



# WebSphere Liberty Profile on z/OS

## Managing, Monitoring and Problem Determination

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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 z/OS , or a Java , or a Liberty , or a z/OS Connect , or a CICS  or a MQ  icon will appear on slides where the information is specific to these products. Don't hesitate to ask questions as to why the icon does or does not appear on certain slides.
- The examples, tips, etc. present in this material are based on firsthand experiences.

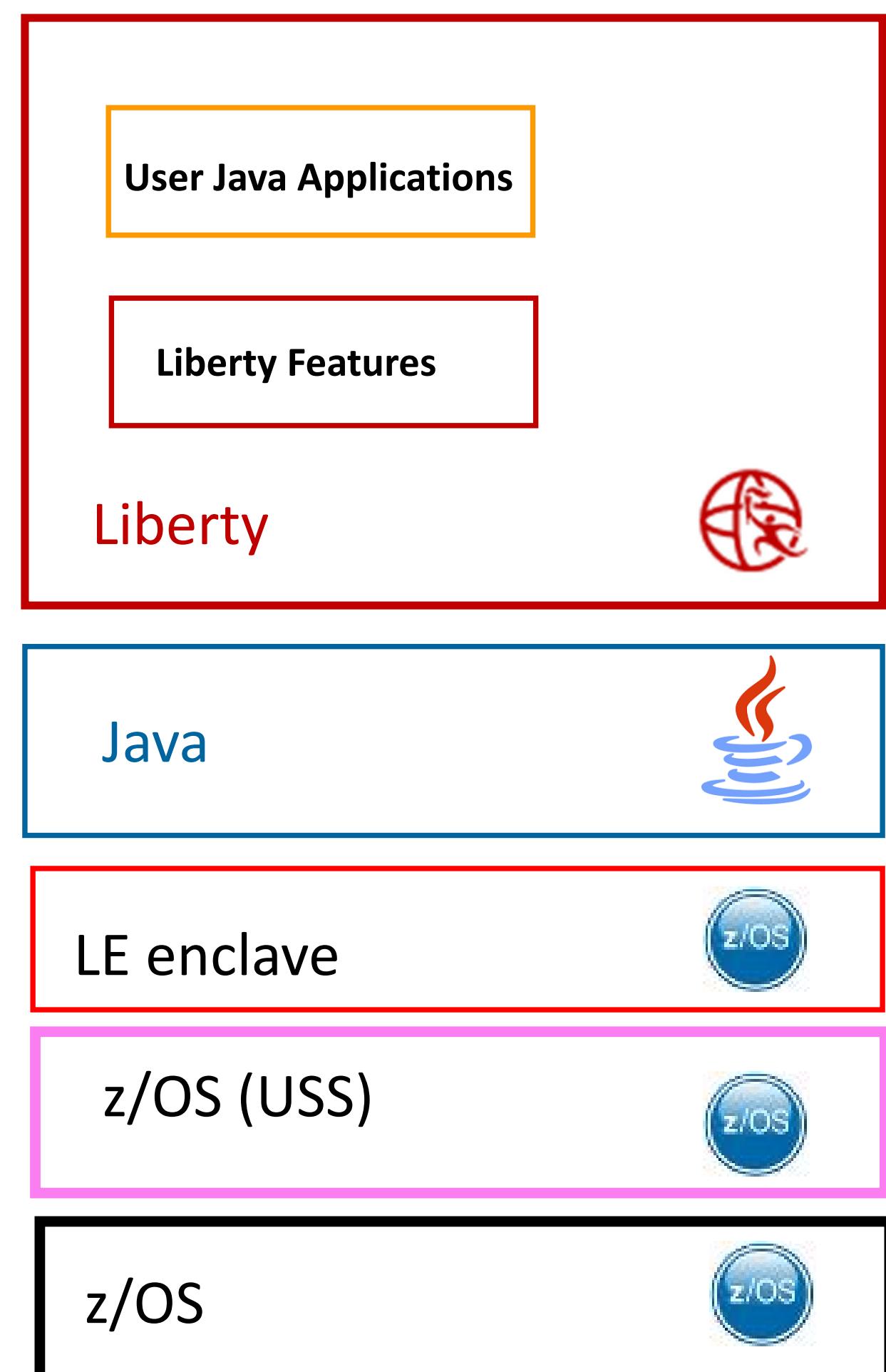
# Agenda

- **Administering Liberty Servers**
  - Useful Liberty features and MVS commands
- **Managing and Monitoring Liberty servers**
  - WLM configurations
  - SMF options
  - Monitoring OMVS processes
  - Connection pooling options
  - 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**



## Liberty basics: It helps to think of a Liberty server on z/OS as a stack or layers of software

- At the foundation, Liberty servers run on z/OS to exploit z/OS quality of services
- Liberty servers are OMVS processes that are either directly started invoking a script or binary executable(e.g. An OMVS command or JCL) or spawn by parent process (e.g., CICS or z/OS Connect) .
- A Liberty server process runs in a Language Environment (LE) enclave configured for Unix System Services tailored for running Java applications.
- The Liberty server provides a environment for running user Java application. A Liberty enviroment on z/OS enables s a set of features that provide access to z/OS services like SAF, WLM, RRS, SMF, etc. to user Java applications.
- Liberty provides an execution environment for multiple concurrent Java application threads and manages connections and security for accessing z/OS resources.



Knowing and understanding the different layers and their relationships is important regarding:

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

z/OS Connect and zOSMF should be considered a Java applications

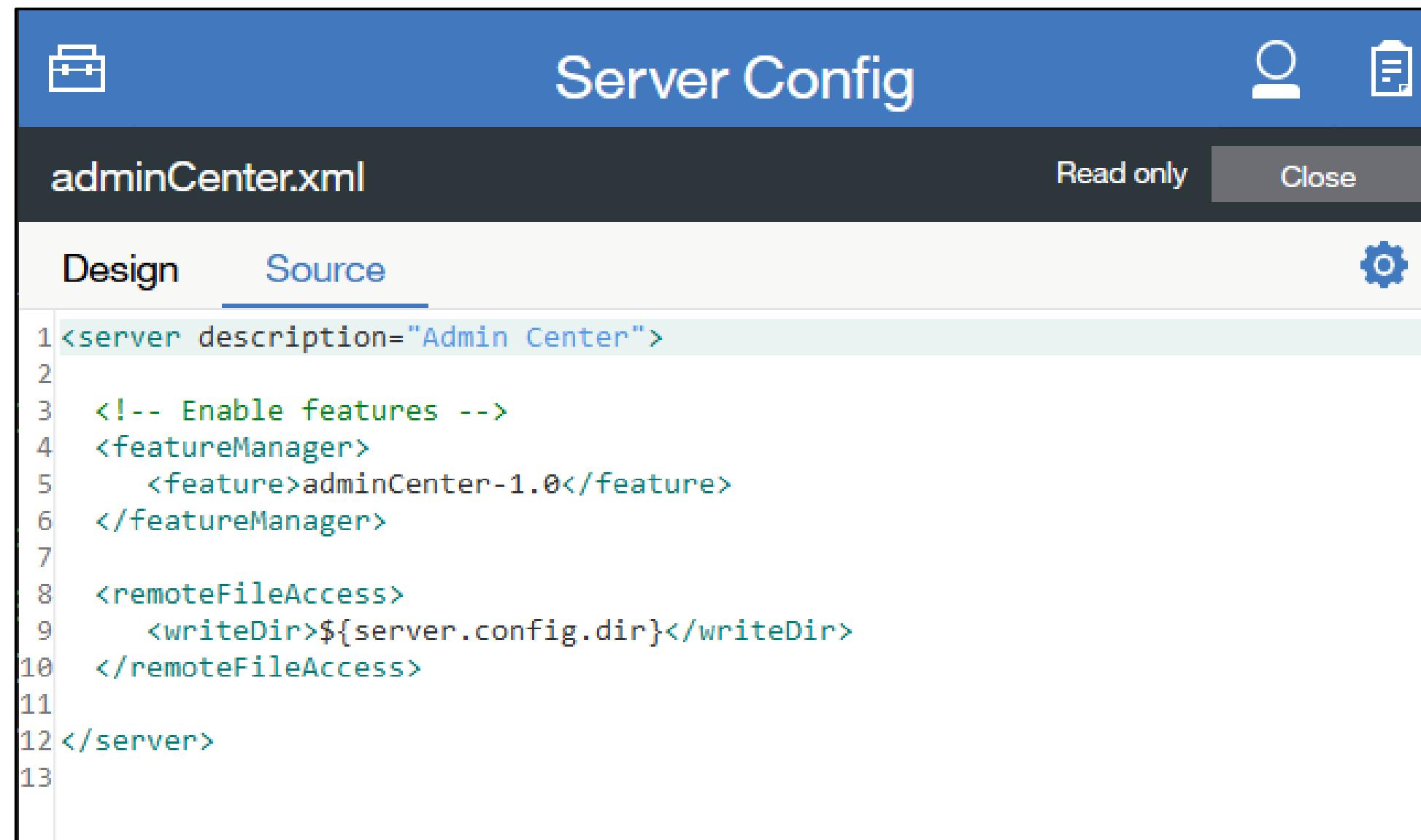
# **Administering Liberty Servers**

**Useful Liberty functions/features and  
MVS commands**



# Liberty feature: adminCenter-1.0

This feature provides a web interface to Administrators for maintaining the server XML configuration.



The screenshot shows a "Server Config" interface titled "adminCenter.xml". The "Source" tab is selected, displaying the following XML code:

```
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

- Web browser interface to the server's configuration files



# Liberty feature: restConnector-2.0

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

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

```
<?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_cicsIpicConnection?port=1491)  
[https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect\\_zosConnectServiceRestClientConnection](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/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/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_zosConnectManager)  
[https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect\\_zosConnectAPIs](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_services)  
[https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect\\_apiRequesters](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 – featureManager example

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

The screenshot shows a browser window with the URL <https://wg31.washington.ibm.com:9443/ibm/api/config/featureManager>. The page displays a JSON object representing the configuration for the `featureManager`.

```
[{"configElementName": "featureManager", "feature": ["appSecurity-2.0", "zosSecurity-1.0", "zosconnect:cicsService-1.0", "transportSecurity-1.0", "zosconnect:apiRequester-1.0", "zosconnect:apiRequester-1.0", "zosconnect:mqService-1.0", "zosWlm-1.0", "restConnector-2.0", "monitor-1.0", "zosRequestLogging-1.0", "adminCenter-1.0", "apiDiscovery-1.0", "zosconnect:zosConnect-2.0", "zosconnect:zosConnectCommands-1.0", "imsmobile:imsmobile-2.0"], "onError": "WARN"}]
```

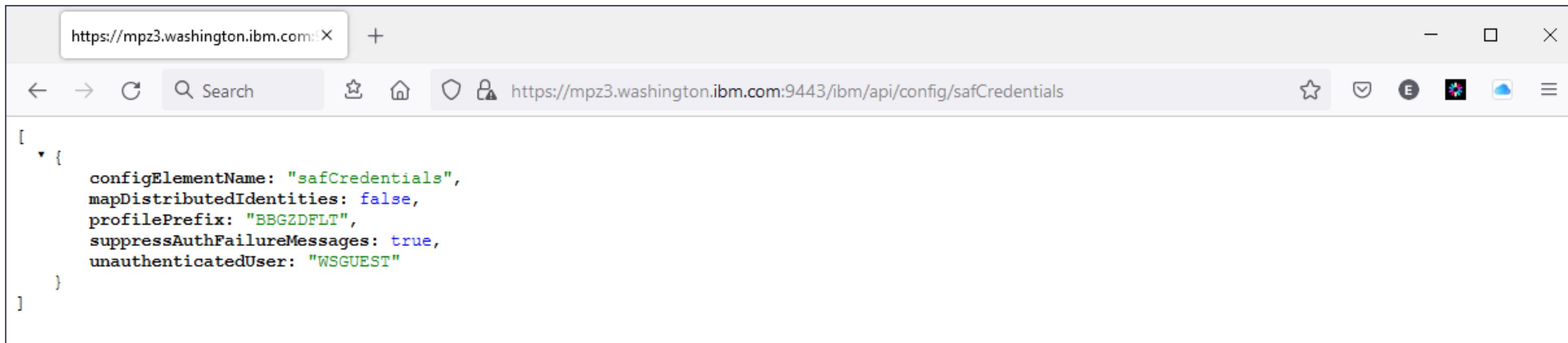
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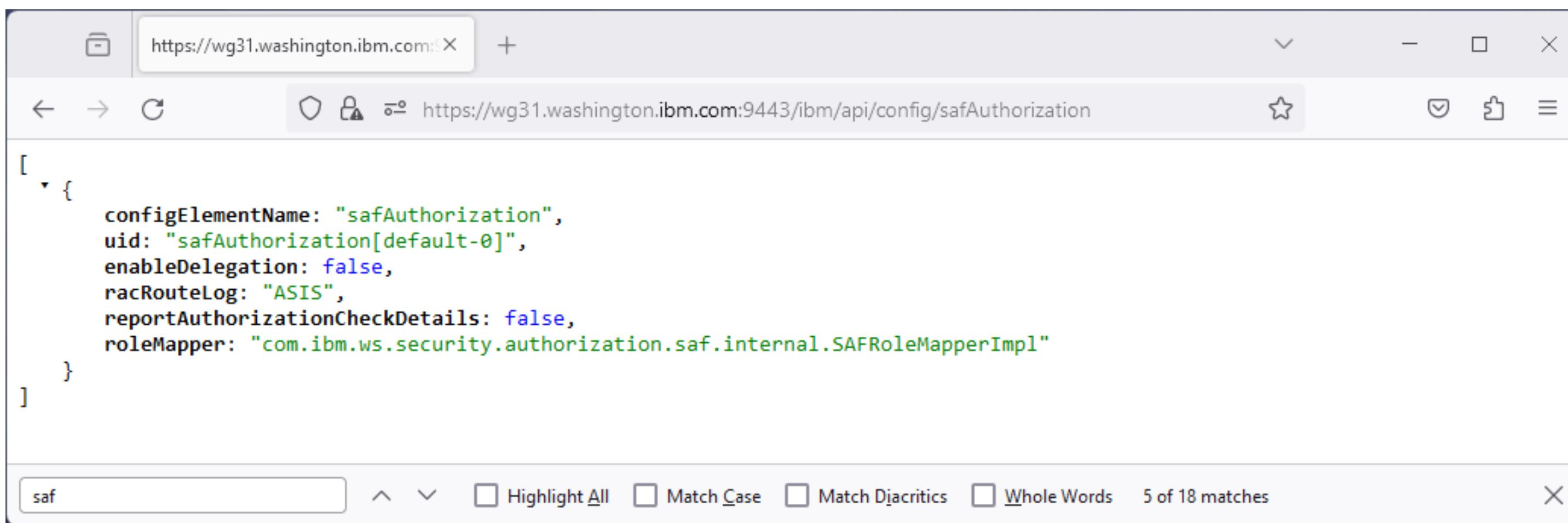
## Liberty feature: restConnector-2.0 – safCredentials/safAuthorization examples

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.SAFRoleMapperImpl"}]
```

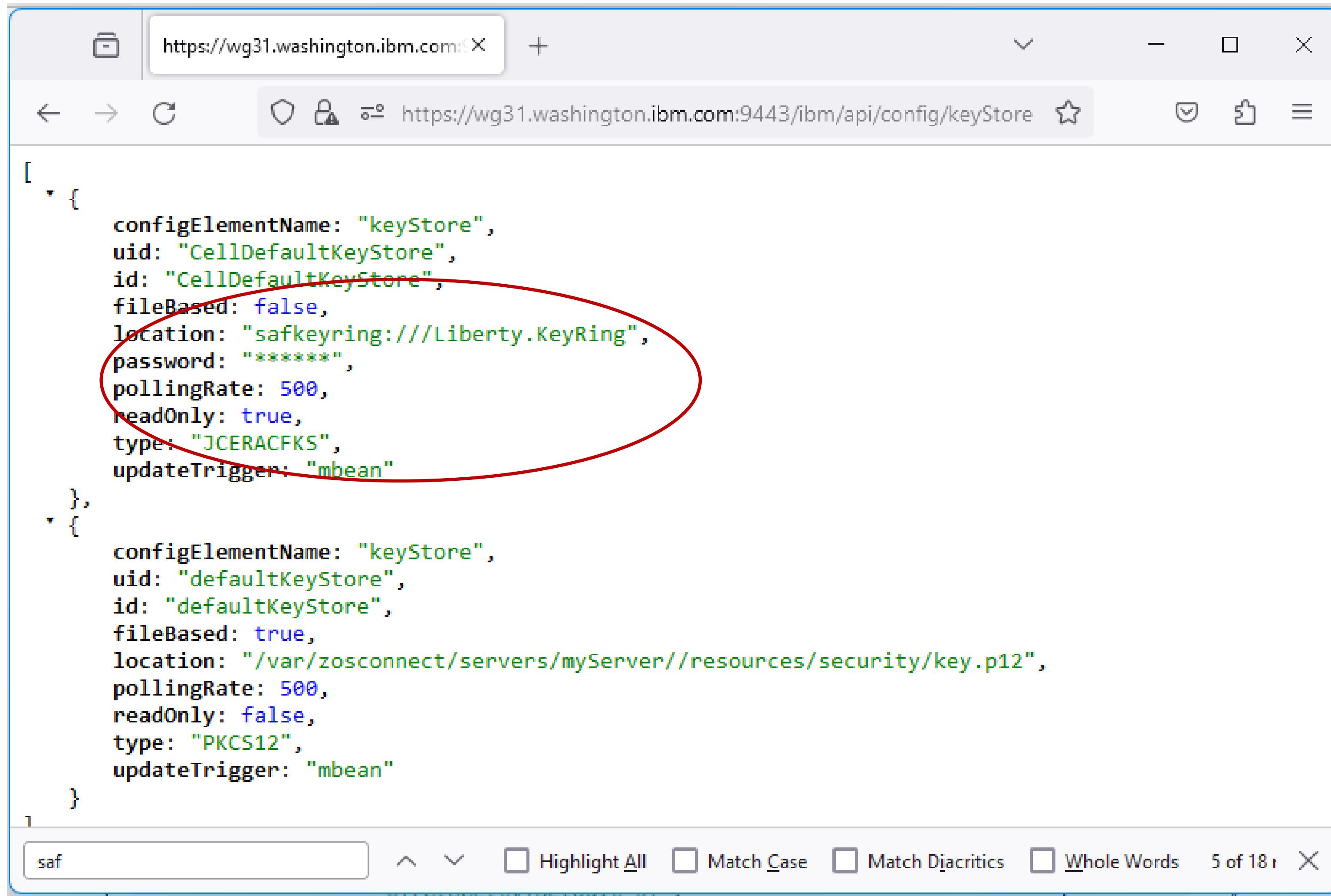
saf

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

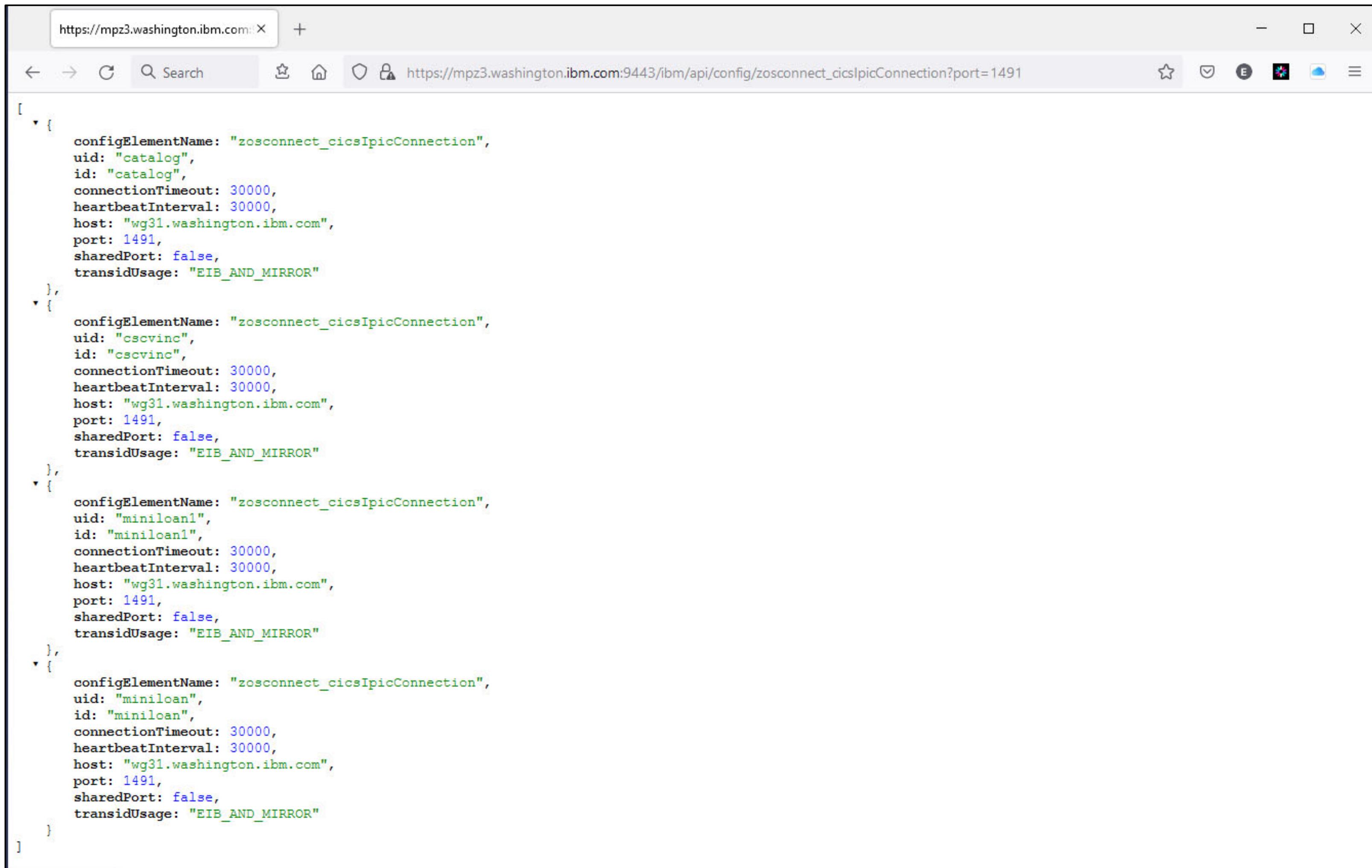


```
[  
  {  
    configElementName: "keyStore",  
    uid: "CellDefaultKeyStore",  
    id: "CellDefaultKeyStore",  
    fileBased: false,  
    location: "safkeyring:///Liberty.KeyRing",  
    password: "*****",  
    pollingRate: 500,  
    readOnly: true,  
    type: "JCERACFKS",  
    updateTrigger: "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](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 – CICS ECI connection factory example

<https://wg31.washington.ibm.com:9443/ibm/api/config/connectionFactory>

The screenshot shows a web browser window displaying a JSON configuration object. The URL in the address bar is <https://wg31.washington.ibm.com:9443/ibm/api/config/connectionFactory>. The JSON content is as follows:

```
[{"configElementName": "connectionFactory", "uid": "ECI", "id": "ECI", "jndiName": "ECI", "properties.eciResourceAdapter": {"TPNName": "", "applid": "", "applidQualifier": "", "cipherSuites": "", "clientSecurity": "", "connectionURL": "tcp://wg31.washington.ibm.com", "keyRingClass": "", "keyRingPassword": "*****", "password": "*****", "portNumber": "2006", "requestExits": "", "serverName": "CICS62", "serverSecurity": "", "socketConnectTimeout": "0", "traceLevel": 3, "tranName": "", "userName": ""}, "api": ["/ibm/api/validation/connectionFactory/ECI"]}]
```

A red box highlights the "properties.eciResourceAdapter" section of the JSON.

