



WebSphere Liberty Profile on z/OS

Managing, Monitoring and Problem Determination

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24 IBM Corporation
Slide 1

Notes and Disclaimers

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

Agenda

- **Administering Liberty Servers**
 - Useful Liberty features and MVS commands
- **Managing and Monitoring Liberty servers**
 - WLM configurations
 - SMF options
 - Monitoring OMVS processes
 - Above the bar storage
 - High availability options
- **Where do I look when things go wrong?**
 - Problem determination techniques
 - Understand the anatomy of messages
- **Appendix – JCL, etc. samples**

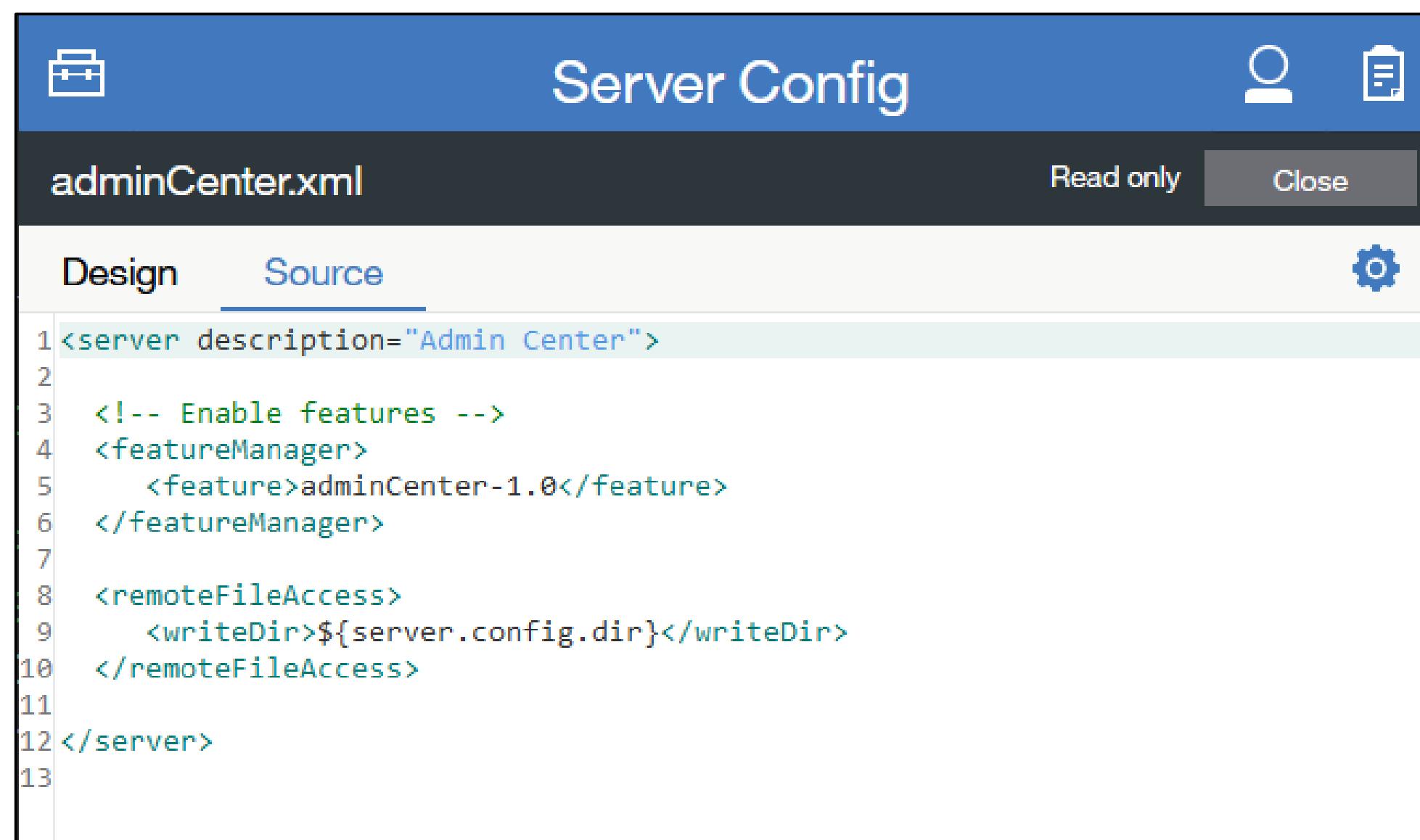
Managing Liberty Servers

**Useful Liberty features and
MVS commands**



Liberty feature: adminCenter-1.0

This feature provides a web interface to Administrators for reviewing and changing the server XML configuration.



The screenshot shows a 'Server Config' interface titled 'adminCenter.xml'. It has tabs for 'Design' and 'Source', with 'Source' selected. The XML code is as follows:

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

Required EJBRoles

```
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)
```

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

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



Liberty feature: adminCenter-1.0 – example

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

Server Config

server.xml

Design Source

Include \${server.config.dir}/zc3lab/wola.xml

Require request authentication

false Select

Indicates that users must provide security credentials in order for z/OS Connect to process requests. This setting applies to requests associated with all service endpoints.

Preserve JSON object payload order

false (default) Select

When enabled the order of entries in a JSON object payload is preserved.

Preserve JSON payload character format

false (default) Select

Indicates if the JSON payload's characters should flow unchanged through z/OS Connect during a service invocation and schema retrievals when using z/OS Connect's data transformations. When it is set to false, UTF-8 encoded characters might be converted to ASCII. To take effect, the attribute definition preserves no value.

Set response encoding to

false (default) Select

Indicates that the character encoding of responses is set to global.

Return all errors in JSON

true (default) Select

When enabled, error responses are returned in JSON format. This is compatible with previous versions of z/OS Connect.

Include \${server.config.dir}/zc3lab/https.xml

Include \${server.config.dir}/zc3lab/hats.xml

Include \${server.config.dir}/zc3lab/ipic.xml

Include \${server.config.dir}/zc3lab/mq.xml

Include \${server.config.dir}/zc3lab/db2.xml

Include \${server.config.dir}/zc3lab/imsData.xml

Include \${server.config.dir}/zc3lab/adminConfig.xml

Feature Manager

z/OS Connect Manager

z/OS Logging

z/OS Connect policy name cicsPolicy

omegamonRequestMonitor-2.0 omeg...

z/OS Connect Interceptors interceptor...

Cross-Origin Resource Sharing default...

HTTP Endpoint defaultHttpEndpoint

Configuration Management

z/OS Connect APIs

z/OS Connect Services

Application Monitoring

Server Config

server.xml

Design Source

Save Close

Press Ctrl+space for content assist.

zosconnect_apiRequester

zosconnect_apiRequesters

zosconnect_auditInterceptor

zosconnect_authData

zosconnect_authorizationInterceptor

zosconnect_authorizationServer

zosconnect_authToken

zosconnect_zosConnectServiceRestClientBasicAuth />

<!-- To access this server from a remote client add a host attribute to the following element, e.g. host="-->

<httpEndpoint host="*" httpPort="9080" httpsPort="9443" id="defaultHttpEndpoint"/>

<!-- add cors to allow cross origin access, e.g. when using swagger UI to fetch swagger doc from zOS Connect Enterprise Edition -->

<cors allowCredentials="true" allowedHeaders="Origin, Content-Type, Authorization, Cache-Control, Expires, Pragma" allowedMethods="GET, POST, PUT, PATCH, DELETE, HEAD, OPTIONS" maxAge="1800" />



Liberty feature: restConnector-2.0

A REST administrative connector that provides real time access to configuration settings from Java clients or a 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.

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

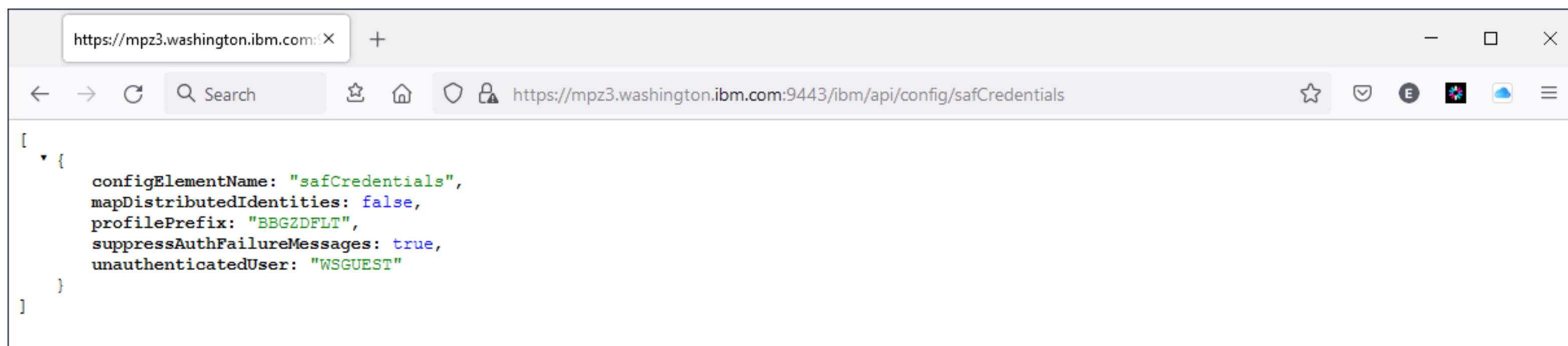
<https://wg31.washington.ibm.com:9443/ibm/api/config/jmsQueue>
https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491
https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectServiceRestClientConnection
https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?id=miniloan
<https://wg31.washington.ibm.com:9443/ibm/api/config/safCredentials>
<https://wg31.washington.ibm.com:9443/ibm/api/config/connectionFactory>
https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectManager
<https://wg31.washington.ibm.com:9443/ibm/api/config/keyStore>
<https://wg31.washington.ibm.com:9443/ibm/api/config/ssl>
<https://wg31.washington.ibm.com:9443/ibm/api/config/sslDefault>
https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectManager
https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectAPIs
https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_services
https://wg31.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(ZCEEUSRS) ACCESS(READ)
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.Reader CLASS(EJBROLE) ID(ZCEEUSRS) ACCESS(READ)
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.allAuthenticatedUsers CLASS(EJBROLE) ID(ZCEEUSRS) ACCESS(READ)
SETR RACLIST(EJBROLE) REFRESH
```

Liberty feature: restConnector-2.0 – safCredentials/safAuthorization examples

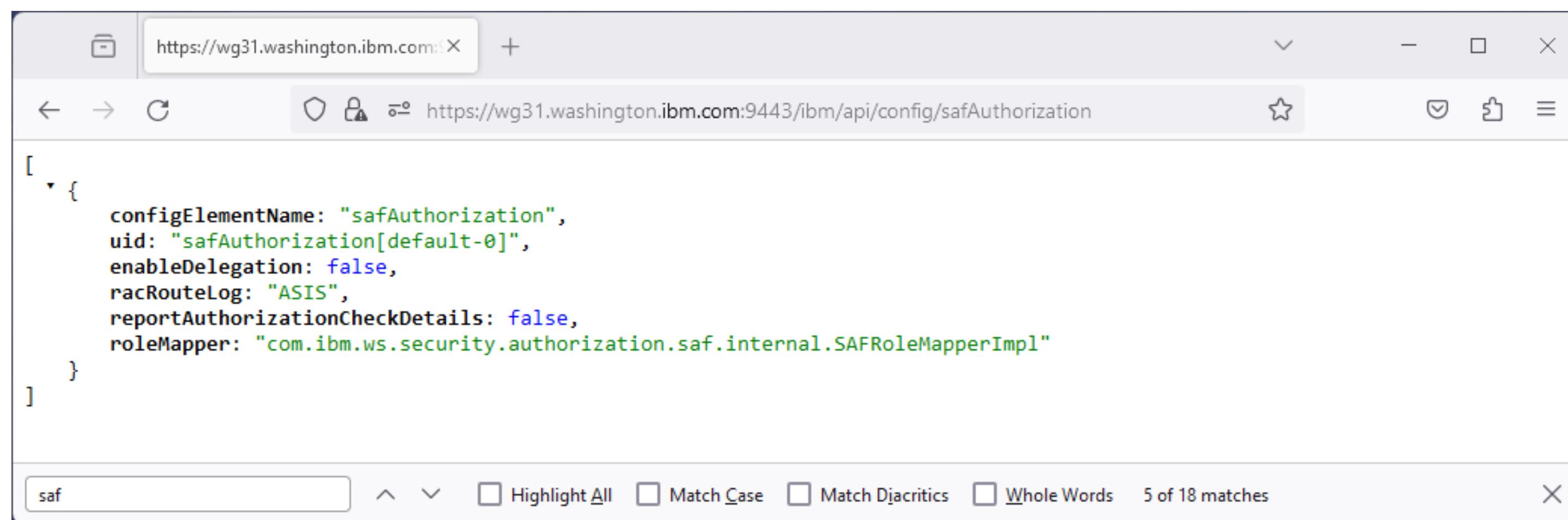


https://wg31.washington.ibm.com:9443/ibm/api/config/safCredentials



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

https://wg31.washington.ibm.com:9443/ibm/api/config/safAuthorization



```
[{"configElementName": "safAuthorization", "uid": "safAuthorization[default-0]", "enableDelegation": false, "racRouteLog": "ASIS", "reportAuthorizationCheckDetails": false, "roleMapper": "com.ibm.ws.security.authorization.saf.internal.SAFAuthorizationRoleMapperImpl"}]
```

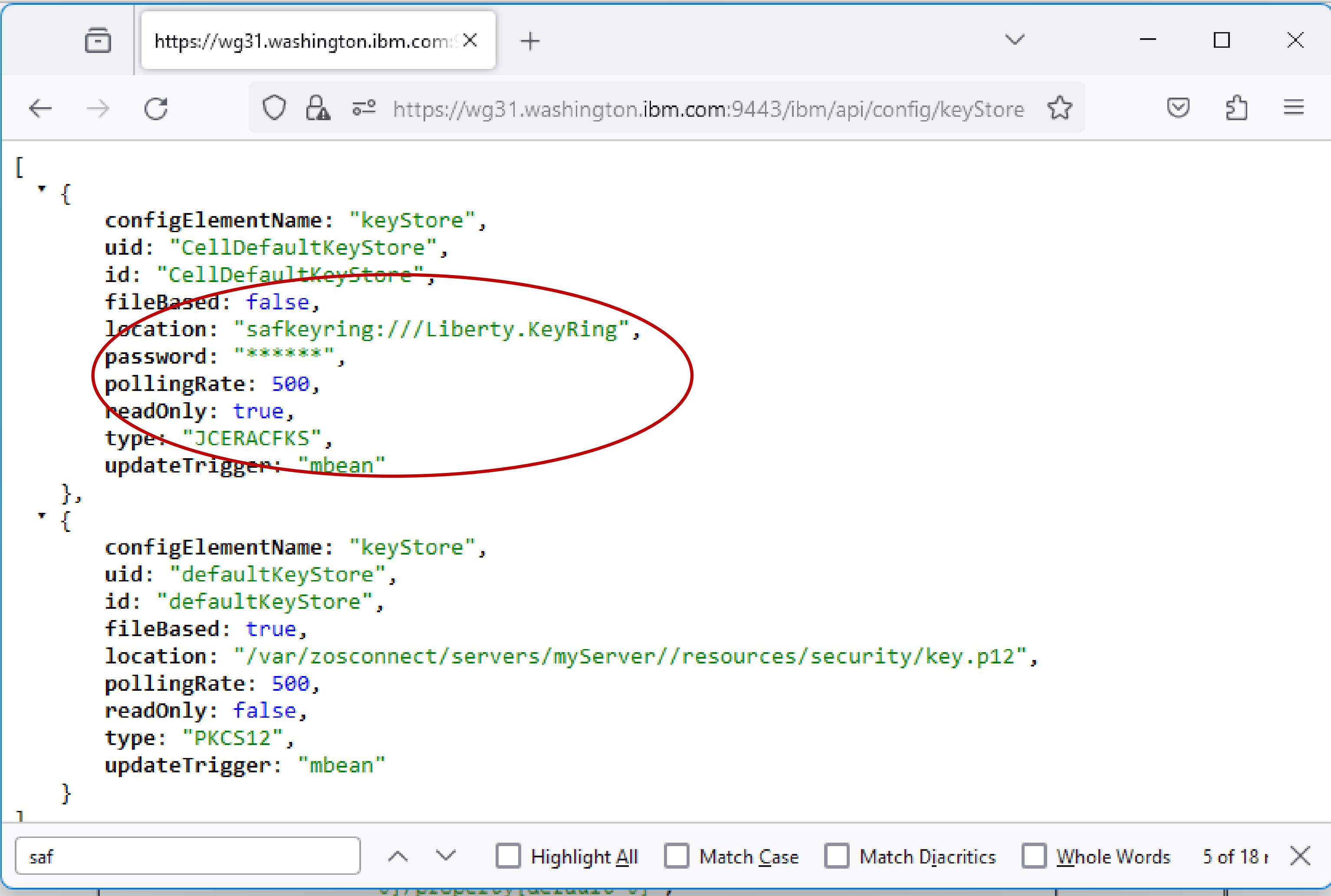
saf

Highlight All Match Case Match Diacritics Whole Words 5 of 18 matches



Liberty feature: restConnector-2.0 – keystore example

https://wg31.washington.ibm.com:9443/ibm/api/config/keyStore

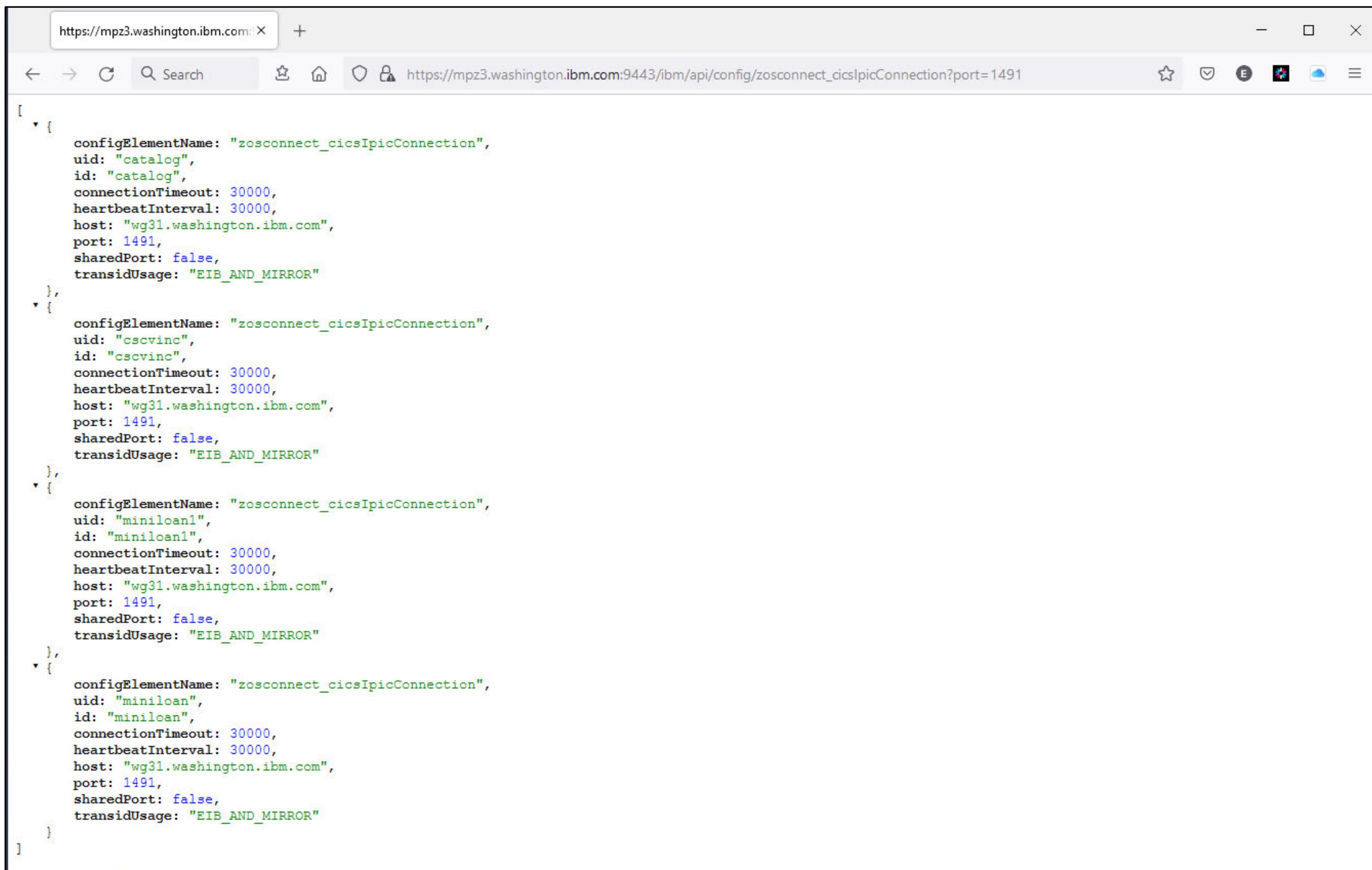


```
[  
  {  
    configElementName: "keyStore",  
    uid: "CellDefaultKeyStore",  
    id: "CellDefaultKeyStore",  
    fileBased: false,  
    location: "safkeyring:///Liberty.KeyRing",  
    password: "*****",  
    pollingRate: 500,  
    readOnly: true,  
    type: "JCERACFKS",  
    updateTrigger: "mbean"  
  },  
  {  
    configElementName: "keyStore",  
    uid: "defaultKeyStore",  
    id: "defaultKeyStore",  
    fileBased: true,  
    location: "/var/zosconnect/servers/myServer//resources/security/key.p12",  
    pollingRate: 500,  
    readOnly: false,  
    type: "PKCS12",  
    updateTrigger: "mbean"  
  }  
]
```



Liberty feature: restConnector-2.0 – zosconnect_cicsIpicConnection example

https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491



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

Liberty feature: restConnector-2.0 – IMS connection factory example

https://wg31.washington.ibm.com:9453/ibm/api/config/imsmobile_imsConnection

The image shows two side-by-side browser windows displaying JSON configuration data for IMS connection factories.

Left Browser Window: The URL is https://wg31.washington.ibm.com:9453/ibm/api/config/imsmobile_imsConnection. The JSON content includes a red box highlighting the "properties.gmoa" section, which contains various connection parameters like hostName, portNumber, and SSL settings. The "api" section lists the endpoint `/ibm/api/validation/connectionFactory/IVP1`.

```
[{"configElementName": "imsmobile_imsConnection", "uid": "IMSCONN", "id": "IMSCONN", "comment": "", "connectionFactoryRef": {"configElementName": "connectionFactory", "uid": "IVP1", "id": "IVP1", "containerAuthDataRef": {"configElementName": "authData", "uid": "Connection1_Auth", "id": "Connection1_Auth", "password": "*****", "user": "USER1"}, "properties.gmoa": {"CMODedicated: false, IMSConnectName: "", SSLEnabled: false, SSLEncryptionType: "Weak", SSLKeyStoreName: "", SSLKeyStorePassword: "*****", SSLProtocol: "TLSv1.0", SSLTrustStoreName: "", SSLTrustStorePassword: "*****", applicationName: "", dataStoreName: "myDStrNm", groupName: "", hostName: "wg31.washington.ibm.com", password: "*****", passwordPhrase: "*****", portNumber: 4000, traceLevel: 1, userName: ""}, "api": ["/ibm/api/validation/connectionFactory/IVP1"]}, "connectionTimeout: "-1", connectionType: "IMSCONNECT", pingIMSConnectionInvoke: false}]
```

Right Browser Window: The URL is <https://wg31.washington.ibm.com:9453/>. It displays a JSON object with a single entry for the "imsmobile_interaction" connection factory, which includes properties like imsConnectCodepage, imsConnectTimeout, and interactionTypeDescription.

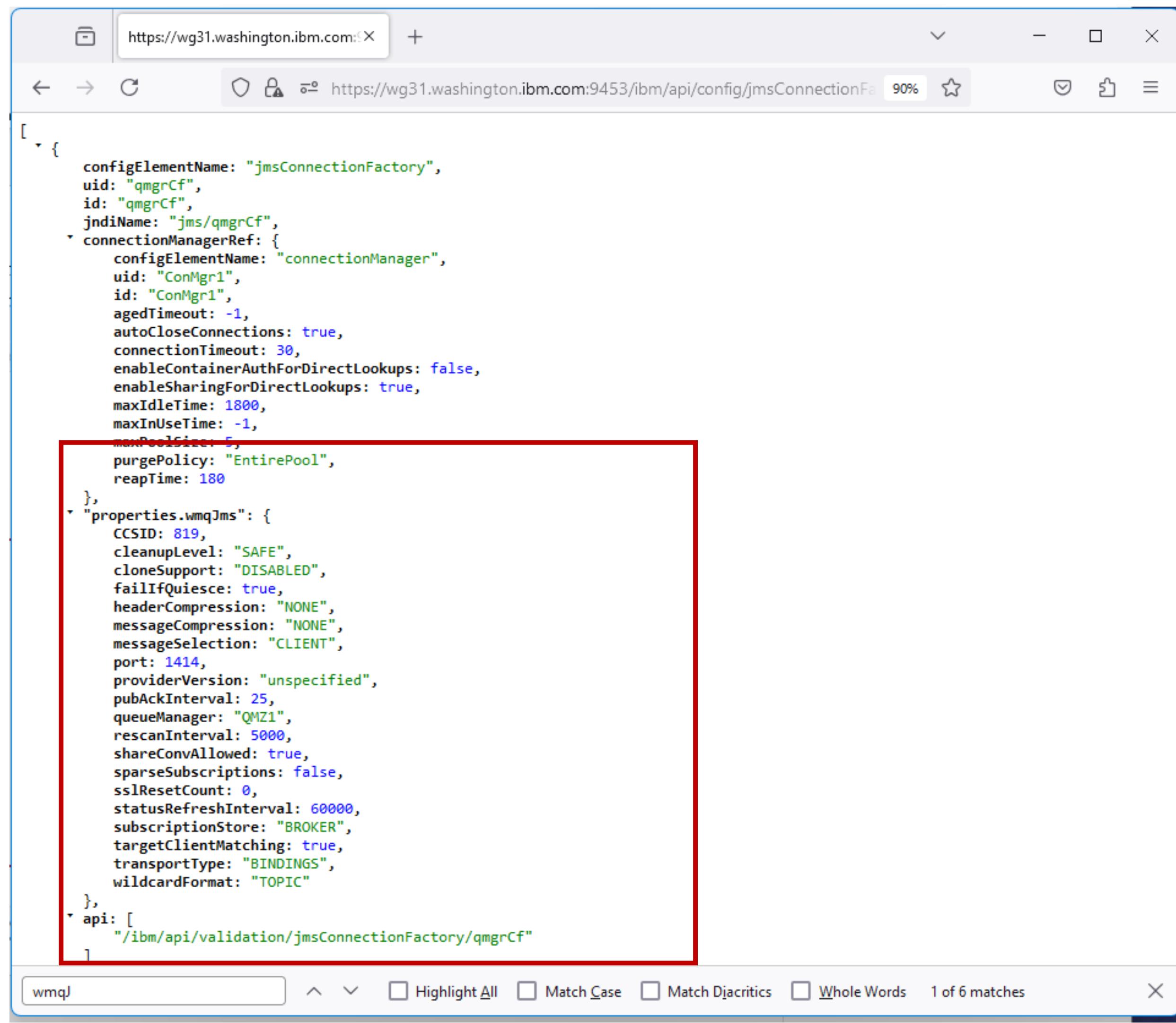
```
[{"configElementName": "imsmobile_interaction", "uid": "IMSINTER", "id": "IMSINTER", "ackNakProvider: 0, comment: "", commitMode: 1, configSchemaVersion: 1, imsConnectCodepage: "Cp1047", imsConnectTimeout: 30000, imsConnectUserMessageExitIdentifier: "*SAMPL1*", imsDatastoreName: "IVP1", inputMessageDataSegmentsIncludeLlzzAndTrancode: true, interactionTimeout: -1, interactionTypeDescription: "SENDRECV", ltermOverrideName: "", outputMessageDataSegmentsIncludeLlzz: true, propagateNetworkSecurityCred: true, propertyType: "TRAN", purgeUndeliverableOutput: true, rerouteUndeliverableOutput: false, resumeTpipeProcessing: 16, returnMfsModname: true, syncLevel: 0, useCM0AckNoWait: true}]
```

A search bar at the bottom of the right window shows the text "imsinter".

Liberty feature: restConnector-2.0 – jmsConnectionFactory example



https://wg31.washington.ibm.com:9453/ibm/api/config/jmsConnectionFactory



