	BLK
CPU	1739K	SRB	0.000	IIPCP	0.02	ENQ
MSO	0	RCT	0.000	IIP	0.31	CRM
SRB	0	IIT	0.000	AAPCP	0.00	LCK
TOT	1739K	HST	0.000	AAP	N/A	SUP
/SEC	2898	IIP	1.844			
ABSRPTN	166K	AAP				
TRX SERV	166K					

MA A

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

mpz3

File Edit Settings View Communication Actions Window Help

Display Filter View Print Options Search Help

SDSF OUTPUT DISPLAY JOHNSONR JOB12740 DSID 112 LINE CHARS 'APIR' FOUND

COMMAND INPUT ==>

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											
TRX SERV	53K												

MA A

05/057

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



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 120 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', with 'Source' being the active tab. To the right of the tabs is a gear icon. The main area contains the XML code:

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

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

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



Liberty SMF 120 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

Conditional Formatting Table Normal Bad Good Neutral Calculation Check Cell

Insert Delete Format Cells

AutoSum Fill Sort & Filter Ideas Sensitivity

Share Comments

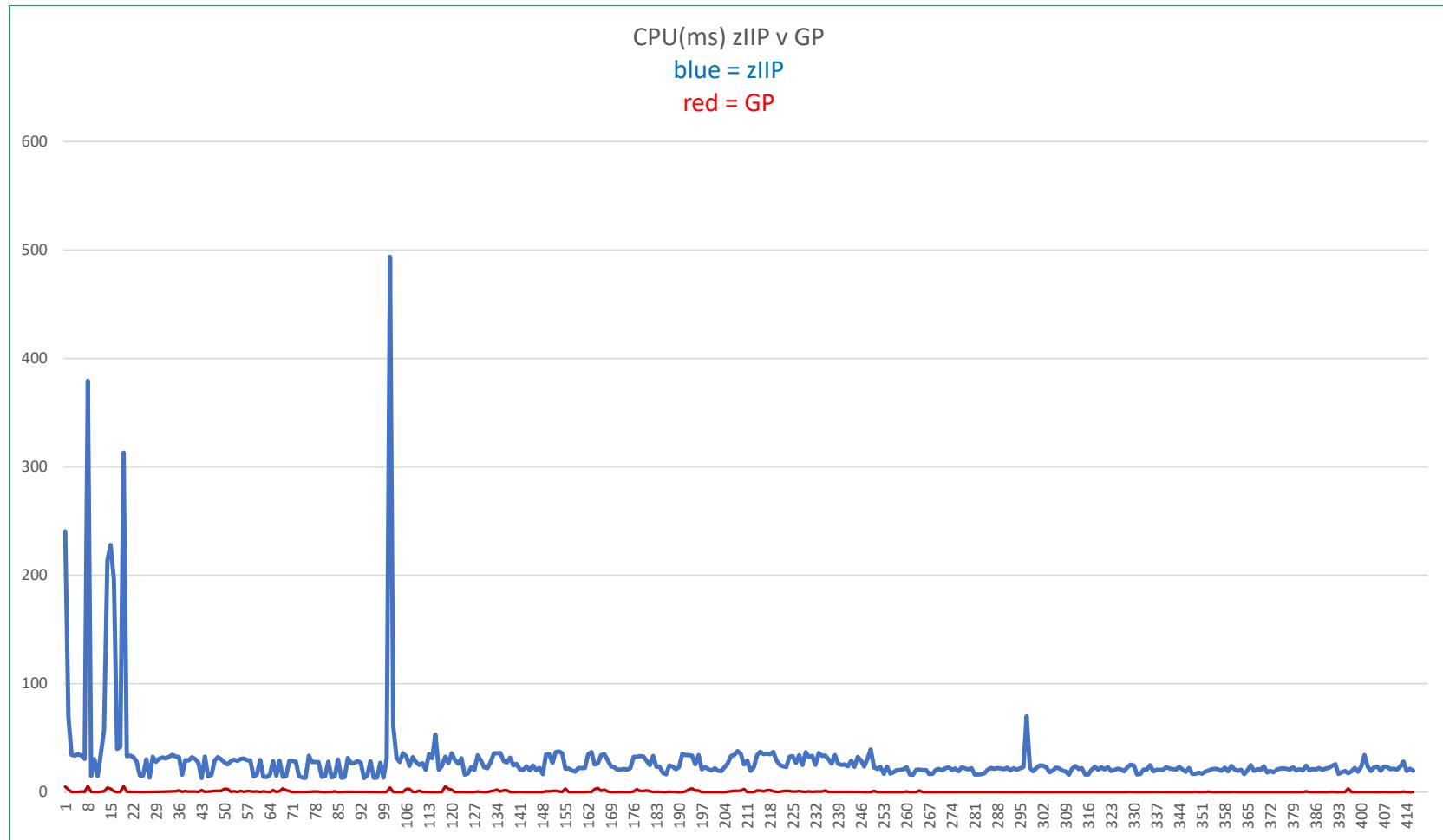
AS9 : 166

1	SystemName	Sysplex	JobName	StartTime	StartTime	EndTime	EndTime	Respon	TranClass	Total CPU	Start Total CPU	E Total CPU	Total IGP(ms)	TotalOffload(ms)	userid	mappedU	requestUF	host port	uri	response	targetPort	remotePo	RemoteAddr
2	MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	6080	TCAPIR	3314772936	4.52E+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	471705165	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	30.66213	0.053870115	30.608257	USER1	/zosConn/mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4306	192.168.17.243	
9	MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	10493	TCAPIR	3802597962	5.38E+09	385.0374	5.576215	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	2338	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	0.16280105	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	262790027	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	1973032107	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	458083508	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	86069826	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	30.900091	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	

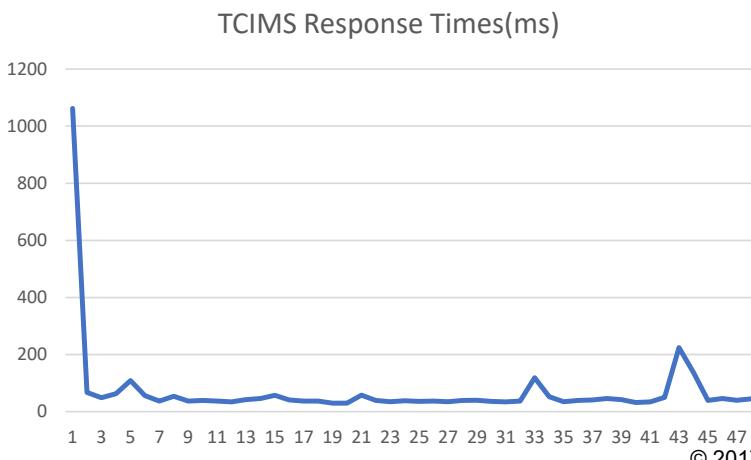
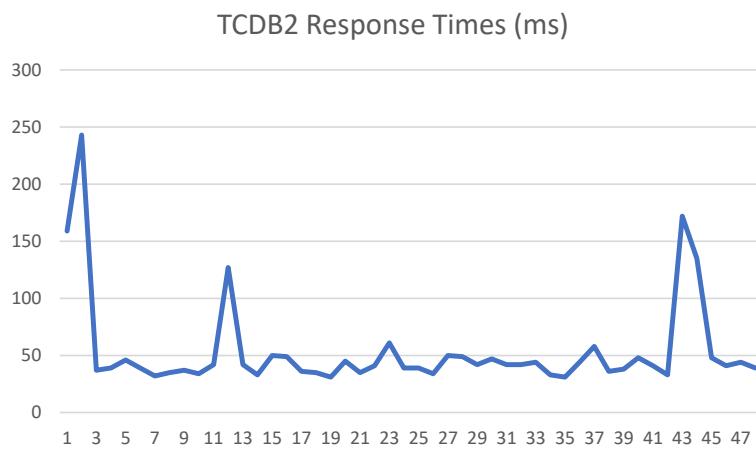
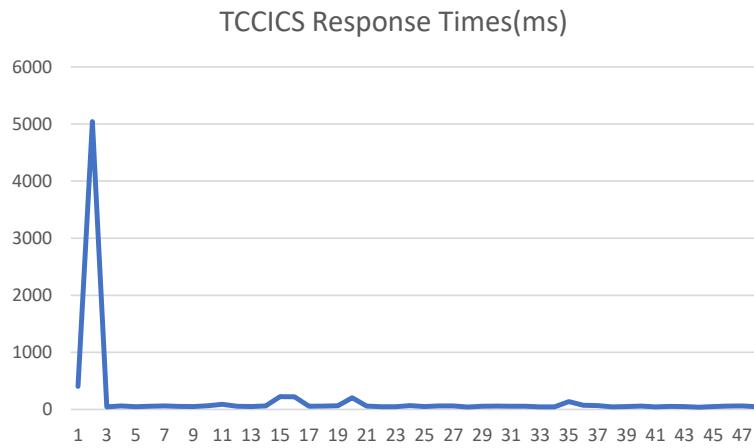
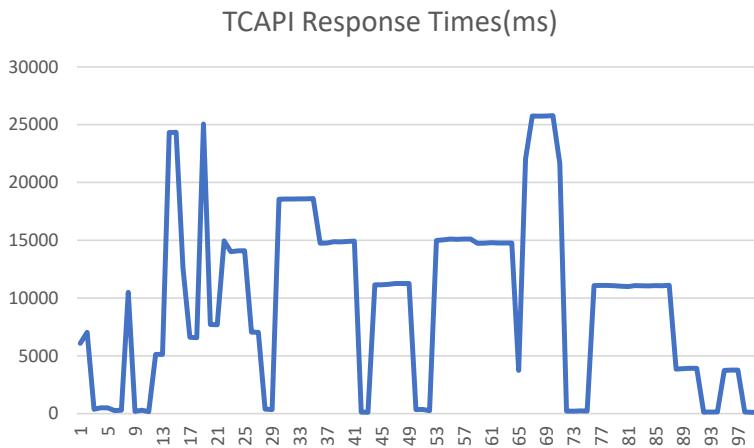
Some fields have been hidden



Liberty SMF 120 type 11 – GP v zIIP comparison example



Liberty SMF 120 type 11 – Response times comparisons example



z/OS Connect SMF 123 server XML configuration (OpenAPI 2)



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.

