zOSSEC1 – IBM z/OS Connect Administration

A dive into Liberty and z/OS Connect Administration

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Disclaimer

- Information in this presentation was derived from product documentation. URLs are provided if more details are desired.
- Additional information included in this presentation was distilled from years of experience as an administrator z/OS products like CICS, IMS, Db2, MQ, etc. as well as Java runtimes environments like WebSphere Application Server and Liberty.
- There will be additional information on slides that will designated as Tech/Tips. These contain information that the author thinks is perhaps at least interesting and hopefully may prove useful to the reader.
- A z/OS or Liberty or z/OS Connect icon will appear on slides where the information is specific to these products. Don't hesitate to ask questions as to why the icon does or does not appear on certain slides.
- The examples, tips, etc. present in this material are based on firsthand experiences and are not necessarily sanctioned by Liberty or z/OS Connect development.

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Agenda

- Review the basics of OMVS, RACF Liberty and z/OS Connect configuration
- Connecting a z/OS Connect server to other z/OS subsystems and API providers
- Useful Liberty features and MVS commands
- Where do I look when things go wrong?
- Managing and Monitoring Liberty and z/OS Connect environments
- Miscellaneous Odds and Ends
- Appendix - sample administrative JCL

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

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Create a z/OS Connect server by using the *zosconnect* command

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

zosconnect create serverName --template=templateName

Where ***templateName*** can be:

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

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

zosconnect create zceesrvr --template=zosconnect:apiRequester

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

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

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Tech/Tip: Verify your OMVS environment*

- Start an OMVS shell session and verify that Java is fully operational by entering command ***java –version***, you see should results like this:

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

- Verify that RACF identities associated with started tasks have OMVS segments with UIDs and GIDs and valid HOME directories and that the identities can invoke Java commands.
- Prevent out-of-memory or other storage issues:
  - Verify the Java runtime is not being limited by system parameters, e.g., *MAXASSIZE (2 147 483 647*), *MAXTHREADS*, etc., for details see *BPXPRM setting* at URL https://www.ibm.com/docs/en/sdk-java-technology/8?topic=SSYKE2_8.0.0/com.ibm.java.vm.80.doc/docs/j9_configure_zos_bpxprm.html
  - Check the value of *ASSIZEMAX* in the OMVS segments of the identifies involved and ensure it is adequate, see *MAXASSIZE* above.
  - Exclude OMVS from any IEFUSI exit, SUBSYS(OMVS,NOEXITS) in PARMLIB member *SMFRPMxx*.
- ***Verify the zconsetup script has been executed. My recommendation is to execute this script in the SMP/E target environment, otherwise it will be lost when service is applied and propagated to other images.***

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***be sure the power plug is plugged into the outlet**

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

	Owner	Group	Other
	Read Write Execute	Read Write Execute	Read Write Execute
Bit	1 1 1	1 0 1	0 0 0
Base-2 Value	[4] [2] [1]	[4] [2] [1]	[4] [2] [1]
	4 + 2 + 1 =	4 + 0 + 1 =	0 + 0 + 0 =
	7 The owner has READ, WRITE and EXECUTE	**5** The group has READ and EXECUTE, but not WRITE	**0** Others have nothing
			
	The **owner** of the file or directory	IDs that are part of the **group** for the file or directory	IDs that are not the owner and not part of the group; that is, **other**
	chmod –R* u+rwx zceesrv1	chmod g+rwx server.xml	chmod –R* o+rx resources chmod –R* o-w resources/security

-R* indicates recursion

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The default server configuration directories and files

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

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

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

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

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

- If you have multiple people with a need to change configuration files, do you share the password of LIBSERV?
  (answer: **no**)
  Sharing passwords is a bad practice. Better to take advantage SAF SURROGAT so permitted users can switch to the owning ID so they can make changes. In fact, LIBSERV should be a PROTECTED identity with no password in the first place.
- If you have multiple people with a need to read or update configuration files, do you simply connect them to LIBGRP?
  (answer: **no**)
  The owner group may be granted access to other resources (on z/OS SAF profiles notably: SERVER) and you do not want others inheriting that. Better to make the configuration group be something different from the owner group and grant READ/WRITE through that group.

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One suggestion for settings of the server configuration permission bits

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

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

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

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

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

N.B. Access for Owner, Group, Others depends on the UID and GID as stored with the directory or file, not the actual SAF identity or group. This means when moving entire filesystems from one LPAR to another using utility ADRDSSU ownership, group access may change to another identity and group. Be consistent in UIDs and GIDs across LPARs.

CWWKB0121I: The server process UMASK value is set to 0000
- sets permission bit for new files deployed using the RESTful artifacts to rw-rw-rw (666 x'OR 000)

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Tech/Tip: Use SAF SURROGAT Resources

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

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

Define a SURROGAT profile for the server's SAF identity

RDEFINE SURROGAT BPX.SRV.*LIBSERV*

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

RDEFINE SURROGAT *LIBSERV*.SUBMIT

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

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

Refresh the SURROGAT in storage profiles

SETROPTS RACLIST(SURROGAT) REFRESH

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

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

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

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

- *Refresh the UNIXPRIV and/or FACILITY instorage profiles*
  SETROPTS RACLIST(UNIXPRIV,FACILITY) REFRESH

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

Use these commands only if you understand the implications.

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


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

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

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

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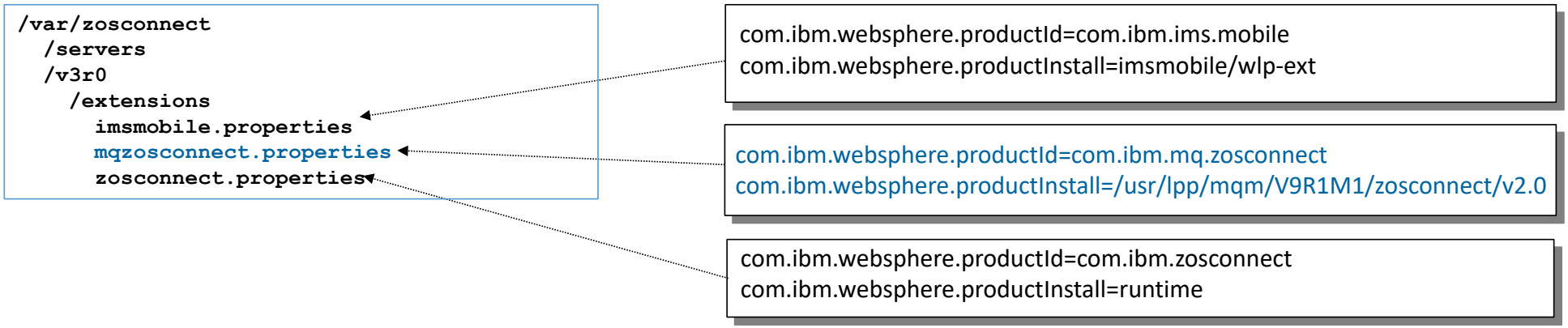
LPAR specific directories and files created by *zconsetup*

The *zconsetup* script creates a symbolic link from the WLP *etc* directory in */usr/lpp/IBM/zosconnect/v3r0/wlp* (normally mounted R/O) to a local R/W directory and will create a default configuration directory and a local extension directory.

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



- This directory structure and contents is created by 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 value of the *com.ibm.websphere.productInstall* directive 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:zosconnect-2.0* or *CWWKE0054E: Unable to open /usr/lpp/IBM/zosconnect/v3r0/wlp/etc/extensions/zosconnect.properties*
- MQ service provider is not shipped with z/OS Connect so the MQ executables are outside of the z/OS Connect directory structure.

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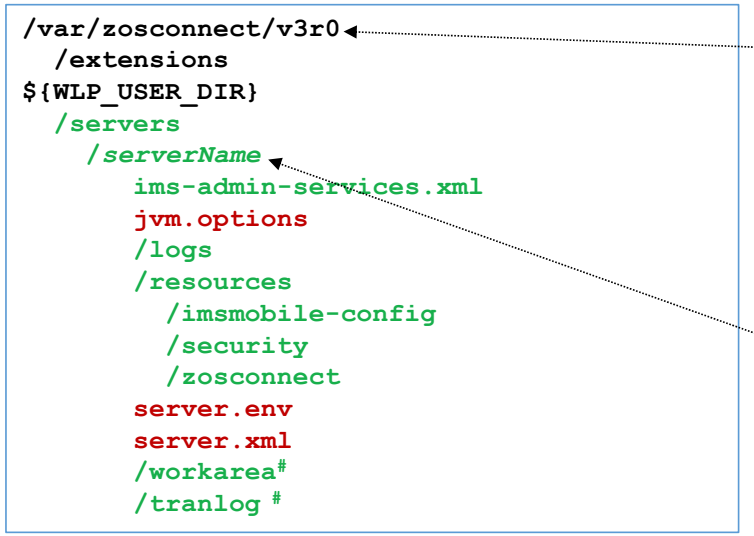
A Tour of a server's directories and files



- 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 by invoking the *zosconnect create serverName* script.
- 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.

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

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

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

SYS1.PARMLIB(BPXPRM##)

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

- Create a dedicated filesystem for the root z/OS Connect */var/zosconnect* directory, e.g., */var/zosconnect*. This provides portability for migrations and system upgrades. Note: This means that MODE(READ) will apply to */var/zosconnect/servers* unless another file system is mounted here.

- 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
```

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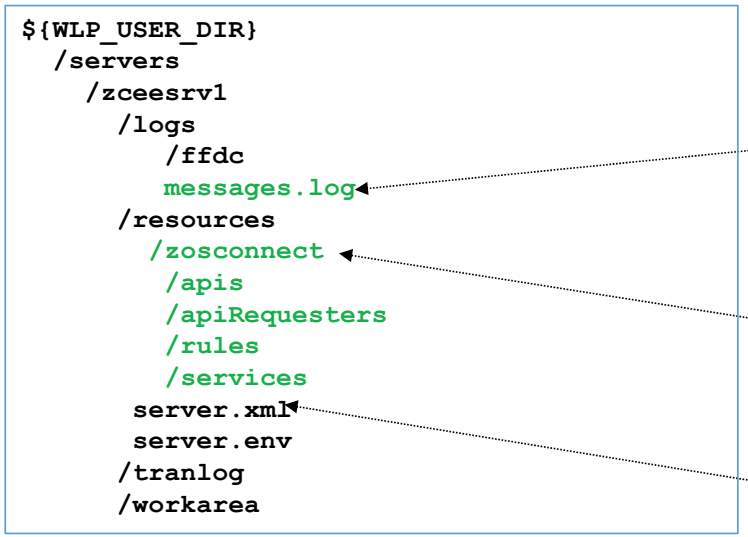
A Tour of Server Configuration Directories and Files

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



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

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

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

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

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Tech/Tip: Liberty environment variables

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

- **WLP_LOGGING_CONSOLE_LOGLEVEL**[#] - The logging level used to filter messages written to system streams (STDOUT). The valid values are INFO, AUDIT, WARNING, ERROR, and OFF. By default, the WLP_LOGGING_CONSOLE_LOGLEVEL environment variable is set to AUDIT. Valid options are:
  - **AUDIT -** Audit and warning messages will be written to the system output stream (STDOUT). Error messages will be written to the system error stream (STDERR).
  - **ERROR -** Error messages will be written to the system error stream (STDERR).
  - **INFO -** Info, audit, and warning messages will be written to the system output stream. Error messages will be written to the system error stream (STDERR)
  - **OFF -** No server output is written to system streams (STDOUT). Only JVM output is written to system streams(STDOUT).
  - **WARNING -** Warning messages will be written to the system output stream (STDOUT). Error messages will be written to the system error stream (STDERR).

  STDOUT and STDERR refer to the DD statements in the server JCL, e.g., spool output.
- **WLP_LOGGING_CONSOLE_FORMAT**[#] - The required format for the console. Valid values are DEV, SIMPLE, or JSON format. By default, WLP_LOGGING_CONSOLE_FORMAT is set to DEV. Valid options are:
  - **DEV -** Use the dev logging format.
  - **JSON -** Use the JSON logging format.
  - **SIMPLE -** Use the simple logging format. As of Liberty release 20.0.0.6 (z/OS Connect V3.034), this format writes the messages to STDOUT and STDERR with time stamps included.
- **WLP_OUTPUT_DIR**[#] - This environment variable can be used to specify an alternative location for server generated output such as logs, the workarea directory, and generated files.
- **WLP_USER_DIR** – This environment variables specifies where the runtime environment looks for shared resources and server definitions.

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

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

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

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Tech/Tip: Liberty Java Directives for controlling output

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

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

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

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

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

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

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

JVM Options example (JCL):
JVM_OPTIONS=-Dcom.ibm.ws.logging.log.directory=/u/johnson/logs -Dcom.ibm.ws.logging.max.file.size=10

bootstrap.properties example:
com.ibm.ws.logging.message.file.name=basqstrtMessages.log
com.ibm.ws.logging.log.directory=/u/common/logs

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

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https://www.ibm.com/docs/en/was-liberty/zos?topic=liberty-logging-trace

Tech/Tip: Initial server.xml configuration file

Default server.xml configuration file

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

    <!-- To access this server from a remote client add a host attribute
    <httpEndpoint id="defaultHttpEndpoint"
                  host="*"
                  httpPort="9080"
                  httpsPort="9443" />
 <!-- add cors to allow cross origin access, e.g. when using swagger
    <cors id="defaultCORSConfig"
          domain="/"
          allowedOrigins="*"
          allowedMethods="GET, POST, PUT, DELETE, OPTIONS"
          allowedHeaders="Origin, Content-Type, Authorization, Cache-Con
          allowCredentials="true"
          maxAge="3600"/>
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  - 18 Line(s) not Displayed
 <!-- config requires updateTrigger="mbean" for REFRESH command support
 <config updateTrigger="mbean" monitorInterval="500"/>

    <zosconnect_zosConnectManager setUTF8ResponseEncoding="true"/>

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

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

Modified server.xml configuration file

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

*Added in V3.0.48 with no HOLD information provided

Simplify maintenance by :

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

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Tech/Tip: Be aware of the default values for updateTrigger and polling attributes

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

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

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

<!-- zosConnect API requesters -->
 <zosconnect_apiRequesters updateTrigger="disabled" pollingRate="5s"/>

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

<!-- zosConnect policies -->
 <zosconnect_policy pollingRate="1m" updateTrigger="disabled"/>

<!-- zosConnect data transformer -->
 <zosconnect_zosConnectDataXform pollingrate="2s" updateTrigger="polled"/>

<!—A security certificate repository -->
 <keystore pollingrate="500ms" updateTrigger="mbean"/>
```

- **disabled** Disables all update monitoring. Configuration changes will not be applied while the server is running.
- **mbean** Server will only update the configuration when prompted by the FileNotificationMbean. The FileNotificationMbean is typically called by an external program such as an integrated development environment or a management application. (Or an MVS MODIFY command)
- **polled** Server will scan for changes at the polling interval on all the configuration files and update the runtime configuration with the changes detected.

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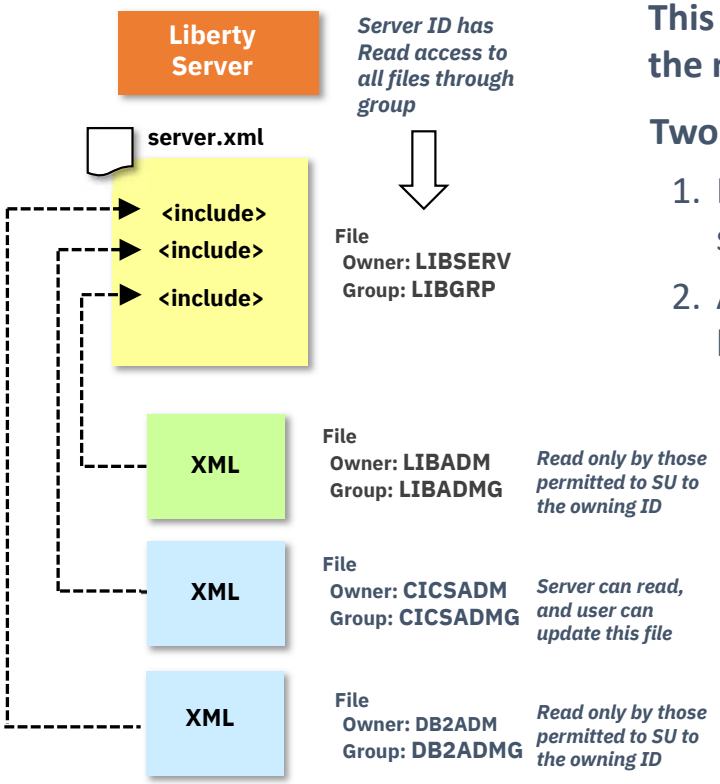
Take advantage of Liberty's supports server XML "include" file processing



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

Two primary uses:

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

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

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

This tells Liberty to ignore XML elements in include file that are also found in the main server.xml
It does not prevent them from injecting configuration elements not found in the main server.xml. If there is a concern about that, don't use include processing.

Nesting of an include file within a include file is possible

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Using “administration include” files to manage the server XML

- Setup a server.xml using ‘include’ statements and allow other administrator to manage those included files, but not the server.xml itself.

- Control what configuration can be overridden in included files using the ‘onConflict’ option provided with the include element (see Ignore, Replace, Merge).

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

server.xml (owned by ID ADMIN1)

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

db2.xml (owned and managed by a DBA)

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

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

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

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

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

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Tech-Tip: Review configuration conflicts

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

onConflict="MERGE"	Conflicting elements will be merged, and the last value encountered will be used.
onConflict="REPLACE"	When elements conflict, the element in the included file will be ignored
onConflict="IGNORE"	Conflicting elements in the included file are ignored.

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

zceesrv1's bootstrap.properties

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

zceesrv2's bootstrap.properties

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

server.xml

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

ipicIDProp.xml

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

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

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

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

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Sharing XML configuration files between servers

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

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

/var/zosconnect/servers/zceesrv1/includes

/var/zosconnect/servers/zceesrv2/includes

/var/zosconnect/servers/zceesrv3/includes

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

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

Contents of the three “includes” directory

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

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

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

So, let’s take this a step further

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Sharing XML configuration files between servers

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

OMVS commands

Symbolic links to a shared local LPAR directory

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

Symbolic links to a shared Sysplex directory

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

/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

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"/>
```

F ZCEESRV1,REFRESH,CONFIG

F ZCEESRV2,REFRESH,CONFIG

F ZCEESRV3,REFRESH,CONFIG

Consider creating an "include" file with just the include statements and then include this file in each server's server.xml file.

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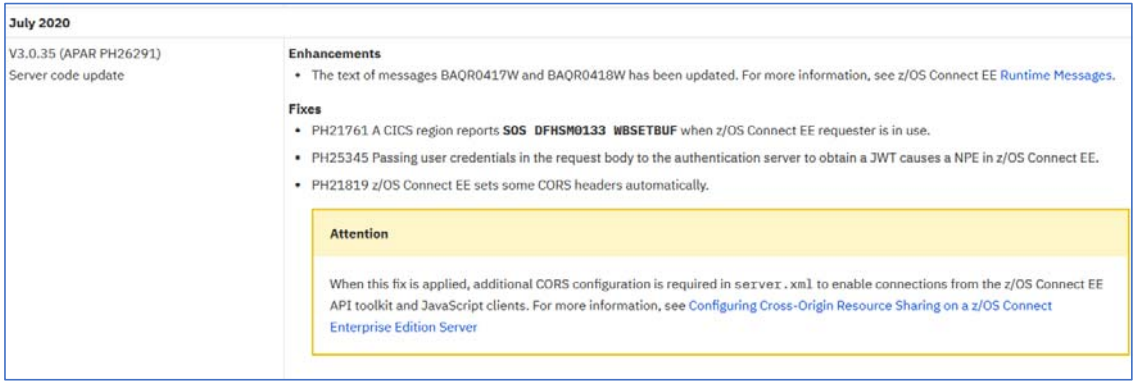
*https://www.ibm.com/docs/en/zos/2.3.0?topic=zuapbfizv-zos-unix-add-global-directory-sysplex-root-file-system

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



July 2020

V3.0.35 (APAR PH26291)
Server code update

Enhancements

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

Fixes

- PH21761 A CICS region reports **SOS DFHSM0133 WBSETBUF** 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"/>
```

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Sharing XML configuration files – using *variable* files

myServer.xml

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

zceeopid.xml

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

server.xml

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

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

safSecurity.xml

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

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

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

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

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

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

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

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

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

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


```
Performing commands:
ln -s /global/zosconnect/includes /var/zcee/includes
ln -s /var/zosconnect/servers/zceesrv1 /var/zcee/zceesrv1
ln -s /var/zosconnect/servers/zceesrv2 /var/zcee/zceesrv2

Changes the ln command from:
ln -s /global/zosconnect/includes /var/zosconnect/servers/zceesrv1/includes
ln -s /global/zosconnect/includes /var/zosconnect/servers/zceesrv2/includes

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

Directory Shortcuts

Which leads to shorter OMVS commands:

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

or

/u/johnson/.profile

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

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

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

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

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

Contents of each of the "resources/zosconnect" directory

```
/apis
/apiRequesters
/rules
/services
```

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

OMVS commands

Symbolic links to a local file system

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

Or a symbolic links to a shared file system

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

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

/global/zosconnect/resources/....

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

shared.xml

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

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

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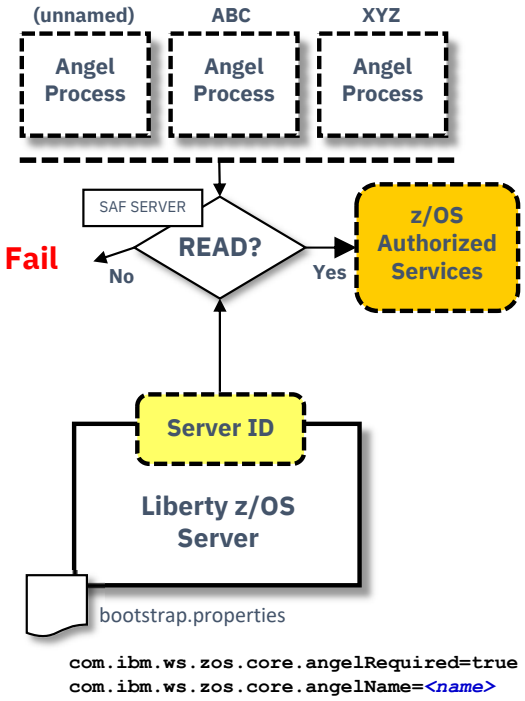
z/OS : The Angel process – what is this about?



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

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

Best practice:

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

List of current Liberty Features

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

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z/OS : SAF SERVER profiles related to the Angel

Best practice:

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

Tech/Tip: The SAFLOG parameter was added in a recent Liberty drop. If this parameter is set to Y, additional security related messages will be written to the JES messages and console if a Liberty server does not have authorization to use an angel-controlled privileged function. See URL
https://www.ibm.com/support/knowledgecenter/SS7K4U_liberty/com.ibm.websphere.wlp.zseries.doc/ae/rwlp_newinrelease.html
Liberty 21.0.6 add a new property to identity 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

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SAF APPL and EJBRole Resources

Connect z/OS Connect users to a common group

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

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

RDEFINE APPL BBGZDFLT UACC(NONE) OWNER(SYS1)
PERMIT BBGZDFLT CLASS(APPL) ACCESS(READ) ID(WSGUEST#, ZCEEUSRS)
SETROPTS RACLIST(APPL) REFRESH

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

