



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  or an IMS  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.

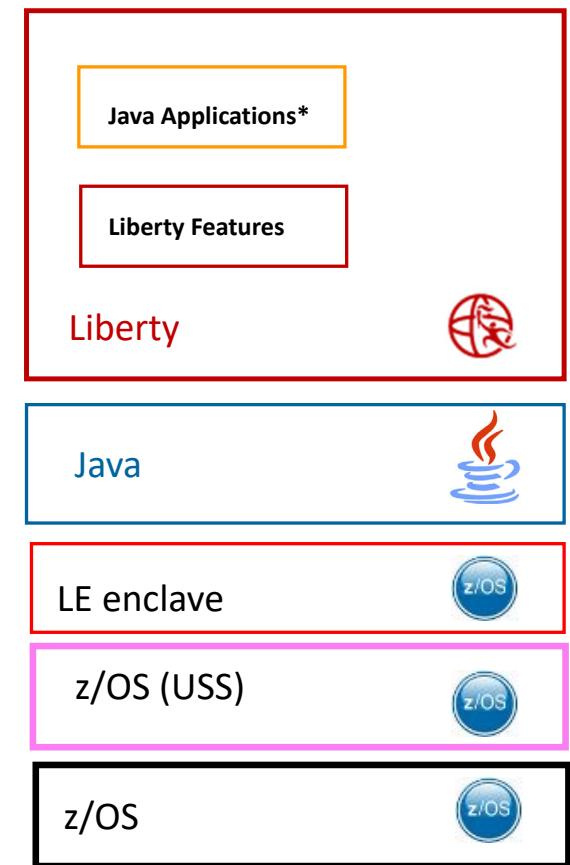
Agenda

- **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 environment 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

Managing Liberty Servers

**Useful Liberty features and
MVS commands**



Liberty feature: adminCenter-1.0

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

```
Server Config
adminCenter.xml
Read only Close

Design Source

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

Required EJBRoles

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

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

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

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

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



Liberty feature: adminCenter-1.0 – example

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

The screenshot shows the IBM Liberty adminCenter-1.0 interface. On the left, a sidebar lists various configuration sections like z/OS Connect Manager, z/OS Logging, and Application Monitoring. The main area is titled "Server Config" and shows the "server.xml" configuration file. The "Source" tab is active, displaying the XML code for the server configuration. A content assist dropdown is open over the XML code, showing suggestions such as "zosconnect_apiRequester", "zosconnect_apiRequesters", "zosconnect_auditInterceptor", etc. A red oval highlights the tooltip "Press Ctrl+space for content assist." located at the top right of the content assist dropdown.



Liberty feature: restConnector-2.0

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

The screenshot shows the 'Server Config' interface for a server named 'restConnector.xml'. The 'Source' tab is selected, displaying the XML configuration:

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

To the right of the configuration, a list of generated REST endpoints is shown:

- <https://wg31.washington.ibm.com:9443/ibm/api/config/jmsQueue>
- https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?port=1491
- https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectServiceRestClientConnection
- https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_cicsIpicConnection?id=miniloan
- <https://wg31.washington.ibm.com:9443/ibm/api/config/safCredentials>
- <https://wg31.washington.ibm.com:9443/ibm/api/config/connectionFactory>
- https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectManager
- <https://wg31.washington.ibm.com:9443/ibm/api/config/keyStore>
- <https://wg31.washington.ibm.com:9443/ibm/api/config/ssl>
- <https://wg31.washington.ibm.com:9443/ibm/api/config/sslDefault>
- https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectManager
- https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_zosConnectAPIs
- https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_services
- https://wg31.washington.ibm.com:9443/ibm/api/config/zosconnect_apiRequesters

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



Liberty feature: restConnector-2.0 – featureManager example

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

The screenshot shows a browser window with the URL <https://mpz3.washington.ibm.com:9443/ibm/api/config/featureManager>. The page displays a JSON object representing the featureManager configuration. The JSON structure is as follows:

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

Liberty feature: restConnector-2.0 – safCredentials/safAuthorization examples



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

A screenshot of a web browser window displaying a JSON configuration object. The URL in the address bar is `https://mpz3.washington.ibm.com:9443/ibm/api/config/safCredentials`. The JSON content is:

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

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

A screenshot of 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/safAuthorization`. The JSON content is:

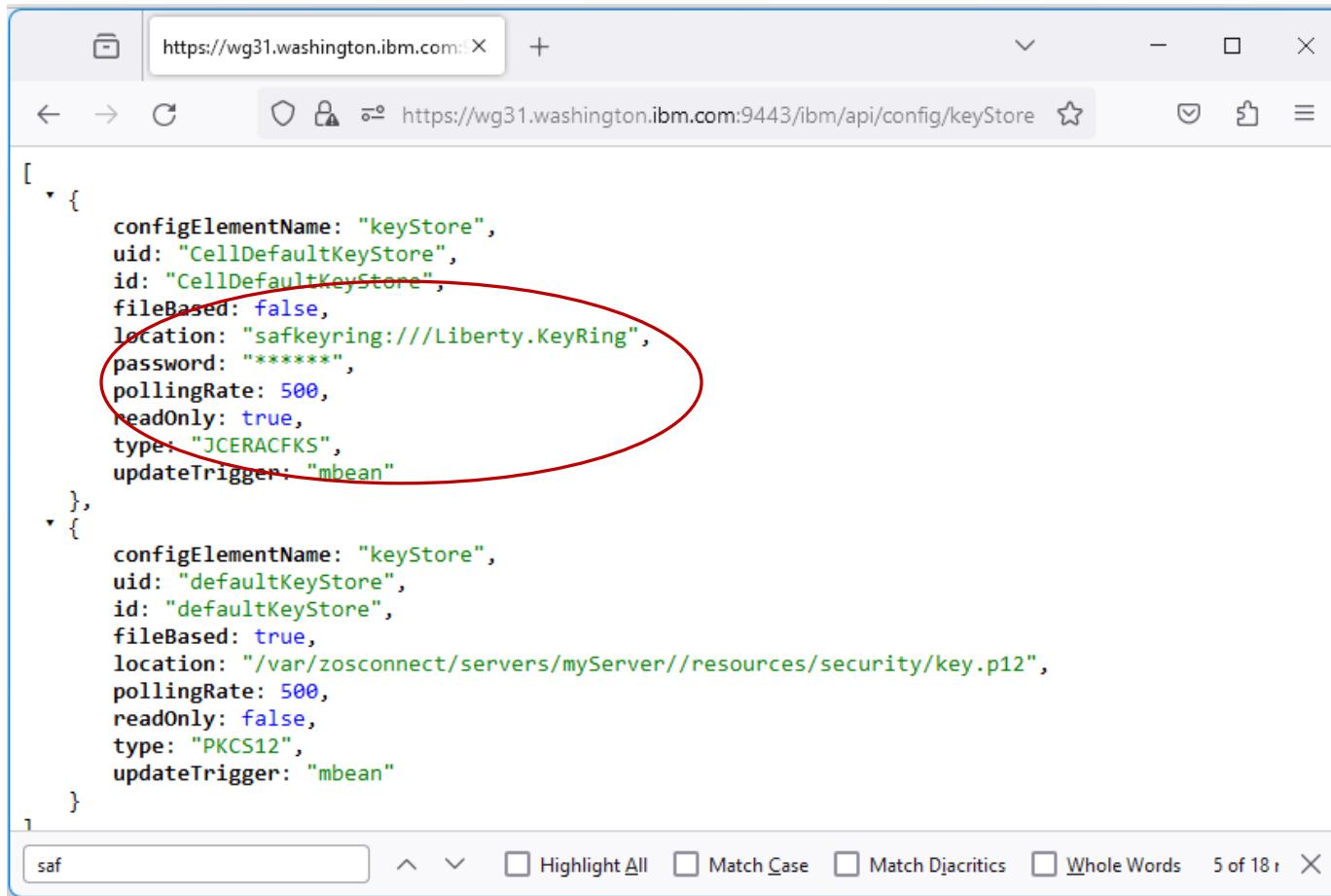
```
[  
  {  
    configElementName: "safAuthorization",  
    uid: "safAuthorization[default-0]",  
    enableDelegation: false,  
    racRouteLog: "ASIS",  
    reportAuthorizationCheckDetails: false,  
    roleMapper: "com.ibm.ws.security.authorization.saf.internal.SAFAuthorizationImpl"  
  }]
```

At the bottom of the browser window, there is a search bar containing the text "saf". Below the search bar are several search-related buttons: "Highlight All", "Match Case", "Match Diacritics", and "Whole Words". To the right of these buttons, it says "5 of 18 matches".



Liberty feature: restConnector-2.0 – keystore example

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

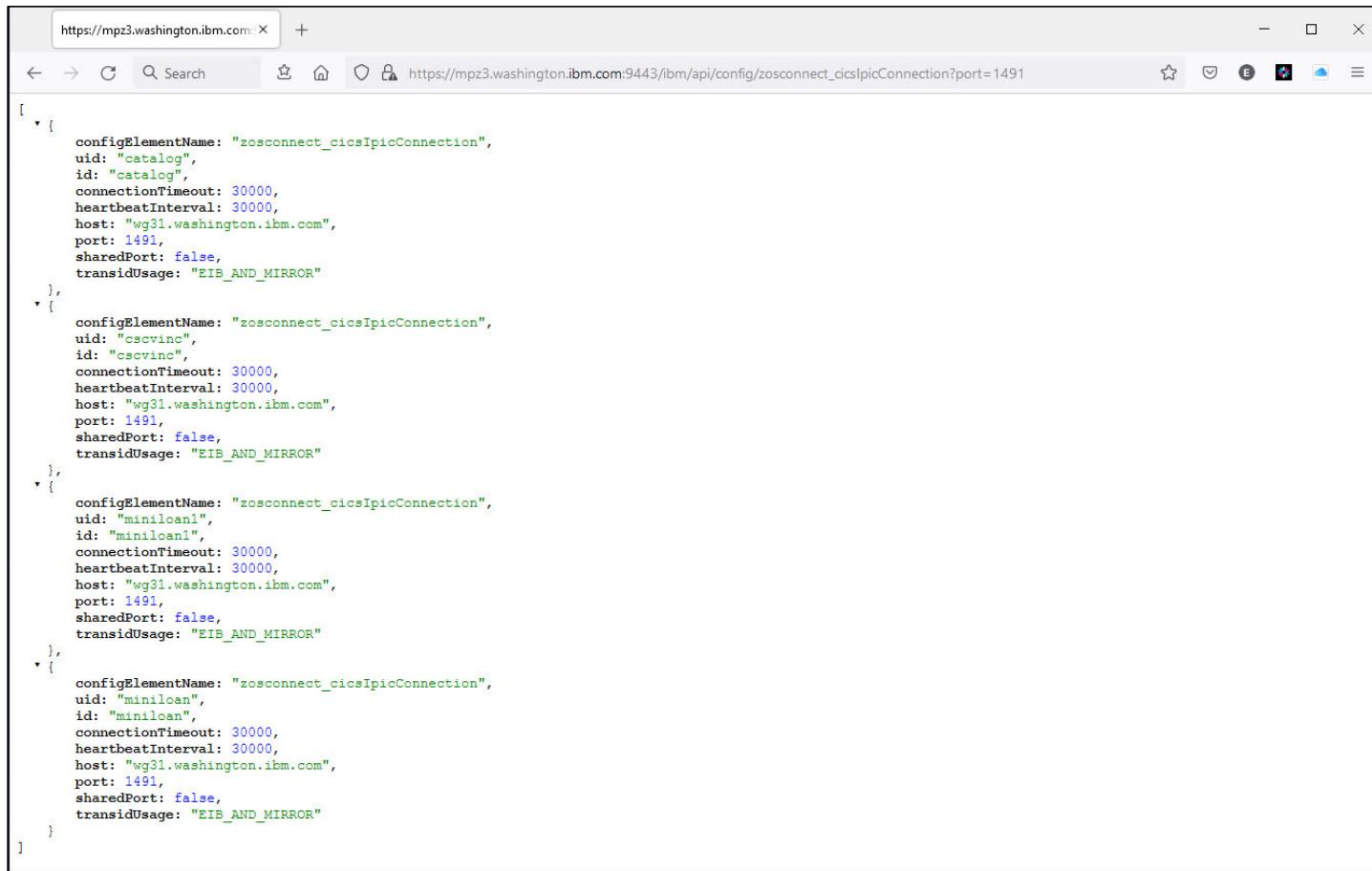


```
[  
  {  
    configElementName: "keyStore",  
    uid: "CellDefaultKeyStore",  
    id: "CellDefaultKeyStore",  
    fileBased: false,  
    location: "safkeyring:///Liberty.KeyRing",  
    password: "*****",  
    pollingRate: 500,  
    readOnly: true,  
    type: "JCEERACFKS",  
    updateTrigger: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



Liberty feature: restConnector-2.0 – zosconnect_cicsIpicConnection example

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



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



Liberty feature: restConnector-2.0 – CICS ECI connection factory example

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

The screenshot shows a browser window with the URL <https://wg31.washington.ibm.com:9443/ibm/api/config/connectionFactory>. The page displays a JSON object representing a connection factory configuration. A red box highlights the 'properties.eciResourceAdapter' section, which contains various properties for the ECI resource adapter. The JSON structure 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"]}]
```

Liberty feature: restConnector-2.0 – IMS connection factory example



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

The image shows two side-by-side browser windows displaying JSON configuration data for Liberty features.

Left Browser Window: The URL is https://wg31.washington.ibm.com:9453/ibm/api/config/imsmobile_imsConnection. The JSON content describes an `imsmobile_imsConnection` configuration element. It includes a `connectionFactoryRef` pointing to `IVP1`, an `authDataRef` for `Connection1_Auth`, and properties related to SSL/TLS, connection timeout, and security. A red box highlights the `properties.gmoa` section, which contains various SSL-related parameters like `SSLProtocol`, `SSLTrustStoreName`, and `SSLTrustStorePassword`.

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

Right Browser Window: The URL is https://wg31.washington.ibm.com:9453/ibm/api/config/imsmobile_interaction. The JSON content describes an `imsmobile_interaction` configuration element. It includes parameters for interaction types, timeouts, and message processing. A search bar at the bottom of this window contains the text `imsinter`.

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

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Liberty feature: restConnector-2.0 – IMS connection factory example



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

The screenshot shows a browser window with the URL https://wg31.washington.ibm.com:9445/ibm/api/config/zosconnect_imsConnection. The page displays a JSON configuration object. A red box highlights the 'properties.gmoa' section, which contains various connection parameters. The JSON structure is as follows:

```
[{"configElementName": "zosconnect_imsConnection", "uid": "imsConn", "id": "imsConn", "commitMode: 1, "connectionFactoryRef": {"configElementName: "connectionFactory", "uid": "imsConnectionFactory", "id": "imsConnectionFactory", "containerAuthDataRef": {"configElementName": "authData", "uid": "IMSCredentials", "id": "IMSCredentials", "password": "*****", "user": "${IMS_USER}"}, "properties.gmoa": {"CMODedicated: false, IMSSConnectName: "", 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/imsConnectionFactory"]}, "imsConnectCodepage: "Cp1047", "imsConnectTimeout: 0, "imsDatastoreName: "IVP1", "interactionTimeout: 0, "pingIMSConnectOnInvoke: false, "propagateNetworkSecurityCred: true, "syncLevel: 0, "tranExpiration: false}]
```

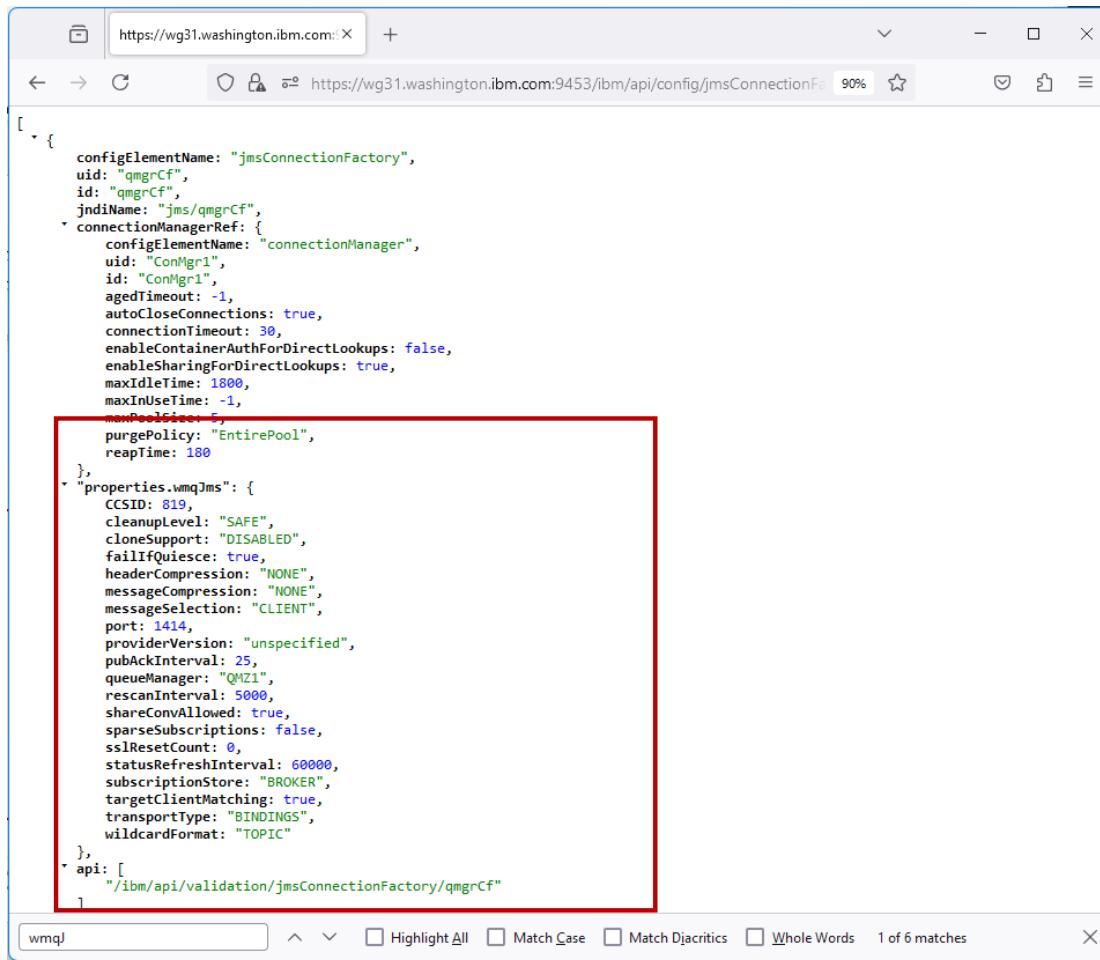
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Liberty feature: restConnector-2.0 – jmsConnectionFactory example



<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": "QM21", "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". The URL is <https://mpz3.washington.ibm.com:9443/api/explorer/#/cscvinc>. The page displays the "Liberty REST APIs" section, specifically for the "cscvinc" service. It lists several API operations:

- cscvinc**:
 - POST /cscvinc/employee
 - DELETE /cscvinc/employee/{employee}
 - GET /cscvinc/employee/{employee}
 - PUT /cscvinc/employee/{employee}
- db2employee**:
 - Show/Hide | List Operations | Expand Operations
- filemgr**:
 - Show/Hide | List Operations | Expand Operations
- imsPhoneBook**:
 - Show/Hide | List Operations | Expand Operations
- jwltvpDemoApi**:
 - 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



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

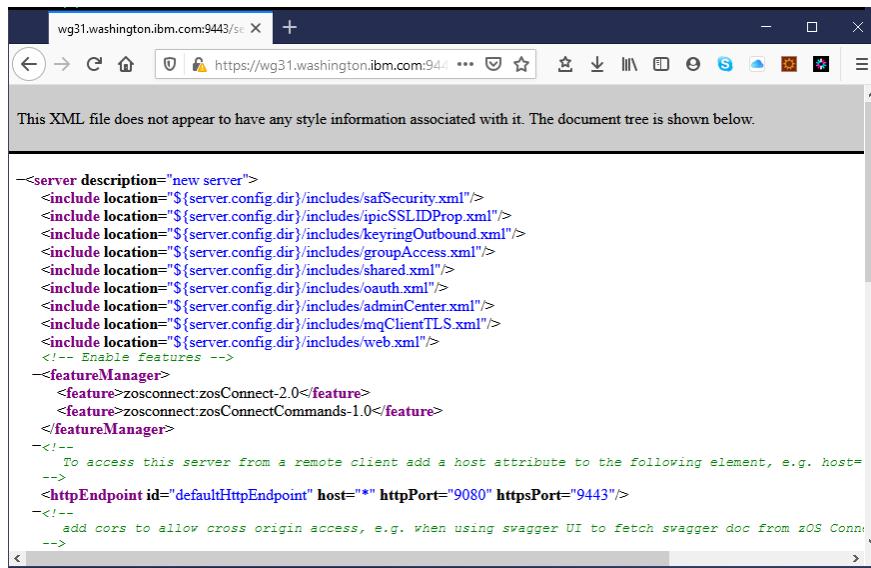
DELETE	/ibmmq/rest/v1/messaging/qmgr/{qmgrName}/queue/{qName}/message	Retrieves the next message from a specified queue.
GET	/ibmmq/rest/v1/messaging/qmgr/{qmgrName}/queue/{qName}/message	Browses the next message from a specified queue.
POST	/ibmmq/rest/v1/messaging/qmgr/{qmgrName}/queue/{qName}/message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



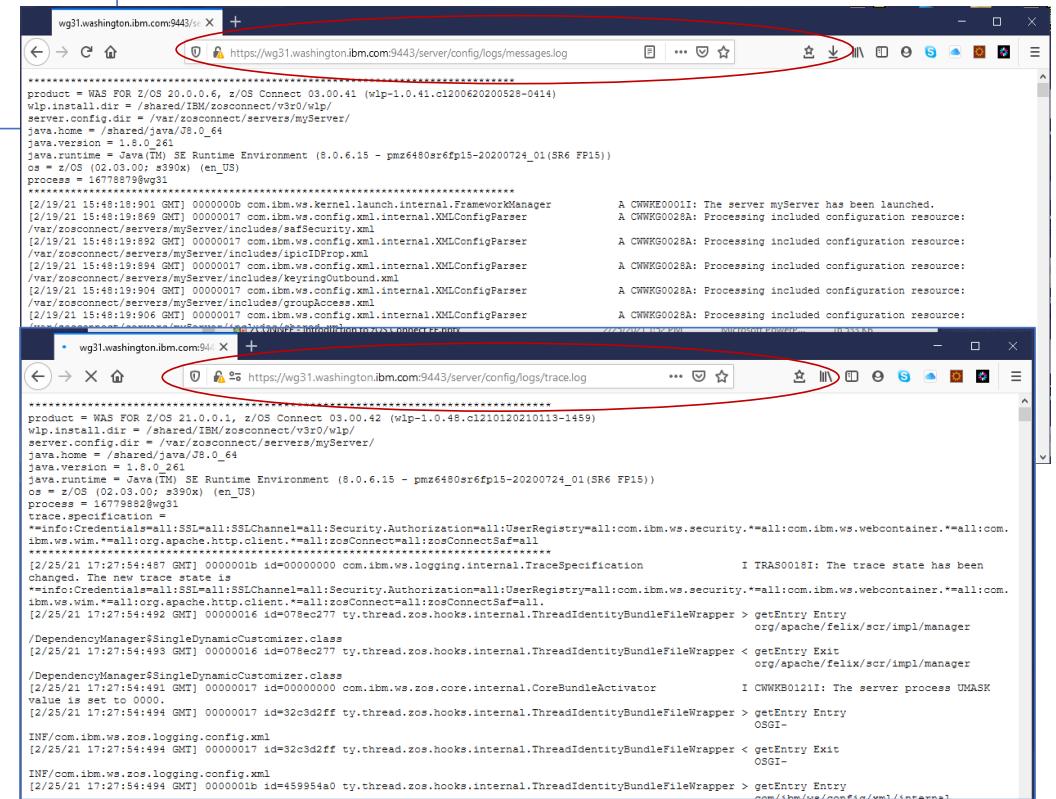
Liberty: Enable as a file server to provide remote access to configuration/logs

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



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

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



The screenshots show the content of three log files:

- messages.log:**

```
product = WAS FOR Z/OS 20.0.0.6, z/OS Connect 03.00.41 (wlp-1.0.41.c1200620200528-0414)
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/zos_0_64
java.version = 1.8.0_261
java.runtime = Java(TM) SE Runtime Environment (8.0.6.15 - pmz6480sr6fp15-20200724_01(SR6 FP15))
os = z/OS (02.03.00; s390x) (en_US)
process = 16778879@wg31

[2/19/21 15:48:19+9800 GMT] 0000001 com.ibm.ws.config.internal.FrameworkManager A CWKK0001I: The server myServer has been launched.
[2/19/21 15:48:19+9800 GMT] 0000001 com.ibm.ws.config.internal.XMLConfigParser A CWKK0028A: Processing included configuration resource:
[2/19/21 15:48:19+9822 GMT] 0000001 com.ibm.ws.config.internal.XMLConfigParser A CWKK0028A: Processing included configuration resource:
[2/19/21 15:48:19+9844 GMT] 0000001 com.ibm.ws.config.internal.XMLConfigParser A CWKK0028A: Processing included configuration resource:
[2/19/21 15:48:19+9866 GMT] 0000001 com.ibm.ws.config.internal.XMLConfigParser A CWKK0028A: Processing included configuration resource:
[2/19/21 15:48:19+9888 GMT] 0000001 com.ibm.ws.config.internal.XMLConfigParser A CWKK0028A: Processing included configuration resource:
[2/19/21 15:48:19+9900 GMT] 0000001 com.ibm.ws.config.internal.XMLConfigParser A CWKK0028A: Processing included configuration resource:
```
- trace.log:**

```
product = WAS FOR Z/OS 21.0.0.1, z/OS Connect 03.00.42 (wlp-1.0.48.c1210120210113-1459)
server.config.dir = /var/zosconnect/servers/myServer/
java.home = /shared/java/zos_0_64
java.version = 1.8.0_261
java.runtime = Java(TM) SE Runtime Environment (8.0.6.15 - pmz6480sr6fp15-20200724_01(SR6 FP15))
os = z/OS (02.03.00; s390x) (en_US)
process = 16779882@wg31
trace.specification =
<info>:Credentials=<all>;SSLChannel=<all>;Security.Authorization=<all>;UserRegistry=<all>;com.ibm.ws.security.*=<all>;com.ibm.ws.webcontainer.*=<all>;com.ibm.ws.wim.*=<all>;org.apache.http.client.*=<all>;zosConnectSafe=<all>

[2/25/21 17:27:54+087 GMT] 0000001b id=00000000 com.ibm.ws.logging.internal.TraceSpecification I TRAS0018I: The trace state has been changed. The new trace state is
<info>:Credentials=<all>;SSLChannel=<all>;Security.Authorization=<all>;UserRegistry=<all>;com.ibm.ws.security.*=<all>;com.ibm.ws.webcontainer.*=<all>;com.ibm.ws.wim.*=<all>;org.apache.http.client.*=<all>;zosConnectSafe=<all>.
[2/25/21 17:27:54+092 GMT] 00000016 id=078ec277 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry org/apache/felix/scr/impl/manager
[2/25/21 17:27:54+093 GMT] 00000016 id=078ec277 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper < getEntry Exit org/apache/felix/scr/impl/manager
[2/25/21 17:27:54+093 GMT] 00000016 id=078ec277 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper < getEntry Exit org/apache/felix/scr/impl/manager
[2/25/21 17:27:54+094 GMT] 00000017 id=32c3d2ff ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry OSGI-INF/INF/com.ibm.ws.zos.logging.config.xml
[2/25/21 17:27:54+094 GMT] 00000017 id=32c3d2ff ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper < getEntry Exit OSGI-INF/INF/com.ibm.ws.zos.logging.config.xml
[2/25/21 17:27:54+094 GMT] 0000001b id=459954a0 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry com/ibm/ws/zos/logging/internal/
```
- log4j.log:**

```
[2/25/21 17:27:54+094 GMT] 0000001b id=459954a0 ty.thread.zos.hooks.internal.ThreadIdentityBundleFileWrapper > getEntry Entry com/ibm/ws/zos/logging/internal/
```

Liberty MVS Commands

F BAQSTRT,CACHE,CLEAR,AUTH

Clears all users that are cached in the Liberty authentication cache

F BAQSTRT,REFRESH,CONFIG

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

F BAQSTRT,REFRESH,APPS

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

F BAQSTRT,REFRESH,KEYSTORE

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

F BAQSTRT,REFRESH,KEYSTORE, ID=OutboundKeyRing

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

F BAQSTRT,CACHE,CLEAR,AUTH

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

F BAQSTRT,PAUSE

To pause the server

F BAQSTRT,STATUS

To display the current status of a server

F BAQSTRT,RESUME

To resume the server

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

Liberty MVS Angel Commands

F BAQZANGL,DISPLAY,SERVERS

Displays a list of servers currently connected to the angel

F BAQZANGL,DISPLAY,SERVERS,PID

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

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

F BAQZANGL,VERSION

Displays the version level of the angel

z/OS Connect MVS Commands (OpenAPI 2)

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

F BAQSTRT,ZCON,REFRESH

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

F BAQSTRT,ZCON,CLEARTOKENCACHE

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

F BAQSTRT,ZCON,CLEARSAFCACHE

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

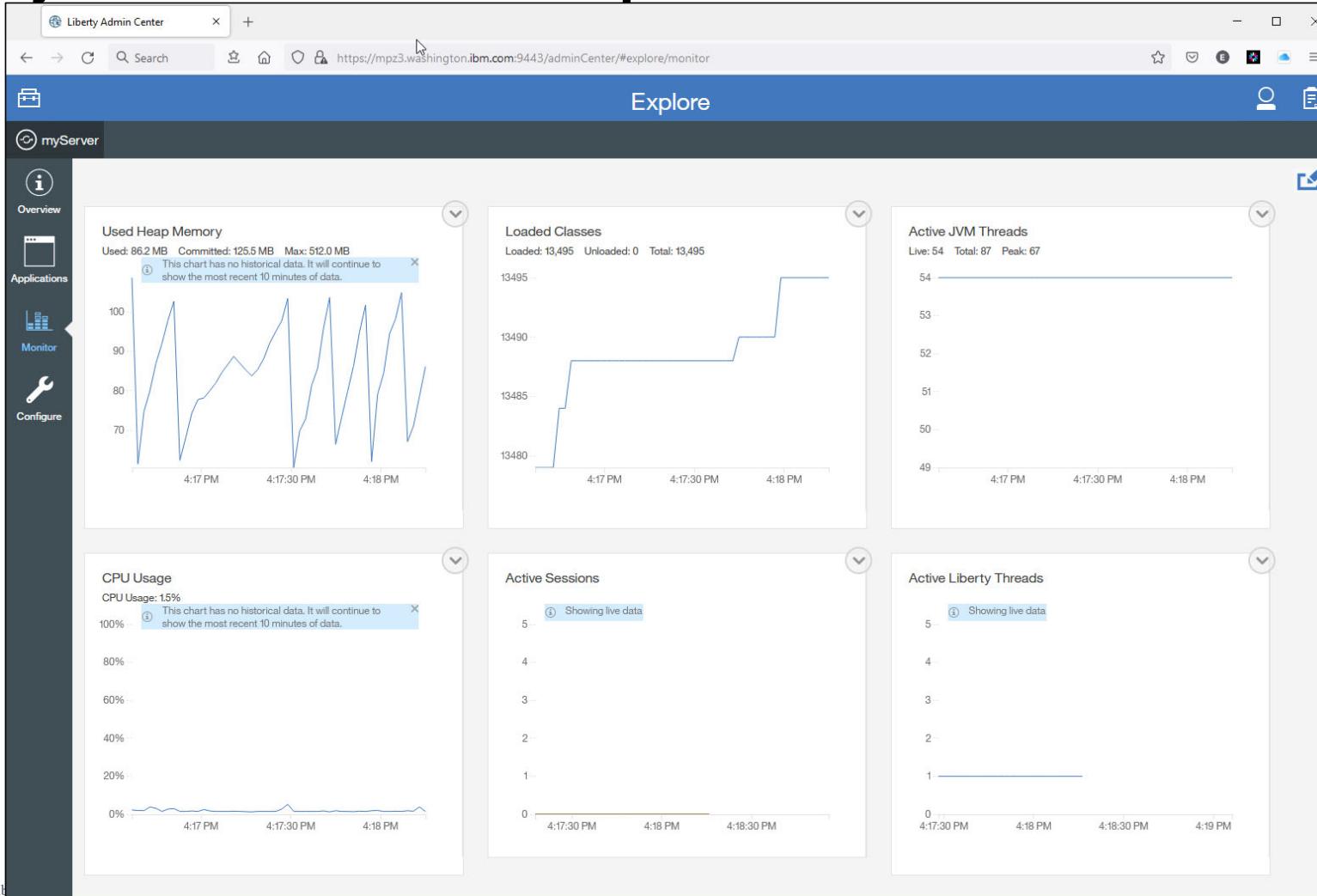
F BAQSTRT,REFRESH,APPS

Monitoring Liberty Servers

Monitoring Liberty, Java Virtual Machines and z/OS



Liberty Admin Center feature provides real time monitoring



mitchj@us.ibm.com

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.

A screenshot of the Eclipse Marketplace window. The search bar at the top contains the text "health center". Below the search bar, a card for "IBM Monitoring and Diagnostic Tools - Health Center 3.0.12" is displayed. The card includes a brief description, a star rating of 24, and a link to "Learn more". To the right of the card is a preview image showing a screenshot of the Health Center application interface. At the bottom of the window, there is a "Marketplaces" section with three icons and buttons for "Back", "Install Now >", "Finish", and "Cancel".

Eclipse Marketplace

Select solutions to install. Press Install Now to proceed with installation.

Press the "more info" link to learn more about a solution.

Search Recent Popular Favorites Installed Research at the Eclipse

Find: health center

All Markets All Categories Go

IBM Monitoring and Diagnostic Tools - Health Center 3.0.12

Health Center is a diagnostic tool for monitoring the status of a running Java or Node.js application. Health Center uses a small amount of processor time and... [more info](#)

Health Center is a diagnostic tool for monitoring the status of a running Java or Node.js application. Health Center uses a small amount of processor time and memory, and can open some log and trace files for analysis. New in version 3.0.12 * UI update for MQTT connection New in version 3.0.11 * Bug fixes and updated agent files New in version 3.0.10 * Bug fixes and performance improvements in the Health Center Agent New in version 3.0.9 * Agent can now be run from outside your Java installation New in version 3.0.8 * New api methods New in version 3.0.7 * Integration with the IBM Eclipse Tools for Bluemix * HTTP data from Node.js visualised in new Events panel New in version 3.0.6: * Classhistogram events added to api *

[Learn more](#)

Marketplaces

< Back Install Now > Finish Cancel



Java Health Center – Monitors the Java environment

Configuring the Monitoring Agent using JVM directives

Java Health Center Directives

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

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

Java Health Center – HEAP analysis example



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

Graph Legend:

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

Summary Table Metrics:

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 Panel Content:

- Using the garbage collection perspective
- Views for basic garbage collection information
- Views for detailed garbage collection information

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Slide 30

Java Health Center – Network analysis example



smf - Eclipse

File Edit Navigate Search Project Data Run Monitored System Window Help

Status Connection

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

Analysis and Recommendations

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

Sockets

Socket ID filter:

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

Sockets open Network I/O

mitchj@us.ibm.com

c0a8:11c9 = 192.168.17.201

Java Health Center – Method Profiling



The screenshot shows the Java Health Center interface in Eclipse, specifically the Method Profiling section. The interface includes a navigation bar, toolbars, and several panes for monitoring system health and analyzing method profiles.

Left Sidebar: Contains links for CPU, Classes, Environment, Events, Garbage Collection, I/O, Locking, Method Profiling (which is currently selected), Method Trace, Native Memory, Network, Threads, and WebSphere Real Time. It also includes Analysis and Recommendations.

Method Profiling Section: This section has two main parts. The top part is a table titled "Sample based profile" showing method samples and their percentages. The bottom part is a graph titled "Samples over time" showing the number of samples over time.

Graph Details: The "Samples over time" graph shows a red circle highlighting a peak in sample count around 2:30 minutes. A large blue arrow points from this peak towards the "Method trace summary" graph below.

Method Profiling Data (Top Table):

Samples	Self (%)	Self	Tree (%)	Tree	Method
2806	27.17	■	27.28	■	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
562	5.44	■	7.26	■	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
440	4.26	■	21.36	■	com.ibm.ws.logging.internal.impl.BaseTraceService.publishTraceLogRecord(com.ibm.ws.loggii
264	2.56	■	2.56	■	java.math.Division.monReduction(int[], java.math.BigInteger, int)
183	1.77		1.79		java.math.Multiplication.square(int[], int, int)
172	1.67		2.32	■	javax.security.auth.Subject.toString(boolean)
150	1.45		1.47		java.math.Division.long.monReduction(int[], int, long)
130	1.26		1.83		com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
128	1.24		1.55		com.ibm.crypto.provider.P256PrimeField.a(int[])
115	1.11		1.14		java.math.Division.long.monReduceSqr(long[], long[], long, int, long)
102	0.99		5.32	■	com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
97	0.94		1.91		com.ibm.ws.logging.internal.impl.BaseTraceService.publishTraceLogRecord(com.ibm.ws.loggii
92	0.89		1.21		java.util.concurrent.ConcurrentHashMap\$Node.getEntryCount()

Method Profiling Data (Bottom Table):

Samples	Self (%)	Self	Tree (%)	Tree	Method
1768	45.63	■	45.78	■	com.ibm.crypto.provider.MD5.a(byte[], int, int, byte[], int)
173	4.46	■	6.3		com.ibm.ws.logging.utils.FileLogHolder.writeRecord(java.lang.String)
152	3.92	■	18.68	■	com.ibm.ws.logging.internal.impl.BaseTraceService.publishTraceLogRecord(com.ibm.ws.loggii
111	2.86	■	2.86	■	java.math.Division.monReduction(int[], java.math.BigInteger, int)
96	2.48	■	2.48	■	java.math.Multiplication.square(int[], int, int)
56	1.45		2.04	■	com.ibm.crypto.provider.x.add(com.ibm.crypto.provider.EllipticPoint)
54	1.39		1.45		java.math.Division.long.monReduceSqr(long[], long[], long, int, long)
54	1.39		1.94		javax.security.auth.Subject.toString(boolean)
53	1.37		1.45		java.math.Division.long.monMulSq(long[], int, long)
51	1.32		1.63		com.ibm.crypto.provider.P256PrimeField.a(int[])
43	1.11		3.59		java.math.Multiplication.multiply(int[], int[], int[], int, int)
39	1.01		5.01		com.ibm.ws.logging.internal.impl.BaseTraceFormatter.formatObj(java.lang.Object)
27	0.7		1.42		com.ibm.ws.logging.internal.impl.BaseTraceFormatter.createFormattedMessage(java.util.Logging

Graph Summary: The "Samples over time" graph shows a significant drop in sample count starting around 2:00 minutes, followed by a gradual recovery.



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

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

