How to use REST support on z/VSE for access to IBM MQ REST API

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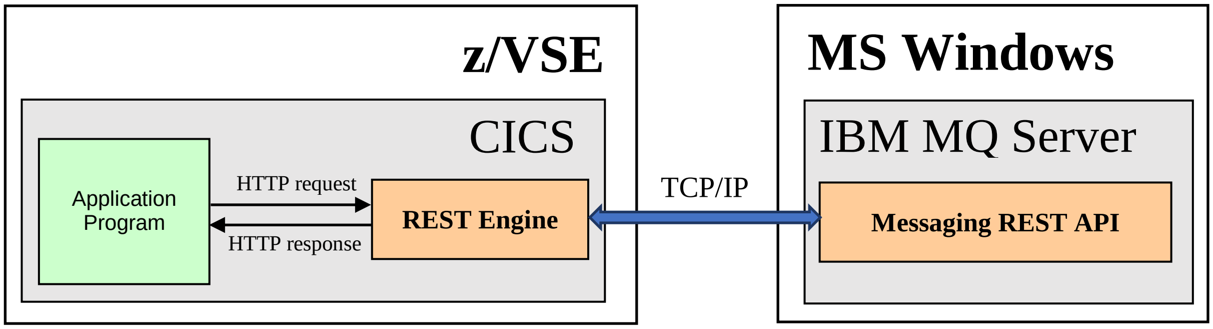
1. Introduction

The document describes the basic knowledge for using the z/VSE REST support for accessing IBM MQ Server on Windows (version 9.1.0). This support gives z/VSE application program an opportunity to communicate with MQ messaging REST API and MQ administrative REST API. The publication covers mainly the first of these APIs (administrative REST API will be involved only for basic testing the MQ server installation).

With the messaging REST API your application program can:

- Create messages on an existing queue (request PUT);
- Read (destructively get) messages from a queue (request DELETE).

An application program sends a REST request to MQ server and receives a response from MQ server via REST Engine (that is provided as a part of the z/VSE 6.2). The REST Engine interacts with MQ, so you don’t need to install additional components on your z/VSE system. The figure below shows the simplified scheme of interaction between z/VSE application program and MQ server.



An application program that communicates with MQ Server is a MQ REST API user which should be configured to the MQ system. In first, a role should be assigned to a user to determine a level of access to MQ objects (for consideration in this publication, it is important to grant a user rights for writing to and reading from a queue). In second, one of the following register types should be defined for authenticating a user:

(1) HTTP basic authentication;
(2) Token-based authentication;
(3) Client certificate authentication.

Also, a user can be configured in the way that allows login with no authentication.

An application program connects to MQ Server using HTTP or secure HTTP (HTTPS) protocol.

Before this document reading you should gain a basic knowledge regarding the Web Services technology and its surrounding protocols and formats. The following terms and abbreviations will be used within this document:

• XML	- Extensible Markup Language
• TCP/IP	- Transmission Control Protocol/Internet Protocol
• HTTP	- Hypertext Transfer Protocol
• HTTPS	- Hypertext Transfer Protocol Secure
• REST	- Representational State Transfer

For information about IBM MQ and REST API, please refer to:
https://www.ibm.com/support/knowledgecenter/SSFKSJ_9.1.0/com.ibm.mq.ref.doc/q049170_.htm

For information about z/SVE support for REST, please see:
https://www.ibm.com/support/knowledgecenter/en/SSB27H_6.2.0/fa2ws_ovw_zvse_support_rest.html

This document supposes that you have an MQ installation and the mqweb server installed and running.

2. Using REST API with no authentication

2.1. *Overview*

Accessing the REST API with no a user authentication can be recommended for development and investigation purposes only and should be forbidden for production systems.

For using REST API with no authentication, you just disable it in the security configuration of the MQ Server.
Also, if you are planning to use secure HTTP (HTTPS) for accessing REST API, you should configure SSL as described in the Appendix C.