```
[{"configElementName": "jmsConnectionFactory", "uid": "qmgrCf", "id": "qmgrCf", "jndiName": "jms/qmgrCf", "connectionManagerRef": {"configElementName": "connectionManager", "uid": "ConMgr1", "id": "ConMgr1", "agedTimeout": -1, "autoCloseConnections": true, "connectionTimeout": 30, "enableContainerAuthForDirectLookups": false, "enableSharingForDirectLookups": true, "maxIdleTime": 1800, "maxInUseTime": -1, "maxPoolSize": 5, "purgePolicy": "EntirePool", "reapTime": 180}, "properties.wmqJms": {"CCSID": 819, "cleanupLevel": "SAFE", "cloneSupport": "DISABLED", "failIfQuiesce": true, "headerCompression": "NONE", "messageCompression": "NONE", "messageSelection": "CLIENT", "port": 1414, "providerVersion": "unspecified", "pubAckInterval": 25, "queueManager": "QM1", "rescanInterval": 5000, "shareConvAllowed": true, "sparseSubscriptions": false, "sslResetCount": 0, "statusRefreshInterval": 60000, "subscriptionStore": "BROKER", "targetClientMatching": true, "transportType": "BINDINGS", "wildcardFormat": "TOPIC"}, "api": ["/ibm/api/validation/jmsConnectionFactory/qmgrCf"]}]
```

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Liberty feature: apiDiscovery-1.0 or OpenAPI-3.0 to display/execute APIs

The screenshot shows a browser window titled "IBM REST API Documentation" with the URL <https://mpz3.washington.ibm.com:9443/api/explorer/#/cscvinc>. The page displays the "Liberty REST APIs" section, which lists various API endpoints under categories like "cscvinc", "db2employee", "filemgr", "imsPhoneBook", "jwtlvpDemoApi", "miniloancics", "mqapi", and "phonebook". Each endpoint is shown with its method (e.g., POST, GET, PUT, DELETE) and path. A "Filter" button is located in the top right corner of the search bar.

cscvinc		Show/Hide List Operations Expand Operations
POST	/cscvinc/employee	
DELETE	/cscvinc/employee/{employee}	
GET	/cscvinc/employee/{employee}	
PUT	/cscvinc/employee/{employee}	
db2employee		Show/Hide List Operations Expand Operations
filemgr		Show/Hide List Operations Expand Operations
imsPhoneBook		Show/Hide List Operations Expand Operations
jwtlvpDemoApi		Show/Hide List Operations Expand Operations
miniloancics		Show/Hide List Operations Expand Operations
mqapi		Show/Hide List Operations Expand Operations
phonebook		Show/Hide List Operations Expand Operations

mitchj@us.ibm.com



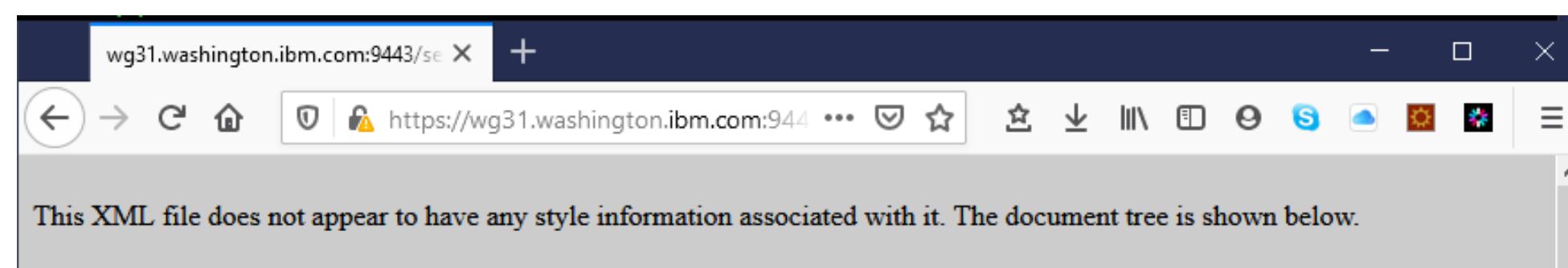
IBM MQ Administrative REST API

qmgr		Show/Hide List Operations Expand Operations
GET	/ibmmq/rest/v1/admin/qmgr	Retrieves details of all queue managers in the IBM MQ installation.
GET	/ibmmq/rest/v1/admin/qmgr/{qmgr}	Retrieves details of a specific queue manager in the IBM MQ installation.
*	GET /ibmmq/rest/v2/admin/qmgr	Retrieves details of all queue managers in the IBM MQ installation.
*	GET /ibmmq/rest/v2/admin/qmgr/{qmgr}	Retrieves details of a specific queue manager in the IBM MQ installation.
qmgr : action		Show/Hide List Operations Expand Operations
POST	/ibmmq/rest/v1/admin/action/qmgr/{qmgrName}/mqsc	Runs an MQSC command.
*	POST /ibmmq/rest/v2/admin/action/qmgr/{qmgrName}/mqsc	Runs an MQSC command.
queue		Show/Hide List Operations Expand Operations
GET	/ibmmq/rest/v1/admin/qmgr/{qmgrName}/queue	Retrieves details of all queues.
POST	/ibmmq/rest/v1/admin/qmgr/{qmgrName}/queue	Creates a queue.
DELETE	/ibmmq/rest/v1/admin/qmgr/{qmgrName}/queue/{qName}	Deletes a queue.
GET	/ibmmq/rest/v1/admin/qmgr/{qmgrName}/queue/{qName}	Retrieves details of a specific queue.
PATCH	/ibmmq/rest/v1/admin/qmgr/{qmgrName}/queue/{qName}	Modifies a queue.
subscription		Show/Hide List Operations Expand Operations
GET	/ibmmq/rest/v1/admin/qmgr/{qmgrName}/subscription	Retrieves details of all subscriptions.
GET	/ibmmq/rest/v1/admin/qmgr/{qmgrName}/subscription/{name}	Retrieves details of a specific subscription.



Liberty: Enable as a file server to provide remote access to configuration/logs

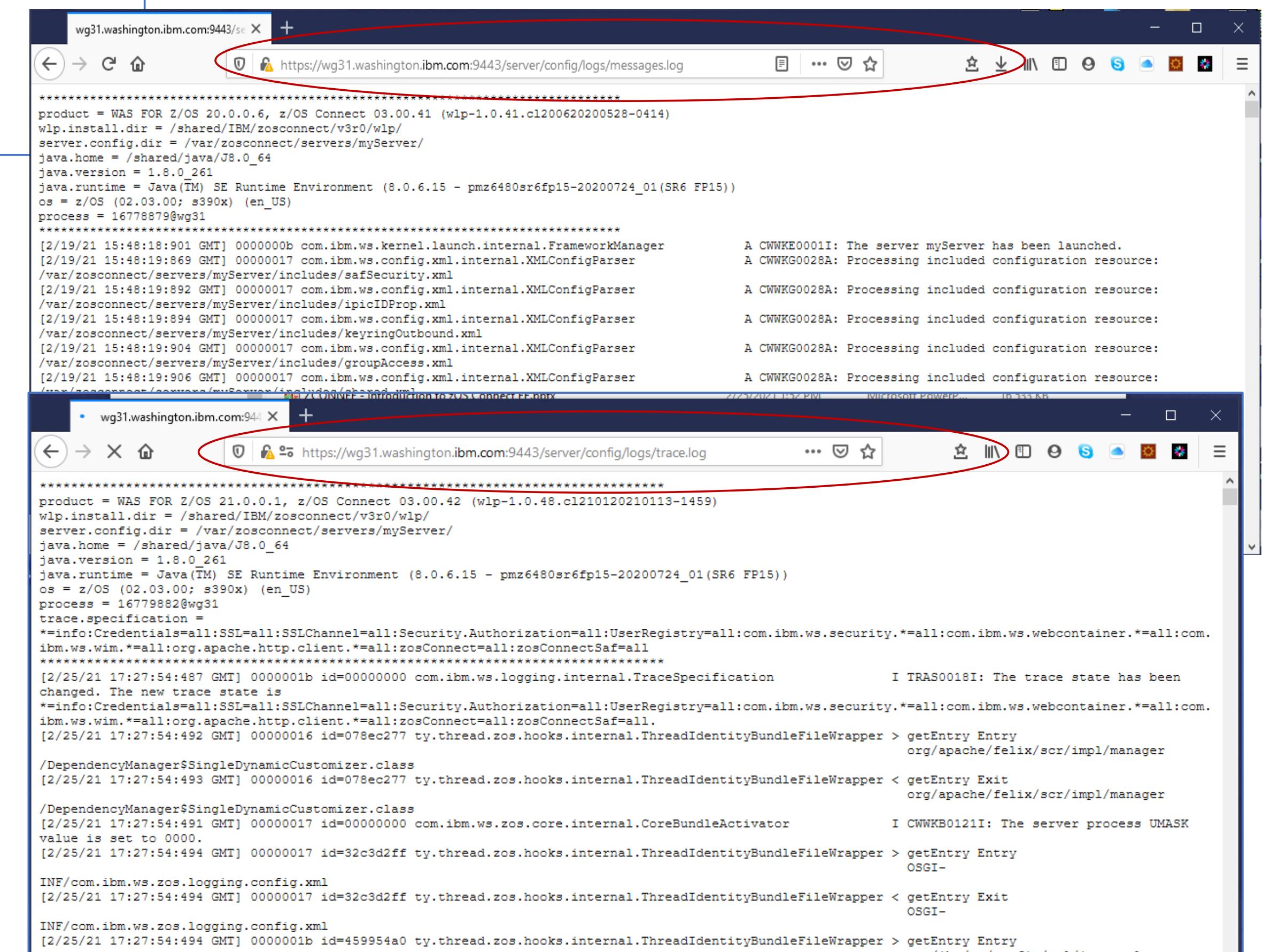
```
<webApplication id="serverConfig-location" name="serverConfig"
  location="${server.config.dir}">
  <web-ext context-root="/server/config"
    enable-file-serving="true" enable-directory-browsing="true">
    <file-serving-attribute name="extendedDocumentRoot"
      value="${server.config.dir}" />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



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

```
<server description="new server">
  <include location="${server.config.dir}/includes/safSecurity.xml"/>
  <include location="${server.config.dir}/includes/ipcSSLIDProp.xml"/>
  <include location="${server.config.dir}/includes/keyringOutbound.xml"/>
  <include location="${server.config.dir}/includes/groupAccess.xml"/>
  <include location="${server.config.dir}/includes/shared.xml"/>
  <include location="${server.config.dir}/includes/oauth.xml"/>
  <include location="${server.config.dir}/includes/adminCenter.xml"/>
  <include location="${server.config.dir}/includes/mqClientTLS.xml"/>
  <include location="${server.config.dir}/includes/web.xml"/>
  <!-- Enable features -->
  <featureManager>
    <feature>zosconnect:zosConnect-2.0</feature>
    <feature>zosconnect:zosConnectCommands-1.0</feature>
  </featureManager>
  <!--
    To access this server from a remote client add a host attribute to the following element, e.g. host=...
  -->
  <httpEndpoint id="defaultHttpEndpoint" host="*" httpPort="9080" httpsPort="9443"/>
  <!--
    add cors to allow cross origin access, e.g. when using swagger UI to fetch swagger doc from zOS Connect...
  -->

```



The server myServer has been launched.
A CWWKG0028A: Processing included configuration resource:
I TRAS001I: The trace state has been changed. The new trace state is
I CWWKB0121I: The server process UMASK value is set to 0000.
OSGI-
OSGI-

Liberty MVS Commands

F BAQSTRT,CACHE,CLEAR,AUTH

Clears all users that are cached in the Liberty authentication cache

F BAQSTRT,REFRESH,CONFIG

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

F BAQSTRT,REFRESH,APPS

Process pending application updates. (Not applicable to z/OS Connect OpenAPI 2 servers)

F BAQSTRT,REFRESH,KEYSTORE

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

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

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

F BAQSTRT,CACHE,CLEAR,AUTH

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

F BAQSTRT,PAUSE

To pause the server

F BAQSTRT,STATUS

To display the current status of a server

F BAQSTRT,RESUME

To resume the server

For more details, see URL <https://www.ibm.com/docs/en/was-liberty/zos?topic=zos-modify-commands>

Liberty MVS Angel Commands

F BAQZANGL,DISPLAY,SERVERS

Displays a list of servers currently connected to the angel

F BAQZANGL,DISPLAY,SERVERS,PID

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

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

F BAQZANGL,VERSION

Displays the version level of the angel

z/OS Connect MVS Commands (OpenAPI 2)

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

F BAQSTRT,ZCON,REFRESH

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

F BAQSTRT,ZCON,CLEARTOKENCACHE

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

F BAQSTRT,ZCON,CLEARSAFCACHE

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

F BAQSTRT,REFRESH,APPS



Tech-Tip: Displaying Liberty 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

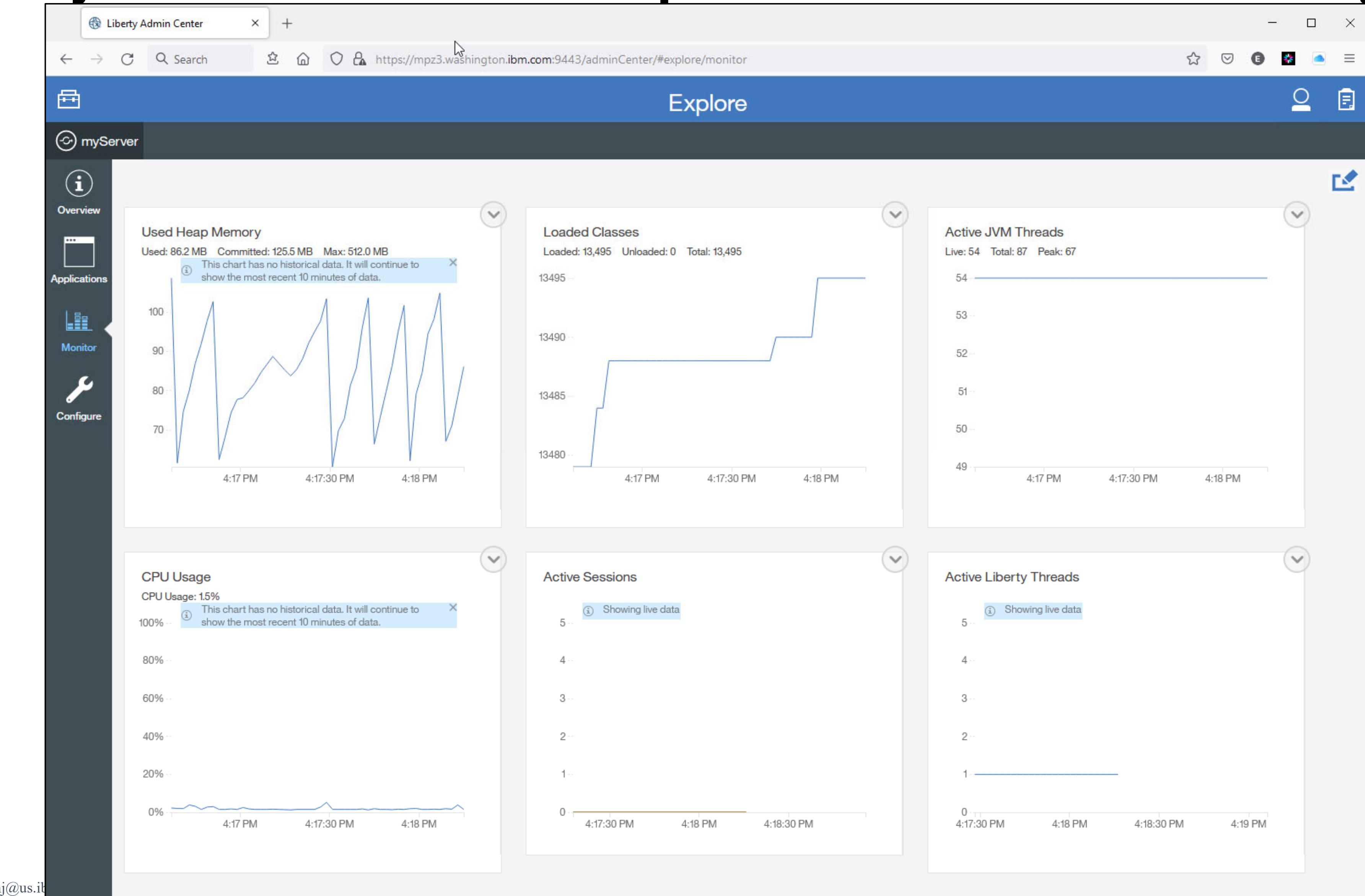
```
ÝERROR  .. BAQR0686E: Program CSCVINC is not available in the CICS region with connection cscvinc and service cscvincService.
ÝERROR  .. BAQR0686E: Program CSCVINC is not available in the CICS region with connection cscvinc and service cscvincService.
ÝERROR  .. BAQR0657E: Transaction abend MIJO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

Monitoring Liberty Servers

Monitoring Liberty, Java Virtual Machines and z/OS



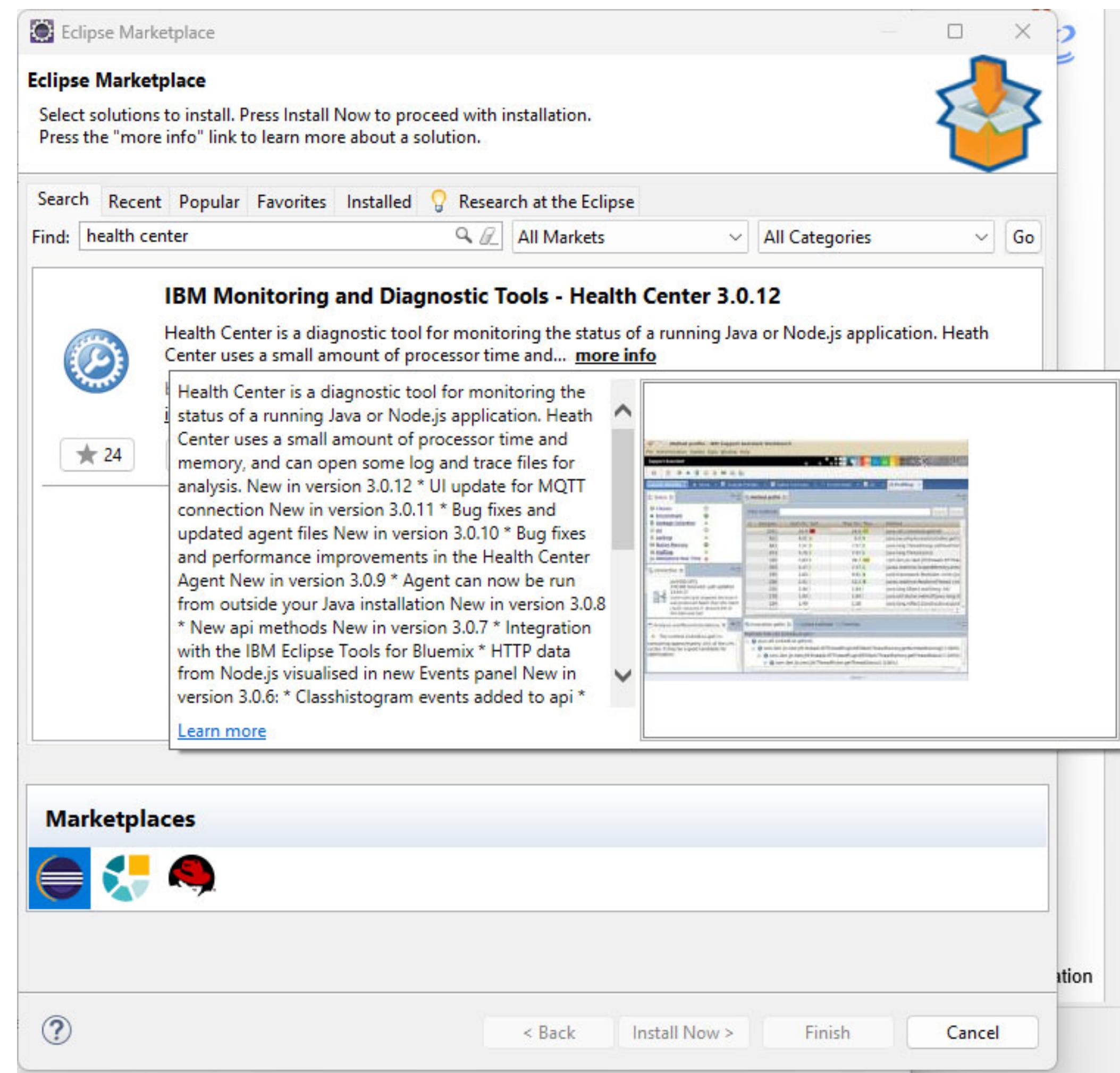
Liberty Admin Center feature provides real time monitoring



Java Health Center – Client Configuration



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





Java Health Center – Monitors the Java environment

Configuring the Monitoring Agent using JVM directives

Java Health Center Directives