```
*****
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   SYSSOUT=*
//STDOUT    DD   SYSSOUT=*
//SYSTSPRT DD   SYSSOUT=*
//SYSTSIN  DD   *
BPXBATCH SH +
java -jar /usr/lpp/java/J8.0_64/lib/ext/healthcenter.jar +
ID=16846267 level=headless +
-Dcom.ibm.java.diagnostics.healthcenter.headless.run.number.of.runs=1
```

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

z/OS Connect

Liberty Features

Liberty

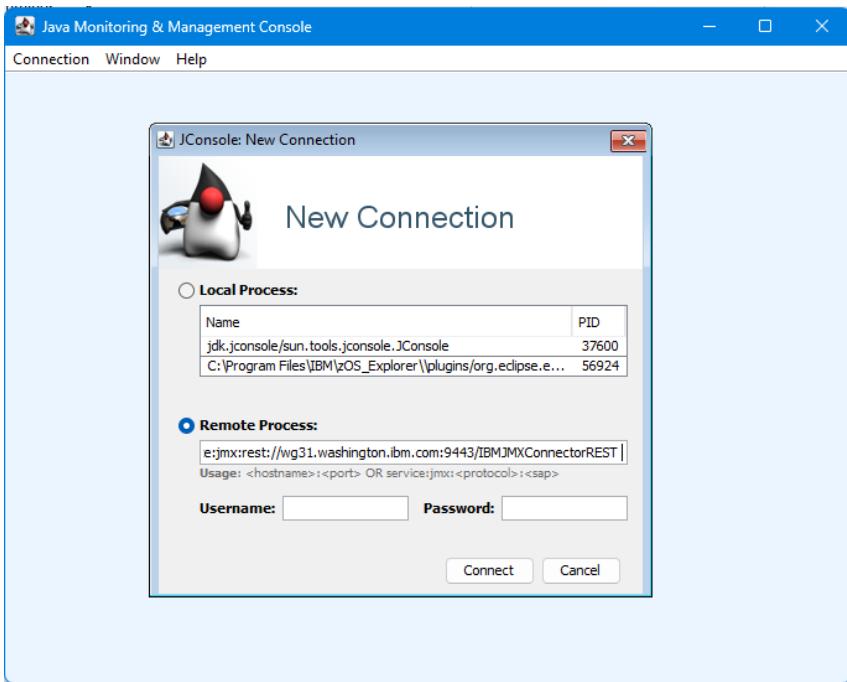


z/OS Connect





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



```
<server description="Additional Features">

    <!-- Enable features -->
    <featureManager>
        <feature>adminCenter-1.0</feature>
        <feature>restConnector-2.0</feature>
        <feature>monitor-1.0</feature>
    </featureManager>

    <remoteFileAccess>
        <readDir>/var/zcee/includes</readDir>
        <readDir>/global/zosconnect/includes</readDir>
        <writeDir>${server.config.dir}</writeDir>
    </remoteFileAccess>

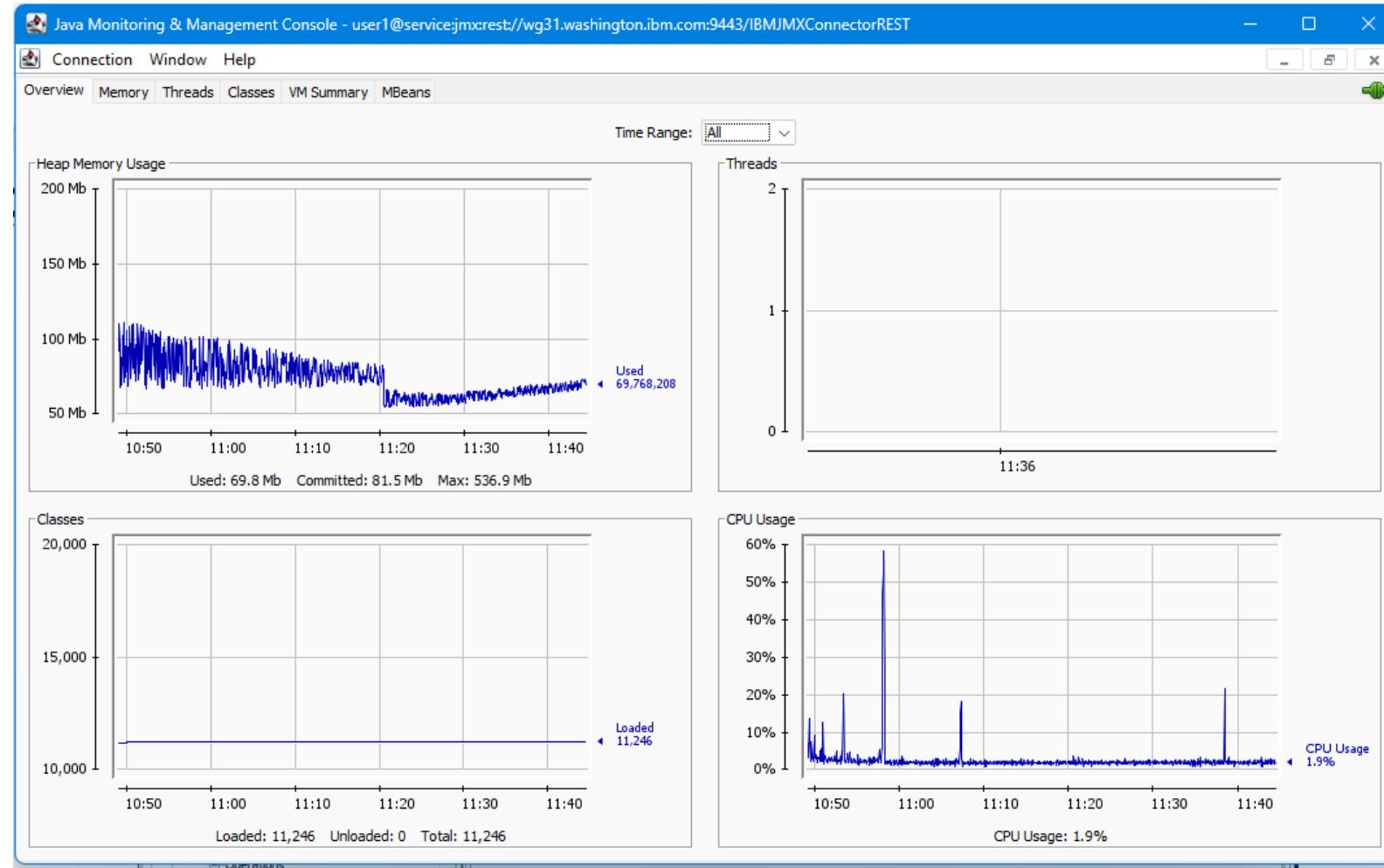
</server>
```

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

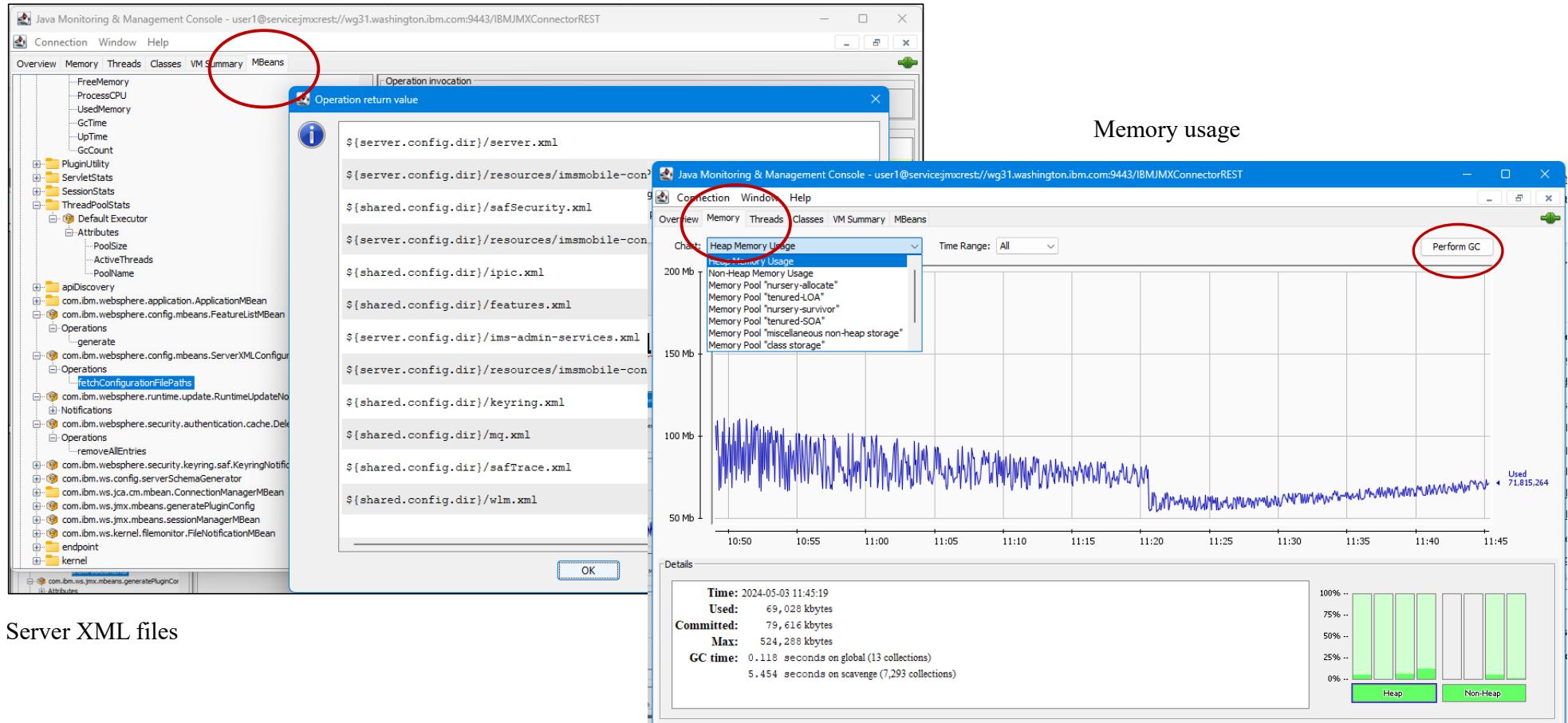
```
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Administrator OWNER(SYS1) UACC(NONE)
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.Reader OWNER(SYS1) UACC(NONE)
RDEFINE EJBROLE BBGZDFLT.com.ibm.ws.management.security.resource.allAuthenticatedUsers OWNER(SYS1) UACC(NONE)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



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



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



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@service:jmx:rest://wg31.washington.ibm.com:9443/IBMJMXConnectorREST". The menu bar includes Connection, Window, Help, Overview, Memory, Threads, Classes, VM Summary, and MBeans. A red circle highlights the "MBeans" tab. The left pane displays a tree view of MBeans, including categories like IBM MQ, JMIImplementation, WebSphere, and various service and utility components. The right pane shows an "Operation invocation" dialog with the code "java.lang.String showPoolContents ()". Below it is an "MBeanOperationInfo" table with columns Name and Value, showing the operation name and its value. A modal dialog titled "Operation return value" displays the result of the "showPoolContents" operation, listing connection details such as name, jndiName, maxPoolSize, size, waiting, unshared, shared, and available connections, along with their managed connection IDs. An "OK" button is at the bottom of this dialog.



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

Display and manage z/OS Connect OpenAPI3 APIs

The screenshot shows the Java Monitoring & Management Console interface. The left pane is a tree view of MBeans, and the right pane provides detailed information about selected MBeans. A red circle highlights the 'Attributes' section of the 'ApplicationMBean' node.