# Liberty feature: restConnector-2.0 – imsMobile\_imsConnection example

[https://wg31.washington.ibm.com:9453/ibm/api/config/imsMobile\\_imsConnection](https://wg31.washington.ibm.com:9453/ibm/api/config/imsMobile_imsConnection)

```
[{"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", pingIMSCollectionInvoke: false}], [{"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}], {"gmoa": "gmoa", "Highlight All": true, "Match Case": false, "Match Diacritics": false, "Whole Words": false, "2 of 10 matches": true}
```

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# 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, specifically the "cscvinc" endpoint. It lists four operations: POST /cscvinc/employee, DELETE /cscvinc/employee/{employee}, GET /cscvinc/employee/{employee}, and PUT /cscvinc/employee/{employee}. Each operation is represented by a colored button (green for POST, red for DELETE, blue for GET, brown for PUT) followed by the path. To the right of the operations, there are "Show/Hide", "List Operations", and "Expand Operations" buttons. Below the "cscvinc" section, there are links to other endpoints: db2employee, filemgr, imsPhoneBook, jwtlvpDemoApi, miniloancics, mqapi, and phonebook, each with their own "Show/Hide", "List Operations", and "Expand Operations" buttons. The bottom left corner of the window shows the email address mitchj@us.ibm.com. The bottom right corner of the slide contains the copyright notice © 2017, 2024 IBM Corporation.

File Edit View History Bookmarks Tools Help

IBM REST API Documentation +

Search https://mpz3.washington.ibm.com:9443/api/explorer/#/cscvinc Filter

### Liberty REST APIs

Discover REST APIs available within Liberty

**cscvinc**

POST /cscvinc/employee

DELETE /cscvinc/employee/{employee}

GET /cscvinc/employee/{employee}

PUT /cscvinc/employee/{employee}

Show/Hide | List Operations | Expand Operations

**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

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# 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.



# IBM MQ Messaging REST API Support

## messaging

Show/Hide | List Operations | Expand Operations

<b>DELETE</b>	/ibmmq/rest/v1/messaging/qmgr/{qmgrName}/queue/{qName}/message	Retrieves the next message from a specified queue.
<b>GET</b>	/ibmmq/rest/v1/messaging/qmgr/{qmgrName}/queue/{qName}/message	Browses the next message from a specified queue.
<b>POST</b>	/ibmmq/rest/v1/messaging/qmgr/{qmgrName}/queue/{qName}/message	Sends a message to a specified queue.
<b>GET</b>	/ibmmq/rest/v1/messaging/qmgr/{qmgrName}/queue/{qName}/messagelist	Browses messages from a specified queue.
* <b>DELETE</b>	/ibmmq/rest/v2/messaging/qmgr/{qmgrName}/queue/{qName}/message	Retrieves the next message from a specified queue.
* <b>GET</b>	/ibmmq/rest/v2/messaging/qmgr/{qmgrName}/queue/{qName}/message	Browses the next message from a specified queue.
* <b>POST</b>	/ibmmq/rest/v2/messaging/qmgr/{qmgrName}/queue/{qName}/message	Sends a message to a specified queue.
* <b>GET</b>	/ibmmq/rest/v2/messaging/qmgr/{qmgrName}/queue/{qName}/messagelist	Browses messages from a specified queue.
* <b>POST</b>	/ibmmq/rest/v2/messaging/qmgr/{qmgrName}/topic/{topicString}/message	Publishes a message to a specified topic.

\* If you are accessing a version earlier than V9.1.5 you must use v1 rather than v2



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

The image displays three browser windows illustrating the use of IBM Liberty as a file server:

- Top Left Window:** Shows the XML configuration file at <https://wg31.washington.ibm.com:9443/se>. The page states: "This XML file does not appear to have any style information associated with it. The document tree is shown below." Below is the XML code:

```
<server description="new server">
  <include location="${server.config.dir}/includes/safSecurity.xml"/>
  <include location="${server.config.dir}/includes/ipicSSLIDProp.xml"/>
  <include location="${server.config.dir}/includes/keyringOutbound.xml"/>
  <include location="${server.config.dir}/includes/groupAccess.xml"/>
  <include location="${server.config.dir}/includes/shared.xml"/>
  <include location="${server.config.dir}/includes/oauth.xml"/>
  <include location="${server.config.dir}/includes/adminCenter.xml"/>
</server>
```

Comments in the code include:

  - `<!-- Enable features -->`
  - `<featureManager>`
  - `<feature>zosconnect:zosConnect`
  - `<feature>zosconnect:zosConnect`
  - `</featureManager>`
  - `<!-- To access this server from -->`
  - `<!-- add cors to allow cross or -->`
- Top Right Window:** Shows the XML configuration for enabling file serving at <https://wg31.washington.ibm.com:9443/server/config>. The configuration is as follows:

```
<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>
```
- Bottom Window:** Shows log files at <https://wg31.washington.ibm.com:9443/server/config/logs>. It contains three log entries:
  - messages.log:** Product details and environment.
  - trace.log:** Trace specification and state change. A red oval highlights the line: `[2/20/21 17:27:54:487 GMT] 0000001b id=00000000 com.ibm.ws.logging.internal.TraceSpecification`.
  - zos.log:** Z/OS specific logs.



# 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. (Applicable to OpenAPI 3 servers only)

## **F BAQSTRT,REFRESH,KEYSTORE**

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

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

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

## **F BAQSTRT,CACHE,CLEAR,AUTH**

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

## **F 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.

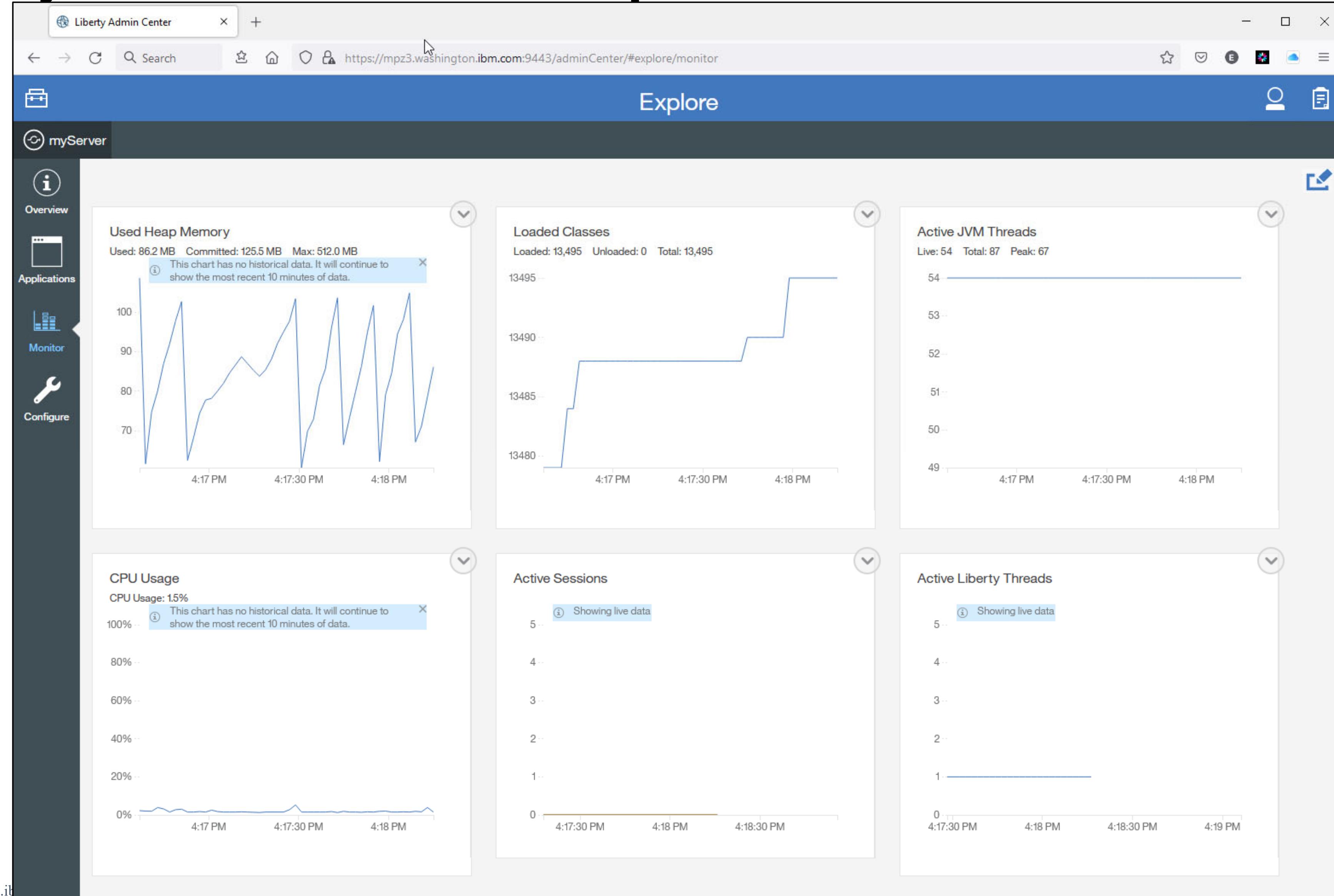
## **F BAQSTRT,REFRESH,APPS**

# **Monitoring Liberty Servers**

## **Monitoring Liberty, Java Virtual Machines and z/OS**



# Liberty Admin Center feature provides real time monitoring





# Java Health Center – Monitors the Java environment

Configuring the Monitoring Agent using JVM directives

## Java Health Center Directives

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

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

**/var/zcee/properties/zceeHCD.properties (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



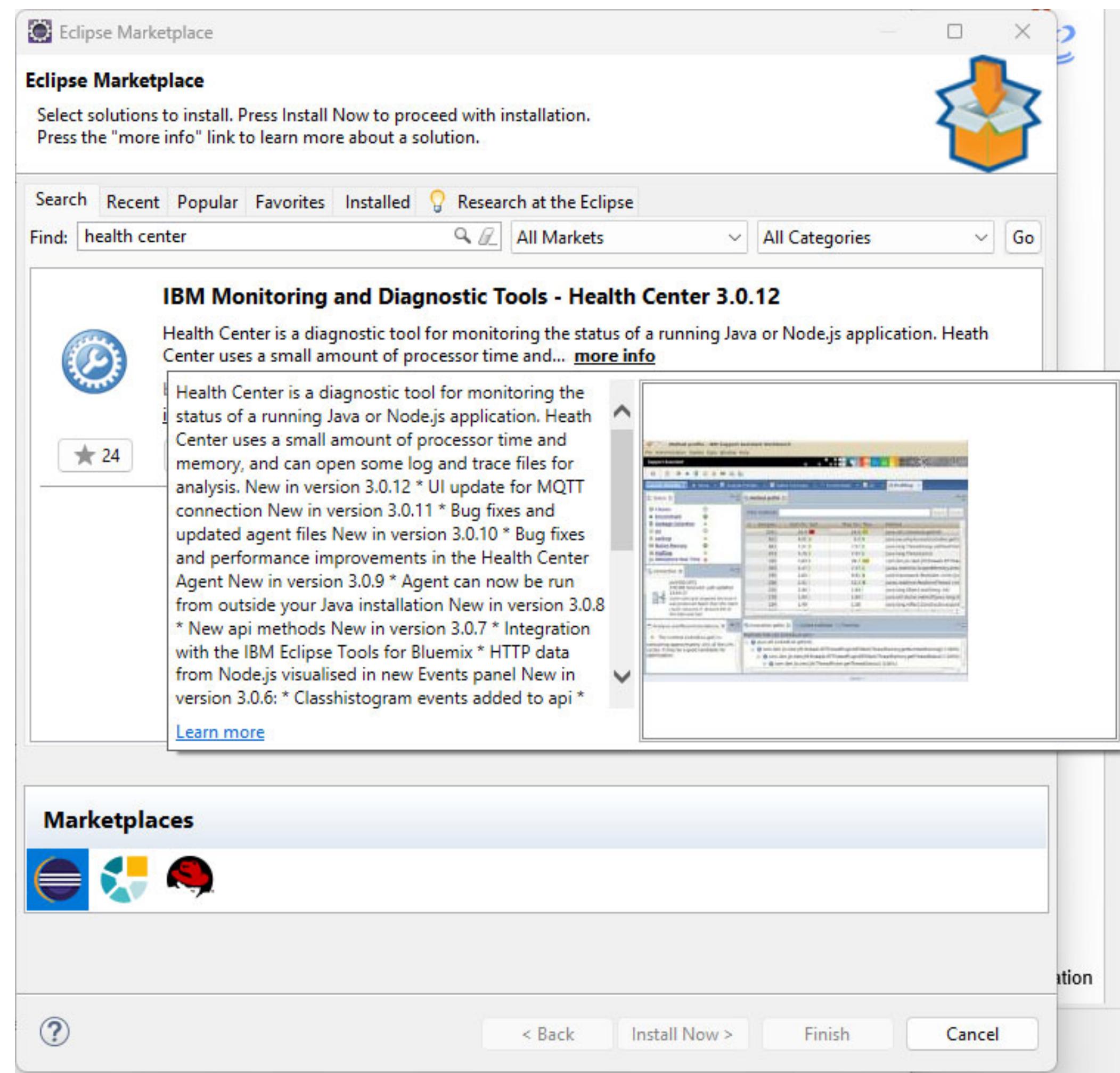
Set the `JVM_OPTIONS` environment variable to the properties file containing the health center directives

```
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 – 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 – HEAP analysis example



The screenshot shows the IBM Java Health Center interface within the Eclipse IDE. The main window displays a timeline graph of heap usage, pause times, and collection activity over a 36-minute period. The left sidebar lists various monitoring perspectives, and the bottom left contains an 'Analysis and Recommendations' section with specific findings about heap growth and collection rates.

**Timeline Graph:** The graph tracks three metrics over time (0:00 to 0:36 minutes):

- Used heap (after collection):** Shown as a solid purple line, it generally increases over time, reaching approximately 45 MB by 0:36.
- Heap size:** Shown as a dashed green line, it remains relatively stable around 45 MB.
- Pause time:** Shown as a dotted blue line, it fluctuates between 10 ms and 50 ms, with a notable peak around 0:28.

**Analysis and Recommendations:**

- Heap usage seems to be growing over time. It increased by 33% in the last third of the log compared to the middle of the log. However, the number of collections decreased by 82%. This indicates that the rate at which your application is producing garbage seems to be slowing down. This may mean that your application will reach a steady-state at which the heap usage will no longer be increasing.
- The mean occupancy in the nursery is 34%. This is low, so the gencon policy is probably an optimal policy for this workload.

**Summary Table:**

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

**Help and Documentation:** The right side of the interface shows the 'Help - Eclipse' documentation for the 'Garbage collection perspective'. It includes sections on using the perspective, views for basic and detailed information, and instructions for controlling collection information.

# Java Health Center – Network analysis example



smf - Eclipse

File Edit Navigate Search Project Data Run Monitored System Window Help

Status Connection Sockets

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

Analysis and Recommendations

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

Socket ID filter: Apply Clear

ID	Type	IP Address	Port	Data sent	Data received	State	Thread [ID] Name
102	Client	0:0:0:ffff:c0a8:11c9	1491	116043 bytes	42284 bytes	Closed	[0x29d2fa00] Equino...
103	Client	0:0:0:ffff:c0a8:11c9	1491	116043 bytes	42284 bytes	Open	[0x2a00aa00] Default...
112	Server	0:0:0:ffff:c0a8:3c	65470	32953 bytes	38334 bytes	Open	[0x2a253d00] Shared...
127	Server	0:0:0:ffff:c0a8:3c	59411	116825 bytes	62048 bytes	Closed	[0x2a019f00] Default...
136	Server	0:0:0:ffff:c0a8:11c9	2446	87343 bytes	98768 bytes	Open	[0x2b38c800] Default...
138	ServerS...	0:0:0:0:0:0	9080	116825 bytes	62048 bytes	Open	[0x2a253d00] Shared...
144	Server	0:0:0:ffff:c0a8:3c	59412	4248 bytes	8818 bytes	Open	[0x2a019f00] Default...
164	ServerS...	0:0:0:0:0:0	9443	116825 bytes	62048 bytes	Open	[0x2a253d00] Shared...
176	Client	0:0:0:ffff:c0a8:11c9	4000	182558 bytes	186691 bytes	Closed	[0x2a00aa00] Default...
183	Client	0:0:0:ffff:c0a8:11c9	4000	182558 bytes	186691 bytes	Open	[0x2a14f400] Default...
186	Server	0:0:0:0:ffff:c0a8:11f3	7883	116825 bytes	62048 bytes	Open	[0x2a253d00] Shared...
196	Server	0:0:0:0:ffff:c0a8:3c	61723	116825 bytes	62048 bytes	Closed	[0x29fcbb00] Default...
204	Server	0:0:0:0:ffff:c0a8:11f3	7880	1428 bytes	602 bytes	Open	[0x2a253d00] Shared...
215	Client	0:0:0:0:ffff:c0a8:11c9	1491	116825 bytes	62048 bytes	Open	[0x2b38c800] Default...
226	Server	0:0:0:0:ffff:c0a8:11f3	7863	2447 bytes	1059 bytes	Closed	[0x2a00aa00] Default...
227	Server	0:0:0:0:ffff:c0a8:11f3	9463	9892 bytes	8675 bytes	Open	[0x2aa3c100] Default...
228	Server	0:0:0:0:ffff:c0a8:11f3	7849	116825 bytes	62048 bytes	Closed	[0x29fcbb00] Default...
230	Server	0:0:0:0:ffff:c0a8:11f3	7850	39936 bytes	54048 bytes	Open	[0x2a00aa00] Default...
231	Server	0:0:0:0:ffff:c0a8:11f3	9463	10868 bytes	7460 bytes	Open	[0x2a14f400] Default...
233	Server	0:0:0:0:ffff:c0a8:11f3	9463	22059 bytes	11436 bytes	Open	[0x2a00aa00] Default...
234	Server	0:0:0:0:ffff:c0a8:11f3	7010	116825 bytes	62048 bytes	Closed	[0x2a00aa00] Default...

Sockets open Network I/O

The chart displays the number of open sockets (y-axis, 0.0 to 25.0) against elapsed time in minutes (x-axis, 0:00 to 7:30). The data shows a significant spike in socket activity between 1:30 and 2:30, followed by a period of relative stability around 15-17 open sockets, with occasional smaller fluctuations.

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:

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.MD5.a(byte[], int, int, byte[], int)
128	1.24	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
115	1.11	java.math.DivisionLong.monMulSq(long[], int, long[])
102	0.99	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
97	0.94	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
92	0.89	com.eclipses.osni.interceptor.MethodInterceptor.intercept(Object, Method, Object, Object)

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)

The bottom left chart, titled "Samples over time", shows the number of samples (y-axis, 0 to 400) versus elapsed time (x-axis, 2:30 to 5:00). A red circle highlights a peak in sample count around 2:30, and a blue arrow points from this peak to the second chart.

The bottom right chart, also titled "Samples over time", shows the number of samples (y-axis, 0 to 300) versus elapsed time (x-axis, 1:48 to 2:24 minutes). This chart shows a similar trend with a peak around 1:54 followed by a decline.



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

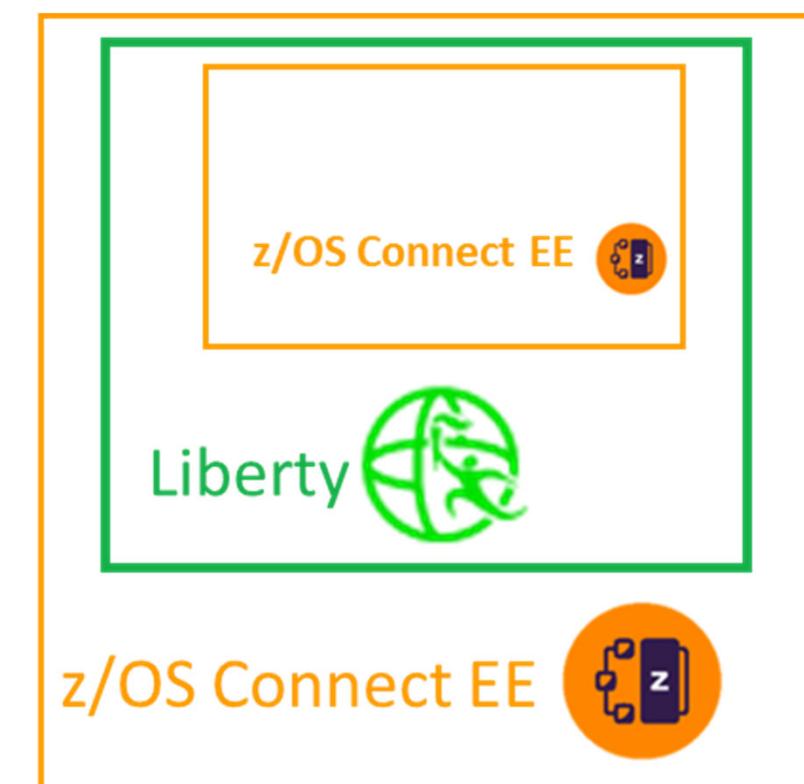
SDSF PROCESS DISPLAY wg31 ALL										LINE 1-5 (5) SCROLL ===> CSR									
COMMAND INPUT ===> <b>PS</b>																			
NP	JOBNAME	Status	Owner	State	CPU-Time	PID	PPID	ASID	ASIDX	LatchWaitPID	Command								
BAQSTRT	WAITING FOR CHILD	LIBSERV	1W	40.01	<b>69050</b>	<b>83955129</b>	42	002A			/bin/sh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

IBM Washington Systems Center

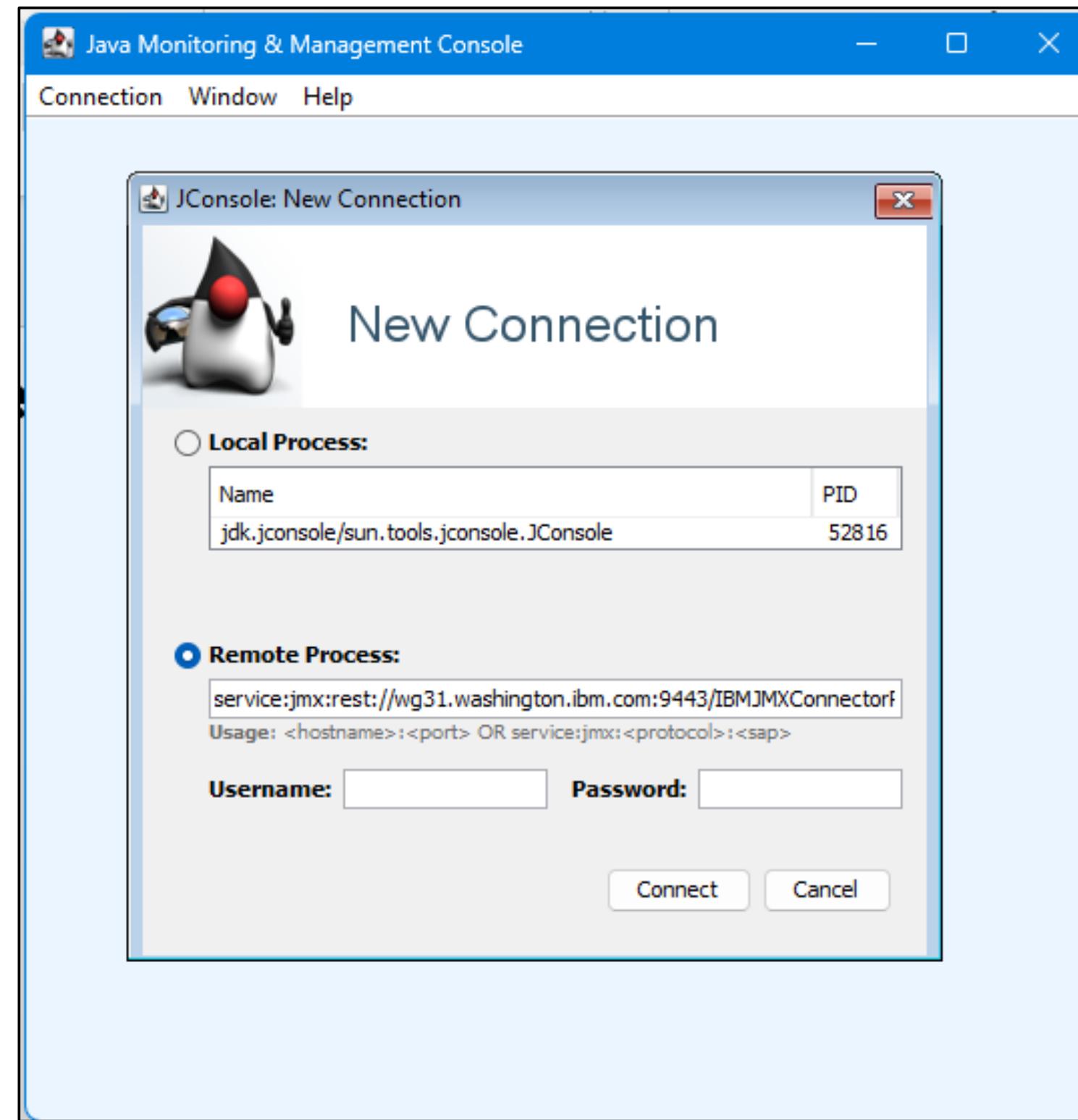
```
*****
product = WAS FOR Z/OS 21.0.0.9, z/OS Connect 03.00.52 (wlp-1.0.56.cl210920210909-1618)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/J8.0_64
java.version = 1.8.0_301
java.runtime = Java(TM) SE Runtime Environment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