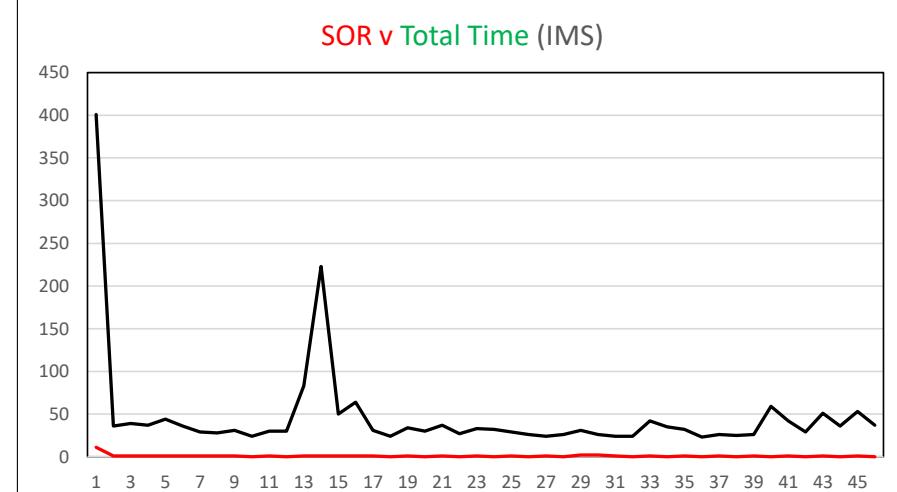
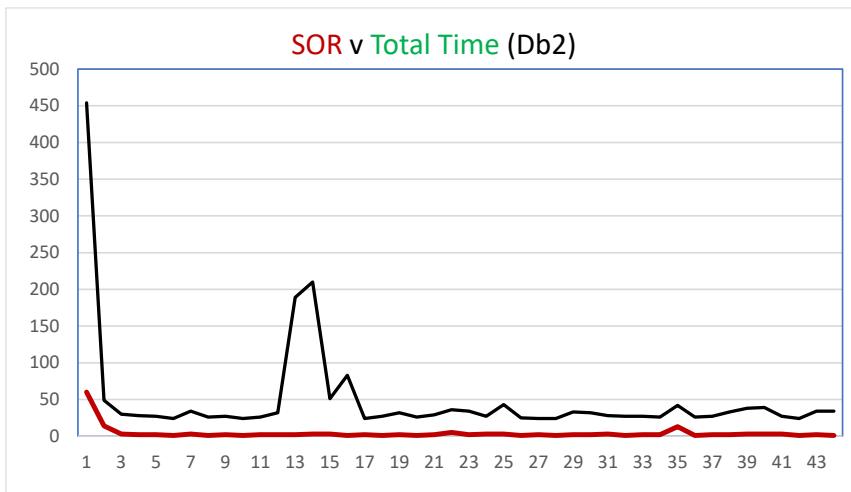
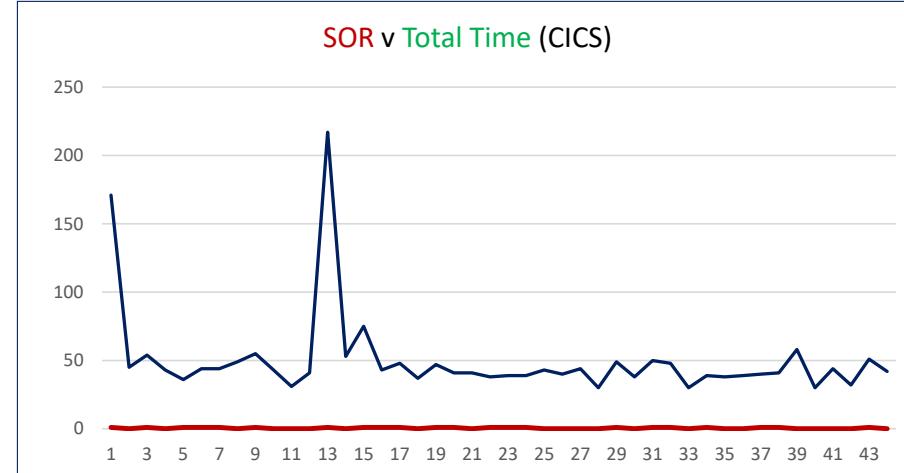
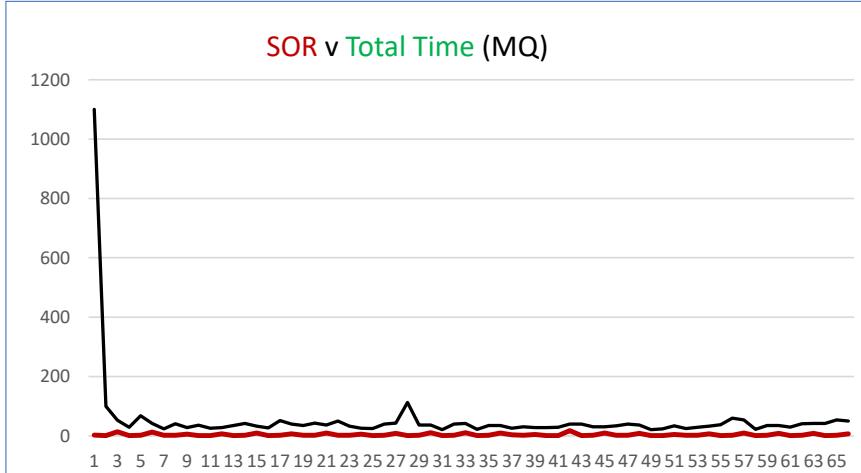
z/OS Connect SMF 123 subtype 1 version 2 (OpenAPI 2) *



Some fields have been hidden

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

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



z/OS Connect SMF 123 subtype 2 version 2 (OpenAPI 2) *



smfout.csv

2021/08/23 18:16:02.725340 UTC

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

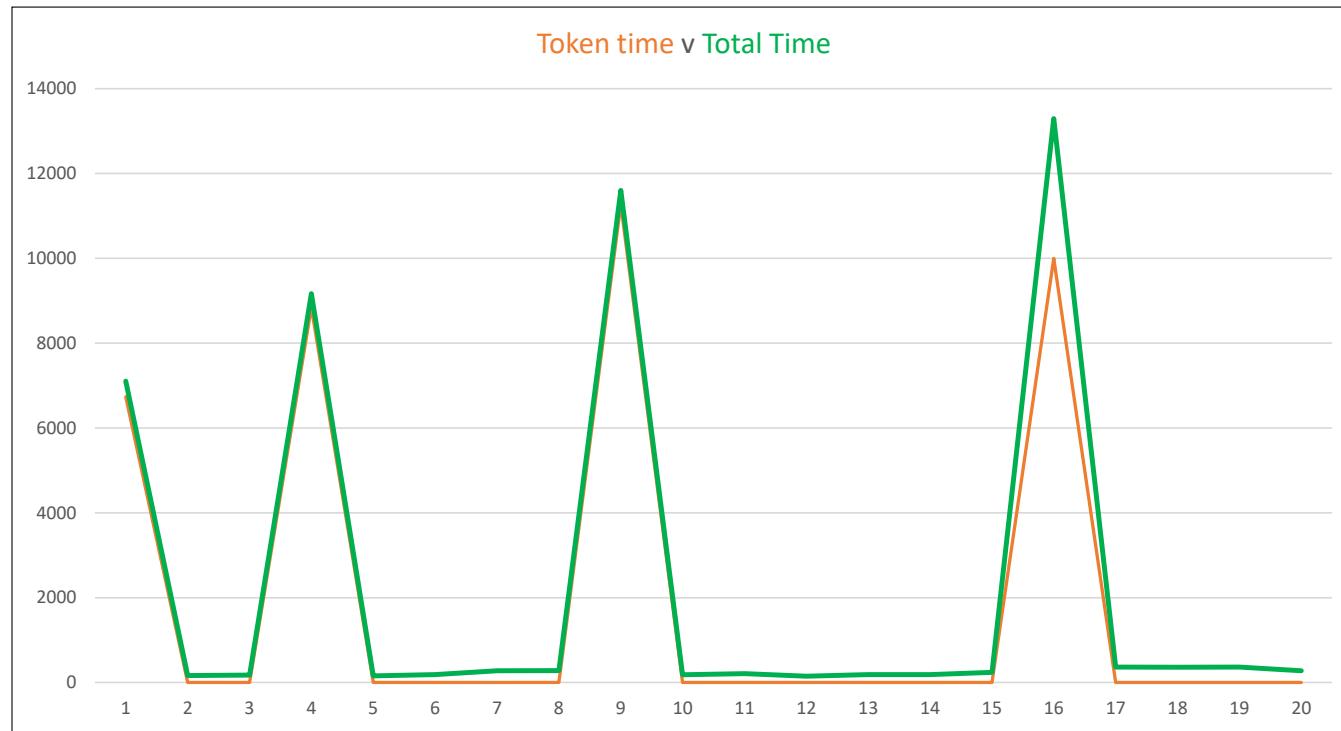
Some fields have been hidden

mitchj@us.ibm.com

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

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z/OS Connect SMF 123 subtype 2 version 2 graph example (OpenAPI 2)