```
RDEFINE EJBROLE BBGZDFLT.zos.connect.access.roles.zosConnectAccess +
    OWNER(SYS1) UACC(NONE)
PERMIT BBGZDFLT.zos.connect.access.roles.zosConnectAccess +
   CLASS(EJBROLE) ID(ZCEEUSRS) ACCESS(READ)
```

Refresh the EJBROLE in storage profiles

SETROPTS RACLIST(EJBROLE) REFRESH

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

\# https://www.ibm.com/support/knowledgecenter/SS7K4U_liberty/com.ibm.websphere.wlp.zseries.doc/ae/twlp_config_security_saf.html
https://www.ibm.com/support/knowledgecenter/SS4SVW_beta/securing/saf_unauthenticated_id.html#concept_saf_unauthenticated_id

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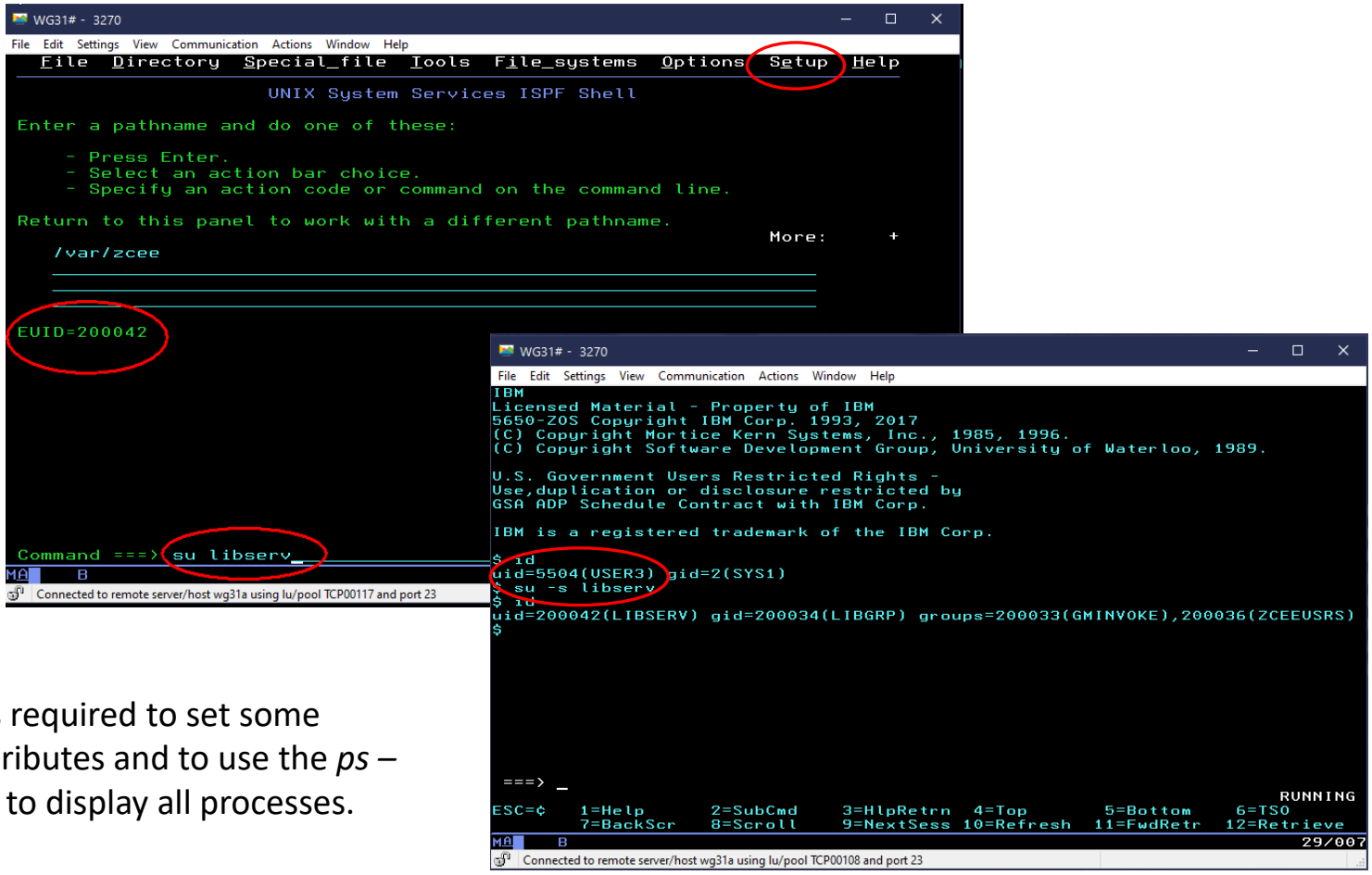
Tech/Tip: z/OS : ISPF/OMVS examples of using SURROGAT access



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

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

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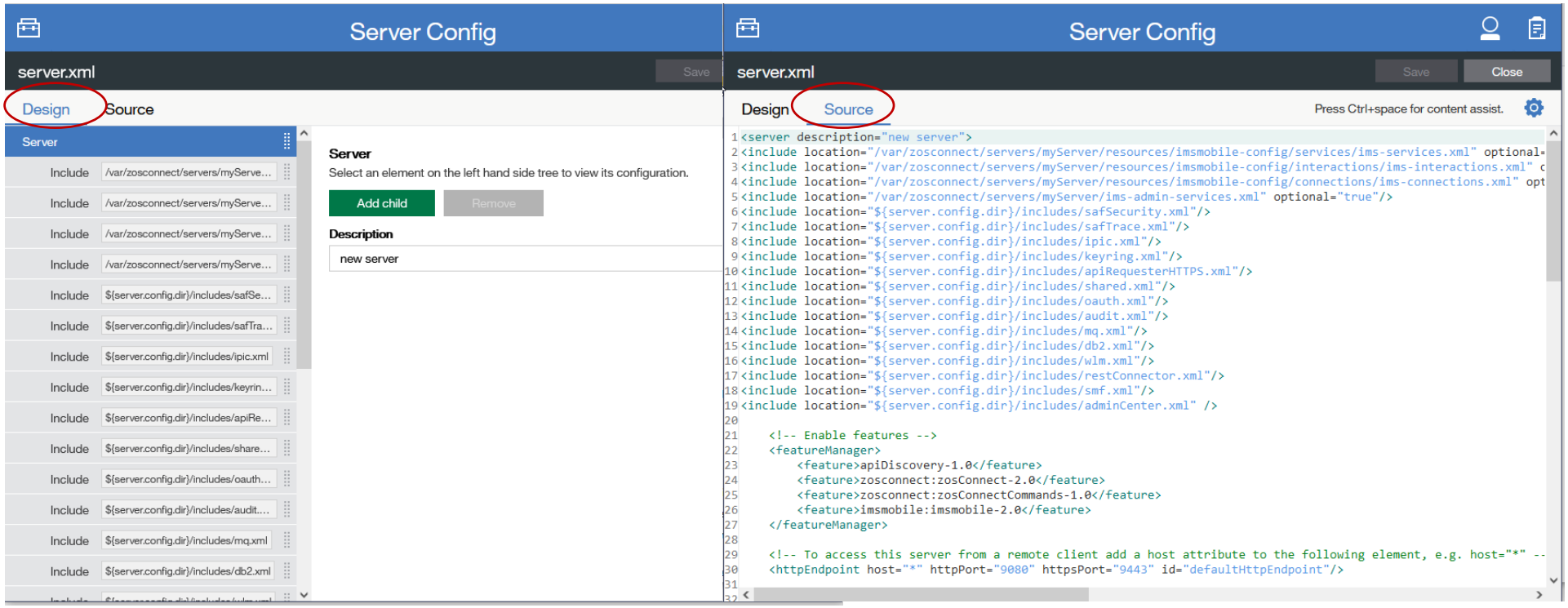
Tech-Tip: Liberty's "adminCenter" Feature

- Provides a web browser interface to the server's configuration files



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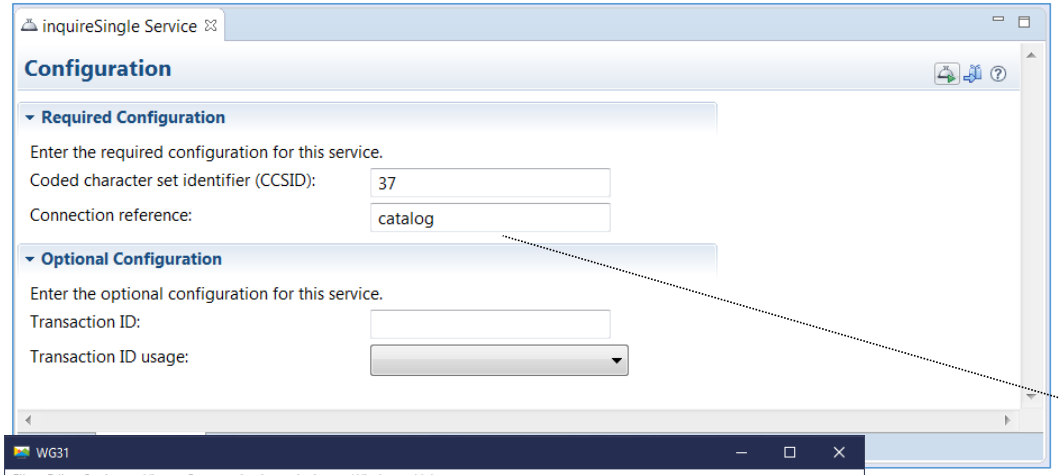
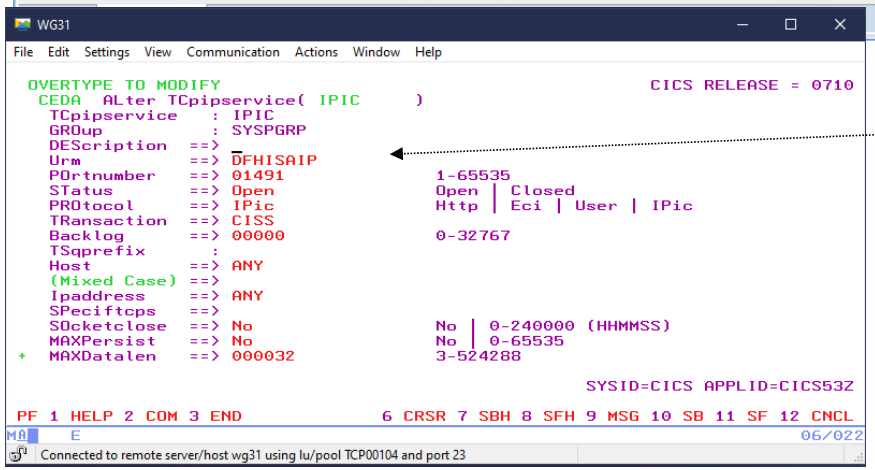
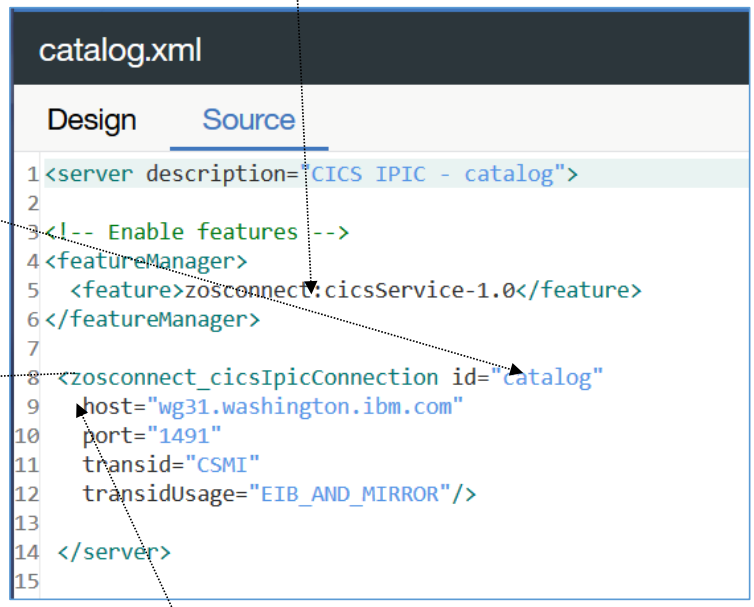
Server XML - Accessing a CICS program using IPIC

The server.xml file is the key configuration file:





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



Define IPIC connection to CICS

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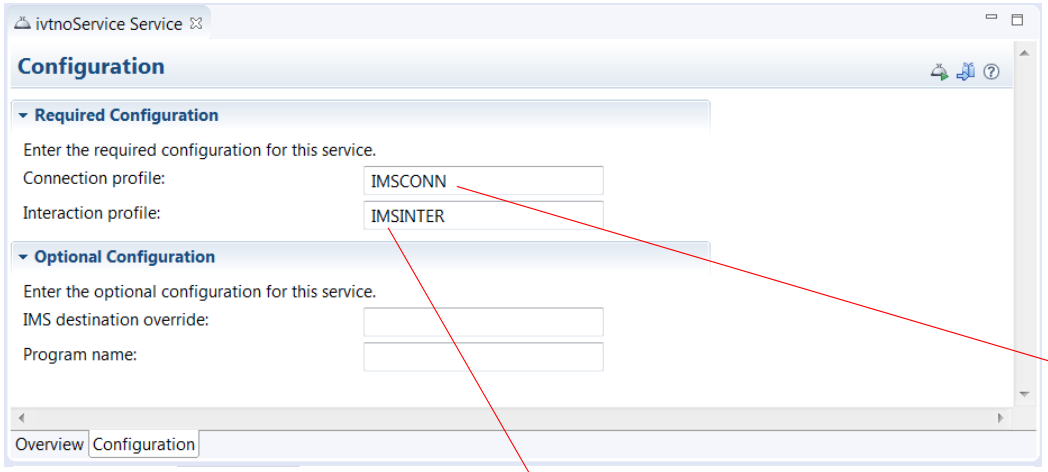
Server XML – Accessing an IMS Transaction using OTMA



IMS Connect HWSCFG

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

Connection

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

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

Interaction

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

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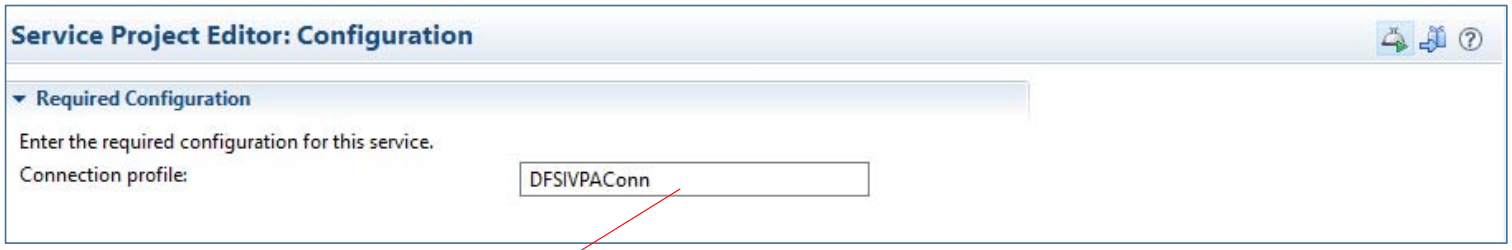
Server XML – Accessing am IMS Database using ODBA



ConnectionFactory

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

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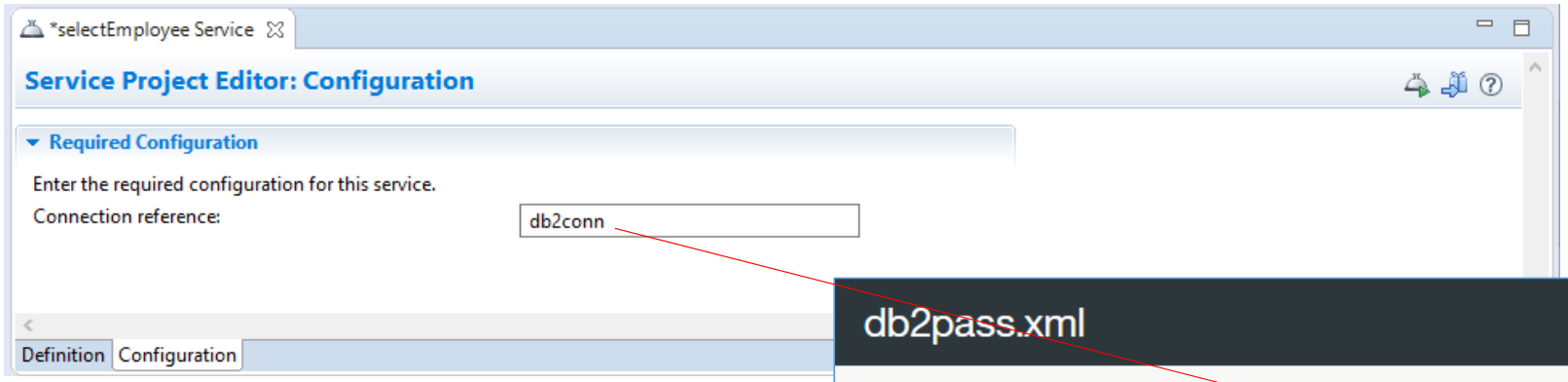
Server XML - Accessing a Db2 REST service




```
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
```

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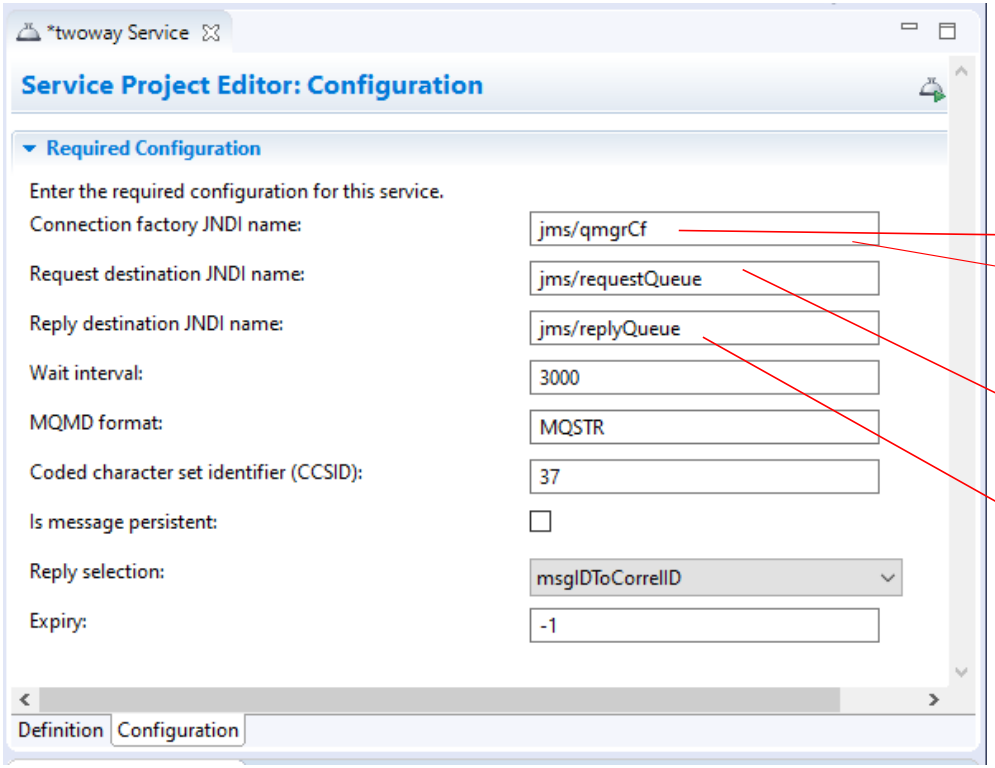
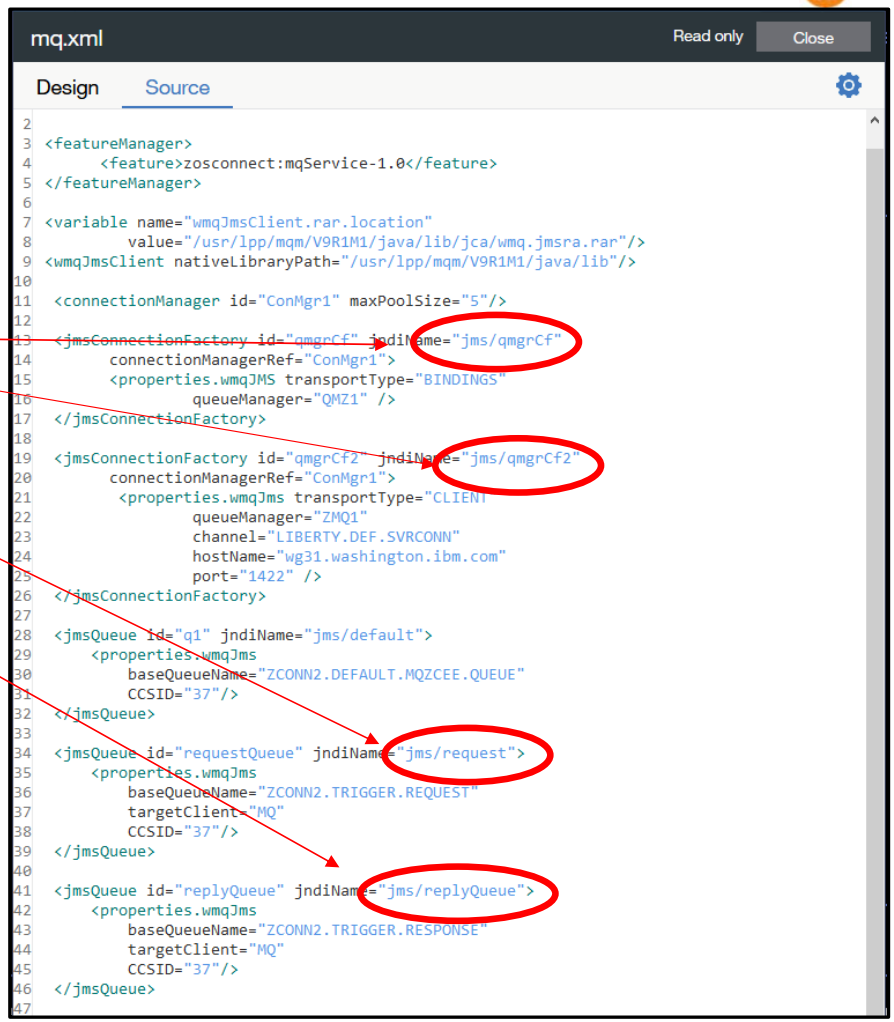
Server XML - Using JMS to access MQ





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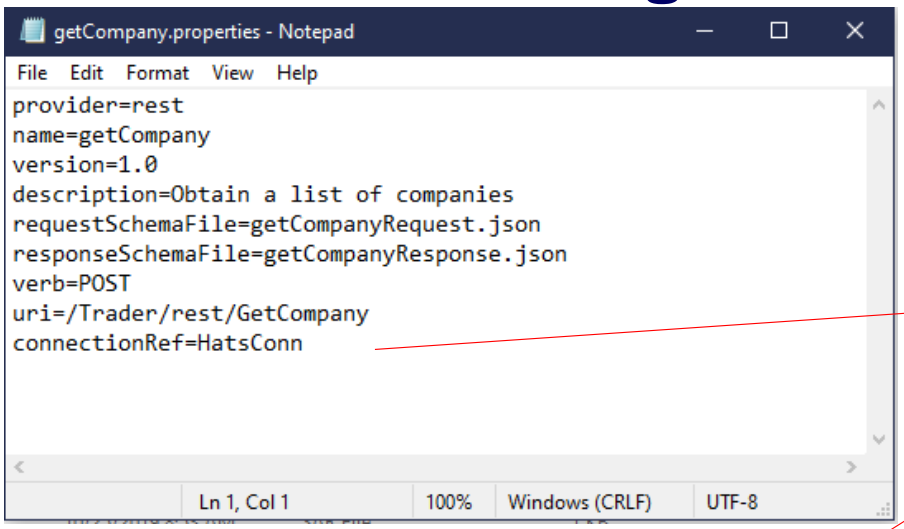
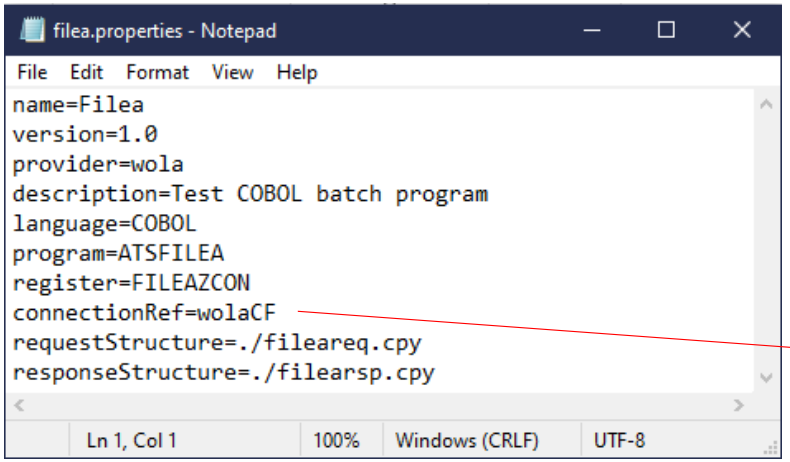
Server XML – Accessing a HATS REST service



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




```
      * 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 'ATSFILEA'                     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.
```

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Server XML – Accessing a DVM server using WOLA

Server Config

dvs.xml — Read only — Close

Design | Source

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <server description="new server">
3
4    <!-- Enable features -->
5    <featureManager>
6        <feature>usr:dvsProvider</feature>
7        <feature>zosLocalAdapters-1.0</feature>
8    </featureManager>
9
10 <!--   Adapter Details with WOLA Group Name (ZCEEDVM) -->
11   <zosLocalAdapters wolaName3="NAME3"
12                     wolaName2="NAME2"
13                     wolaGroup="ZCEEDVM"/>
14
15 <!--   DVS Service Details with Register Name (ZCEEDVM) -->
16   <zosconnect_zosConnectService invokeURI="/dvs"
17    serviceDescription=""
18    serviceRef="dvsService"
19    serviceName="dvsService"
20    id="zosConnectDvsService"/>
21
22   <usr_dvsService invokeURI="/dvs"
23    serviceName="DVSS1"
24    registerName="ZCEEDVM"
25    connectionFactoryRef="wolaCF"
26    id="dvsService"/>
27
28   <connectionFactory jndiName="eis/ola" id="wolaCF">
29       <properties.ola/>
30   </connectionFactory>
31
32   <zosconnect_zosConnectService serviceRef="svc1"
33    serviceAsyncRequestTimeout="600s"
34    serviceName="dvs1" id="sdef1"/>
35
36     <zosconnect_localAdaptersConnectService
37      connectionWaitTimeout="7200"
38      connectionFactoryRef="wolaCF"
39      serviceName="DVSS1"
40      registerName="ZCEEDVM"
41      id="svc1"/>
42
43 </server>
44
```