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

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

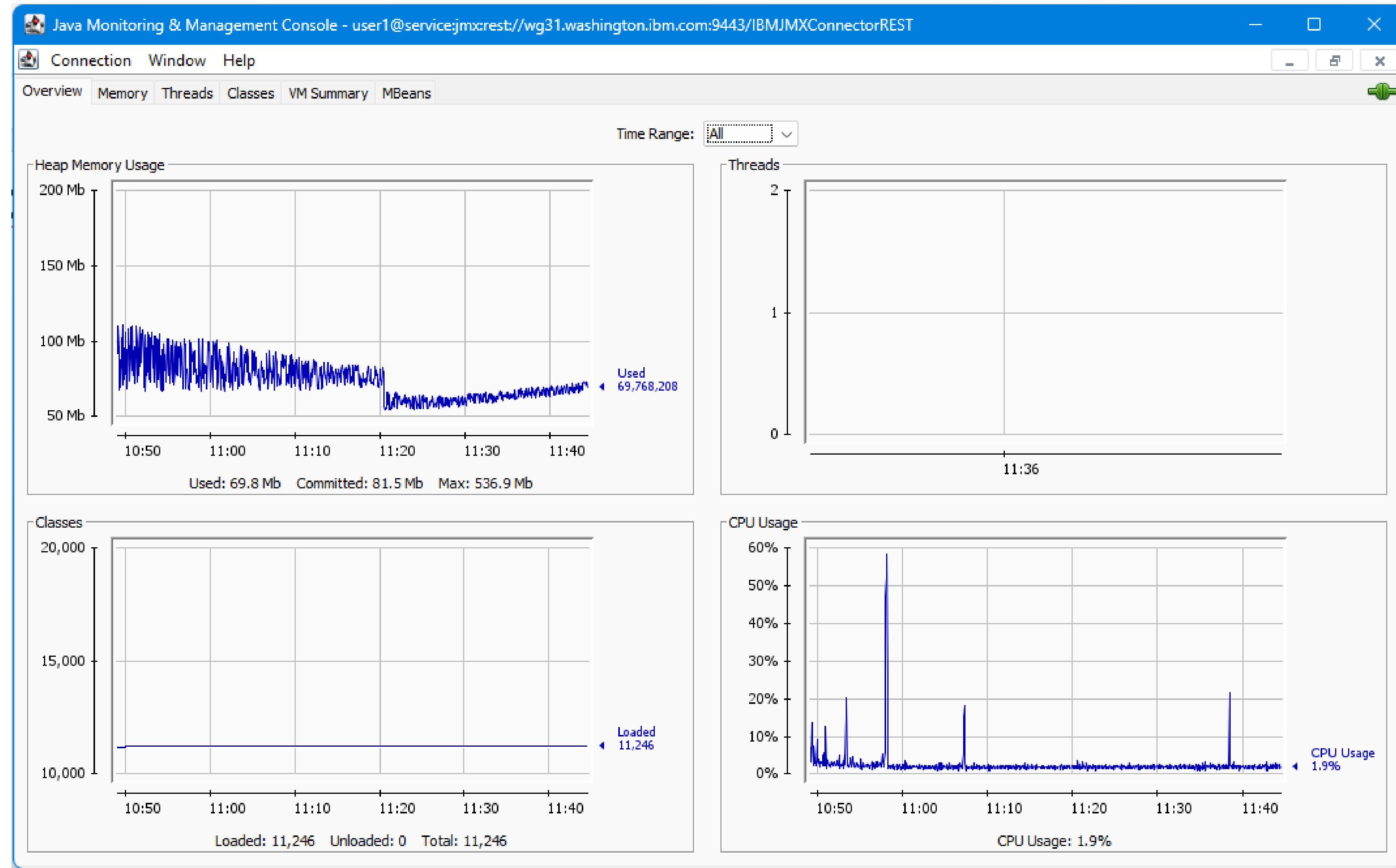


# Using Java's jConsole with Liberty features restConnector-2.0 and monitor-1.0

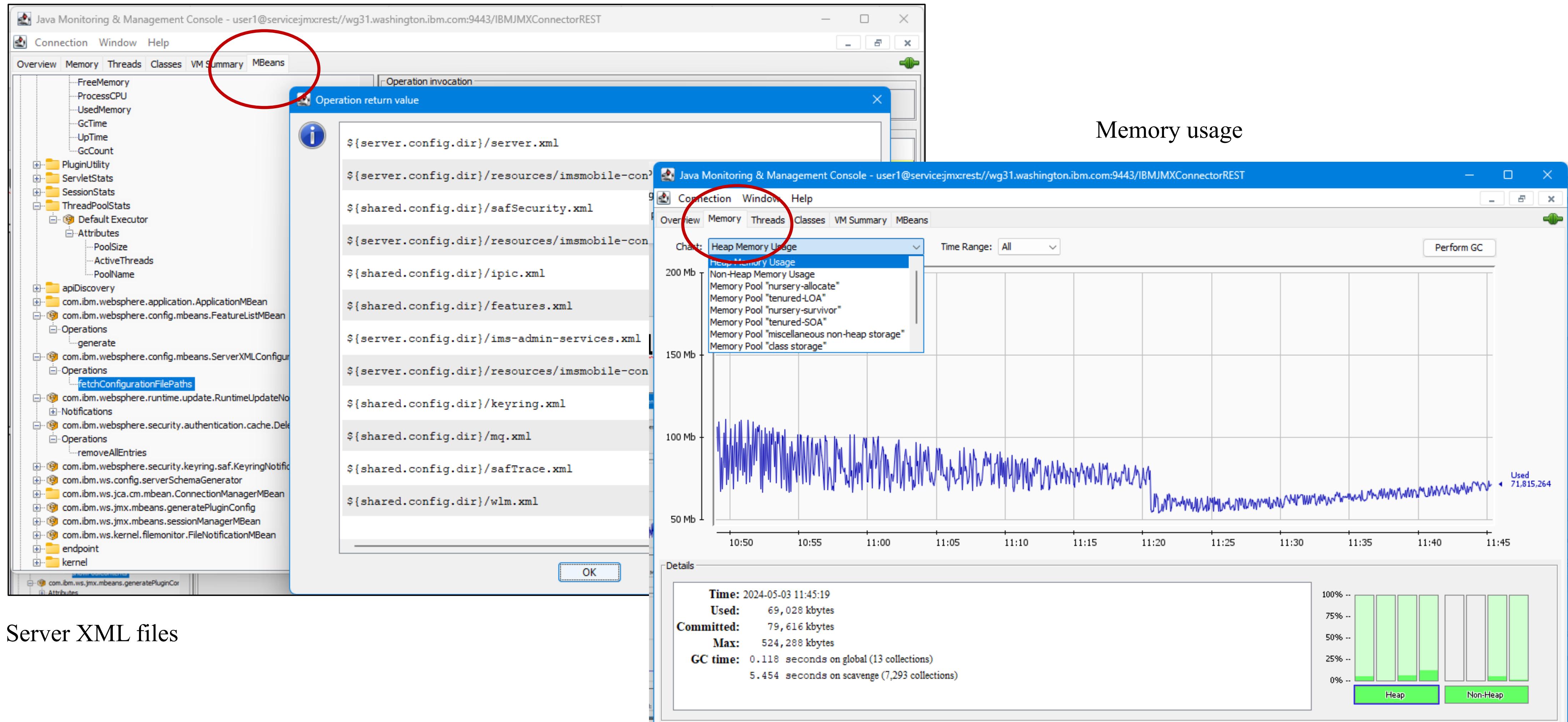


```
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Administrator OWNER(SYS1) UACC(NONE)
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Reader OWNER(SYS1) UACC(NONE)
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.allAuthenticatedUsers OWNER(SYS1) UACC(NONE)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

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# 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 IBM MQ, JImplementation, WebSphere (with sub-folders like ConnectionPoolStats, DynaCache, FileService, FileTransfer, JvmStats, PluginUtility, ServletStats, SessionStats, ThreadPoolStats, apiDiscovery, and several com.ibm.websphere.\* entries), and various com.ibm.ws.\* and com.ibm.lang.\* entries. The right pane shows the "Operation invocation" section with "java.lang.String showPoolContents ()". Below it is the "MBeanOperationInfo" table:

Name	Value
Operation:	
Name	showPoolContents

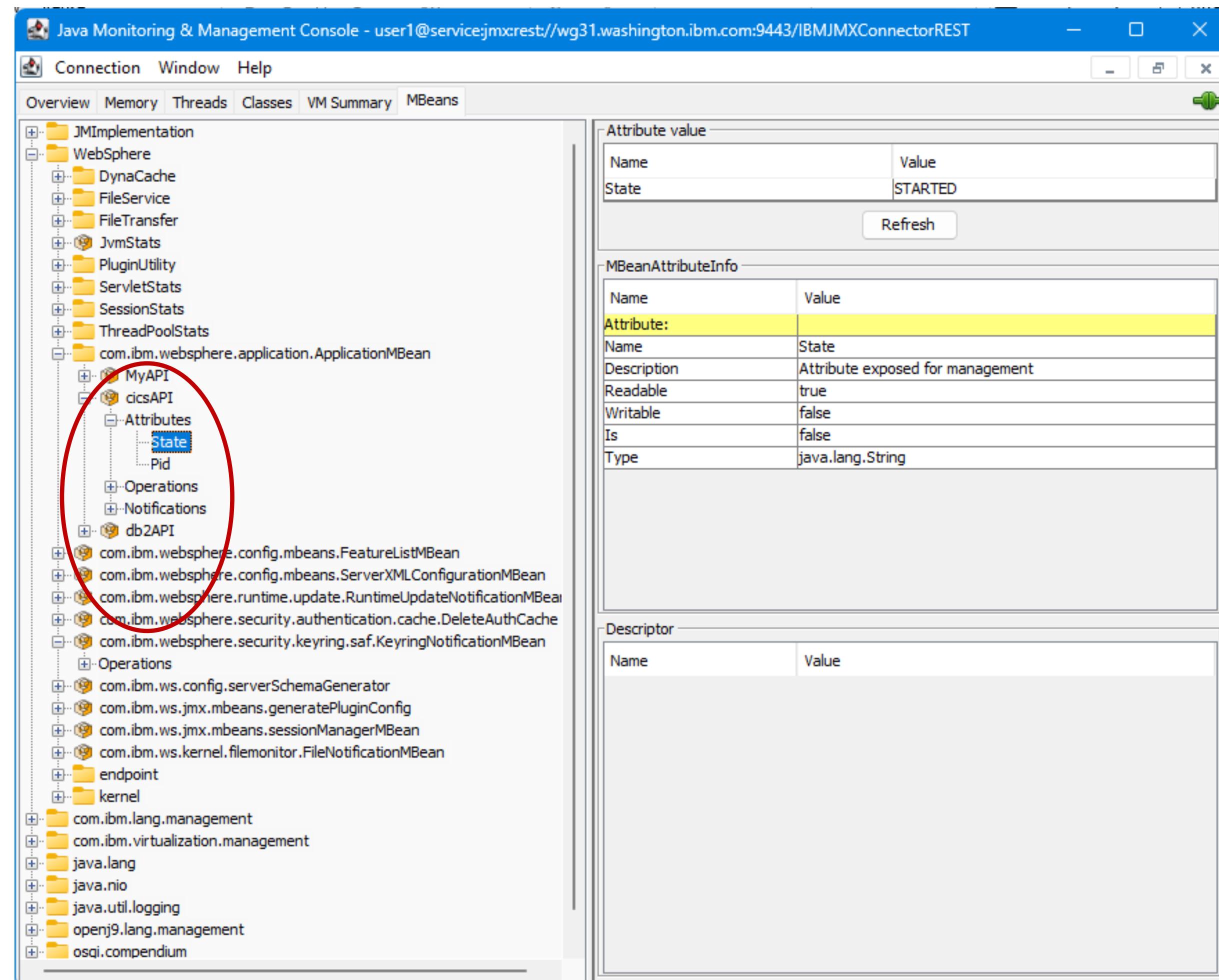
A modal dialog titled "Operation return value" is displayed, containing the following information:

```
PoolManager@1badcb0
name=WebSphere:type=com.ibm.ws.jca.cm.mbean.ConnectionPoolManager
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



# 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			JOHNSON	2021/09/04
WMQFTE			JOHNSON	2011/08/31
WMQFTER			JOHNSON	2011/08/31
WMQFTEZ			JOHNSON	2011/08/31
ZCEEADM			JOHNSON	2021/08/02
ZCEEAPIR			JOHNSON	2021/08/05
ZEECICS			JOHNSON	2021/08/05
ZCEEDB2			JOHNSON	2021/08/05
ZCEEIMS			JOHNSON	2021/08/05
ZCEEMQ			JOHNSON	2021/08/05
ZCEEOTHR			JOHNSON	2021/08/02
ZCEESTC			JOHNSON	2021/09/02

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

10/004

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

## 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 \*\*\*\*\*

19/004

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

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## WLM "CB" Classification Rules

mpz3

Subsystem-Type Xref Notes Options Help

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

Command ==> \_\_\_\_\_

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

Description . . . . . WLP/zCEE Transactions

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

Action	Type	Name	Start
1	CN	myServer	_____
2	TC	TCADM	_____
2	TC	TCAPIR	_____
2	TC	TCCICS	_____
2	TC	TCDB2	_____
2	TC	TCIMS	_____
2	TC	TCMQ	_____
2	TC	TCOTHR	_____

-----Class-----

Service	Report
OPS_HIGH	ZCEEOTHR
OPS_HIGH	BAQSTC
OPS_HIGH	ZCEEADM
OPS_HIGH	ZCEEAPIR
OPS_HIGH	ZEECICS
OPS_HIGH	ZCEEDB2
OPS_HILO	ZCEEIMS
OPS_MED	ZCEEMQ
OPS_LOW	ZCEEOTHR

07/021

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

mpz3

File Edit Settings View Communication Actions Window Help

Subsystem-Type Xref Notes Options Help

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

Command ==> \_\_\_\_\_

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

Description . . . . . WLP/zCEE Transactions

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

Action	Type	Name	Start
1	CN	zceex	_____
2	TC	TCADM	_____
2	TC	TCAPIR	_____
2	TC	TCDB2	_____
2	TC	TCCICS	_____
2	TC	TCIMS	_____
2	TC	TCMQ	_____
2	TC	TCOTHR	_____

-----Class-----

Service	Report
OPS_HIGH	ZCEEOTHR
OPS_HIGH	ZCEESTC
OPS_HIGH	ZCEEADM
OPS_HIGH	ZCEEAPIR
OPS_HIGH	ZEECICS
OPS_HILO	ZCEEDB2
OPS_HILO	ZCEEIMS
OPS_MED	ZCEEMQ
OPS_HILO	ZCEEOTHR

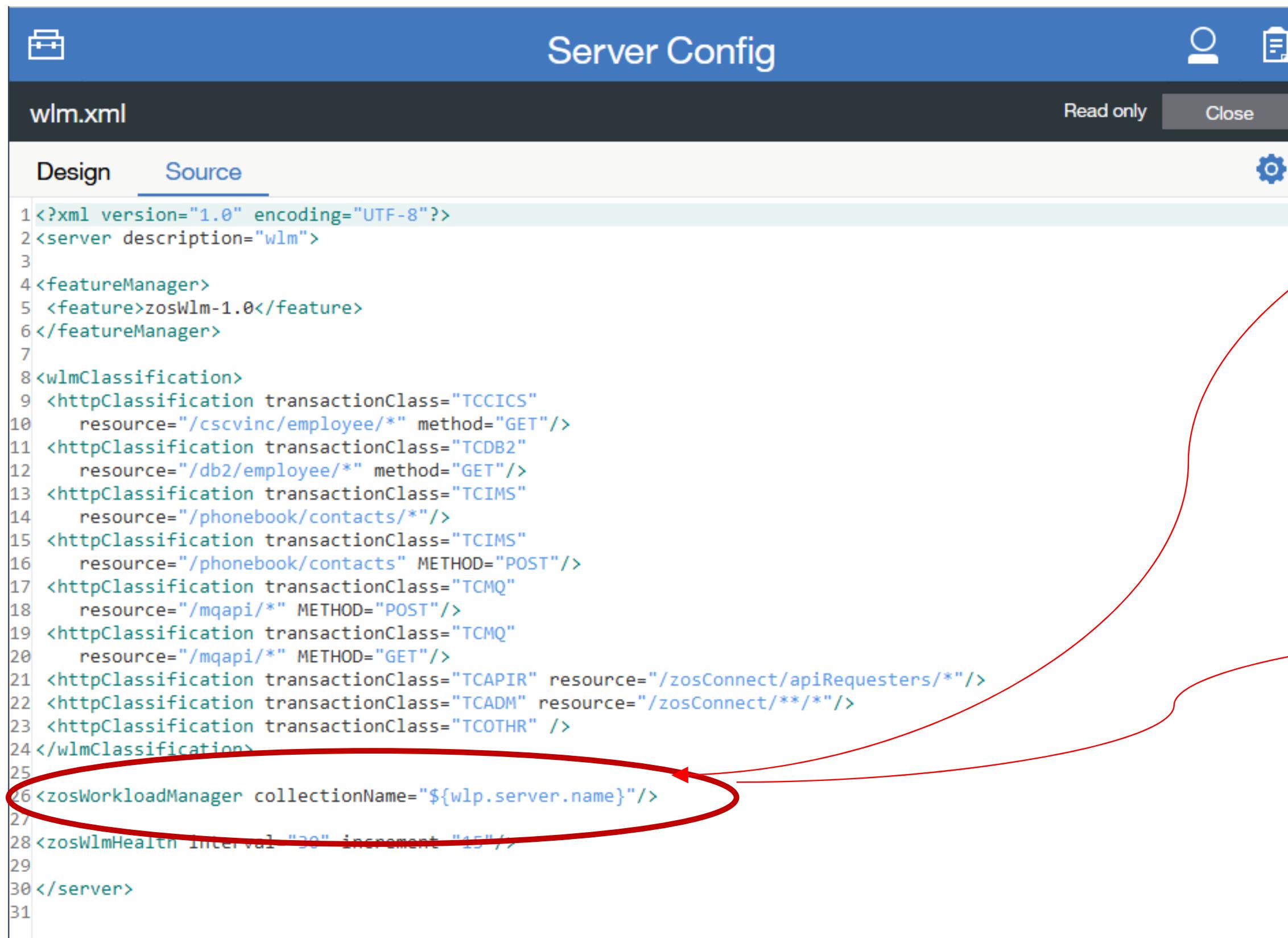
07/021

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

# 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.

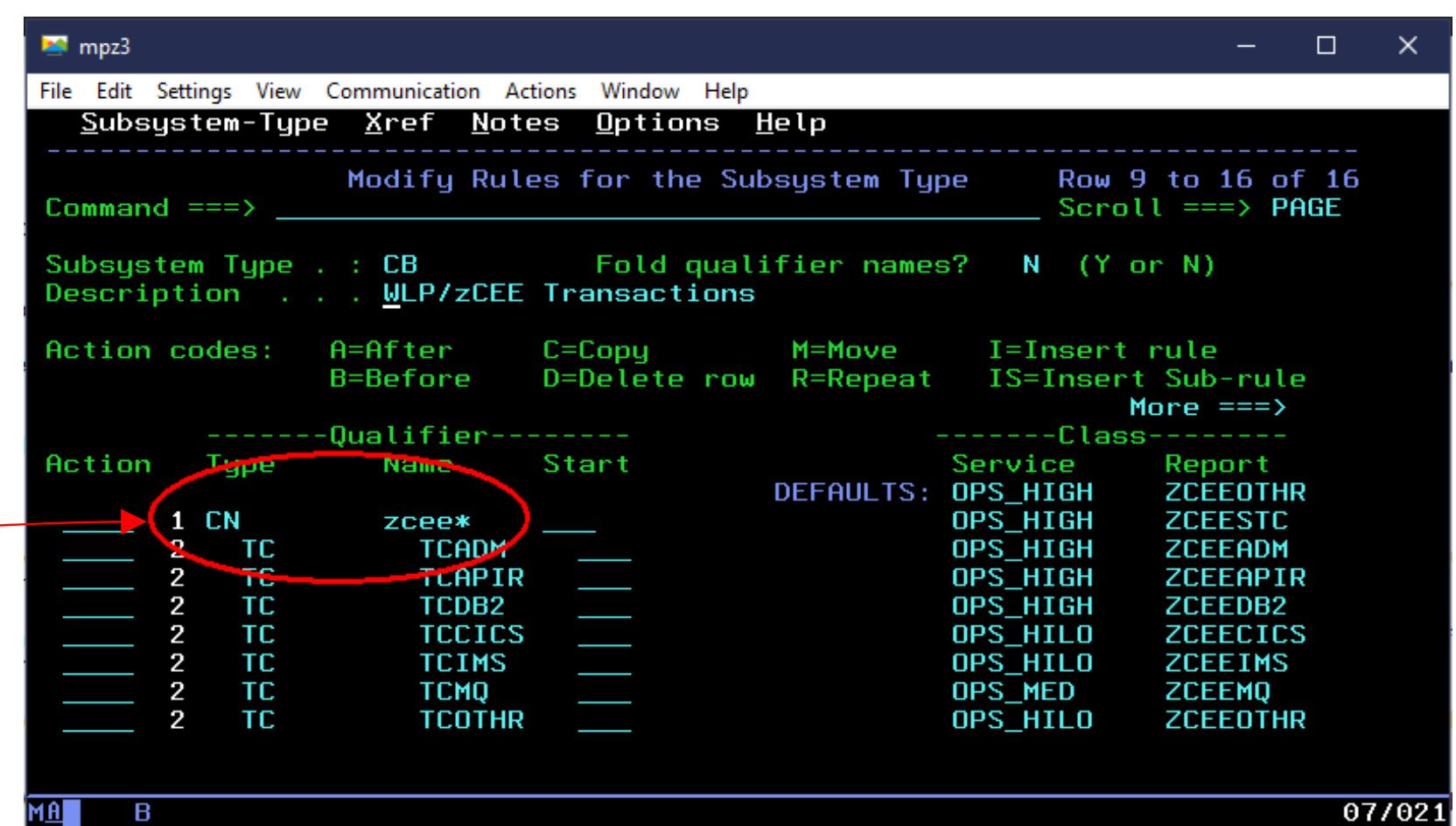


```

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

```

Related to WLM CN name.