```
healthcenter:level=headless  
com.ibm.java.diagnostics.healthcenter.headless.output.directory=/var/zcee/hcd  
com.ibm.java.diagnostics.healthcenter.socket.readwrite=on  
com.ibm.java.diagnostics.healthcenter.headless.files.to.keep=2  
com.ibm.java.diagnostics.healthcenter.headless.delay.start=value=0  
com.ibm.java.diagnostics.healthcenter.headless.run.pause.duration=0  
com.ibm.java.diagnostics.healthcenter.headless.run.duration=0  
com.ibm.java.diagnostics.healthcenter.headless.run.number.of.runs=0  
com.ibm.diagnostics.healthcenter.readonly=on
```

run without a client directory where HCD will be stored
collect socket sent/receive data
number of HCD files to retain
delay start value in minutes
pause between runs, in minutes
run duration, in minutes
number of runs
no client connections allowed

Add directives to bootstrap.properties or a JVM properties file, e.g.,

/var/zcee/properties/zceeHCD.properties (see next page)

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

All the health center directives should be on one line.

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

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

Java Health Center – Monitoring Agent Configuration



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

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

Java Health Center – HEAP analysis example



The screenshot shows the IBM Java Health Center interface within the Eclipse IDE. The main window displays a graph of heap usage and pause times over time, with three data series: Used heap (after collection) in purple, Heap size in green, and Pause time in blue. The graph spans from 0:00 to 0:36 minutes. Below the graph is a summary table of garbage collection metrics. To the right, a help panel provides information on using the garbage collection perspective.

Summary Table Metrics:

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

Help Panel Content:

- Using the garbage collection perspective**: View data such as heap usage, pause times, summary table, object allocations, and tuning recommendation sections in the Health Center garbage collection perspective. Some data is not available for non-Java™ applications.
- Views for basic garbage collection information**: These views are available for all application types:
 - Heap and pause times: A graph of [heap usage](#) and [pause times](#).
 - Summary: A [summary table](#) of important garbage collection metrics.
- Views for detailed garbage collection information**: These views are available only for Java applications, and only if you enable detailed garbage collection information according to the instructions in [Controlling the collection of garbage collection information \(Java applications only\)](#).
 - Object allocations: A table that shows the [allocation of objects](#) within a specified size range.
 - Samples by request site: A profile of sampled object allocations, grouped by the call site of the allocation request.
 - Samples by object: A profile of sampled object allocations, grouped by the type of object allocated.
 - Call hierarchy: This view shows data when you select a row in the Object allocations, Samples by request site, or Samples by object views. For example, if you select a row in the Samples by object view, this view shows the hierarchy of calls to allocations of that object.
 - Timeline: A visual indication of when object allocations were requested. This view shows data when you select a row in the Object allocations or Samples by request site views.



Java Health Center – Network analysis example

smf - Eclipse

File Edit Navigate Search Project Data Run Monitored System Window Help

Status Connection Sockets

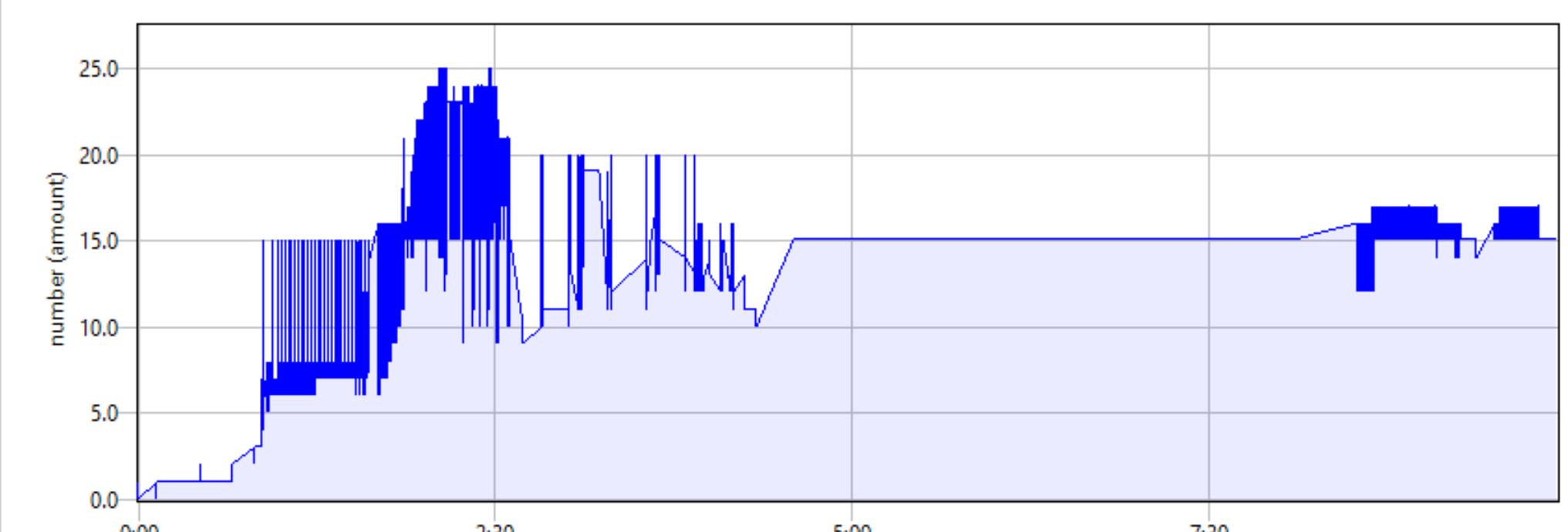
CPU Classes Environment Events Garbage Collection I/O Locking Method Profiling Method Trace Native Memory Network Threads WebSphere Real Time

Socket ID filter: Apply Clear

ID	Type	IP Address	Port	Data sent	Data received	State	Thread [ID] Name
102	Client	0:0:0:ffff:c0a8:11c9	1491	116043 bytes	42284 bytes	Closed	[0x29d2fa0] Equino...
103	Client	0:0:0:ffff:c0a8:11c9	1491	116043 bytes	42284 bytes	Open	[0x2a00aa0] Default...
112	Server	0:0:0:ffff:c0a8:3c	65470	32953 bytes	38334 bytes	Open	[0xa253d00] Shared...
127	Server	0:0:0:ffff:c0a8:3c	59411			Closed	[0xa019f00] Default...
136	Server	0:0:0:ffff:c0a8:11c9	2446	87343 bytes	98768 bytes	Open	[0xb38c800] Default...
138	ServerS...	0:0:0:0:0	9080			Open	[0xa253d00] Shared...
144	Server	0:0:0:ffff:c0a8:3c	59412	4248 bytes	8818 bytes	Open	[0xa019f00] Default...
164	ServerS...	0:0:0:0:0	9443			Open	[0xa253d00] Shared...
176	Client					Closed	[0xa00aa00] Default...
183	Client	0:0:0:ffff:c0a8:11c9	4000	182558 bytes	186691 bytes	Open	[0xa14f400] Default...
186	Server	0:0:0:ffff:c0a8:11f3	7883			Open	[0xa253d00] Shared...
196	Server	0:0:0:ffff:c0a8:3c	61723			Closed	[0x29fcbb00] Default...
204	Server	0:0:0:ffff:c0a8:11f3	7880	1428 bytes	602 bytes	Open	[0xa253d00] Shared...
215	Client	0:0:0:ffff:c0a8:11c9	1491	116825 bytes	62048 bytes	Open	[0xb38c800] Default...
226	Server	0:0:0:ffff:c0a8:11f3	7863	2447 bytes	1059 bytes	Closed	[0xa00aa00] Default...
227	Server	0:0:0:ffff:c0a8:11f3	9463	9892 bytes	8675 bytes	Open	[0x2aa3c100] Default...
228	Server	0:0:0:ffff:c0a8:11f3	7849			Closed	[0x29fcbb00] Default...
230	Server	0:0:0:ffff:c0a8:11f3	7850	39936 bytes	54048 bytes	Open	[0xa00aa00] Default...
231	Server	0:0:0:ffff:c0a8:11f3	9463	10868 bytes	7460 bytes	Open	[0xa14f400] Default...
233	Server	0:0:0:ffff:c0a8:11f3	9463	22059 bytes	11436 bytes	Open	[0xa00aa00] Default...
234	Server	0:0:0:0:ffff:0-0.11f3	7010			Closed	[0x2620-0001 Default]

Sockets open Network I/O

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c0a8:11c9 = 192.168.17.201

Java Health Center – Method Profiling



The screenshot shows the Eclipse Java Health Center interface, specifically the Method Profiling section. The main window title is "smf - Eclipse". The menu bar includes File, Edit, Navigate, Search, Project, Data, Run, Monitored System, Window, and Help.

The left sidebar contains several monitoring categories: CPU (selected), Classes, Environment, Events, Garbage Collection, I/O, Locking, Method Profiling (selected), Method Trace, Native Memory, Network, Threads, and WebSphere Real Time.

The central area displays two tables of method profiling data and a timeline graph.

Table 1 (Top): Sample based profile

Samples	Self (%)	Method
2806	27.17	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
562	5.44	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
440	4.26	com.ibm.ws.logging.internal.impl.BaseTraceService.publishTraceLogRecord(com.ibm.ws.logging...)
264	2.56	java.math.Division.monReduction(int[], java.math.BigInteger, int)
183	1.77	java.math.Multiplication.square(int[], int, int[])
172	1.67	javax.security.auth.Subject.toString(boolean)
150	1.45	java.math.DivisionLong.monReduceSq(long[], long[], long, int, long[])
130	1.26	com.ibm.crypto.provider.P256PrimeField.a(int[])
128	1.24	com.ibm.crypto.provider.P256PrimeField.b(int[])
115	1.11	java.math.DivisionLong.monMulSq(long[], int, long[])
102	0.99	com.ibm.ws.logging.util.TraceRecordWriter.writeRecord(TraceRecord)
97	0.94	com.ibm.ws.logging.util.TraceRecordWriter.writeRecord(TraceRecord)
92	0.89	org.eclipse.osni.interceptor.CallerInterceptor.intercept(CallerInterceptor)

Table 2 (Bottom): Sample based profile

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

Timeline Graph (Bottom Left): Samples over time

This graph plots the number of samples (y-axis, 0 to 400) against elapsed time (x-axis, 2:30 to 5:00). A red circle highlights a peak in activity around 2:30, and a blue arrow points from this peak to the corresponding row in the top table.

Timeline Graph (Bottom Right): Samples over time

This graph plots the number of samples (y-axis, 0 to 300) against elapsed time (x-axis, 1:48 to 2:24 minutes). It shows a similar trend of high initial activity followed by a decline.



Tech-Tip: Sample JCL - Restarting the Java Health Center collection

SDSF PROCESS DISPLAY wg31 ALL							LINE 1-5 (5) SCROLL ===> CSR							Command
NP	JOBNAME	Status	Owner	State	CPU-Time	PID	PPID	ASID	ASIDX	LatchWaitPID				
BAQSTRT	WAITING FOR CHILD	LIBSERV	LIBSERV	1W	40.01	69050	83955129	42	002A		/bin/sh	/usr/lpp/IBM/zosconnect/v3r0/bin		
BAQSTRT	OTHER KERNEL WAIT	LIBSERV	LIBSERV	HK	40.01	16846267	69050	42	002A		/usr/lpp/java/J8.0_64/bin/java -javagen			
BAQZANGL	SWAPPED, RUNNING	LIBANGE	LIBANGE	1RI	0.01	50399398	83953829	77	004D		/usr/lpp/IBM/zosconnect/v3r0/wplib/nat			
BAQZANGL	SWAPPED, FILE SYS KERNEL WAIT	LIBANGE	LIBANGE	1FI	0.01	83953829	1	77	004D		BPXBATA2			
BAQSTRT	FILE SYS KERNEL WAIT	LIBSERV	LIBSERV	1F	40.01	83955129	1	42	002A		BPXBATSL			

```
*****
product = WAS FOR Z/OS 21.0.0.9, z/OS Connect 03.00.52 (wlp-1.0.56.cl210920210909-1618)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/J8.0_64
java.version = 1.8.0_301
java.runtime = Java(TM) SE Runtime Environment (8.0.6.36 - pmz6480sr6fp36-20210913_01(SR6 FP36))
os = z/OS (02.03.00; s390x) (en_US)
process = 16846267@wg31
*****
```

```
//JOHNONS 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.

z/OS Connect

Liberty Features

Liberty

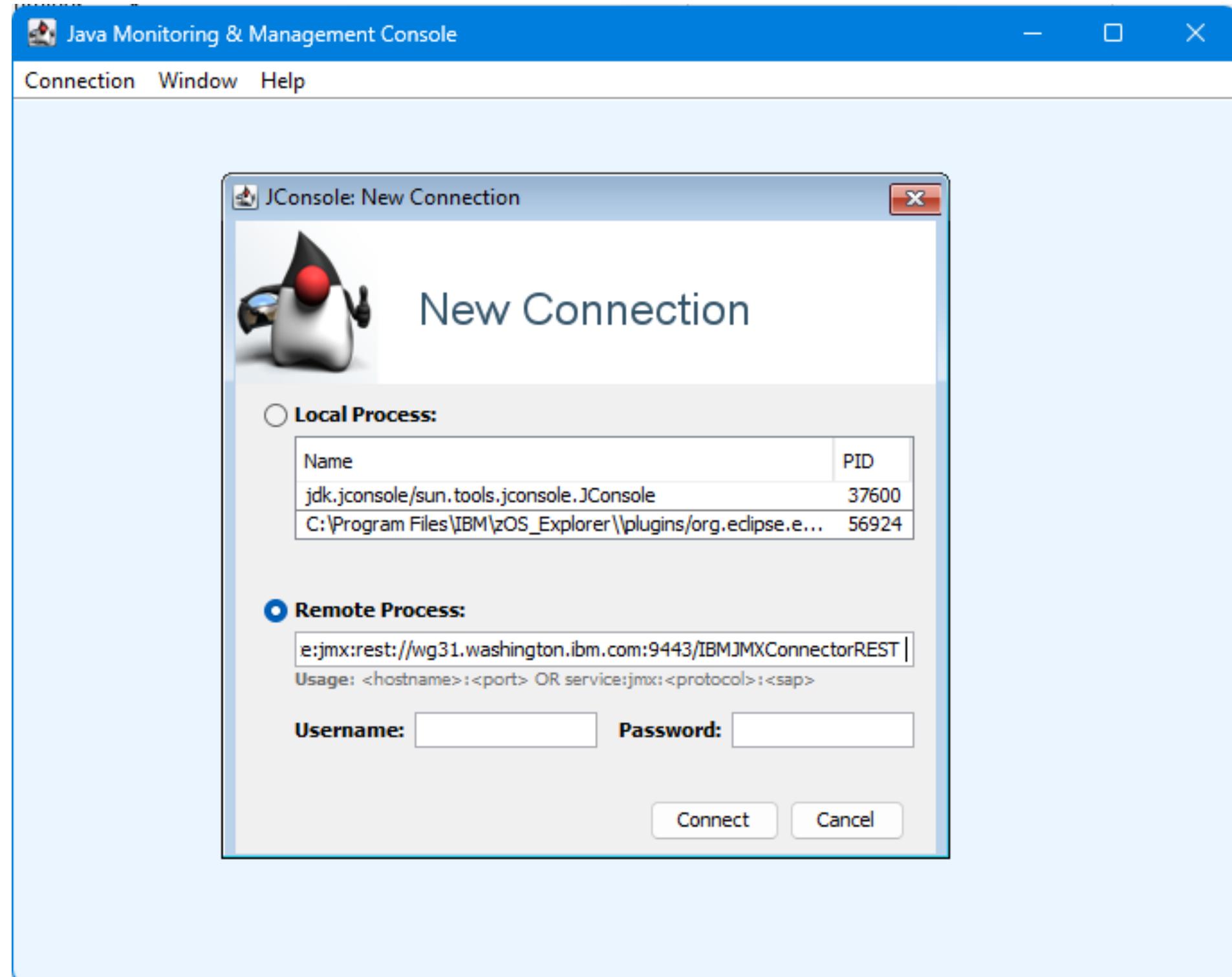


z/OS Connect





Using Java's jConsole with Liberty features restConnector-2.0 and monitor-1.0

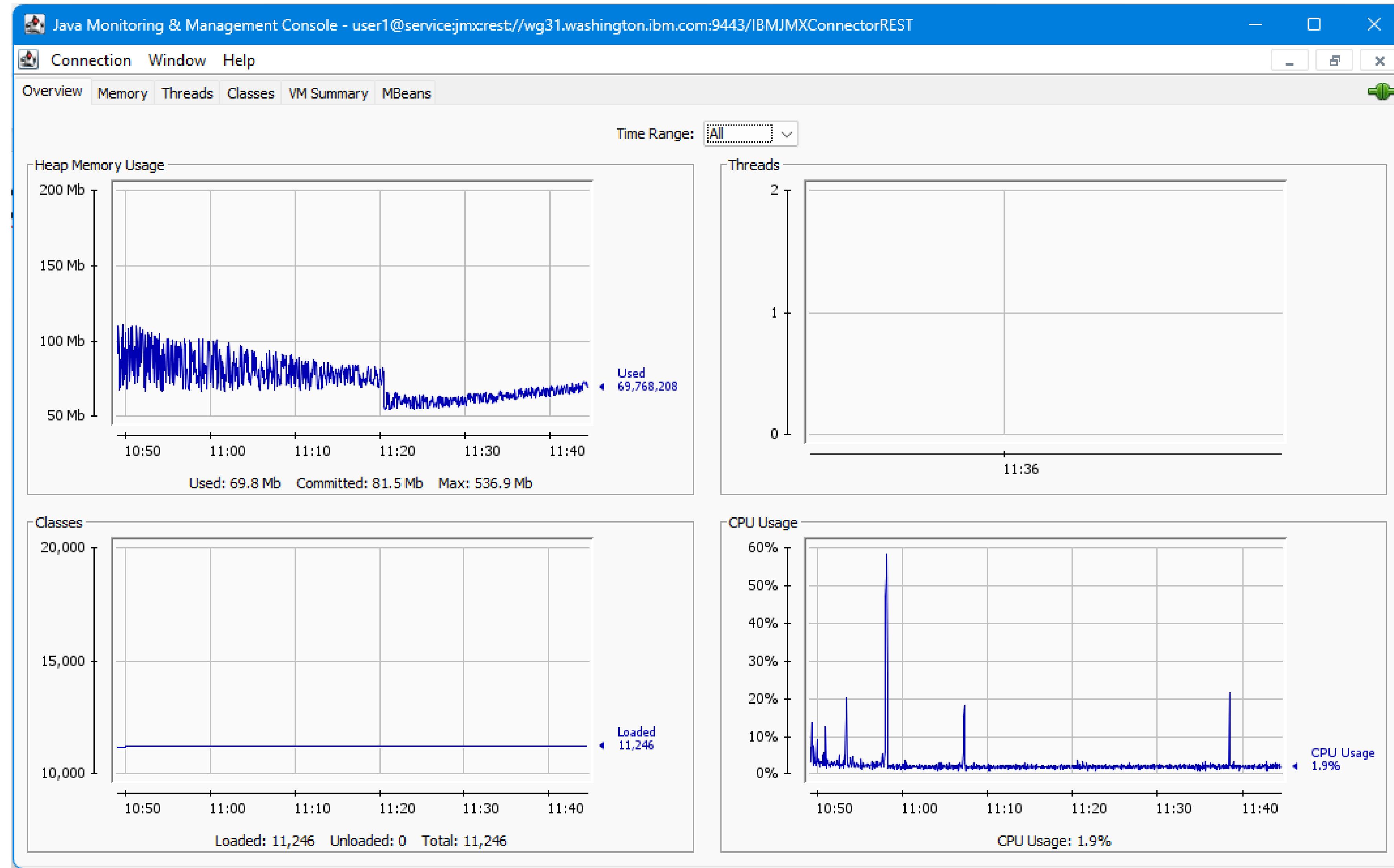


```
<server description="Additional Features">  
    <!-- Enable features -->  
    <featureManager>  
        <feature>adminCenter-1.0</feature>  
        <feature>restConnector-2.0</feature>  
        <feature>monitor-1.0</feature>  
    </featureManager>  
  
    <remoteFileAccess>  
        <readDir>/var/zcee/includes</readDir>  
        <readDir>/global/zosconnect/includes</readDir>  
        <writeDir>${server.config.dir}</writeDir>  
    </remoteFileAccess>  
  
</server>
```

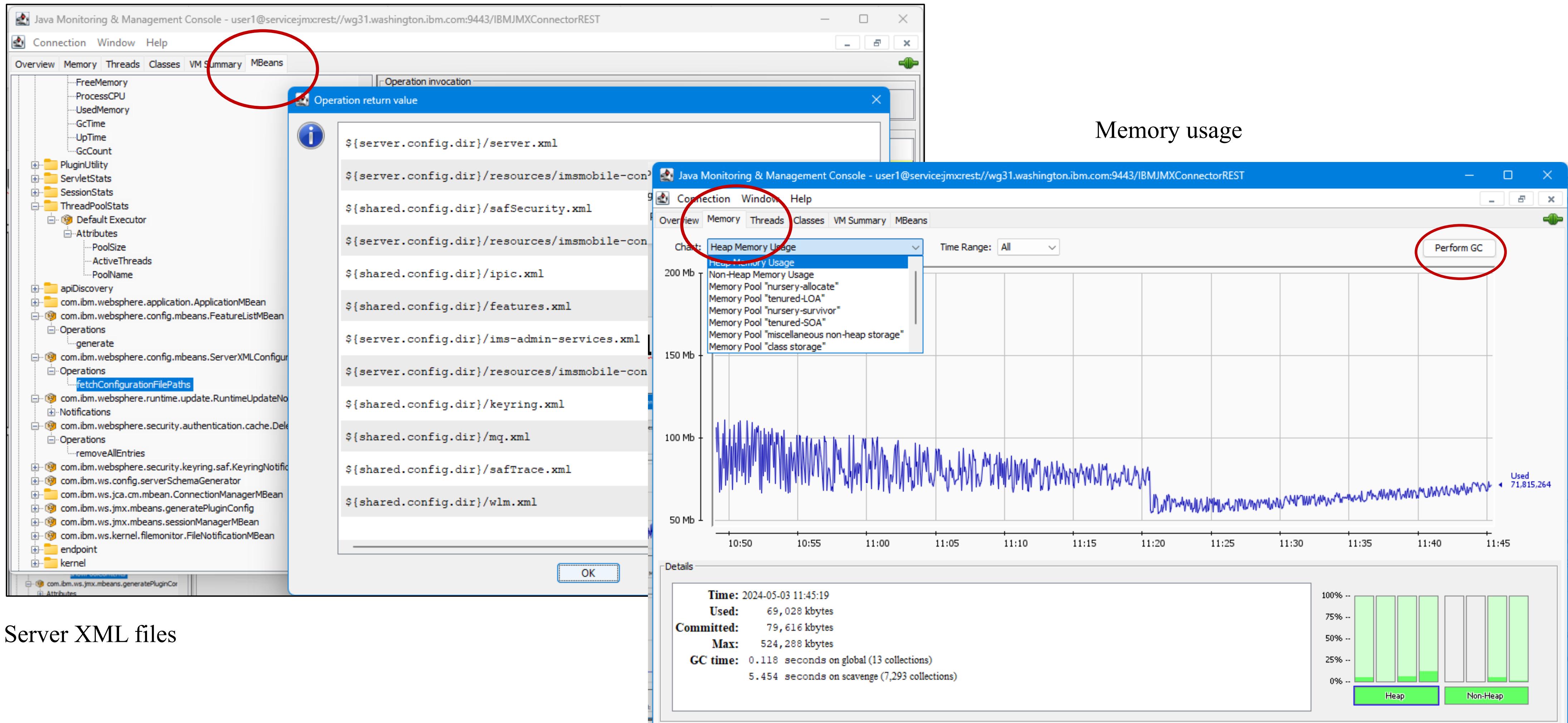
Monitoring a z/OS Liberty server using JMX and REST Clients: <https://ibm.biz/BdahXK>

```
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(ZCEEUSRS) ACCESS(READ)  
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.Reader CLASS(EJBROLE) ID(ZCEEUSRS) ACCESS(READ)  
PERMIT BBGZDFLT.com.ibm.ws.management.security.resource.allAuthenticatedUsers CLASS(EJBROLE) ID(ZCEEUSRS) ACCESS(READ)  
SETR RACLIST(EJBROLE) REFRESH
```

Using Java's jConsole with Liberty features restConnector-2.0 and monitor-1.0



Using Java's jConsole with Liberty features restConnector-2.0 and monitor-1.0



Server XML files

Using Java's jConsole with Liberty features restConnector-2.0 and monitor-1.0



Display connection pool utilization

The screenshot shows the Java Monitoring & Management Console interface. The title bar reads "Java Monitoring & Management Console - Fred@servicejmx:rest://wg31.washington.ibm.com:9443/IBMJMXConnectorREST". The menu bar includes Connection, Window, Help, Overview, Memory, Threads, Classes, VM Summary, and MBeans. A red circle highlights the "MBeans" tab. The left pane displays a tree view of MBeans, including categories like IBM MQ, JImplementation, WebSphere, and various service and utility components. The right pane shows the "Operation invocation" section with "java.lang.String showPoolContents ()". Below it is the "MBeanOperationInfo" table:

Name	Value
Operation:	
Name	showPoolContents

A modal dialog titled "Operation return value" is displayed, containing the following information:

PoolManager@1badcb0
name=WebSphere:type=com.ibm.ws.jca.cm.mbean.ConnectionManager
jndiName=none
maxPoolSize=555
size=2
waiting=0
unshared=0
shared=0
available=2
ManagedConnection@475ca2d6=Reusable
ManagedConnection@92aa45f3=Reusable

At the bottom of the dialog is an "OK" button.



Using Java's jConsole with Liberty features restConnector-2.0 and monitor-1.0

Display and manage z/OS Connect OpenAPI3 APIs

The screenshot shows the Java Monitoring & Management Console interface. The title bar reads "Java Monitoring & Management Console - user1@service:jmx:rest://wg31.washington.ibm.com:9443/IBMJMXConnectorREST". The menu bar includes Connection, Window, Help, Overview, Memory, Threads, Classes, VM Summary, and MBeans. The left pane displays a hierarchical tree of MBeans, with a red circle highlighting the "State" attribute under the "Attributes" section of the "MyAPI" MBean. The right pane contains three tabs: "Attribute value", "MBeanAttributeInfo", and "Descriptor". The "Attribute value" tab shows a table with one row: Name (State) and Value (STARTED). The "MBeanAttributeInfo" tab shows a table with several rows: Attribute (highlighted), Name (State), Description (Attribute exposed for management), Readable (true), Writable (false), Is (false), and Type (java.lang.String). The "Descriptor" tab is currently empty.

Workload Manager - Definitions

WLM Report Classes

```

mpz3
Report-Class View Notes Options Help
----- Report Class Selection List Row 1 to 12 of 12
Command ==> _____
Action Codes: 1=Create, 2=Copy, 3=Modify, 4=Browse, 5=Print, 6=Delete,
            /=Menu Bar
----- Last Change -----
Action Name Description User Date
--- BAQSTC
--- WMQFTE
--- WMQFTER
--- WMQFTEZ
--- ZCEEADM
--- ZEEAPIR
--- ZEECICS
--- ZEEDB2
--- ZEEIMS
--- ZCEEMQ
--- ZEEOTHR
--- ZEEESTC
***** Bottom of data *****

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

```

WLM Service Classes

```

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

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

----- Period -- Goal -----
Action # Duration Imp. Description
    1      1   Execution velocity of 70
***** Bottom of data *****

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

```

WLM "CB" Classification Rules

Action	Type	Name	Start	Service	Report
1	CN	myServer		OPS_HIGH	ZCEEOTHR
2	TC	TCADM		OPS_HIGH	ZCEEADM
2	TC	TCAPIR		OPS_HIGH	ZEEAPIR
2	TC	TCCICS		OPS_HIGH	ZEECICS
2	TC	TCDB2		OPS_HIGH	ZEEDB2
2	TC	TCIMS		OPS_HILO	ZEEIMS
2	TC	TCMQ		OPS_MED	ZCEEMQ
2	TC	TCOTHR		OPS_LOW	ZCEEOTHR

Action	Type	Name	Start	Service	Report
1	CN	zceex		OPS_HIGH	ZCEEOTHR
2	TC	TCADM		OPS_HIGH	ZCEESTC
2	TC	TCAPIR		OPS_HIGH	ZCEEADM
2	TC	TCDB2		OPS_HIGH	ZEEDB2
2	TC	TCCICS		OPS_HILO	ZEECICS
2	TC	TCIMS		OPS_HILO	ZEEIMS
2	TC	TCMQ		OPS_MED	ZCEEMQ
2	TC	TCOTHR		OPS_HILO	ZCEEOTHR

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Workload Manager – WLM Classification server XML

The corresponding required server XML configuration

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

The diagram illustrates the connection between the WLM Classification XML configuration and the resulting WLM subsystem rules. A red circle highlights the XML code for the *zosWorkloadManager* element, which is mapped to the 'CN' (Classification Name) column in the WLM subsystem rules table. Another red circle highlights the *zosWlmHealth* element, which is mapped to the 'TC' (Transaction Class) column.

Related to WLM CN name.