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
```

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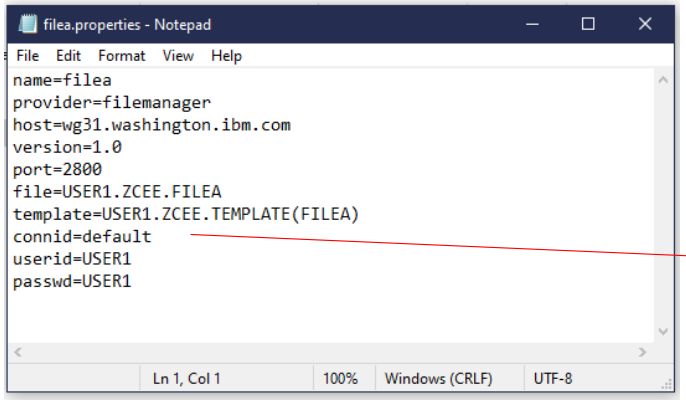
Server XML – Accessing a File Manager server



SYS1.PROCLIB(IPVSRV1)

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

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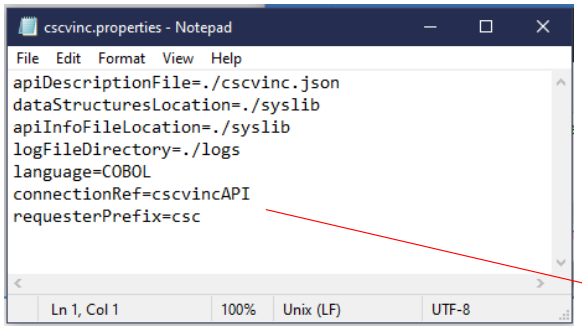
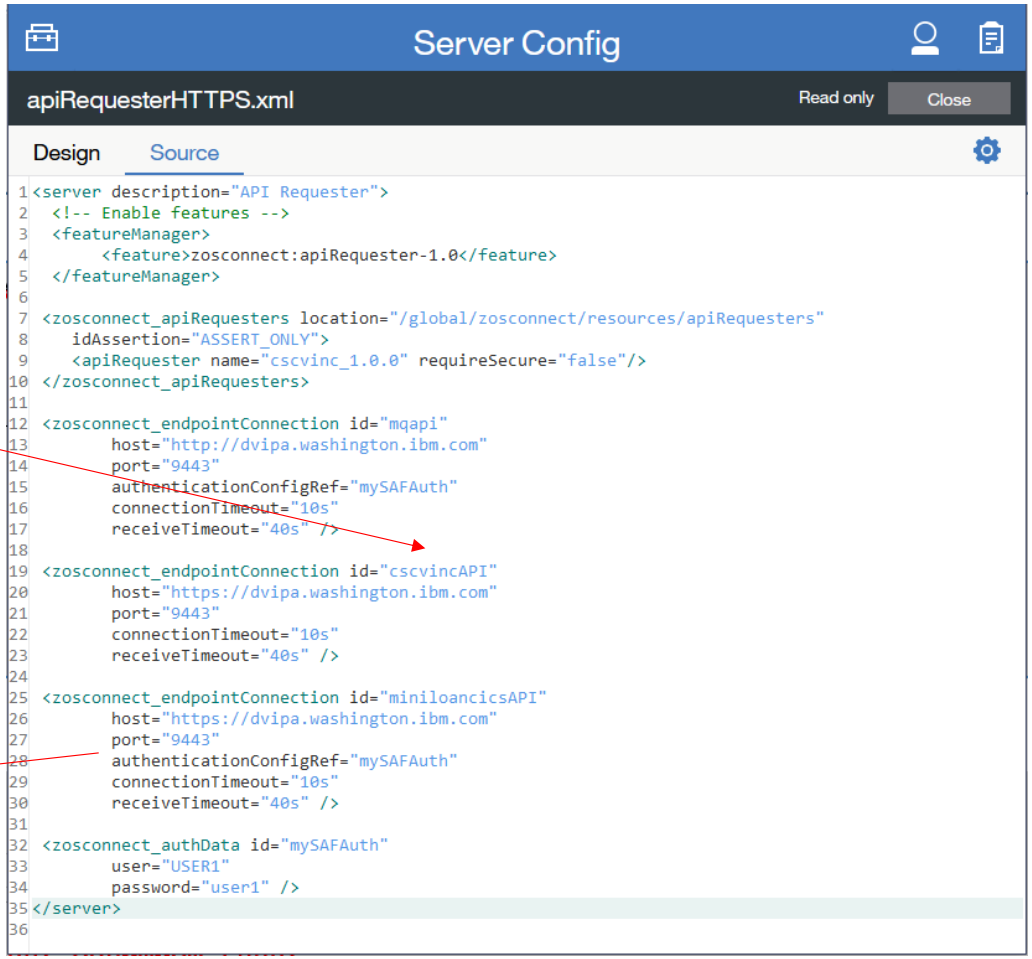
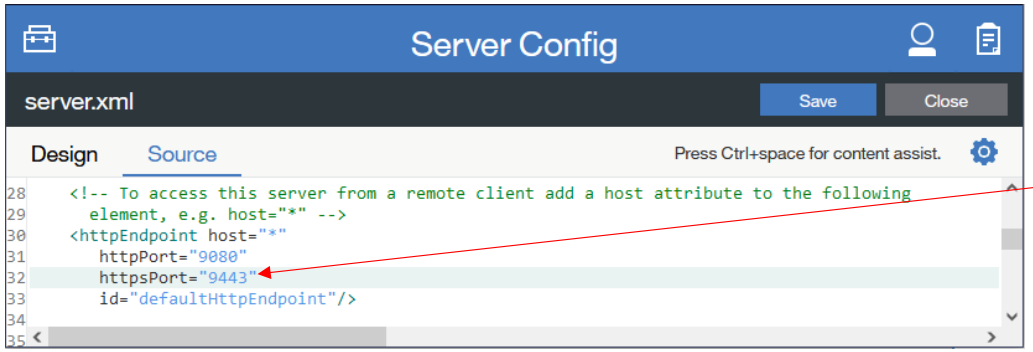
Server XML – Accessing a z/OS Connect API Provider







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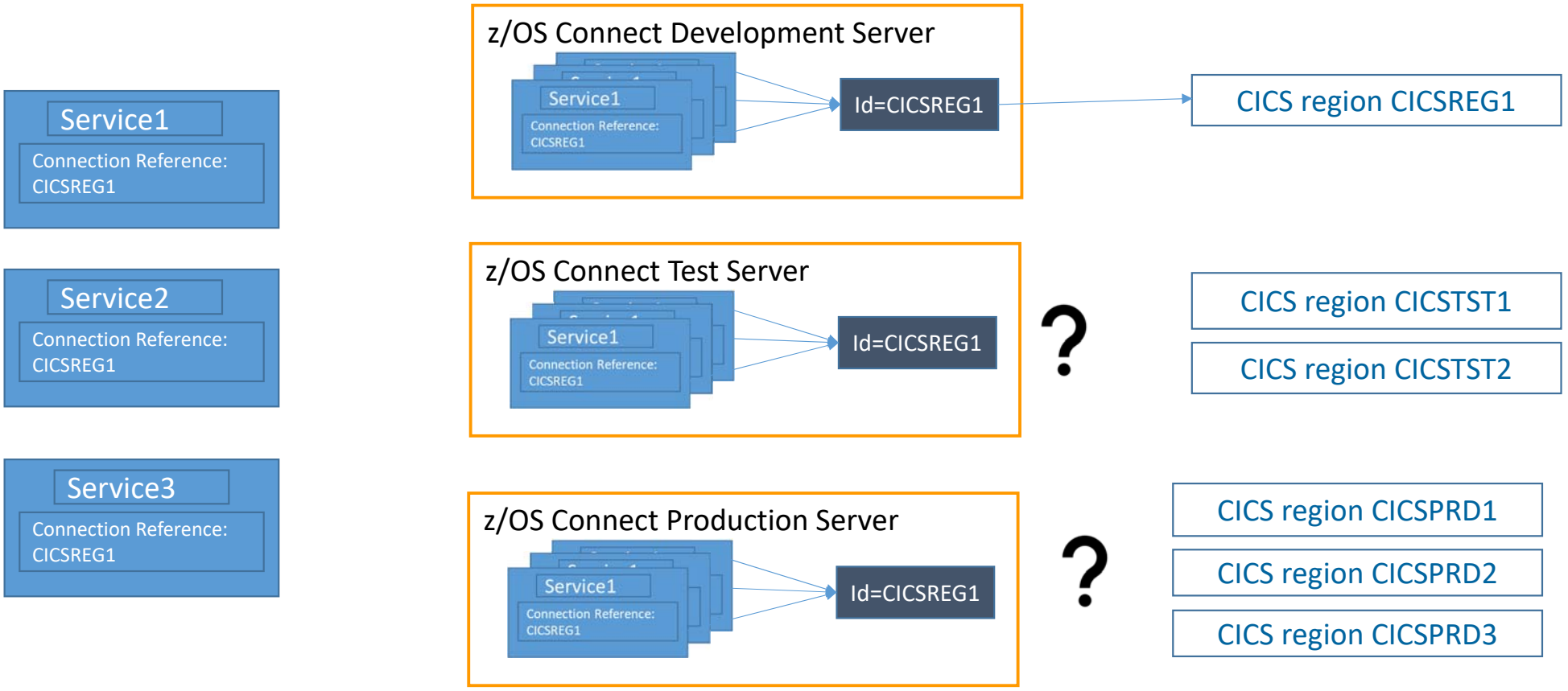
Use naming conventions for service connection references

Don’t couple connection names to specific systems



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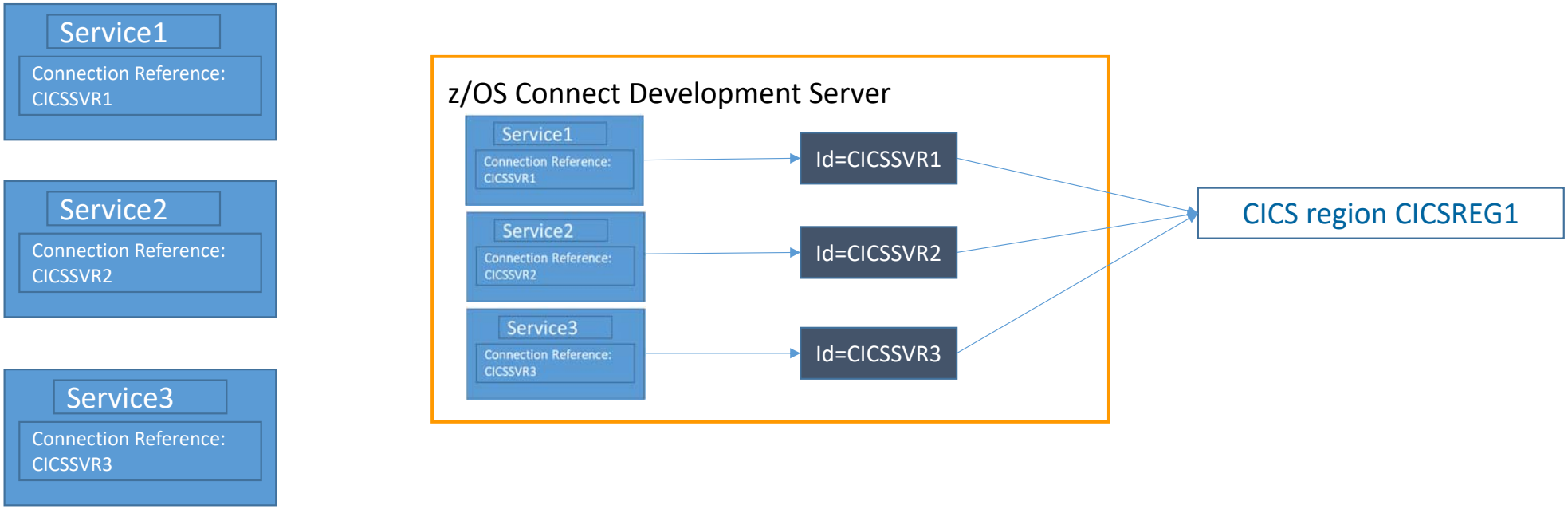
Use naming conventions for service connection references

Use application meaningful names for connection references



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Useful Liberty features and MVS commands

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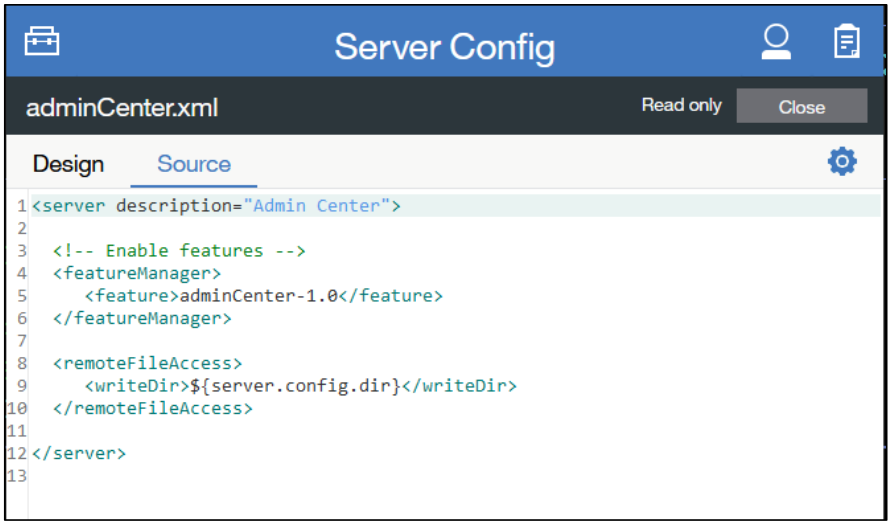
Use the adminCenter-1.0 feature to update the server XML from a browser

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




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

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

SETR RACLIST(EJBROLE) REFRESH
```

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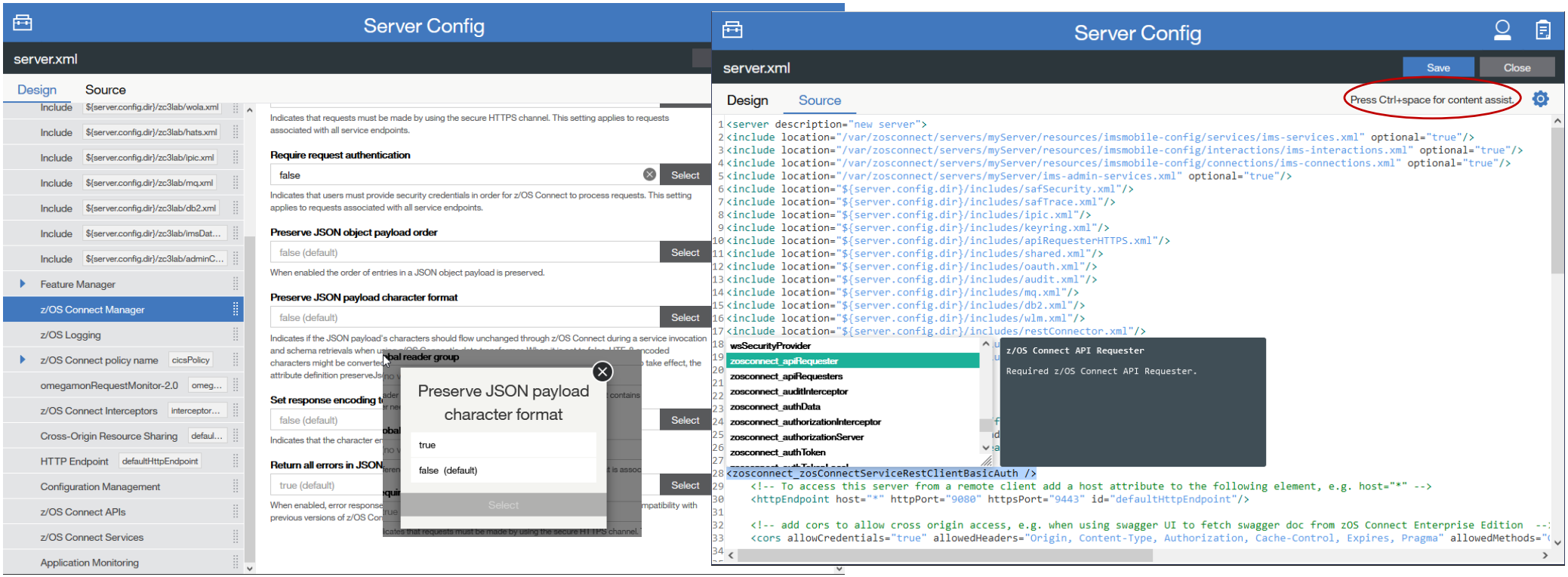
Tech-Tip: Liberty's "adminCenter" Feature to update server XML

- Web browser interface to the server's configuration files



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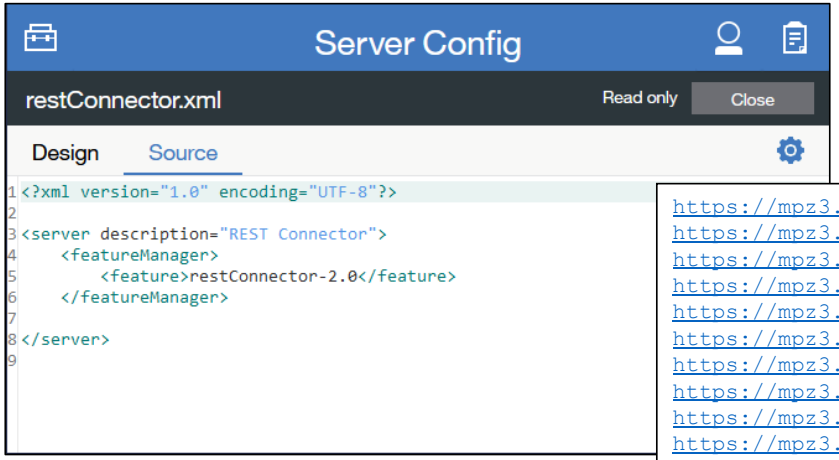
Use the restConnector-2.0 feature to see real time configuration details

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.



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

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

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

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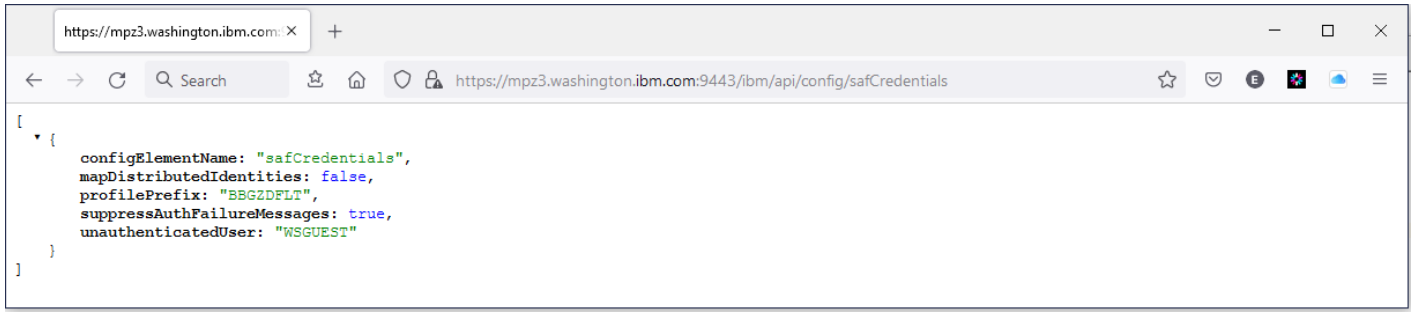
restConnector-2.0 feature examples

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




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

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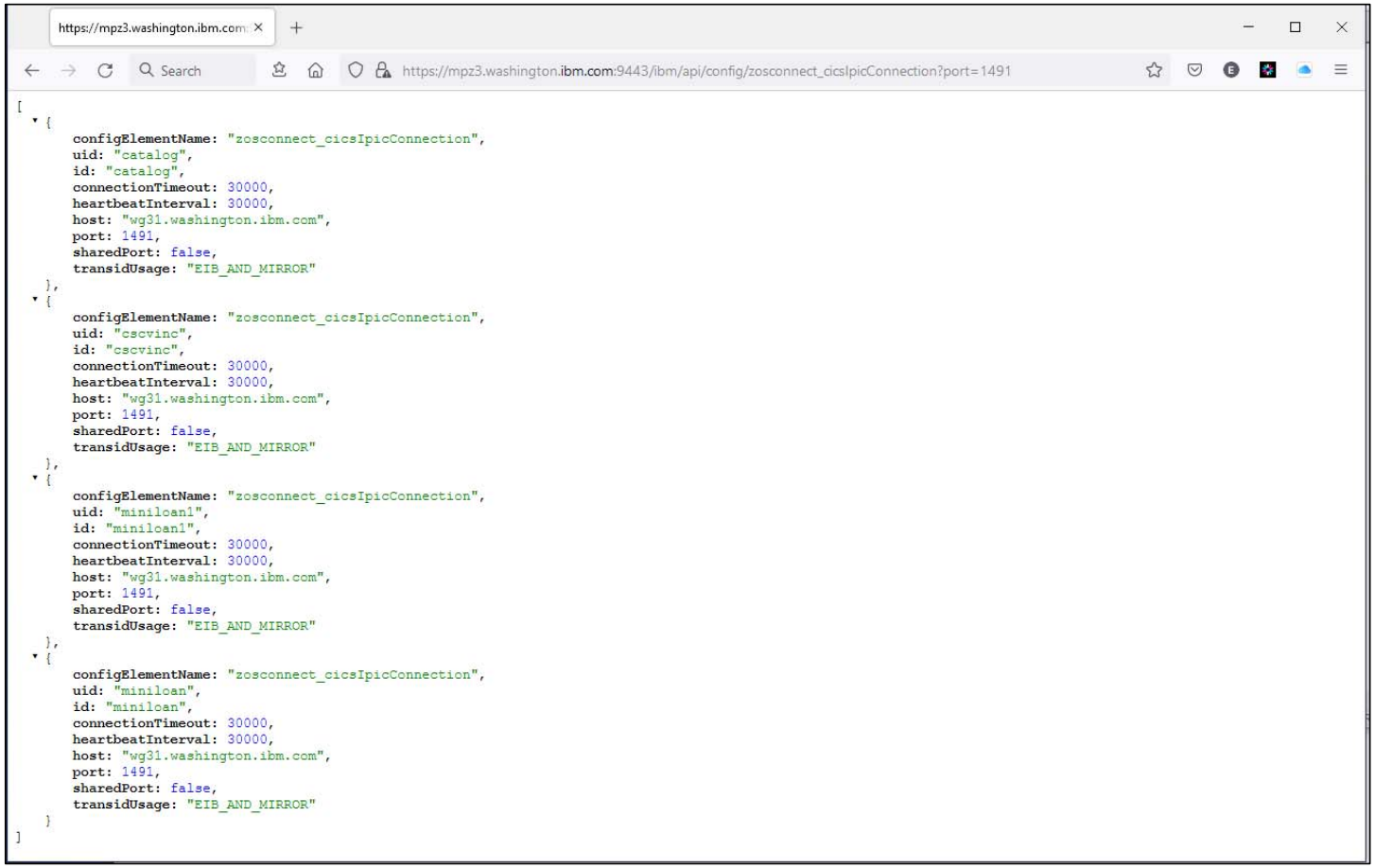
restConnector-2.0 feature

`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: "miniloan1",
      id: "miniloan1",
      connectionTimeout: 30000,
      heartbeatInterval: 30000,
      host: "wg31.washington.ibm.com",
      port: 1491,
      sharedPort: false,
      transidUsage: "EIB_AND_MIRROR"
  },
  {
      configElementName: "zosconnect_cicsIpicConnection",
      uid: "miniloan",
      id: "miniloan",
      connectionTimeout: 30000,
      heartbeatInterval: 30000,
      host: "wg31.washington.ibm.com",
      port: 1491,
      sharedPort: false,
      transidUsage: "EIB_AND_MIRROR"
  }
]
```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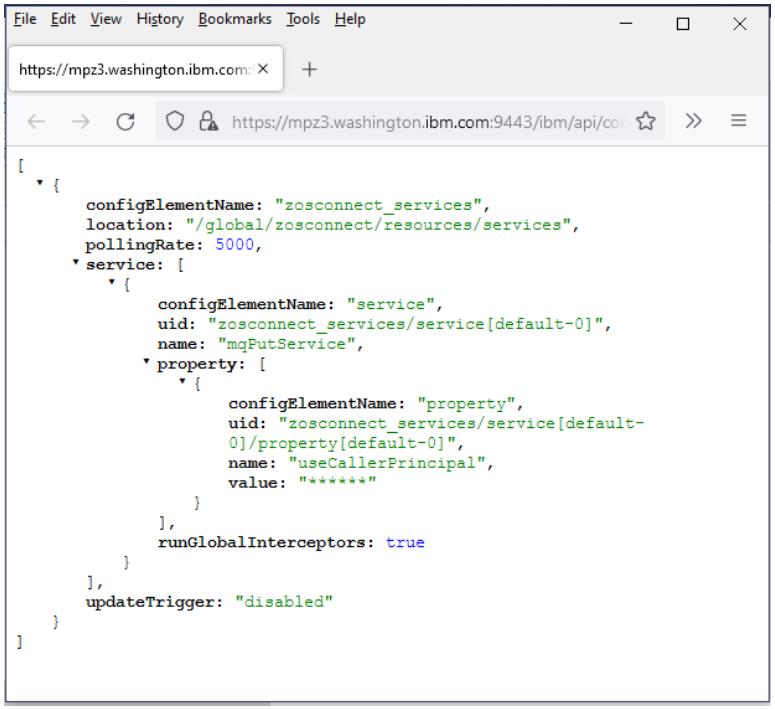
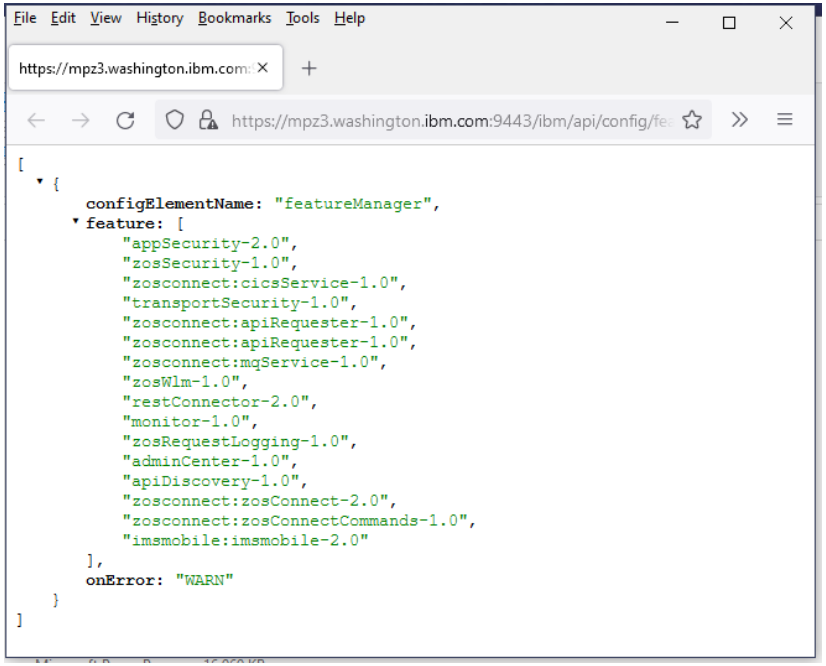
restConnector-2.0 feature

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



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



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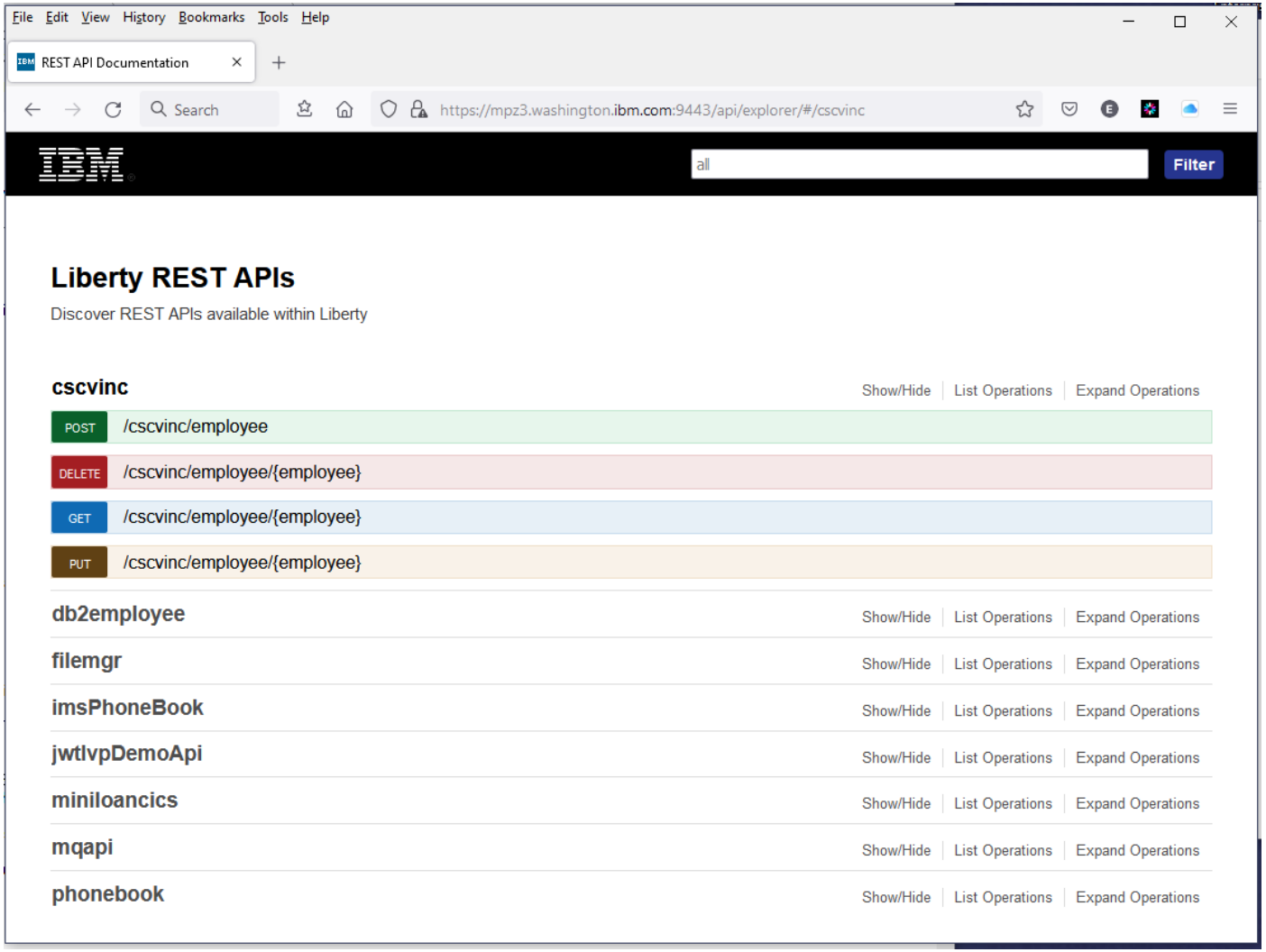
Use the apiDiscovery-1.0 feature to execute RESTful APIs directly*



*V3.0.48

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Liberty MVS Commands

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

F BAQSTRT,REFRESH,KEYSTORE
Use the command to refresh the keystore instorage profiles for the server.

F BAQSTRT,REFESH,KEYSTORE,ID=*OutboundKeyRing*
To refresh a specific keystore defined in the server XML with ID=OutboundKeyRing.

F BAQSTRT,CACHE,CLEAR,AUTH
Clears all users that are cached in the Liberty authentication cache.

F BAQZANGL,DISPLAY,SERVERS
Displays a list of servers currently connected to the angel

F BAQZANGL,DISPLAY,SERVERS,PID
Displays a list of servers currently connected to the angel code along with the server's PIDs.

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

F BAQZANGL,VERSION
Displays the version level of the angel

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z/OS Connect MVS Commands

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

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

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

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

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Where do I look when things go wrong?

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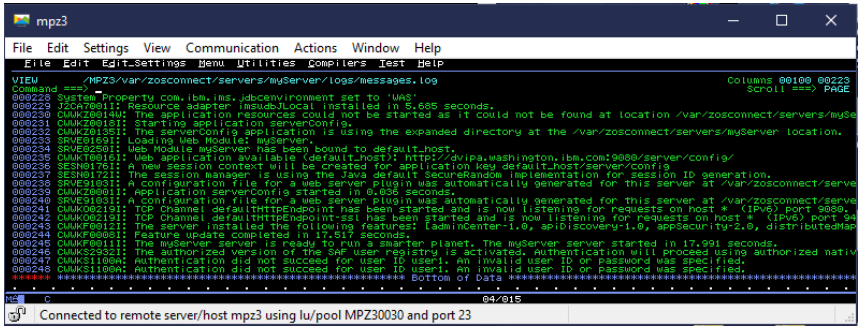
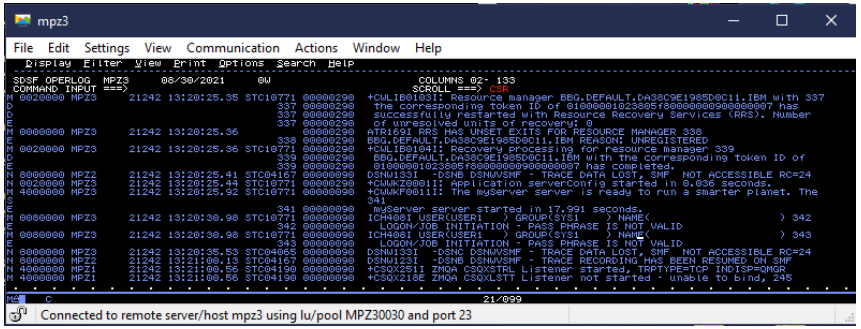
Where to find information when a problem occurs.

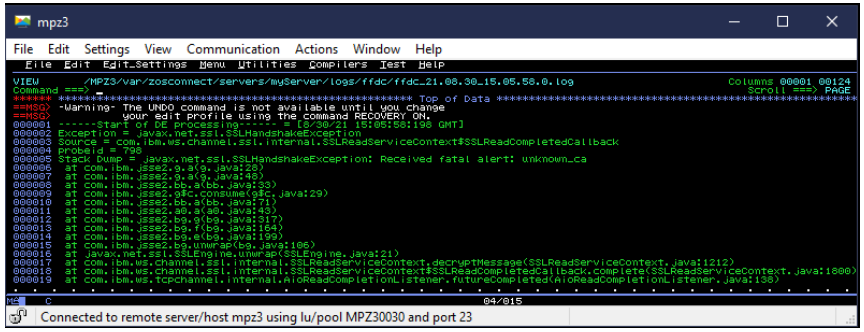
messages.log



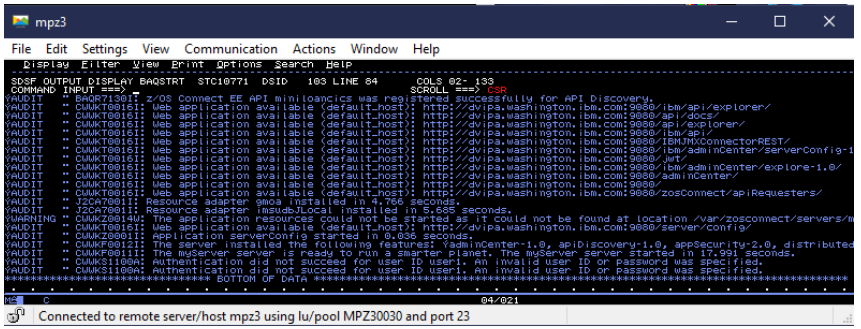
SYSLOG/STC JESMSGLG DD



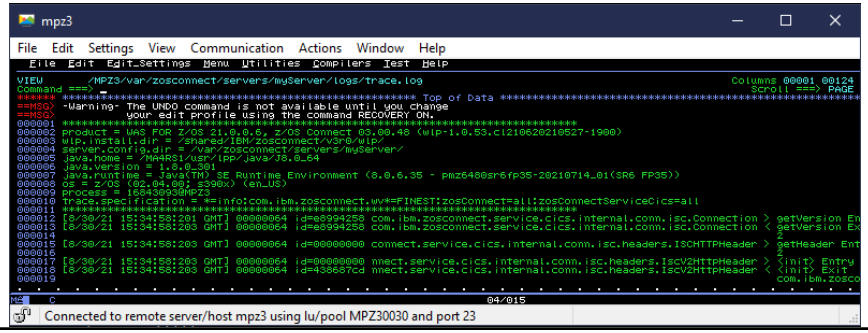
First Failure Data Collection (FFDC) dumps



STC STDOUT DD



trace.out



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Issues and problems can be categorized

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

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

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

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