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	ZCEEICCS
2	TC	TCMQ		OPS_MED	ZCEEMQ
2	TC	TCOTHR		OPS_HILO	ZCEEOTHR



# 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"}]
```

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# RMF SMF Type 72 Service Class Reports

mpz3

File Edit Settings View Communication Actions Window Help

Display Filter View Print Options Search Help

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

COMMAND INPUT ==>

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

MA A

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

mpz3

File Edit Settings View Communication Actions Window Help

Display Filter View Print Options Search Help

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

COMMAND INPUT ==>

POLICY=WSCPOL

REPORT CLASS=ZCEE~~APIR~~

PERIOD=1

- TRANSACTIONS --		TRANS-TIME	HHH.MM.SS.FFFFFFF	TRANS-APPL%-----CP-IIPCP/AAPCP-IIP/AAP	---ENCLAVES---	
Avg	0.14	ACTUAL	424835	TOTAL 0.12	0.12 0.73	
MPL	0.14	EXECUTION	424707	MOBILE 0.00	0.00 0.00	
ENDED	200	QUEUED		CATEGORYA 0.00	0.00 0.00	
END/S	0.33	R/S AFFIN		CATEGORYB 0.00	0.00 0.00	
#SWAPS	0	INELIGIBLE				
EXCTD	0	CONVERSION				
		STD DEV	1.381943			
----SERVICE----	SERVICE TIME	--APPL %--	--PROMOTED--	--DASD I/O--	----STORAGE----	-PAGE-IN RATES-
IOC	0 CPU	5.073 CP	0.12	BLK 0.000	SSCHRT 2.4	AVG 0.00
CPU	4485K SRB	0.000 IIPCP	0.12	ENQ 0.000	RESP 0.4	TOTAL 0.00
MSO	0 RCT	0.000 IIP	0.73	CRM 0.000	CONN 0.3	SHARED 0.00
SRB	0 IIT	0.000 AAPCP	0.00	LCK 0.000	DISC 0.0	
TOT	4485K HST	0.000 AAP	N/A SUP	0.000 Q+PEND	0.0	
/SEC	7474 IIP	4.363		IOSQ 0.0		
ABSRPTN	53K AAP	N/A				
TRX SERV	53K					

MA A

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 defines a server with a feature manager containing monitor and zosRequestLogging features.

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

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

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



# Liberty SMF 120 Subtype 11 – WP102312 Plugin

AutoSave (Off) Search Mitch Johnson MJ

File Home Insert Page Layout Formulas Data Review View Help ACROBAT

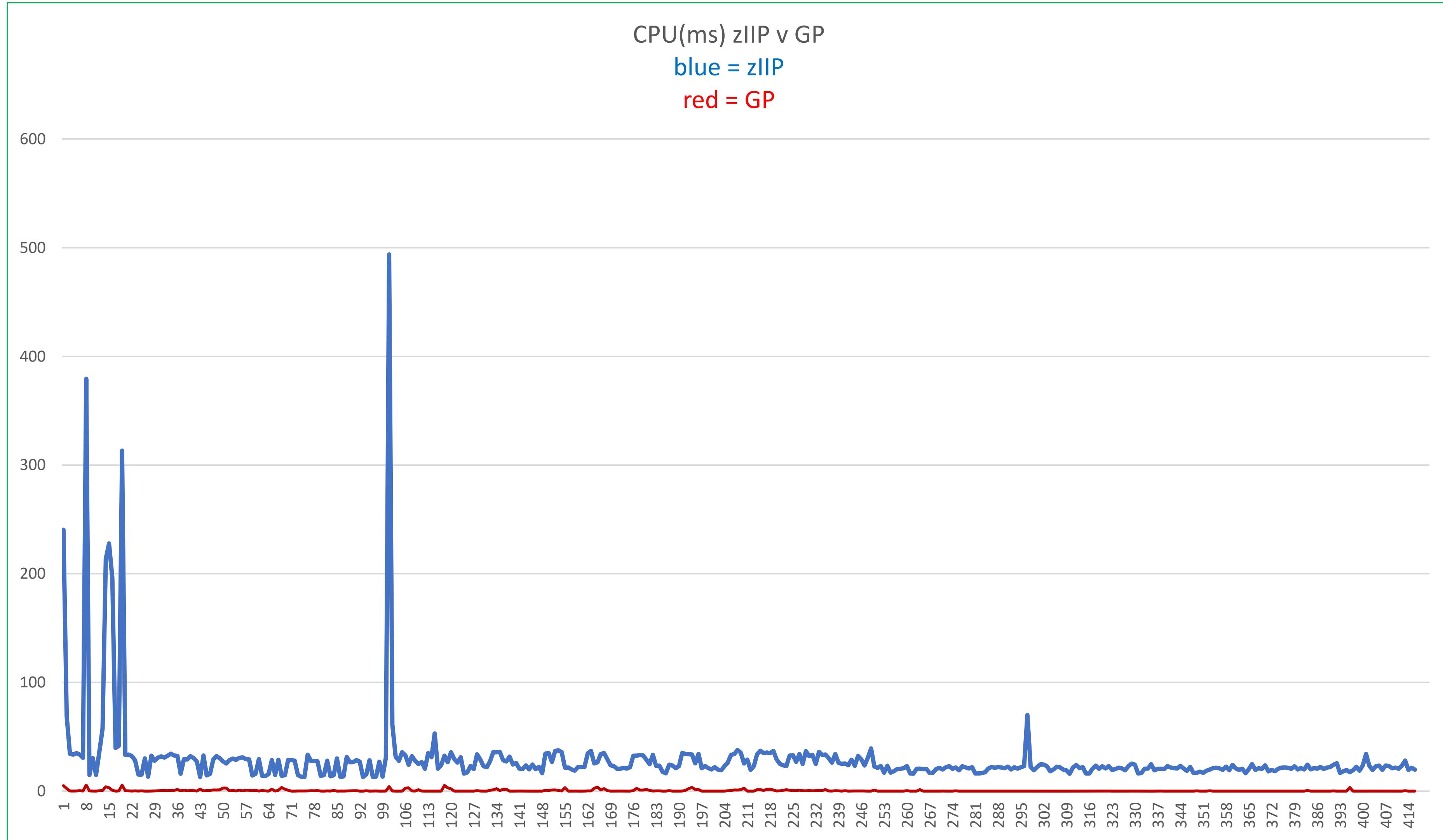
Cut Copy Format Painter Paste Font Alignment Number Styles Cells Editing Ideas Sensitivity

AS9 166

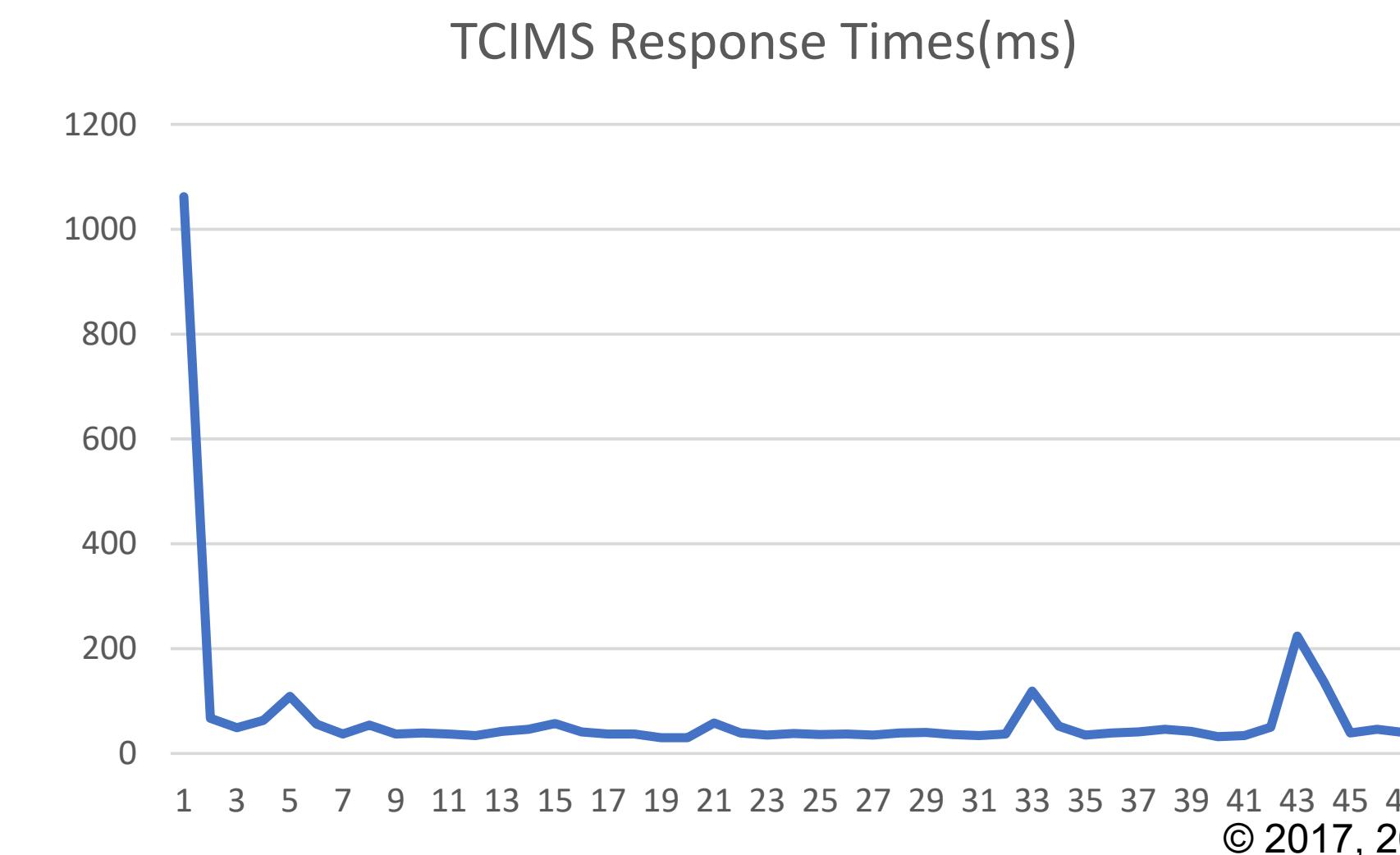
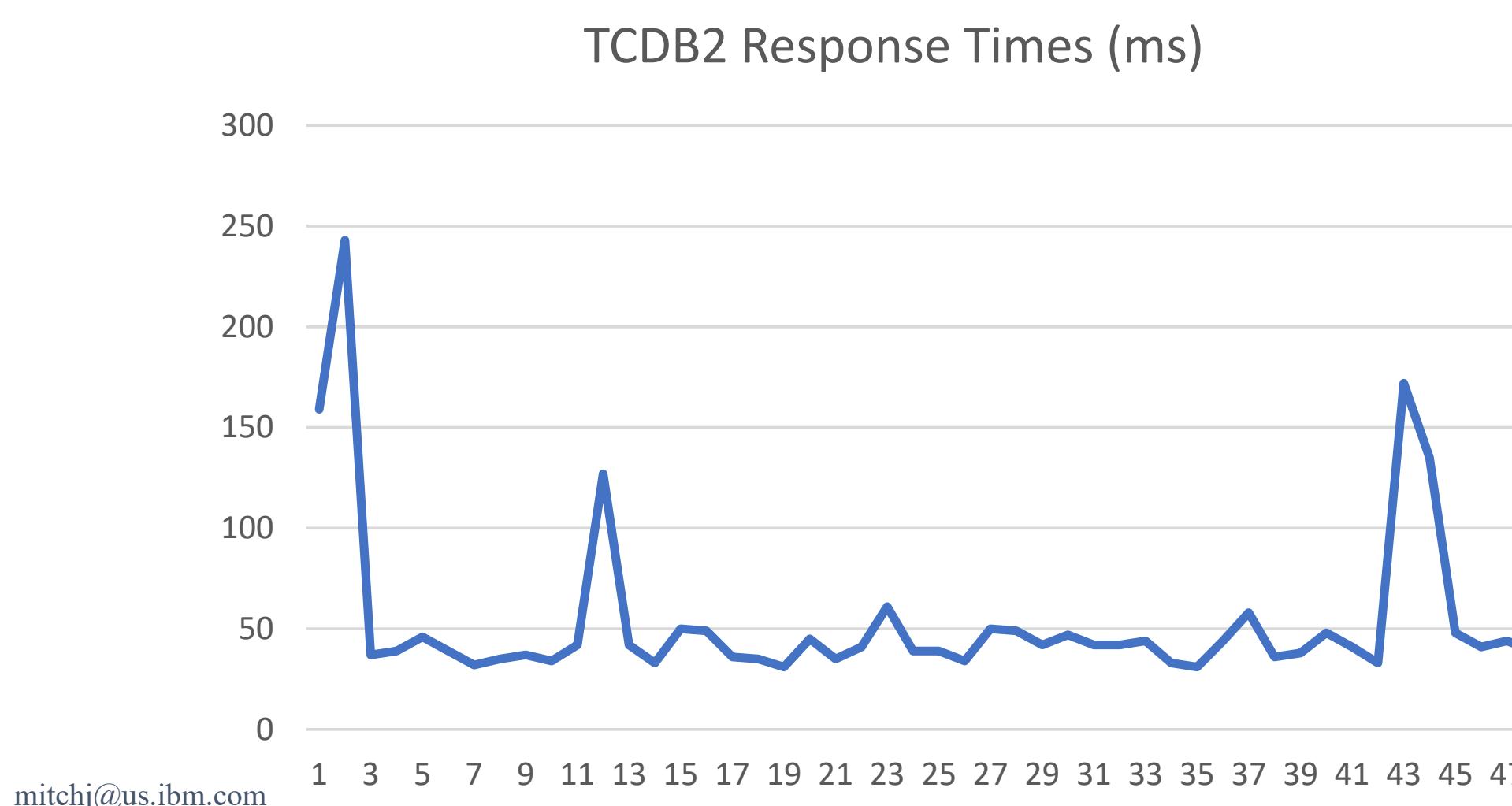
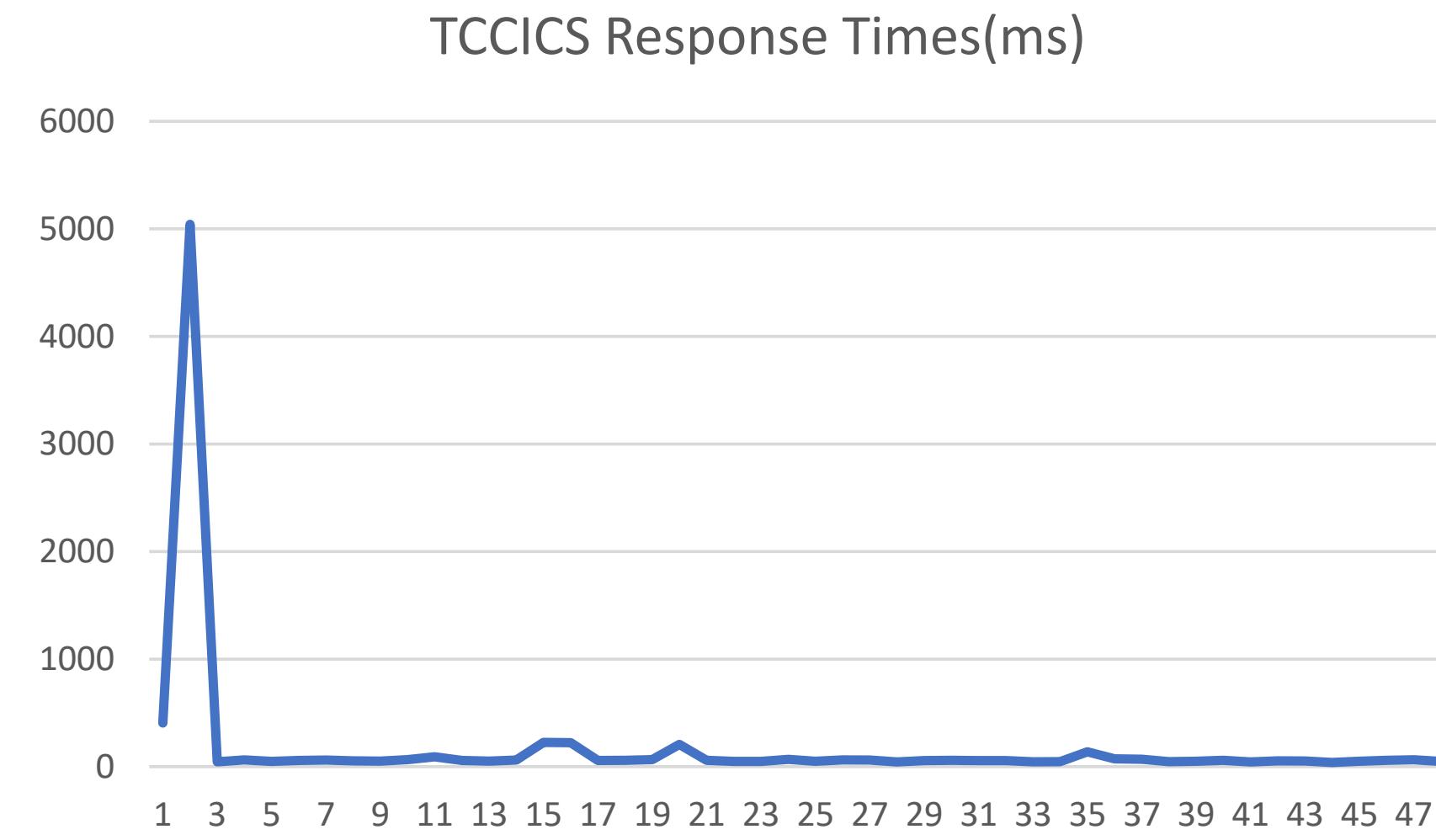
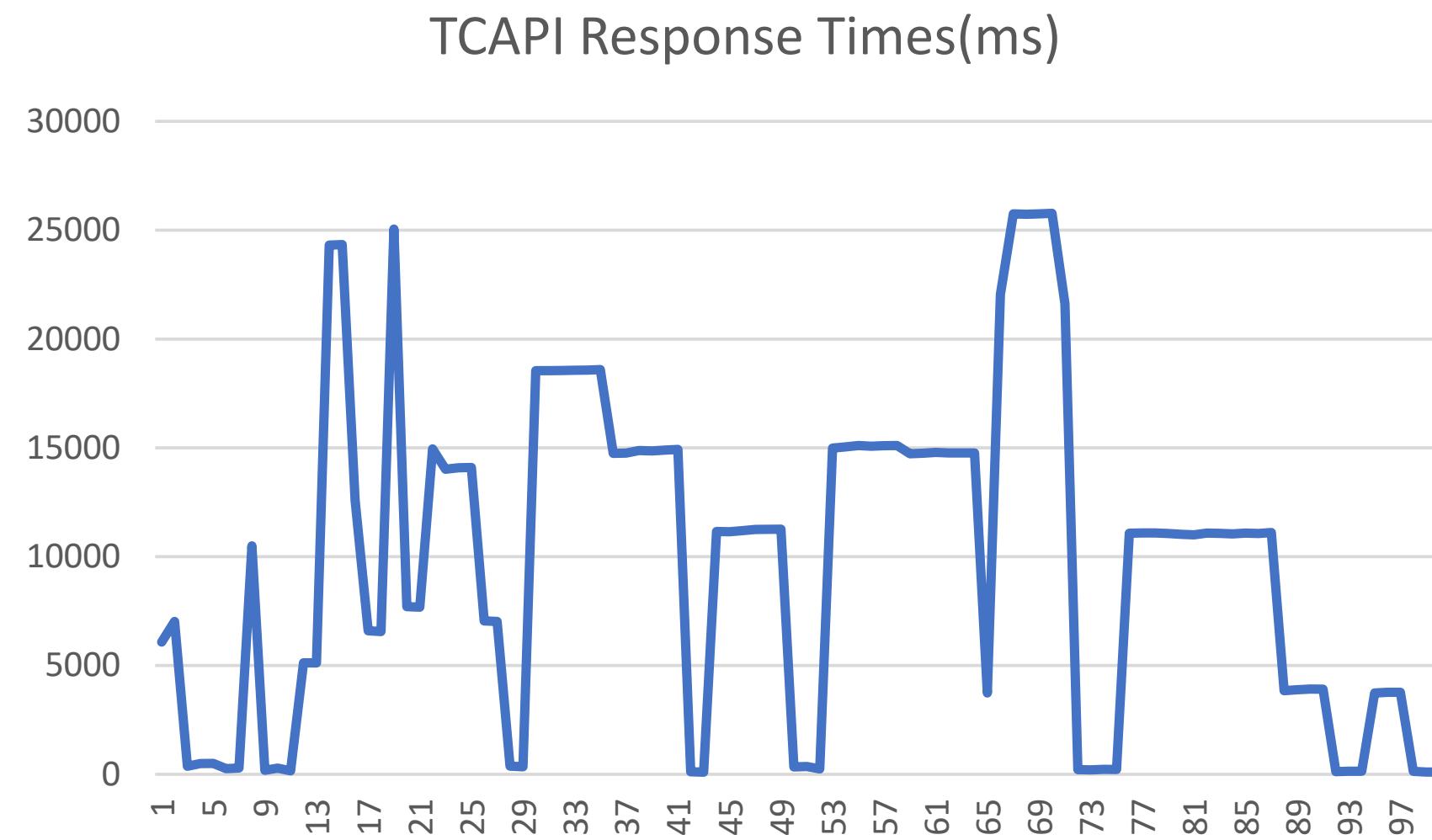
1	B	C	E	P	Q	R	S	T	U	V	W	Z	AA	AB	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
2	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	6080	TCAPIR	3314772936	4.32E+09	245.5195	5.0110927	240.508381	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4283	192.168.17.243	
3	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7030	TCAPIR	178821759	471750165	71.51572	2.334169	69.18156	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4286	192.168.17.243	
4	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	374	TCAPIR	4327455460	4.469E+09	34.44008	0.10757129	34.332504	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4301	192.168.17.243	
5	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	495	TCAPIR	2762287407	2.9E+09	33.65053	0.057430662	33.5931	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4304	192.168.17.243	
6	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	500	TCAPIR	4484655211	4.629E+09	35.15451	0.12540185	35.020004	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4303	192.168.17.243	
7	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	262	TCAPIR	4637789017	4.777E+09	34.10823	0.42818993	33.680042	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4305	192.168.17.243	
8	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	293	TCAPIR	542458283	668050357	30.66213	0.053870115	30.608257	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4306	192.168.17.243	
9	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	10493	TCAPIR	3802597962	5.38E+09	385.0374	5.576215	379.46115	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4285	192.168.17.243	
10	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	185	TCAPIR	5384541333	5.446E+09	15.04486	0.15656103	14.888303	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4308	192.168.17.243	
11	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	282	TCAPIR	1028119195	1.153E+09	30.38298	0.04661279	30.336363	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4309	192.168.17.243	
12	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	163	TCAPIR	901260513	962209631	14.88016	0	14.8801565	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4310	192.168.17.243	
13	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	5126	TCAPIR	3137255105	3.284E+09	35.92899	0.33009765	35.598892	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4313	192.168.17.243	