BAQSMFP output (OpenAPI 2)



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

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

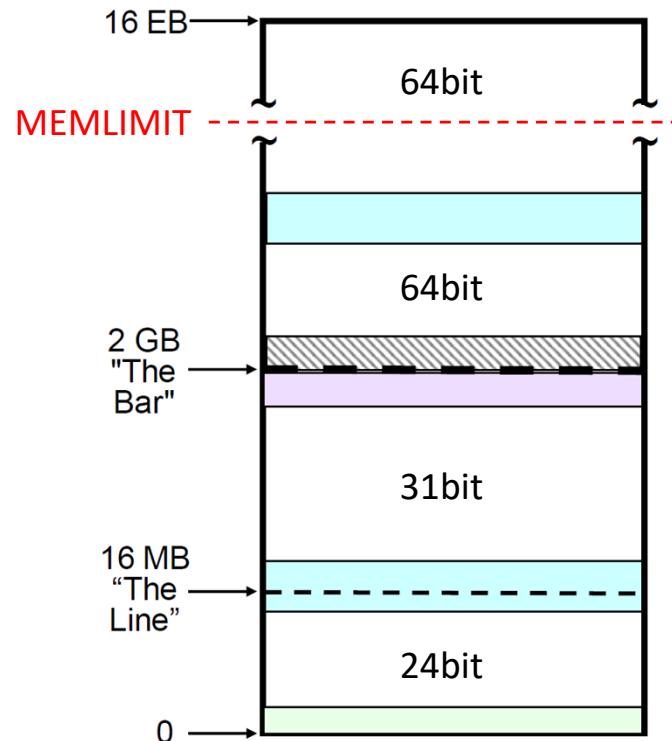
CICS Performance Analyzer

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

Memory - MEMLIMIT

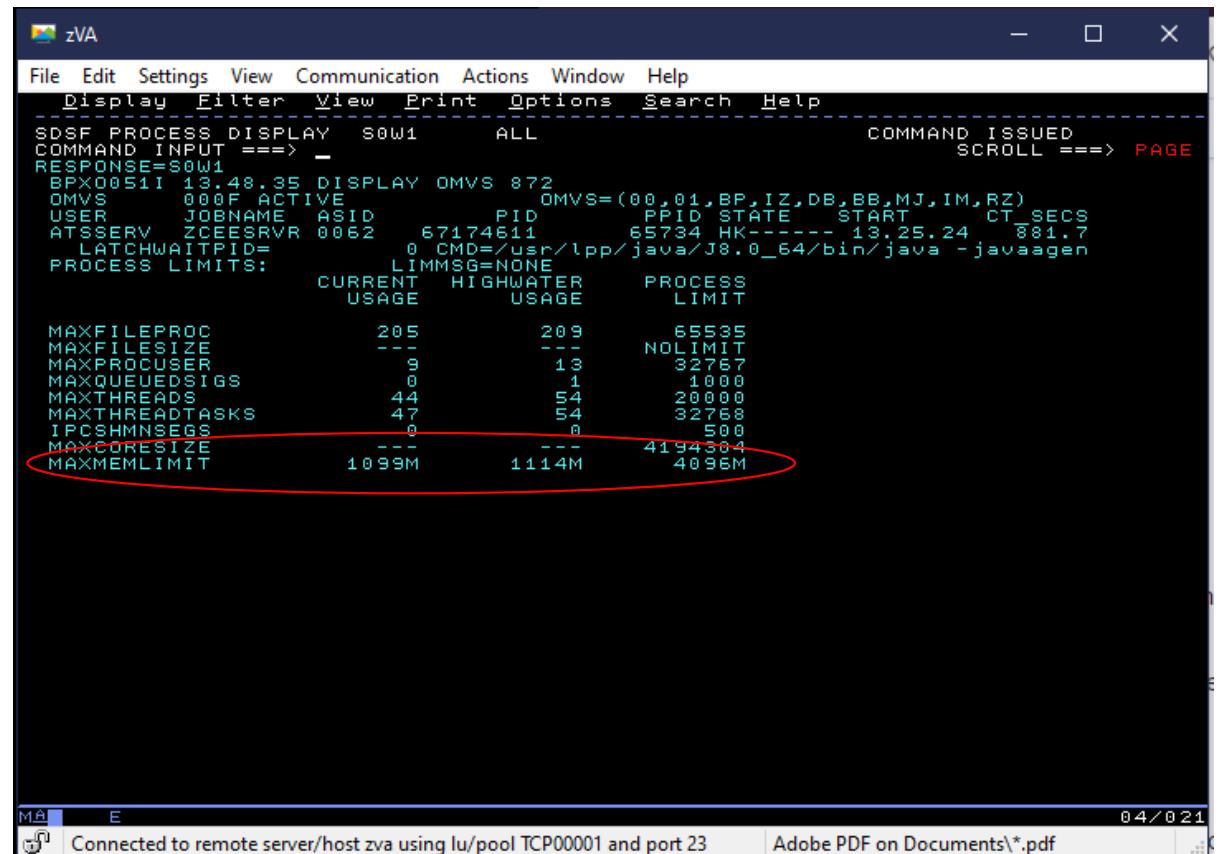
```
//ZCON EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,  
//      PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS.'
```

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



MEMLIMIT

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



```

zVA
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF PROCESS DISPLAY S0W1 ALL COMMAND ISSUED
COMMAND INPUT ===> - SCROLL ===> PAGE
RESPONSE=S0W1
BPX0051I 13.48.35 DISPLAY OMVS 872
OMVS 000F ACTIVE OMVS=(00,01,BP,IZ,DB,BB,MJ,IM,RZ)
USER JOBNAME ASID PID PPID STATE START CT SECS
ATSSERV ZCEESRVR 0062 67174611 65734 HK---- 13.25.24 881.7
LATCHWAITPID= 0 CMD=/usr/lpp/java/J8.0_64/bin/java -javaagen
PROCESS LIMITS: LIMMSG=NONE
               CURRENT HIGHWATER PROCESS
               USAGE   USAGE   LIMIT
MAXFILEPROC      205      209      65535
MAXFILESIZE     ---      ---      NOLIMIT
MAXPROCUSER      9       13      32767
MAXQUEUEDSIGS    0        1      1000
MAXTHREADS       44       54      20000
MAXTHREADTASKS   47       54      32768
IPCSHMNSEGS     0        0      500
MAXCORESIZE     ---      ---      4194304
MAXMEMLIMIT     1098M    1114M    4096M

```

The screenshot shows the z/OS zVA interface with the SDSF PROCESS DISPLAY command running. The output displays various system parameters and process limits. A red oval highlights the last row of the table, which represents the maximum memory limit (MAXMEMLIMIT) set to 4096M.

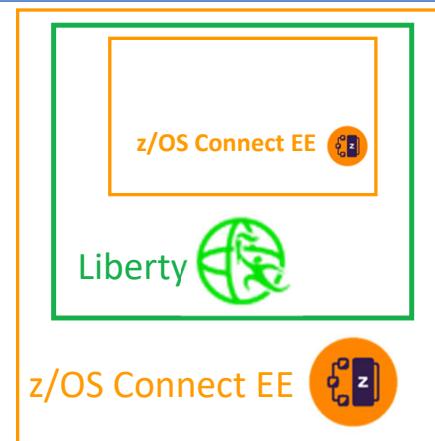


Locating the server's process ID

SDSF PROCESS DISPLAY MPZ3 ALL		LINE 1-5 (5)									
COMMAND INPUT ===> PS		SCROLL ===> CSR									
NP	JOBNAME	Status	Owner	State	CPU-Time	PID	PPID	ASID	ASIDX	LatchWaitPID	Command
BAQSTRT	WAITING FOR CHILD	LIBSERV	1W	40.01	69050	83955129	42	002A			/bin/sh /usr/lpp/IBM/zosconnect/v3r0/bin
BAQSTRT	OTHER KERNEL WAIT	LIBSERV	HK	40.01	16846267	69050	42	002A			/usr/lpp/java/J8.0_64/bin/java -javagen
BAQZANGL	SWAPPED, RUNNING	LIBANGE	1RI	0.01	50399398	83953829	77	004D			/usr/lpp/IBM/zosconnect/v3r0/wplib/nat
BAQZANGL	SWAPPED, FILE SYS KERNEL WAIT	LIBANGE	1FI	0.01	83953829	1	77	004D			BPXBATA2
BAQSTRT	FILE SYS KERNEL WAIT	LIBSERV	1F	40.01	83955129	1	42	002A			BPXBATSL

Tech-Tip: The **PS** SDSF command requires access to SAF SDSF resource ISFCMD.ODSP.PROCESS.*.

```
*****
product = WAS FOR Z/OS 21.0.0.9, z/OS Connect 03.00.52 (wlp-1.0.56.cl210920210909-1618)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/J8.0_64
java.version = 1.8.0_301
java.runtime = Java(TM) SE Runtime Environment (8.0.6.36 - pmz6480sr6fp36-20210913_01(SR6 FP36))
os = z/OS (02.03.00; s390x) (en_US)
process = 16780584@wg31
*****
```





MEMLIMIT Recommendations

- Don't reach the maximum!
 - Results in Java Out Of Memory errors and system abends
 - z/OS Connect EE will stop processing API requests

- Ensure this doesn't happen
 - Limit the Liberty Default Executor thread pool

`<executor maxThreads="300" />`

- **maxThreads** default value is **-1** No Limit!
- **MEMLIMIT** =
 - Maximum JVM Heap Size (-Xmx)
 - + 20% of the Maximum Heap Size (for JIT caches and other JVM requirements)
 - + Default Executor pool **maxThreads * 3MB**

Maximum JVM Heap Size – half the available memory with a minimum of 16 MB and a maximum of 512 MB



MEMLIMIT Recommendations

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

The screenshot shows the SDSF PROCESS DISPLAY output for server WG31. The output includes a table of process limits:

	CURRENT	HIGHWATER	PROCESS
	USAGE	USAGE	LIMIT
MAXFILEPROC	203	206	10000
MAXFILESIZE	--	--	NOLIMIT
MAXPROCUSER	0	7	200
MAXQUEUEDSIGS	0	1	1000
MAXTHREADS	34	40	10000
MAXTHREADTASKS	34	40	5000
IOPSHNSEGS	0	0	500
MAXCORESIZE	--	--	4194304
MAXMEMLIMIT	1026M	1061M	4096M

A red oval highlights the rows for MAXTHREADS, MAXTHREADTASKS, and MAXCORESIZE.