Action	Type	Name	Start	Service	Report
1	CN	zceex*		OPS_HIGH	ZCEEOTHR
2	TC	TCADM		OPS_HIGH	ZCEEESTC
2	TC	TCDB2		OPS_HIGH	ZCEEADM
2	TC	TCCICS		OPS_HILO	ZCEEAPIR
2	TC	TCIMS		OPS_HILO	ZCEECICS
2	TC	TCMQ		OPS_MED	ZCEEIMQ
2	TC	TCOTHR		OPS_HILO	ZCEEOTHR

RMF SMF Type 72 Service Class Reports



```

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

```



Liberty SMF 120 Subtype 11

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



The screenshot shows the 'Server Config' interface with a blue header bar containing icons for a briefcase, user profile, and save. The title 'Server Config' is in the center. Below the header, a dark navigation bar has 'smf.xml' on the left and 'Read only' and 'Close' buttons on the right. A gear icon is in the top right corner of the main content area. The main content area contains two tabs: 'Design' and 'Source'. The 'Source' tab is selected, showing XML code. The code is numbered from 1 to 10:

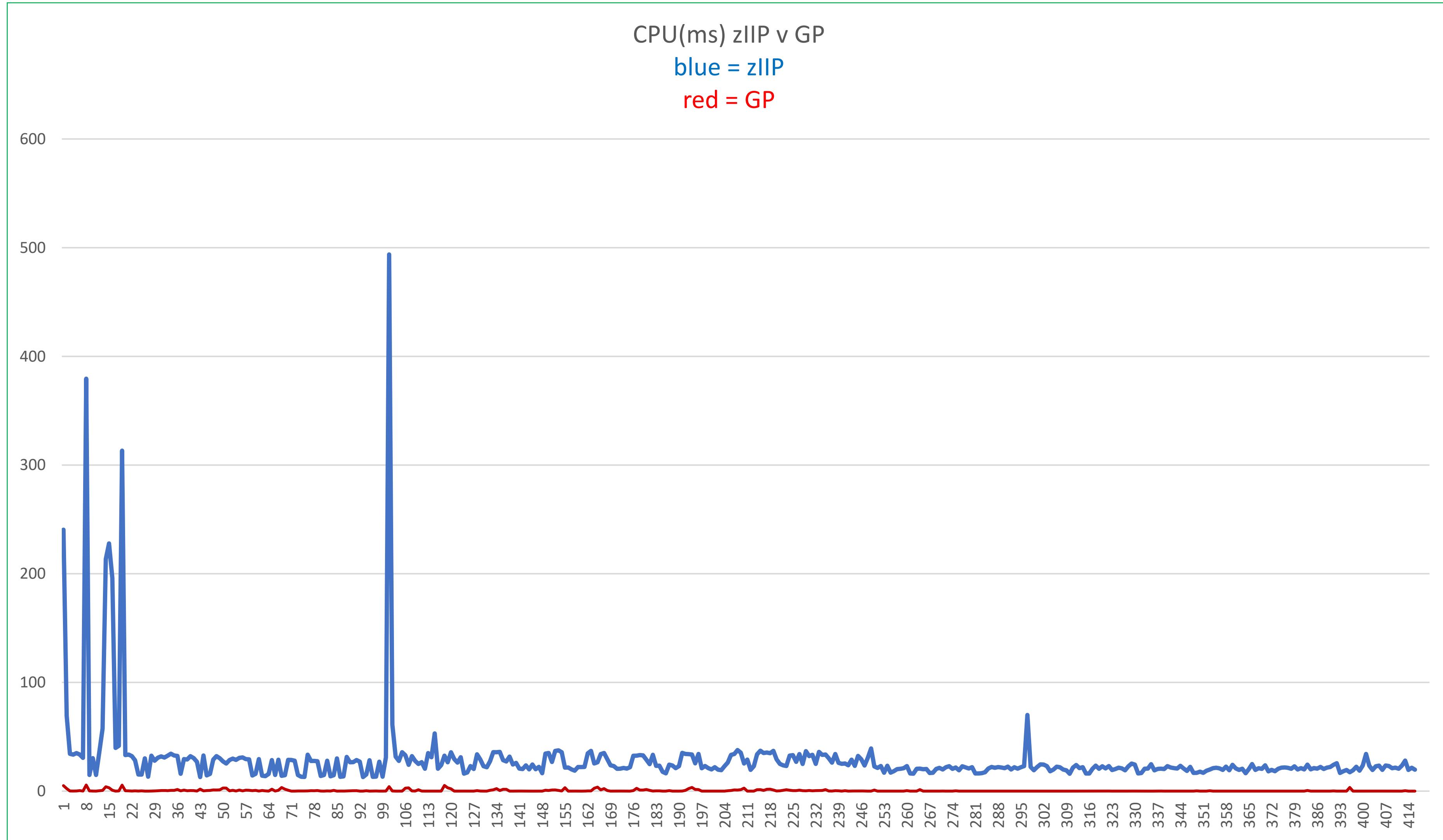
```
1 <?xml version="1.0" encoding="UTF-8"?>
2
3 <server description="SMF">
4   <featureManager>
5     <feature>monitor-1.0</feature>
6     <feature>zosRequestLogging-1.0</feature>
7   </featureManager>
8
9 </server>
10
```

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

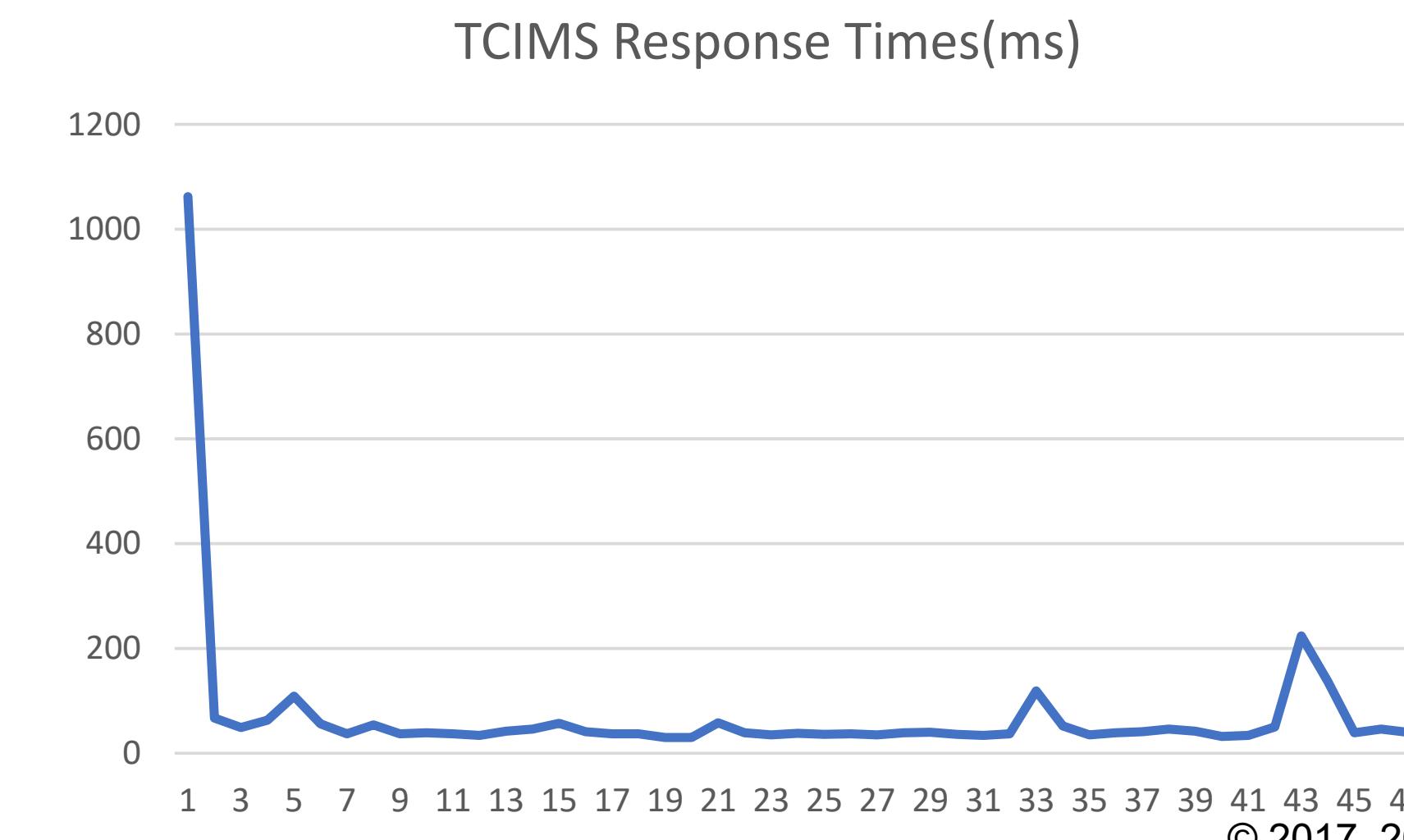
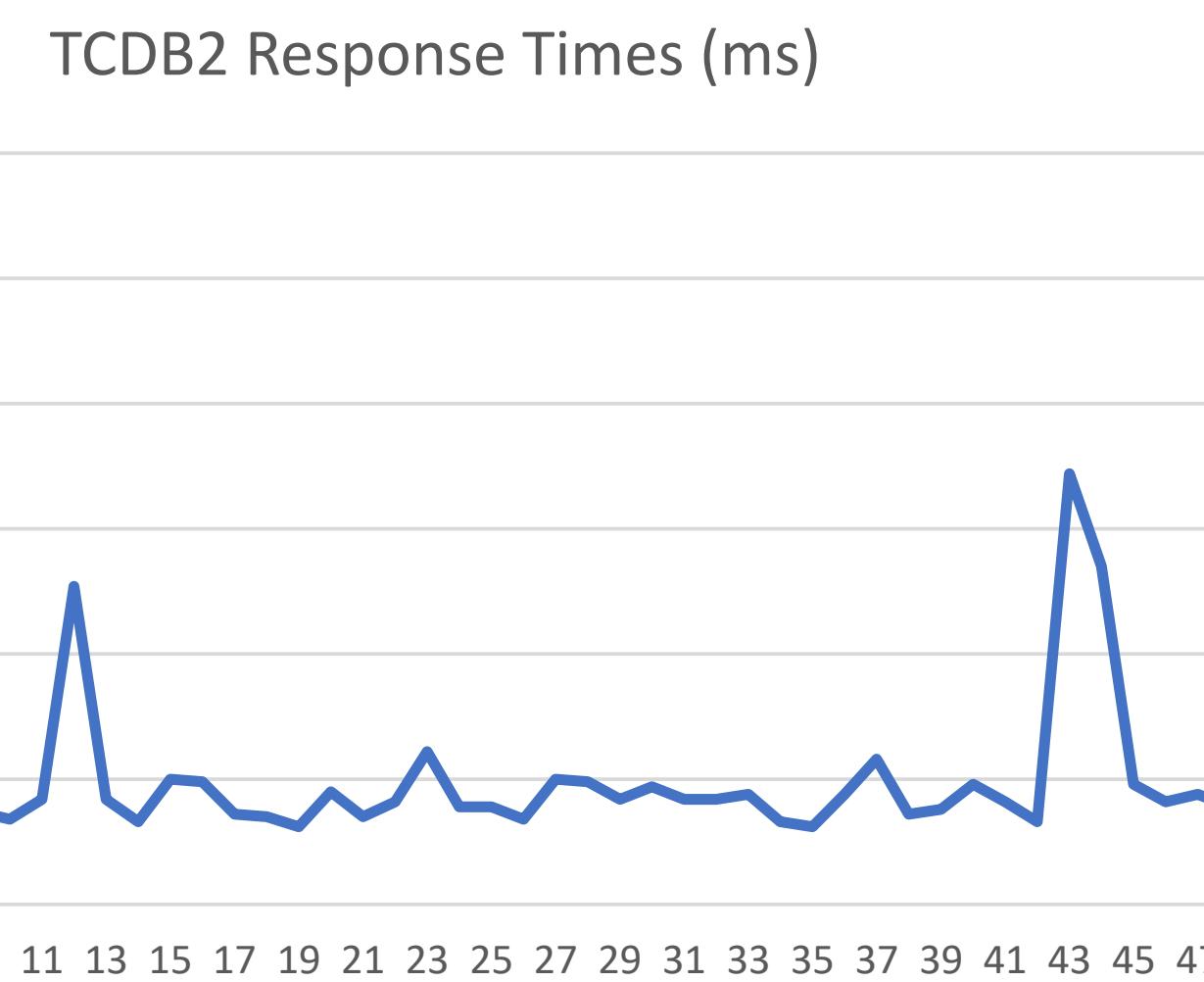
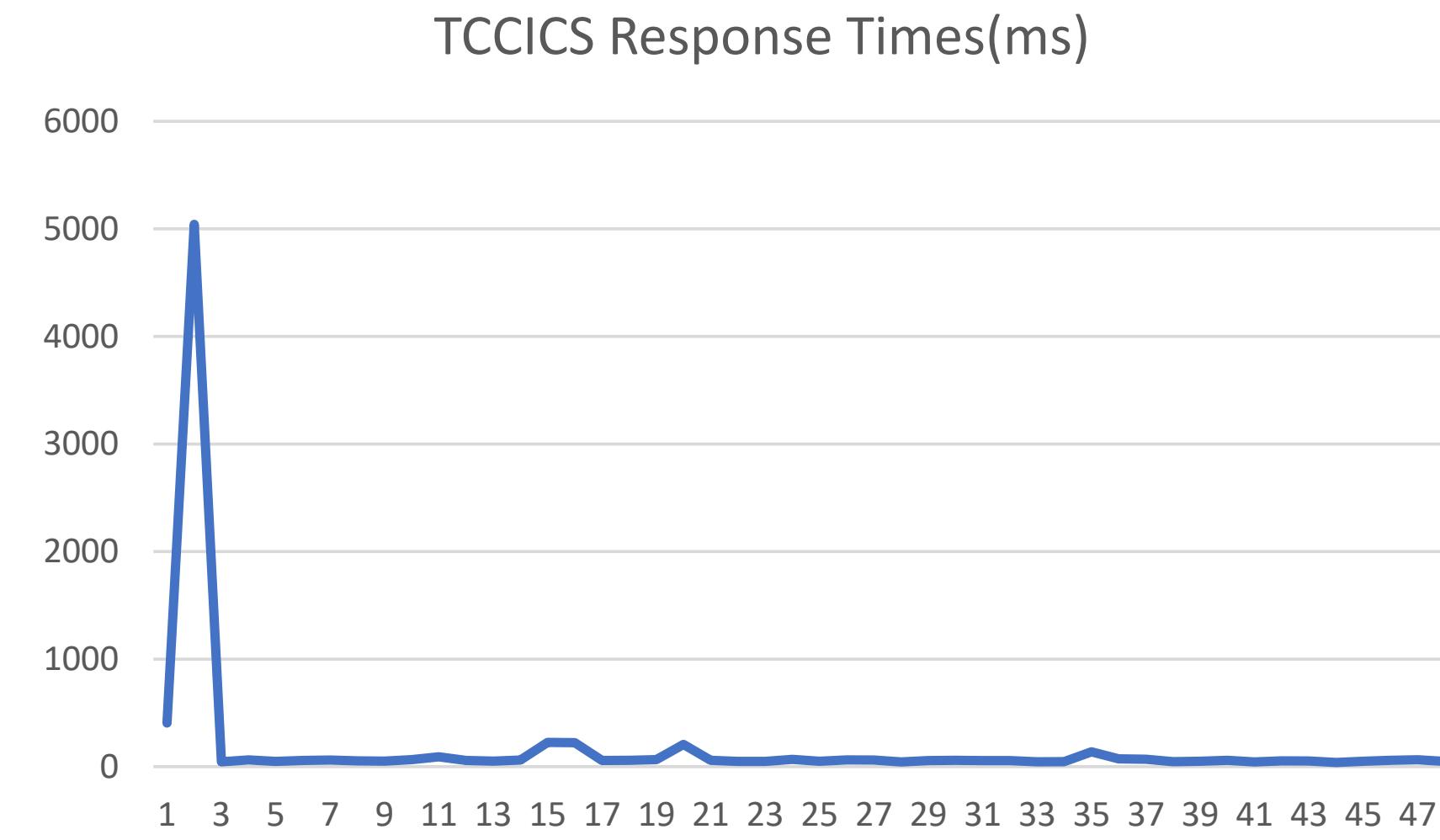
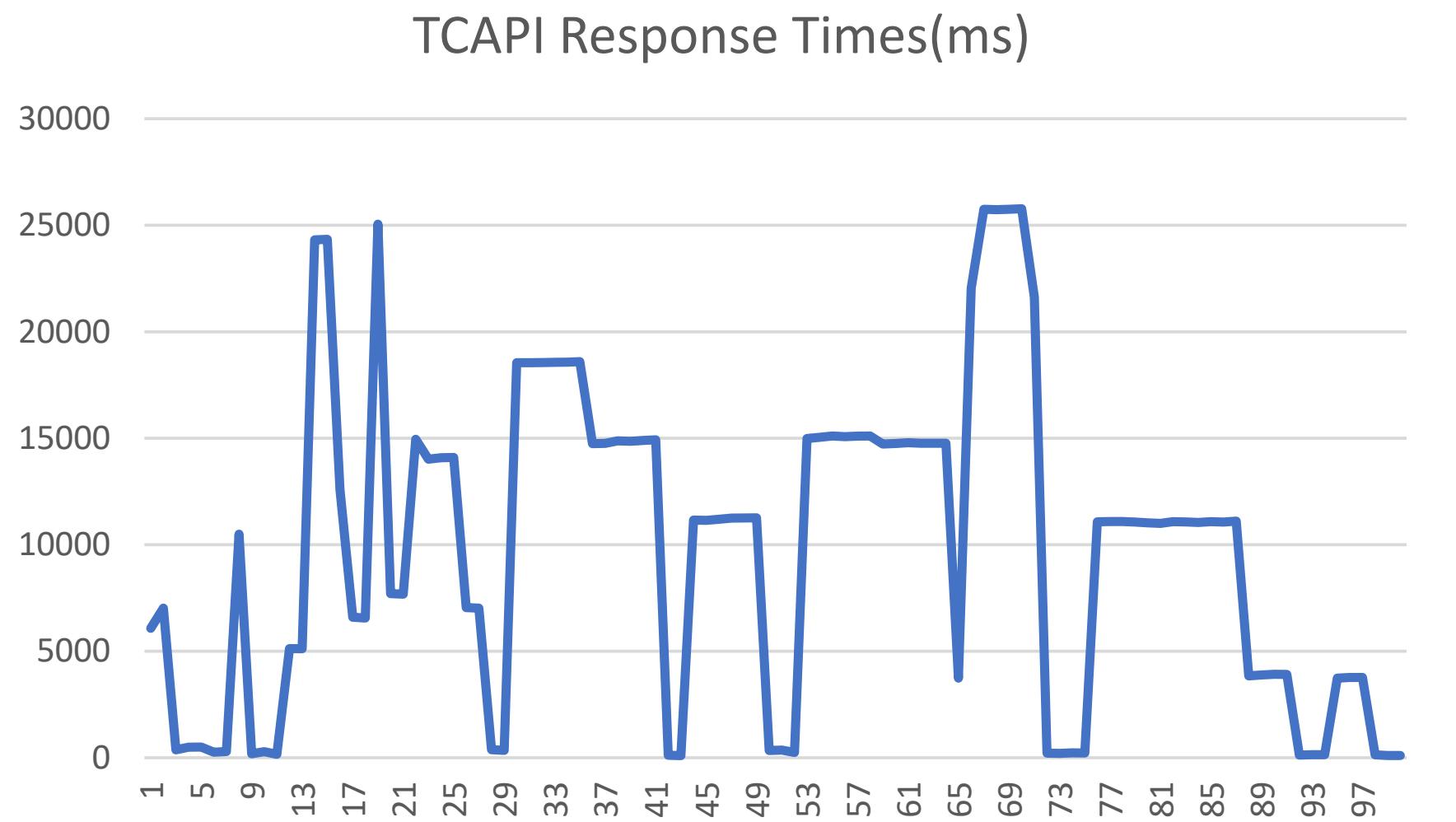
<https://www.ibm.com/support/pages/node/6355403>