14	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	5122	TCAPIR	4890213483	5.128E+09	58.01673	0.61064285	57.40609	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4314	192.168.17.243	
15	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	24315	TCAPIR	13036032356	1.393E+10	217.4406	4.0119	213.4287	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4282	192.168.17.243	
16	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	24338	TCAPIR	1463812131	2.41E+09	230.9845	3.1036336	227.8809	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4284	192.168.17.243	
17	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	12587	TCAPIR	1160912461	1.967E+09	196.8579	0.7669092	196.09096	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4315	192.168.17.243	
18	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	6599	TCAPIR	5303866625	5.467E+09	39.78177	0.020269532	39.761494	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4316	192.168.17.243	
19	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	6565	TCAPIR	6143860672	6.315E+09	41.86705	0.16208105	41.704967	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4317	192.168.17.243	
20	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	25052	TCAPIR	2622790027	3.928E+09	318.7149	5.489483	313.22546	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4281	192.168.17.243	
21	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7709	TCAPIR	4477460136	4.615E+09	33.52233	0.35891944	33.163406	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4322	192.168.17.243	
22	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7682	TCAPIR	1973032107	2.112E+09	33.81701	0.19548193	33.621525	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4321	192.168.17.243	
23	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	14950	TCAPIR	458083508	590213570	32.25832	0.0489917	32.209324	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4323	192.168.17.243	
24	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	14016	TCAPIR	61401222	178390269	28.56178	0.2347461	28.327032	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4325	192.168.17.243	
25	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	14088	TCAPIR	86069826	148846164	15.32625	0.0541626	15.272091	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4326	192.168.17.243	
26	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	14097	TCAPIR	5471350509	5.535E+09	15.43587	0.21740967	15.218459	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4324	192.168.17.243	
27	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7051	TCAPIR	5358173556	5.482E+09	30.16547	0.001757324	30.163715	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4328	192.168.17.243	
28	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	7029	TCAPIR	2281578411	2.336E+09	13.27289	0	13.272889	USER1	/zosConn(mpz3.was	9080	/zosConnect/apiRequeste	166	9080	4327	192.168.17.243	
29	MPZ3	MPZPLEX	BAQSTRT	Friday	Au	3.84E+12	Friday	Au	3.84E+12	379	TCAPIR	1054429318	1.188E+09	32.66632	0.067269534										



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



# Liberty SMF 120 type 11 – Response times comparisons example



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# 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 (OpenAPI 2) \***



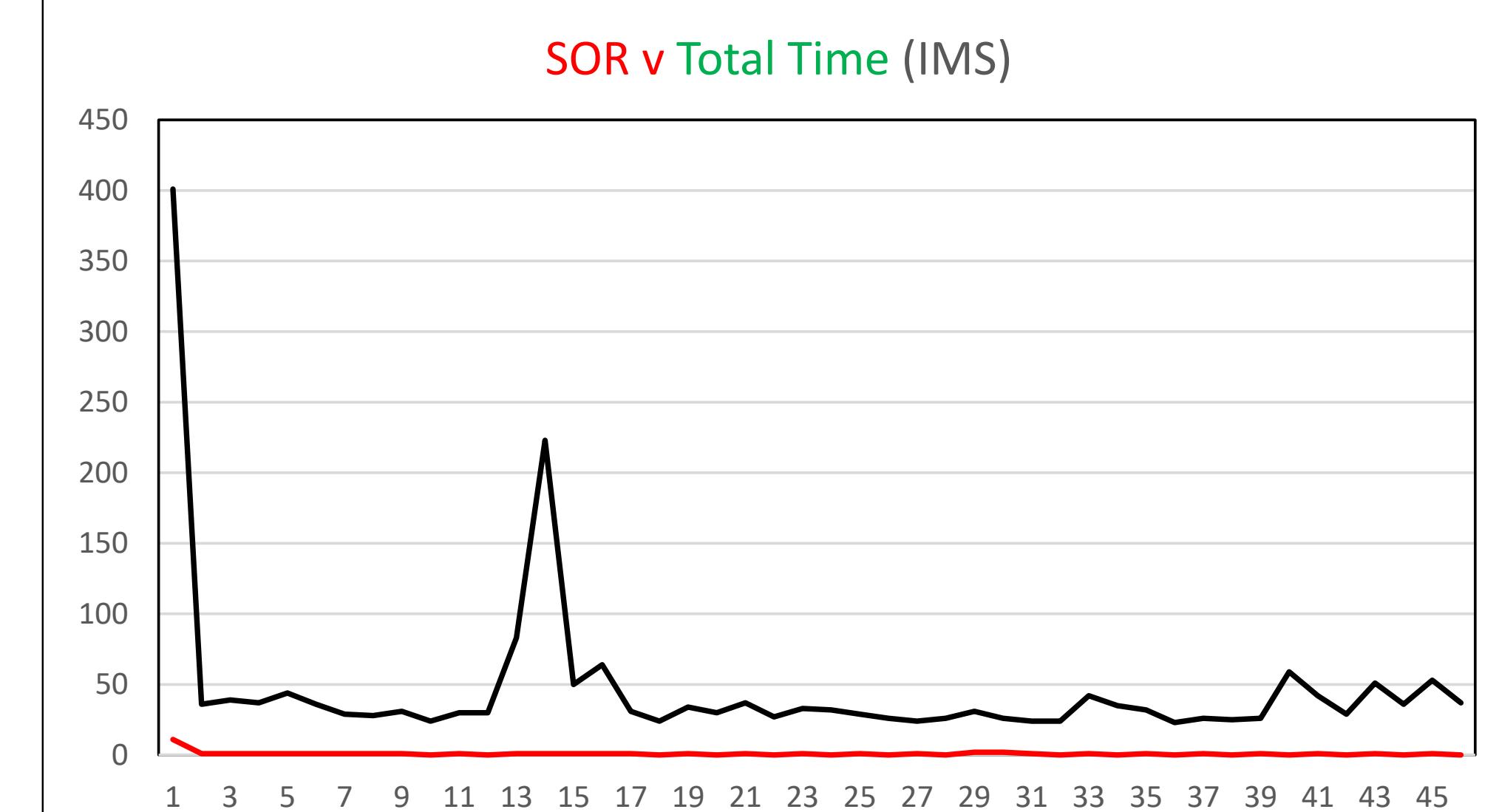
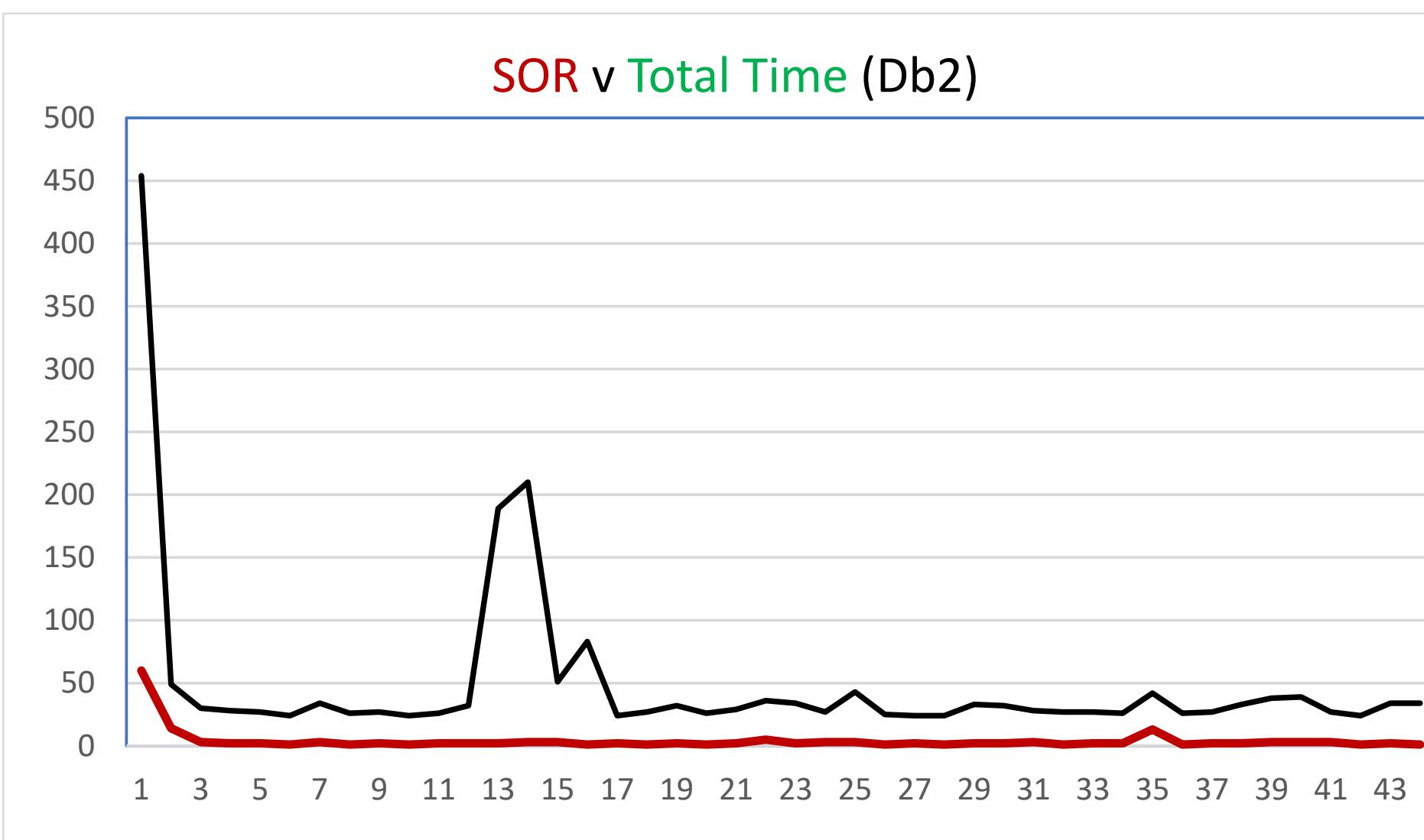
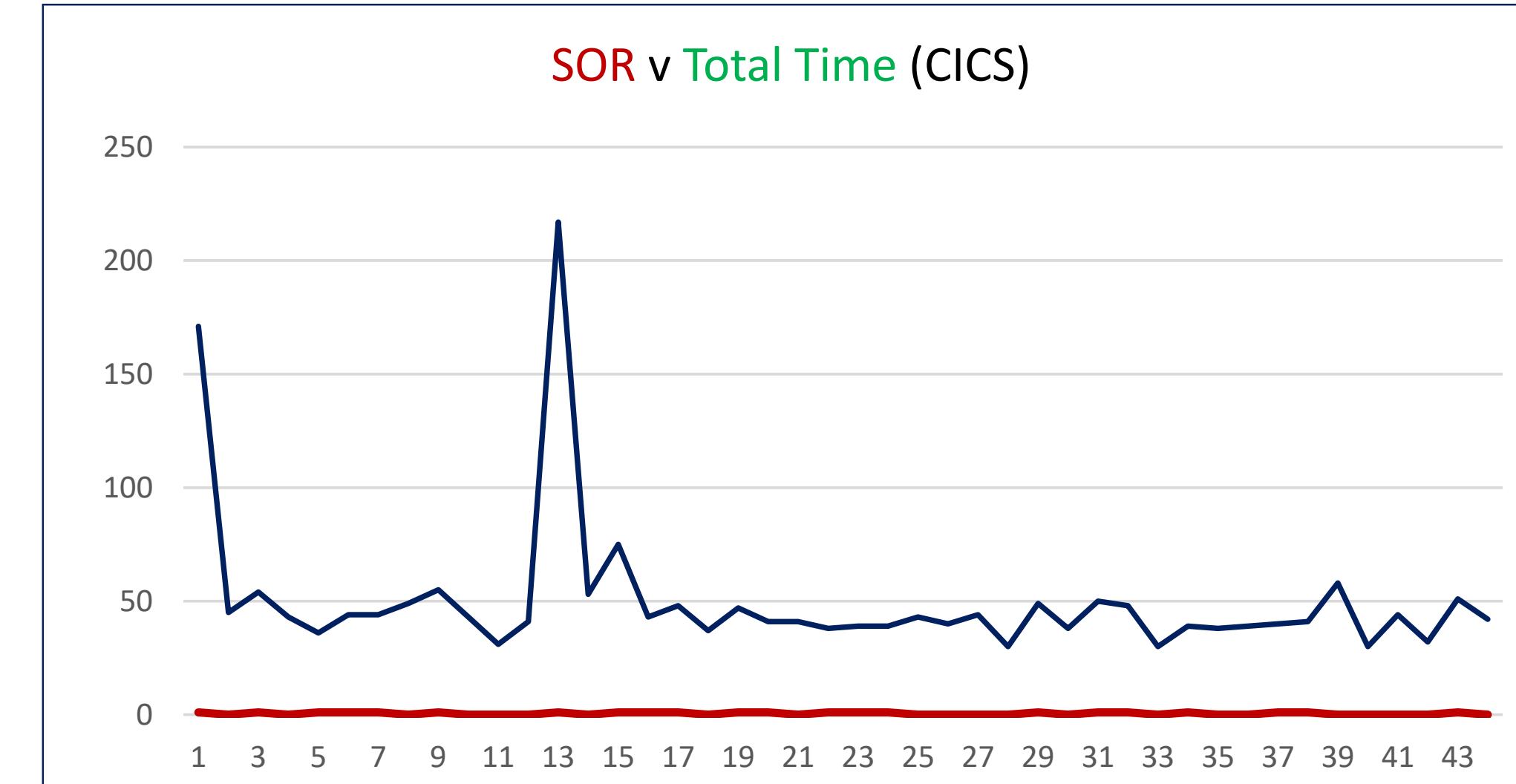
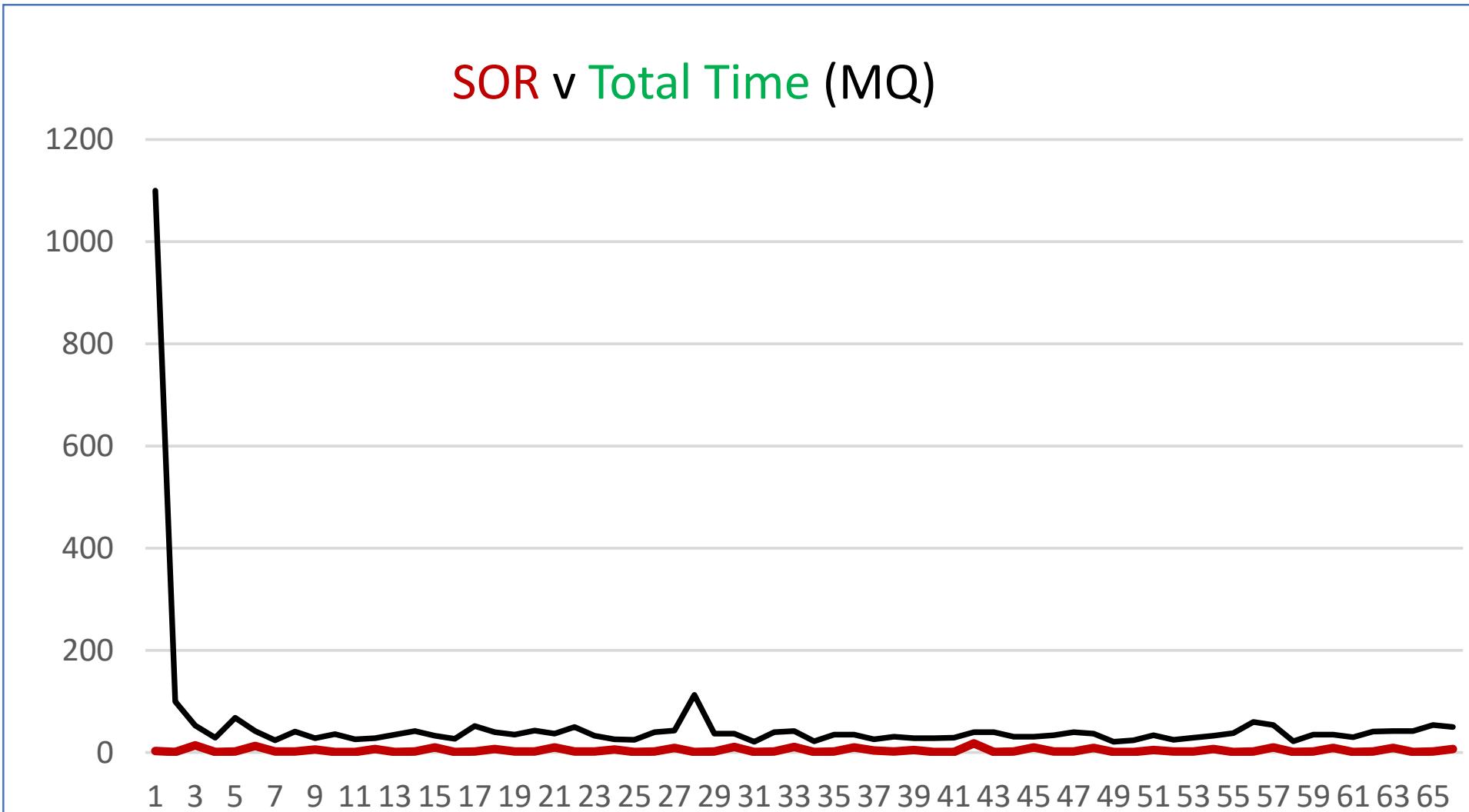
mitchj@us.ibm.com

## Some fields have been hidden

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

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



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



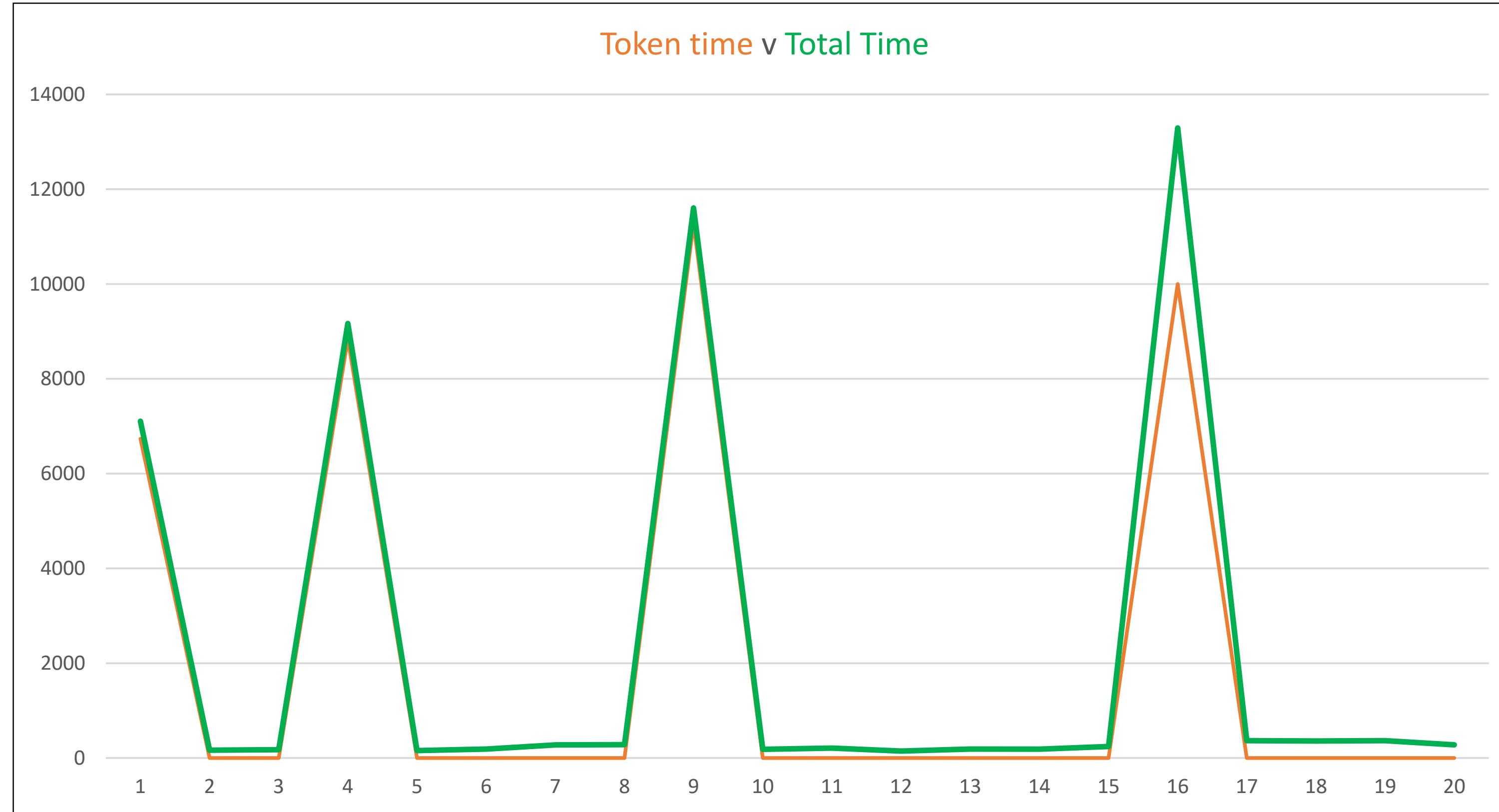
## Some fields have been hidden

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

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





# Liberty Connection Management

## Liberty default connection pool management <connectionManager>

- **agedTimeout** The number of seconds before a physical connection can be discarded by the pool maintenance thread. The default value of -1 disables this timeout.
- **connectionTimeout** Amount of time after which a connection request will time out with an exception when no connections are available.
- **maxIdleTime** Amount of time a connection can be unused or idle until it can be discarded during pool maintenance.
- **maxPoolSize** Maximum number of physical connections for a pool.
- **minPoolSize** Minimum number of physical connections to maintain in the pool.
- **purgePolicy** Specifies which connections to destroy when a “stale” connection is detected in a pool (EntirePool, FailingConnectionOnly or ValidateAllConnections)
- **reapTime** Amount of time between runs of the pool maintenance thread. Should be less than agedTimeout and maxIdleTime.