- Ensure SOR connections are configured appropriately
 - IPIC Send Sessions, IMS Connection Pool, Db2 http max connections
- Take action when USAGE comes within 80-90% of **maxThreads**

IBM z Omegamon for JVM

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

- WG31 - 3270**: A main window titled "z/OS Connect Request Summary". It shows a table of API requests with columns: APIName, Service, SoR ID, Reference, Resource. The table includes rows for "Last 30 Minute(s)", "Last 1 Hour(s)", and "Date/Time Range". Below the table are sections for "Columns" and "API Name" (listing services like catalog, db2employee, filea, filequeue, *ADMIN*, phonebook).
- WG31 - 3270**: A window titled "Requests by Service Name". It shows a table of requests for different services with columns: Service, Request, Error, Timeout, Response Time, and OS Conn Avg.
- WG31 - 3270**: A window titled "z/OS Connect Request Detail". It displays a detailed log of a specific request, including event time, request type, API name, URI, query string, method, port, HTTP code, timeout, service name, total req time, z/OS conn time, soR resp time, soR ID, soR ref, soR resource, remote address, request length, response length, correlator, operation, provider, and user ID.

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
Command ==> Auto Update : Off
KJJZCDD z/OS Connect Request Detail
SMF ID : WG31 Coll ID : KJJ1

```

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
Command ==> Auto Update : Off
KJJZCDD z/OS Connect Request Detail
SMF ID : WG31 Coll ID : KJJ1

```

Event time..... 04/02/19 18:47:54.267
Request Type... API
API name.... cscvinc
Request URI... /cscvinc/employee/444444
Query String...
Method..... GET
Port..... 9453
HTTP code.... 200 (OK)
Timeout..... No
Service Name... cscvincService
Total Req Time.. 0.008006s
z/OS Conn Time.. 0.005515s
SoR Resp Time.. 0.002491s
SoR ID.... USIBMWZ .CICS59Z
SoR Ref.... cscvinc
SoR Resource.. CSMI_CSCVINC
Remote Address.. 192.168.0.141
Request Length.. 0
Response Length.. 302
Correlator.... e6e2d3d7d3c5e7400011000010d5ea50
Operation.... getCscvincService
Provider.... CICS-1.0
User ID.... Fred

```

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

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

Event time..... 04/02/19 19:07:04.090
Request Type... API
API name.... phonebook
Request URI... /phonebook/contacts/LAST1
Query String...
Method..... GET
Port..... 9453
HTTP code.... 200 (OK)
Timeout..... No
Service Name... ivtnoService
Total Req Time.. 0.345265s
z/OS Conn Time.. 0.169460s
SoR Resp Time.. 0.181805s
SoR ID.... IVPN
SoR Ref.... IVTNO
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

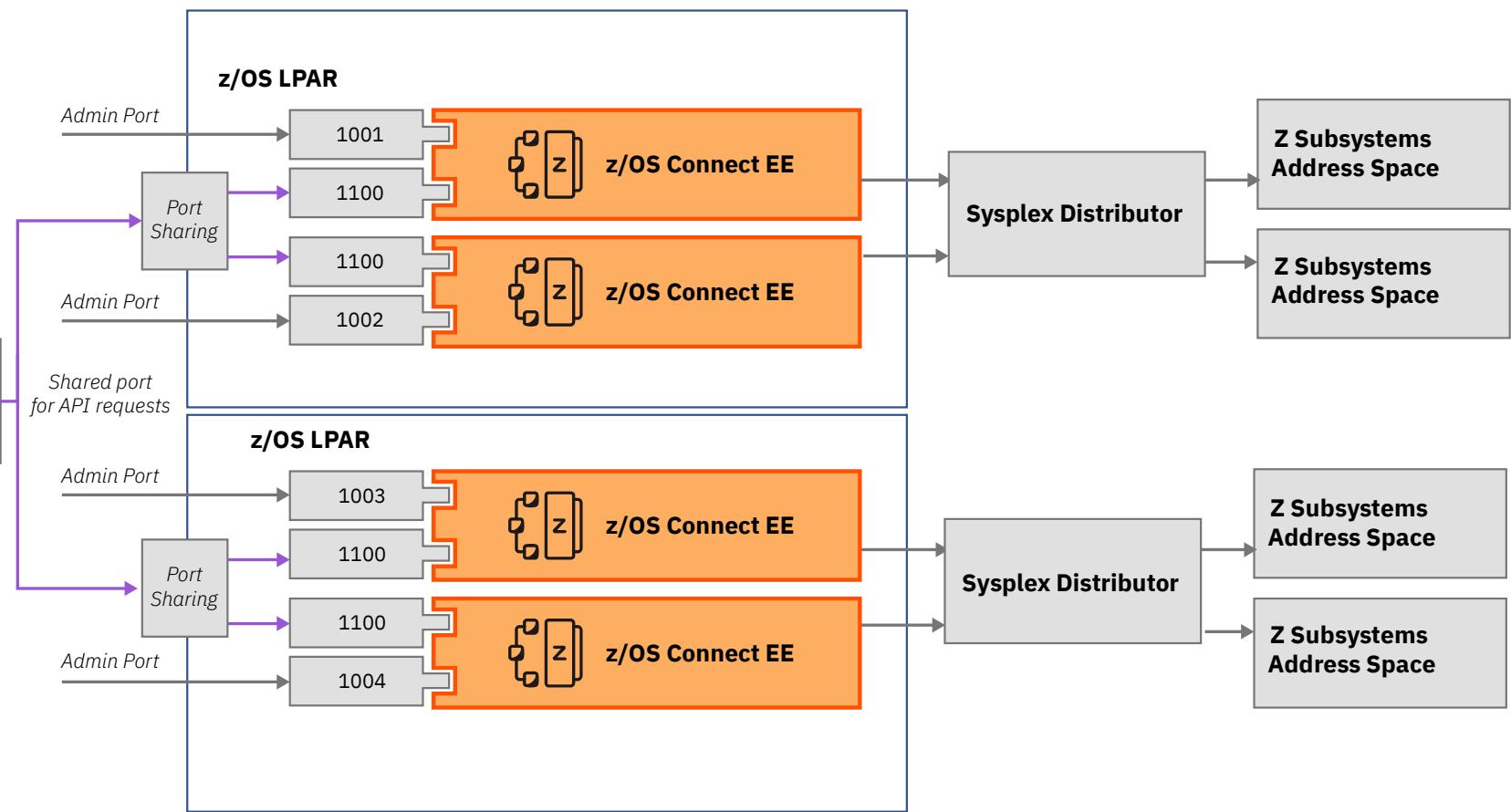
Connected to remote server/host wg31a using lu/pool TCP00109 and port 23

Miscellaneous Odds and Ends



High Availability

- Topology



i ibm.biz/zosconnect-ha-concepts

i ibm.biz/zosconnect-scenarios

Sysplex DVIPAs



SYS1.TCPIP.TCPPARMS (IPNODES)

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

SYS1.TCPIP.TCPPARMS (PROFMPZ3)

```
IPCONFIG SYSPLEXROUTING  
DYNAMICXCF 172.1.1.243 255.255.255.0 3  
VIPADYNAMIC  
VIPADEFINE 255.255.255.0 192.168.17.240  
VIPADISTRIBUTE DEFINE DISTM ROUNDROBIN|BASEWLM 192.168.17.240  
PORT 23 1416 1491 2446 9443 9453 9463  
DESTIP  
172.1.1.241  
172.1.1.242  
172.1.1.243  
ENDVIPADYNAMIC
```

No SERVERWLM option

HOMETEST

```
EZA0619I Running IBM MVS TCP/IP CS V2R4 TCP/IP Configuration Tester  
EZA0602I TCP Host Name is: MPZ3  
  
EZA0605I Using Name Server to Resolve MPZ3  
EZA0611I The following IP addresses correspond to TCP Host Name: MPZ3  
EZA0612I 192.168.17.243  
EZA0614I The following IP addresses are the HOME IP addresses defined in PROFILE.TCPIP:  
EZA0615I 192.168.17.243  
EZA0615I 172.1.1.243  
EZA0615I 192.168.17.240  
EZA0615I 127.0.0.1  
  