Liberty SMF 120 type 11 – GP v zIIP comparison example



Liberty SMF 120 type 11 – Response times comparisons example



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



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

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

Server Config

audit.xml

Read only Close

Design Source

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <server description="SMF reporting">
3
4   <zosconnect_zosConnectManager
5     globalInterceptorsRef="interceptorList_g"/>
6
7   <zosconnect_authorizationInterceptor id="auth"
8     safCacheTimeout="600"/>
9
10  <zosconnect_auditInterceptor id="audit"
11    apiRequesterSmfVersion="2"
12    apiProviderSmfVersion="2"/>
13
14  <zosconnect_zosConnectInterceptors id="interceptorList_g"
15    interceptorRef="audit"/>
16
17</server>
18
```

Server Config

audit.xml

Read only Close

Design Source

Server

- z/OS Connect Manager
- z/OS Connect Authorization Interceptor auth
- z/OS Connect EE SMF Audit Interceptor audit

z/OS Connect Interceptors interceptorList_g

Sequence

0 (default)

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

API provider SMF Version

2

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

auditApiProviderRequestHeaders.name

(no value)

auditApiProviderRequestHeaders.desc

auditApiProviderResponseHeaders.name

(no value)

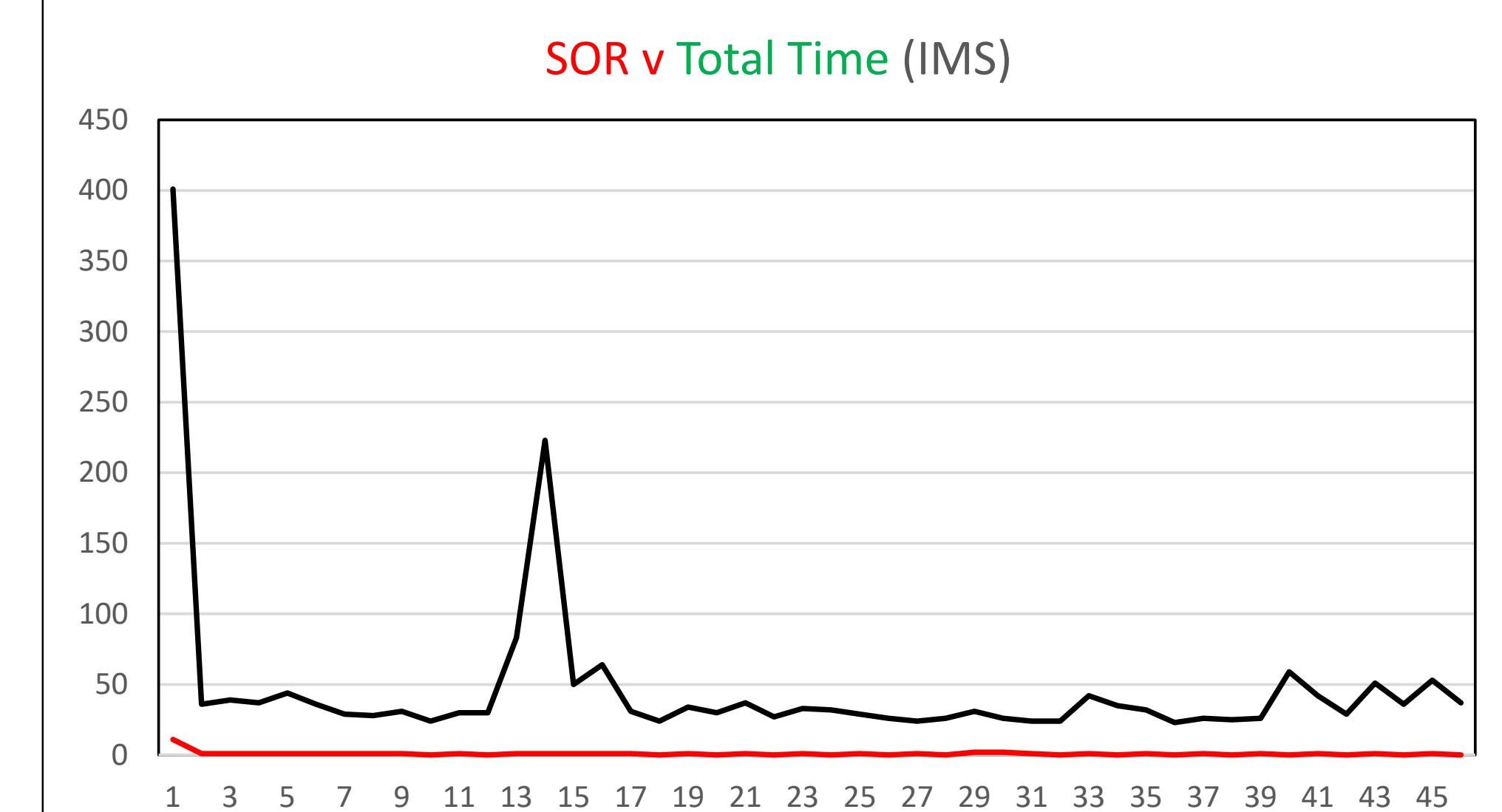
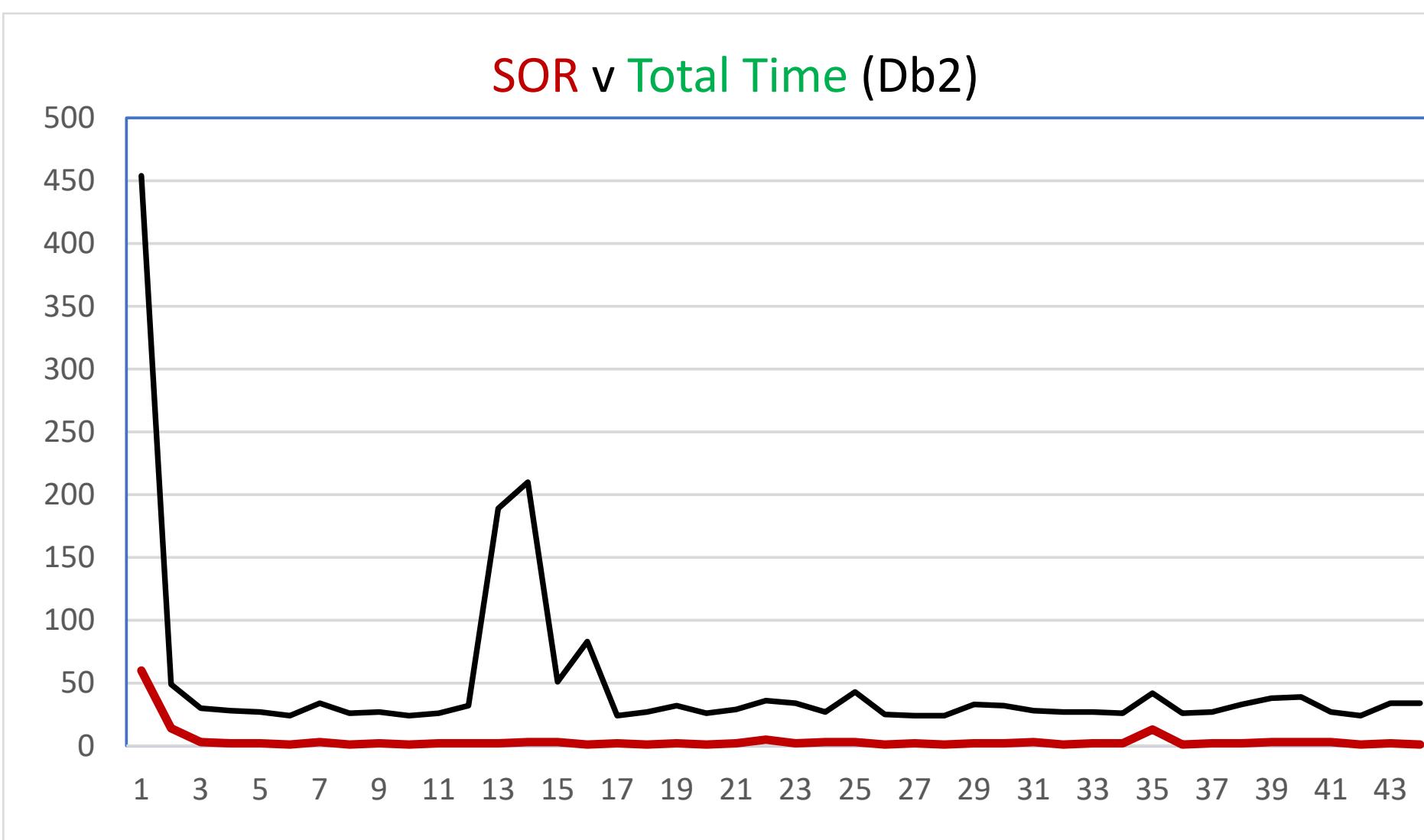
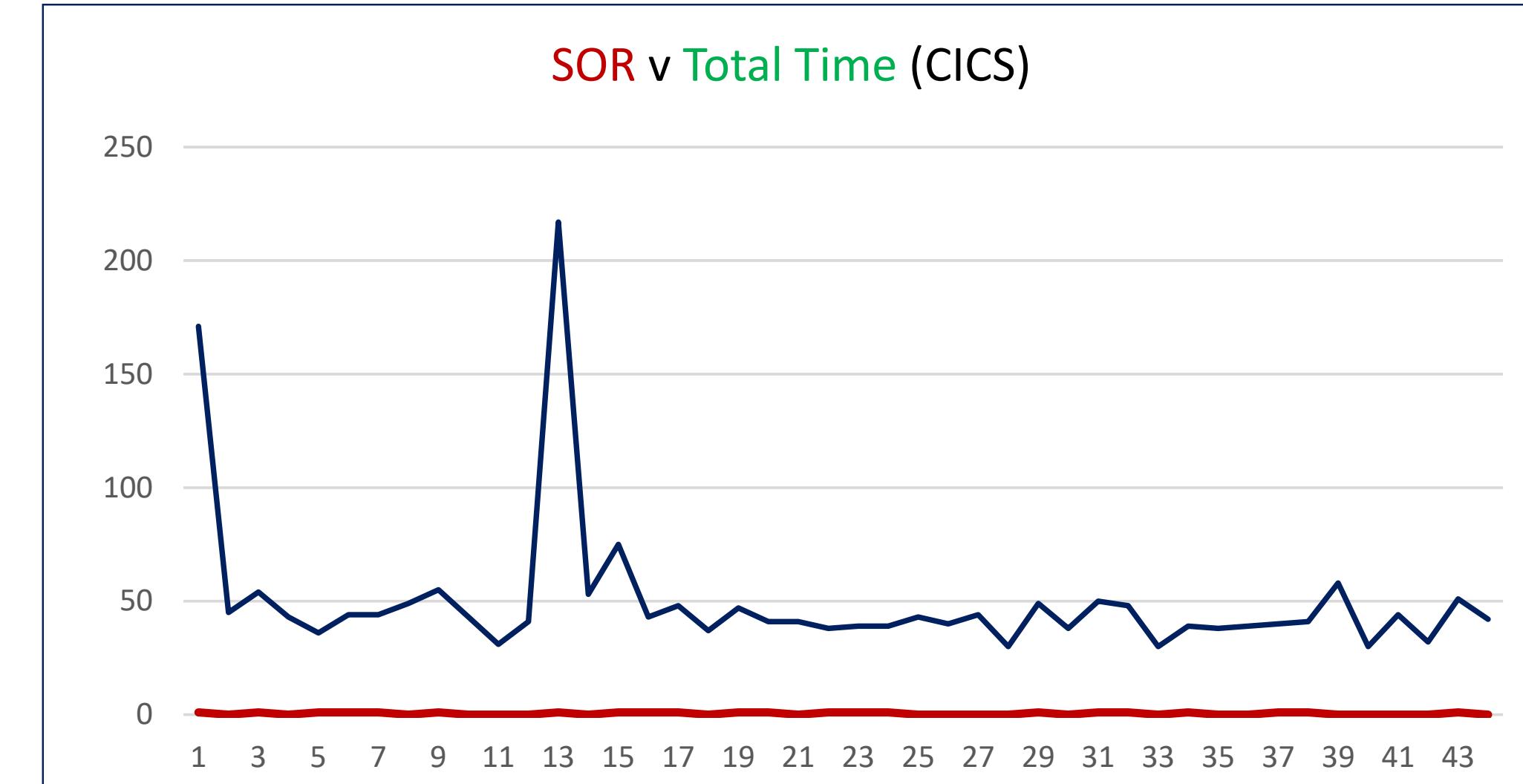
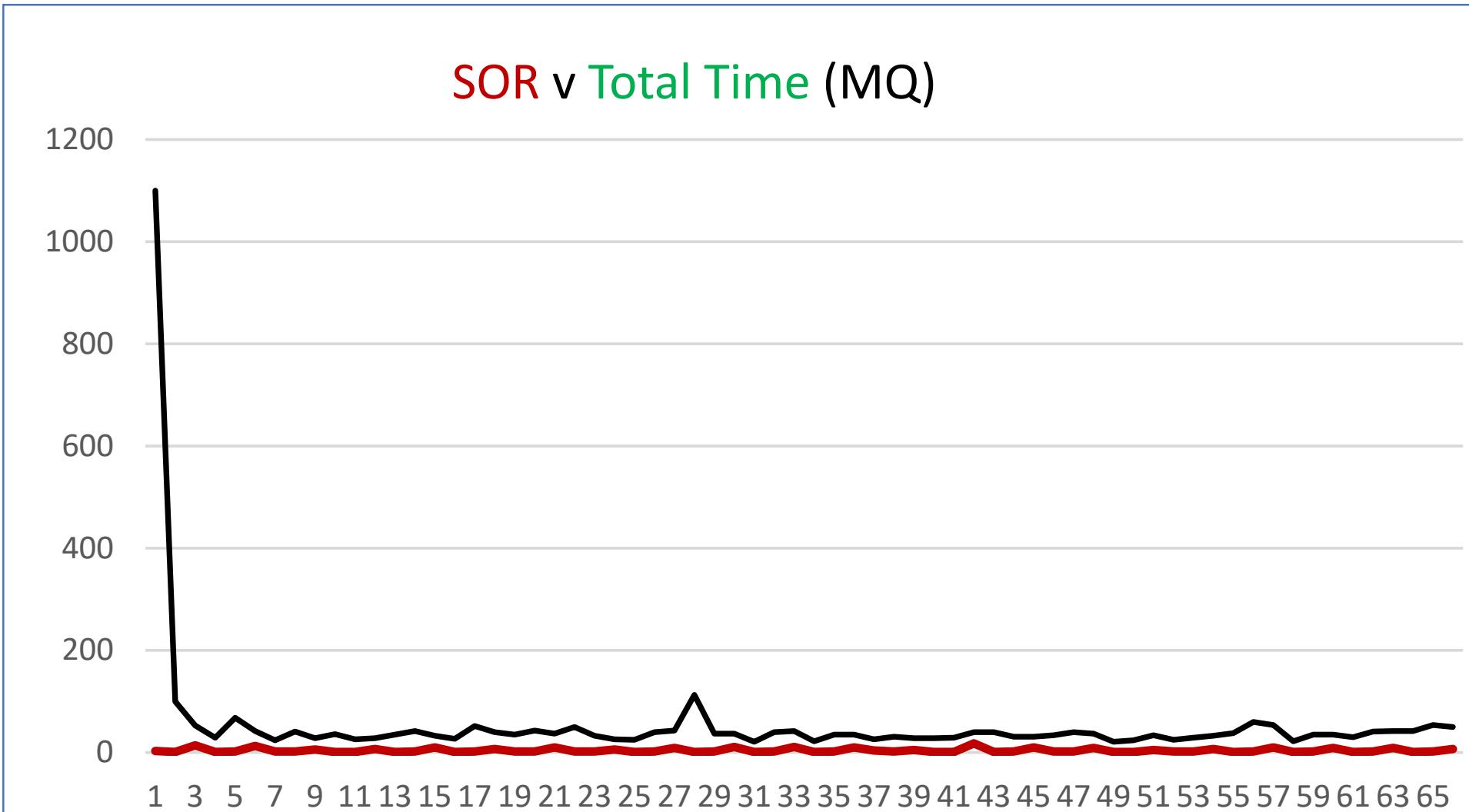
auditApiProviderResponseHeaders.desc

API requester SMF Version

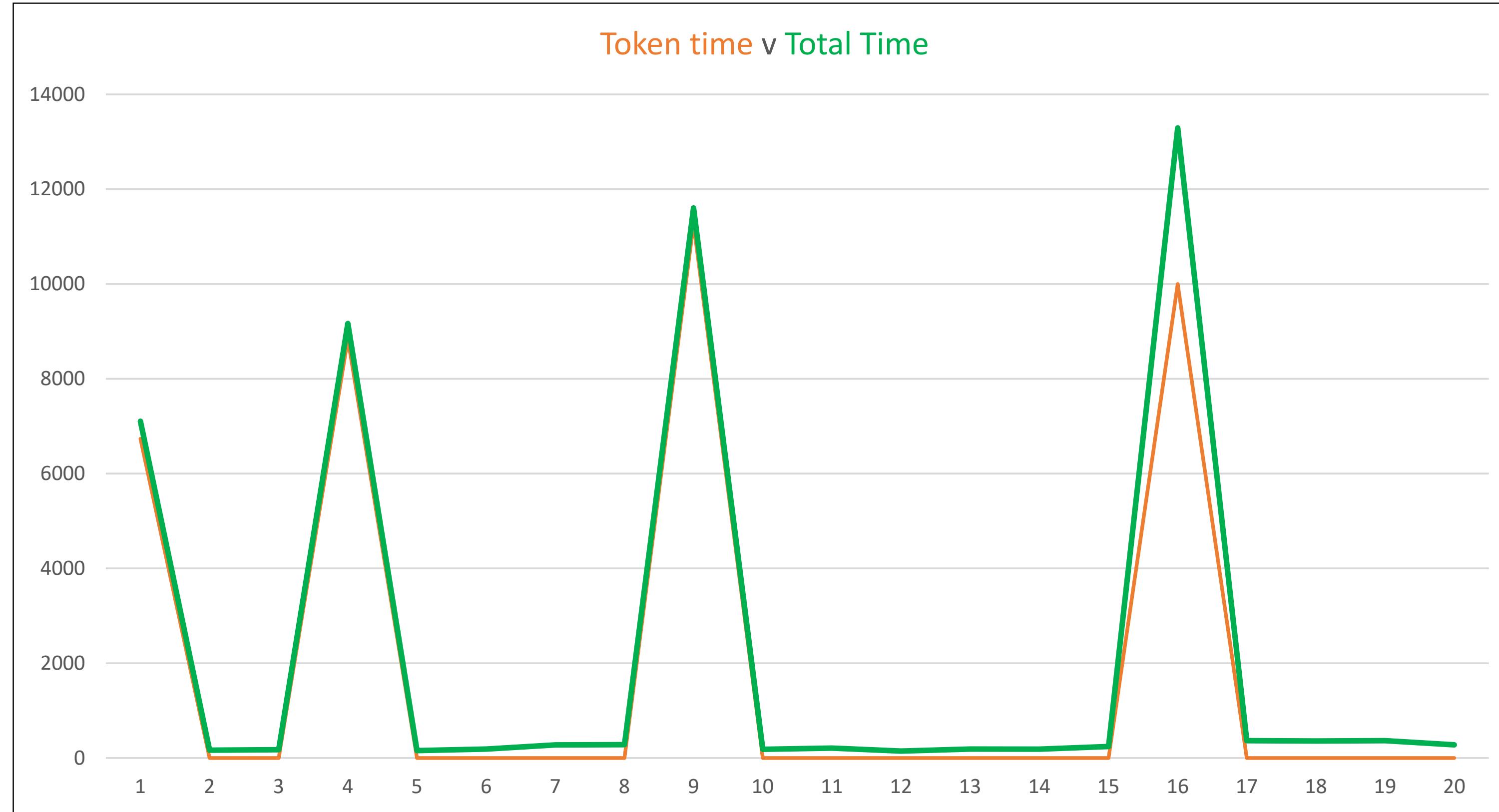
2

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

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



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

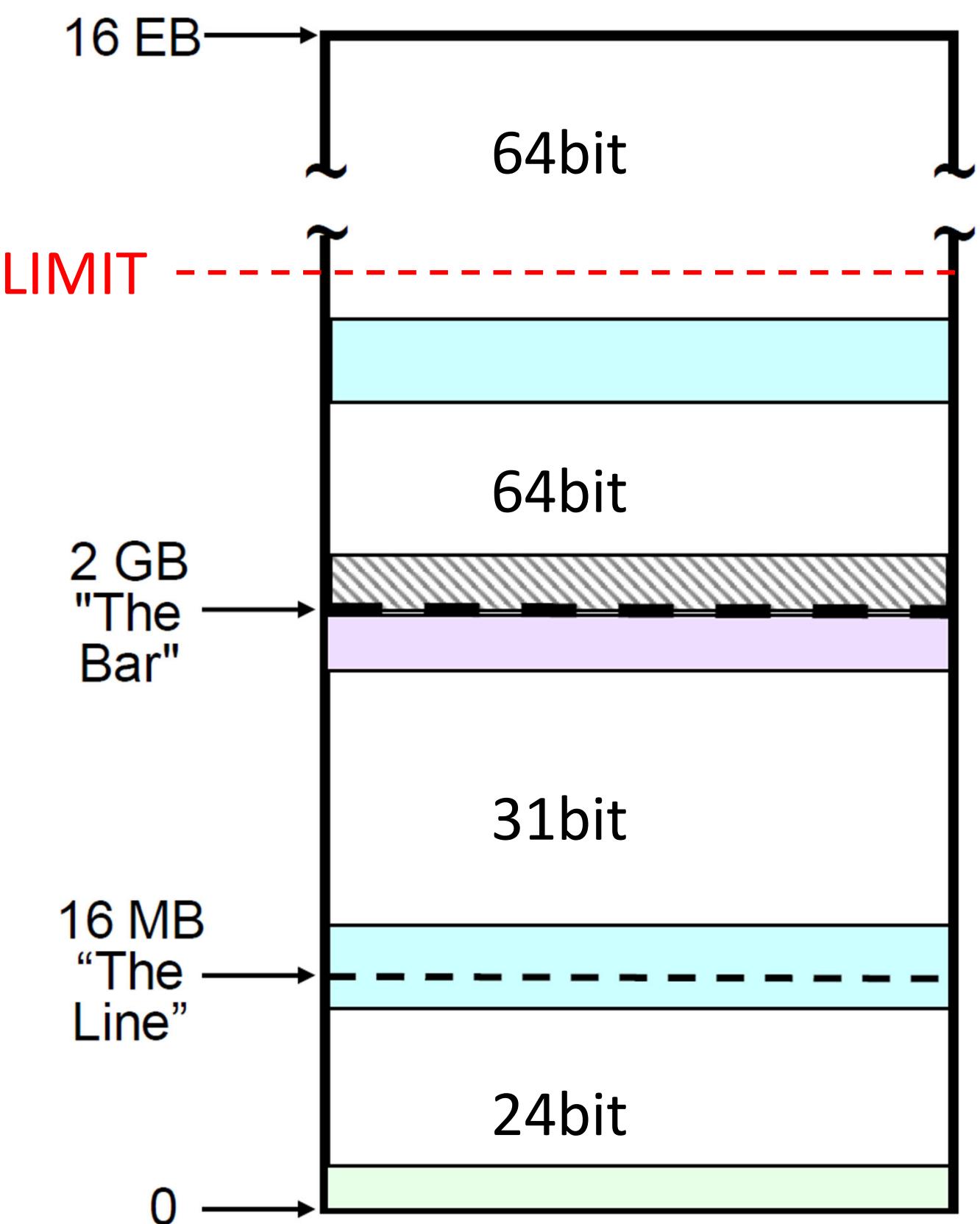


Memory and Storage

MEMLIMIT - memory storage above-the-bar

```
//ZCON EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=4G,  
//      PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS.'
```

- Limits the amount of 64-bit storage
 - Only a limit, not pre-allocated
- z/OS uses above the bar storage for:
 - Native thread stack storage
- Java uses above the bar storage for:
 - Heap storage
 - Caches
 - Java thread

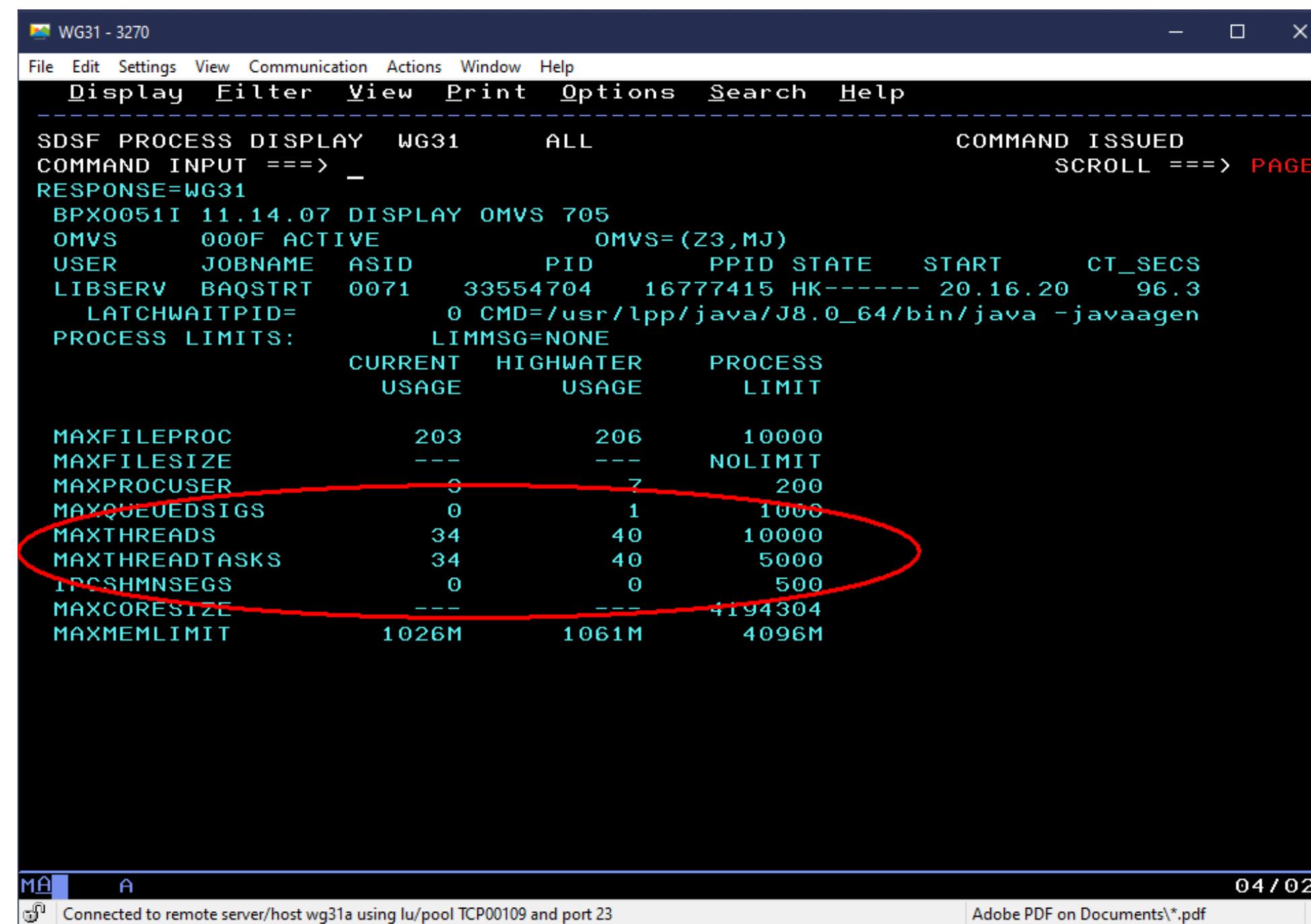


messages.log

CWWKB0125I: This server requested a REGION size of 0KB. The below-the-line storage limit is 8MB and the above-the-line storage limit is 1725MB.
 CWWKB0126I: MEMLIMIT=1000. MEMLIMIT CONFIGURATION SOURCE=JCL.

Native threads

- Native threads require 3Mb of above the bar storage (2Mb for LE and 1Mb for the JVM)
 - Monitor thread usage for the address space
 - *D OMVS,LIMITS,PID=<server pid>*



```

WG31 - 3270
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF PROCESS DISPLAY WG31 ALL
COMMAND INPUT ==> -
RESPONSE=WG31
BPX0051I 11.14.07 DISPLAY OMVS 705
OMVS 000F ACTIVE OMVS=(Z3,MJ)
USER JOBNAME ASID PID PPID STATE START CT_SECS
LIBSERV BAQSTRT 0071 33554704 16777415 HK----- 20.16.20 96.3
LATCHWAITPID= 0 CMD=/usr/lpp/java/J8.0_64/bin/java -javaagen
PROCESS LIMITS: LIMMSG=NONE
CURRENT HIGHWATER PROCESS
USAGE USAGE LIMIT
MAXFILEPROC 203 206 10000
MAXFILESIZE --- --- NOLIMIT
MAXPROCUSER 0 7 200
MAXQUEUEDSIGS 0 1 1000
MAXTHREADS 34 40 10000
MAXTHREADTASKS 34 40 5000
ITC_SHMNSEGS 0 0 500
MAXCORESIZE --- --- 4194304
MAXMEMLIMIT 1026M 1061M 4096M

```

Connected to remote server/host wg31a using lu/pool TCP00109 and port 23 04 / 021

- MAXTHREADS must be greater than or equal to MAXTHREADTASK
- Take action when USAGE comes within 80-90% of maxThreads



Tech-Tip: Java heap storage

- Java heap is the area of memory managed by the Java Virtual Machine (JVM) where Java class objects and other objects instantiated by Java applications running in the JVM are stored and resides above the bar. The JVM obtains storage in the heap storage on behalf of the Java applications.
- A process known as garbage collection reclaims the storage when the object is no longer, for more information see URL https://docs.oracle.com/cd/E15289_01/JRSDK/garbage_collect.htm

Non-standard Java options related to garbage collection and heap storage*

- Xgcpolicy:gencon Garbage collection policy, the default is *gencon* and is the recommended garbage collection policy
- Xms<size> Initial heap size, defaults to *8MB* on z/OS
- Xmx<size> Maximum heap size, defaults to half the available memory with a minimum of *16 MB* and a maximum of *512 MB*

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

Standard Java options related garbage collection reporting*

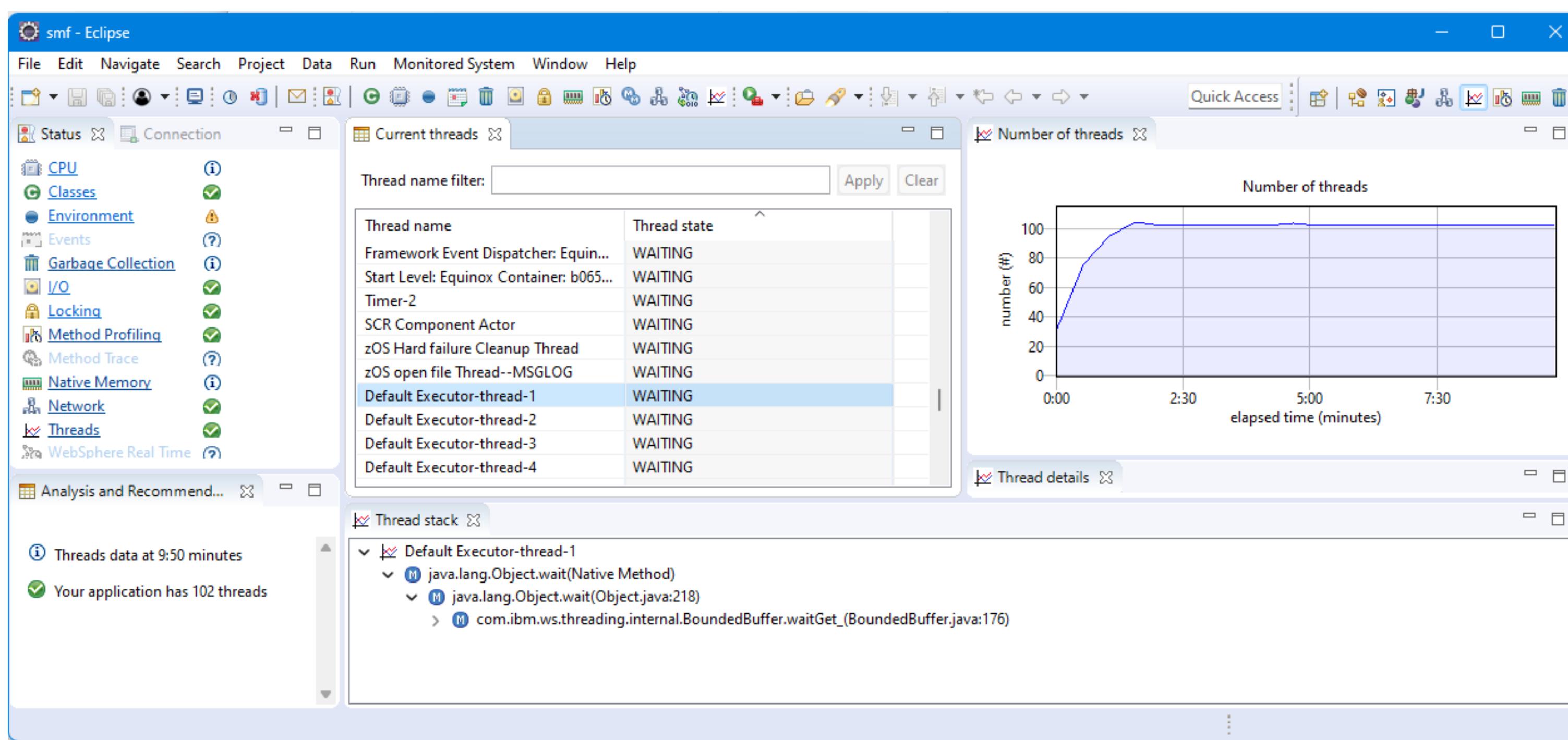
- verbose:gc Writes verbose garbage collection information.
- verbose:sizes Writes information to stderr describing the active memory usage settings.

<https://www.ibm.com/docs/en/sdk-java-technology/8?topic=options-standard>



Java threads

- Java threads handle application requests (executor threads), garbage collection and other Java housekeeping functions.
 - Each Java thread require 1.6Kb of Java heap storage
 - The maximum number of executor threads defaults to unlimited.
 - The maximum number of executor threads can be limited with configuration element `<executor maxThreads="300"/>`
 - The attribute *maxOpenConnections* attribute in the *tcpOptions* configuration element should be set to less than or equal to the value of the maximum number of executor threads.





MEMLIMIT Recommendations

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

`<executor maxThreads="300"/>`

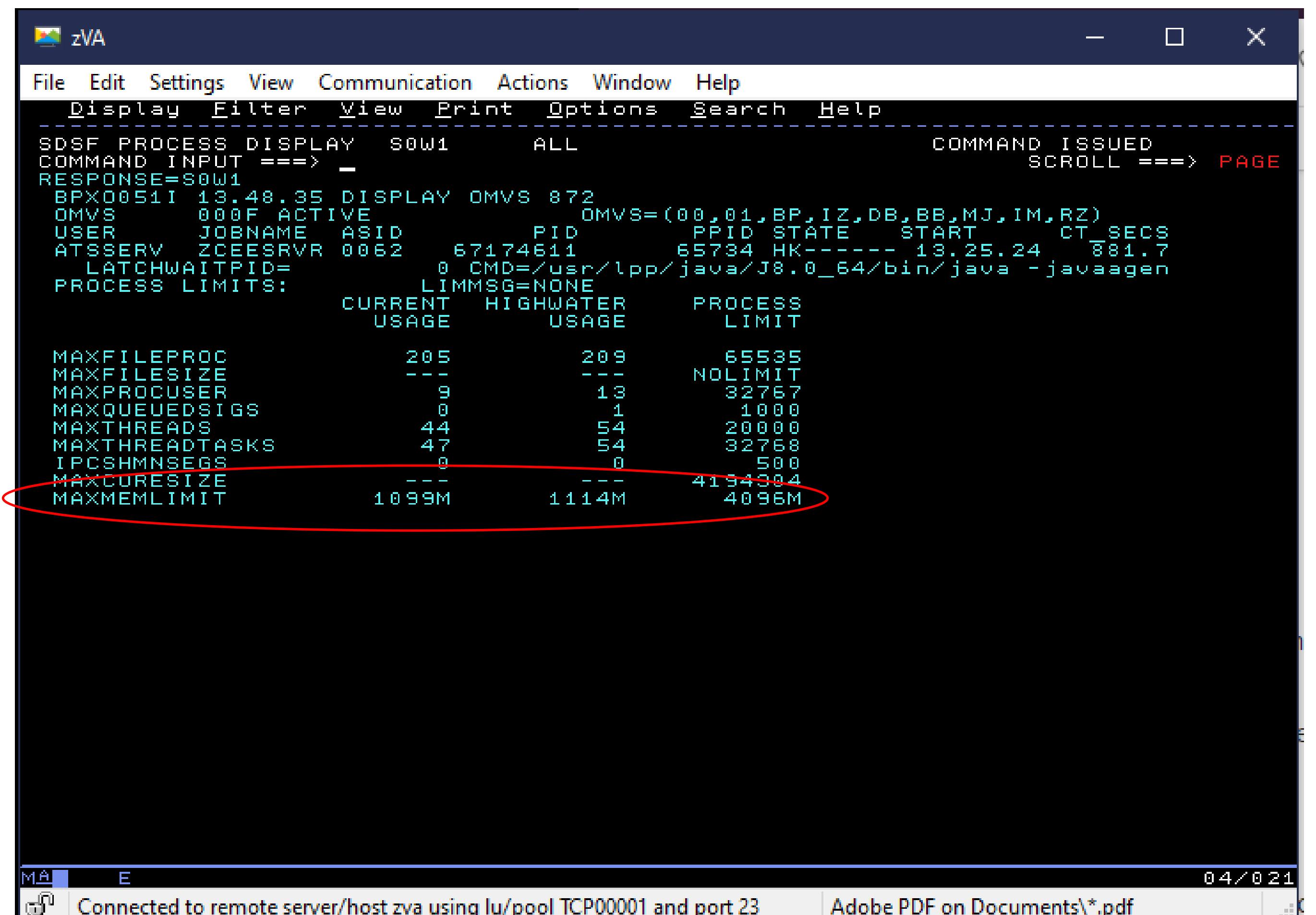
Maximum JVM Heap Size – half the available memory with a minimum of 16 MB and a maximum of 512 MB

MEMLIMIT – management

- MEMLIMIT values
 - MEMLIMIT = maximum Java heap size + 50% of maximum heap size

or

 - MEMLIMIT = maximum Java heap size + 20% of Java heap size + (number of executor threads * 3Mb)
- Monitor periodically
 - To track high water mark with MVS command
D OMVS,LIMITS,PID=<server pid>
- Don't reach the maximum!
 - Results in Java Out Of Memory errors and system abends
 - Liberty will stop processing requests