```
<connectionManager id="ConMgr1"  
    agedTimeout=-1  
    connectionTimeout=30s  
    maxIdleTime=1800s  
    maxPoolSize=50  
    minPoolSize=0  
    purgePolicy= "EntirePool"  
    reapTime=180/>
```



# IMS Connect TCPIP configuration parameters

In the IMS Connect **TCPIP** configuration statement, you can set the following limits on the amount of time IMS Connect waits in the following stages of communication:

- The **TIMEOUT** parameter determines how long IMS Connect keeps a connection open if the client does not send any input after the connection is **first** established.
- The **IDLETO** parameter determines how long IMS Connect keeps a connection that is in **RECV** state open **after** the prior client interaction completes.
- The **TIMEOUT** parameter also determines how long IMS Connect waits for a response from IMS before IMS Connect notifies the client of the timeout and returning the socket connection to a **RECV** state.

```
HWS=(ID=IMS15HWS,XIBAREA=100,RACF=Y,RRS=Y)
TCPIP=(HOSTNAME=TCPIP,
       ECB=Y,           This allows TCP/IP to post an ECB into IMS Connect to improve performance
       PORT=(ID=4000, IDLETO=4500), Idle timeout value set to 4500 hundredths of a second
       PORT=(ID=4001),           Idle timeout value is set to global default
       PORT=(ID=4002, IDLETO=3600), Idle timeout value set to 3600 hundredths of a second
       PORTID=(4003),           Idle timeout value is set to global default
       IDLETO=5500,             Global idle timeout value set to 5500 hundredths of a second
       RACFID=JOHNSON,
       TIMEOUT=5000)
```



# IMS Connection Management Attributes

## IMS connection profiles (imsmobile\_imsConnection)

- **connectionFactoryRef** – Set this file to the name (ID) of the ConnectionFactory configuration element

## IMS interaction profiles (imsmobile\_interaction)

- **imsConnectTimeout** - Specify the time in milliseconds to wait for a reply after sending a message to IMS Connect.  
General guidelines for setting the imsConnectTimeout value:
  - This value should be equal or larger than the value for interactionTimeout.
  - This value should be at least 5 seconds shorter than the value for the *asyncRequestTimeout* attribute of the *zosconnect\_zosConnectManager* element in server.xml.
- **interactionTimeout** - Specify the time in milliseconds for the transaction to be processed by IMS. After sending a message to IMS, IMS Connect waits for a reply from IMS until this timeout value is reached..
  - Valid values are -1, 0, or between 1 and 3600000 (one hour), inclusively.
  - A value of 0 means that the timeout value is determined by IMS Connect.
  - A value of -1 (the default) means to wait indefinitely.
- **transExpiration** - Indicates to IMS OTMA, when the execution timeout value is reached, whether the transaction is considered expired, and OTMA no longer needs to process it. When this property is set to true, the IMS TM resource adapter client application indicates to OTMA that the transaction can be discarded after the execution times out. This function relieves OTMA from having to process unnecessary messages. The default is false.

Tip: The imsConnectTimeout value should be equal or larger than the value for interactionTimeout.



# Connection Management for IMS TM

Use the connectionManagerRef attribute in an IMS ConnectionFactory to provide a connection pool for connections to IMS Connect.

```
<connectionManager id="IMSTMConnMgr1" agedTimeout=-1 connectionTimeout=30 maxIdleTime=1800 maxPoolSize=50  
minPoolSize=0 purgePolicy="EntirePool" reaptTime=180/>  
<connectionManager id="IMSTMConnMgr2" agedTimeout=-1 connectionTimeout=30 maxIdleTime=1800 maxPoolSize=200  
minPoolSize=0 purgePolicy="EntirePool" reaptTime=180/>  
  
<imsmobile_imsConnection id="IMSCONN1" connectionFactoryRef="IMSCF1"/>  
<connectionFactory id="IMSCF1" connectionManagerRef="IMSTMConnMgr1" containerAuthDataRef="Connection1_Auth" >  
    <properties.gmoa hostName="wg31.washington.ibm.com" portNumber="4000" applicationName="IMSTMPL"/>  
</connectionFactory>  
  
<imsmobile_imsConnection id="IMSCONN2" connectionFactoryRef="IMSCF2"/>  
<connectionFactory id="IMSCF2" connectionManagerRef="IMSTMConnMgr2" containerAuthDataRef="Connection1_Auth" >  
    <properties.gmoa hostName="wg31.washington.ibm.com" portNumber="4000" applicationName="IMSTMPL"/>  
</connectionFactory>  
  
<imsmobile_interaction id="IMSINTER1" imsConnectTimeout="30000"  
                      interactionTimeout="20000" ... />  
<imsmobile_interaction id="IMSINTER2" imsConnectTimeout="20000"  
                      interactionTimeout="15000" ... />
```

The total of *maxPoolSize* in the *connectionManager* configuration elements should not exceed the value of the IMS Connect *MAXSOC* attribute – 1,

- The imsConnectTimeout value is the time the service provider waits for a reply after sending a message to IMS Connect
- The interactionTimeout value is passed to IMS Connect. IMS Connect sends the message to IMS and then waits that long for a reply. If there is none there is a timeout in IMS Connect and IMS Connect sends a timeout to the service provider.



# TCP/IP considerations with IMS Connect

On the Liberty TCP/IP environment, ensure:

- **TCPNODELAY=DISABLE**. This allows optimization of transmission but depends on the client environment. Allows for multiple writes and waits for the buffer to be filled before sending.
- **SO\_Linger=Y,VALUE=10** ensures no loss of data. The close of the socket is blocked until ACK is received or 10 seconds, whichever comes first.

In PROFILE.TCPIP configuration on the IMS Connect endpoint, ensure:

- IMS Connect PORT set to NODELAYACKS. This allows ACKS to be sent immediately.
- Specify SHAREPORT, which allows IMS Connect PORTS to be shared by multiple IMS Connect instances on the same stack.
- TCPCONFIG INTERVAL or KEEPALIVEOPTIONS INTERVAL allows TCP/IP to maintain a connection that can be inactive for long periods of time.
- SOMAXCONN must be defined large enough for maximum concurrent connections.

From Redbook *IMS Performance and Tuning Guide*, SG24-7324-00



# Connection Management for IMS DB

Use the `connectionManagerRef` attribute in an IMS ConnectionFactory to provide a connection pool for connections to IMS Connect.

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

<connectionManager id="IMSDBConnMgr" agedTimout=-1 connectionTimeout=30
maxIdleTIme=1800 maxPoolSize=50 minPoolSize=0 purgePolicy="EntirePool"
reapTIme=180/>
```

The `maxPoolSize` in the `connectionManager` configuration element should not exceed the value of the IMS Connect `MAXSOC` attribute.



# Connection Management for MQ

Use the connectionManagerRef attribute in a JMS ConnectionFactory to provide a connection pool for connections to a queue manager.

```
<jmsConnectionFactory id="qmgrCf" jndiName="jms/qmgrCf"  
connectionManagerRef="MQConnMgr">  
  <properties.wmqJMS transportType="CLIENT"  
    queueManager="ZMQ1"  
    channel="LIBERTY.DEF.SVRCONN"  
    hostName="wg31.washington.ibm.com"  
    port="1422" />  
</jmsConnectionFactory>  
  
<connectionManager id="MQConnMgr" agedTimout=-1 connectionTimeout=30  
  maxIdleTIme=1800 maxPoolSize=50 minPoolSize=0 purgePolicy="EntirePool"  
reapTIme=180/>
```

The *maxPoolSize* in the *connectionManager* configuration element should not exceed the value of the *MAXINST* or *MAXINSTC* attributes of the queue manager's server-connection channel.



## Connection Management for outbound HTTP request, e.g., Db2, etc.

Outbound connections to Db2, authorization servers, API requesters servers are managed by z/OS Connect code (as is any endpoint configured by the use of a z/OS Connection configuration element).

Connections are managed and/or configured by the use of Java system parameters (-D) *http.maxConnections* and *http.keepAlive*.

- Dhttp.maxConnections=5
- Dhttp.keepAlive=true



## TLS sessions

- When connections timeout, it is still possible to avoid the impact of full handshakes by reusing the TLS session id
- Configured by setting the `sslSessionTimeout` attribute on the `sslOptions` element to an amount of time
- Example setting `server.xml` file

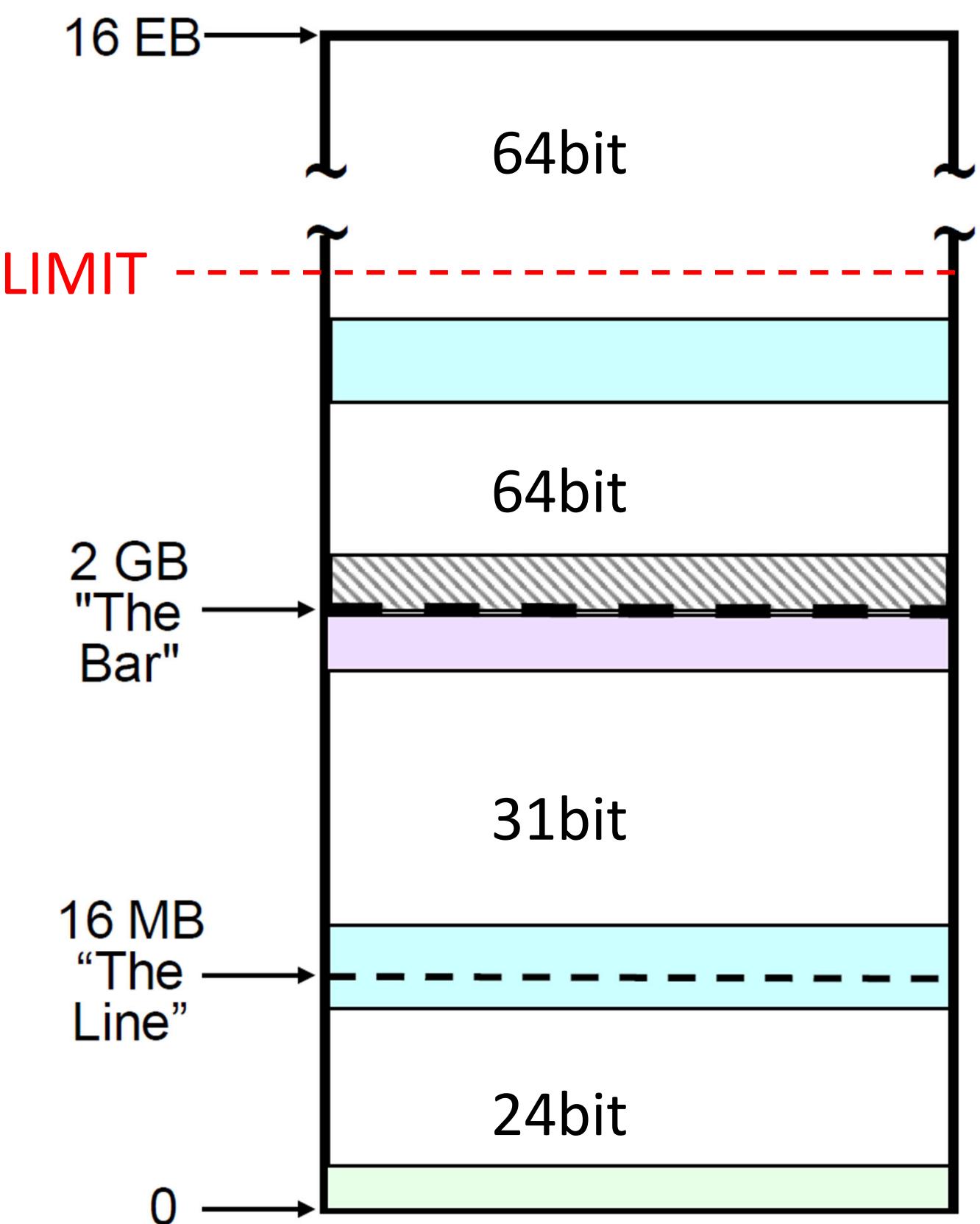
```
<httpEndpoint host="*" httpPort="80" httpsPort="443" id="defaultHttpEndpoint"  
httpOptionsRef="httpOpts" sslOptionsRef="mySSLOptions"/>  
  
<httpOptions id="httpOpts" keepAliveEnabled="true" maxKeepAliveRequests="100"  
persistTimeout="1m"/>  
  
<sslOptions id="mySSLOptions" sslRef="DefaultSSLSettings"  
sslSessionTimeout="10m"/>
```

- This sets the timeout limit of an TLS session to **10 minutes** (default is 8640ms)

# 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](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\*

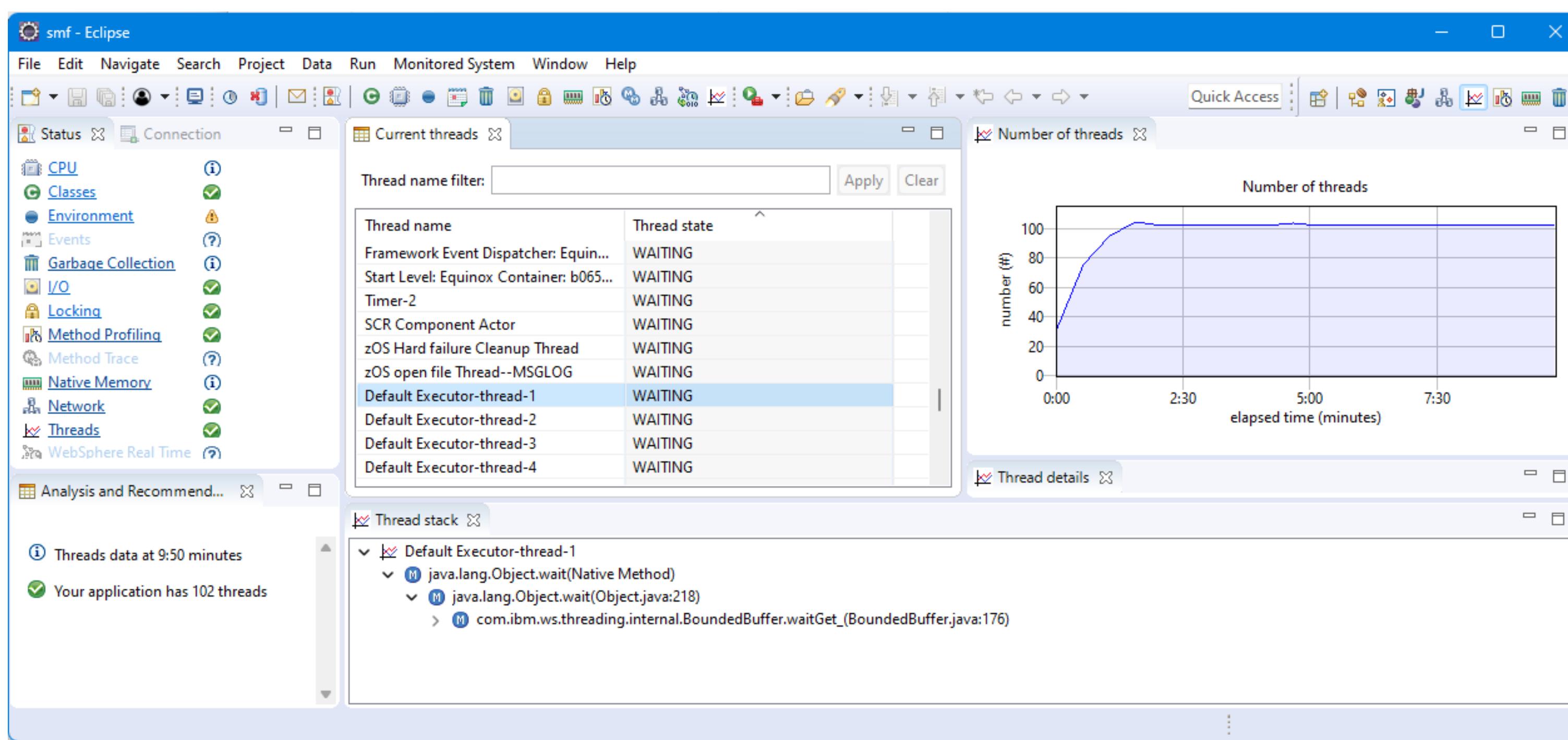
- verbose:gc Writes verbose garbage collection information.
- verbose:sizes Writes information to stderr describing the active memory usage settings.

<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

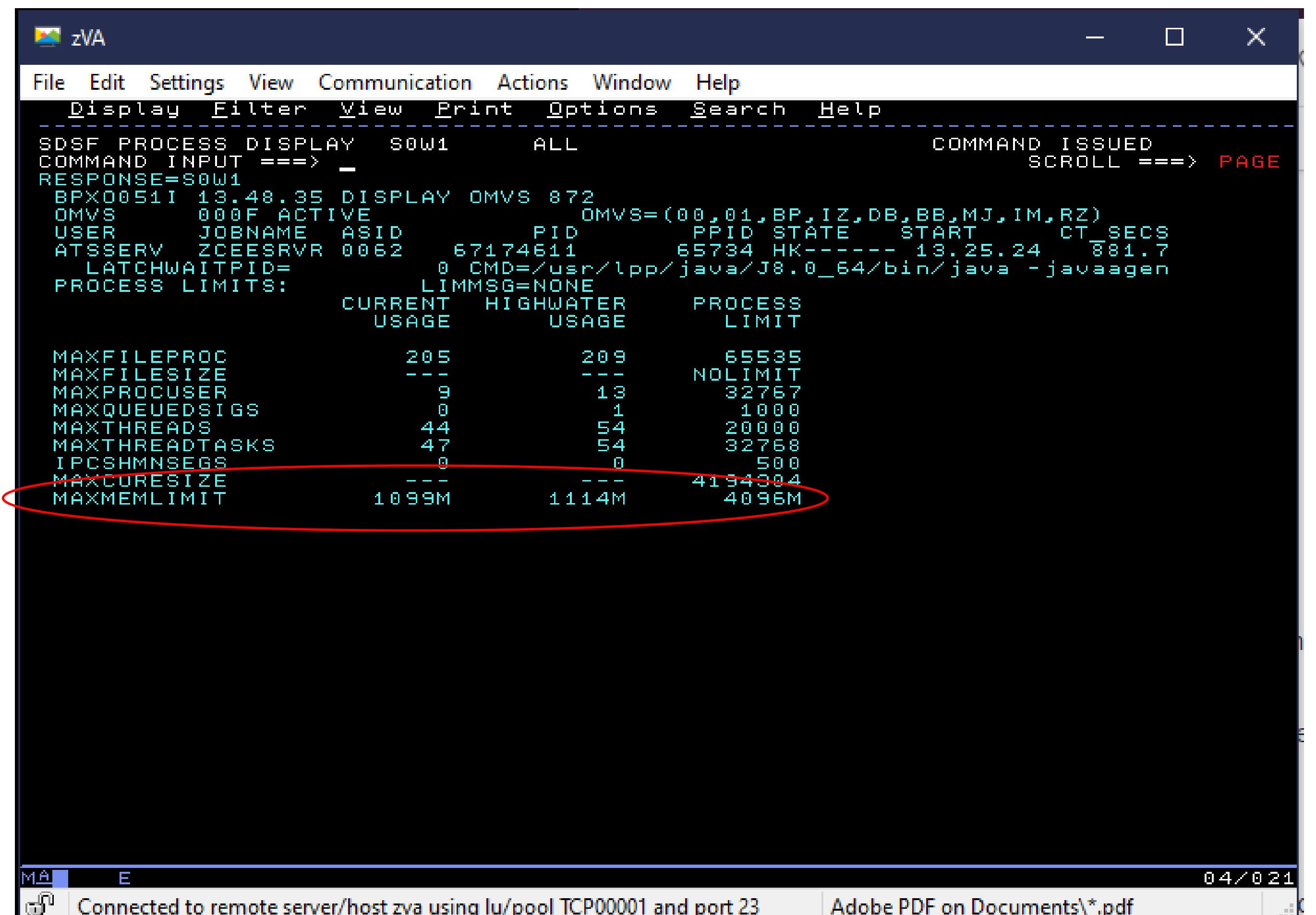
- Don't reach the maximum!
  - Results in Java Out Of Memory errors and system abends
  - z/OS Connect EE will stop processing API requests
- Ensure this doesn't happen
  - Limit the Liberty Default Executor thread pool
    - `maxThreads` default value is `-1` No Limit!
  - **MEMLIMIT** =
    - Maximum 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 PROCESS
                USAGE USAGE LIMIT
MAXFILEPROC    205    209    65535
MAXFILESIZE   ---   --- NOLIMIT
MAXPROCUSER     9    13    32767
MAXQUEUEDSIGS   0     1    1000
MAXTHREADS     44    54    20000
MAXTHREADTASKS  47    54    32768
IPCSHMNSEGS    0     0    500
MAXCORESIZE   ---   --- 4194304
MAXMEMLIMIT   1099M  1114M  4096M

```

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 last row of the process limits table, which is MAXMEMLIMIT. The table shows current usage (1099M), high watermark (1114M), and the limit itself (4096M).



# Inbound persistent connections

- Persistent connections can be used to avoid too many handshakes
- Configured by setting the `keepAliveEnabled` attribute on the `httpOptions` element to **true**
- Example setting `server.xml` file

```
<httpEndpoint host="*" httpPort="80" httpsPort="443" id="defaultHttpEndpoint"  
httpOptionsRef="httpOpts"/>  
  
<httpOptions id="httpOpts" keepAliveEnabled="true" maxKeepAliveRequests="500"  
persistTimeout="1m" />
```

- This sets the connection timeout to **1 minute** (default is 30 seconds) and sets the maximum number of persistent requests that are allowed on a single HTTP connection to **500**
- It is recommended to set a maximum number of persistent requests when connection workload balancing is configured
- It is also necessary to configure the client to support persistent connections

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



# Where to find information when a problem occurs.

**messages.log**

```
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/messages.log
Command ==>
000228 System Property com.ibm.lms.jdbcenvironment set to 'WAS'.
000229 J2CA7001I: Resource adapter imsudsJLocal installed in 5.665 seconds.
000230 CUWIKZ0014U: The application resources could not be started as it could not be found at location /var/zosconnect/servers/myServer/server/config.
000231 CUWIKZ0018I: Starting application serverConfig.
000232 CUWIKZ0018I: The web server application is using the expanded directory at the /var/zosconnect/servers/myServer location.
000233 SRVE0169I: Loading Web Module myServer has been bound to default_host.
000235 CUWIKZ0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/server/config/
000236 SESN0176I: A new session context will be created for application key default_host/server/config
000237 CUWIKZ0018I: The session context uses the java defaultSecureRandom implementation for session ID generation.
000238 SRVE0105I: A configuration file for a web server plugin was automatically generated for this server at /var/zosconnect/server
000239 CUWIKZ0011I: Application serverConfig started in 0.036 seconds.
000240 SRVE0105I: A configuration file for a web server plugin was automatically generated for this server at /var/zosconnect/server
000241 CUWIKZ0219I: TCP Channel defaultHTTPEndpoint has been started and is now listening for requests on host * (IPv6) port 9080.
000242 CUWIKZ0219I: TCP Channel defaultHTTPEndpoint has been started and is now listening for requests on host * (IPv6) port 94
000243 CUWIKZ0219I: TCP Channel defaultHTTPEndpoint has been started and is now listening for requests on host * (IPv6) port 94
000244 CUWIKF0008I: Feature Update completed in 17.519 seconds.
000245 CUWIKF0011I: The myServer server is ready to run a smarter planet. The myServer server started in 17.991 seconds.
000246 CUWIKS2932I: The authorized version of the SAF user registry is activated. Authentication will proceed using authorized native
000247 CUWIKS1100A: Authentication did not succeed for user ID user1. An invalid user ID or Password was specified.
000248 CUWIKS1100A: Authentication did not succeed for user ID user1. An invalid user ID or Password was specified.
***** Bottom of Data *****
```

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Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23

**STC STDCALL DD (TFC) LOG**