EZA0618I All IP addresses for MPZ3 are in the HOME list!  
EZA0622I Hometest was successful - all Tests Passed!
```

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

The screenshot shows a browser window titled "REST API Documentation". The address bar contains the URL <https://dvipa.washington.ibm.com:9443/api/explorer/>. The main content area is titled "Liberty REST APIs" and displays a list of APIs categorized by their names. Each category has a table with four rows: POST, DELETE, GET, and PUT. The first category, "cscvinc", is expanded, showing its specific API endpoints. Other collapsed categories include "db2employee", "filemgr", "imsPhoneBook", "jwtvpDemoApi", "miniloancics", "mqapi", and "phonebook". Each row in the table has "Show/Hide", "List Operations", and "Expand Operations" links.

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

db2employee			
Show/Hide	List Operations	Expand Operations	

filemgr			
Show/Hide	List Operations	Expand Operations	

imsPhoneBook			
Show/Hide	List Operations	Expand Operations	

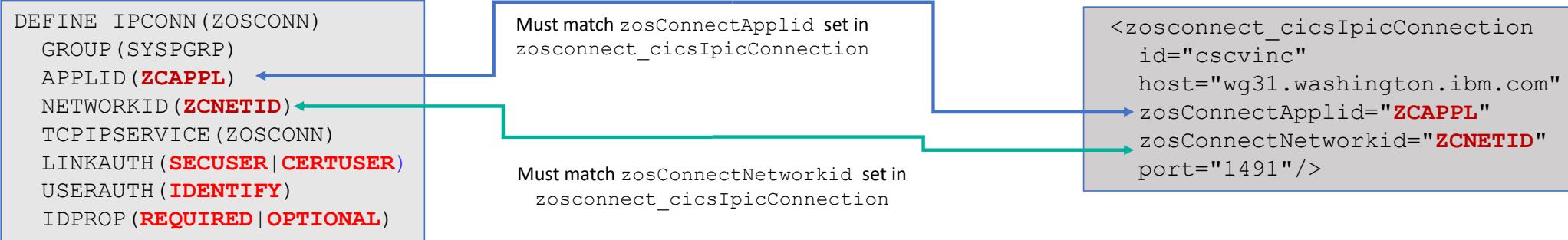
jwtvpDemoApi			
Show/Hide	List Operations	Expand Operations	

miniloancics			
Show/Hide	List Operations	Expand Operations	

mqapi			
Show/Hide	List Operations	Expand Operations	

phonebook			
Show/Hide	List Operations	Expand Operations	

CICS IPCONN Resource



LINKAUTH Determines the user identity to be used for link security. The value is either **CERTUSER** or **SECUSER**. A value of **CERTUSER** sets the link identity to the identity associated with the client certificate received from the client endpoint (TLS mutual authentication is required). A value of **SECUSER** sets the link identity to the value of the *SECURITYNAME* attribute as defined in the IPCONN resource.

USERAUTH Identifies how the identity under which the attached transaction attach security will run. Since a password is not available, a value of **VERIFY** is not possible. A value of **LOCAL** means the current link identity is used. A value of **DEFAULTUSER** means the CICS default identity is used. For identity propagation purposes, the value of **USERAUTH** should be **IDENTIFY** (no password will be required) so the identity provided by the client is used for executing the attached transaction. TLS must be used if the client is in a different Sysplex.

IDPROP Determines whether the original distributed identity authenticated by the z/OS Connect server is also propagated to CICS in addition to the mapped identity used for z/OS Connect authorization checks. A value of **NOTALLOWED** does not propagate the original distributed identity. A value of **OPTIONAL** will propagate to CICS the original distributed identity, if available. A value of **REQUIRED** requires that the original distributed identity be propagated to CICS. TLS must be used if the client is in a different Sysplex.

CERTIFICATE Provides the label of the certificate connected to the CICS key ring to be used for server endpoint certificate during a TLS handshake.



Flowing an identity to CICS

The server.xml file is the key configuration file:

The diagram illustrates the flow of configuration from the server.xml file to the TCP/IP configuration and finally to the IPConn configuration. Arrows point from the highlighted sections in the server.xml code to the corresponding sections in the TCP/IP and IPConn configuration windows.

```
ipicSSLIDProp.xml
1<server description="CICS IPIC ID propagation connections">
2
3<!-- Enable features -->
4<featureManager>
5  <feature>zosconnect:cicsService</feature>
6</featureManager>
7
8<zosconnect_cicsIpIpcConnection id="catalog"
9  host="wg31.washington.ibm.com"
10 port="1493"
11 zosConnectNetworkid="CSCVINC"
12 zosConnectApplid="CSCVINC"
13 transid= M10
14 transidUsage="EIB_AND_MIRROR"
15 sslCertsRef="cicsSSLSettings"/>
16
17</server>
18
```

WG31

```
I TCPIPS
RESULT - OVERTYPE TO MODIFY
Ipipservice(CSCVINC)
Openstatus( Open
Port(01493)
Protocol(Init)
Ssltype(Ssl)
Transid(CIIS)
Authenticate(Noauthentic)
Connections(00000)
Backlog( 01024 )
Maxdatalen( 000000 )
Urm( DFHISIP )
Privacy(Supported)
Ciphers(3538392F3233)
Host(ANY)
Ipaddress(192.168.17.201)
Hosttype(Any)
Ipresolved(192.168.17.201)
+ Ipfamily(Ipv4family)

SYSID=CICS APPLID=CICS532
TIME: 13.12.07 DATE: 02/22/21
PF 1 HELP 2 HEX 3 END      5 VAR      7 SBH 8 SFH 10 SB 11 SF
MB D
Connected to remote server/host wg31 using lu/pool TCP00137 and port 23
01/02
```

WG31

```
I IPCONN
RESULT - OVERTYPE TO MODIFY
Ipconn(CSCVINC)
Applid(CSCVINC)
Networkid(CSCVINC)
Selstatus( Inservice )
Connstatus( Released )
Seltype(Nossl)
PurgeType( )
Ha(Notrequired)
ReceiveCount(001)
SendCount(000)
Tcpipservice(CSCVINC)
Port()
Host()
HostType()
Ipresolved(0.0.0.0)
Ipfamily(Unknown)
PendStatus( NotPending )
+ RecovStatus( Norecovdata )

SYSID=CICS APPLID=CICS532
TIME: 12.36.15 DATE: 02/22/21
PF 1 HELP 2 HEX 3 END      5 VAR      7 SBH 8 SFH 10 SB 11 SF
MB D
Connected to remote server/host wg31 using lu/pool TCP00135 and port 23
17/04
```



Identity Propagation and CICS High Availability

Assume the service installed in a server files use the following *Connection reference* values:

- cscvinc
- catalog
- miniloan

If identity propagation is required for all connection, then the CICS IPCONN resources defined in the CICs that correspond to a `zosconnect_cicsIpicConnection` configuration elements must be dedicated to that z/OS Connect server and connection reference can not be reused.

Simplify administration by still sharing a common `cicsIpicConnection` XML configuration element by using variables and a bootstrap properties file or “variables” XML file

Server baqsvr1's bootstrap.properties

```
ipicPort=1491  
cicsHost=192.168.17.241  
serverPrefix=baqsvr1
```

Server baqsvr2's bootstrap.properties

```
cicsHost=192.168.17.242  
ipicPort=1491  
serverPrefix=baqsvr2
```

ipicIDProp.xml