MBeanAttributeInfo for State:

Name	Value
Name	State
Description	Attribute exposed for management
Readable	true
Writable	false
Is	false
Type	java.lang.String

Descriptor for State:

Name	Value

<https://github.com/ibm-wsc/zCONNEE-Wildfire-Workshop/blob/master/misc/Monitoring%20a%20zOS%20Liberty%20server%20using%20jMX%20and%20REST%20clients.pdf>

Workload Manager - Definitions

WLM Report Classes

Report Class Selection List Row 1 to 12 of 12

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

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

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

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

WLM Service Classes

Modify a Service Class Row 1 to 2 of 2

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 *****

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mitchj@us.ibm.com

WLM "CB" Classification Rules

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

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

Description : WLP/zCEE Transactions

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

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

-----Class-----

Defaults: OPS_HIGH ZCEEOTHR
OPS_HIGH ZCEEADM
OPS_HIGH ZCEEAPIR
OPS_HIGH ZEECICCS
OPS_HILO ZEEIMS
OPS_MED ZCEEMQ
OPS_LOW ZCEEOTHR

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

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

Description : WLP/zCEE Transactions

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

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

-----Class-----

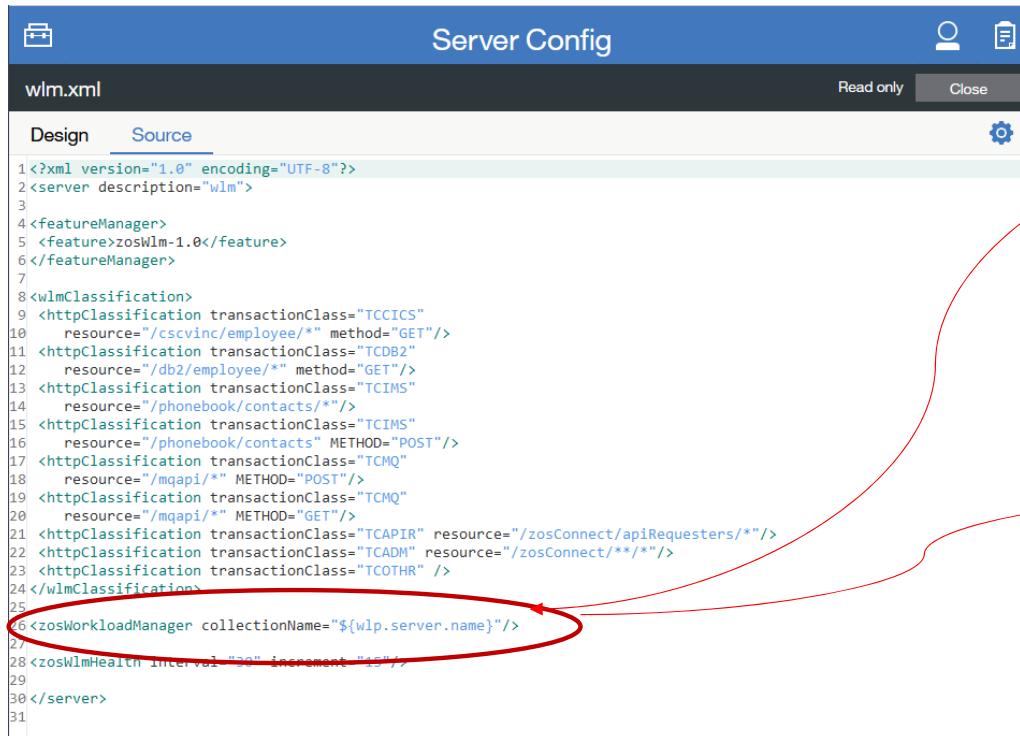
Defaults: OPS_HIGH ZCEEOTHR
OPS_HIGH ZCEESTC
OPS_HIGH ZCEEADM
OPS_HIGH ZCEEAPIR
OPS_HIGH ZCEEDB2
OPS_HILO ZEECICCS
OPS_MED ZCEEMQ
OPS_HILO ZCEEOTHR

Connected to remote server/host mpz3 using lu/pool MPZ30008 and port 23 07/021

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.



```

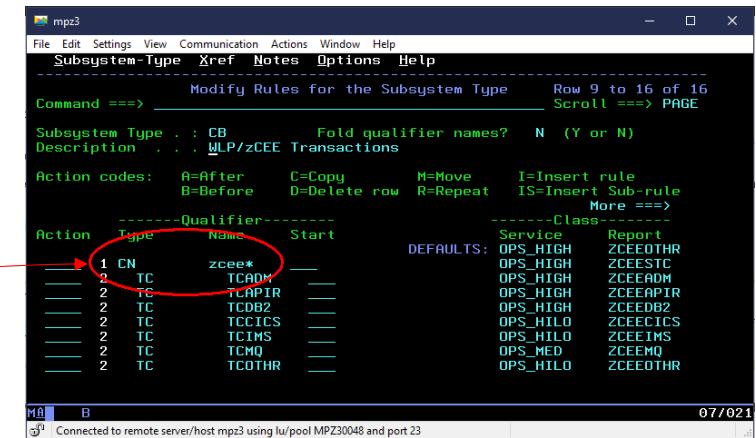
Server Config
wlm.xml
Read only Close

Design Source

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

```

Related to WLM CN name.



Action	Type	Name	Start	Service	Report
1	CN	zcees*			
2	TC	TCADM			
2	TC	TCDB2			
2	TC	TCCICS			
2	TC	TCIMS			
2	TC	TCMQ			
2	TC	TCOTHR			



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. Each element represents an 'httpClassification' rule with the following fields:

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

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

RMF SMF Type 72 Service Class Reports

mpz3

File Edit Settings View Communication Actions Window Help

Display Filter View Print Options Search Help

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

COMMAND INPUT ==>

POLICY=WSCPOL REPORT CLAS

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

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

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

mpz3

File Edit Settings View Communication Actions Window Help

Display Filter View Print Options Search Help

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

COMMAND INPUT ==>

POLICY=WSCPOL REPORT CLASS=ZCEEAPIR PERIOD=1

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

---SERVICE----		SERVICE TIME	--APPL %--	--PROMOTED--	--DASD I/O--	---STORAGE----	-PAGE-IN RATES-
IOC	0	CPU	5.073	CP 0.12	BLK 0.000	SSCHRT 2.4	Avg 0.00 Single 0.0
CPU	4485K	SRB	0.000	IIPCP 0.12	ENQ 0.000	RESP 0.4	Total 0.00 Block 0.0
MSO	0	RCT	0.000	IIP 0.73	CRM 0.000	CONN 0.3	Shared 0.00 Shared 0.0
SRB	0	IIT	0.000	AAPCP 0.00	LCK 0.000	DISC 0.0	
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						

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

mpz3

File Edit Settings View Communication Actions Window Help

Display Filter View Print Options Search Help

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

COMMAND INPUT ==>

POLICY=WSCPOL REPORT CLASS=ZCEEAPIR PERIOD=1

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

---SERVICE----		SERVICE TIME	--APPL %--	--PROMOTED--	--DASD I/O--	---STORAGE----	-PAGE-IN RATES-
IOC	0	CPU	5.073	CP 0.12	BLK 0.000	SSCHRT 2.4	Avg 0.00 Single 0.0
CPU	4485K	SRB	0.000	IIPCP 0.12	ENQ 0.000	RESP 0.4	Total 0.00 Block 0.0
MSO	0	RCT	0.000	IIP 0.73	CRM 0.000	CONN 0.3	Shared 0.00 Shared 0.0
SRB	0	IIT	0.000	AAPCP 0.00	LCK 0.000	DISC 0.0	
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						

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



Liberty SMF 120 Subtype 11

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



The screenshot shows the 'Server Config' interface with a blue header bar. In the center, it says 'Server Config'. On the left is a small icon of a server. On the right are icons for user profile, search, and refresh. Below the header, the title 'smf.xml' is displayed, followed by 'Read only' and a 'Close' button. There are two tabs: 'Design' and 'Source', with 'Source' being the active tab. To the right of the tabs is a gear icon. The main area contains XML code:

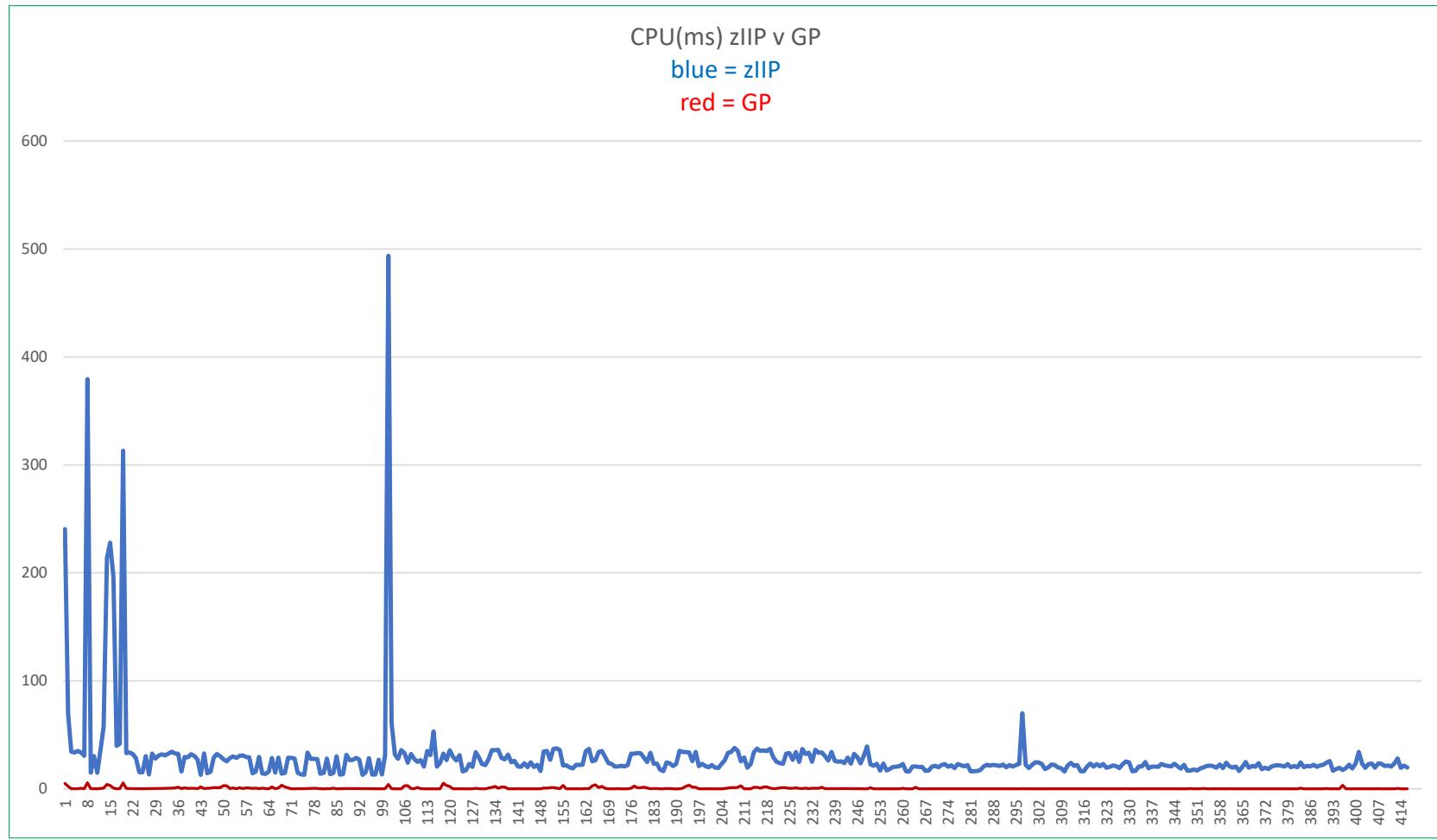
```
1<?xml version="1.0" encoding="UTF-8"?>
2
3<server description="SMF">
4    <featureManager>
5        <feature>monitor-1.0</feature>
6        <feature>zosRequestLogging-1.0</feature>
7    </featureManager>
8
9</server>
10
```

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

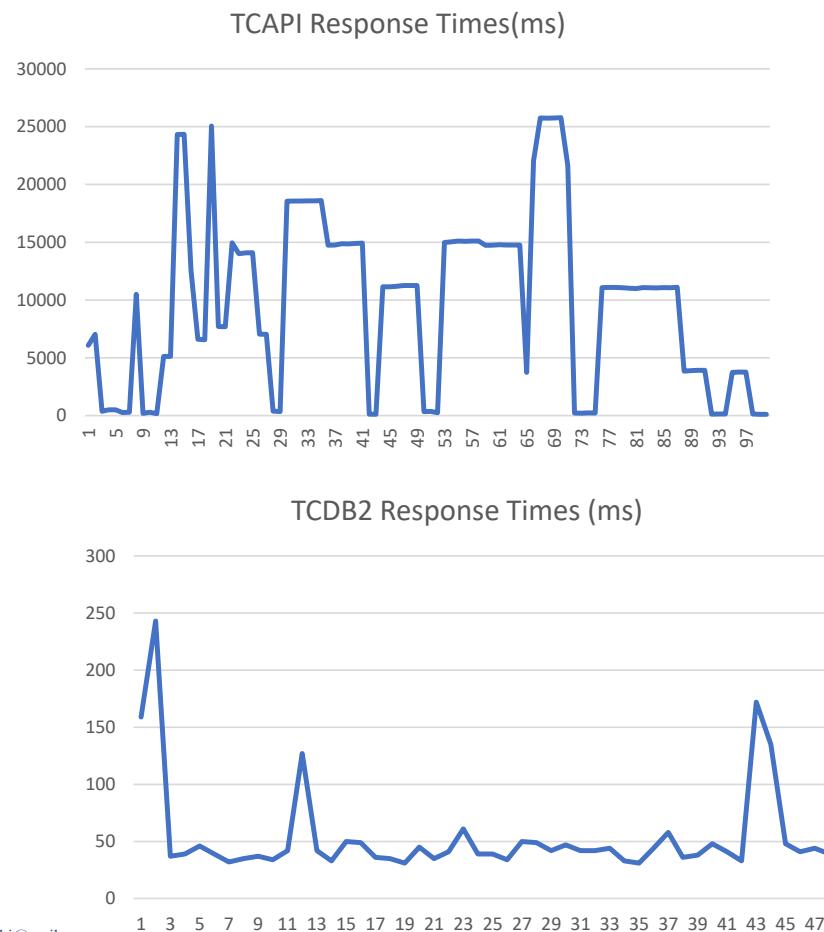
<https://www.ibm.com/support/pages/node/6355403>



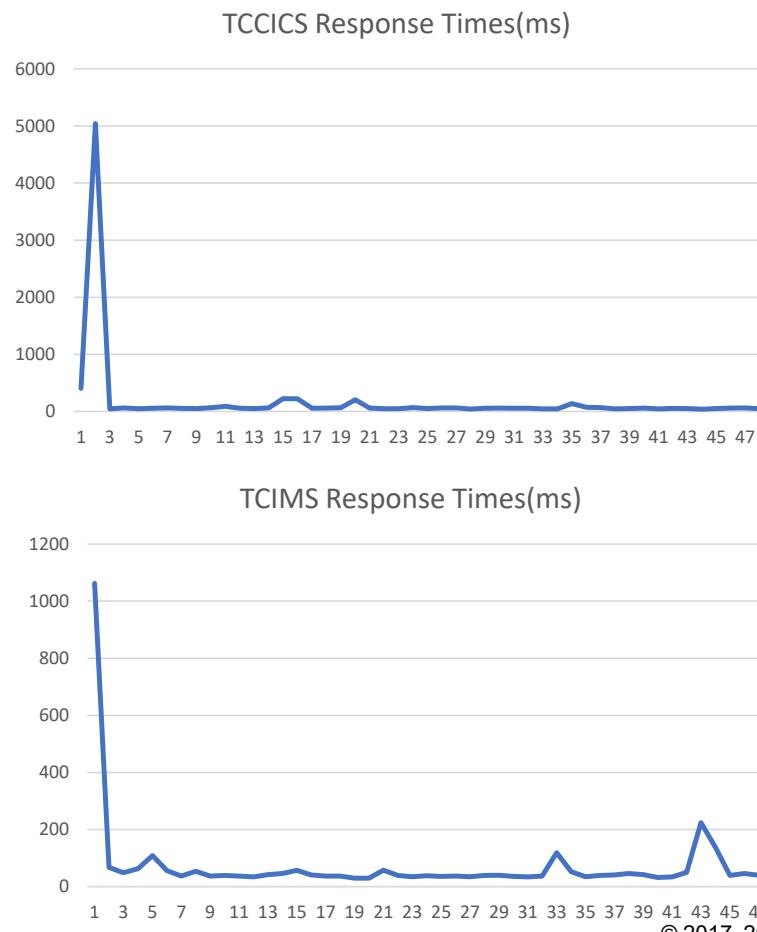
Liberty SMF 120 type 11 – GP v zIIP comparison example



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

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

Server Config

audit.xml

Read only Close

Design Source

Server

z/OS Connect Manager

z/OS Connect Authorization Interceptor **auth**

z/OS Connect EE SMF Audit Interceptor **audit**

z/OS Connect Interceptors **interceptorList_g**

Sequence
0 (default)

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

API provider SMF Version
2

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

auditApiProviderRequestHeaders.name
(no value)

auditApiProviderRequestHeaders.desc

auditApiProviderResponseHeaders.name
(no value)

auditApiProviderResponseHeaders.desc

API requester SMF Version
2

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

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



REC_TYPE		SUBTYPE	SUBTYPE_VERSION	TRIPLET_C	TRIPLET_C	HTTP_REQ_TYPE	USER_NAME	USER_NAME	CLIENT_IP	API_NAME	API_VERS	TIME_ZC_EN	TIME_ZC_SO	TIME_SO_TIME	ZCInboundTime(us)	SORTime(us)	ZCOutboundTime(us)	TotalTime(us)	TotalTime(s)	SP_NAMES	SOR_REF	SOR_IDEN	SOR_RESOURCE	REQ_I
123		1	2																					
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/21 12021/08/2021/08/2021/1/				41355	913	9306	51575	0.0516	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/21 12021/08/2021/08/2021/1/				25471	756	3442	29669	0.0297	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				33757	1072	7176	42007	0.042	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				22424	1683	3430	27538	0.0275	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				24569	835	6861	32266	0.0323	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				23687	894	6740	31321	0.0313	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				39183	813	5873	45869	0.0459	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				28666	442	3328	32437	0.0324	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				62785	1454	14099	78338	0.0783	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				63645	720	10646	75013	0.075	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				32949	956	7546	41452	0.0415	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				35064	774	7185	43023	0.043	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				29211	577	3953	33743	0.0337	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				19984	764	7056	27805	0.0278	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				70534	834	18331	89700	0.0897	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				59928	1413	8672	70014	0.07	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				34807	561	5141	40510	0.0405	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				103793	5375	15872	125041	0.125	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				103356	1792	12380	117530	0.1175	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		
MPZ3	ZCON	2	40	200	NO	distuser1	USER1	192.168.1:cscvinc	1.0.0		2021/08/23 12021/08/2021/08/2021/1/				97134	987	14433	112554	0.1126	CICS-1.0	cscvinc	USIBMWZ CSMI,CSCVINC		