```
********************************************************************************
product = WAS FOR Z/OS 21.0.0.6, z/OS Connect 03.00.48 (wlp-1.0.53.cl210620210527-1900)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/zceeopid/
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           A CWWKE0001I: The server zceeopid has been launched.
[9/3/21 13:38:04:439 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser              A CWWKG0028A: Processing included configuration resource
[9/3/21 13:38:04:466 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser              A CWWKG0028A: Processing included configuration resource
[9/3/21 13:38:04:470 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser              A CWWKG0028A: Processing included configuration resource
[9/3/21 13:38:04:473 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser              A CWWKG0028A: Processing included configuration resource
[9/3/21 13:38:04:476 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser              A CWWKG0028A: Processing included configuration resource
[9/3/21 13:38:04:481 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser              A CWWKG0028A: Processing included configuration resource
[9/3/21 13:38:04:610 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker           I CWWKB0125I: This server requested a REGION size of 0KB
[9/3/21 13:38:04:612 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker           I CWWKB0126I: MEMLIMIT=2000. MEMLIMIT CONFIGURATION SOUR
[9/3/21 13:38:04:628 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker           I CWWKB0122I: This server is connected to the default an
[9/3/21 13:38:04:679 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker           I CWWKB0103I: Authorized service group KERNEL is availab
[9/3/21 13:38:04:680 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker           I CWWKB0103I: Authorized service group LOCALCOM is avail
[9/3/21 13:38:04:680 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker           I CWWKB0103I: Authorized service group PRODMGR is availa
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 148 Line(s) not Displayed
[9/3/21 13:38:42:347 GMT] 00000040 om.ibm.ws.app.manager.rar.internal.RARApplicationHandlerImpl A J2CA7001I: Resource adapter imsudbJLocal installed in
[9/3/21 13:38:42:419 GMT] 0000003e com.ibm.ws.jmx.connector.server.rest.RESTAppListener         I CWWKX0103I: The JMX REST connector is running and is a
[9/3/21 13:38:42:422 GMT] 0000003e com.ibm.ws.jmx.connector.server.rest.RESTAppListener         I CWWKX0103I: The JMX REST connector is running and is a
[9/3/21 13:38:42:428 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPPort                      I CWWKO0219I: TCP Channel defaultHttpEndpoint has been s
[9/3/21 13:38:42:431 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPPort                      I CWWKO0219I: TCP Channel defaultHttpEndpoint-ssl has be
[9/3/21 13:38:42:437 GMT] 00000042 com.ibm.ws.webcontainer.osgi.mbeans.PluginGenerator         I SRVE9103I: A configuration file for a web server plugi
[9/3/21 13:38:42:489 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager           A CWWKF0012I: The server installed the following feature
[9/3/21 13:38:42:490 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager           I CWWKF0008I: Feature update completed in 37.484 seconds
[9/3/21 13:38:42:490 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager           A CWWKF0011I: The zceeopid server is ready to run a smar
[9/3/21 13:41:31:640 GMT] 00000045 .security.openidconnect.client.internal.OidcClientConfigImpl I CWWKS1700I: OpenID Connect client ATS configuration su
[9/3/21 13:41:31:691 GMT] 00000045 rity.authentication.filter.internal.AuthenticationFilterImpl I CWWKS4358I: The authentication filter ATSAuthFilter co
[9/3/21 13:41:32:824 GMT] 00000053 com.ibm.zosconnect.service.cics.internal.conn.isc.Connection 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.

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Basic security issues – Sometimes you are lucky

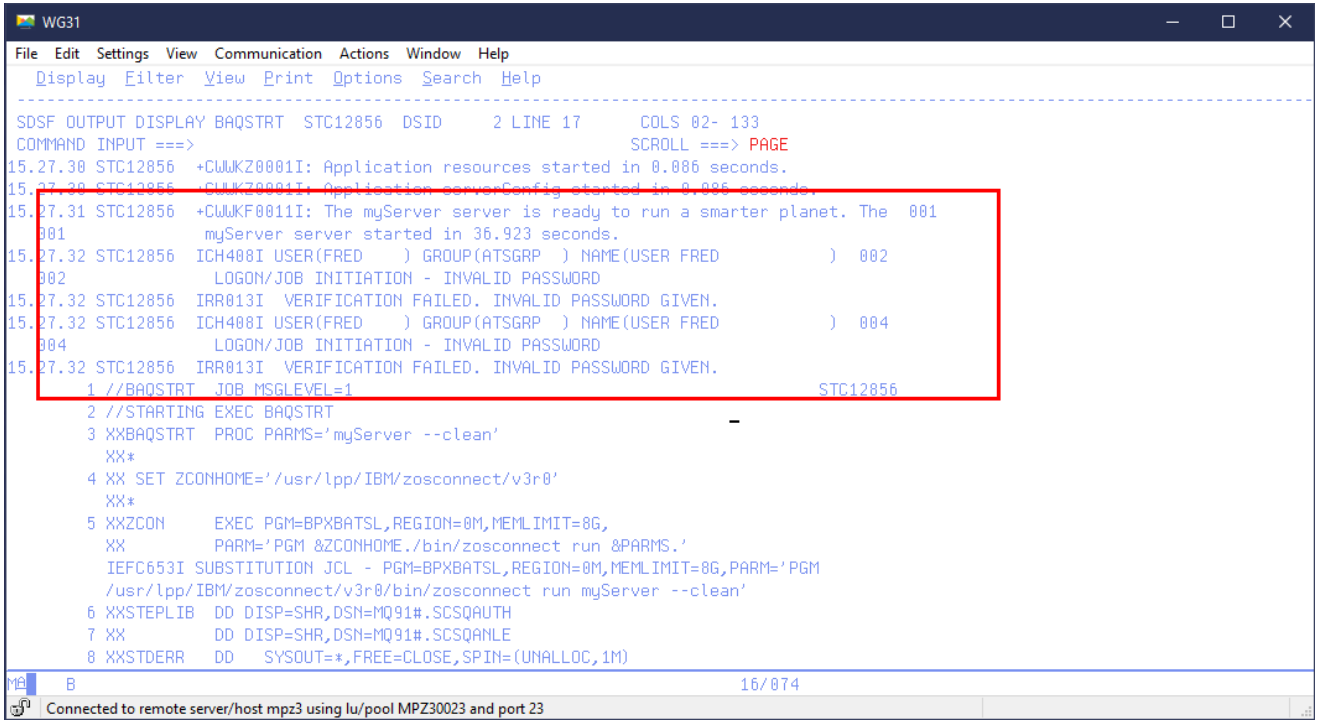
The STDOUT may show:

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

And the messages.log displays:

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

But the JESMSGLG and SYSLOG displays:



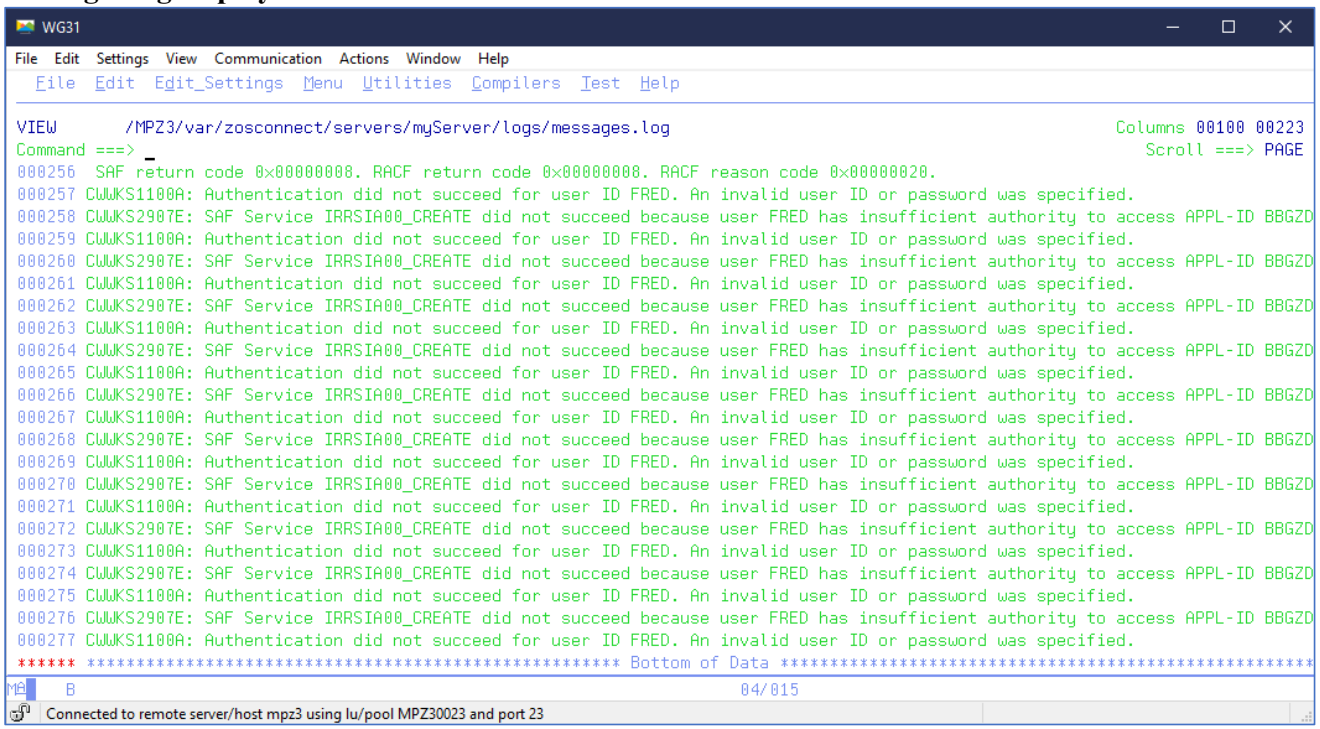
Basic security issues – Some times you have to dig a little more

The STDOUT may show:

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

But there are no SAF messages in the SYSLOG:

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



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

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

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

Table 1. initACEE create return codes

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

Hex '20' = Dec '32'

Root cause – No READ access to APPL resource BBGZDFLT

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

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Basic security issues – Sometimes there is misdirection

The STDOUT may show:

```
 SDSF OUTPUT DISPLAY BAQSTRT  STC12844  DSID   103 LINE 98      COLS 02- 133
 COMMAND INPUT ===> _                                          SCROLL ===> PAGE
ÝAUDIT   ¨ CWWKZ0001I: Application serverConfig started in 4.006 seconds.
ÝAUDIT   ¨ CWWKZ0001I: Application resources started in 4.007 seconds.
ÝAUDIT   ¨ CWWKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/zosConnect/apiRequesters/
ÝAUDIT   ¨ CWWKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/
ÝAUDIT   ¨ CWWKF0012I: The server installed the following features: ÝadminCenter-1.0, apiDiscovery-1.0, appSecurity-2.0, distributed
ÝAUDIT   ¨ CWWKF0011I: The myServer server is ready to run a smarter planet. The myServer server started in 66.646 seconds.
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.
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.
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.
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.
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.
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.
******************************** BOTTOM OF DATA **************************************************************
```

```
MA     B                                                                 04/021
```

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

Symptom: client see HTTP 403 – Authorization Failed. There were no useful messages in STDOUT or messages.log locations.

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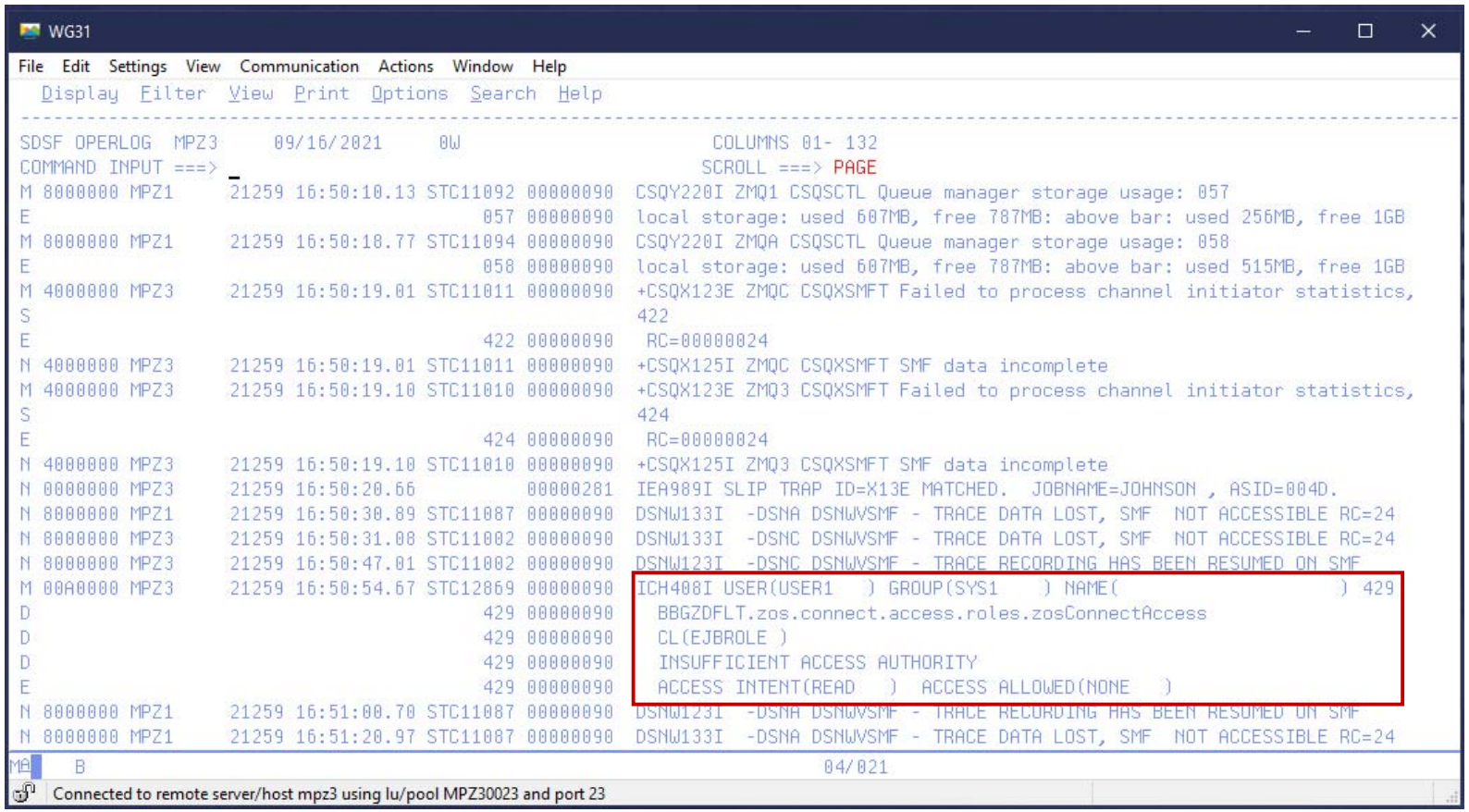
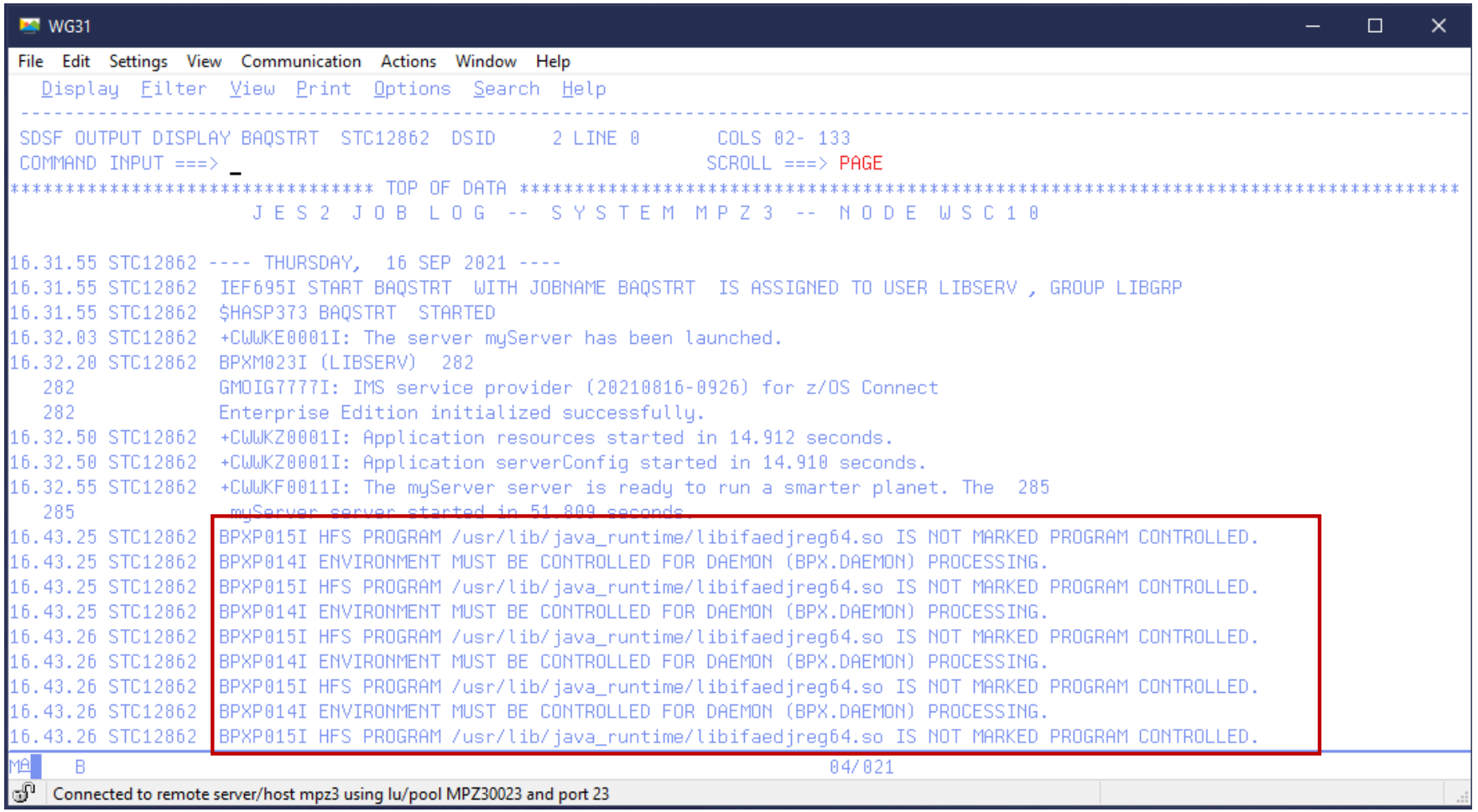
Basis security issues - Use the SYSLOG/JESMSGLG output

The SYSLOG shows a ICH408I message:



Root cause – No READ access to EJBROLE BBGZDFLT.zos.connect.access.roles.zosConnectAccess.

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



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

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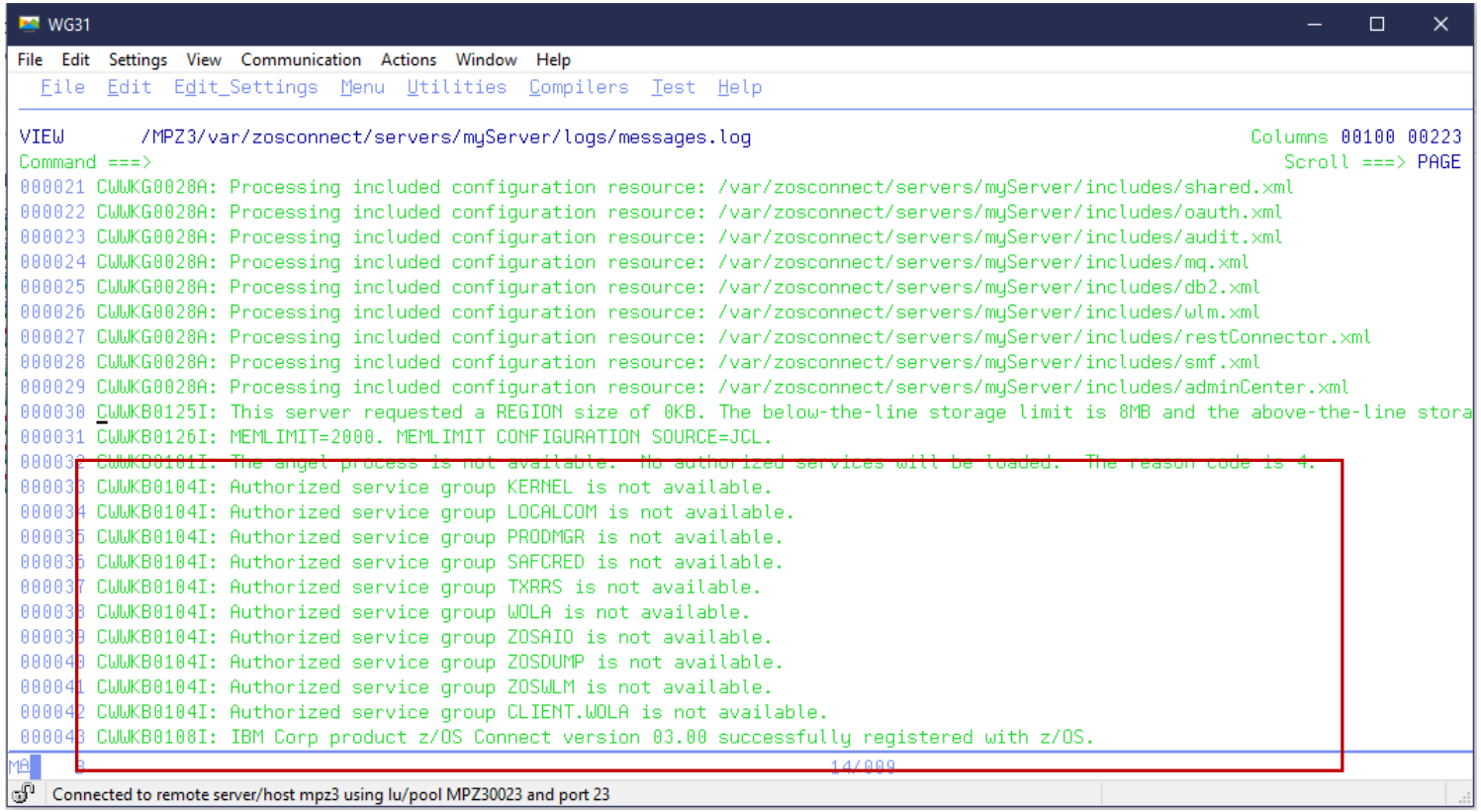
Basic security issues - SYSLOG/JESMSGLG output (even more misdirection)

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 and Liberty is failing over to trying to use OMVS security.