```
<zosconnect_cicsIpicConnection id="cscvinc"  
host="${cicsHost}"  
zosConnectNetworkid="${wlp.server.name}"  
zosConnectApplid="${wlp.server.name}"  
sharedPort="true" port="${ipicPort}"  
preferredSpecificHost="${cicsHost}"  
preferredSpecifPort="${ipicPort}"  
reconnectInterval=30/>  
<zosconnect_cicsIpicConnection id="catalog"  
host="${cicsHost}"  
zosConnectNetworkid="${serverPrefix}C"  
zosConnectApplid="${serverPrefix}C"  
sharedPort="true" port="${ipicPort}"  
preferredSpecificHost= "${cicsHost}"  
preferredSpecifPort="${ipicPort}"  
reconnectInterval=3600/>
```

→ baqsvr1 or baqsvr2

→ baqsvr1C or baqsvr2C

CICS IPIC connection processing for high availability load balancing*

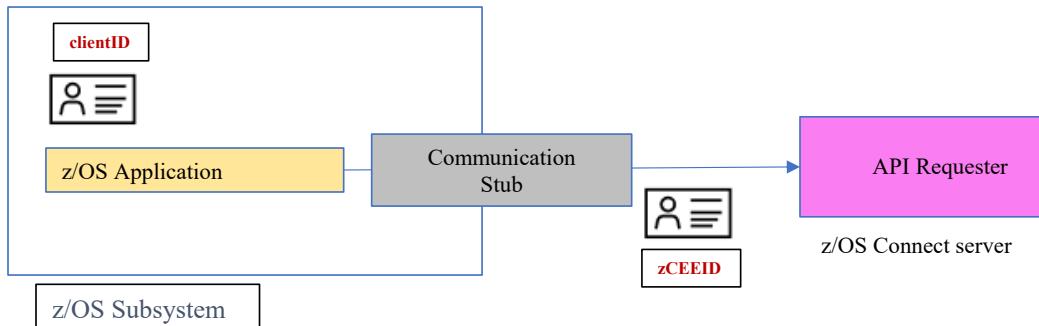


If the *reconnectInterval* attribute is set, at the specified time interval, a check is made to see if a new connection attempt should be attempted. A new connection is established if the current connection properties are not the preferred connection properties:

- If *reconnectInterval*, *preferredSpecificHost* and *preferredSpecificPort* are not set,
 - New connection attempts are disabled (this is the default behavior).
- If *reconnectInterval* is set and *preferredSpecificHost* and *preferredSpecificPort* are not set,
 - A new connection is attempted at the interval specified by the *reconnectInterval* time. Use this to enable regular connection rebalancing.
- If *reconnectInterval* and *preferredSpecificPort* are set and *preferredSpecificHost* is not set,
 - A new connection is attempted at the expiration time interval and if the current connected port in use does not match the preferred port
 - Relevant when shared port is for a single LPAR
 - Specific CICS region is preferred
- If *reconnectInterval* and *preferredSpecificHost* are set and *preferredSpecificPort* is not set
 - A new connection is attempted at the expiration time interval and if the current host in use does not match the preferred port
 - Relevant when shared port is across Sysplex
 - Any CICS region on a specific LPAR is preferred
- If *reconnectInterval*, *preferredSpecificHost* and *preferredSpecificPort* are all set
 - A new connection is attempted at the expiration time interval time and if both the current host and port in use do not match the preferred host and port
 - Relevant when shared port is on a single LPAR or across a Sysplex
 - Specific CICS region is preferred.

When the reconnection attempt results in a new connection to a CICS region, new requests are sent over the new connection. Previous connections will continue and when all requests have completed processing, the previous or old connection will be closed.

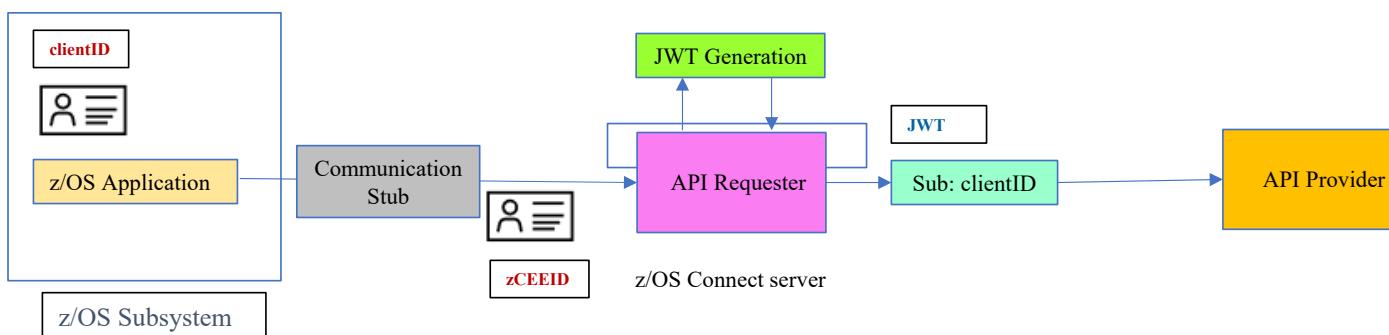
API Requester - authentication with identity assertion and JWT generation



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

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

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



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



Use z/OS Connect API Policies to change runtime behavior (OpenAPI 2)

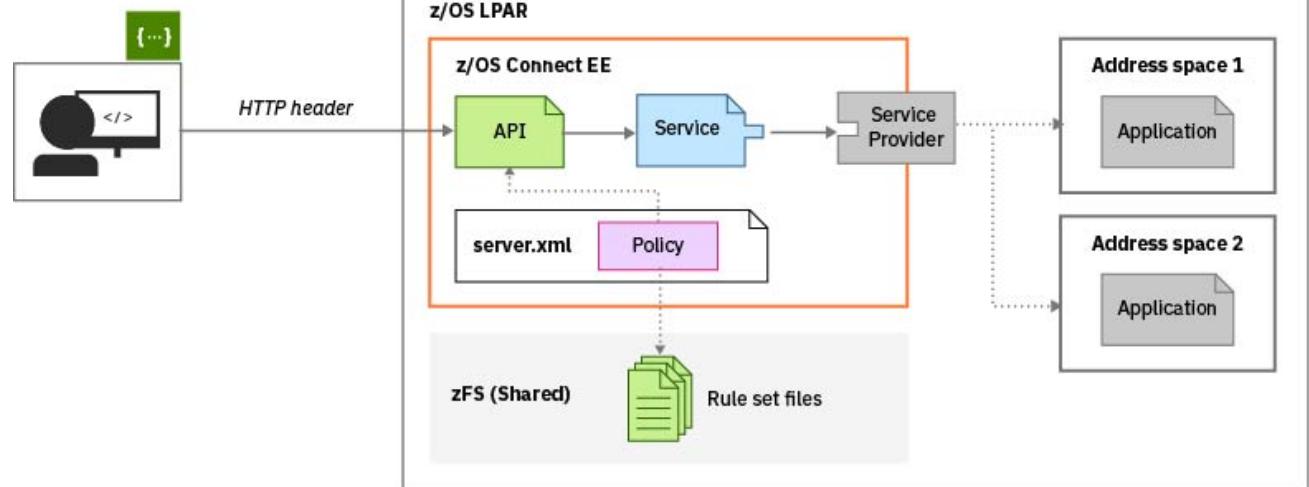
- HTTP header properties can be used to select alternative for IMS (V3.0.4) , CICS (V3.0.10), Db2 (V3.0.36) or MQ (V3.0.39)
- Policies can be configured globally for every API in the server or for individual APIs (V3.0.11)

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 (OpenAPI 2)

```
<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 for the 'GET.employee.{numb}' operation. It displays the following configuration:

- Body - cscvincServiceOperation**: Contains a placeholder for the service operation body.
- HTTP Request**: Contains:
 - HTTP Headers**:
 - cicsMirror**: optional string
 - cicsConnection**: optional string
 - Path Parameters**:
 - {numb}**: Required string
 - Query Parameters**: None listed.
- Body - cscvincServiceOperation**: Placeholder for the response body.

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.
```

Today we covered

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

z/OS Connect Wildfire Github Site <https://ibm.biz/BdPRGD>



The screenshot displays two GitHub repository pages side-by-side. The left repository, 'ibm-wsc/zCONNEE-Wildfire-Workshop', shows a file tree. Two specific folders are circled in red: 'AdminSecurity' and 'xml'. The right repository, 'ibm-wsc/zCONNEE-Wildfire-Workshop / AdminSecurity /', shows a list of files and commits. The 'xml' folder's contents are listed under 'zCONNEE-Wildfire-Workshop / AdminSecurity /'.

ibm-wsc/zCONNEE-Wildfire-Workshop

- master
- 1 branch
- 0 tags

AdminSecurity

xml

ibm-wsc/zCONNEE-Wildfire-Workshop / AdminSecurity /

File/Commit	Actions	Date
Customization Basic Configuration(1of2) (1).pdf	Add files via upload	last month
Customization Basic Configuration(1of2) (2).pdf	Add files via upload	last month
Customization Security and CICS.pdf	Add files via upload	last month
Customization Security and DB2.pdf	Add files via upload	last month
Customization Security and JWT Tokens.pdf	Add files via upload	last month
Customization Security and MQ.pdf	Add files via upload	last month
Customization Security when accessing an IMS Database....	Add files via upload	last month
Customization Security when accessing an IMS Transactio...	Add files via upload	last month
Customization Security with MVS Batch.pdf	Add files via upload	last month
admin	Create admin	last month

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- Contact your IBM representative to schedule access to these exercises

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Thank you for listening and your questions.

Additional Material

Sample Administrative JCL

Server XML – Accessing a HATS REST service (OpenAPI 2)



```
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

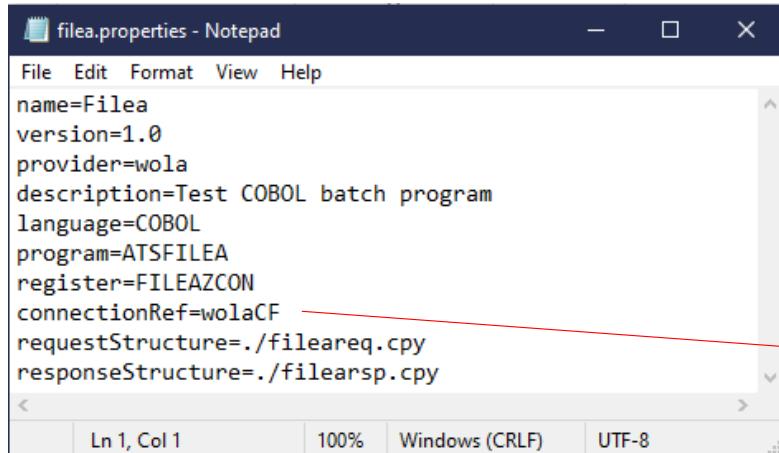
Design Source

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

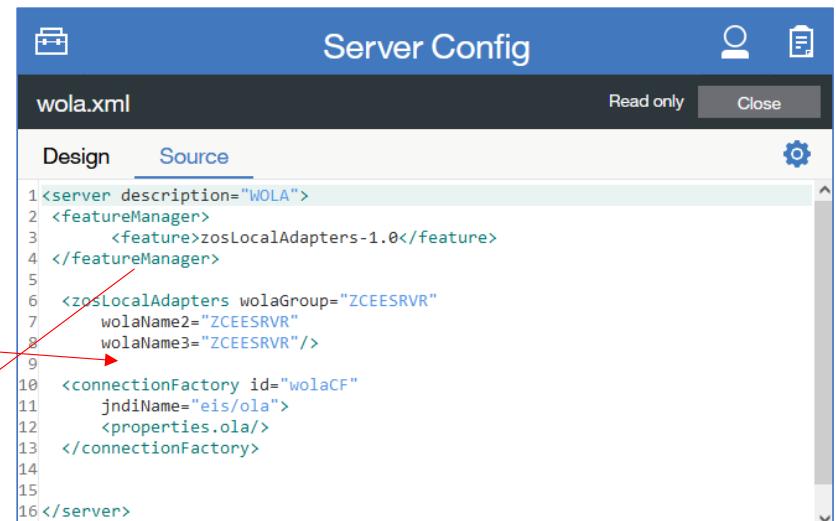
HATS Liberty server.xml

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

Server XML- Accessing an MVS application using WOLA (OpenAPI 2)



```
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
```