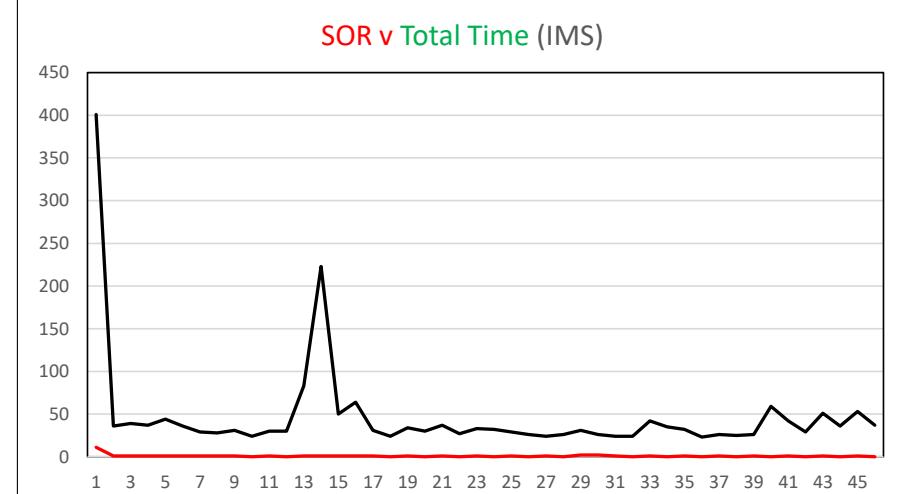
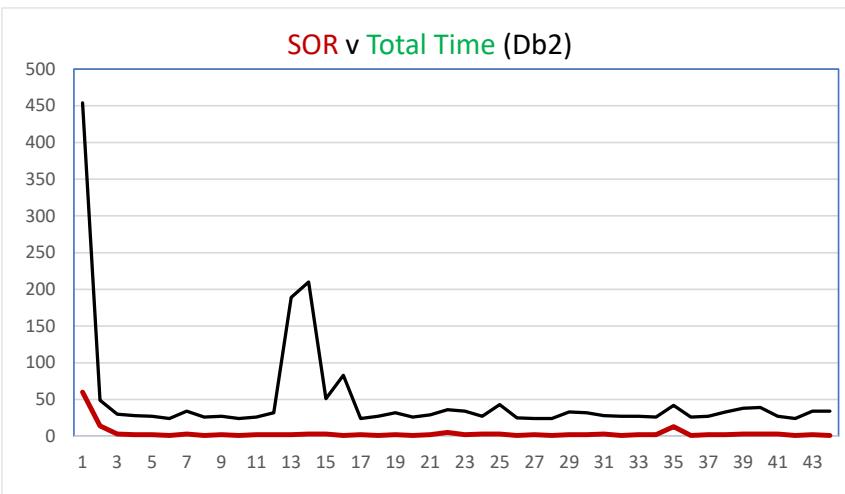
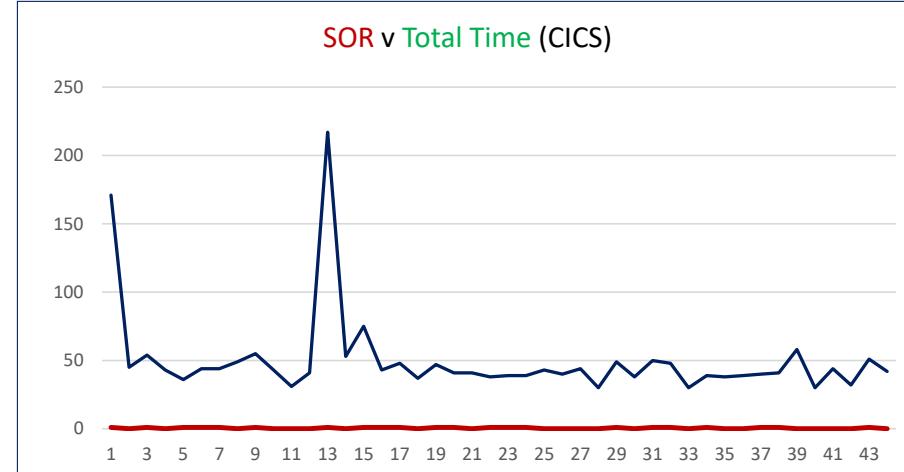
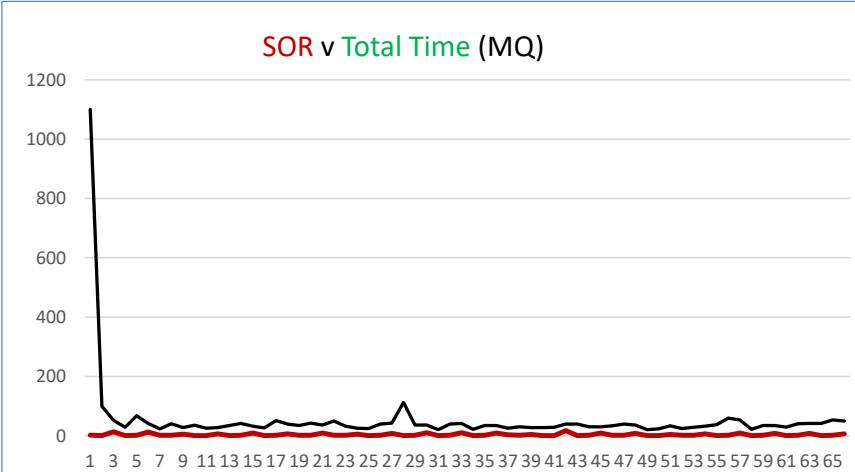
mitchj@us.ibm.com

Some fields have been hidden

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

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Slide 48

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



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



smfout.csv

File Home Insert Page Layout Formulas Data Review View Help ACROBAT

Font Alignment Number Styles Cells Editing Ideas Sensitivity

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

A B C D U V W X Y Z AA AI AJ AK AL AM AAC AP AQ AR AS AT AU AV AW AX AY

27 SMF123_RSMF123_S SMF123_SUBTYPE_VERSION

28 123 2 2

29

30 SID SSI TRIPLET_C TRIPLET_U HTTP_REQ_STAT REQ_RETREQ_PAYL RESP_PA1 USER_NA USER_NA | ENDPOINT_1ENDPOINT TIME_ST|TIME_TIME_1 TII TIM TIME_ENDPOL StubTime ZCInboun TokenTim EndPointTime ZCOutbou TotalTime(us) TotalTime(s) MVS_JOB M

31 MPZ3 ZCON 2 40 200 200 NO 0 272 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 95384 108577 6734453 131423 25653 7103301 7.103301 USER1GE5JC

32 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 114313 7767 318 40583 2105 166276 0.1663 USER1GE5JC

33 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 112903 7193 130 51158 1905 175644 0.1756 USER1GE5JC

34 MPZ3 ZCON 2 40 200 200 NO 0 271 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 103999 102634 8843582 110850 3497 9166156 9.1662 USER1GE4JC

35 MPZ3 ZCON 2 40 200 200 NO 0 271 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 82840 4956 128 65685 1900 156097 0.1561 USER1GE4JC

36 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 116458 10778 288 58698 1778 189030 0.189 USER1GE5JC

37 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 149159 20483 614 102698 1760 277114 0.2771 USER1GE5JC

38 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 153803 23181 285 101022 1775 281176 0.2812 USER1GE4JC

39 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 140685 70595 11275606 113382 1920 11603168 11.6032 USER1GE1JC

40 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 108088 7624 222 65726 1746 184303 0.1843 USER1GE5JC

41 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 119784 9945 282 76225 1773 209052 0.2091 USER1GE4JC

42 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 94511 5061 132 44576 2427 147407 0.1474 USER1GE1JC

43 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 56951 10497 126 118293 1703 189186 0.1892 USER1GE5JC

44 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 55110 7646 210 122479 1616 187974 0.188 USER1GE4JC

45 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 119104 10588 354 109467 1604 242675 0.2427 USER1GE1JC

46 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 3051028 17103 9999318 222997 1770 13292831 13.2928 USER1GE7JC

47 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 129965 20381 121 212563 1870 366316 0.3663 USER1GE5JC

48 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 117036 17792 768 221666 1796 360790 0.3608 USER1GE4JC

49 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 121667 23095 468 217285 1673 366393 0.3664 USER1GE1JC

50 MPZ3 ZCON 2 40 200 200 NO 0 269 USER1 |GET 2021/08/2021/0220202:2021/08/2318: 115629 13252 685 146376 1659 279825 0.2798 USER1GE1JC

51

52 REC_TYPE SUBTYPE SUBTYPE VERSION

smfout

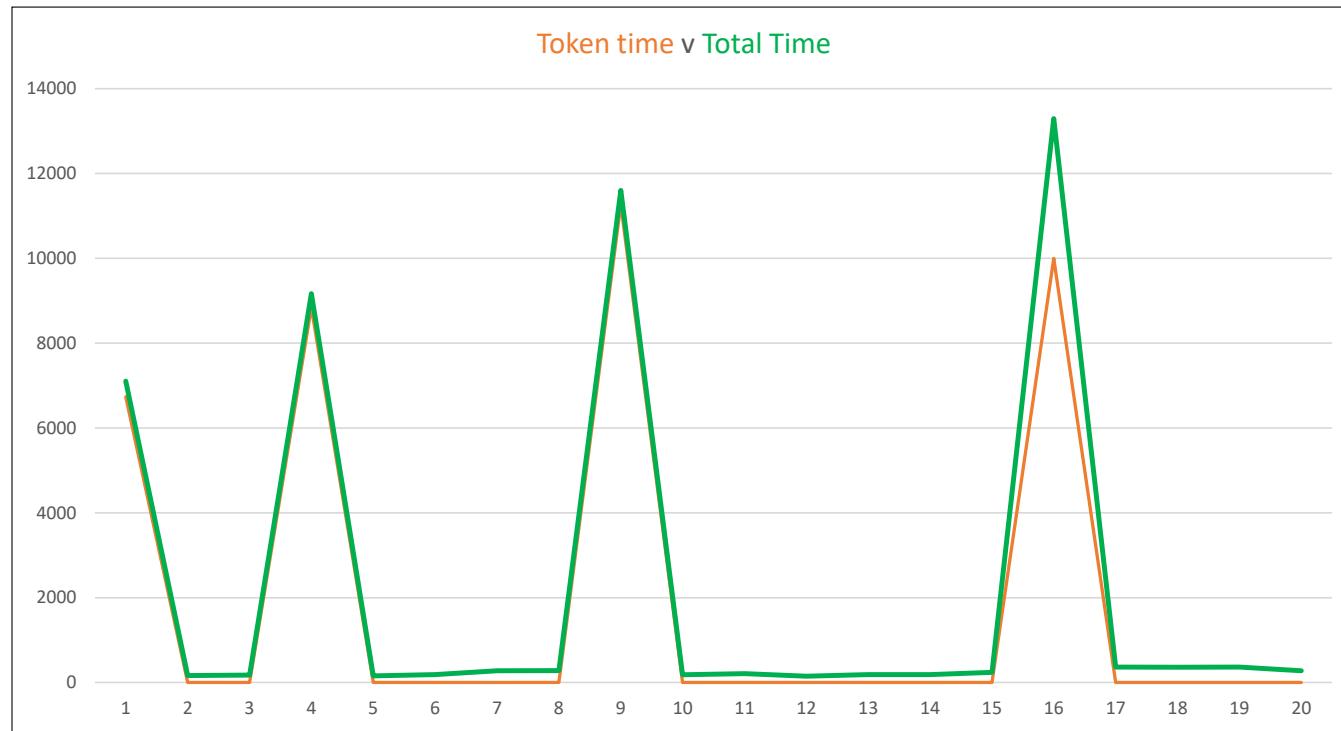
Ready

Some fields have been hidden

mitchj@us.ibm.com

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

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



Connection Management



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



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 IDELTO 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" reapTIme=180/>  
<connectionManager id="IMSTMConnMgr2" agedTimeout=-1 connectionTimeout=30 maxIdleTime=1800 maxPoolSize=200  
minPoolSize=0 purgePolicy="EntirePool" reapTIme=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="IMSTMAPL"/>  
</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="IMSTMAPL"/>  
</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="DFSIVPAConn" 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"/>
```

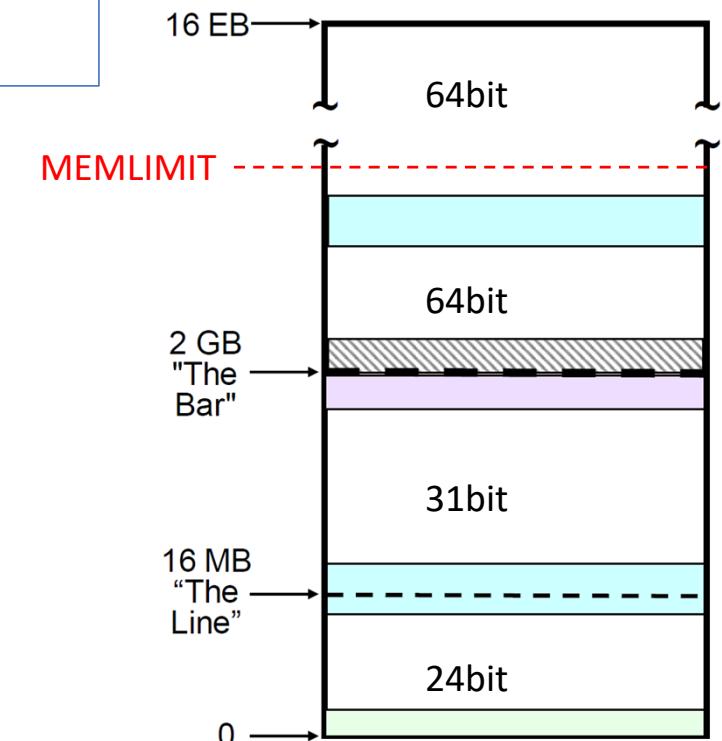
- This sets the timeout limit of an TLS session to **10 minutes** (default is 8640ms)

Memory and Storage

MEMLIMIT - memory storage above-the-bar

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

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



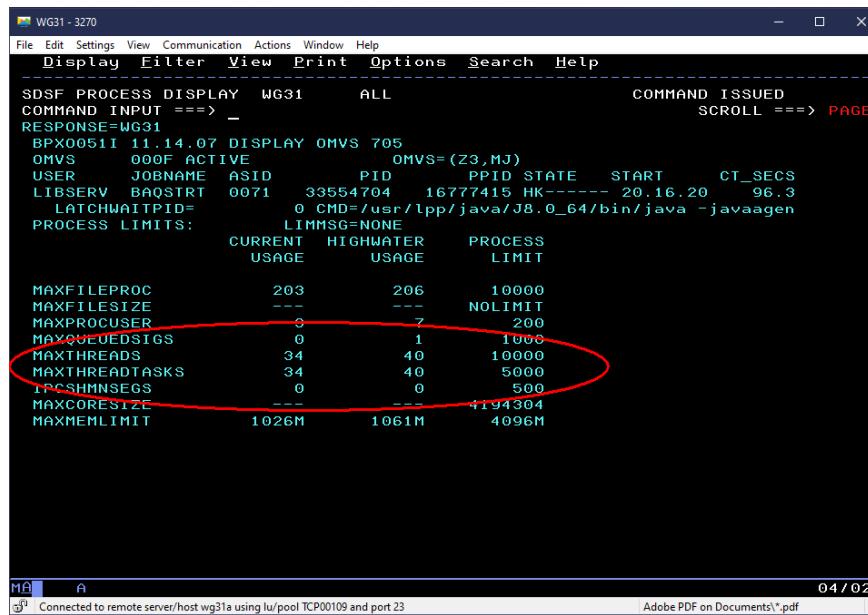
messages.log

CWWKB0125I: This server requested a REGION size of 0KB. The below-the-line storage limit is 8MB and the above-the-line storage limit is 1725MB.

CWWKB0126I: MEMLIMIT=1000. MEMLIMIT CONFIGURATION SOURCE=JCL.

Native threads

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