```
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/ffdc/ffdc_21.08.30_15.05.58.0.log
Command ==>
***** ***** Top of Data *****
==MSG> -Warning- The UNDO command is not available until you change
==MSG> your edit profile using the command RECOVERY ON.
000001 --Start of DE Processing---- = [8/30/21 15:05:58:198 GMT]
000002 Exception: javax.net.ssl.SSLHandshakeException
000003 Source: com.ibm.ws.channel.ssl.internal.SSLReadServiceContext#SSLReadCompletedCallback
000004 probeId = 798
000005 Stack Dump = javax.net.ssl.SSLHandshakeException: Received fatal alert: unknown_ca
000006 at com.ibm.ws.channel.ssl.internal.SSLReadServiceContext#SSLReadCompletedCallback
000007 at com.ibm.jsser2.g.a(a,Java:28)
000008 at com.ibm.jsser2.bb(a,bb,Java:15)
000009 at com.ibm.jsser2.bf(a,bf,Java:15)
000010 at com.ibm.jsser2.bb,af(b,Java:29)
000011 at com.ibm.jsser2.a0,a(a,Java:45)
000012 at com.ibm.jsser2.bb,g(b,Java:317)
000013 at com.ibm.jsser2.bb,g(b,Java:164)
000014 at com.ibm.jsser2.bb,g(b,Java:164)
000015 at com.ibm.jsser2.bb,g(b,Java:106)
000016 at javax.net.ssl.SSLEngine.unwrap(SSLEngine.java:21)
000017 at com.ibm.ws.channel.ssl.internal.SSLReadServiceContext.decryptMessage(SSLReadServiceContext.java:1212)
000018 at com.ibm.ws.channel.ssl.internal.SSLReadServiceContext#SSLReadCompletedCallback.complete(SSLReadServiceContext.java:1000)
000019 at com.ibm.ws.tcpchannel.internal.AioReadCompletionListener.futureCompleted(AioReadCompletionListener.java:138)
***** Bottom of Data *****
```

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Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23

**trace.out**

```
VIEW /MPZ3/var/zosconnect/servers/myServer/logs/trace.log
Command ==>
***** ***** Top of Data *****
==MSG> -Warning- The UNDO command is not available until you change
==MSG> your edit profile using the command RECOVERY ON.
000001 **** FOR Z/OS 21.08.30 z/OS selected @ 00.48 (IP-1.0.53.c1210620210527-1900)
000002 WLP_INSTALL_DIR=/var/zosconnect/zosconnect/v20.15
000003 server.config.dir = /var/zosconnect/servers/myServer/
000004 Java.home = /MA4RS1/usr/lpp/java/J8.0.64
000005 Java.version = 1.8.0_301
000006 Java.runtime = IBM SE Runtime Environment (8.0.6.35 - PMZ6480sr6fp35-20210714_01(SR6 FP35))
000007 Java.runtime.OS = (02.04.00.00.990x) (en_US)
000008 process = 16843@938mpz3
000009 trace.specification = ==info:com.ibm.zosconnect,wv==FINEST:zosConnect=all:zosConnectServiceCics=all
000010
000011 **** Bottom of Data *****
000012 [8/30/21 15:34:58:201 GMT] 00000064 id=0000000 connect.service.cics.internal.conn.isc.Connection > getVersion Ent
000013 [8/30/21 15:34:58:203 GMT] 00000064 id=e8994268 com.ibm.zosconnect.service.cics.internal.conn.isc.Connection > getVersion Ex
000014
000015 [8/30/21 15:34:58:203 GMT] 00000064 id=0000000 connect.service.cics.internal.conn.isc.headers.ISCHTTPHeader > getHeader Ent
000016
000017 [8/30/21 15:34:58:203 GMT] 00000064 id=0000000 inect.service.cics.internal.conn.isc.headers.IscV2HTTPHeader > <init> Entry
000018 [8/30/21 15:34:58:203 GMT] 00000064 id=438687cd inect.service.cics.internal.conn.isc.headers.IscV2HTTPHeader < init> Exit
000019
```

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Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23

## SYSLOG/STC JESMSGGL DD

```
SDSF OERLOG MPZ3 08/30/2021 0W COLUMNS 02- 133
COMMAND INPUT ==> SCROLL ==> CSR
M 0020000 MPZ3 21242 13:20:25.35 STC10771 00000290 +CUWIKZ0018I: Resource manager BBG.DEFAULT.DA38C9E1985D6C0IBM with 337
D 0020000 MPZ3 21242 13:20:25.35 00000290 The corresponding token ID of 01000001023805f8000000900000007 has successfully restarted with Resource Recovery Services (RRS). Number
E 0020000 MPZ3 21242 13:20:25.35 00000290 of unresolved units of recovery: 0
M 0000000 MPZ3 21242 13:20:25.36 00000290 ATR1691 RRS HAS UNSET EXITS FOR RESOURCE MANAGER 338
H 0020000 MPZ3 21242 13:20:25.36 STC10771 00000290 BBG.DEFAULT.DA38C9E1985D6C0IBM REASON UNREGISTERED
D 0020000 MPZ3 21242 13:20:25.36 00000290 The corresponding token ID of 01000001023805f8000000900000007 has completed.
E 0020000 MPZ3 21242 13:20:25.44 STC10771 00000290 +CUWIKF0011I: Application serverConfig started in 0.036 seconds.
M 4000000 MPZ3 21242 13:20:25.92 STC10771 00000290 +CUWIKF0011I: The myServer server is ready to run a smarter Planet. The
S 4000000 MPZ3 21242 13:20:30.98 STC10771 00000290 myServer server started in 17.991 seconds.
E 4000000 MPZ3 21242 13:20:30.98 STC10771 00000290 ICH4081 USER(USER1 ) GROUP(GSYS1 ) NAME( ) 342
M 0080000 MPZ3 21242 13:20:30.98 STC10771 00000290 ICH4081 USER(USER1 ) GROUP(GSYS1 ) NAME( ) 343
E 0080000 MPZ3 21242 13:20:30.98 STC10771 00000290 ICH4081 USER(USER1 ) GROUP(GSYS1 ) NAME( ) 344
M 8000000 MPZ2 21242 13:20:41.41 STC04167 00000290 DSNU133I -DSNE DSNUVSMF - TRACE DATA LOST, SMF NOT ACCESSIBLE RC=24
N 8000000 MPZ2 21242 13:20:41.44 STC04167 00000290 +CUWIKF0011I: Application serverConfig started in 0.036 seconds.
M 4000000 MPZ3 21242 13:20:41.92 STC10771 00000290 +CUWIKF0011I: The myServer server is ready to run a smarter Planet. The
S 4000000 MPZ3 21242 13:20:41.92 STC10771 00000290 myServer server started in 17.991 seconds.
E 4000000 MPZ3 21242 13:20:41.92 STC10771 00000290 ICH4081 USER(USER1 ) GROUP(GSYS1 ) NAME( ) 345
M 4000000 MPZ1 21242 13:21:00.56 STC04190 00000290 DSNU123I -DSNE DSNUVSMF - TRACE RECORDING HAS BEEN RESUMED ON SMF
N 4000000 MPZ1 21242 13:21:00.56 STC04190 00000290 +CSQX251I ZMQA CSQXSTRL Listener started, TRPTYPE=TCP INDISP=QMGR
M 4000000 MPZ1 21242 13:21:00.56 STC04190 00000290 +CSQX218E ZMQA CSQXLSTT Listener not started - unable to bind, 245
***** Bottom of Data *****
```

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Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23

**STC STDOUT DD**

```
SDSF OUTPUT DISPLAY BAQSTRT STC10771 DSID 103 LINE 84 COLUMNS 02- 133
COMMAND INPUT ==> SCROLL ==> CSR
YAUDIT " BAQR7130I: z/OS Connect EE API minilancies was registered successfully for API Discovery.
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/explorer/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/docs/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/explorer/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/explorer/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/explorer/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/adminCenter/serverConfig/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/adminCenter/jwt/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/adminCenter/explore-1.0/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/adminCenter/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/api/adminCenter/
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/zosConnect/apiRequesters/
YAUDIT " J2CA70011I: Resource adapter smoa installed in 4.765 seconds.
YAUDIT " CUWIKZ0014W: The application resources could not be started as it could not be found at location /var/zosconnect/servers/m
YAUDIT " CUWIKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/server/config/
YAUDIT " CUWIKT0016I: Application serverConfig started in 0.036 seconds.
YAUDIT " CUWIKF0011I: The myServer server is ready to run a smarter Planet. The myServer server started in 17.991 seconds.
YAUDIT " CUWIKS1100A: Authentication did not succeed for user ID user1. An invalid user ID or password was specified.
YAUDIT " CUWIKS1100A: Authentication did not succeed for user ID user1. An invalid user ID or password was specified.
***** Bottom of Data *****
```

04/021

Connected to remote server/host mpz3 using lu/pool MPZ30030 and port 23

# Issues and problems can be categorized

- First realize that actual products problems do occur, but they are rare. In my experience most problems and issues can be resolved with a little investigation and some analysis. I have found that most problems and issues will fall in 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/zceoepid/  
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  
*****  
[9/3/21 13:38:02:831 GMT] 00000013 com.ibm.ws.kernel.launch.internal.FrameworkManager  
[9/3/21 13:38:04:439 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser  
[9/3/21 13:38:04:466 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser  
[9/3/21 13:38:04:470 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser  
[9/3/21 13:38:04:473 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser  
[9/3/21 13:38:04:476 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser  
[9/3/21 13:38:04:481 GMT] 0000001f com.ibm.ws.config.xml.internal.XMLConfigParser  
[9/3/21 13:38:04:610 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker  
[9/3/21 13:38:04:612 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker  
[9/3/21 13:38:04:628 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker  
[9/3/21 13:38:04:679 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker  
[9/3/21 13:38:04:680 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker  
[9/3/21 13:38:04:680 GMT] 00000021 com.ibm.ws.zos.core.internal.NativeServiceTracker  
- - - - -  
[9/3/21 13:38:42:347 GMT] 00000040 om.ibm.ws.app.manager.rar.internal.RARApplicationHandlerImpl  
[9/3/21 13:38:42:419 GMT] 0000003e com.ibm.ws.jmx.connector.server.rest.RESTAppListener  
[9/3/21 13:38:42:422 GMT] 0000003e com.ibm.ws.jmx.connector.server.rest.RESTAppListener  
[9/3/21 13:38:42:428 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPPort  
[9/3/21 13:38:42:431 GMT] 0000002c com.ibm.ws.tcpchannel.internal.TCPPort  
[9/3/21 13:38:42:437 GMT] 00000042 com.ibm.ws.webcontainer.osgi.mbeans.PluginGenerator  
[9/3/21 13:38:42:489 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager  
[9/3/21 13:38:42:490 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager  
[9/3/21 13:38:42:490 GMT] 0000002c com.ibm.ws.kernel.feature.internal.FeatureManager  
[9/3/21 13:41:31:640 GMT] 00000045 .security openidconnect.client.internal.OidcClientConfigImpl  
[9/3/21 13:41:31:691 GMT] 00000045 http.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 zceoepid has been launched.  
A CWWKG0028A: Processing included configuration resource  
I CWWKB0125I: This server requested a REGION size of 0KB  
I CWWKB0126I: MEMLIMIT=2000. MEMLIMIT CONFIGURATION SOUR  
I CWWKB0122I: This server is connected to the default an  
I CWWKB0103I: Authorized service group KERNEL is availab  
I CWWKB0103I: Authorized service group LOCALCOM is avail  
I CWWKB0103I: Authorized service group PRODMGR is availa  
- - - - - 148 Line(s) not Displayed  
A J2CA7001I: Resource adapter imsudbJLocal installed in  
I CWWKX0103I: The JMX REST connector is running and is a  
I CWWKX0103I: The JMX REST connector is running and is a  
I CWWKO0219I: TCP Channel defaultHttpEndpoint has been s  
I CWWKO0219I: TCP Channel defaultHttpEndpoint-ssl has be  
I SRVE9103I: A configuration file for a web server plugi  
A CWWKF0012I: The server installed the following feature  
I CWWKF0008I: Feature update completed in 37.484 seconds  
A CWWKF0011I: The zceoepid 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

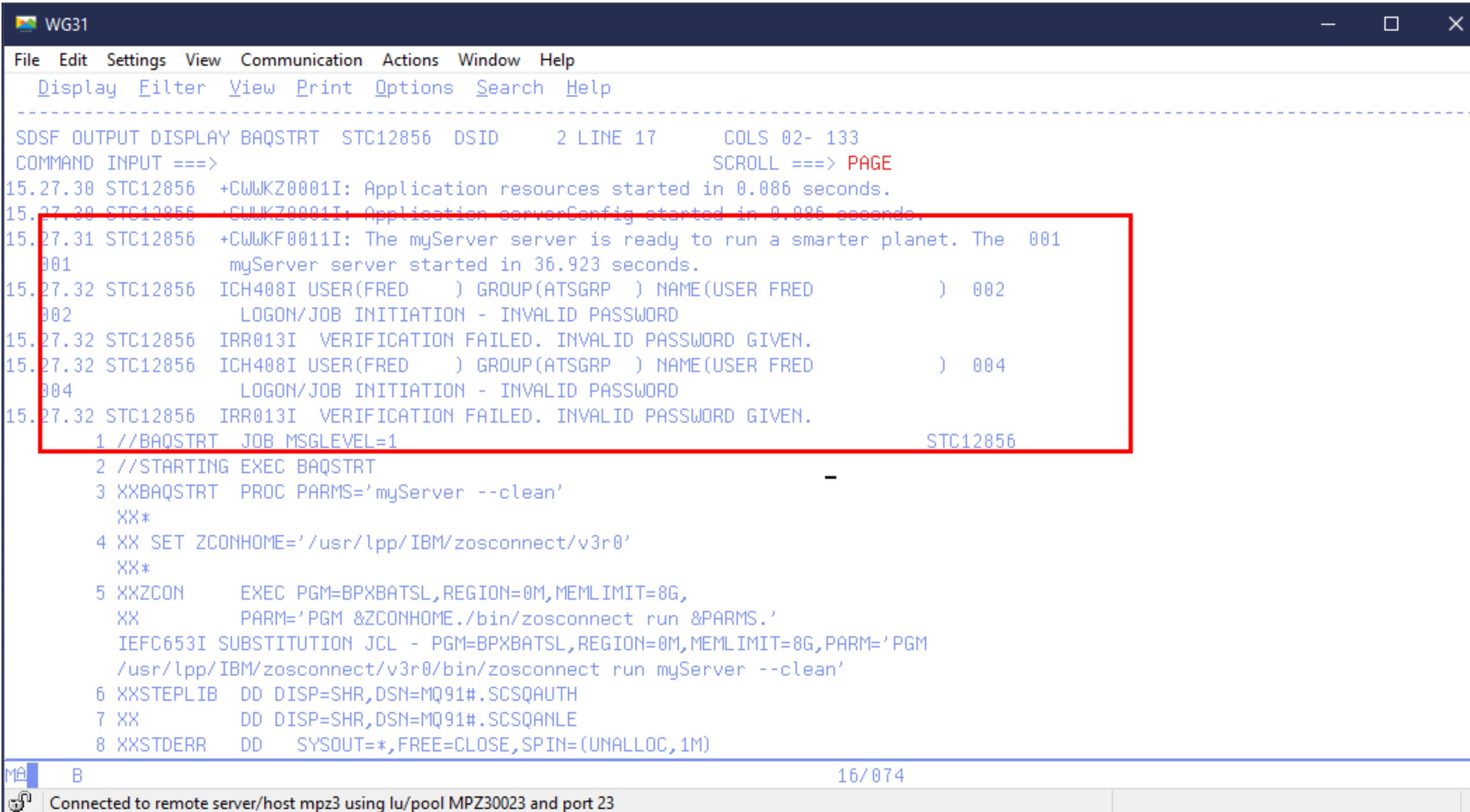
The STDOUT may show:

```
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)

mitchj@us.ibm.com 16/074 © 2017, 2024 IBM Corporation  
Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23

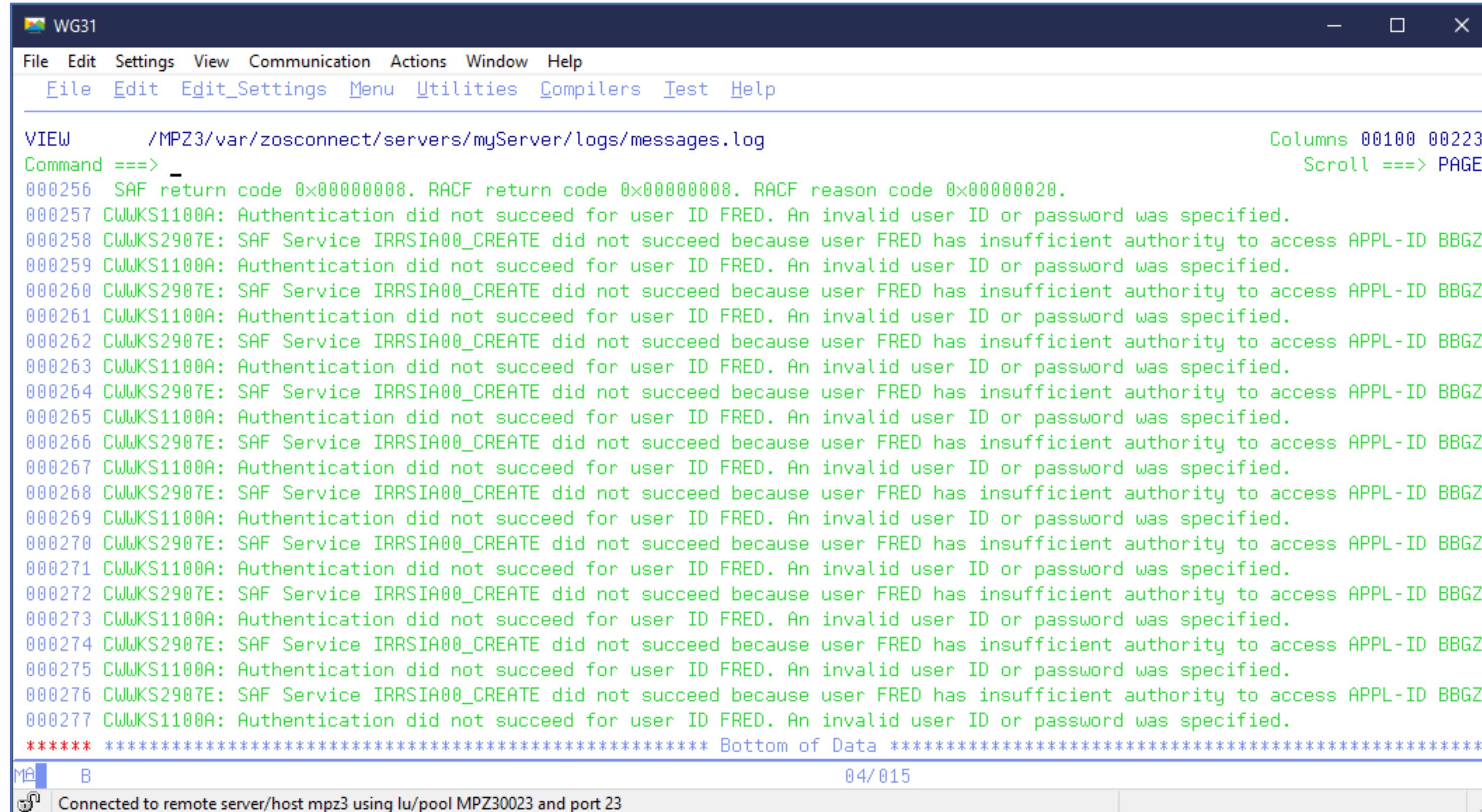
# Basic security issues – Sometimes you must dig a little more

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

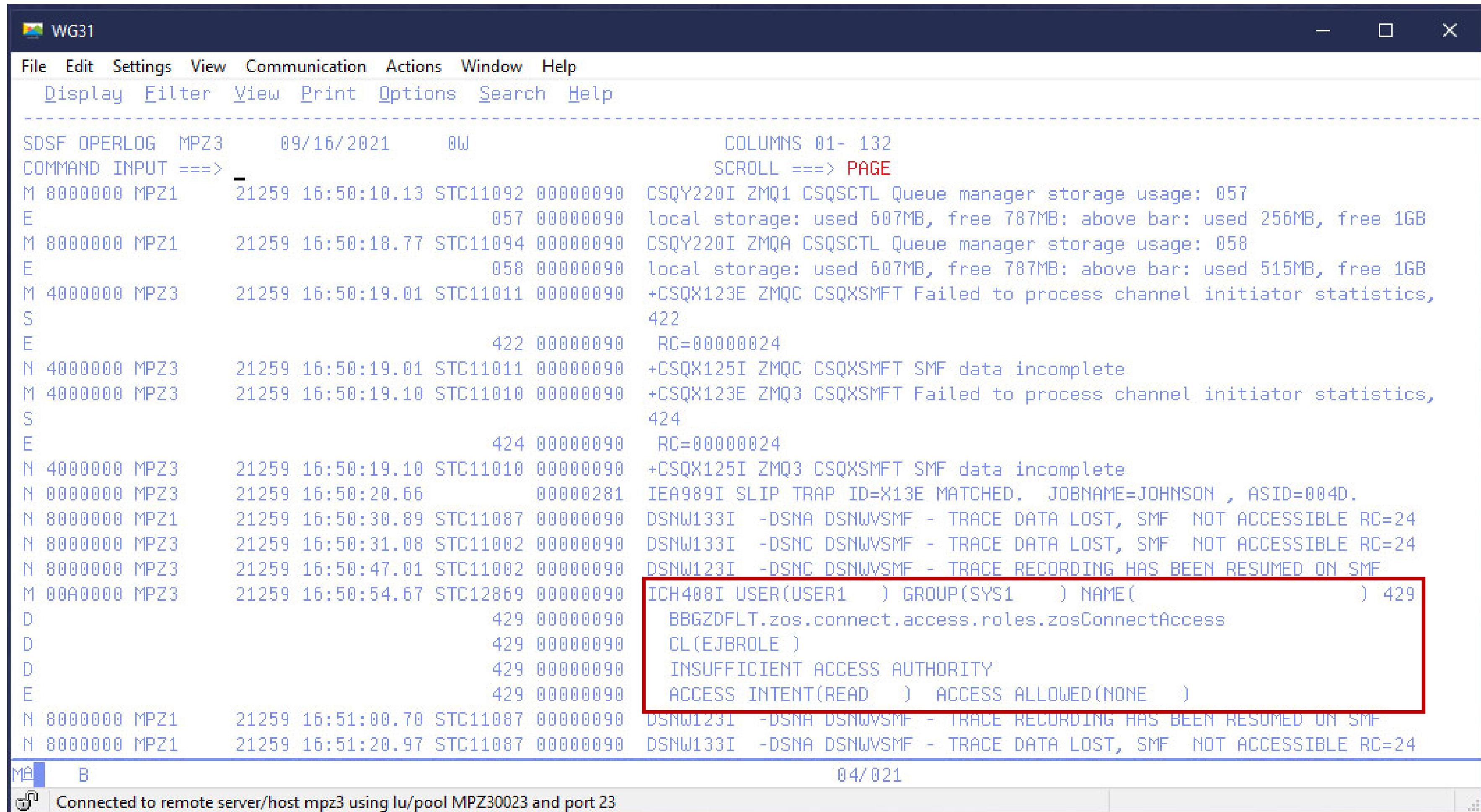
SAF return code	RACF® return code	RACF reason code	Explanation
0	0	0	The service was successful.
4	0	0	RACF is not installed.
8	8	4	Parameter list error occurred.
8	8	8	An internal error occurred during RACF processing.
8	8	12	Recovery environment could not be established.
8	8	16	User ID is not defined 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 <a href="#">Return and reason codes</a> .