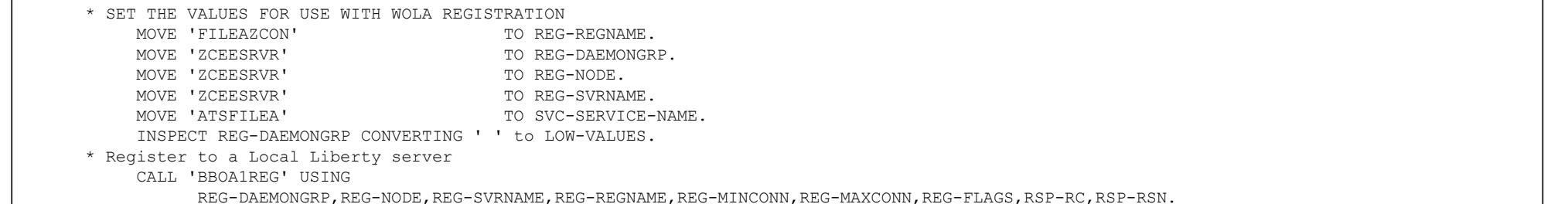


Server Config

wola.xml

Design Source

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



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



Server XML – Accessing a DVM server using WOLA (OpenAPI 2)

Server Config

dvs.xml

Read only Close

Design Source

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

DVS.AVZS.SAVZEXEC (AVZSIN00)

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

Server XML – Accessing a File Manager server (OpenAPI 2)

```
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

Design Source

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

Read only Close

SYS1.PROCLIB(IPVSRV1)

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

Example of z/OS Connect Authorization Levels (OpenAPI 2) (this config has issues)



```
<zosconnect_zosConnectManager>
    globalInterceptorsRef="interceptorList_g"
    globalAdminGroup="SYSPGRP" globalOperationsGroup="GBLOPERS"
    globalInvokeGroup="GBLINVKE" globalReaderGroup="GBLRDR"/>

<zosconnect_zosConnectAPIs>
    <zosConnectAPI name="cscvinc"
        adminGroup="CSCADMIN" operationsGroup="CSCOPERS"
        invokeGroup="CSCINVKE" readerGroup="CSCREADR"/>
    <zosConnectAPI name="db2employee"
        adminGroup="DB2ADMIN" operationsGroup="DB2OPERS"
        invokeGroup="DB2INVKE" readerGroup="DB2READR"/>
</zosconnect_zosConnectAPIs>

<zosconnect_services>
    <service name="cscvincSelectService"
        adminGroup="CSCADMIN" operationsGroup="CSCOPERS"
        invokeGroup="CSCINVKE" readerGroup="CSCREADR"/>
    <service name="selectEmployee"
        adminGroup="DB2ADMIN" operationsGroup="DB2OPERS"
        invokeGroup="DB2INVKE" readerGroup="DB2READR"/>
</zosconnect_services>

<zosconnect_apiRequesters>
    <apiRequester name="cscvincSelectService"
        adminGroup="CSCADMIN" operationsGroup="CSCOPERS"
        invokeGroup="CSCINVKE" readerGroup="CSCREADR"/>
    <apiRequester name="selectEmployee"
        adminGroup="DB2ADMIN" operationsGroup="DB2OPERS"
        invokeGroup="DB2INVKE" readerGroup="DB2READR"/>
</zosconnect_apiRequesters>
```

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This works as you expect once the artifacts are deployed but:

- Only members of groups SYSPGRP, GBLOPERS or GBLRDR can connect to a z/OS server from the API toolkit (the tooling attempts a GET request for a list of all deployed services and APIs).
- Only members of groups SYSPGRP or GBLOPERS can deploy new z/OS Connect API, service or API requester artifacts (POST access for operations is not available until after the artifact is deployed)

Tech-Tip: When groups are specified for zosConnectAPI, service, or apiRequester configuration elements, the global groups are ignored for certain functions. Other functions, e.g., deploy new artifact, get a list or service statistics, only use the global group membership.



z/OS Connect Authorization Summary (OpenAPI 2)

- Members of groups SYSPGRP, GBLOPERS, DB2ADMIN or DB2OPERS can not manage (e.g., change, stop or delete) z/OS Connect artifacts *managed* by group CSCOPERS or CSCADMIN.
- Members of groups SYSPGRP, GBLOPERS, CSCADMIN or CSCOPERS can not manage (e.g., change, stop or delete) z/OS Connect artifacts *managed* by group DB2OPERS or DB2ADMIN.
- Only members of group CSCADMIN, CSCINV, DB2ADMIN or DB2INVKE can invoke the artifacts defined in the subordinate element:
 - Members of group CSCADMIN or CSCVINKE can invoke artifacts managed by CSCINVKE
 - Members of group DB2ADMIN or DB2INVKE can invoke artifacts managed by DB2INVKE
 - Members of groups SYSPGRP or GBLINVKE can not invoke any artifacts protected by these specific subordinate groups.
- Only members of groups SYSPGRP, GBLOPERS or GBLRDR can connect to a z/OS server from the API toolkit.
- Only members of groups SYSPGRP or GBLOPERS can deploy new z/OS Connect API, service or API requester artifacts.



Tech-Tip: Solution for z/OS Connect Authorization Levels (OpenAPI 2)

```
<zosconnect_zosConnectManager>
    globalInterceptorsRef="interceptorList_g"
    globalAdminGroup="SYSPGRP" globalOperationsGroup="GBLOPERS , CSCOPERS , DB2OPERS"
    globalInvokeGroup="GBLINVKE" globalReaderGroup="GBLRDR"/>

<zosconnect_zosConnectAPIs>
    <zosConnectAPI name="cscvinc" operationsGroup="CSCOPERS" invokeGroup="CSCINV"/>
    <zosConnectAPI name="db2employee" operationsGroup="DB2OPERS" invokeGroup="DB2INVKE"/>
</zosconnect_zosConnectAPIs>

<zosconnect_services>
    <service name="cscvincSelectService" operationsGroup="CSCOPERS" invokeGroup="CSCINV"/>
    <service name="selectEmployee" operationsGroup="DB2OPERS" invokeGroup="DB2INVKE"/>
</zosconnect_services>

<zosconnect_apiRequesters>
    <apiRequester name="cscvincSelectService" operationsGroup="CSCOPERS" invokeGroup="CSCINV"/>
    <apiRequester name="selectEmployee" operationsGroup="DB2OPERS" invokeGroup="DB2INVKE"/>
</zosconnect_apiRequesters>
```

- Now members of groups SYSPGRP, GBLOPERS, **CSCOPERS**, **DB2OPERS** and GBLRDR can connect to a z/OS server from the API toolkit.
- Members of groups SYSPGRP, GBLOPERS, **CSCOPERS**, and **DB2OPERS** can deploy new artifacts.
- Only members of group **CSCOPERS** and **DB2OPERS** can manage artifacts after they are deployed.

When a partial list of subordinate groups are provided, the corresponding default global groups for the absence groups are used.



Interceptor - server XML example (OpenAPI 2)

```
<zosconnect_zosConnectManager  
    globalInterceptorsRef="interceptorList_g"  
    globalAdminGroup="SYSPGRP"  
    globalOperationsGroup="GBLOPERS"  
    globalInvokeGroup="GBLINVKE"  
    globalReaderGroup="GBLDRR"/>  
  
<zosconnect_authorizationInterceptor id="auth"/>  
<zosconnect_auditInterceptor id="audit"/>  
<zosconnect_zosConnectInterceptors id="interceptorList_g"  
    interceptorRef="auth"/>  
<zosconnect_zosConnectInterceptors id="interceptorList_a"  
    interceptorRef="auth,audit"/>  
  
<zosconnect_zosConnectAPIs>  
    <zosConnectAPI name="catalog"  
        runGlobalInterceptorsRef="true"  
        adminGroup="aapigrp1,aapigrp2"  
        operationsGroup="oapigrp1,oapigrp2"  
        invokeGroup="iapigrp1,oapigrp2"  
        readerGroup="rapigrp1,rapigrp2"/>  
</zosconnect_zosConnectAPIs>  
  
<zosconnect_apiRequesters>  
    <apiRequester name="cscvincapi_1.0.0"  
        runGlobalInterceptorsRef="false"  
        interceptorsRef="interceptorList_a"  
        adminGroup="aaprgrp1,aaprgrp2"  
        operationsGroup="oaprgrp1,oaprgrp2"  
        invokeGroup="iaprgrp1,oaprgrp2"  
        readerGroup="raprgrp1,raprgrp2"/>  
</zosconnect_apiRequesters>  
  
<zosconnect_services>  
    <service id="selectByEmployee" name="selectEmployee"  
        runGlobalInterceptorsRef="false"  
        interceptorsRef="interceptorList_a"  
        adminGroup="asrvgrp1,asrvgrp2"  
        operationsGroup="osrvgrp1,osrvgrp2"  
        invokeGroup="isrvgrp1,isrvgrp2"  
        readerGroup="rsrvrgrp1,rsrvgrp2"/>  
</zosconnect_services>
```

```
ADDGROUP SYSPGRP OMVS (AUTOGID) *  
ADDGROUP GBLINVKE OMVS (AUTOGID) *  
CONNECT FRED GROUP (SYSPGRP)  
CONNECT USER1 GROUP (GBLINVKE)
```

Global interceptor list – authorization interceptor only

Alternative interceptor list – authorization and audit interceptors

This avoids duplication of interceptors

Note that these are z/OS Connect configuration elements. Documented in the z/OS Connect KC

Tech/Tip: Server XML example – combining TLS/AUTH interceptor (OpenAPI 2)



```
<zosconnect_zosConnectManager  
    requireAuth="true"  
    requireSecure="true"  
    globalInterceptorsRef="interceptorList_g"  
    globalAdminGroup="SYSPGRP"  
    globalOperationsGroup="GBLOPERS"  
    globalInvokeGroup="GBLINVKE"  
    globalReaderGroup="GBLRDR"/>  
  