```

WG31 - 3270
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF PROCESS DISPLAY WG31 ALL COMMAND ISSUED
COMMAND INPUT ==> -
SCROLL ==> PAGE
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
IPCShmNsegs      0         0      500
MAXCORESIZE      ---      --- 4194304
MAXMEMLIMIT      1026M    1061M   4096M

```

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



Tech-Tip: Java heap storage

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

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

- Xgcpolicy:gencon Garbage collection policy, the default is *gencon* and is the recommended garbage collection policy
 - Xms<size> Initial heap size, defaults to *8MB* on z/OS
 - Xmx<size> Maximum heap size, defaults to half the available memory with a minimum of *16 MB* and a maximum of *512 MB*
- <https://www.ibm.com/docs/en/sdk-java-technology/8?topic=reference-default-settings>

Standard Java options related garbage collection reporting*

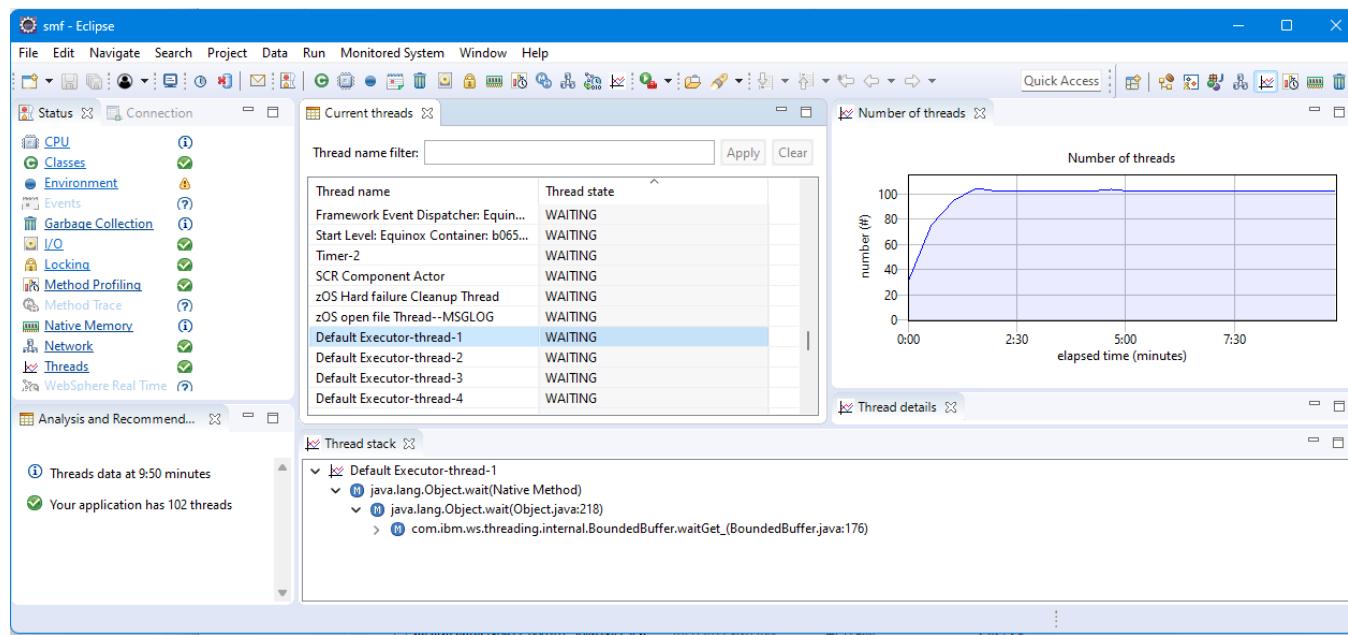
- verbose:gc Writes verbose garbage collection information.
- verbose:sizes Writes information to stderr describing the active memory usage settings.

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



Java threads

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





MEMLIMIT Recommendations

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

```
<executor maxThreads="300"/>
```

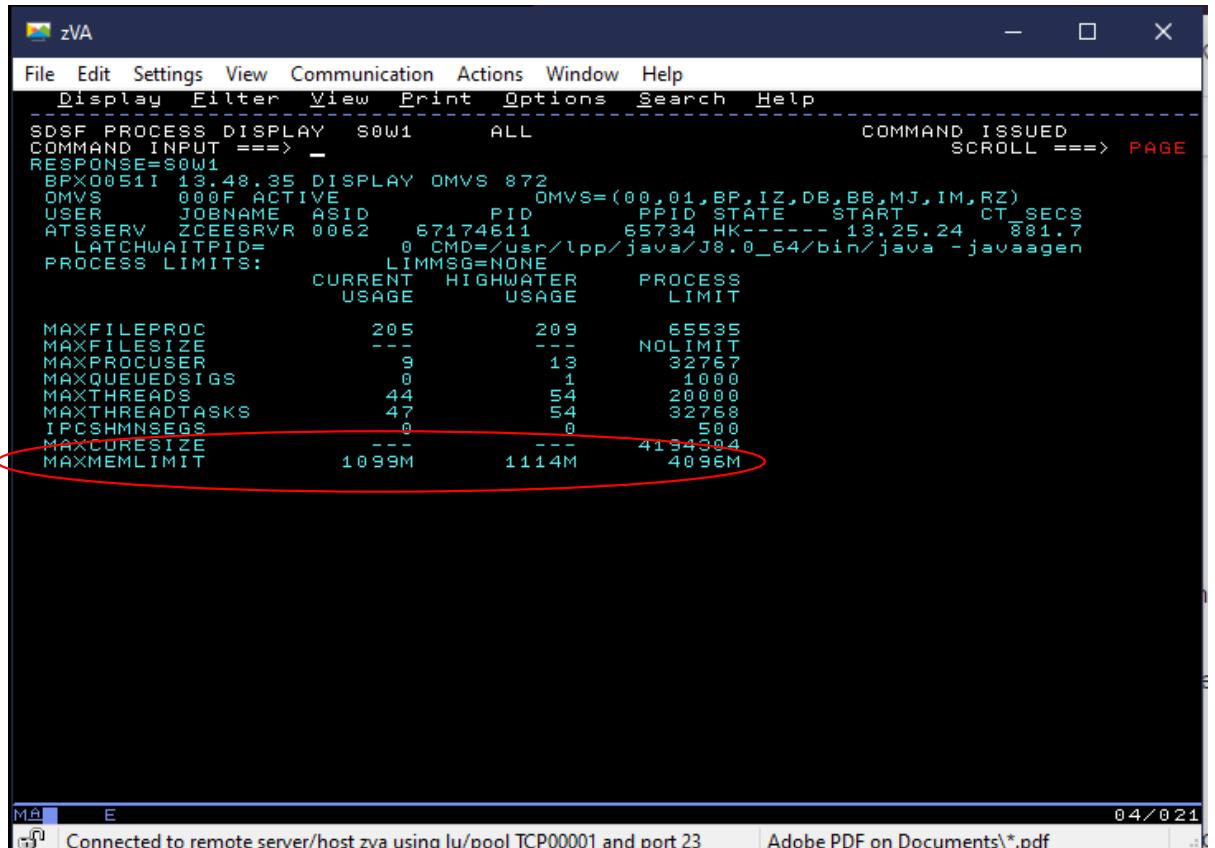
Maximum JVM Heap Size – half the available memory with a minimum of 16 MB and a maximum of 512 MB

MEMLIMIT – management

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

or

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



```

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

```

Connected to remote server/host zva using lu/pool TCP00001 and port 23 Adobe PDF on Documents*.pdf 04 / 021

Where do I look when things go wrong?

Issues and problems can be categorized

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

- Basic Security issues**

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

- Advanced Security issues**

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

- z/OS Connect XML Configuration issues**

- Missing or misspelled configuration attributes (remember the Liberty XML parser is too forgiving)

- External resource Issues**

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

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

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



```
*****
product = WAS FOR Z/OS 21.0.0.6, z/OS Connect 03.00.48 (wlp-1.0.53.c1210620210527-1900)
wlp.install.dir = /shared/IBM/zosconnect/v3r0/wlp/
server.config.dir = /var/zosconnect/servers/zceepid/
java.home = /MA4RS1/usr/lpp/java/J8.0_64
java.version = 1.8.0_301
java.runtime = Java(TM) SE Runtime Environment (8.0.6.35 - pmz6480sr6fp35-20210714_01(SR6 FP35) )
os = z/OS (02.04.00; s390x) (en_US)
process = 16843186@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 .litty.authentication.filter.internal.AuthenticationFilterImpl
[9/3/21 13:41:32:824 GMT] 00000053 com.ibm.zosconnect.service.cics.internal.conn.isc.Connection
```

A CWWKE0001I: The server zceepid has been launched.
A CWWKG0028A: Processing included configuration resource
I CWWKB0125I: This server requested a REGION size of 0KB
I CWWKB0126I: MEMLIMIT=2000. MEMLIMIT CONFIGURATION SOUR
I CWWKB0122I: This server is connected to the default an
I CWWKB0103I: Authorized service group KERNEL is availab
I CWWKB0103I: Authorized service group LOCALCOM is avail
I CWWKB0103I: Authorized service group PRODMGR is availa
- - - - - 148 Line(s) not Displayed
A J2CA7001I: Resource adapter imsudbJLocal installed in
I CWWKX0103I: The JMX REST connector is running and is a
I CWWKX0103I: The JMX REST connector is running and is a
I CWWKO0219I: TCP Channel defaultHttpEndpoint has been s
I CWWKO0219I: TCP Channel defaultHttpEndpoint-ssl has be
I SRVE9103I: A configuration file for a web server plugi
A CWWKF0012I: The server installed the following feature
I CWWKF0008I: Feature update completed in 37.484 seconds
A CWWKF0011I: The zceepid server is ready to run a smar
I CWWKS1700I: OpenID Connect client ATS configuration su
I CWWKS4358I: The authentication filter ATSAuthFilter co
BAQR0680I: CICS connection cscvinc established with 10

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



Basic security issues – Sometimes the problem is easy to find

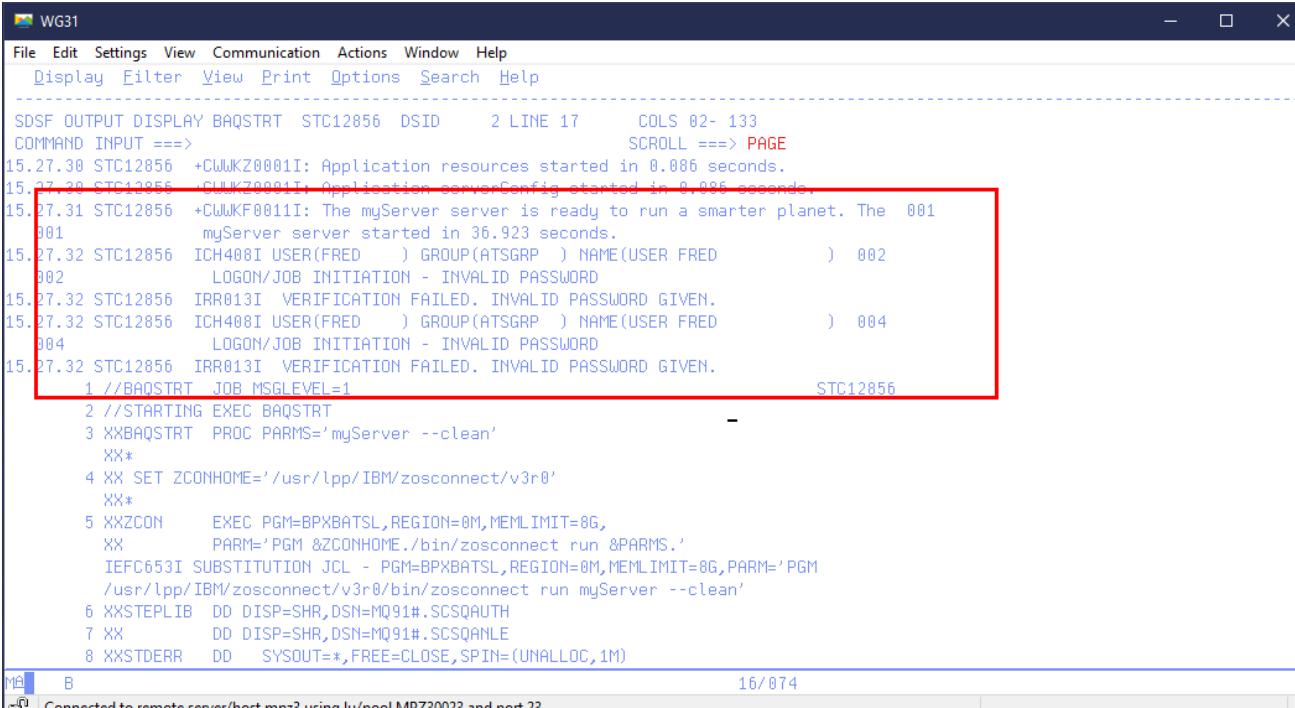
The STDOUT may show:

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

And the messages.log displays:

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

But the JESMSGGLG and SYSLOG displays:



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

SDSF OUTPUT DISPLAY BAQSTRT STC12856 DSID 2 LINE 17 COLS 02- 133
COMMAND INPUT ==> SCROLL ==> PAGE
15.27.30 STC12856 +CWWKZ0001I: Application resources started in 0.086 seconds.
15.27.30 STC12856 +CWWKZ0001I: Application serverConfig started in 0.085 seconds.
15.27.31 STC12856 +CWWKF001II: The myServer server is ready to run a smarter planet. The 001
001 myServer server started in 36.923 seconds.
15.27.32 STC12856 ICH408I USER(FRED ) GROUP(ATSGRP ) NAME(USER FRED ) 002
002 LOGON/JOB INITIATION - INVALID PASSWORD
15.27.32 STC12856 IRR013I VERIFICATION FAILED. INVALID PASSWORD GIVEN.
15.27.32 STC12856 ICH408I USER(FRED ) GROUP(ATSGRP ) NAME(USER FRED ) 004
004 LOGON/JOB INITIATION - INVALID PASSWORD
15.27.32 STC12856 IRR013I VERIFICATION FAILED. INVALID PASSWORD GIVEN.
1 //BADSTRT JOB MSGLEVEL=1 STC12856
2 //STARTING EXEC BAQSTRT
3 XXBAQSTRT PROC PARMs='myServer --clean'
XX*
4 XX SET ZCONHOME='/usr/lpp/IBM/zosconnect/v3r0'
XX*
5 XXZCON EXEC PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,
XX PARM='PGM &ZCONHOME./bin/zosconnect run &PARMS.'
IEFC653I SUBSTITUTION JCL - PGM=BPXBATSL,REGION=0M,MEMLIMIT=8G,PARM='PGM
/usr/lpp/IBM/zosconnect/v3r0/bin/zosconnect run myServer --clean'
6 XXSTEPLIB DD DISP=SHR,DSN=MQ91#.SCSQAUTH
7 XX DD DISP=SHR,DSN=MQ91#.SCSQANLE
8 XXSTDERR DD SYSOUT=*,FREE=CLOSE,SPIN=(UNALLOC,1M)
```

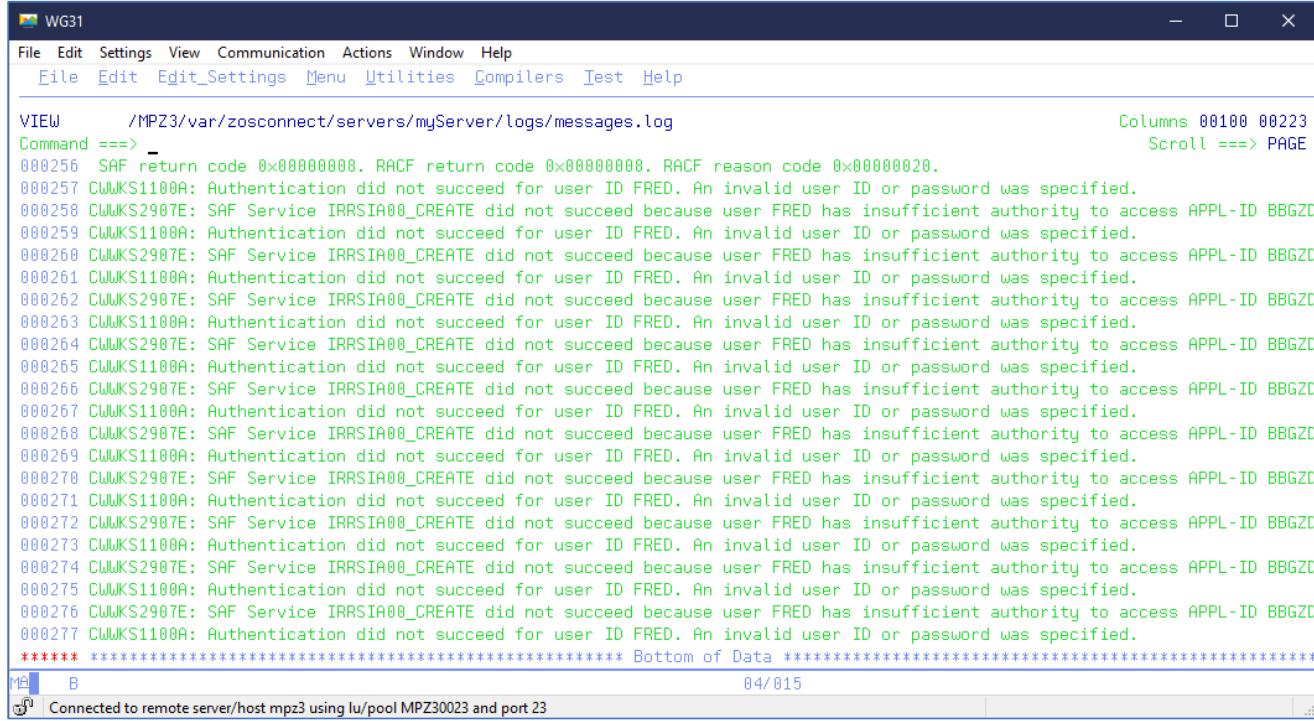
Basic security issues – Sometimes you must dig a little more

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 BBGZDFLT.
000275  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
000276  CWWKS2907E: SAF Service IRRSIA00_CREATE did not succeed because user FRED has insufficient authority to access APPL-ID BBGZD
000277  CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.