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External resource issues (HTTP 500) - CICS

The client sees:

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

The STDOUT may show:

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

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External resource issues (HTTP 500) – Db2

The client sees:

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

The STDOUT may show:

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

The messages.log displays:

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

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

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

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Tech-Tip: An HTTP 500 shortcut

z/OS Connect EE

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

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

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Before continuing, let's step back - what is a Java stack trace?

```
[9/6/21 22:51:19:981 GMT] 00000039 com.ibm.ejs.j2c.ConnectionEventListener                    A J2CA0056I: The Connection Manager received
a fatal connection error from the Resource Adapter for resource null. The exception is: javax.resource.spi.EISSystemException: ICO0001E:
com.ibm.connector2.ims.ico.IMSTCPIPManagedConnection@c341a0aa.processOutputOTMAMsg(Connection, InteractionSpec, Record, Record) error. IMS
Connect returned an error: RETCODE=[4], REASONCODE=[NFNDDST] [Datastore not found.   ]
 at com.ibm.connector2.ims.ico.IMSManagedConnection.processOutputOTMAMsg(IMSManagedConnection.java:4042)
 at com.ibm.connector2.ims.ico.IMSTCPIPManagedConnection.callSendRecv(IMSTCPIPManagedConnection.java:241)
 at com.ibm.connector2.ims.ico.IMSManagedConnection.call(IMSManagedConnection.java:1625)
 at com.ibm.connector2.ims.ico.IMSConnection.call(IMSConnection.java:213)
 at com.ibm.connector2.ims.ico.IMSInteraction.execute(IMSInteraction.java:586)
 at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.executeTranServiceInputTMRA(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

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First Failure Data Collection (FFDC)

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

MQ service provider classes

Root cause – Queue was configured to disable the MQPUT request

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The FFDC dump is more than a Java stack trace

```
------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@2d85bccc
    strings[0] = "TraceComponent[com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl,class
com.ibm.zosconnect.endpoint.connection.internal.OAuthConfigImpl,[zosConnectApiRequesterToken],com.ibm.zosconnect.endpoint
.connection.internal.resources.ZosConnectEndpointConnection,null]"
  CFG_ELEMENT_ID = "id"
  CFG_GRANTTYPE = "grantType"
  id = "myoAuthConfig"
  grantType = "password"
  authServer = class com.ibm.zosconnect.endpoint.connection.internal.AuthorizationServerImpl@ed6c1e8c
 .  .  .
 sslCertsRef = "OutboundSSLSettings"
   connectionTimeout = 30000
   receiveTimeout = 60000
   id = "myoAuthServer"
```

z/OS Connect Java classes

The FFDC dump for a network issue

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

Base Java classes
z/OS Connect Java classes

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

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


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

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

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Use the messages.log and FFDC log together

messages.log

```
[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.DetailedJMSException: 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 unexpectedJMSException
occurred while processing a request for service 'mqGetService'. The exception message was 'MQJCA1011: Failed to allocate a JMS connection.'.
```

Spacing added between lines to improve readability

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The FFDC dump showing additional JMS information

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

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

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A FFDC dump showing a SSL Handshake issue

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

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

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Other common TLS handshake issues

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

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

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

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

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

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

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

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

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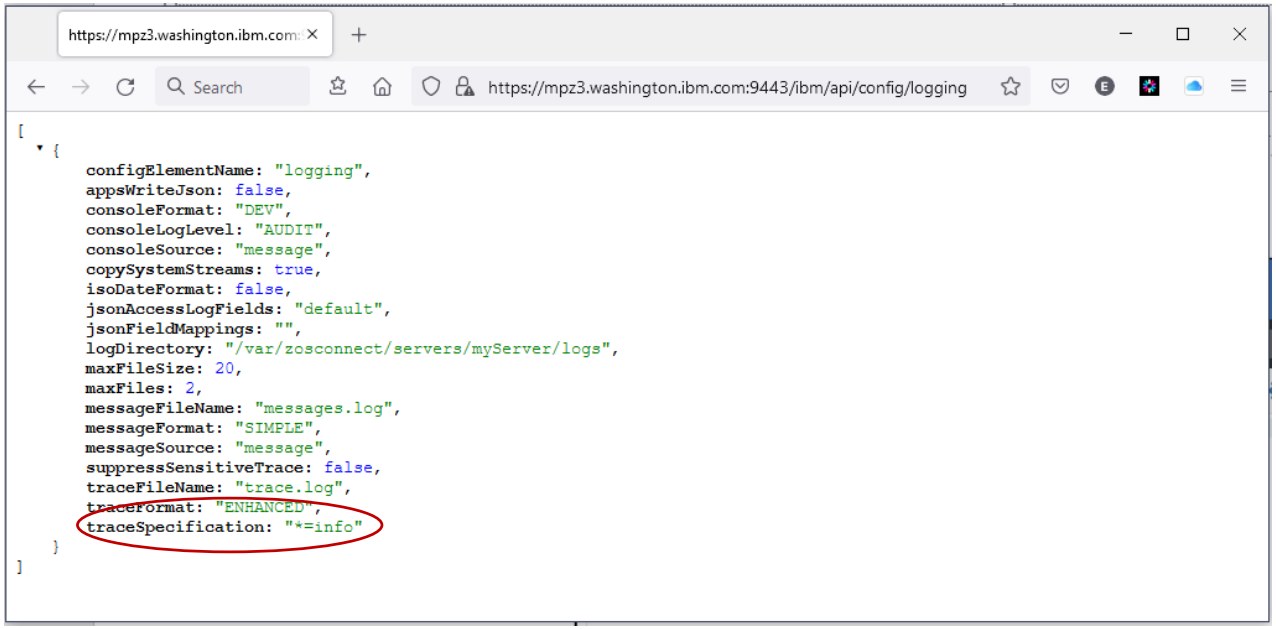
trace.out – use as a last resort or at the request of Level 2

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

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



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

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Managing trace specification

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

server.xml

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

safTrace.xml

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

cicsTrace.xml

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

imsTrace.xml

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

Enables enhanced tracing

(after adding an “include” file)