<zosconnect_authorizationInterceptor id="auth"/>  
<zosconnect_zosConnectInterceptors id="interceptorList_g"  
    interceptorRef="auth"/>  
  
<zosconnect_apiRequesters>  
    <apiRequester name="cscvincapi_1.0.0"  
        requireSecure="false"  
        invokeGroup="iaprgrp1"/>  
</zosconnect_apiRequesters>
```

Global TLS security and authentication are enabled.

TLS security is disabled for this API requester archive artifact. Avoiding the HTTP 302 REDIRECT error.

This configuration would allow a MVS batch job to authenticate to z/OS Connect and use HTTP for the protocol (when an AT-TLS outbound policy is not available). Only authorization identities which are members of groups identified as administrators or invokers would be authorized to invoke this API requester.

F BAQSTRT,ZCON,CLEARSAFCACHE



Tech-Tip: Liberty's “adminCenter” Feature

- The Web browser interface feature “adminCenter” was used to display 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" and the file name is "server.xml".
- The "Save" button is visible.
- The "Design" tab is selected, indicated by a red circle.
- The main area shows a tree view under "Server" with several "Include" entries:

 - Include /var/zosconnect/servers/myServer...
 - Include /var/zosconnect/servers/myServer...
 - Include /var/zosconnect/servers/myServer...
 - Include /var/zosconnect/servers/myServer...
 - Include \${server.config.dir}/includes/safSe...
 - Include \${server.config.dir}/includes/safTra...
 - Include \${server.config.dir}/includes/ipic.xml
 - Include \${server.config.dir}/includes/keyrin...
 - Include \${server.config.dir}/includes/apiRe...
 - Include \${server.config.dir}/includes/share...
 - Include \${server.config.dir}/includes/oauth...
 - Include \${server.config.dir}/includes/audit...
 - Include \${server.config.dir}/includes/mq.xml
 - Include \${server.config.dir}/includes/db2.xml

- Below the tree view, there is a "Description" field containing "new server".
- Buttons for "Add child" and "Remove" are present.

Right View (Source Tab):

- The title bar says "Server Config" and the file name is "server.xml".
- The "Save" and "Close" buttons are visible.
- The "Source" tab is selected, indicated by 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="${server.config.dir}/includes/adminCenter.xml"/>
10<include location="${server.config.dir}/includes/apiRequesterHTTPS.xml"/>
11<include location="${server.config.dir}/includes/shared.xml"/>
12<include location="${server.config.dir}/includes/oauth.xml"/>
13<include location="${server.config.dir}/includes/audit.xml"/>
14<include location="${server.config.dir}/includes/mq.xml"/>
15<include location="${server.config.dir}/includes/db2.xml"/>
16<include location="${server.config.dir}/includes/wlm.xml"/>
17<include location="${server.config.dir}/includes/restConnector.xml"/>
18<include location="${server.config.dir}/includes/smf.xml"/>
19<include location="${server.config.dir}/includes/adminCenter.xml" />
```

- The XML code continues with comments and additional elements.

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

```
ALLOC FILE(SYSTCPT) DA(*)  
ping wg31.washington.ibm.com  
Resolver Trace Initialization Complete -> 2021/09/12 12:54:37.36  
  
res_init Resolver values:  
Setup file warning messages = No  
CTRACE TRACERES option = No  
Global Tcp/Ip Dataset = SYS1.TCPIP.TCPPARMS(TCPDAT3)  
Default Tcp/Ip Dataset = SYS1.TCPIP.TCPPARMS(TCPDAT3)  
Local Tcp/Ip Dataset = //DD:SYSTCPD  
                      ==> SYS1.TCPIP.TCPPARMS(TCPDAT3)  
Translation Table = SYS1.TCPIP.STANDARD.TCPXLBIN  
UserId/JobName = JOHNSON  
Caller API = TCP/IP Sockets Extended  
Caller Mode = EBCDIC  
System Name = WSC13 (from VMCF)  
UnresponsiveThreshold = 25  
(G) DataSetPrefix = SYS1.TCPIP  
(G) HostName = MPZ3  
.  
.  
.  
res_query Failed: RetVal = -1, RC = 1, Reason = 0x78981005  
res_querydomain Failed: RetVal = -1, RC = 1, Reason = 0x78981005  
res_search Failed: RetVal = -1, RC = 1, Reason = 0x78981005  
GetAddrInfo Closing IOCTL Socket 0x00000000  
BPX1CLO: RetVal = 0, RC = 0, Reason = 0x00000000  
GetAddrInfo Failed: RetVal = -1, RC = 1, Reason = 0x78AE1004  
GetAddrInfo Ended: 2021/09/12 12:55:32.364732  
*****  
EZZ3111I Unknown host 'WG31.WASHINGTON.IBM.COM'
```

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

Identity assertion and/or JWT generation Extended Attribute (OpenAPI 2)

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

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

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

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

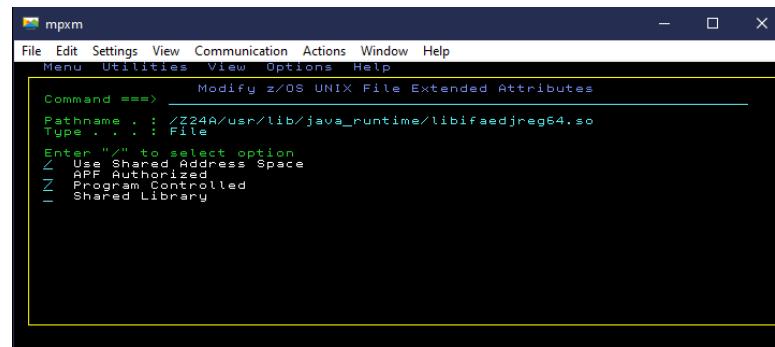
```
RDEFINE SURROGAT clientID.BAQASSRT UACC(NONE) OWNER(SYS1)
PERMIT clientID.BAQASSRT CLASS(SURROGAT) ACCESS(READ) ID(zCEEID)
```

OR

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

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

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



Sample JCL - Check Java installation by display Java version information

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

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



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

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



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

cscvinc.properties

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

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

Sample JCL - Executing multiple OMVS commands in one step

```

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

```

Always be aware of the beginning and trailing spaces.

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



Sample JCL - Executing the Liberty *securityUtility* command

```
*****  
/* Use securityUtility to encrypt a password using an  
/* encryption key stored in a certificate  
*****  
//IKJEFT01 EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *  
BPXBATCH SH +  
/usr/lpp/IBM/zosconnect/v3r0/wlp/bin/securityUtility encode +  
--encoding=aes +  
--keyring=safkeyring://JOHNSON/Liberty.KeyRing +  
--keyringType=JCERACFKS --keyLabel="Johnson Client Cert" +  
passwordToEncrypt
```

```
<featureManager>  
  <feature>zosPasswordEncryptionKey-1.0</feature>  
</featureManager>  
  
<zosPasswordEncryptionKey  
keyring="safkeyring://JOHNSON/Liberty.KeyRing"  
label="Johnson Client Cert" type="JCERACFKS"/>
```

```
*****  
/* Use securityUtility to encrypt a password using an  
/* encryption key string  
*****  
//IKJEFT01 EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *  
BPXBATCH SH +  
/usr/lpp/IBM/zosconnect/v3r0/wlp/bin/securityUtility encode +  
--encoding=aes -key myEncryptionKey +  
passwordToEncrypt
```

```
wlp.password.encryption.key=myEncryptionKey
```



Sample JCL - Executing the Liberty *productInfo* command

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

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

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

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

Sample JCL - Copy WOLA executables from OMVS to a PDSE

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



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

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

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

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



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

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

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

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

Sample JCL – Generate WLM Workload Activity Reports

```
//JOHNSONS JOB (ACCOUNT),NOTIFY=&SYSUID,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)  
//DELETE EXEC PGM=IDCAMS  
//SYSPRINT DD SYSOUT=*  
//SYSIN DD *  
    DELETE JOHNSON.DUMPSMF.SORT  
//RMFSORT EXEC PGM=SORT,REGION=0M  
//SORTIN DD DISP=SHR,DSN=MPZ3.DUMPSMF  
//SORTOUT DD DISP=(,CATLG),DSN=JOHNSON.DUMPSMF.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.DUMPSMF.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)									
COMMAND INPUT ==> PS		SCROLL ==> CSR									
NP	JOBNAME	Status	Owner	State	CPU-Time	PID	PPID	ASID	ASIDX	LatchWaitPID	Command
BAQSTRT	WAITING FOR CHILD	LIBSERV	1W	40.01	69050	83955129	42	002A			/bin/sh /usr/lpp/IBM/zosconnect/v3r0/bin
BAQSTRT	OTHER KERNEL WAIT	LIBSERV	HK	40.01	16846267	69050	42	002A			/usr/lpp/java/J8.0_64/bin/java -javagen
BAQZANGL	SWAPPED, RUNNING	LIBANGE	1RI	0.01	50399398	83953829	77	004D			/usr/lpp/IBM/zosconnect/v3r0/wlplib/nat
BAQZANGL	SWAPPED, FILE SYS KERNEL WAIT	LIBANGE	1FI	0.01	83953829		1	77	004D		BPXBATA2
BAQSTRT	FILE SYS KERNEL WAIT	LIBSERV	1F	40.01	83955129		1	42	002A		BPXBATSL

```
*****
product = WAS FOR z/OS 21.0.0.9, z/OS Connect 03.00.52 (wlp-1.0.56.cl210920210909-1618)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/J8.0_64
java.version = 1.8.0_301
java.runtime = Java(TM) SE Runtime Environment (8.0.6.36 - pmz6480sr6fp36-20210913_01(SR6 FP36))
os = z/OS (02.03.00; s390x) (en_US)
process = 16780584@wg31
*****
```

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