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

A B

Connected to remote server/host mpz3 using lu/pool MPZ30023 and port 23

04/015

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

mitchj@us.ibm.com

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

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



Table 1. initACEE create return codes

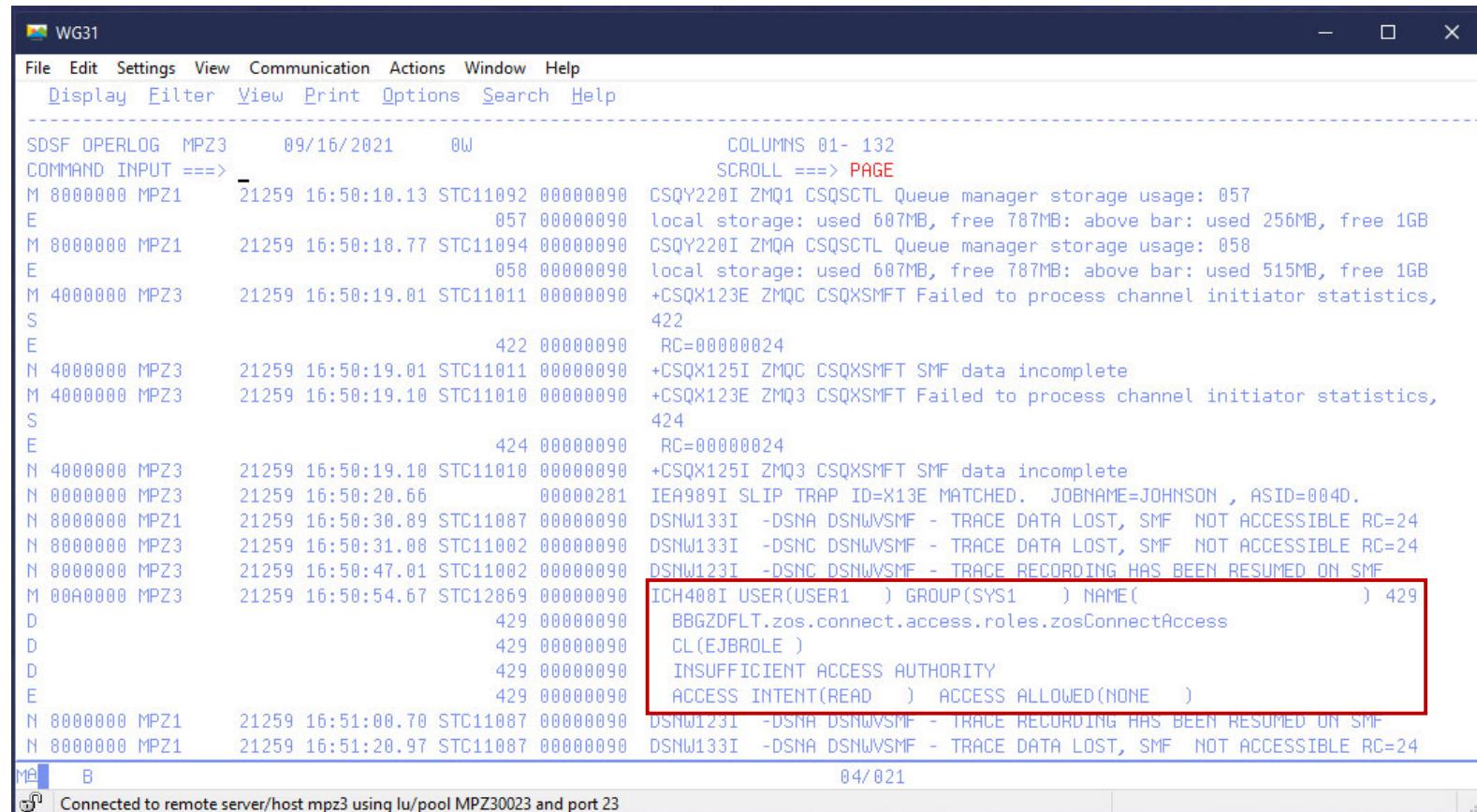
SAF return code	RACF® return code	RACF reason code	Explanation
0	0	0	The service was successful.
4	0	0	RACF is not installed.
8	8	4	Parameter list error occurred.
8	8	8	An internal error occurred during RACF processing.
8	8	12	Recovery environment could not be established.
8	8	16	User ID is not defined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

Hex '20' = Dec '32'

Root cause – No READ access to APPL resource BBGZDFLT

Basis security issues - Use the SYSLOG/JESMSGGLG output

The SYSLOG shows a ICH408I message:



```

WG31
File Edit Settings View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF OPERLOG MPZ3 09/16/2021 0W
COMMAND INPUT ===> -
M 8000000 MPZ1 21259 16:50:10.13 STC11092 00000090 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 000000281 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 DSNW123T -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.



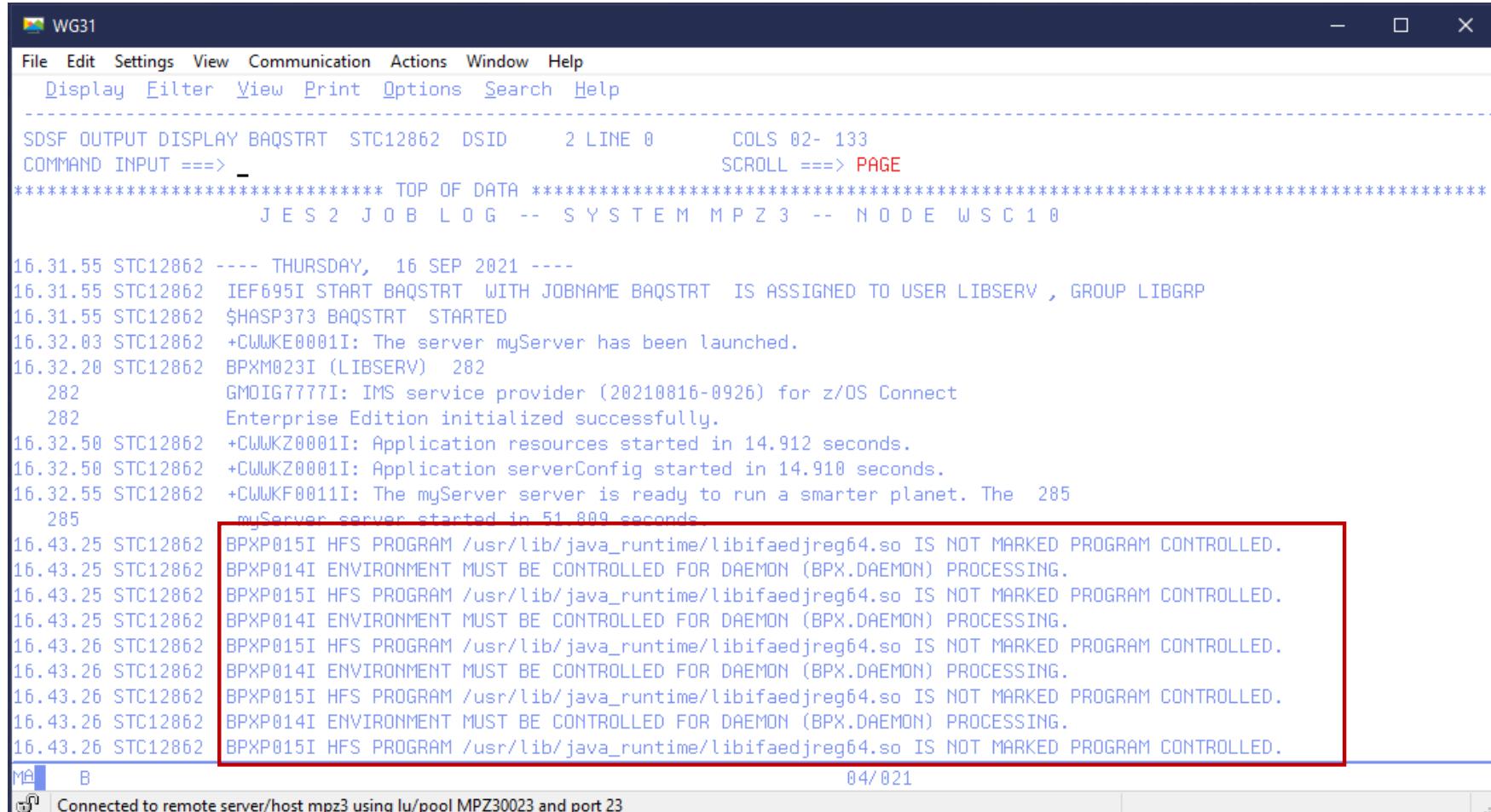
Basic security issues – Sometimes there is misdirection

The STDOUT may show:

The screenshot shows a terminal window titled "WG31". The menu bar includes File, Edit, Settings, View, Communication, Actions, Window, Help, Display, Filter, View, Print, Options, Search, and Help. The main pane displays a log of messages from an IBM Z system. The log starts with system configuration details like SDSF OUTPUT DISPLAY BAQSTRT and command inputs. It then lists numerous audit messages (YAUDIT) indicating failed authentication attempts for a user named FRED. The messages are repetitive, showing various error codes and details about the failed login attempts. At the bottom of the log, a footer reads "***** BOTTOM OF DATA *****". The status bar at the bottom of the window shows "Connected to remote server/host mpz3 using lu/pool MPZ30019 and port 23" and the date "04/021".

```
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: YadminCenter-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.
YAUDIT   " CWWKS1100A: Authentication did not succeed for user ID FRED. An invalid user ID or password was specified.
*****
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 JOBNAME BAQSTRT IS ASSIGNED TO USER LIBSERV , GROUP LIBGRP
16.31.55 STC12862 $HASP373 BAQSTRT STARTED
16.32.03 STC12862 +CLWJKE0001I: The server myServer has been launched.
16.32.20 STC12862 BPXMF023I (LIBSERV) 282
     282          GMDIG7777I: IMS service provider (20210816-0926) for z/OS Connect
     282          Enterprise Edition initialized successfully.
16.32.50 STC12862 +CLWJKZ0001I: Application resources started in 14.912 seconds.
16.32.50 STC12862 +CLWJKZ0001I: Application serverConfig started in 14.910 seconds.
16.32.55 STC12862 +CLWJKF0011I: The myServer server is ready to run a smarter planet. The 285
     285          myServer server started in 51.809 seconds
16.43.25 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.25 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.25 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.25 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.26 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.
16.43.26 STC12862 BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING.
16.43.26 STC12862 BPXP015I HFS PROGRAM /usr/lib/java_runtime/libifaedjreg64.so IS NOT MARKED PROGRAM CONTROLLED.

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

```

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



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

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

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



External resource issues (HTTP 500)

The client sees:

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

The STDOUT may show:

```
ÝWARNING " BAQR0429W: API db2employee encountered an error while processing a request under URL  
https://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.IMSTCIPManagedConnection@c341a0aa.processOutputOTMAMsg(Connection, InteractionSpec, Record, Record) error. IMS
Connect returned an error: RETCODE=[4], REASONCODE=[NFNDDST] [Datastore not found. ]
at com.ibm.connector2.ims.ico.IMSManagedConnection.processOutputOTMAMsg(IMSManagedConnection.java:4042)
at com.ibm.connector2.ims.ico.IMSTCIPManagedConnection.callSendRecv(IMSTCIPManagedConnection.java:241)
at com.ibm.connector2.ims.ico.IMSManagedConnection.call(IMSManagedConnection.java:1625)
at com.ibm.connector2.ims.ico.IMSConnection.call(IMSConnection.java:213)
at com.ibm.connector2.ims.ico.IMSInteraction.execute(IMSInteraction.java:586)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.executeTransServiceInputTMRA(Unknown Source)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.invokeTransactionService(Unknown Source)
at com.ibm.ims.gateway.services.IMSGatewayServiceImpl.invoke(Unknown Source)
at com.ibm.ims.zconnect.provider.clients.GatewayServiceClient.doPost(Unknown Source)
at com.ibm.ims.zconnect.provider.clients.IMSClient.doInvoke(Unknown Source)
at com.ibm.ims.gateway.config.services.IMSZServiceHandlerImpl.invoke(Unknown Source)
at com.ibm.ims.gateway.config.services.IMSZServiceImpl.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ZosConnectServiceImpl.apiInvoke(Unknown Source)
at com.ibm.zosconnect.internal.ServiceManagerImpl.invoke(Unknown Source)
at com.ibm.zosconnect.internal.ApiManagerImpl.invokeApi(Unknown Source)
at com.ibm.zosconnect.internal.web.ServiceProxyServlet$3.run(Unknown Source)
at com.ibm.ws.webcontainer.async.ServiceWrapper.wrapAndRun(ServiceWrapper.java:236)
at com.ibm.ws.webcontainer.async.ContextWrapper.run(ContextWrapper.java:28)
at com.ibm.ws.webcontainer.async.WrapperRunnableImpl.run(WrapperRunnableImpl.java:89)
at com.ibm.ws.threading.internal.ExecutorServiceImpl$RunnableWrapper.run(ExecutorServiceImpl.java:238)
at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1160)
at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:635)
at java.lang.Thread.run(Thread.java:825)
```

A J2CA0056I: The Connection Manager received
a fatal connection error from the Resource Adapter for resource null. The exception is: javax.resource.spi.EISSystemException: ICO0001E:
com.ibm.connector2.ims.ico.IMSTCIPManagedConnection@c341a0aa.processOutputOTMAMsg(Connection, InteractionSpec, Record, Record) error. IMS
Connect returned an error: RETCODE=[4], REASONCODE=[NFNDDST] [Datastore not found.]

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



z/OS Connect Java classes

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



The FFDC dump for a network issue

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

Base Java classes
z/OS Connect Java classes

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

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Use the messages.log and FFDC log together

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

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



```
[9/12/21 14:56:45:652 GMT] 00000045 com.ibm.ws.logging.internal.impl.IncidentImpl           I FFDC1015I: An FFDC Incident has been  
created: "com.ibm.msg.client.jms.DetailedJMSEception: MQJCA1011: Failed to allocate a JMS connection.  
  
An internal error caused an attempt to allocate a connection to fail.  
  