```

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

```

The screenshot shows the zVA interface with the DISPLAY OMVS command running. The output displays various system parameters and process limits. A red oval highlights the 'MAXMEMLIMIT' row, which shows a current usage of 1099M, a high watermark of 1114M, and a limit of 4096M.

Where do I look when things go wrong?

Issues and problems can be categorized

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

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

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



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

```
*****
product = WAS FOR z/OS 21.0.0.6, z/OS Connect 03.00.48 (wlp-1.0.53.cl210620210527-1900)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/zceepid/
java.home = /MA4RS1/usr/lpp/java/J8.0_64
java.version = 1.8.0_301
java.runtime = Java(TM) SE Runtime Environment (8.0.6.35 - pmz6480sr6fp35-20210714_01(SR6 FP35))
os = z/OS (02.04.00; s390x) (en_US)
process = 16843186@wg31
*****
[19/3/21 13:38:02:831 GMT] 00000013 com.ibm.ws.kernel.launch.internal.FrameworkManager
[9/3/21 13:38:04:439 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:466 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:470 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:473 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:476 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:481 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser
[9/3/21 13:38:04:610 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:612 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:628 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:679 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:680 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
[9/3/21 13:38:04:680 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker
- - - - - 
[9/3/21 13:38:42:347 GMT] 00000040 om.ibm.ws.app.manager.rar.internal.RARApplicationHandlerImpl
[9/3/21 13:38:42:419 GMT] 0000003e com.ibm.ws.jmx.connector.server.rest.RESTAppListener
[9/3/21 13:38:42:422 GMT] 0000003e com.ibm.ws.jmx.connector.server.rest.RESTAppListener
[9/3/21 13:38:42:428 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPEndpoint
[9/3/21 13:38:42:431 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPEndpoint
[9/3/21 13:38:42:437 GMT] 00000042 com.ibm.ws.webcontainer.osgi.mbeans.PluginGenerator
[9/3/21 13:38:42:489 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager
[9/3/21 13:38:42:490 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager
[9/3/21 13:38:42:490 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager
[9/3/21 13:41:31:640 GMT] 00000045 .security.openidconnect.client.internal.OidcClientConfigImpl
[9/3/21 13:41:31:691 GMT] 00000045 liberty.authentication.filter.internal.AuthenticationFilterImpl
[9/3/21 13:41:32:824 GMT] 00000053 com.ibm.zosconnect.service.cics.internal.conn.isc.Connection
*****
A CWWKE0001I: The server zceepid has been launched.
A CWWKG0028A: Processing included configuration resource
I CWWKB0125I: This server requested a REGION size of 0KB
I CWWKB0126I: MEMLIMIT=2000. CONFIGURATION SOURCE
I CWWKB0122I: This server is connected to the default an
I CWWKB0103I: Authorized service group KERNEL is availab
I CWWKB0103I: Authorized service group LOCALCOM is avail
I CWWKB0103I: Authorized service group PRODMGR is availa
- - - - - 148 Line(s) not Displayed
A J2CA7001I: Resource adapter imsudbJLocal installed in
I CWWKX0103I: The JMX REST connector is running and is a
I CWWKX0103I: The JMX REST connector is running and is a
I CWWKO0219I: TCP Channel defaultHttpEndpoint has been s
I CWWKO0219I: TCP Channel defaultHttpEndpoint-ssl has be
I SRVE9103I: A configuration file for a web server plugi
A CWWKF0012I: The server installed the following feature
I CWWKF0008I: Feature update completed in 37.484 seconds
A CWWKF0011I: The zceepid server is ready to run a smar
I CWWKS1700I: OpenID Connect client ATS configuration su
I CWWKS4358I: The authentication filter ATSAuthFilter co
I BAQR0680I: CICS connection cscvinc established with 10
```

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



Basic security issues – Sometimes the problem is easy to find

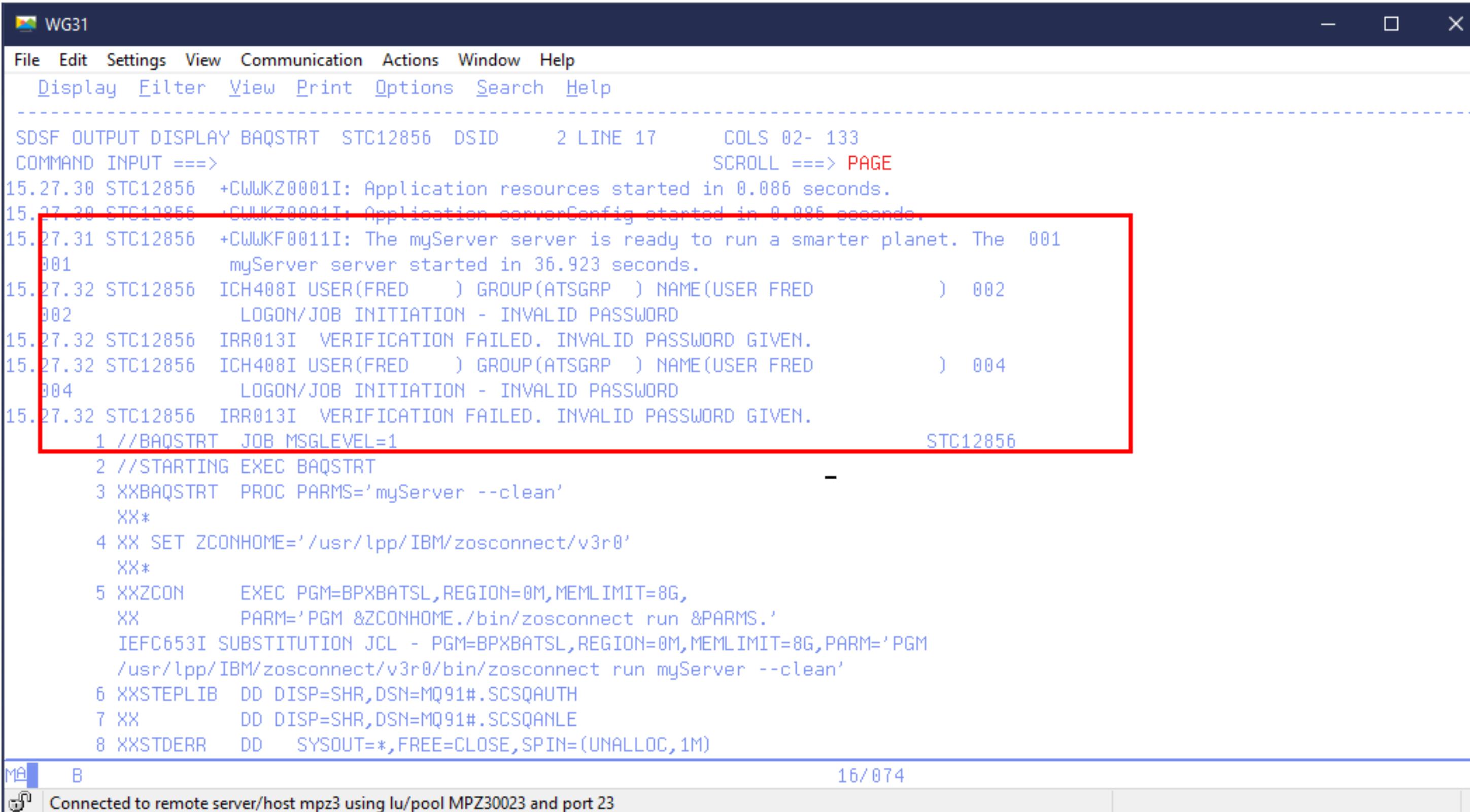
The STDOUT may show:

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

And the messages.log displays:

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

But the JESMSGLOG and SYSLOG displays:



```
WG31  
File Edit Settings View Communication Actions Window Help  
Display Filter View Print Options Search Help  
-----  
SDSF OUTPUT DISPLAY BAQSTRT STC12856 DSID 2 LINE 17 COLS 02- 133  
COMMAND INPUT ==> SCROLL ==> PAGE  
15.27.30 STC12856 +CWWKZ0001I: Application resources started in 0.086 seconds.  
15.27.30 STC12856 +CWWKZ0001I: Application serverConfig started in 0.086 seconds.  
15.27.31 STC12856 +CWWJKF0011I: The myServer server is ready to run a smarter planet. The 001  
001 myServer server started in 36.923 seconds.  
15.27.32 STC12856 ICH408I USER(FRED ) GROUP(ATSGRP ) NAME(USER FRED ) 002  
002 LOGON/JOB INITIATION - INVALID PASSWORD  
15.27.32 STC12856 IRR013I VERIFICATION FAILED. INVALID PASSWORD GIVEN.  
15.27.32 STC12856 ICH408I USER(FRED ) GROUP(ATSGRP ) NAME(USER FRED ) 004  
004 LOGON/JOB INITIATION - INVALID PASSWORD  
15.27.32 STC12856 IRR013I VERIFICATION FAILED. INVALID PASSWORD GIVEN.  
1 //BAQSTRT JOB MSGLEVEL=1 STC12856  
2 //STARTING EXEC BAQSTRT  
3 XXBAQSTRT PROC PARMs='myServer --clean'  
XX*  
4 XX SET ZCONHOME='/usr/lpp/IBM/zosconnect/v3r0'  
XX*  
5 XXZCON EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,  
XX PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS.'  
IEFC653I SUBSTITUTION JCL - PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,PARM='PGM  
'/usr/lpp/IBM/zosconnect/v3r0/bin/zosconnect run myServer --clean'  
6 XXSTEPLIB DD DISP=SHR,DSN=MQ91#.SCSQAUTH  
7 XX DD DISP=SHR,DSN=MQ91#.SCSQANLE  
8 XXSTDERR DD SYSOUT=*,FREE=CLOSE,SPIN=(UNALLOC,1M)  
16/074  
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
```

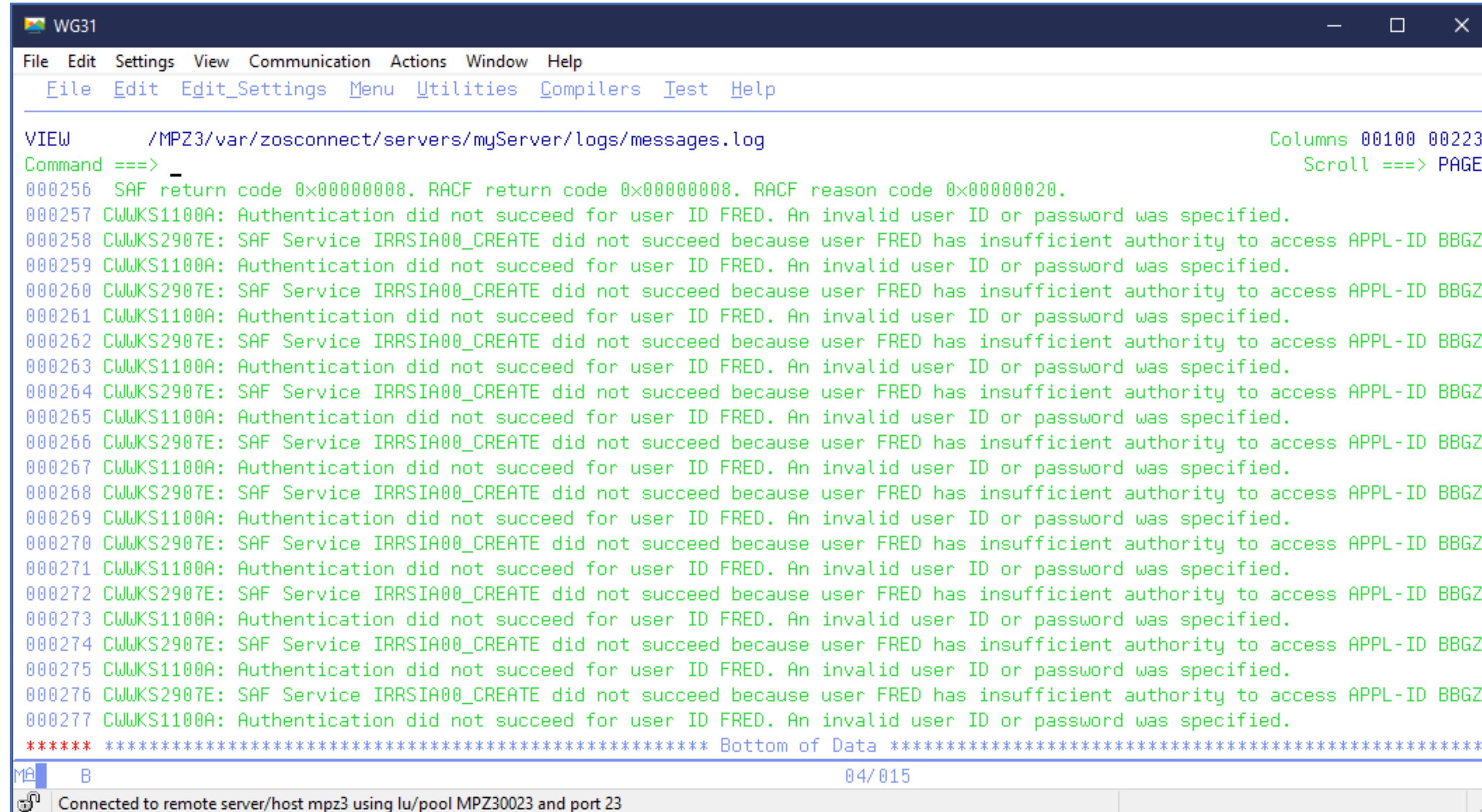
Basic security issues – Sometimes you must dig a little more

The STDOUT may show:

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

But there are no SAF messages in the SYSLOG:

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



```
VIEW      /MPZ3/var/zosconnect/servers/myServer/logs/messages.log
Command ==> -
000256  SAF return code 0x00000008. RACF return code 0x00000008. RACF reason code 0x00000020.
000257  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000258  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000259  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000260  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000261  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000262  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000263  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000264  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000265  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000266  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000267  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000268  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000269  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000270  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000271  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000272  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000273  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000274  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000275  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000276  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000277  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.

***** ***** Bottom of Data *****
```

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 in return and reason codes

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



Table 1. initACEE create return codes

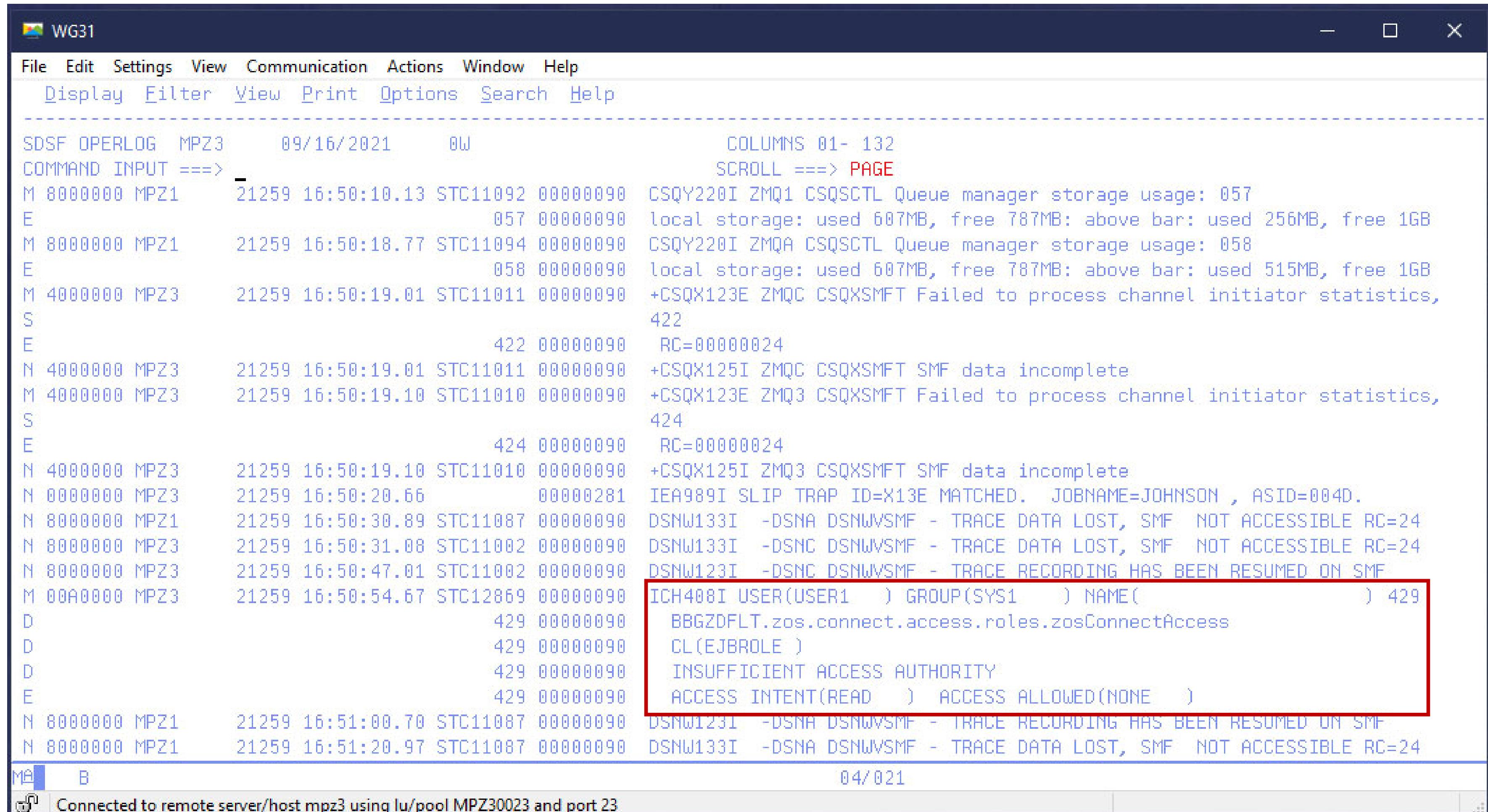
SAF return code	RACF® return code	RACF reason code	Explanation
0	0	0	The service was successful.
4	0	0	RACF is not installed.
8	8	4	Parameter list error occurred.
8	8	8	An internal error occurred during RACF processing.
8	8	12	Recovery environment could not be established.
8	8	16	User ID is not defined 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

Basis security issues - Use the SYSLOG/JESMSGLG output

The SYSLOG shows a ICH408I message:



```

WG31

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

SDSF OPERLOG MPZ3      09/16/2021     0W          COLUMNS 01- 132
COMMAND INPUT ===> -   SCROLL ===> PAGE
M 8000000 MPZ1      21259 16:50:10.13 STC11092 00000090 CSQY220I ZMQ1 CSQSCTL Queue manager storage usage: 057
E                               057 00000090 local storage: used 607MB, free 787MB; above bar: used 256MB, free 1GB
M 8000000 MPZ1      21259 16:50:18.77 STC11094 00000090 CSQY220I ZMQA CSQSCTL Queue manager storage usage: 058
E                               058 00000090 local storage: used 607MB, free 787MB; above bar: used 515MB, free 1GB
M 4000000 MPZ3      21259 16:50:19.01 STC11011 00000090 +CSQX123E ZMQC CSQXSMFT Failed to process channel initiator statistics,
S                                         422
E                               422 00000090 RC=00000024
N 4000000 MPZ3      21259 16:50:19.01 STC11011 00000090 +CSQX125I ZMQC CSQXSMFT SMF data incomplete
M 4000000 MPZ3      21259 16:50:19.10 STC11010 00000090 +CSQX123E ZMQ3 CSQXSMFT Failed to process channel initiator statistics,
S                                         424
E                               424 00000090 RC=00000024
N 4000000 MPZ3      21259 16:50:19.10 STC11010 00000090 +CSQX125I ZMQ3 CSQXSMFT SMF data incomplete
N 0000000 MPZ3      21259 16:50:20.66      00000281 IEA989I SLIP TRAP ID=X13E MATCHED.  JOBNAME=JOHNSON , ASID=004D.
N 8000000 MPZ1      21259 16:50:30.89 STC11087 00000090 DSNW133I -DSNA DSNWVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
N 8000000 MPZ3      21259 16:50:31.08 STC11002 00000090 DSNW133I -DSNC DSNWVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
N 8000000 MPZ3      21259 16:50:47.01 STC11002 00000090 DSNW123I -DSNC DSNWVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
M 00A0000 MPZ3      21259 16:50:54.67 STC12869 00000090 ICH408I USER(USER1 ) GROUP(SYS1 ) NAME(          ) 429
D                               429 00000090 BBGZDFLT.zos.connect.access.roles.zosConnectAccess
D                               429 00000090 CL(EJBROLE )
D                               429 00000090 INSUFFICIENT ACCESS AUTHORITY
E                               429 00000090 ACCESS INTENT(READ ) ACCESS ALLOWED(NONE )
N 8000000 MPZ1      21259 16:51:00.70 STC11087 00000090 DSNW123I -DSNA DSNWVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
N 8000000 MPZ1      21259 16:51:20.97 STC11087 00000090 DSNW133I -DSNA DSNWVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24

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

```

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



Basic security issues – Sometimes there is misdirection

The STDOUT may show:

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

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

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

```

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

16.31.55 STC12862 ---- THURSDAY, 16 SEP 2021 ----
16.31.55 STC12862 IEF695I START BAQSTRT WITH JOBNM BAQSTRT IS ASSIGNED TO USER LIBSERV , GROUP LIBGRP
16.31.55 STC12862 $HASP373 BAQSTRT STARTED
16.32.03 STC12862 +CWUJKE0001I: The server myServer has been launched.
16.32.20 STC12862 BPXM023I (LIBSERV) 282
282 GMDIG7777I: IMS service provider (20210816-0926) for z/OS Connect
282 Enterprise Edition initialized successfully.
16.32.50 STC12862 +CWUWKZ0001I: Application resources started in 14.912 seconds.
16.32.50 STC12862 +CWUWKZ0001I: Application serverConfig started in 14.910 seconds.
16.32.55 STC12862 +CWUWKF0011I: The myServer server is ready to run a smarter planet. The 285
285 myServer server started in 51.809 seconds
16.43.25 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.25 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.25 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.25 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.26 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.26 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.