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 ==> -
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
-----
```

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

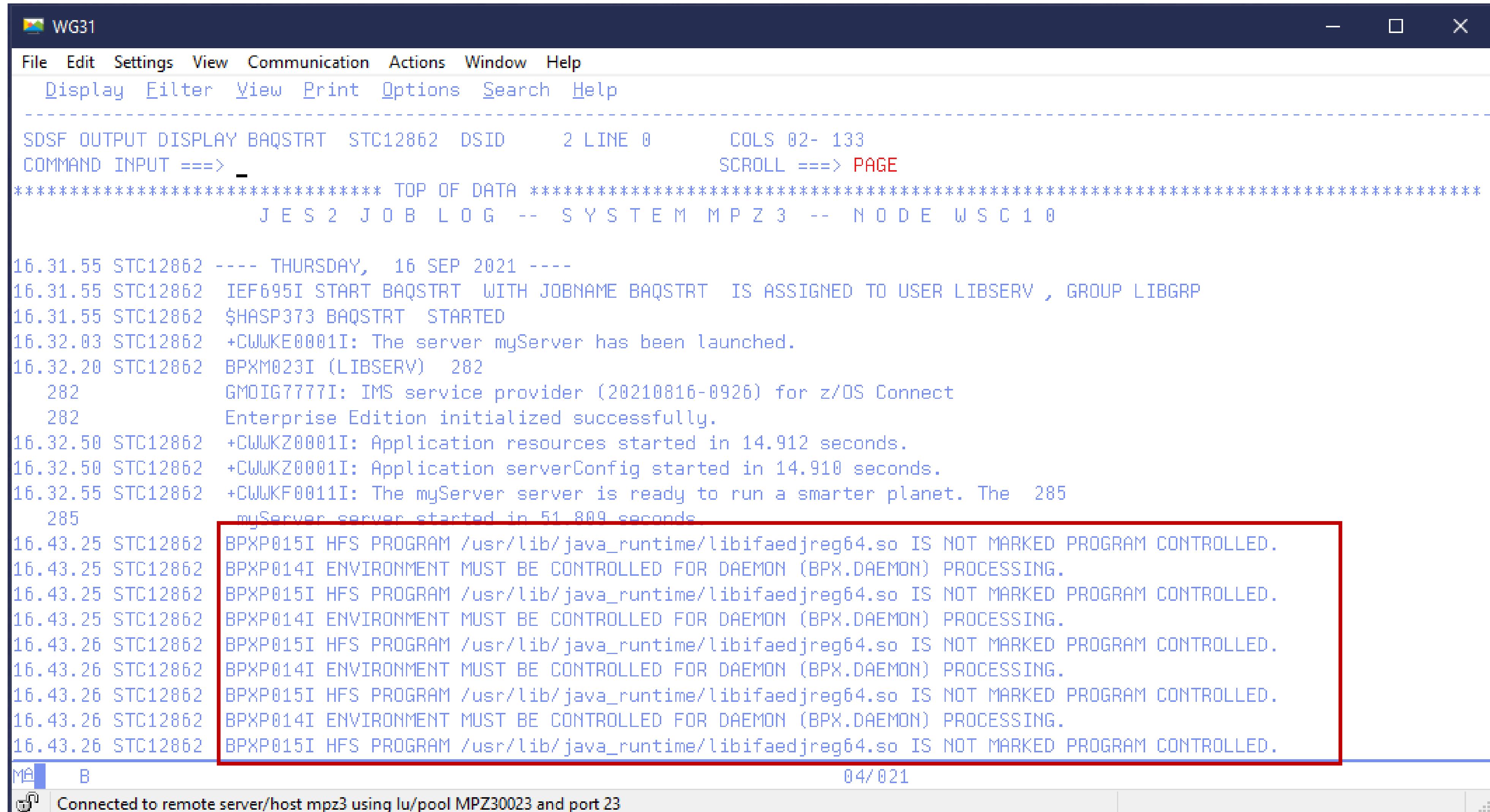
SDSF OUTPUT DISPLAY BAQSTRT STC12844 DSID 103 LINE 98 COLS 02- 133  
COMMAND INPUT ==> SCROLL ==> PAGE

```
YAUDIT  " CWWKZ0001I: Application serverConfig started in 4.006 seconds.  
YAUDIT  " CWWKZ0001I: Application resources started in 4.007 seconds.  
YAUDIT  " CWWKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/zosConnect/apiRequesters/  
YAUDIT  " CWWKT0016I: Web application available (default_host): http://dvipa.washington.ibm.com:9080/  
YAUDIT  " CWWKF0012I: The server installed the following features: YadmindCenter-1.0, apiDiscovery-1.0, appSecurity-2.0, distributed  
YAUDIT  " CWWKF0011I: The myServer server is ready to run a smarter planet. The myServer server started in 66.646 seconds.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
YAUDIT  " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.  
***** BOTTOM OF DATA *****
```

MA B 04/021

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

# 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.*

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

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

```
VIEW      /MPZ3/var/zosconnect/servers/myServer/logs/messages.log          Columns 00100 00223
Command ==>
000021 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/shared.xml
000022 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/oauth.xml
000023 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/audit.xml
000024 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/mq.xml
000025 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/db2.xml
000026 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/wlm.xml
000027 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/restConnector.xml
000028 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/smf.xml
000029 CWKG0028A: Processing included configuration resource: /var/zosconnect/servers/myServer/includes/adminCenter.xml
000030 CWKB0125I: This server requested a REGION size of 0KB. The below-the-line storage limit is 8MB and the above-the-line stor
000031 CWWKRB0126I: MFML TMTT=20000. MFML TMTT CONFIGURATION SOURCE=TCI
000032 CWKB0101I: The angel process is not available. No authorized services will be loaded. The reason code is 4.
000033 CWKB0104I: Authorized service group KERNEL is not available.
000034 CWKB0104I: Authorized service group LOCALCOM is not available.
000035 CWKB0104I: Authorized service group PRODMGR is not available.
000036 CWKB0104I: Authorized service group SAFCRE is not available.
000037 CWKB0104I: Authorized service group TXRRS is not available.
000038 CWKB0104I: Authorized service group WOLA is not available.
000039 CWKB0104I: Authorized service group ZOSAIO is not available.
000040 CWKB0104I: Authorized service group ZOSDUMP is not available.
000041 CWKB0104I: Authorized service group ZOSWLM is not available.
000042 CWKB0104I: 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:

IMS service provider classes  
z/OS Connect Java classes

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

Root cause – Datastore mistyped in the interaction configuration

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# First Failure Data Collection (FFDC)

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

MQ service provider classes

Root cause – Queue was configured to disable the MQPUT request



# 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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# 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: cURL trace of a TLS Handshake

- \* successfully set certificate verify locations:
  - \* CAfile: certauth.pem
  - CApath: none
  - \* TLSv1.3 (OUT), TLS handshake, Client hello (1):
  - \* TLSv1.3 (IN), TLS handshake, Server hello (2):
  - \* TLSv1.2 (IN), TLS handshake, Certificate (11):
  - \* TLSv1.2 (IN), TLS handshake, Server key exchange (12):
  - \* TLSv1.2 (IN), TLS handshake, Server finished (14):
  - \* TLSv1.2 (OUT), TLS handshake, Client key exchange (16):
  - \* TLSv1.2 (OUT), TLS change cipher, Change cipher spec (1):
  - \* 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: Dec 23 04:00:00 2020 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.
- \* 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):



# A FFDC dump showing an SSL Handshake issue

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

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

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

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

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



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

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

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

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

# 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.

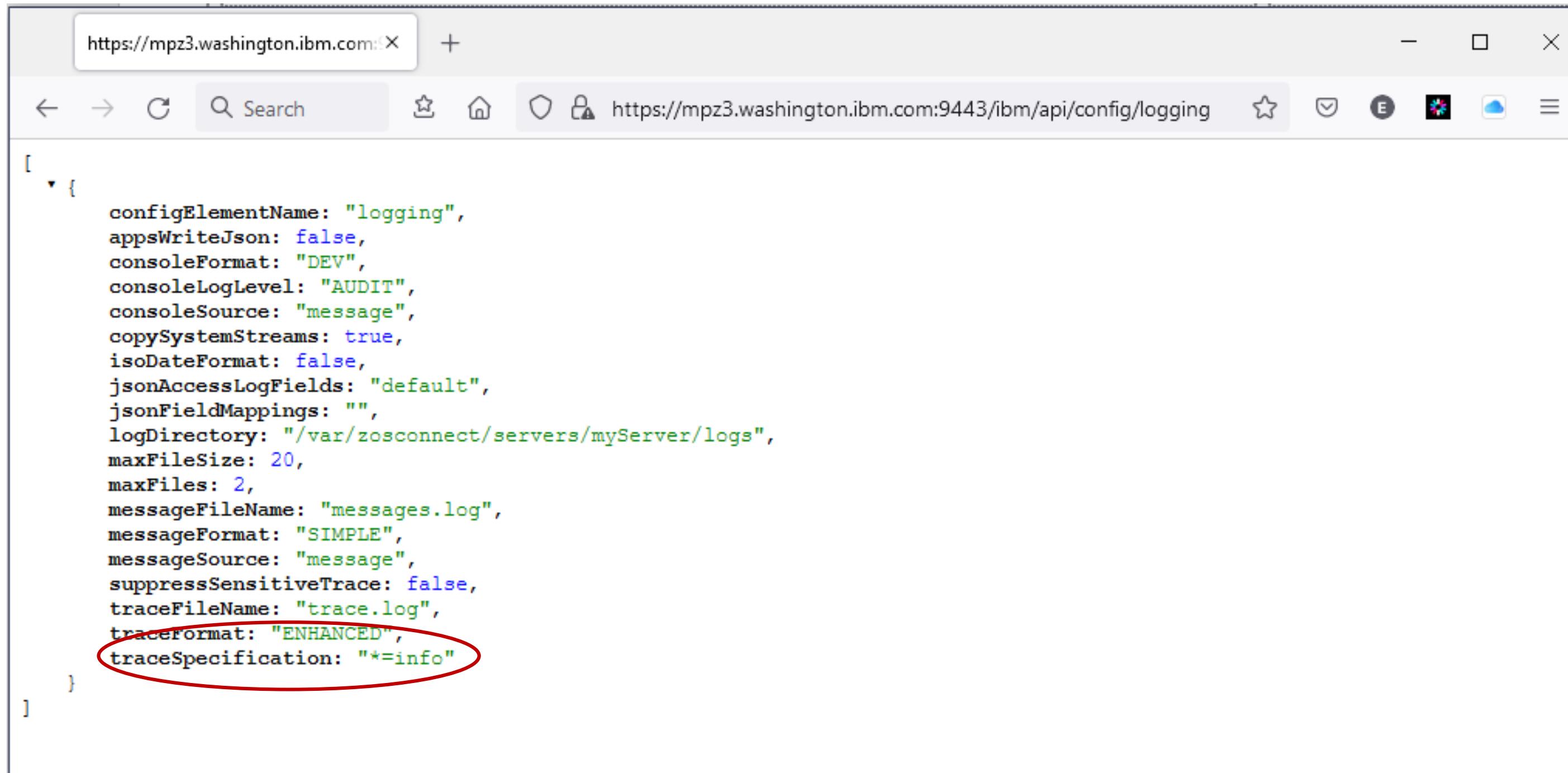
- Another possibility is that the TLS handshake the negotiations between the client and server failed, e.g.,  
*javax.net.ssl.SSLHandshakeException: Client requested protocol SSLv3 is not enabled or supported in server context*



# 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`



The screenshot shows a web browser window with the URL `https://wg31.washington.ibm.com:9443/ibm/api/config/logging`. The page displays a JSON object representing the logging configuration. A red oval highlights the `traceSpecification` field, which is set to `"*=info"`.

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

## Enabling trace in z/OS Connect EE server

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



# Managing trace specifications

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

## server.xml

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

## safTrace.xml

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

## cicsTrace.xml

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

## imsTrace.xml

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

## Enables enhanced tracing

(after adding an “include” file)  
F 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
003698      < getSSLConfig Exit
003699      SSLConfig.toString() {
003700      - - - - - 4 Line(s) not Displayed
003701      > determineIfCSIV2SettingsApply Entry
003702      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
003703      < determineIfCSIV2SettingsApply (original settings) Exit
003704      - - - - - 43 Line(s) not Displayed
003705      3 keyStoreType: JCERACFKS
003706      3 trustStoreType: JCERACFKS
003707      - - - - - 44 Line(s) not Displayed
003708      3 keyStore: safkeyring://Liberty.KeyRing
003709      3 keyStoreName: CellDefaultKeyStore
003710      3 keyStorePassword: *****
003711      3 trustStore: safkeyring://Liberty.KeyRing
003712      3 trustStoreName: CellDefaultKeyStore
003713      3 trustStorePassword: *****
003714      - - - - - 2 Line(s) not Displayed
003715      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
003716      - - - - - 1 Line(s) not Displayed
004117 k      3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004118      - - - - - 375 Line(s) not Displayed
004119      3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004120      - - - - - 1 Line(s) not Displayed
004121      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004122      - - - - - 22 Line(s) not Displayed
004144      > isTransportSecurityEnabled Entry
004145      < isTransportSecurityEnabled true Exit
004146      - - - - - 1 Line(s) not Displayed
004150      > getSSLConfig: DefaultSSLSettings Entry
004151      < getSSLConfig Exit
004152      SSLConfig.toString() {
004153      - - - - - 4 Line(s) not Displayed
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
004199      - - - - - 43 Line(s) not Displayed
004243      3 keyStoreType: JCERACFKS
004244      3 trustStoreType: JCEPKEK
004245      - - - - - 44 Line(s) not Displayed
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: *****
004253      - - - - - 2 Line(s) not Displayed
004254      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004255      - - - - - 1 Line(s) not Displayed
004630 k      3 Error occurred during a read, exception:javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004631      - - - - - 375 Line(s) not Displayed
004632      3 Caught exception during unwrap, javax.net.ssl.SSLHandshakeException: Empty server certificate chain
004633      - - - - - 1 Line(s) not Displayed
004655      (com.ibm.ssl.remoteHost=*, com.ibm.ssl.direction=inbound, com.ibm.ssl.remotePort=9443, com.ibm.ssl.endPointName=defaultHttpEndpoint-ssl)
004656      - - - - - 22 Line(s) not Displayed
004657      > isTransportSecurityEnabled Entry
004658      < isTransportSecurityEnabled true Exit
004659      - - - - - 1 Line(s) not Displayed
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 two GitHub repository pages side-by-side.

**Left Repository:** [ibm-wsc/zCONNEE-Wildfire-Workshop](#)

- Code tab selected.
- Branch: master (1 branch, 0 tags).
- Commits by emitchj:
  - Delete ZCONNEE - Introduction (with AdminSecurity folder circled)
  - Add files via upload (with AdminSecurity folder circled)
  - Customization Basic Configuration(1of2) (1).pdf
  - Customization Basic Configuration(1of2) (2).pdf
  - Customization Security and CICS.pdf
  - Customization Security and DB2.pdf
  - Customization Security and JWT Tokens.pdf
  - Customization Security and MQ.pdf
  - Customization Security when accessing an IMS Database....
  - Customization Security when accessing an IMS Transaction...
  - Customization Security with MVS Batch.pdf
  - admin
- README.md
- README.md

**Right Repository:** [zCONNEE-Wildfire-Workshop/AdminSecurity](#)

- Code tab selected.
- Branch: master (1 branch, 0 tags).
- Commits by emitchj:
  - Add files via upload
  - Customization Basic Configuration(1of2) (1).pdf
  - Customization Basic Configuration(1of2) (2).pdf
  - Customization Security and CICS.pdf
  - Customization Security and DB2.pdf
  - Customization Security and JWT Tokens.pdf
  - Customization Security and MQ.pdf
  - Customization Security when accessing an IMS Database....
  - Customization Security when accessing an IMS Transaction...
  - Customization Security with MVS Batch.pdf
  - admin

mitchj@us.ibm.com

- Contact your IBM representative to schedule access to these exercises

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Thank you for listening and your questions.

## **Miscellaneous Odds and Ends**

# Sysplex DVIPAs

## SYS1.TCPIP.TCPPARMS (IPNODES)

```
192.168.17.241 MPZ1.DMZ MPZ1 mpz1.washington.ibm.com
192.168.17.242 MPZ2.DMZ MPZ2 mpz2.washington.ibm.com
192.168.17.243 wg31.DMZ wg31 wg31.washington.ibm.com
192.168.17.240 dvipa dvipa.washington.ibm.com
```

## SYS1.TCPIP.TCPPARMS (PROFwg31)

```
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**

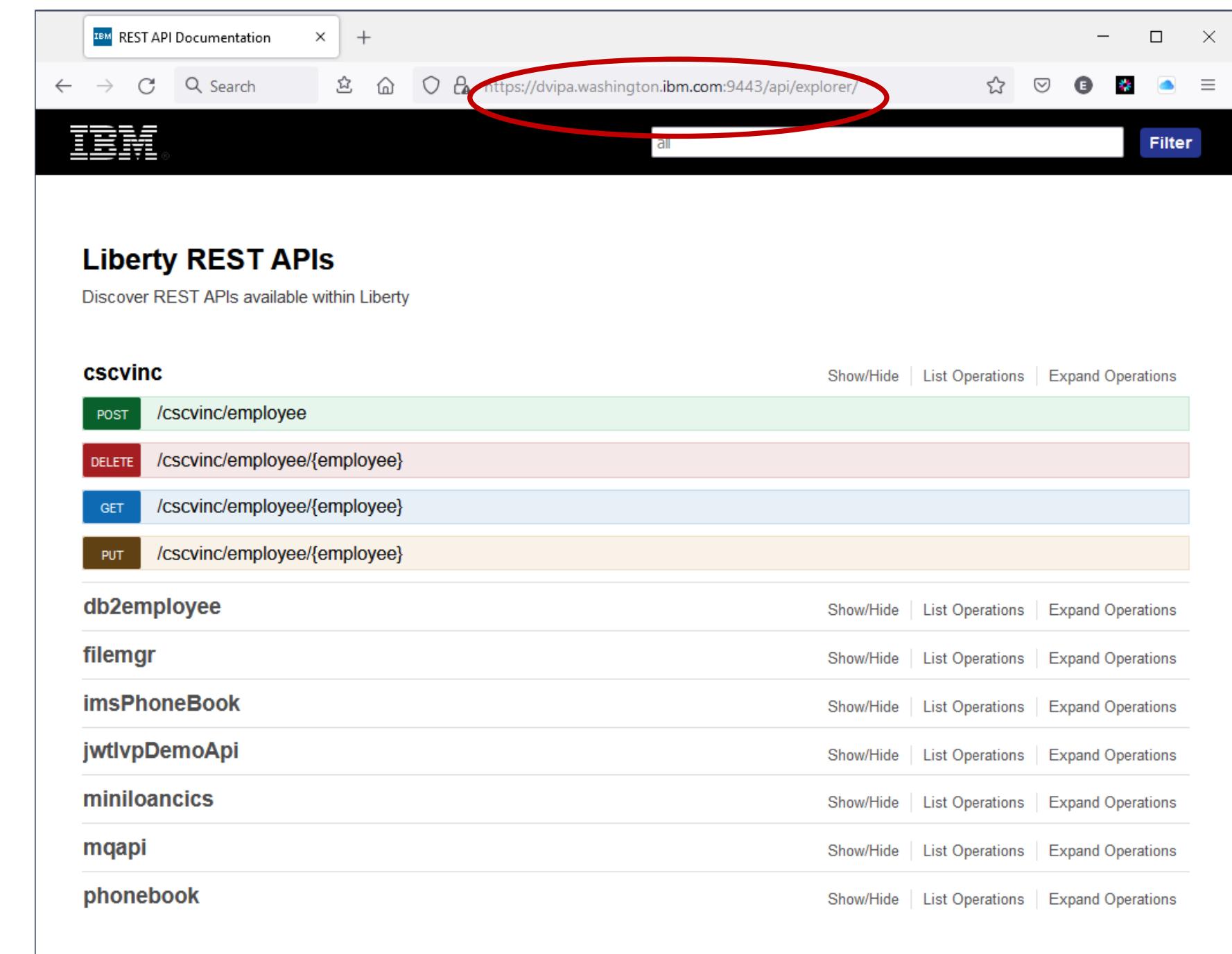
## HOMETEST

```
EZA0619I Running IBM MVS TCP/IP CS V2R4 TCP/IP Configuration Tester
EZA0602I TCP Host Name is: wg31

EZA0605I Using Name Server to Resolve wg31
EZA0611I The following IP addresses correspond to TCP Host Name: wg31
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 wg31 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	
<b>POST</b>	/cscvinc/employee
<b>DELETE</b>	/cscvinc/employee/{employee}
<b>GET</b>	/cscvinc/employee/{employee}
<b>PUT</b>	/cscvinc/employee/{employee}
<b>db2employee</b>	
<b>filemgr</b>	
<b>imsPhoneBook</b>	
<b>jwtlvpDemoApi</b>	
<b>miniloancics</b>	
<b>mqapi</b>	
<b>phonebook</b>	

# 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)

# Sample JCL - Executing the Liberty *productInfo* command



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

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

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

```
cicsService-1.0 ÿ1.0.0"  
wmqJmsClient-1.1 ÿ1.0.0"  
wmqJmsClient-2.0 ÿ1.0.0"  
Product Extension: mqzosconnect  
mqService-1.0 ÿ1.0.0"  
Product Extension: imsmobile  
imsmobile-2.0 ÿ2.0.0.202108160933"  
Product validation completed successfully.
```



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

```
//JOHNSONS JOB (ACCOUNT),JOHNSON,NOTIFY=JOHNSON,REGION=0M,  
// CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)  
//EXPORT EXPORT SYMLIST=(*  
// SET REPORT='LibertyExport'  
//JAVA EXEC PROC=JVMPRC86,  
// JAVAACLs='com.ibm.ws390.sm.smfview.JclSmf'  
//STDENV DD DISP=SHR,DSN=JOHNSON.JCLLIB.CNTL(STDENV)  
//SMFDATA DD DISP=SHR,DSN=wg31.DUMPSMF  
//SMFENV DD *,SYMBOLS=EXECSYS  
# Specify the plugin to use  
plugin=&REPORT  
# Specify where the output goes  
output=/u/johnson/&REPORT..csv  
# Uncomment (and change the value as appropriate) to filter  
#matchServer=BAQSTRT
```

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

# Sample JCL – Generate WLM Workload Activity Reports



```
//JOHNSONS JOB (ACCOUNT), NOTIFY=&SYSUID, REGION=0M,  
// CLASS=A, MSGCLASS=H, MSGLEVEL=(1, 1)  
//DELETE EXEC PGM=IDCAMS  
//SYSPRINT DD SYSOUT=*  
//SYSIN DD *  
    DELETE JOHNSON.DUMPSMF.SORT  
//RMFSORT EXEC PGM=SORT, REGION=0M  
//SORTIN DD DISP=SHR, DSN=wg31.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 */
```