```
F BAQSTRT,REFRESH,CONFIG
```

Disable enhanced tracing

```
F BAQSTRT,LOGGING='*=INFO’
```

Or

```
F BAQSTRT,REFRESH,CONFIG
```

(after removing the “include” file

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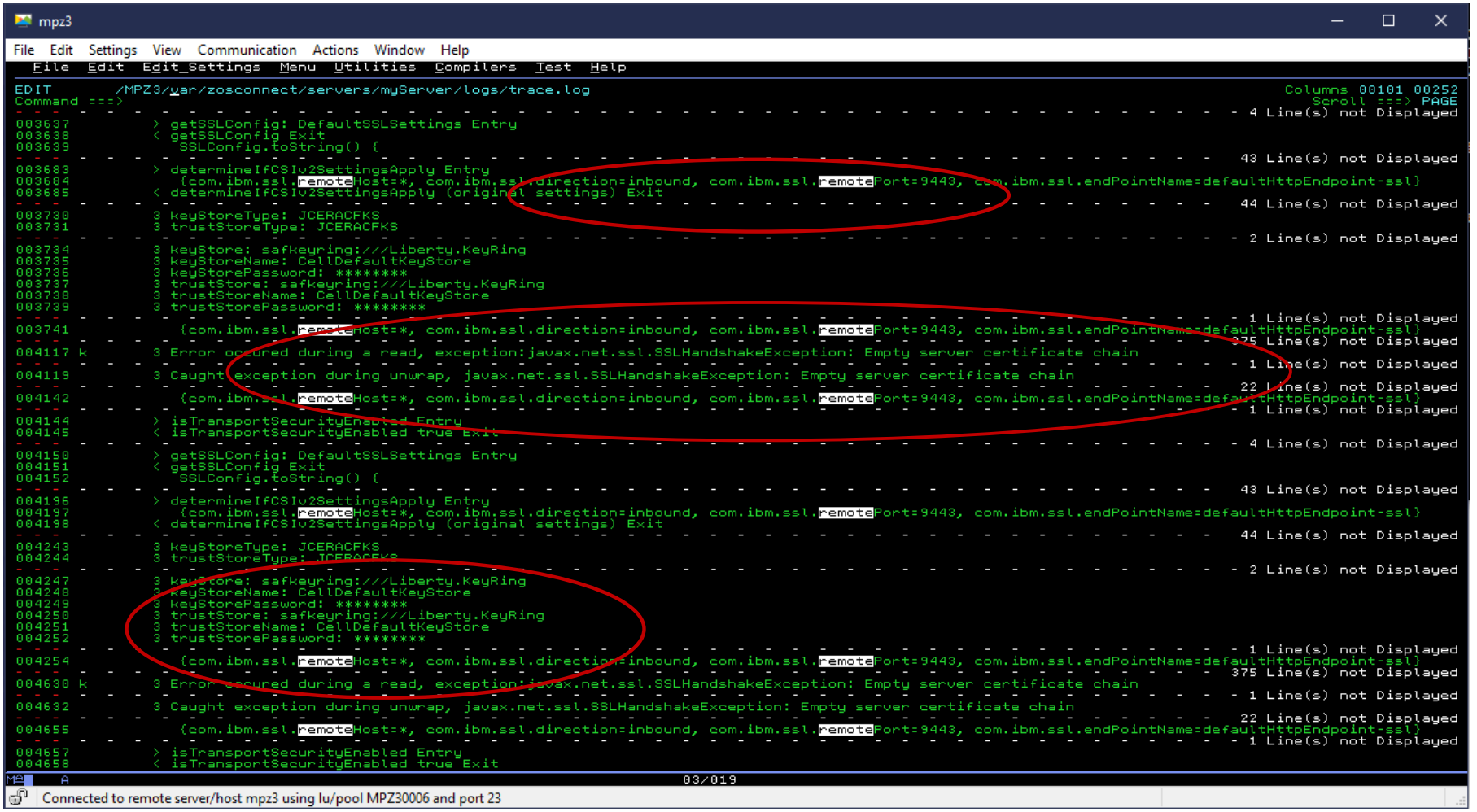
trace.out file



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

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Monitoring Java, Liberty and z/OS Connect

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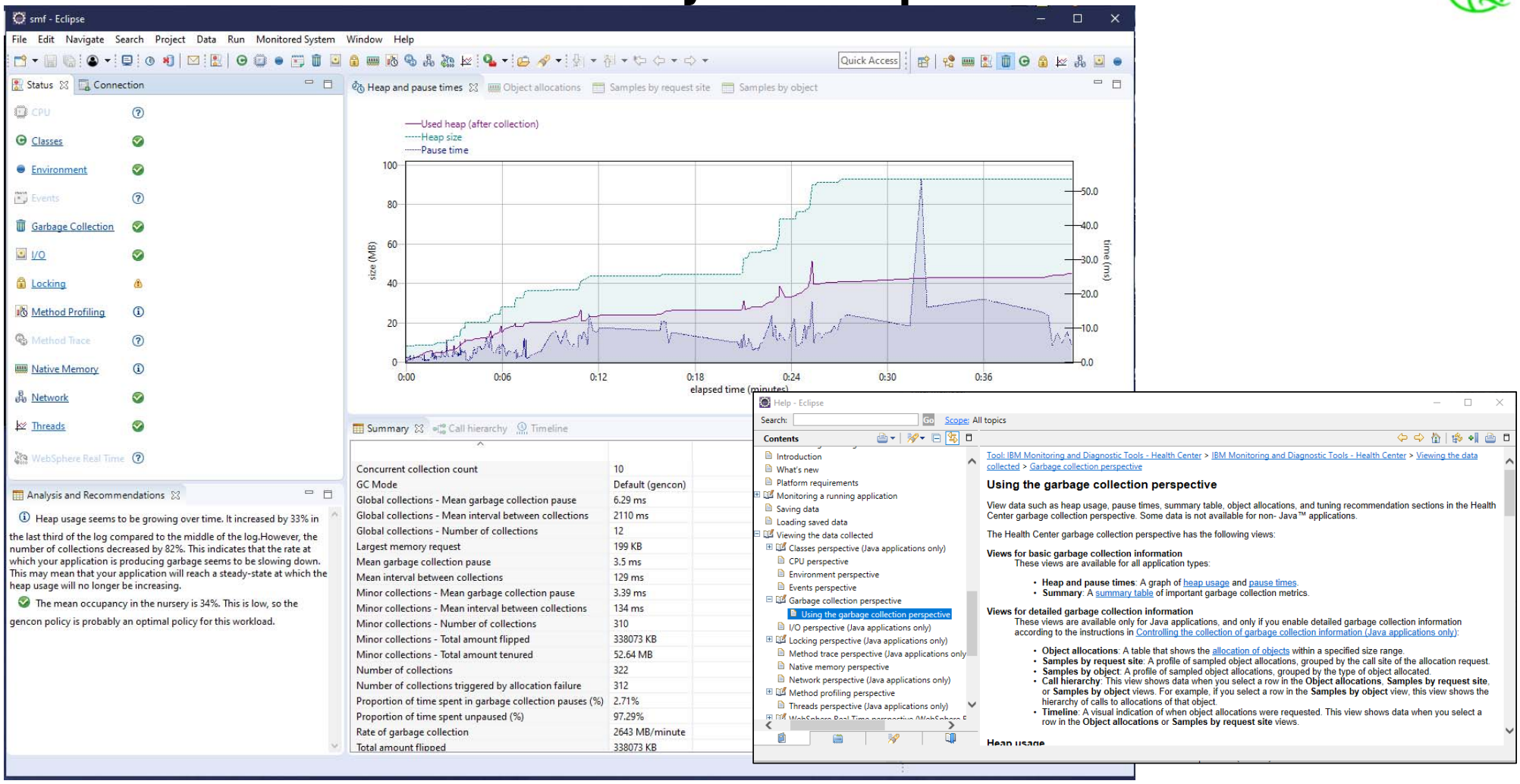
Java Health Center – HEAP analysis example



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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

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Java Health Center – Monitoring Agent Configuration

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

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

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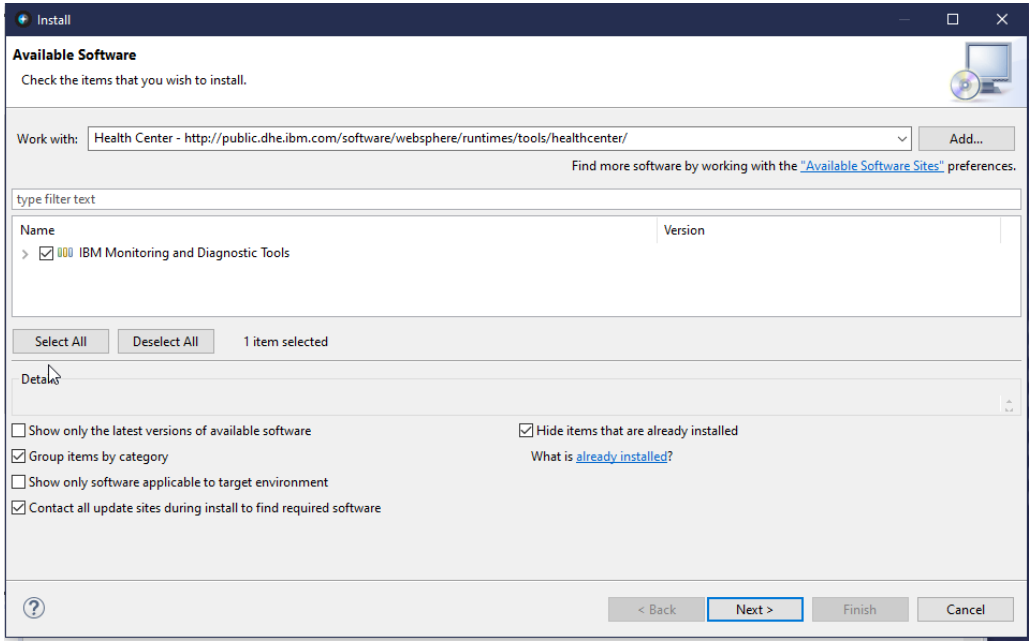
Java Health Center – Client Configuration

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/

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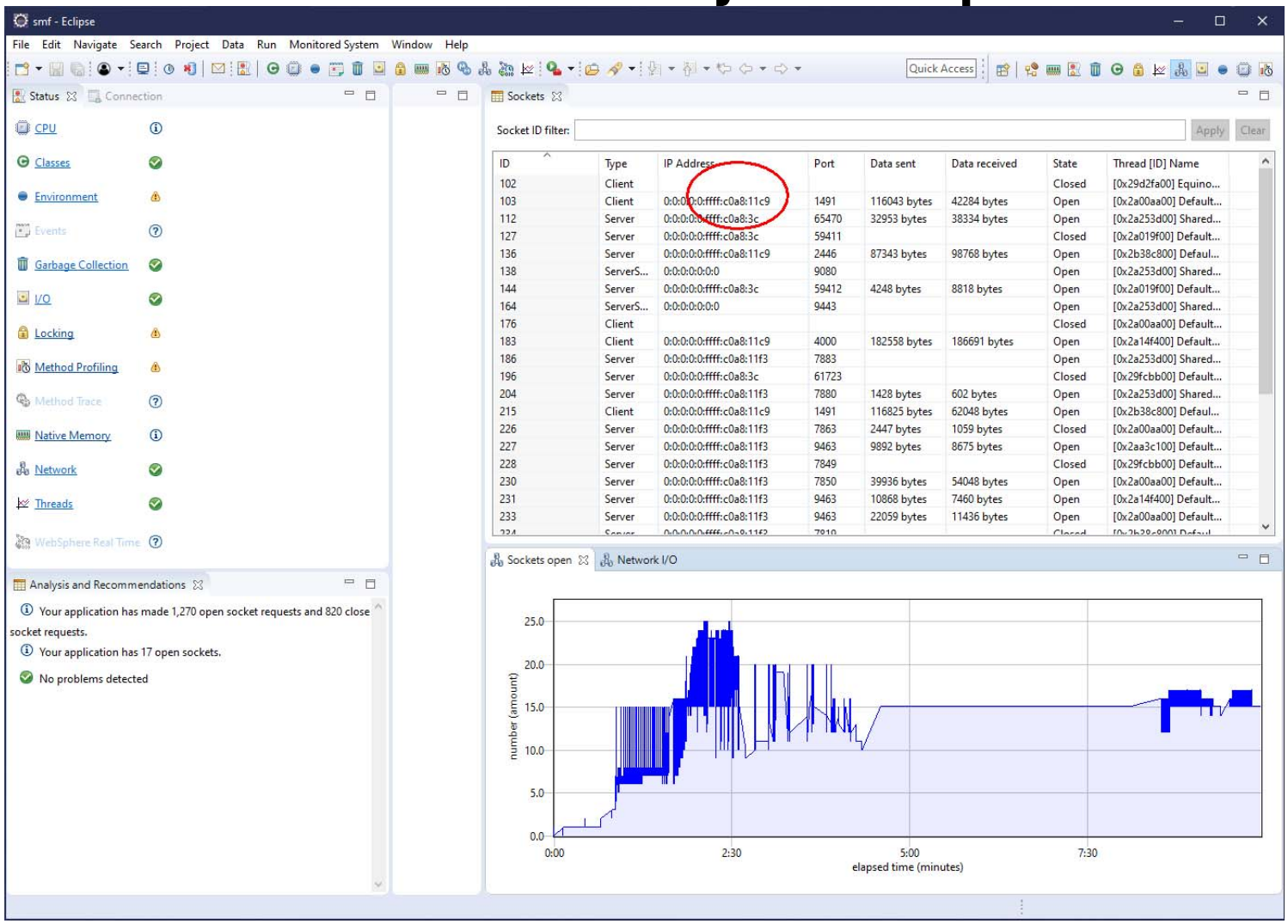
Java Health Center – Network analysis example



c0a8:11c9 = 192.168.17.201

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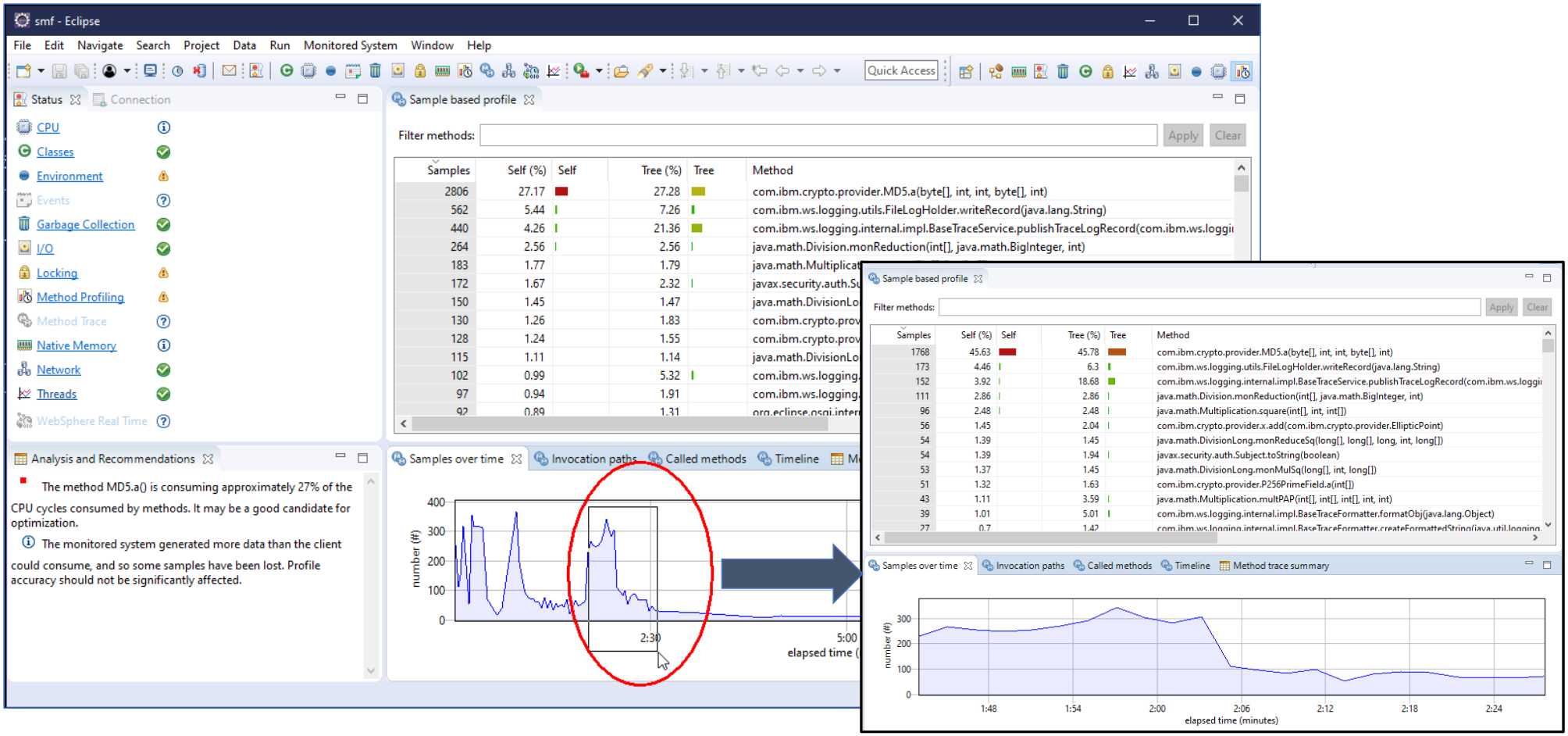
Java Health Center – Method Profiling



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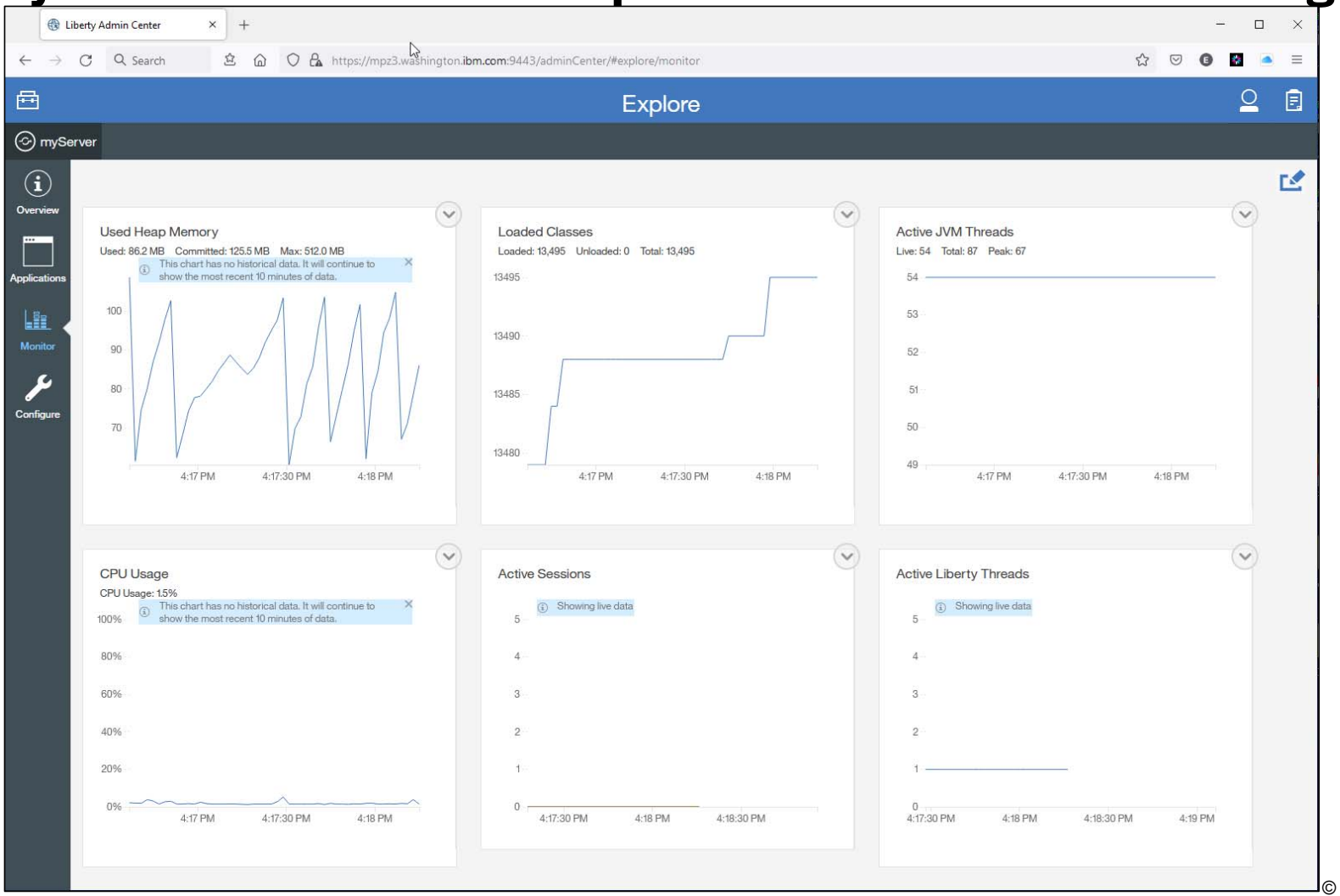
Liberty Admin Center feature provides real time monitoring



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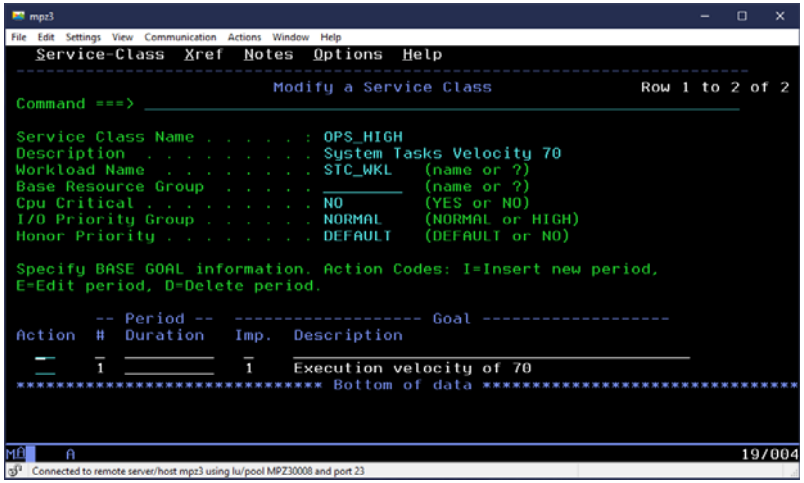
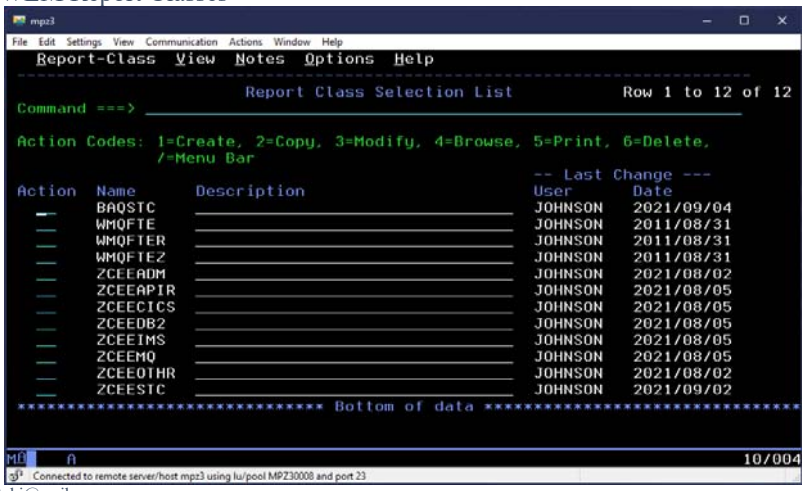
Workload Manager - Definitions

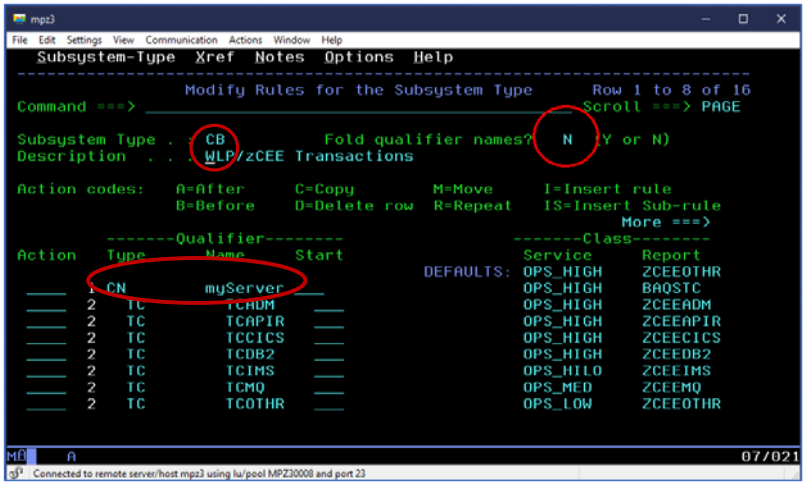
WLM Service Classes

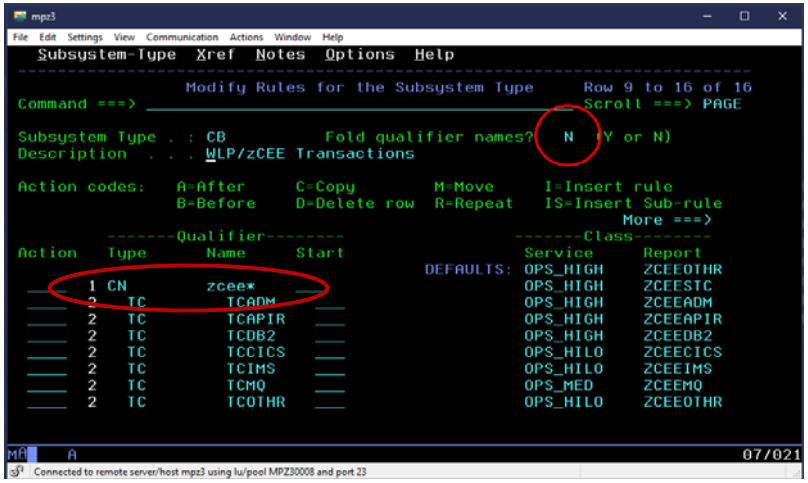


WLM Report Classes



WLM "CB" Classification Rules





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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 *wlmClassifcation* 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 — Read only — Close

Design | Source

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

Related to WLM CN name.

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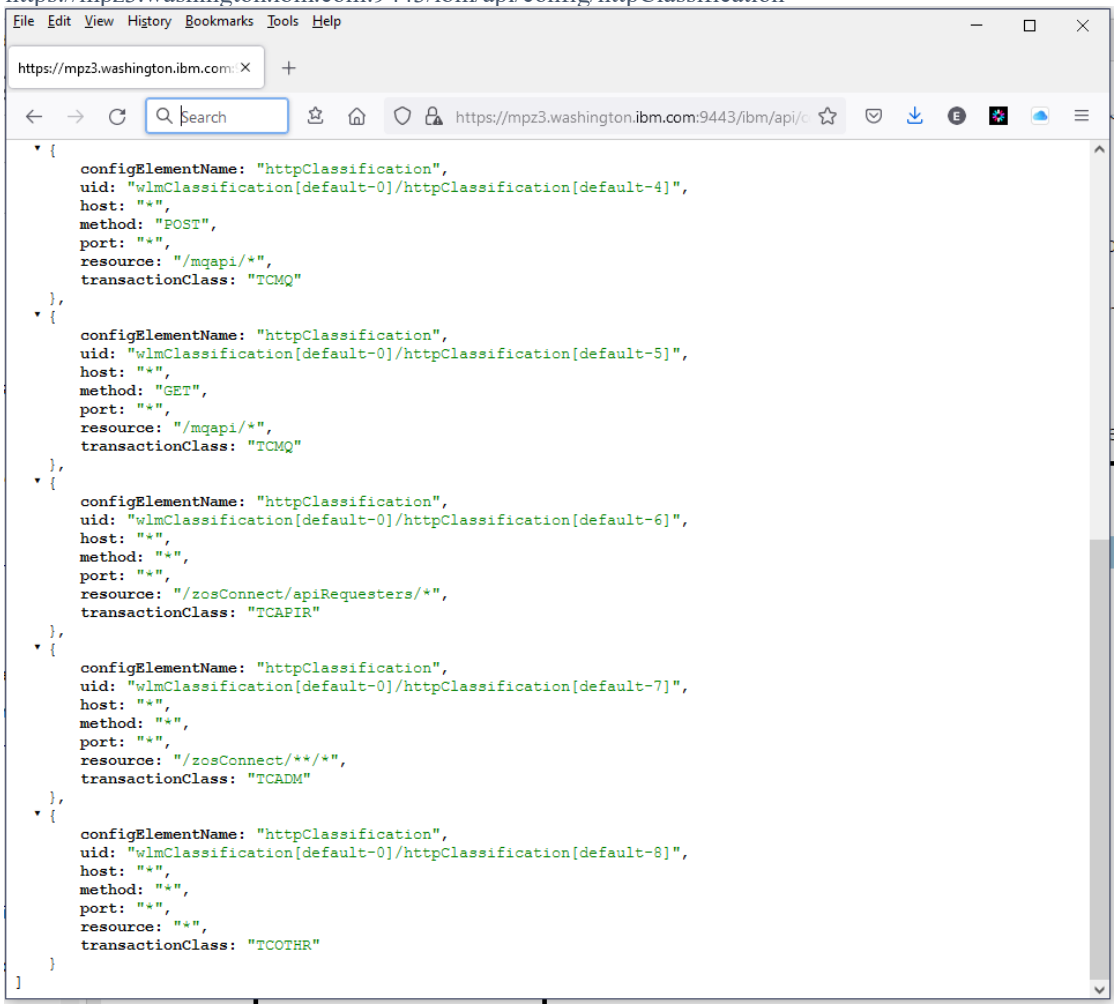
Workload Manager – Active HTTP Classification

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



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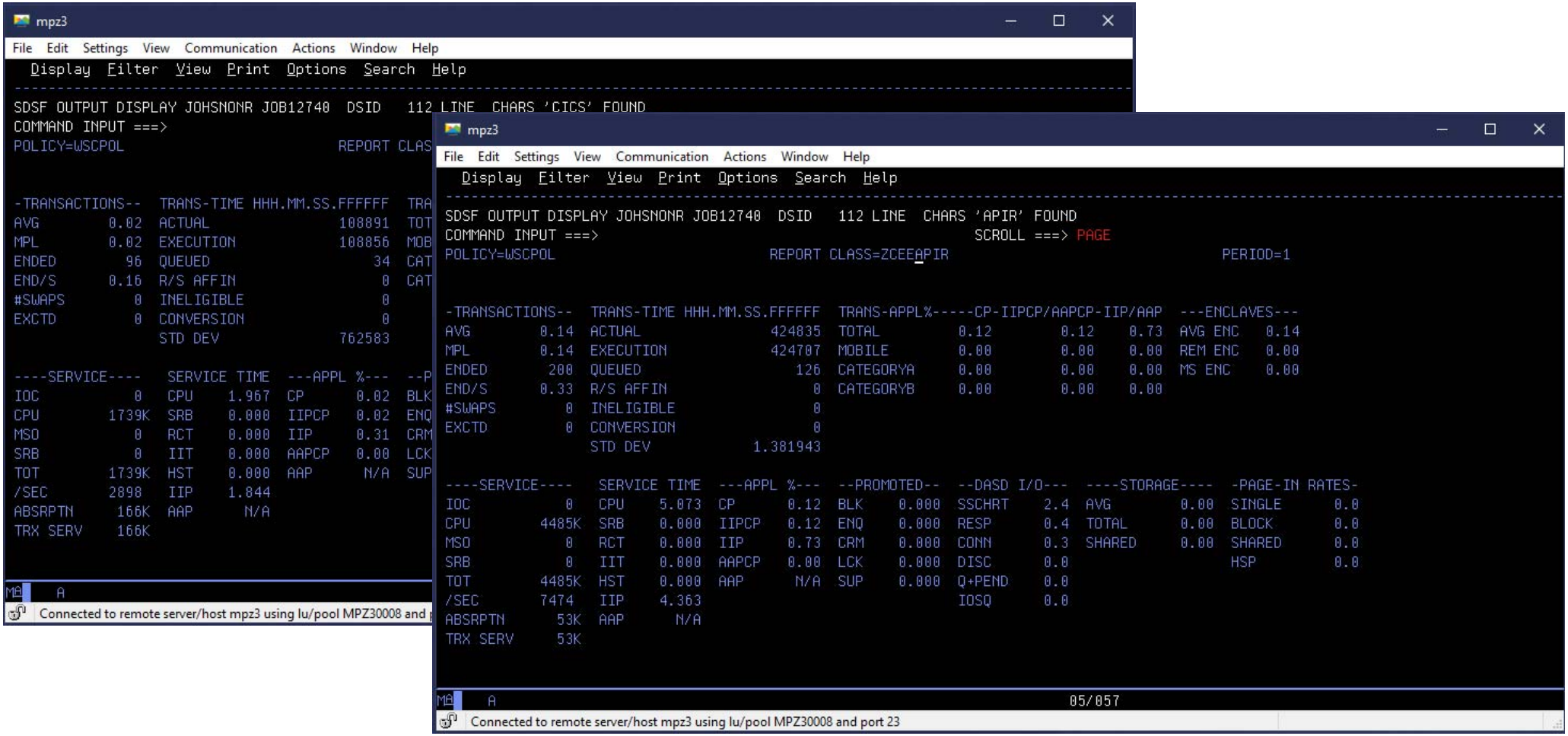
RMF SMF Type 72 Service Class Reports



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Liberty SMF 120 Subtype 11

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

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

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

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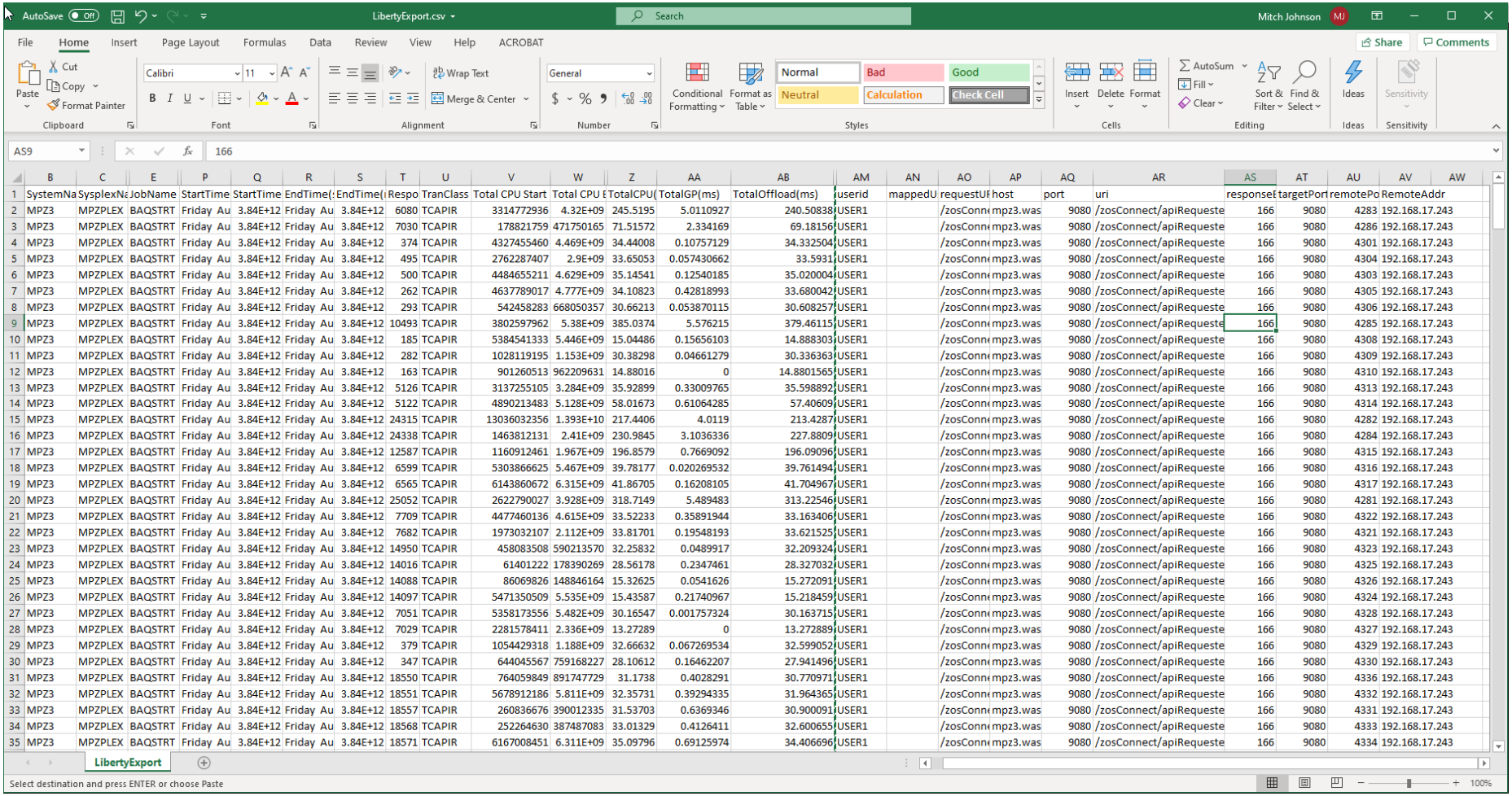
Liberty SMF 120 Subtype 11 – WP102312 Plugin



SystemNa	SysplexNa	JobName	StartTime	StartTime	EndTime(	EndTime(	Respo	TranClass	Total CPU Start	Total CPU E	TotalCPU(	TotalGP(ms)	TotalOffload(ms)	userid	mappedU	requestUF	host	port	uri	responseE	targetPort	remotePo	RemoteAddr
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	6080	TCAPIR	3314772936	4.32E+09	245.5195	5.0110927	240.50838	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4283	192.168.17.243
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	7030	TCAPIR	178821759	471750165	71.51572	2.334169	69.18156	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4286	192.168.17.243
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
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
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	500	TCAPIR	4484655211	4.629E+09	35.14541	0.12540185	35.020004	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4303	192.168.17.243
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	262	TCAPIR	4637789017	4.777E+09	34.10823	0.42818993	33.680042	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4305	192.168.17.243
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
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
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
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
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	163	TCAPIR	901260513	962209631	14.88016	0	14.8801565	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4310	192.168.17.243
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
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
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
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	24338	TCAPIR	1463812131	2.41E+09	230.9845	3.1036336	227.8809	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4284	192.168.17.243
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
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	6599	TCAPIR	5303866625	5.467E+09	39.78177	0.020269532	39.761494	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4316	192.168.17.243
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	6565	TCAPIR	6143860672	6.315E+09	41.86705	0.16208105	41.704967	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4317	192.168.17.243
MPZ3	MPZPLEX	BAQSTRT	Friday Au	3.84E+12	Friday Au	3.84E+12	25052	TCAPIR	2622790027	3.928E+09	318.7149	5.489483	313.22546	USER1		/zosConn	mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4281	192.168.17.243
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

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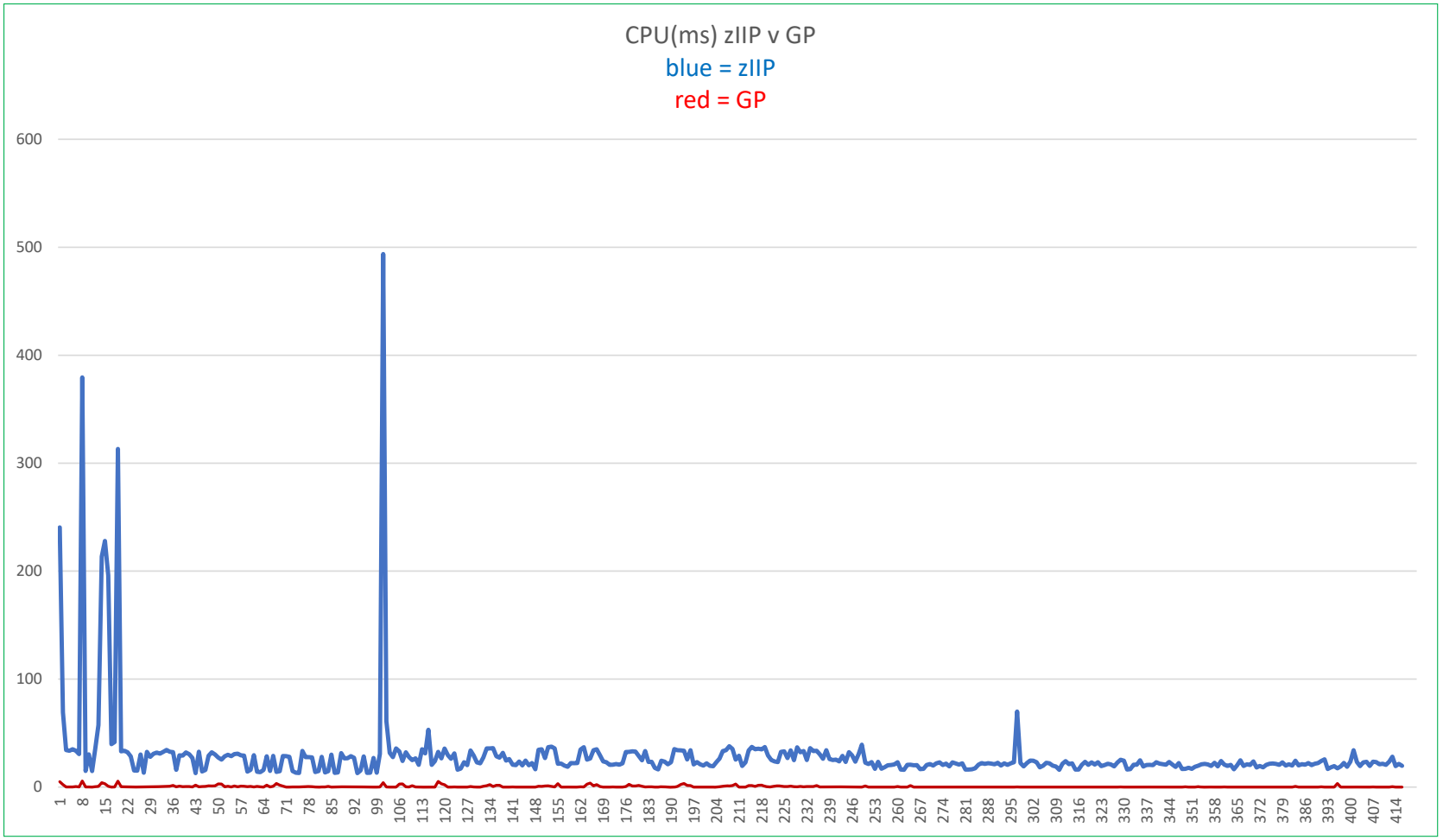
Liberty SMF 120 type 11 – GP v zIPP comparison example



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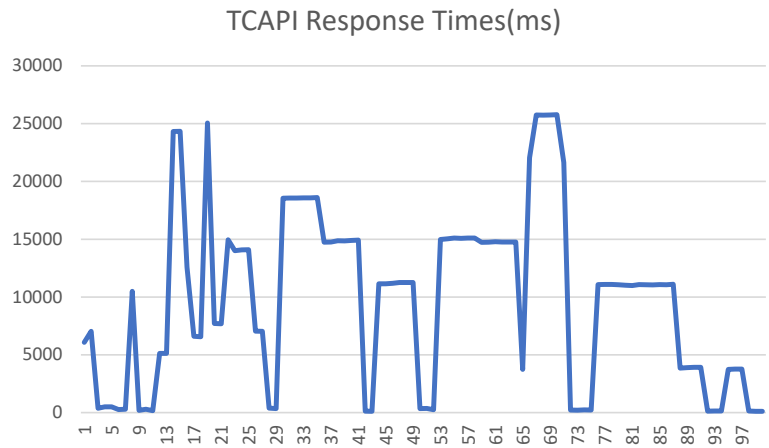
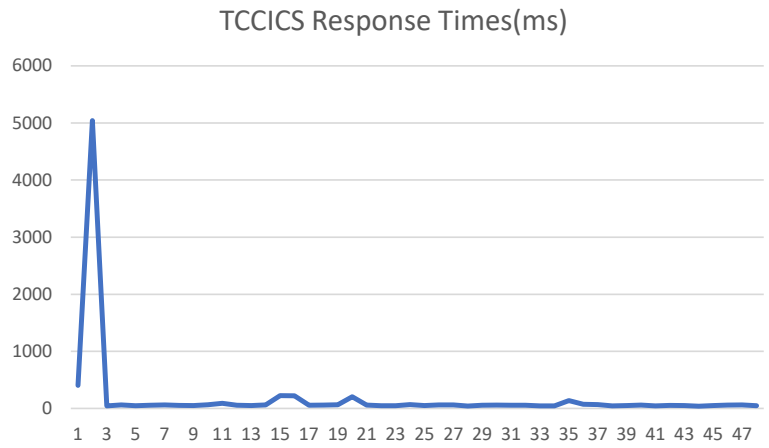
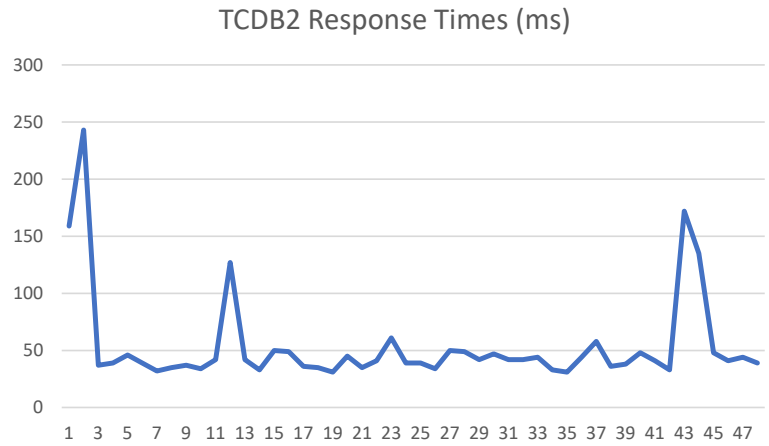
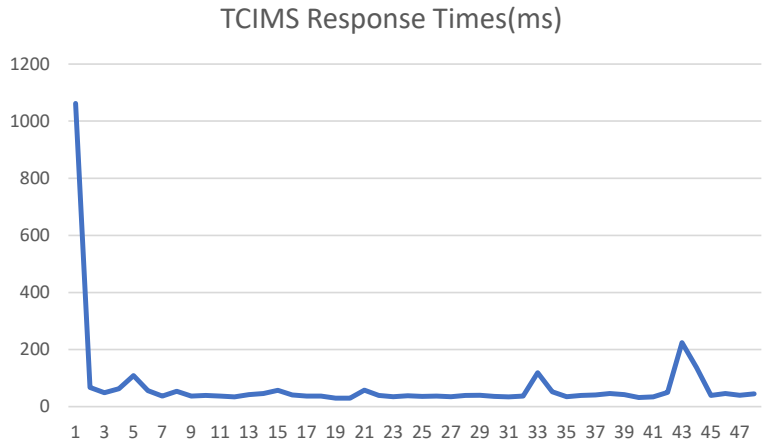
Liberty SMF 120 type 11 – Response times comparisons example









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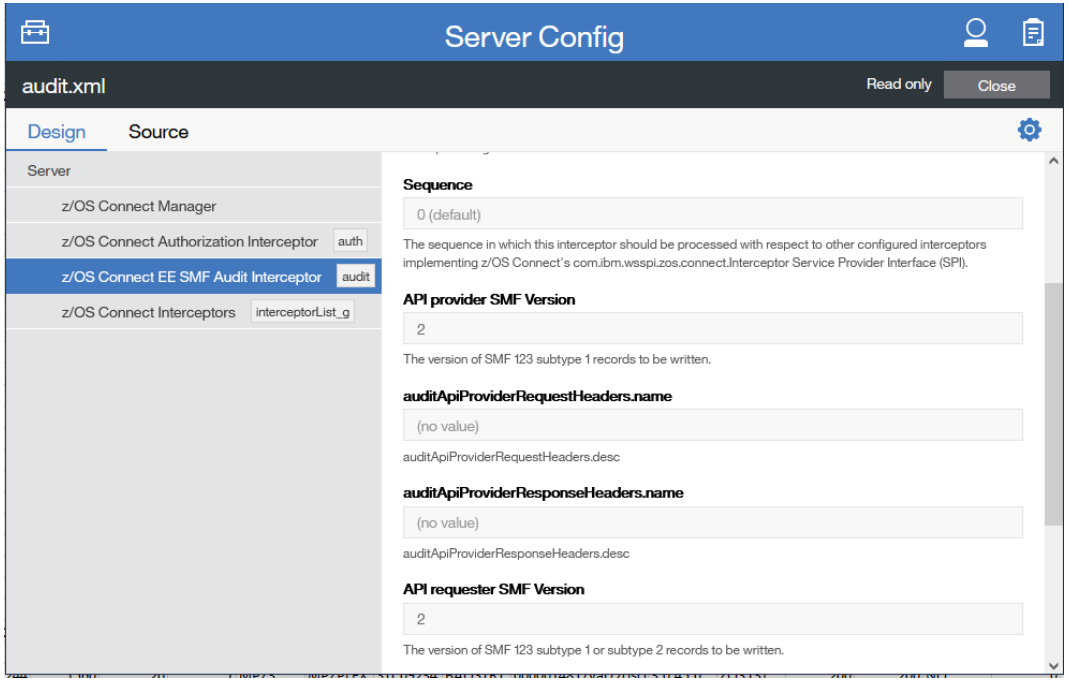
z/OS Connect SMF 123 server XML configuration

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

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



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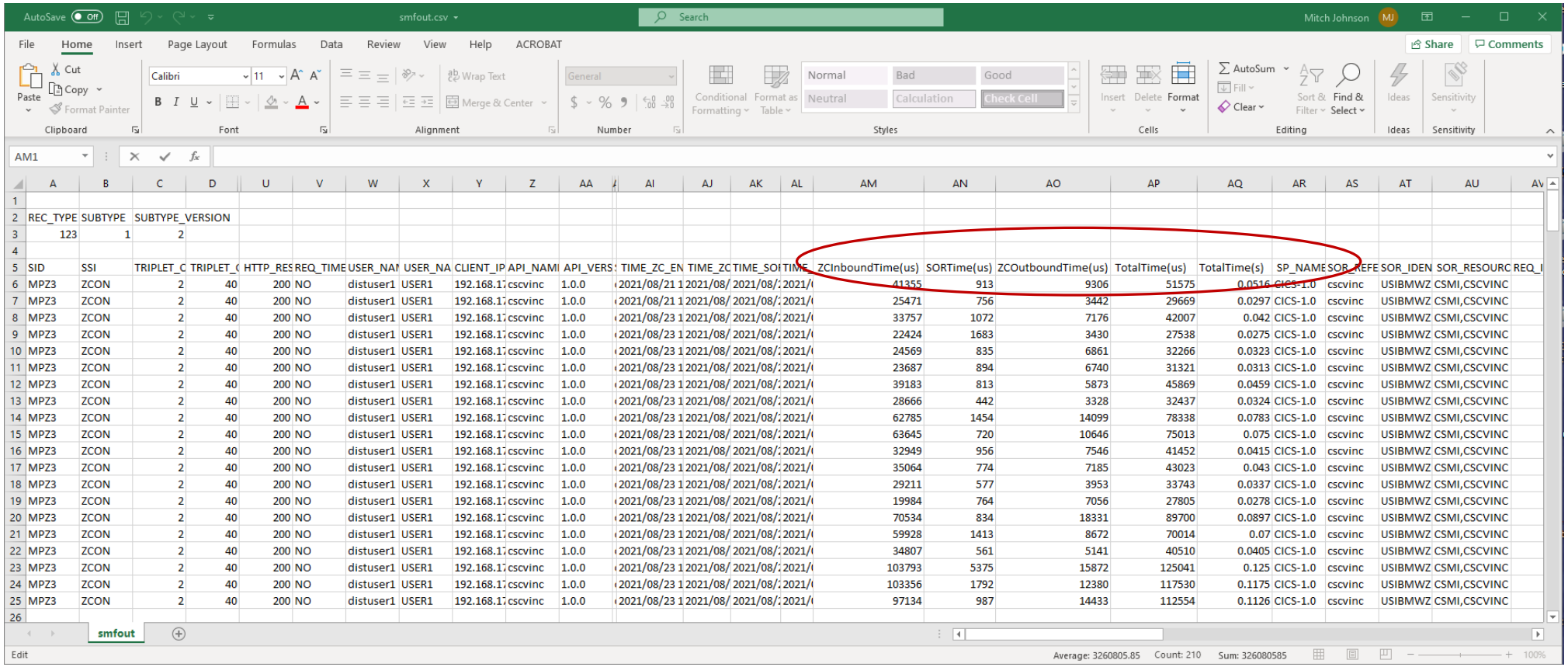
z/OS Connect SMF 123 subtype 1 version 2 *



REC_TYPE	SUBTYPE	SUBTYPE_VERSION	SID	SSI	TRIPLET_C	TRIPLET_(	HTTP_RES	REQ_TIME	USER_NAI	USER_NA	CLIENT_IP	API_NAMI	API_VERS	TIME_ZC_EN	TIME_ZC	TIME_SOI	TIME_	ZCInboundTime(us)	SORTime(us)	ZCOutboundTime(us)	TotalTime(us)	TotalTime(s)	SP_NAME	SOR_REFE	SOR_IDEN	SOR_RESOURC	REQ_I
123	1	2	MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/21 1	2021/08/	2021/08/2	2021/(	41355	913	9306	51575	0.0516	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/21 1	2021/08/	2021/08/2	2021/(	25471	756	3442	29669	0.0297	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	33757	1072	7176	42007	0.042	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	22424	1683	3430	27538	0.0275	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	24569	835	6861	32266	0.0323	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	23687	894	6740	31321	0.0313	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	39183	813	5873	45869	0.0459	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	28666	442	3328	32437	0.0324	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	62785	1454	14099	78338	0.0783	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	63645	720	10646	75013	0.075	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	32949	956	7546	41452	0.0415	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	35064	774	7185	43023	0.043	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	29211	577	3953	33743	0.0337	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	19984	764	7056	27805	0.0278	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	70534	834	18331	89700	0.0897	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	59928	1413	8672	70014	0.07	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	34807	561	5141	40510	0.0405	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	103793	5375	15872	125041	0.125	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	103356	1792	12380	117530	0.1175	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	
			MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1	cscvinc	1.0.0	2021/08/23 1	2021/08/	2021/08/2	2021/(	97134	987	14433	112554	0.1126	CICS-1.0	cscvinc	USIBMWZ	CSMI,CSCVINC	

Some fields have been hidden

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

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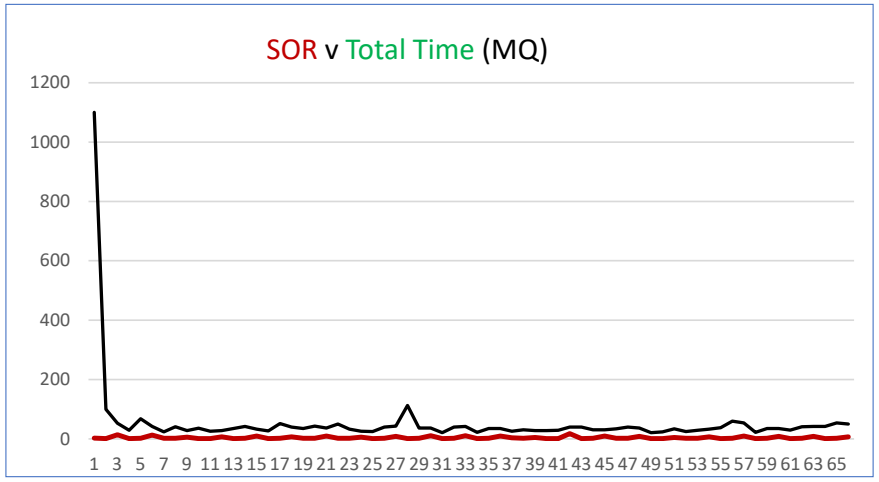
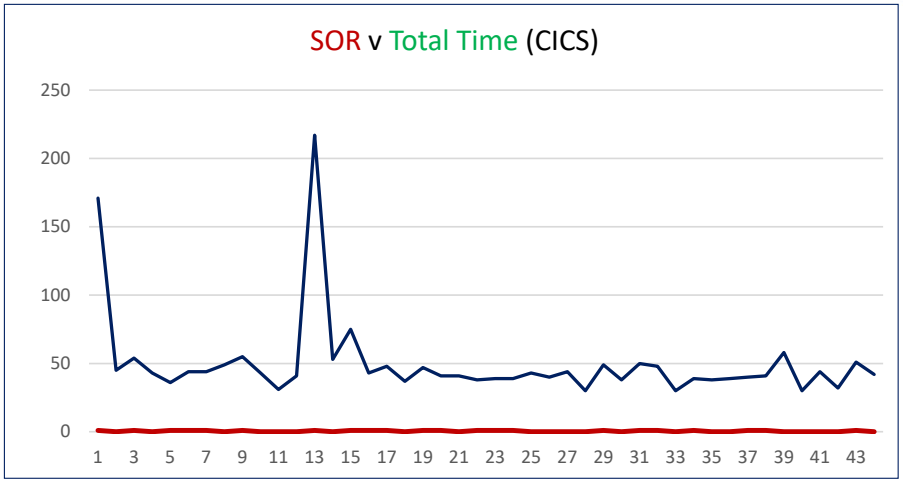
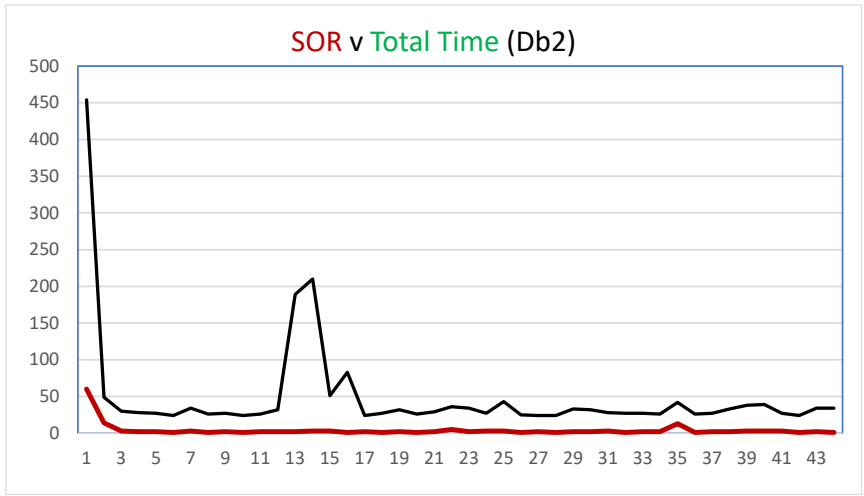
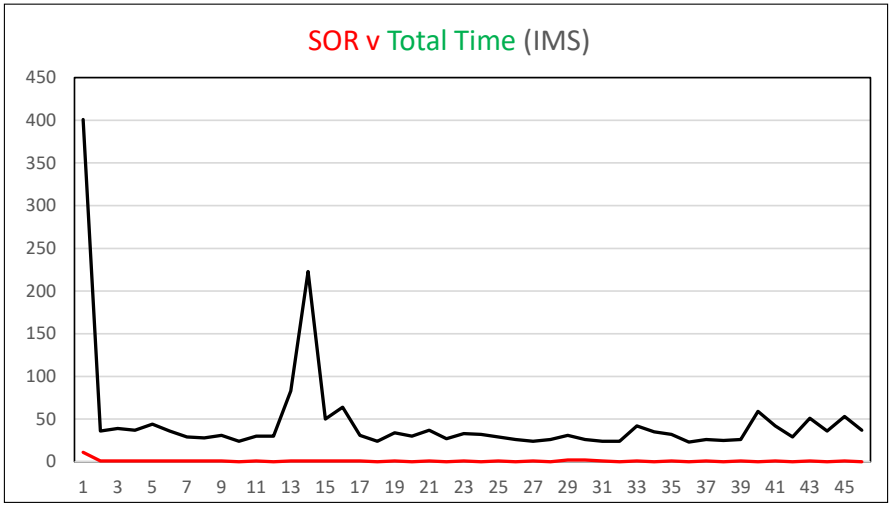
z/OS Connect SMF 123 subtype 1 version 2 graph examples









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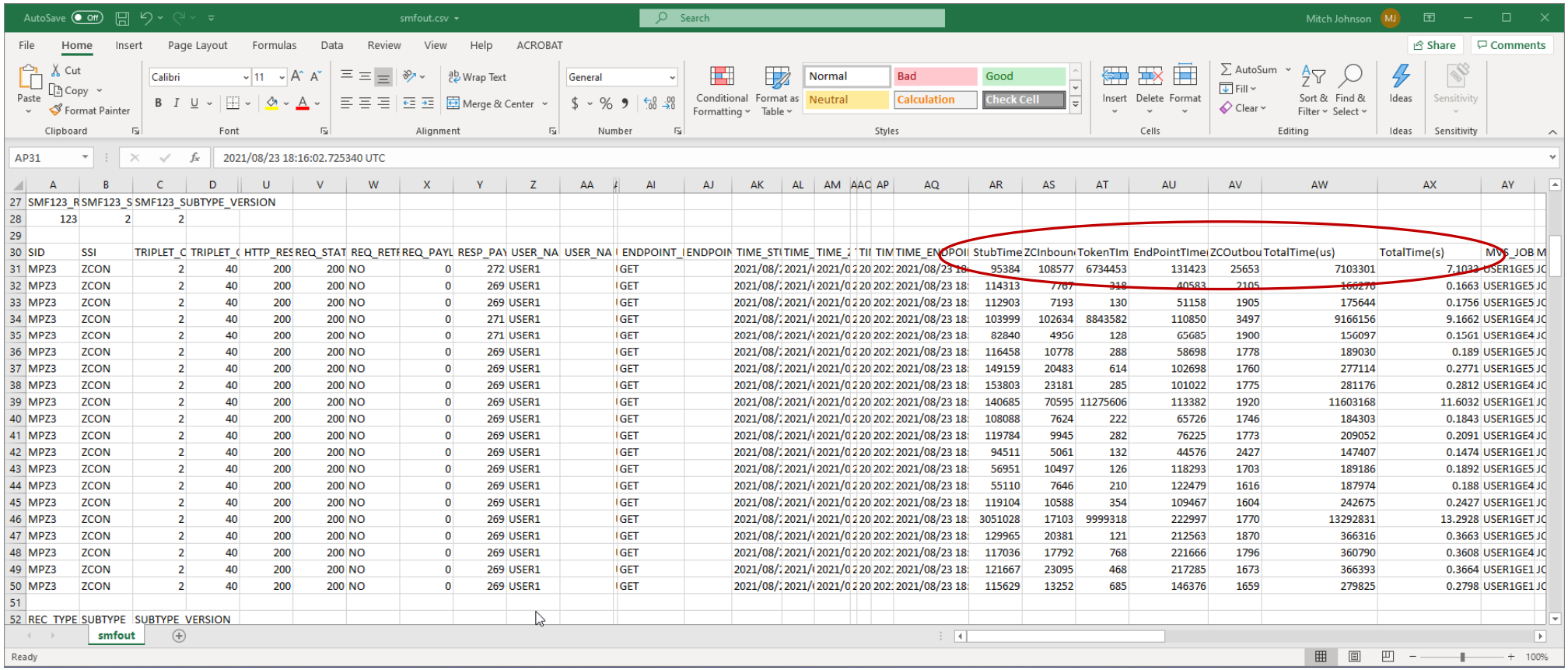
z/OS Connect SMF 123 subtype 2 version 2 *



	A	B	C	D	U	V	W	X	Y	Z	AA	AI	AJ	AK	AL	AM	AAC	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY
27	SMF123_R	SMF123_S	SMF123_SUBTYPE_VERSION																								
28	123	2	2																								
29																											
30	SID	SSI	TRIPLET_C	TRIPLET_(	HTTP_RES	REQ_STAT	REQ_RETI	REQ_PAYL	RESP_PAY	USER_NA	USER_NA	ENDPOINT_I	ENDPOIN	TIME_STI	TIME_TIME_2	TII	TIM	TIME_EN	POI	StubTime	ZCInboun	TokenTim	EndPointTime	ZCOutbou	TotalTime(us)	TotalTime(s)	MVS_JOB	M
31	MPZ3	ZCON	2	40	200	200	NO	0	272	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	95384	108577	6734453	131423	25653	7103301	7.1033	USER1GE5	JC
32	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	114313	7767	318	40583	2105	166276	0.1663	USER1GE5	JC
33	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	112903	7193	130	51158	1905	175644	0.1756	USER1GE5	JC
34	MPZ3	ZCON	2	40	200	200	NO	0	271	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	103999	102634	8843582	110850	3497	9166156	9.1662	USER1GE4	JC
35	MPZ3	ZCON	2	40	200	200	NO	0	271	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	82840	4956	128	65685	1900	156097	0.1561	USER1GE4	JC
36	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	116458	10778	288	58698	1778	189030	0.189	USER1GE5	JC
37	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	149159	20483	614	102698	1760	277114	0.2771	USER1GE5	JC
38	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	153803	23181	285	101022	1775	281176	0.2812	USER1GE4	JC
39	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	140685	70595	11275606	113382	1920	11603168	11.6032	USER1GE1	JC
40	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	108088	7624	222	65726	1746	184303	0.1843	USER1GE5	JC
41	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	119784	9945	282	76225	1773	209052	0.2091	USER1GE4	JC
42	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	94511	5061	132	44576	2427	147407	0.1474	USER1GE1	JC
43	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	56951	10497	126	118293	1703	189186	0.1892	USER1GE5	JC
44	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	55110	7646	210	122479	1616	187974	0.188	USER1GE4	JC
45	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	119104	10588	354	109467	1604	242675	0.2427	USER1GE1	JC
46	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	3051028	17103	9999318	222997	1770	13292831	13.2928	USER1GET	JC
47	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	129965	20381	121	212563	1870	366316	0.3663	USER1GE5	JC
48	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	117036	17792	768	221666	1796	360790	0.3608	USER1GE4	JC
49	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	121667	23095	468	217285	1673	366393	0.3664	USER1GE1	JC
50	MPZ3	ZCON	2	40	200	200	NO	0	269	USER1		GET		2021/08/2	2021/(	2021/0	2	20	202	2021/08/23 18:	115629	13252	685	146376	1659	279825	0.2798	USER1GE1	JC
51																											
52	REC_TYPE	SUBTYPE	SUBTYPE_VERSION																								

Some fields have been hidden

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

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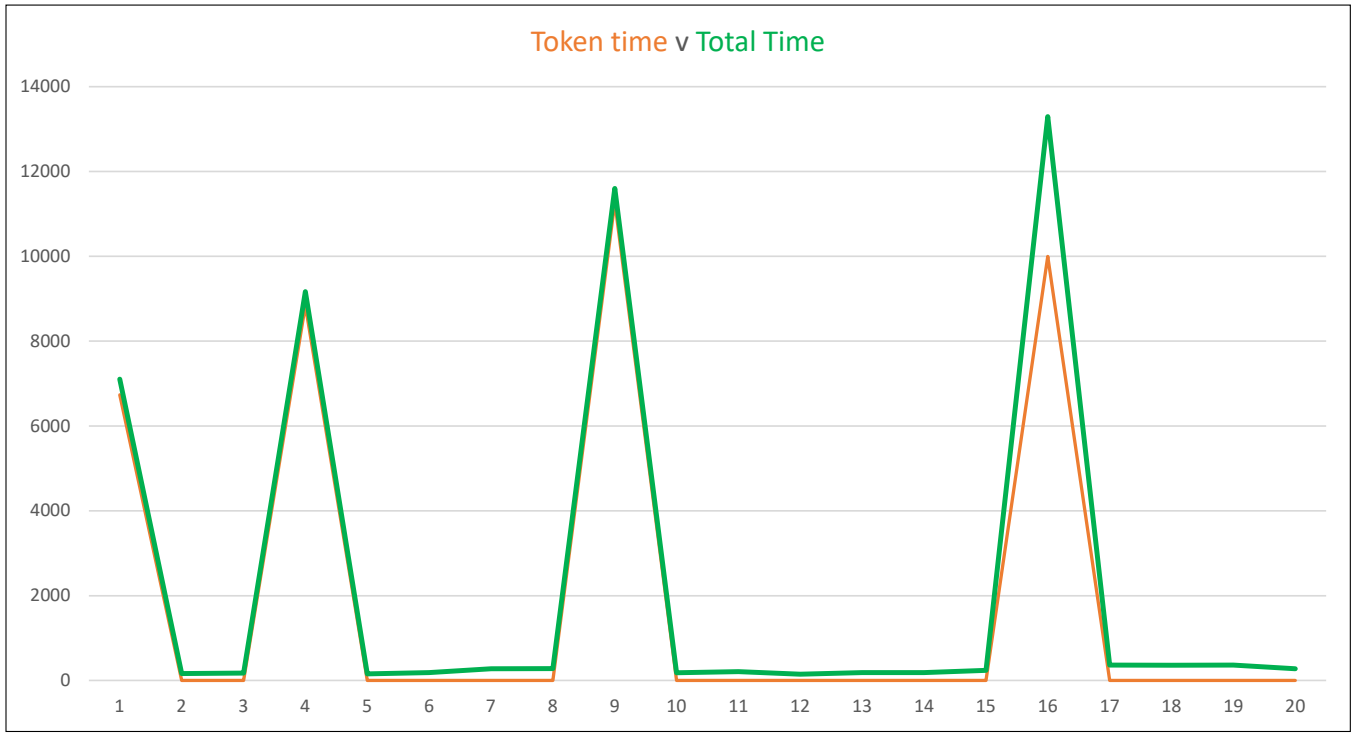
z/OS Connect SMF 123 subtype 2 version 2 graph example



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BAQSMFP output