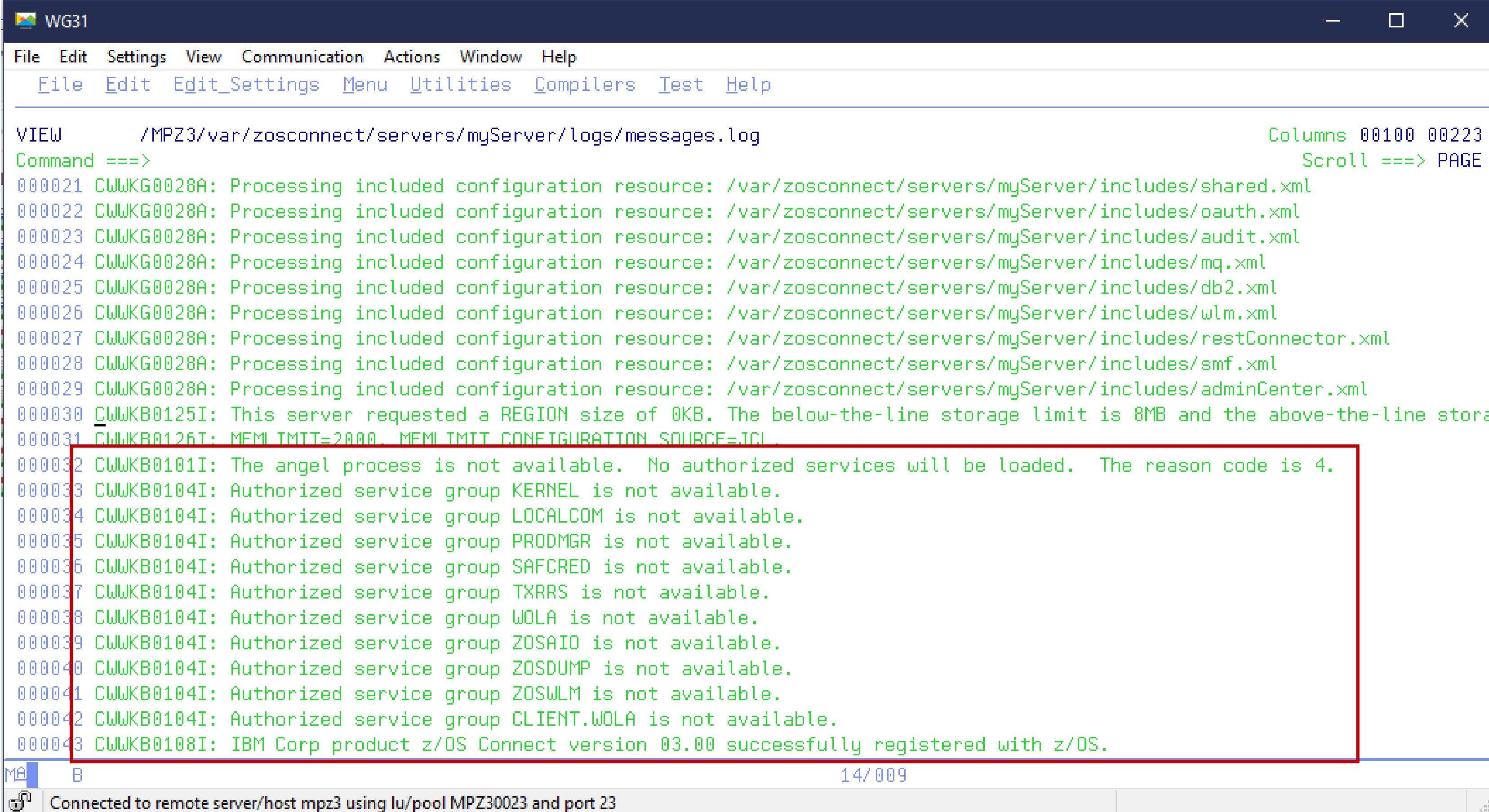
MA B 04/021
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23

```

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

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

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



```
VIEW      /MPZ3/var/zosconnect/servers/myServer/logs/messages.log          Columns 00100 00223
Command ==>
000021 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/shared.xml
000022 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/oauth.xml
000023 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/audit.xml
000024 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/mq.xml
000025 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/db2.xml
000026 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/wlm.xml
000027 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/restConnector.xml
000028 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/smf.xml
000029 CWUKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/adminCenter.xml
000030 CWWKB0125I: This server requested a REGION size of 0KB. The below-the-line storage limit is 8MB and the above-the-line stor
000031 CWWKB0126I: MFML TMTT=20000. MFML TMTT CONFIGURATION SOURCE=TCI
000032 CWWKB0101I: The angel process is not available. No authorized services will be loaded. The reason code is 4.
000033 CWWKB0104I: Authorized service group KERNEL is not available.
000034 CWWKB0104I: Authorized service group LOCALCOM is not available.
000035 CWWKB0104I: Authorized service group PRODMGR is not available.
000036 CWWKB0104I: Authorized service group SAFCRE is not available.
000037 CWWKB0104I: Authorized service group TXRRS is not available.
000038 CWWKB0104I: Authorized service group WOLA is not available.
000039 CWWKB0104I: Authorized service group ZOSAIO is not available.
000040 CWWKB0104I: Authorized service group ZOSDUMP is not available.
000041 CWWKB0104I: Authorized service group ZOSWLM is not available.
000042 CWWKB0104I: Authorized service group CLIENT.WOLA is not available.
000043 CWWKB0108I: IBM Corp product z/OS Connect version 03.00 successfully registered with z/OS.

MA B 14/009
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23
```



External resource issues (HTTP 500)

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://wg31.washington.ibm.com:9443/db2/employee/948478.
```

While the messages.log display

```
[9/16/21 21:00:55:811 GMT] 00000051 com.ibm.zosconnect.service.cics.internal.conn.ISCECIRequest E BAQR0657E: Transaction abend MIJO occurred in CICS while using CICS connection cscvinc and service cscvincDeleteService.  
[9/16/21 21:00:55:815 GMT] 00000051 com.ibm.zosconnect.internal.web.ServiceProxyServlet W BAQR0429W: API cscvinc encountered an error while processing a request under URL https://wg31.washington.ibm.com:9443/cscvinc/employee/948478.
```

The STDOUT may show:

```
ÝWARNING `` BAQR0429W: API db2employee encountered an error while processing a request under URL  
https://wg31.washington.ibm.com:9443/db2/employee/948478.
```

The messages.log displays:

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

Tech-Tip: An HTTP 500 shortcut – look elsewhere

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

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

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



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)
```

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.]

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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Slide 67



First Failure Data Collection (FFDC)

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

MQ service provider classes

Root cause – Queue was configured to disable the MQPUT request



The FFDC dump is more than just a Java stack trace

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

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

Use the messages.log and FFDC log together



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

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

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

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

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

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



The FFDC dump showing additional JMS information

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

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

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Slide 72



A FFDC dump showing an SSL Handshake issue

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

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

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

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

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

Tech/Tip: Details of the flow with mutual authentication (TLS 1.2)



1. A Client sends a request to server for a protected session in a ***ClientHello*** message. Included in the request is the TLS capabilities of the client (e.g., TLS 1.2 or 1.3) and a list of supported ciphers in preference order.
2. The server selects the TLS version and selects cipher from the list sent by the client and returns this information in a ***ServerHello*** message.
3. The server's certificate public information (including the **public key**) is sent to the client in a ***Certificate*** message.
4. The server sends cryptographic information for the client to use for encrypting a pre-master key in a ***Server key exchange*** message.
5. **For mutual authentication, the server sends a *CertificateRequest* message requesting a client's personal certificate.**
6. The server concludes by sending a ***ServerHelloDone*** message.
7. The client verifies the server's certificate with its trust store.
8. **If mutual authentication is requested, the client sends its public personal certificate information in a *Certificate* message**
9. The client then uses the **server's public key** to generate and encrypt a 48 byte “premaster secret” message which is sent to the server in a ***ClientKeyExchange*** message.
10. **When mutual authentication is requested, a digitally signature (hashed) of the concatenation of all previous handshake messages is encrypted with the client's private key sent in a *CertificateVerify* message.**
11. The ***Change Cipher*** message is used to change the cipher used during the handshake so all subsequent messages will be encrypted using a different cipher.
12. The server uses its **private key** to decrypt the “premaster secret” message (**only the private key can be used to decrypt the message**).
13. **If mutual authentication is requested, the server verifies the client's personal certificate with its key ring and uses the client's public key to decrypt and verify the message sent in the *CertificateVerify* message.**
14. Both the Client and Server use the “premaster secret” to compute a ‘master secret’, also known as “shared secret” or “session key” (symmetric encryption)
15. Client and server will use this “shared secret” or “session key” to encrypt messages sent between the endpoints.



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

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

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

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

Common TLS handshake issues

With a few exceptions, most of TLS errors may require a review of a trace.

I use the *traceSpecification* as shown below:

```
<logging traceSpecification="com.ibm.ws.security.*=all:SSLChannel=all:SSL=all:zosConnectSaf=all"/>
```

This will generate a *trace.out* file in the *logs* subdirectory. This trace will provide details about the key ring and certificates involved in the handshake. There is a wealth of information about the flow between the client and server endpoints. Review this trace for exceptions. The following exceptions are some of the most commonly experienced.

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

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

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

Caught exception during unwrap, javax.net.ssl.SSLException: Received fatal alert: bad_certificate

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

Common TLS handshake issues

- ***FFDC1015I: An FFDC Incident has been created: "java.io.IOException: Failed validating certificate paths com.ibm.ws.ssl.config.WSKeyStore\$1 do_getKeyStore" at ffdc_19.12.04_20.51.47.0.log***

This can occur when the CA certificate used to sign the server's personal certificate was not connected to the server's local trust store (key ring on z/OS).

- ***java.io.IOException: IOException invoking https://132.25.33.351:9443/employees/John?validated=true: HTTPS hostname wrong: should be <132.25.33.351>***

In this situation the endpoint for the outbound API request was configured to use an IP address rather than a hostname. This should not be an issue unless an exchange of digital certificates is required.

The trace showed that during the handshake process the outbound API provider server's certificate had a common name (CN) which specified the hostname of the TCPIP stack where the API resided. This hostname was not known (e.g., DNS-resolvable) on the TCPIP stack where the z/OS Connect server was executing. This meant that communications back to the API requester's TCPIP stack based on the hostname was not possible which caused the IO exception. The best solution would be to use the host name in the server.xml configuration rather than the IP address and either add an entry to the local TCPIP stack's hostname (e.g., hosts) file for the IP address and hostname or add an entry to the DNS servers used by this TCPIP stack.

Common TLS handshake issues



- **CWPKI0022E: SSL HANDSHAKE FAILURE:** A signer with SubjectDN CN=USER3 D. Client, OU=LIBERTY, O=IBM was sent from the target host. The signer might need to be added to local trust store `safkeyring://Liberty.KeyRing`, located in SSL configuration alias `DefaultSSLSettings`. The extended error message from the SSL handshake exception is: PKIX path building failed: `com.ibm.security.cert.IBMCertPathBuilderException: unable to find valid certification path to requested target`

This message is indicating a personal certificate was presented in a TLS handshake and there was no corresponding certificate authority certificate connect to the local trust store (e.g., key ring). This can occur either for client connecting to the server or an API requester request going to an API provider.

Identify the certificate authority which signed this personal certificate and connect it to the keyring with usage CERTAUTH.

Common TLS handshake issues

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

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

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

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

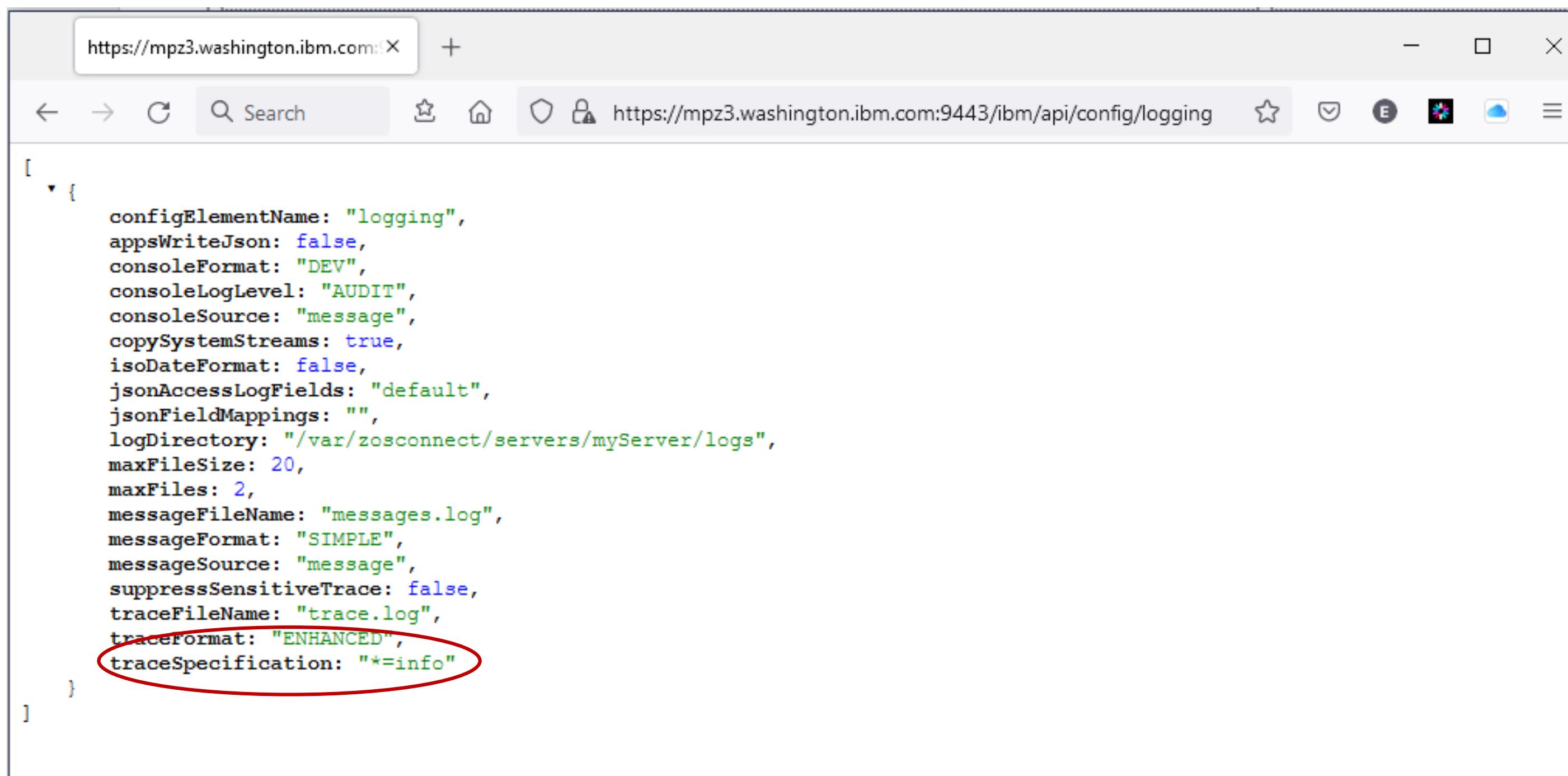
- Another possibility is that the TLS handshake the negotiations between the client and server failed, e.g.,
javax.net.ssl.SSLHandshakeException: Client requested protocol SSLv3 is not enabled or supported in server context



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

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

`https://wg31.washington.ibm.com:9443/ibm/api/config/logging`



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

Enabling trace in z/OS Connect EE server

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



Managing trace specifications

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

server.xml

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

safTrace.xml

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

cicsTrace.xml

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

imsTrace.xml

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

Enables enhanced tracing

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

Disable enhanced tracing

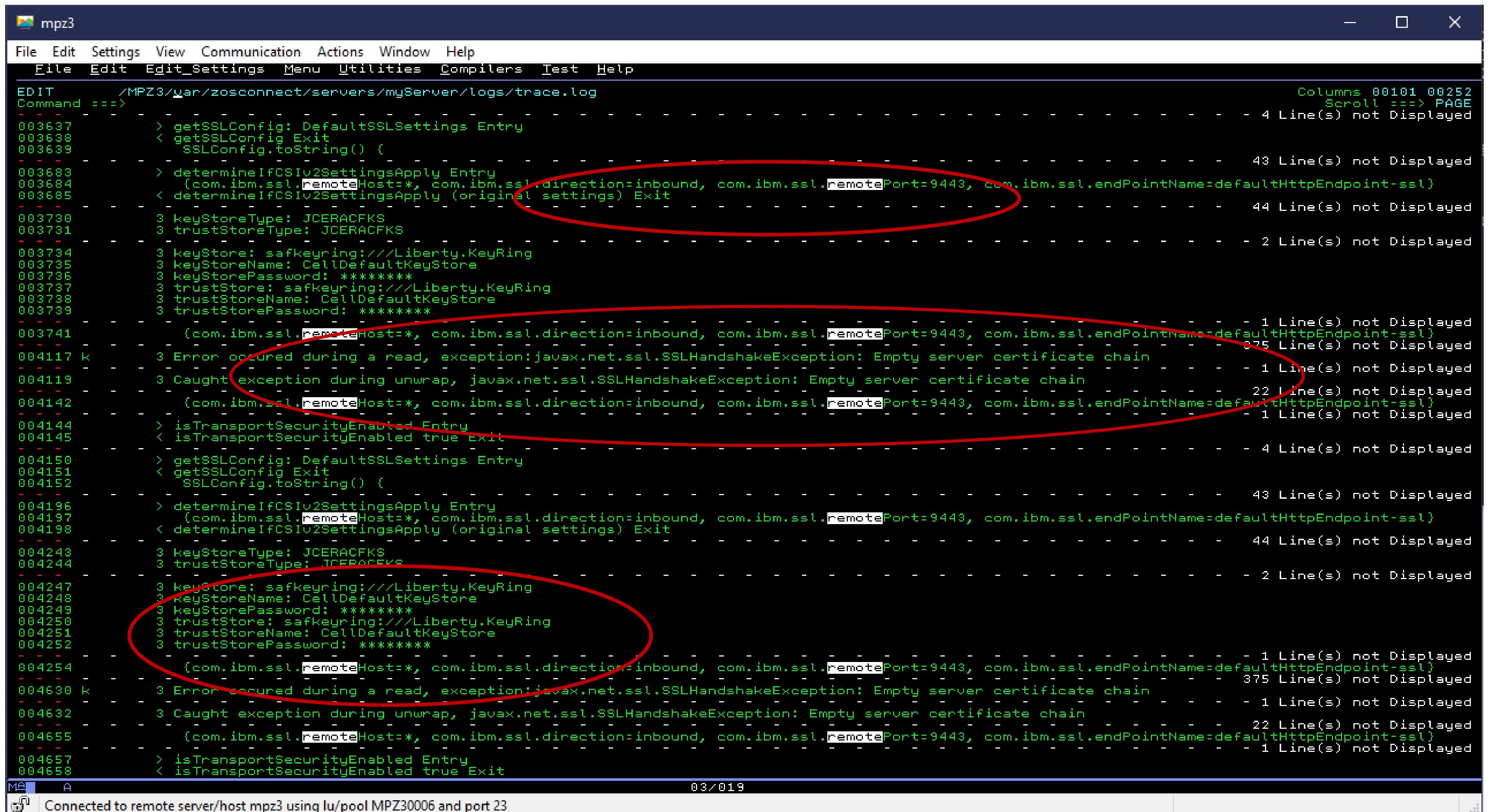
F BAQSTART,LOGGING='*=INFO'

Or

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



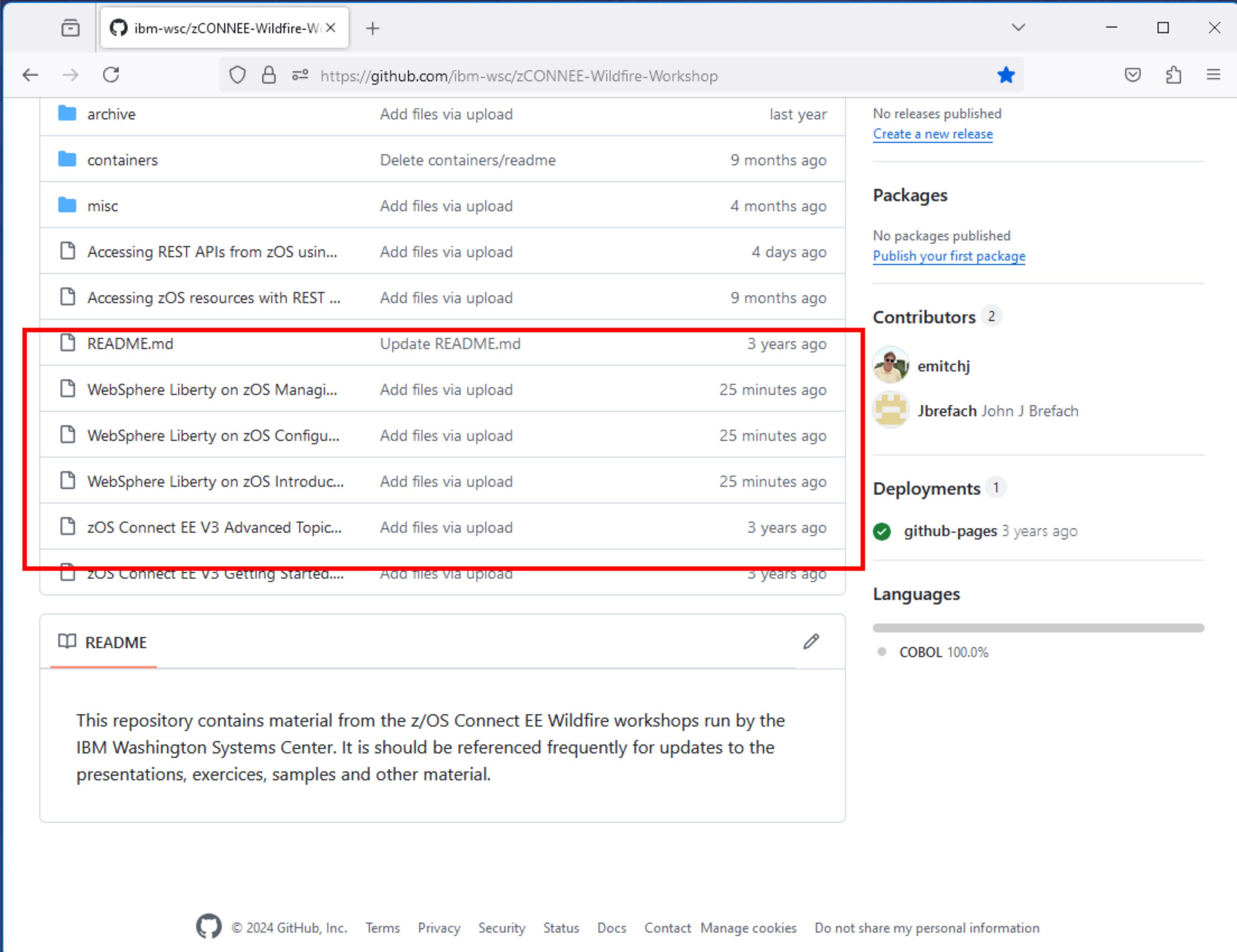
trace.out file



```
mpz3
File Edit Settings View Communication Actions Window Help
File Edit Edit_Settings Menu Utilities Compilers Test Help
EDIT /MPZ3/var/zosconnect/servers/myServer/logs/trace.log Columns 00101 00252
Command ==> Scroll ==> PAGE
003697      > getSSLConfig: DefaultSSLSettings Entry 4 Line(s) not Displayed
003698      < getSSLConfig Exit
003699          SSLConfig.toString() {
003700      > determineIfCSIV2SettingsApply Entry
003701          {com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl}
003702      < determineIfCSIV2SettingsApply (original settings) Exit
003703      3 keyStoreType: JCERACFKS
003704      3 trustStoreType: JCERACFKS
003705      3 keyStore: safkeyring://Liberty.KeyRing
003706      3 keyStoreName: CellDefaultKeyStore
003707      3 keyStorePassword: *****
003708      3 trustStore: safkeyring://Liberty.KeyRing
003709      3 trustStoreName: CellDefaultKeyStore
003710      3 trustStorePassword: *****
003711      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004117 k      3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004119      3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004142      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004144      > isTransportSecurityEnabled Entry
004145      < isTransportSecurityEnabled true Exit
004150      > getSSLConfig: DefaultSSLSettings Entry 4 Line(s) not Displayed
004151      < getSSLConfig Exit
004152          SSLConfig.toString() {
004196      > determineIfCSIV2SettingsApply Entry
004197          {com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl}
004198      < determineIfCSIV2SettingsApply (original settings) Exit
004243      3 keyStoreType: JCERACFKS
004244      3 trustStoreType: JCEPKEK
004247      3 keyStore: safkeyring://Liberty.KeyRing
004248      3 keyStoreName: CellDefaultKeyStore
004249      3 keyStorePassword: *****
004250      3 trustStore: safkeyring://Liberty.KeyRing
004251      3 trustStoreName: CellDefaultKeyStore
004252      3 trustStorePassword: *****
004254      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004630 k      3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004632      3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004655      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004657      > isTransportSecurityEnabled Entry
004658      < isTransportSecurityEnabled true Exit
MA A
Connected to remote server/host mpz3 using lu/pool MPZ30006 and port 23
03/019
```

z/OS Connect Wildfire Github Site

<https://ibm.biz/BdPRGD>



The screenshot shows a GitHub repository page for `ibm-wsc/zCONNEE-Wildfire-Workshop`. The main content area displays a list of files and folders. A red box highlights several recent uploads:

File/Folder	Action	Last Updated
README.md	Update README.md	3 years ago
WebSphere Liberty on zOS Managi...	Add files via upload	25 minutes ago
WebSphere Liberty on zOS Configu...	Add files via upload	25 minutes ago
WebSphere Liberty on zOS Introduc...	Add files via upload	25 minutes ago
zOS Connect EE V3 Advanced Topic...	Add files via upload	3 years ago
ZOS Connect EE v3 Getting Started....	Add files via upload	3 years ago

Below this list is a `README` file containing the following text:

```
This repository contains material from the z/OS Connect EE Wildfire workshops run by the IBM Washington Systems Center. It is should be referenced frequently for updates to the presentations, exercises, samples and other material.
```

On the right side of the page, there are sections for **Releases**, **Packages**, **Contributors**, **Deployments**, and **Languages**. The **Contributors** section lists `emitchj` and `Jbrefach John J Brefach`. The **Deployments** section shows one entry for `github-pages` updated 3 years ago. The **Languages** section indicates 100.0% COBOL.

mitchj@us.ibm.com

Thank you for listening and your questions.

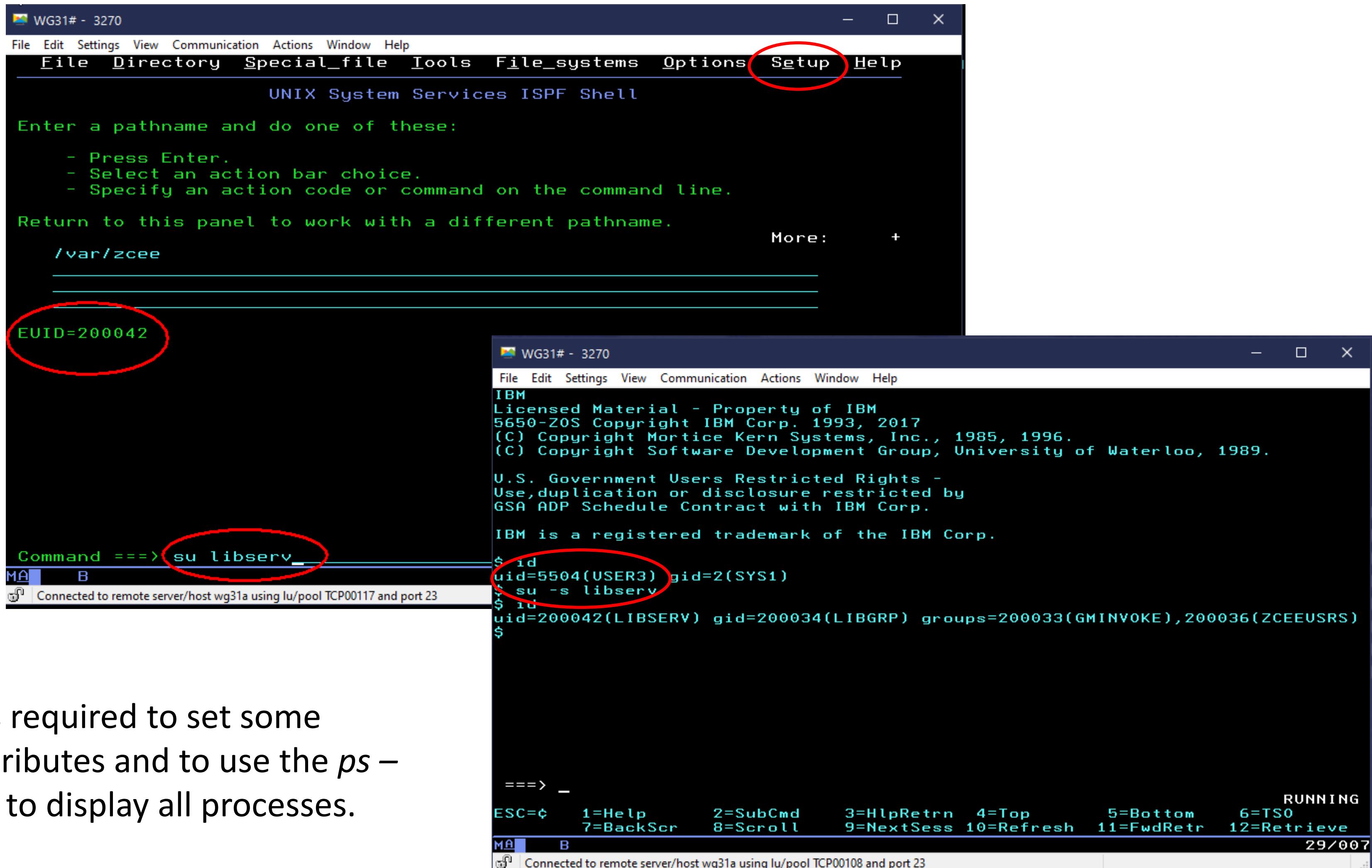
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Slide 83



Thank you for listening and your questions.

Miscellaneous Odds and Ends

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



The image contains two screenshots of the ISPF/OMVS interface. The top screenshot shows the ISPF Shell menu bar with the 'Setup' option circled in red. The bottom screenshot shows a terminal window with several command-line interactions circled in red.

Top Screenshot (ISPF Shell):

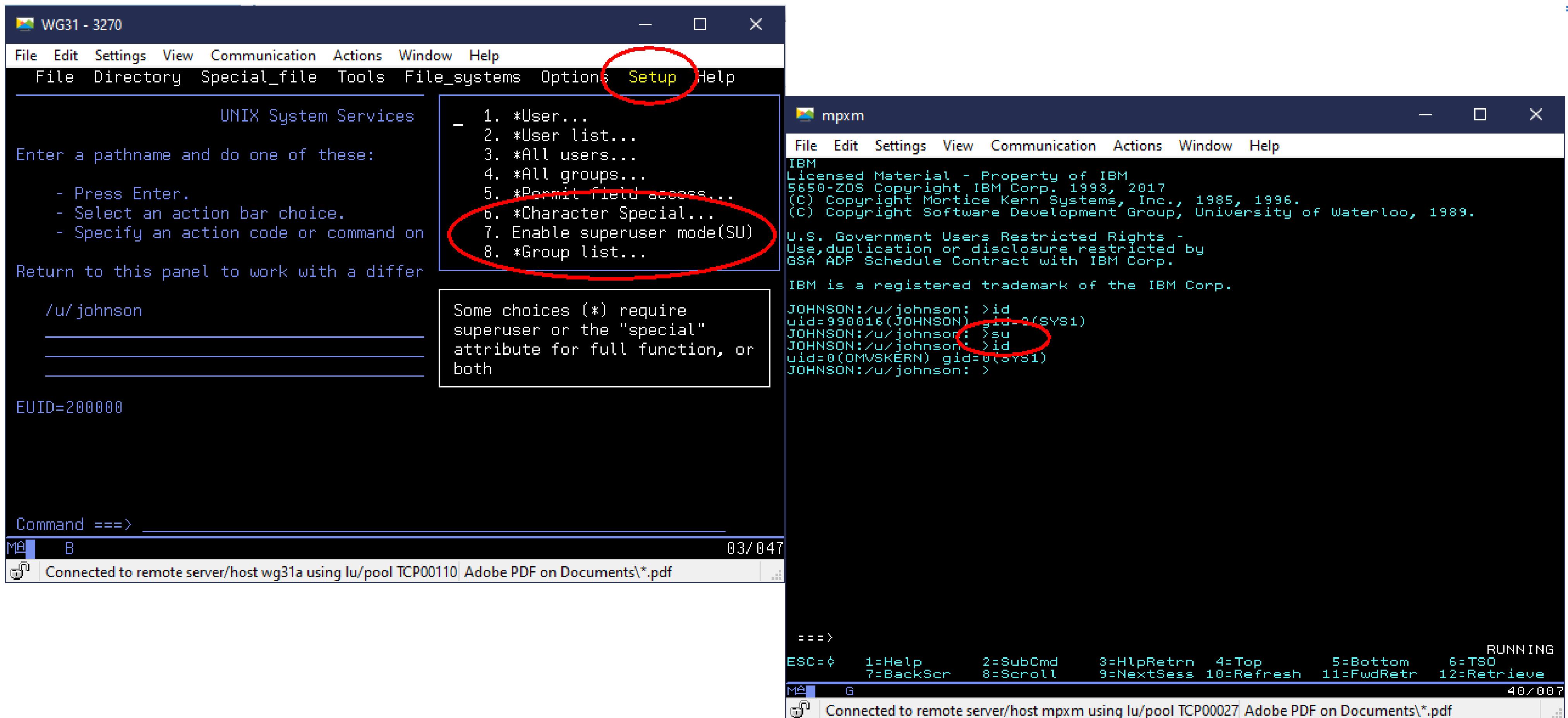
- Menu bar: File, Directory, Special_file, Tools, File_systems, Options, **Setup**, Help.
- Submenu: UNIX System Services ISPF Shell.
- Text area: Enter a pathname and do one of these:
 - Press Enter.
 - Select an action bar choice.
 - Specify an action code or command on the command line.
- Text area: Return to this panel to work with a different pathname.
- Text area: /var/zcee
- Text area: More: +
- Text area: EUID=200042 (circled in red)

Bottom Screenshot (Terminal):

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

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

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



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

Tech-Tip: Identity assertion and/or JWT generation Extended Attribute Requirement

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

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

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

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

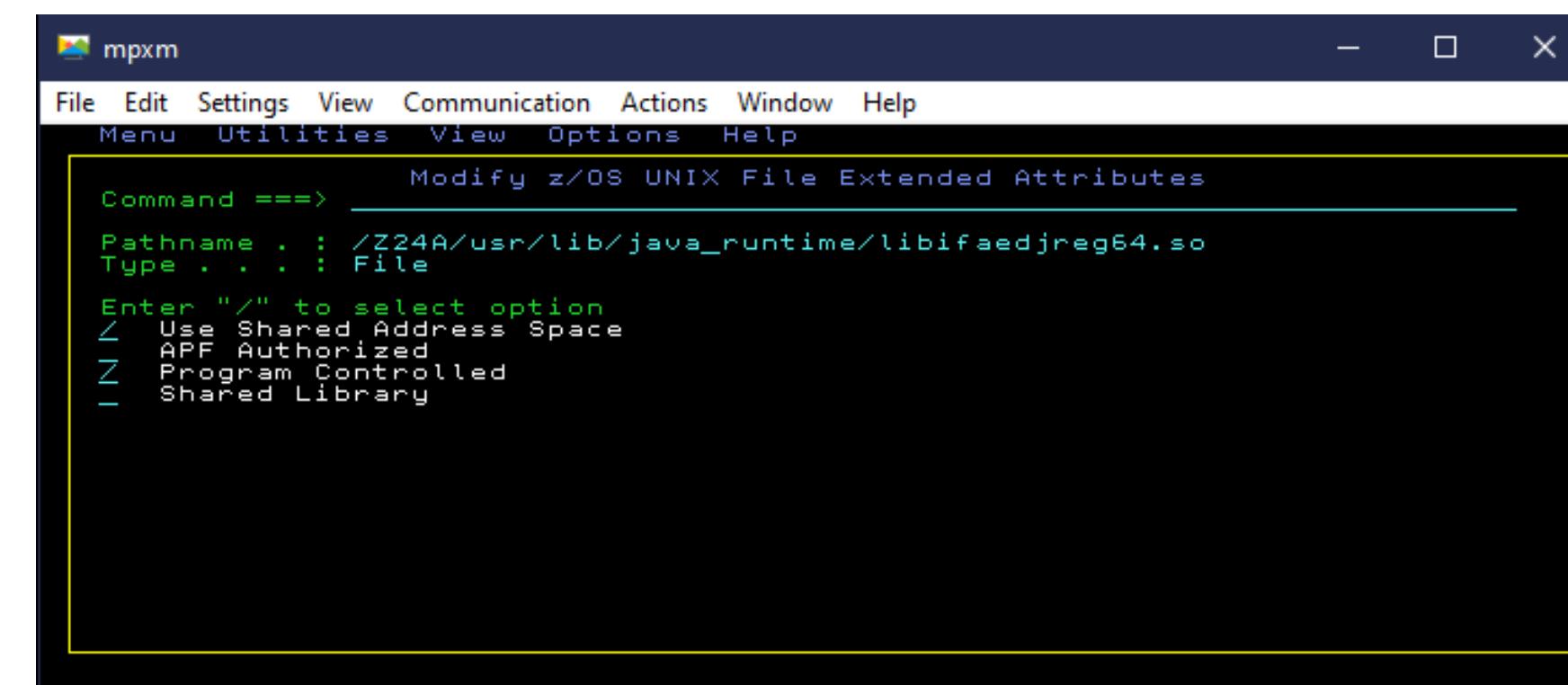
**RDEFINE SURROGAT *clientID.BAQASSRT* UACC(NONE) OWNER(SYS1)
PERMIT *clientID.BAQASSRT* CLASS(SURROGAT) ACCESS(READ) ID(*zCEEID*)**

OR

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

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

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



Tech-Tip: Use Symbolic links to simplify commands used in OMVS and JCL

Performing commands:

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

Will change these OMVS commands from:

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

To simpler (and shorter) OMVS commands:

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

Directory Shortcuts

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

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

ln -s oldname newname

These symbolic links can be used as JCL symbols

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

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

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

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



Workload Manager – Active HTTP Classification

https://wg31.washington.ibm.com:9443/ibm/api/config/httpClassification

The screenshot shows a web browser window displaying a JSON array of configuration elements for "httpClassification". Each element is defined by the following fields:

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

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



Tech-Tip: Copying 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'"
```

Tech-Tip: Sample JCL - Executing the Liberty *securityUtility* command



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

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

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

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

Tech-Tip: Sample Sysplex DVIPAs Configuration

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
```

SERVERWLM is not an option

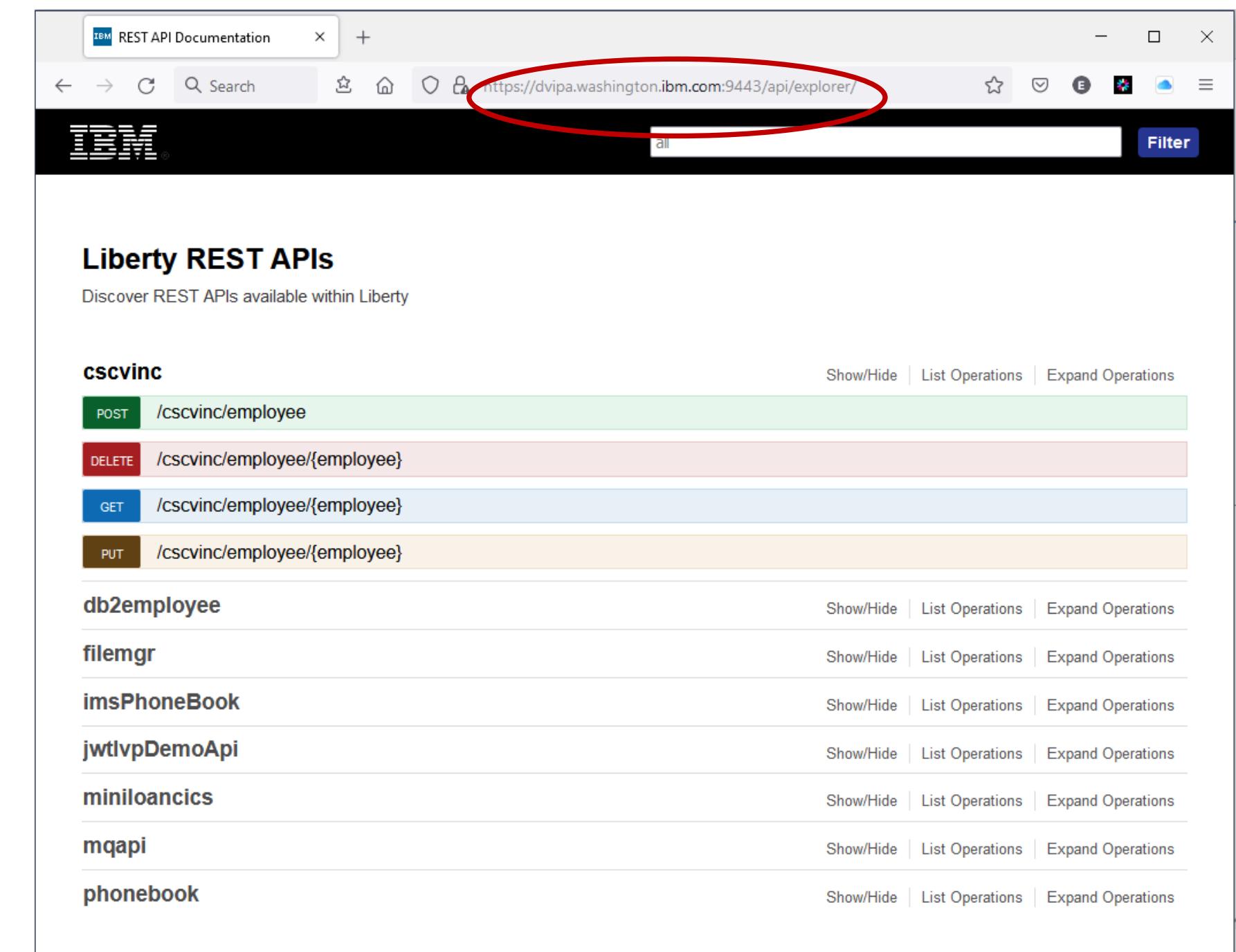
HOMETEST

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

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

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

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



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

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

```

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

res_init Resolver values:
Setup file warning messages = No
CTRACE TRACERES option = No
Global Tcp/Ip Dataset = SYS1.TCPIP.TCPPARMS(TCPDAT3)
Default Tcp/Ip Dataset = SYS1.TCPIP.TCPPARMS(TCPDAT3)
Local Tcp/Ip Dataset = //DD:SYSTCPD
                         ==> SYS1.TCPIP.TCPPARMS(TCPDAT3)
Translation Table = SYS1.TCPIP.STANDARD.TCPXLBIN
UserId/JobName = JOHNSON
Caller API = TCP/IP Sockets Extended
Caller Mode = EBCDIC
System Name = WSC13 (from VMCF)
UnresponsiveThreshold = 25
(G) DataSetPrefix = SYS1.TCPIP
(G) HostName = wg31
. . .
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
*****
EZ2311I Unknown host 'WG31.WASHINGTON.IBM.COM'

```

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

Tech/Tip: Details of the flow with mutual authentication (TLS 1.2)



1. A Client sends a request to server for a protected session in a ***ClientHello*** message. Included in the request is the TLS capabilities of the client (e.g., TLS 1.2 or 1.3) and a list of supported ciphers in preference order.
2. The server selects the TLS version and selects cipher from the list sent by the client and returns this information in a ***ServerHello*** message.
3. The server's certificate public information (including the **public key**) is sent to the client in a ***Certificate*** message.
4. The server sends cryptographic information for the client to use for encrypting a pre-master key in a ***Server key exchange*** message.
5. **For mutual authentication, the server sends a *CertificateRequest* message requesting a client's personal certificate.**
6. The server concludes by sending a ***ServerHelloDone*** message.
7. The client verifies the server's certificate with its trust store.
8. **If mutual authentication is requested, the client sends its public personal certificate information in a *Certificate* message**
9. The client then uses the **server's public key** to generate and encrypt a 48 byte “premaster secret” message which is sent to the server in a ***ClientKeyExchange*** message.
10. **When mutual authentication is requested, a digitally signature (hashed) of the concatenation of all previous handshake messages is encrypted with the client's private key sent in a *CertificateVerify* message.**
11. The ***Change Cipher*** message is used to change the cipher used during the handshake so all subsequent messages will be encrypted using a different cipher.
12. The server uses its **private key** to decrypt the “premaster secret” message (**only the private key can be used to decrypt the message**).
13. **If mutual authentication is requested, the server verifies the client's personal certificate with its key ring and uses the client's public key to decrypt and verify the message sent in the *CertificateVerify* message.**
14. Both the Client and Server use the “premaster secret” to compute a ‘master secret’, also known as “shared secret” or “session key” (symmetric encryption)
15. Client and server will use this “shared secret” or “session key” to encrypt messages sent between the endpoints.

Tech/Tip: Using a cURL trace to show the flow with mutual authentication



- * successfully set certificate verify locations:
- * TLSv1.3 (OUT), TLS handshake, Client hello (01):
- * TLSv1.3 (IN), TLS handshake, Server hello (02):
- * TLSv1.2 (IN), TLS handshake, Certificate (11):
- * TLSv1.2 (IN), TLS handshake, Server key exchange (12):
- * **TLSv1.2 (IN), TLS handshake, Request CERT (13):**
- * TLSv1.2 (IN), TLS handshake, Server finished (14):
- * **TLSv1.2 (OUT), TLS handshake, Certificate (11):**
- * **TLSv1.2 (OUT), TLS handshake, Client key exchange (16):**
- * **TLSv1.2 (OUT), TLS handshake, CERT verify (15):**
- * TLSv1.2 (OUT), TLS change cipher, Change cipher spec (01):
- * TLSv1.2 (OUT), TLS handshake, Finished (20):
- * TLSv1.2 (IN), TLS handshake, Finished (20):
- * SSL connection using TLSv1.2 / ECDHE-RSA-AES256-GCM-SHA384
- * Server certificate:
- * subject: O=IBM; OU=LIBERTY; CN=wg31.washington.ibm.com
- * start date: Jan 4 04:00:00 2021 GMT
- * expire date: Jan 1 03:59:59 2023 GMT
- * common name: wg31.washington.ibm.com (matched)
- * issuer: OU=LIBERTY; CN=CA for Liberty
- * SSL certificate verify ok.

```
enum {
    hello_request(0),
    client_hello(1),
    server_hello(2),
    certificate(11),
    server_key_exchange (12),
    certificate_request(13),
    server_hello_done(14),
    certificate_verify(15),
    client_key_exchange(16),
    finished(20),
    (255) }
HandshakeType;
```

* TLS 1.2 <https://tools.ietf.org/html/rfc5246>
TLS 1.3 <https://tools.ietf.org/html/rfc8446>



Tech-Tip: CICS IPCONN and TCPIPSERVICE resources for HA

CICS Specific TCPIPSERVICE - IPIC

```
TCpipservice : IPIC1
GROup       : SYSPGRP
Urm          ==> DFHISAIP
POrtnumber   ==> 01492
SStatus      ==> Open
PROtocol     ==> IPic
TRansaction  ==> CISS
Host         ==> ANY
Ipaddress    ==> ANY
SPeciftcp   ==>
```

CICS Generic TCPIPSERVICE - IPICG

```
TCpipservice : IPICG1
GROup       : SYSPGRP
Urm          ==> DFHISAIP
POrtnumber   ==> 01491
SStatus      ==> Open
PROtocol     ==> IPic
TRansaction  ==> CISS
Host         ==> ANY
Ipaddress    ==> ANY
SPeciftcp   ==> IPIC
```

A client connects first to the CICS region's generic port (1491) and then the CICS region redirects the client to the region's specific port (1492).

I IPCONN ACQ

```
STATUS: RESULTS - OVERTYPE TO MODIFY
Ipc(BAQSVR1 ) App(BAQSVR1) Net(BAQSVR1) Ins Acq Nos
        Rece(001) Sen(000) Tcp(IPIC)
Ipc(BAQSVR1C) App(BAQSVR1C) Net(BAQSVR1C) Ins Acq Nos
        Rece(001) Sen(000) Tcp(IPIC)
Ipc(BAQSVR1M) App(BAQSVR1M) Net(BAQSVR1M) Ins Acq Nos
        Rece(001) Sen(000) Tcp(IPIC)
Ipc(BAQSVR2 ) App(BAQSVR2) Net(BAQSVR2) Ins Acq Nos
        Rece(001) Sen(000) Tcp(IPIC)
Ipc(BAQSVR2C) App(BAQSVR2C) Net(BAQSVR2C) Ins Acq Nos
        Rece(001) Sen(000) Tcp(IPIC)
Ipc(BAQSVR2M) App(BAQSVR2M) Net(BAQSVR2M) Ins Acq Nos
        Rece(001) Sen(000) Tcp(IPIC)
```

Number of
IPCONN resources
equals the number
of zCEE server
times the number of
unique connection
references

¹CICS requires the specific TCPIPSERVICE be installed before the corresponding generic TCPIPSERVICE resource. TCPIPServices are installed in alphabetically order, so the name of specific service must be alphabetically prior to the name of the generic TCPIPSERVICE.



Tech-Tip" CICS IPIC connection processing for high availability load balancing*

If the *reconnectInterval* attribute is set, at the specified time interval, a check is made to see if a new connection attempt should be attempted

A new connection is established if the current connection properties are not the preferred connection properties:

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

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



Tech-Tip: Executing the z/OS Connect *zconsetup* script using JCL

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



Tech-Tip: Differences between z/OS Connect OpenAPI2 and OpenAPI3 server.xml files

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

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

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

    <zosconnect_zosConnectManager setUTF8ResponseEncoding="true"/>

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

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

</server>
```

* Include these features if not already present.

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

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

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

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

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

</server>
```

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



Tech-TIP: Contrast a Liberty JCL procedure versus a z/OS Connect JCL procedure

```
//ZCEESRVR PROC PARMs='serverName'  
///*  
// SET ZCONHOME='/usr/lpp/IBM/zosconnect/v3r0'  
// SET INSTDIR='/usr/lpp/liberty_zos/21.0.0.9'  
///*  
//ZCON      EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,  
// PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS. --clean'  
// PARM='PGM &INSTDIR./lib/native/zos/s390x/bbgzsrv &PARMS'  
//STDOUT    DD   SYSOUT=*  
//STDERR    DD   SYSOUT=*  
//STDIN     DD   DUMMY  
//MSGLOG    DD   SYSOUT=*  
//STDENV    DD   *  
BPX_SHAREAS=YES  
CEE_RUNOPTS=HEAPPOOLS (ON) ,HEAPPOOLS64 (ON)  
JAVA_HOME=/usr/lpp/java/J8.0_64  
WLP_USER_DIR=/var/zosconnect  
JVM_OPTIONS=-Dcom.ibm.ws.zos.core.angelName=zCEEAngel -Xmx512m  
OPENJ9_JAVA_OPTIONS=-Xoptionsfile=/var/zcee/properties/myServer.property
```

OMVS
LE
JAVA
LIBERTY
z/OS Connect

Tech-Tip: Executing Gradle build commands in JCL



```
//JOHNSONS JOB (ACCOUNT),JOHNSON,NOTIFY=&SYSUID,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)  
//*****  
//* SET SYMBOLS  
//*****  
//EXPORT EXPORT SYMLIST=(*)  
// SET JAVAHOME='/usr/lpp/java/J8.0_64'  
// SET GRADLSRC='/u/johnson/gradle'  
// SET GRADLE='/usr/lpp/gradle/gradle-7.6.1'  
//*****  
//* Step GRADLE - Invoke the gradle build command  
//*****  
//CSCVINC EXEC PGM=IKJEFT01,REGION=0M  
//SYSTSPRT DD SYSOUT=*  
//SYSERR DD SYSOUT=*  
//STDOUT DD SYSOUT=*  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH +  
export JAVA_HOME=&JAVAHOME; +  
cd &GRADLSRC./cscvinc; +  
&GRADLE./bin/gradle build -i
```

settings.gradle

```
pluginManagement {  
    repositories {  
        maven {  
            url '/u/johnson/gradle/gradleLibs'  
        }  
    }  
}
```

build.gradle

```
plugins {  
    id 'com.ibm.zosconnect.requester' version '1.1.7'  
}
```

This assumes the z/OS Connect provided *dependencies.zip* files was expanded into directory */u/johnson/gradle/gradleLibs* using command *jar -tf dependencies.zip* and that the gradle files *settings.gradle* and *build.gradle* are encoded in ASCII in directory */u/johnson/gradle/cscvinc*

Tech-Tip: - Executing the z/OS Connect Build Toolkit in JCL



```
//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.

Tech-Tip: 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=stop+  
pped > null; +  
$CURL/bin/curl -X DELETE -s +  
--cacert /u/johnson/CERTAUTH.PEM --user FRED:FRED +  
https://wg31.washington.ibm.com:9445/zosConnect/apis/cscvinc > null; +  
$CURL/bin/curl -X POST -s +  
--cacert /u/johnson/CERTAUTH.PEM --user FRED:FRED +  
--data-binary @/u/johnson/cscvinc.aar +  
--header "Content-Type: application/zip" +  
https://wg31.washington.ibm.com:9445/zosConnect/apis  
*****  
/* STEP CURL - use curl to invoke the API cscvinc  
*****  
//INVOKE EXEC CURL  
//SYSTSIN DD *,SYMBOLS=EXECSYS  
BPXBATCH SH export CURL=&CURL; $CURL/bin/curl -X GET -s +  
--cacert /u/johnson/CERTAUTH.PEM --user FRED:FRED +  
https://wg31.washington.ibm.com:9445/cscvinc/employee/000100
```

Always be aware of the beginning and trailing spaces.

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



Tech-Tip: 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'"
```

Tech-Tip: 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,
// JAVAACL= 'com.ibm.ws390.sm.smfview.JclSmf'
//STDENV DD DISP=SHR,DSN=JOHNSON.JCLLIB.CNTL(STDENV)
//SMFDATA DD DISP=SHR,DSN=MPZ3.DUMPSPMF
//SMFENV DD *,SYMBOLS=EXEC SYS
# Specify the plugin to use
plugin=&REPORT
# Specify where the output goes
output=/u/johnson/&REPORT..csv
# Uncomment (and change the value as appropriate) to filter
#matchServer=BAQSTRT
```

```
JOHNSON.JCLLIB.CNTL(STDENV)
. /etc/profile
export JAVA_HOME=/usr/lpp/java/J8.0_64
export PATH=/bin:"${JAVA_HOME}"/bin
LIBPATH=/lib:/usr/lib:"${JAVA_HOME}"/bin
LIBPATH="$LIBPATH":"${JAVA_HOME}"/lib/s390x
LIBPATH="$LIBPATH":"${JAVA_HOME}"/lib/s390x/j9vm
LIBPATH="$LIBPATH":"${JAVA_HOME}"/bin/classic
export LIBPATH="$LIBPATH":

# Customize your CLASSPATH here
APP_HOME=${JAVA_HOME}
CLASSPATH=$APP_HOME:"${JAVA_HOME}"/lib:"${JAVA_HOME}"/lib/ext
CLASSPATH=/u/johnson/lib/bbosmfv.jar:$CLASSPATH
CLASSPATH=/u/johnson/lib/WP102312_Plugins.jar:$CLASSPATH

# Add Application required jars to end of CLASSPATH
for i in "${APP_HOME}"/*.jar; do
    CLASSPATH="$CLASSPATH":$i"
done
export CLASSPATH="$CLASSPATH":

# Configure JVM options
IJO="-Xms16m -Xmx128m"
export IBM_JAVA_OPTIONS="$IJO "
```

Tech-Tip: Using ADRDSSU to dump/restore MVS data sets

ZCEEDUMP

```
//EXPORT EXEC 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)
```

Tech-Tip: 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=*
```

Tech-Tip: Generate WLM Workload Activity Reports

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