See the linked exception for details of the failure. com.ibm.zosconnect.service.mq.OneWayMQServiceInvocation 0004" at  
ffdc_21.09.12_14.56.45.1.log
```



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



The FFDC dump showing additional JMS information

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

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

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A FFDC dump showing an SSL Handshake issue

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

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

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

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

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

Tech/Tip: 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 from 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 know as "shared secret" or "session key" (symmetric encryption)
15. Client and server will use this "shared secret" or "session key" to encrypts messages sent between the endpoints.



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

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

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

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

Common TLS handshake issues

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

I use the *traceSpecification* as shown below:

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

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

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

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

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

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

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

Common TLS handshake issues

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

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

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

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

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

Common TLS handshake issues

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

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

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

Common TLS handshake issues

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

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

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

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

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



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

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

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

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

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

Enabling trace in z/OS Connect EE server

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



Managing trace specifications

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

server.xml

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

safTrace.xml

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

cicsTrace.xml

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

imsTrace.xml

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

Enables enhanced tracing

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

Disable enhanced tracing

F BAQSTRT,LOGGING='*=INFO'

Or

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



trace.out file

mpz3

File Edit Settings View Communication Actions Window Help

File Edit Edit_Settings Menu Utilities Compilers Test Help

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

Command ==>

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

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

003730 3 keyStoreType: JCERACFKS
003731 3 trustStoreType: JCERACFKS

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

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

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

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

004243 3 keyStoreType: JCERACFKS
004244 3 trustStoreType: JCERACFKS

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

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

Columns 00101 00252
Scroll ==> PAGE

03/019

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



z/OS Connect Wildfire Github Site

<https://ibm.biz/BdPRGD>

The screenshot shows a GitHub repository page. At the top, there's a navigation bar with a file icon, a search bar containing "ibm-wsc/zCONNEE-Wildfire-Workshop", and a plus sign icon. Below the bar, the URL "https://github.com/ibm-wsc/zCONNEE-Wildfire-Workshop" is displayed. The main content area has a light gray background with a blue header bar.

Files

- archive
- containers
- misc
- Accessing REST APIs from zOS usin...
- Accessing zOS resources with REST ...
- README.md
- WebSphere Liberty on zOS Managi...
- WebSphere Liberty on zOS Configu...
- WebSphere Liberty on zOS Introdu...
- zOS Connect EE V3 Advanced Topic...
- ZOS Connect EE V5 Getting Started....

Last updated

- Add files via upload last year
- Delete containers/readme 9 months ago
- Add files via upload 4 months ago
- Add files via upload 4 days ago
- Add files via upload 9 months ago
- Update README.md 3 years ago
- Add files via upload 25 minutes ago
- Add files via upload 25 minutes ago
- Add files via upload 25 minutes ago
- Add files via upload 3 years ago
- Add files via upload 3 years ago

No releases published
[Create a new release](#)

Packages
No packages published
[Publish your first package](#)

Contributors 2

- emitchj
- Jbrefach John J Brefach

Deployments 1

- [github-pages](#) 3 years ago

Languages

- COBOL 100.0%

README

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

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mitchj@us.ibm.com

Thank you for listening and your questions.

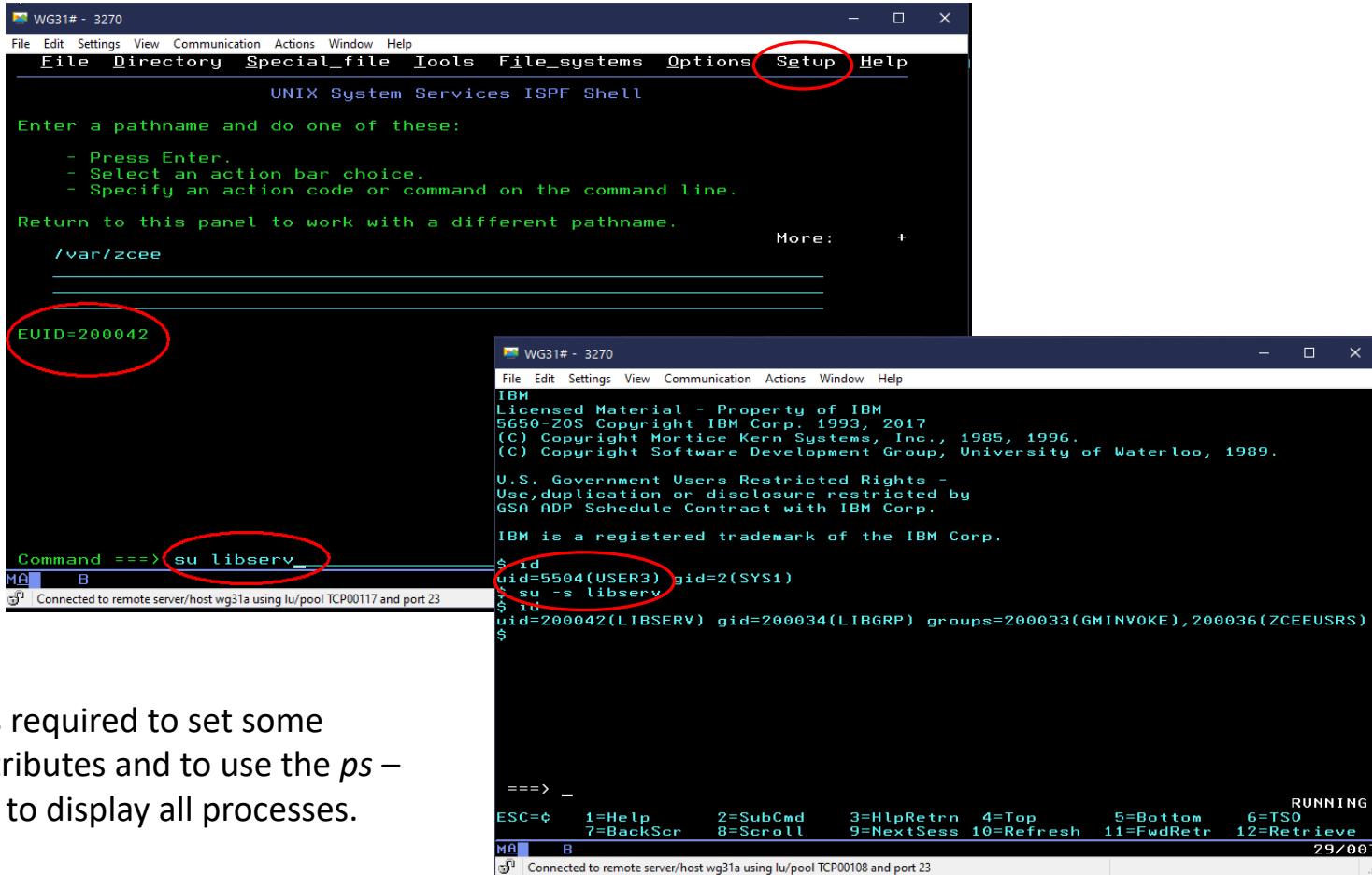
© 2017, 2024 IBM Corporation
Slide 99



Thank you for listening and your questions.

Miscellaneous Odds and Ends

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



The image contains two side-by-side screenshots of the ISPF/OMVS interface on a z/OS system.

Screenshot 1 (Left):

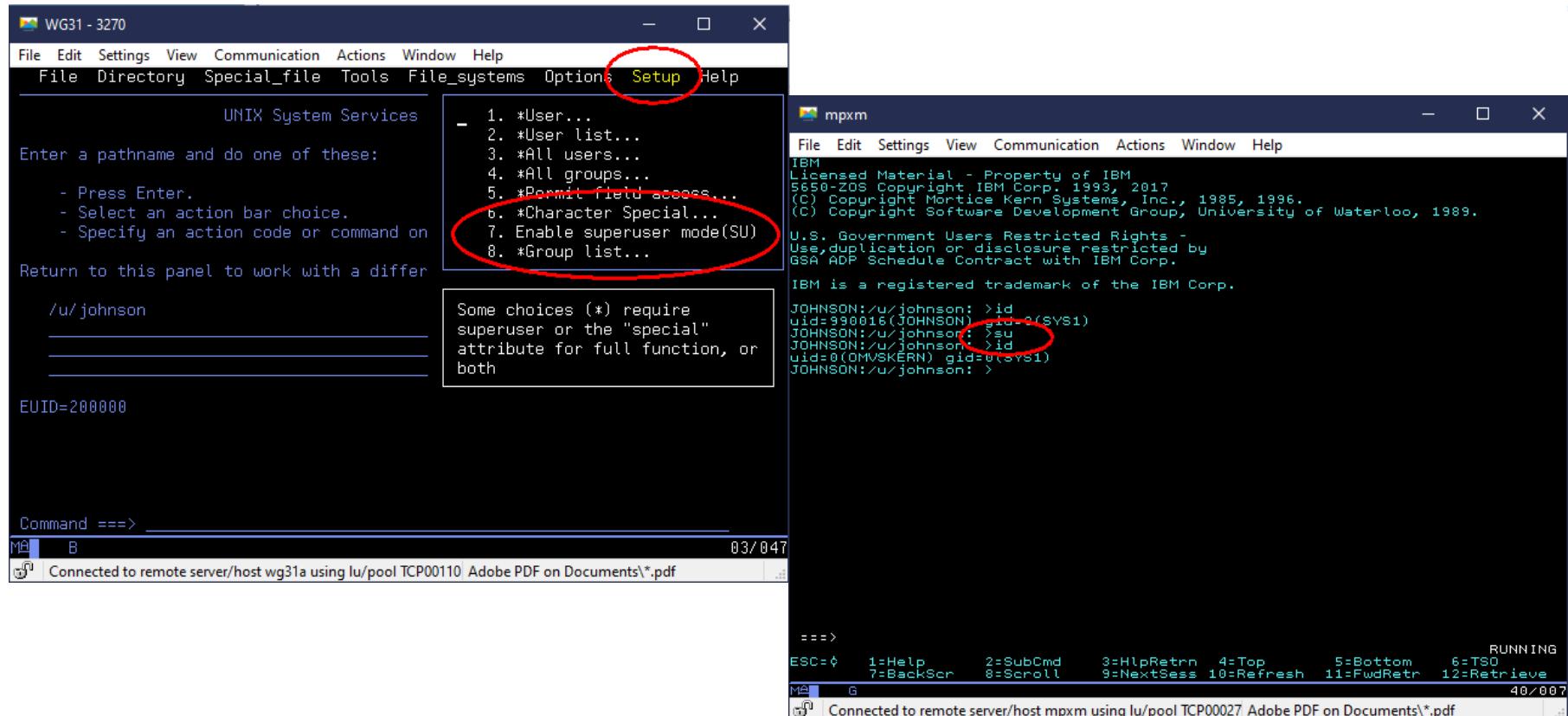
- The title bar shows "WG31# - 3270".
- The menu bar includes "File", "Edit", "Settings", "View", "Communication", "Actions", "Window", "Help", "File", "Directory", "Special_file", "Tools", "File_systems", "Options", "Setup" (which is circled in red), and "Help".
- The sub-menu "UNIX System Services ISPF Shell" is displayed.
- The message area says "Enter a pathname and do one of these:" followed by three bullet points: "- Press Enter.", "- Select an action bar choice.", and "- Specify an action code or command on the command line.".
- The command line shows "/var/zcee".
- A status message at the bottom left says "EUID=200042" (circled in red).
- The command line shows "Command ==> su libserv" (circled in red).
- The status bar at the bottom indicates "Connected to remote server/host wg31a using lu/pool TCP00117 and port 23".

Screenshot 2 (Right):

- The title bar shows "WG31# - 3270".
- The menu bar includes "File", "Edit", "Settings", "View", "Communication", "Actions", "Window", "Help", "IBM", "Licensed Material - Property of IBM", "5650-ZOS Copyright IBM Corp. 1993, 2017", "(C) Copyright Mortice Kern Systems, Inc., 1985, 1996.", "(C) Copyright Software Development Group, University of Waterloo, 1989.", "U.S. Government Users Restricted Rights - Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.", "IBM is a registered trademark of the IBM Corp.", "s id", "uid=5504(USER3) gid=2(SYS1)", "su -s libserv", "s id", "uid=200042(LIBSERV) gid=200034(LIBGRP) groups=200033(GMINVOKE),200036(ZCEEUSRS)", "\$".
- The status bar at the bottom indicates "Connected to remote server/host wg31a using lu/pool TCP00108 and port 23".
- The bottom of the screen shows a function key legend: "====> -" followed by "ESC=<" and "1=Help, 2=SubCmd, 3=HlpRetrn, 4=Top, 5=Bottom, 6=TSO, 7=BackScr, 8=Scroll, 9=NextSess, 10=Refresh, 11=FwdRetr, 12=Retrieve".
- The date "29/007" is also visible in the status bar.

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

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



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

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

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

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

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

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

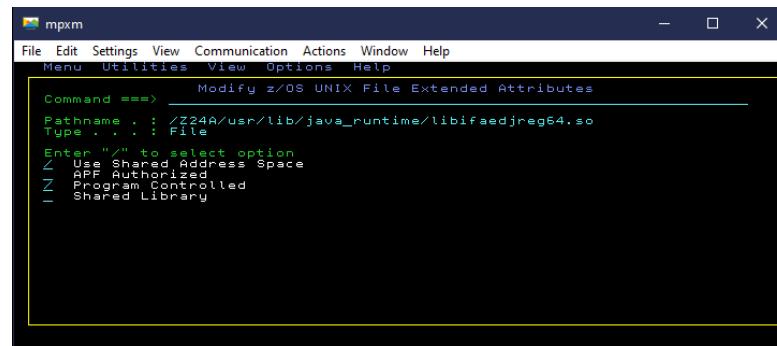
```
RDEFINE SURROGAT clientID.BAQASSRT UACC(NONE) OWNER(SYS1)
PERMIT clientID.BAQASSRT CLASS(SURROGAT) ACCESS(READ) ID(zCEEID)
```

OR

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

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

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





Tech-Tip: Displaying Liberty messages on the console and/or STDERR spool

server.xml

```
<zosLogging wtoMessage=
  "BAQR0657E,BAQR0658E,BAQR0660E,BAQR0686E,BAQR0687E"
  hardCopyMessage=
  "BAQR0657E,BAQR0658E,BAQR0660E,BAQR0686E,BAQR0687E"/>
```

MVS Console

```
18.12.02 STC00137 +BAQR0686E: Program CSCVINC is not available in the CICS region with
  811           connection ID cscvinc; service cscvincService failed.
18.12.02 STC00137 +BAQR0686E: Program CSCVINC is not available in the CICS region with
  812           connection ID cscvinc; service cscvincService failed.
19.07.12 STC00137 +BAQR0657E: Transaction abend MIJO occurred in CICS while using
  745           connection cscvinc and service cscvincService.
```

STDERR

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

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

Performing commands:

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

Will change these OMVS commands from:

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

To simpler (and shorter) OMVS commands:

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

Directory Shortcuts

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

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

ln -s oldname newname

These symbolic links can be used as JCL symbols

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

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

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

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

Tech-Tip: Copying WOLA executables from OMVS to a PDSE

```

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

```



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

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

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

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

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

Tech-Tip: Sample Sysplex DVIPAs Configuration

SYS1.TCPIP.TCPPARMS (IPNODES)

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

SYS1.TCPIP.TCPPARMS (PROFMPZ3)

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

SERVERWLM is not an option

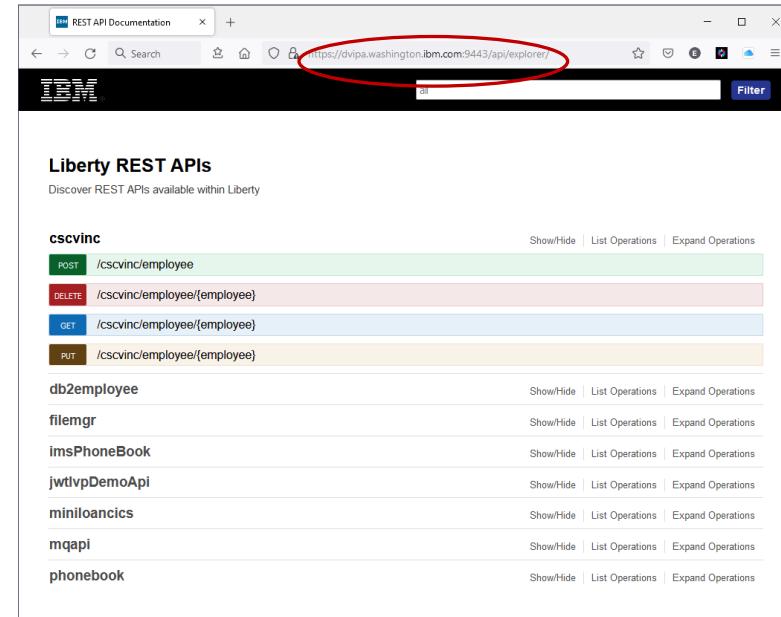
HOMETEST

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

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

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

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



The screenshot shows a browser window displaying the Liberty REST APIs documentation. The URL in the address bar is <https://dvipa.washington.ibm.com:9443/api/explorer/>. The page lists various RESTful endpoints categorized by their base URLs:

- cscvinc**
 - POST** /cscvinc/employee
 - DELETE** /cscvinc/employee/{employee}
 - GET** /cscvinc/employee/{employee}
 - PUT** /cscvinc/employee/{employee}
- db2employee**
- filemgr**
- imsPhoneBook**
- jwttvpDemoApi**
- miniloancics**
- mqapi**
- phonebook**

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

```

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

res_init Resolver values:
Setup file warning messages = No
CTRACE TRACERES option = No
Global Tcp/Ip Dataset = SYS1.TCPIP.TCPPARMS(TCPDAT3)
Default Tcp/Ip Dataset = SYS1.TCPIP.TCPPARMS(TCPDAT3)
Local Tcp/Ip Dataset = //DD:SYSTCPD
                      ==> SYS1.TCPIP.TCPPARMS(TCPDAT3)
Translation Table = SYS1.TCPIP.STANDARD.TCPXLBIN
UserId/JobName = JOHNSON
Caller API = TCP/IP Sockets Extended
Caller Mode = EBCDIC
System Name = WSC13 (from VMCF)
UnresponsiveThreshold = 25
(G) DataSetPrefix = SYS1.TCPIP
(G) HostName = wg31
. . .
res_query Failed: RetVal = -1, RC = 1, Reason = 0x78981005
res_querydomain Failed: RetVal = -1, RC = 1, Reason = 0x78981005
res_search Failed: RetVal = -1, RC = 1, Reason = 0x78981005
GetAddrInfo Closing IOCTL Socket 0x00000000
BPX1CL0: RetVal = 0, RC = 0, Reason = 0x00000000
GetAddrInfo Failed: RetVal = -1, RC = 1, Reason = 0x78AE1004
GetAddrInfo Ended: 2021/09/12 12:55:32.364732
*****
EZ3111I Unknown host 'WG31.WASHINGTON.IBM.COM'

```

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

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 from 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 know as "shared secret" or "session key" (symmetric encryption)
15. Client and server will use this "shared secret" or "session key" to encrypts messages sent between the endpoints.

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



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

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

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



Tech-Tip: CICS IPCONN and TCPIPSERVICE resources for HA

CICS Specific TCPIPSERVICE - IPIC

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

CICS Generic TCPIPSERVICE - IPICG

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

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

I IPCONN ACQ

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

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

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



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

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

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

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

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

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

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

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



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

    <!-- To access this server from a remote client add a host attribute
        to fetch swagger doc from zOS Connect Enterprise Edition -->
    <httpEndpoint id="defaultHttpEndpoint"
        host="*"
        httpPort="9080"
        httpsPort="9443" />
    <!-- add cors to allow cross origin access, e.g. when using swagger UI
        to fetch swagger doc from zOS Connect Enterprise Edition -->
    <cors id="defaultCORSConfig"
        - - - - - 24 Line(s) not Displayed
    <!-- config requires updateTrigger="mbean" for REFRESH command support
-->
<config updateTrigger="mbean" monitorInterval="500"/>

    <zosconnect_zosConnectManager setUTF8ResponseEncoding="true"/>

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

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

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

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

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

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

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

</server>
```

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

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

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

OMVS
LE
JAVA
LIBERTY
z/OS Connect

Tech-Tip: Executing Gradle build commands in JCL

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

settings.gradle

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

build.gradle

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

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

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



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

cscvinc.properties

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

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

Tech-Tip: Executing multiple OMVS commands in one step

```

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

```

Always be aware of the beginning and trailing spaces.

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

Tech-Tip: Copy WOLA executables from OMVS to a PDSE

```

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

```



Tech-Tip: BBOSMFV (Extract Liberty SMF 120 Subtype 11 records)

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

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

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

ZCEEDUMP

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

ZCEERSTR

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

Tech-Tip: Define and format a ZFS data set using IOEAGFMT

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

Tech-Tip: Generate WLM Workload Activity Reports

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