```
************************************
* SMF123.1 V2 Request Data Section *
************************************
SMF123S1_REQ_TYPE = API (1)
SMF123S1_HTTP_RESP_CODE = 500
SMF123S1_REQ_TIMED_OUT = NO
SMF123S1_USER_NAME = FRED
SMF123S1_USER_NAME_MAPPED =
SMF123S1_CLIENT_IP_ADDR = 192.168.0.60
SMF123S1_API_NAME = db2employee
SMF123S1_API_VERSION = 1.0.0
SMF123S1_SERVICE_NAME = selectEmployee
SMF123S1_SERVICE_VERSION = 1.0.0
SMF123S1_REQ_METHOD = GET
SMF123S1_REQ_QUERY_STR =
SMF123S1_REQ_TARGET_URI = /db2/employee/000010
SMF123S1_REQ_PAYLOAD_LEN = 0
SMF123S1_RESP_PAYLOAD_LEN = 0
SMF123S1_TIME_ZC_ENTRY = 0x00DA2FB8 38ED5494 04000000 08880001
UTC_CONV_TIME_ZC_ENTRY = 2021/08/19 15:30:24.905545 UTC
SMF123S1_TIME_ZC_EXIT  = 0x00DA2FB8 38F3883F A8000000 08880001
UTC_CONV_TIME_ZC_EXIT  = 2021/08/19 15:30:24.930947 UTC
SMF123S1_TIME_SOR_SENT = 0x00DA2FB8 38F232A9 76000000 08A00001
UTC_CONV_TIME_SOR_SENT = 2021/08/19 15:30:24.925482 UTC
SMF123S1_TIME_SOR_RECV = 0x00DA2FB8 38F300A4 AA000000 08880001
UTC_CONV_TIME_SOR_RECV = 2021/08/19 15:30:24.928778 UTC
SMF123S1_SP_NAME = restclient-1.0
SMF123S1_SOR_REFERENCE = Db2Conn
SMF123S1_SOR_IDENTIFIER = Db2:DSN2LOC,wg31.washington.ibm.com:2446
SMF123S1_SOR_RESOURCE = services/zCEEService/selectEmployee
SMF123S1_REQ_ID = 302
SMF123S1_TRACKING_TOKEN = 0x42415131 77734859 41514159 314E6670 31395046
35304455 312B6E7A 51454241
 514E6F76 75446A74 564A5145 41413D3D 40404040 40404040 40404040 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_RETRIED = NO
SMF123S2_REQ_PAYLOAD_LEN = 0
SMF123S2_RESP_PAYLOAD_LEN = 269
SMF123S2_USER_NAME = USER1
SMF123S2_USER_NAME_MAPPED =
SMF123S2_USER_NAME_ASSERTED = USER1
SMF123S2_API_REQ_NAME = cscvinc_1.0.0
SMF123S2_API_REQ_VERSION = 1.0.0
SMF123S2_ENDPOINT_REFERENCE = cscvincAPI
SMF123S2_ENDPOINT_HOST = https://mpz3.washington.ibm.com
SMF123S2_ENDPOINT_PORT = 9463
SMF123S2_ENDPOINT_FULL_PATH = /cscvinc/employee/111111
SMF123S2_ENDPOINT_METHOD = GET
SMF123S2_ENDPOINT_QUERY_STR =
SMF123S2_TIME_STUB_SENT = 0x00DA2FC1 7D34CE8B 4A000000 084C0001
UTC_CONV_TIME_STUB_SENT = 2021/08/19 16:11:52.420584 UTC
SMF123S2_TIME_ZC_ENTRY  = 0x00DA2FC1 7D58AEE0 0E000000 08A00001
UTC_CONV_TIME_ZC_ENTRY  = 2021/08/19 16:11:52.567534 UTC
SMF123S2_TIME_ZC_EXIT   = 0x00DA2FC1 87DCB806 E6000000 08880001
UTC_CONV_TIME_ZC_EXIT   = 2021/08/19 16:12:03.594112 UTC
SMF123S2_TIME_TOKEN_GET_START   = 0x00DA2FC1 7D59D3A6 E6000000 08A00001
UTC_CONV_TIME_TOKEN_GET_START   = 2021/08/19 16:11:52.572218 UTC
SMF123S2_TIME_TOKEN_GET_FINISH  = 0x00DA2FC1 7D59DF85 CC000000 088C0001
UTC_CONV_TIME_TOKEN_GET_FINISH  = 2021/08/19 16:11:52.572408 UTC
SMF123S2_TIME_ENDPOINT_SENT     = 0x00DA2FC1 7D5A0328 04000000 088C0001
UTC_CONV_TIME_ENDPOINT_SENT     = 2021/08/19 16:11:52.572978 UTC
SMF123S2_TIME_ENDPOINT_RECEIVED = 0x00DA2FC1 87DC8216 58000000 08880001
UTC_CONV_TIME_ENDPOINT_RECEIVED = 2021/08/19 16:12:03.593249 UTC
SMF123S2_MVS_JOBNAME = USER1GE2
SMF123S2_MVS_JOBID = JOB09543
SMF123S2_MVS_SYSNAME = MPZ3
SMF123S2_MVS_ASID = 54
SMF123S2_MVS_SID = MPZ3
SMF123S2_REQ_ID = 732
SMF123S2_TRACKING_TOKEN = 0x42415131 77734859 41514159 314E6670 31395046 35304455 312B6E7A 51454241
 514E6F76 77583159 7275414F 40404040 40404040 40404040 40404040 40404040
SMF123S2_REQ_HDR1 =
SMF123S2_REQ_HDR2 =
SMF123S2_REQ_HDR3 =
```

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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 -----
                            Avg         Max      Req ID    ZC Entry
SOR Sent Latency          .0326       .3781         551    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 -----
                            Avg         Max      Req ID    ZC Entry
SOR Sent Latency          .0478       .5953         488    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 -----
                            Avg         Max      Req ID    ZC Entry
SOR Sent Latency          .0300       .0589         450    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
```

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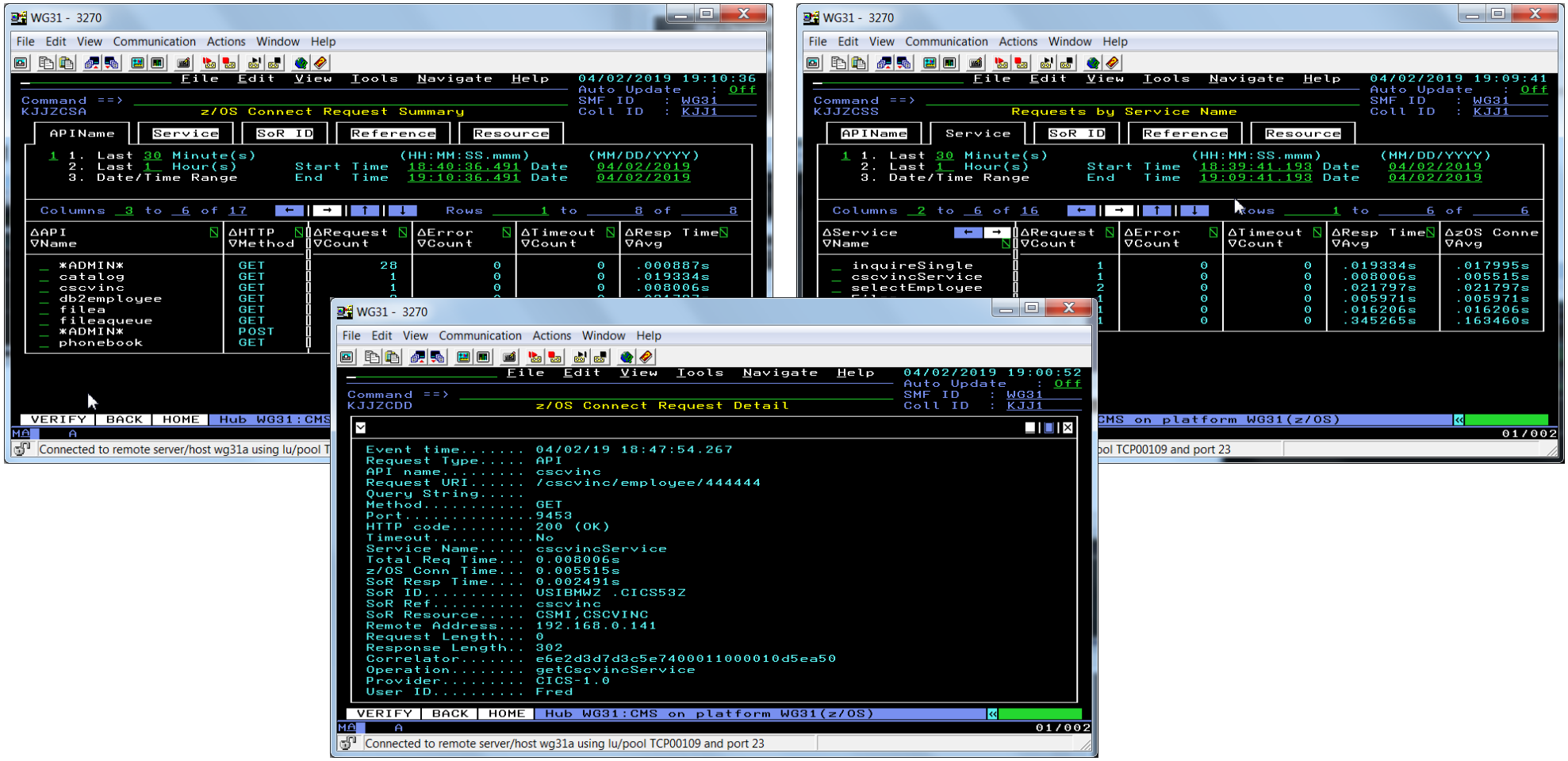
IBM z Omegamon for JVM



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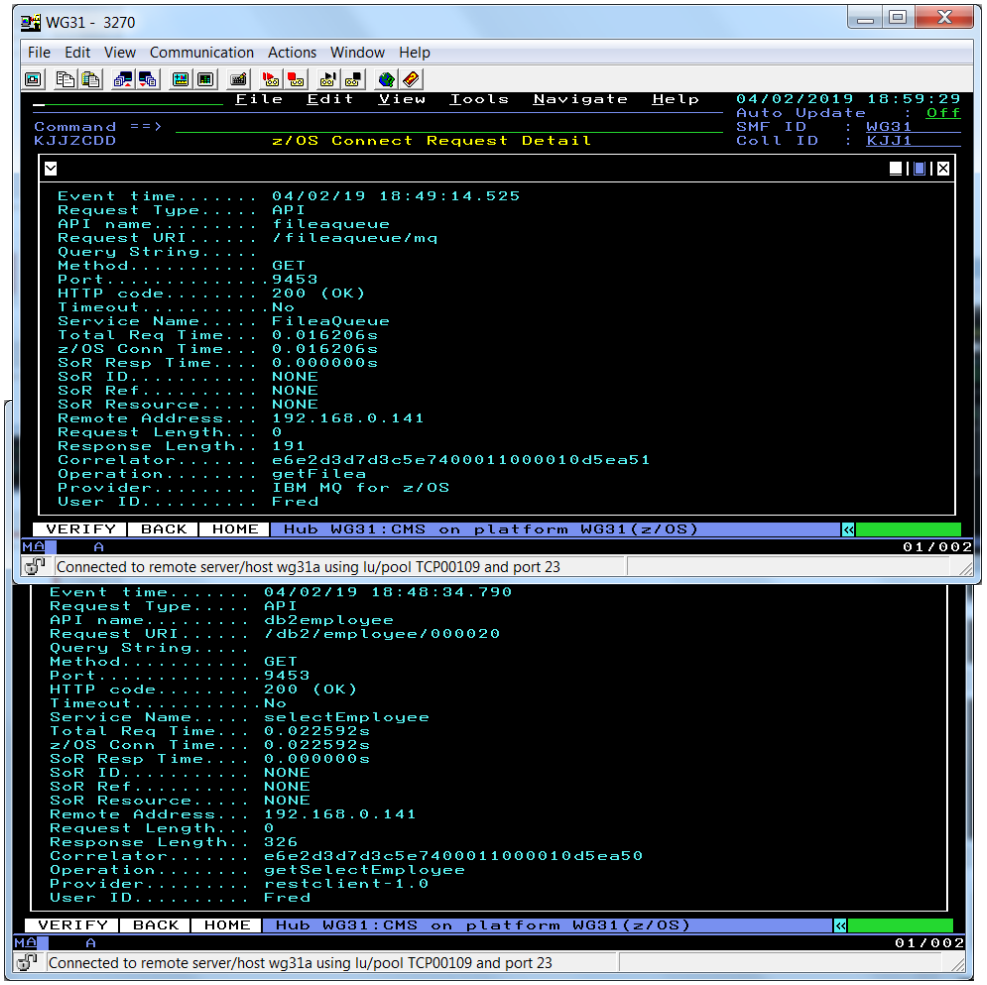
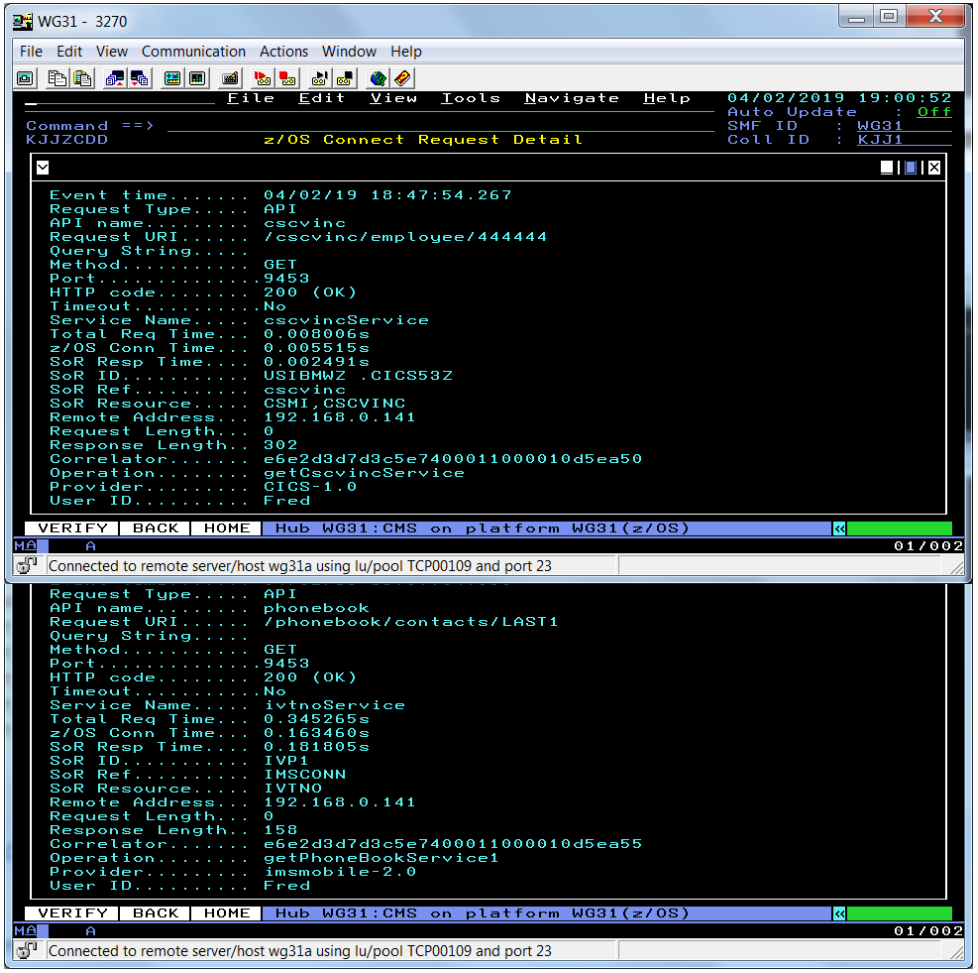
IBM z Omegamon for JVM





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Miscellaneous Odds and Ends

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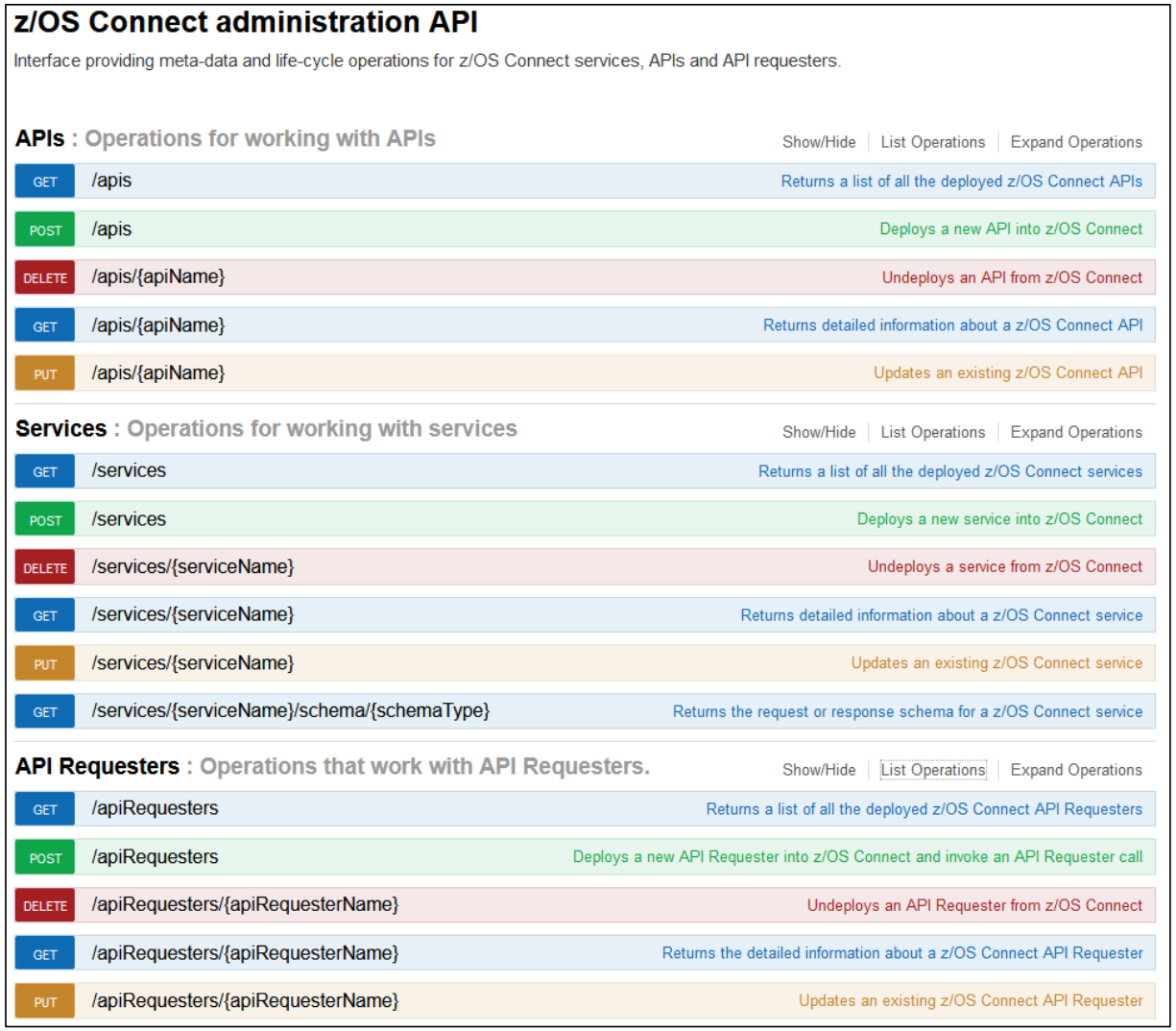

z/OS Connect administration API

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

APIs : Operations for working with APIs

Show/Hide | List Operations | Expand Operations

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

Services : Operations for working with services

Show/Hide | List Operations | Expand Operations

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

API Requesters : Operations that work with API Requesters.

Show/Hide | List Operations | Expand Operations

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

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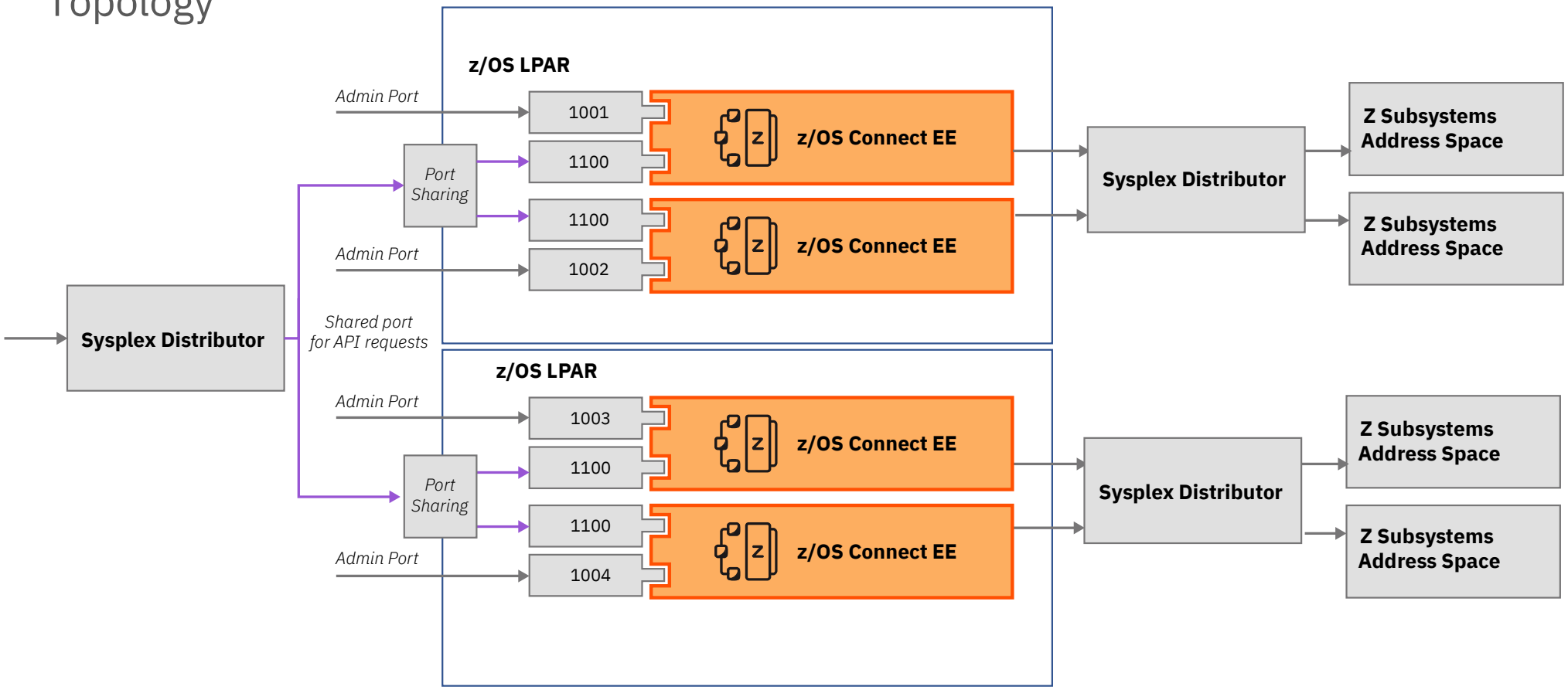
High Availability

Topology



ibm.biz/zosconnect-ha-concepts

ibm.biz/zosconnect-scenarios

Sysplex DVIPAs

SYS1.TCPIP.TCPPARMS(IPNODES)

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

SYS1.TCPIP.TCPPARMS(PROFMPZ3)

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

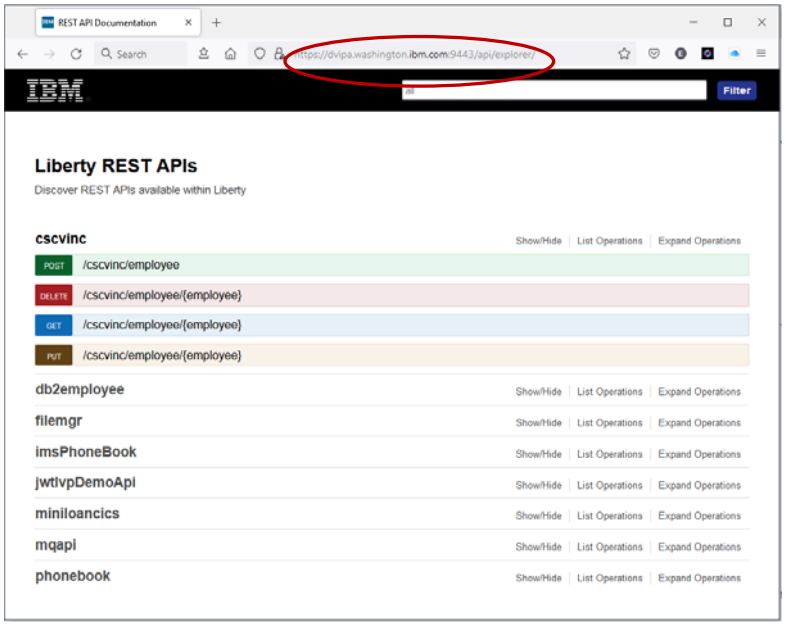
HOMETEST

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

EZA0605I Using Name Server to Resolve MPZ3
EZA0611I The following IP addresses correspond to TCP Host Name: MPZ3
EZA0612I 192.168.17.243
EZA0614I The following IP addresses are the HOME IP addresses defined in PROFILE.TCPIP:
EZA0615I 192.168.17.243
EZA0615I 172.1.1.243
EZA0615I 192.168.17.240
EZA0615I 127.0.0.1

EZA0618I All IP addresses for MPZ3 are in the HOME list!
EZA0622I Hometest was successful - all Tests Passed!
```

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



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

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.
```

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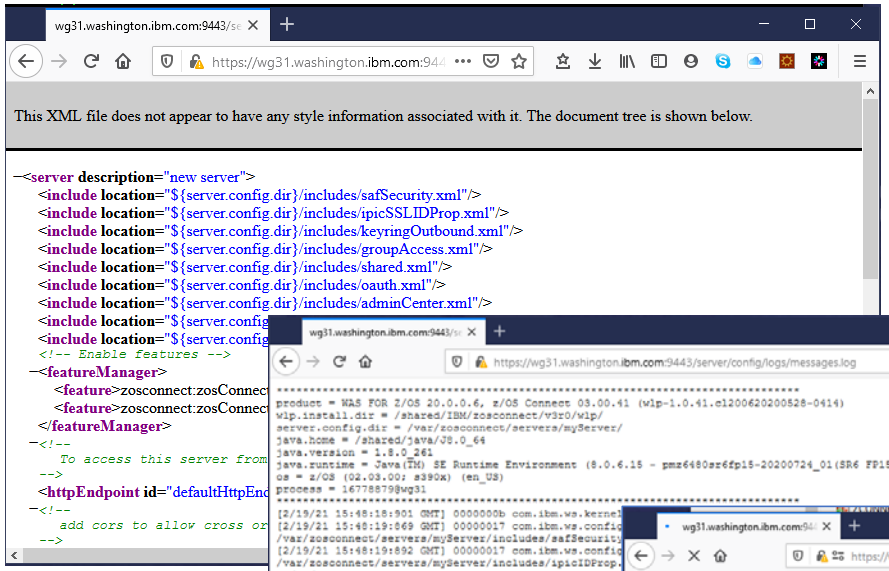
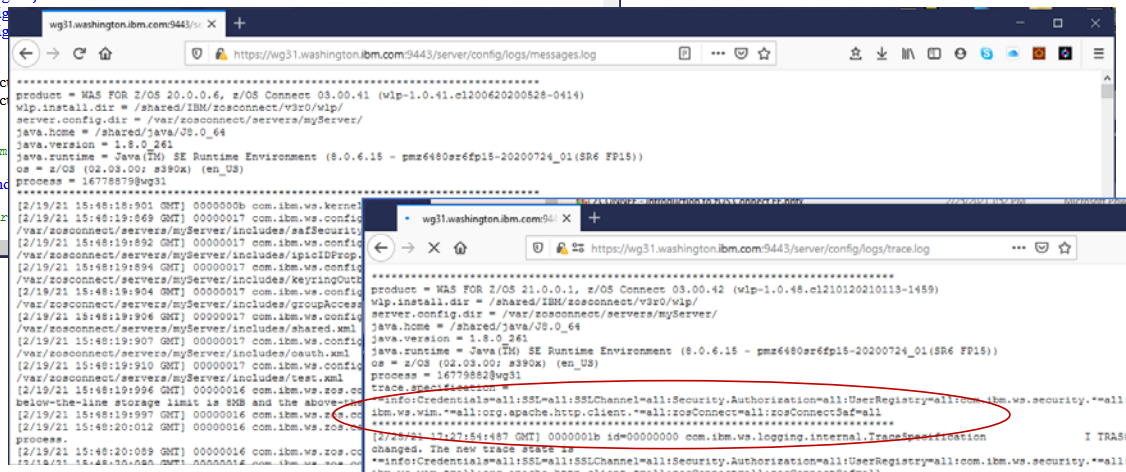
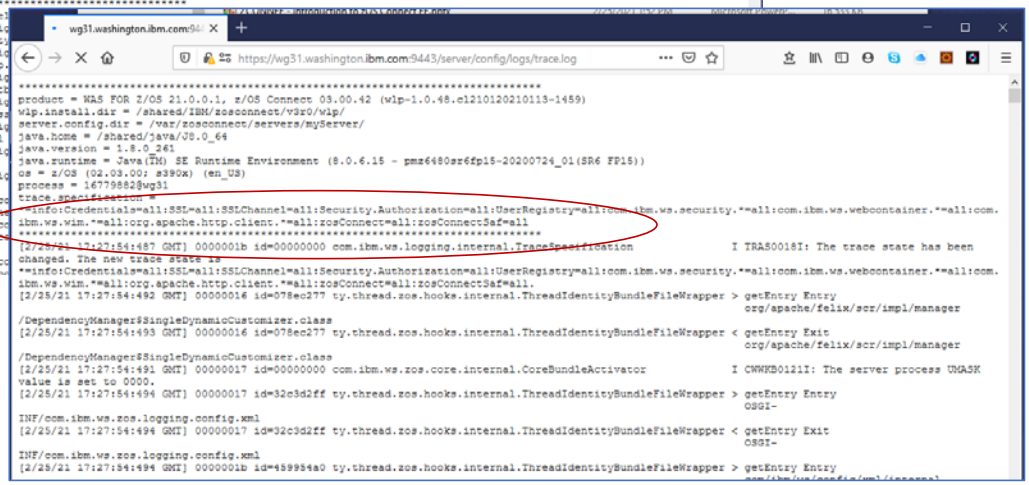
Provide remote access to configuration/log information




```
<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>
```





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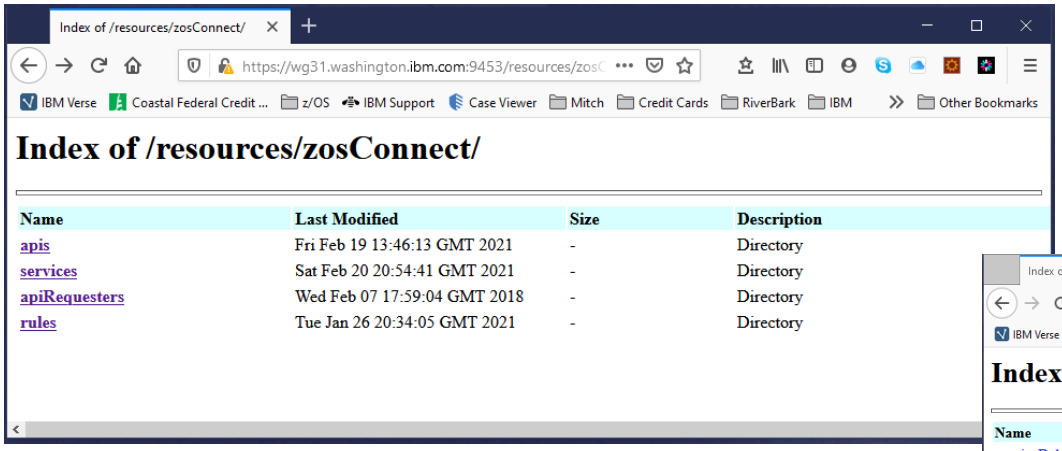
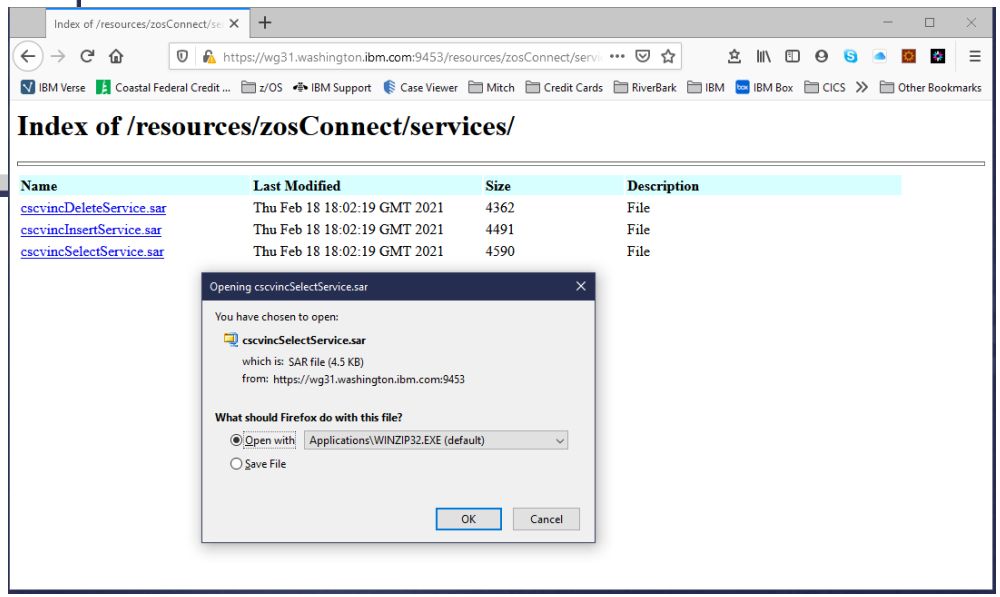
Provide remote access to z/OS Connect archives files






```
<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>
```

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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

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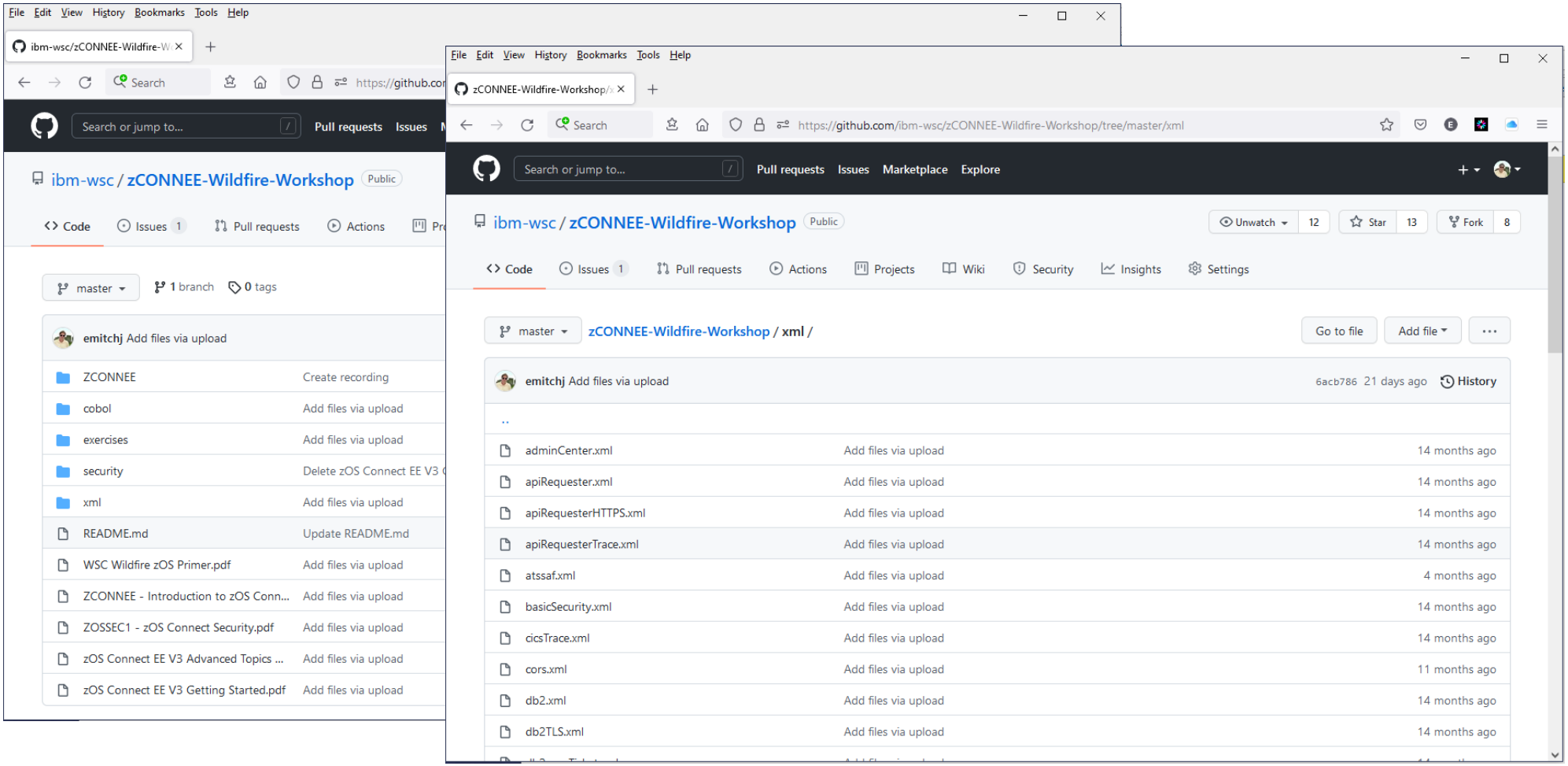
z/OS Connect Wildfire Github Site

https://ibm.biz/Bdf8BZ

z/OS Connect EE



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Thank you for listening and your questions.

Additional Material
Sample Administrative JCL

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Sample JCL - Check Java installation by display Java version information

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

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

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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.

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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

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Sample JCL - Executing the Liberty *productInfo* command

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

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

cicsService-1.0 Ý1.0.0¨
wmqJmsClient-1.1 Ý1.0.0¨
wmqJmsClient-2.0 Ý1.0.0¨
Product Extension: mqzosconnect
mqService-1.0 Ý1.0.0¨
Product Extension: imsmobile
imsmobile-2.0 Ý2.0.0.202108160933¨
Product validation completed successfully.
```

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


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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'"
```

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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/bbomsmfv.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 "
```


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

ZCEEDUMP

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

ZCEERSTR

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

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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=*
```

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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
 //MFPINPUT DD DISP=SHR,DSN=JOHNSON.DUMPSMF.SORT
 //MFPMSGDS DD SYSOUT=*
//SYSIN    DD   *
 SYSOUT(O)
 SYSRPTS(WLMGL(RCPER))   /*WORKLOAD ACTIVITY REPORT  */
```

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Sample JCL - Restarting the Java Health Center collection

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

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

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

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