2.2. *Disabling a user authentication*

To disable a user authentication, you should:

(1) Replace the MQ Server security configuration file (mqwebuser.xml) by the no_security.xml sample (that provides HTTP with no authentication or role mapping). The mqwebuser.xml file located in the directory *MQ_DATA_DIRECTORY*\web\installations\installationName\servers\mqweb (please keep its backup copy before replacing); the file no_security.xml can be found in the directory *MQ_INSTALLATION_PATH*\web\mq\samp\configuration.

(2) Edit the mqwebuser.xml file as follows:

- Enable the MQ server for listening HTTP/HTTPS requests on all IP addresses by uncommenting the line:
  ```
  <variable name="httpHost" value="*"/>
  ```
- Enable HTTPS on the port 9443 by adding the line:
  ```
  <variable name="httpsPort" value="9443"/>
  ```
  (this is “just in case”: on MQ Server the port 9443 is used for HTPPS requests by default)

2.3. *Verification of the MQ Server accessibility*

To make sure that MQ server is accessible for a user with no authentication, send the request POST to the messaging REST API for creating a new message. For example, the following cURL command results in creation of the message `Hello world!` on the existing queue `testQueue`:

```
curl -k -X POST
http://localhost:9080/ibmmq/rest/v1/messaging/qmgr/mq1/queue/test
Queue/message -d "Hello world!" -H "Content-Type:text/plain"
```

To verify that the new message has been created, send the request DELETE; in normal case, the requested message body will be displayed on Windows console like to the following:

```
curl -k -X DELETE
http://localhost:9080/ibmmq/rest/v1/messaging/qmgr/mq1/queue/test
Queue/message
Hello world!
```

For information regarding cURL facility refer to the Appendix B. For the verification, you can use the Postman tool as well (Appendix B).

2.4. *Samples of programs*

The samples POST_HTTP(s)_NA and DELETE_HTTP(s)_NA demonstrate the basic technique of programming (on the COBOL programming language) for using REST API with no authentication. To obtain the samples refer to the Appendix D.

The sample POST_HTTP(s)_NA implements the procedure of message creation by the HTTP request POST. The request can be sent either without options or with an option that provides a created message with specific attribute (you can specify the only option for a request or several options at once). HTTP request headers are used for options specification.

The sample covers all available options:

- Create simple text message (no options, no message attributes);
- Create the message with correlation ID (the header “ibm-mq-md-correlationId”);
- Create the message with expiry duration (the header “ibm-mq-md-expiry”);
- Create the message with persistence (the header “ibm-mq-md-persistence”). The message with “persistence” attribute stays in the queue after MQ server restart;
- Create the message with the “Reply-To” destination (the header “ibm-mq-md-replyTo”).

For details, please refer to
https://www.ibm.com/support/knowledgecenter/SSFKSJ_9.1.0/com.ibm.mq.ref.dev.doc/q130750_.htm

The sample DELETE_HTTP(s)_NA shows the messages retrieving (with deletion) by the HTTP request DELETE. The request without options returns the first available message; when specify a request option (in a request HTTP header) you are filtering messages for extraction from the queue (several options can be specified at once).

The sample covers all available options:

- Get first available message (no options);
- Get next available message with specified correlation ID (the header ”correlationId”);
- Get next available message with message ID (the header “messageId”);
- Wait specified number of milliseconds for a new message if there are no available messages by now (the header “wait”).

Before these samples running you should update the queue URL (value MQ-SERVER-URL within samples) with actual IP address, port number, queue manager name and queue name. Also, you need to comment and uncomment the proper lines (containing the server URL) for using HTTP or HTTPS protocol.

You can make sample more verbose if running it in the DEBUG mode by uncommenting and commenting the respective lines:

```
      *    SOURCE-COMPUTER. IBM-370 WITH DEBUGGING MODE.
          SOURCE-COMPUTER. IBM-370.
```

3. Using REST API with HTTP basic authentication

3.1. *Overview*

For using REST API with HTTP basic authentication, you need:

- Configure a Windows user to the MQ Server (see Configuration of the MQ user);
- Provide each HTTP request of an application program with the name and password of the configured user (as described in the Samples of programs).

Also, for accessing REST API with the secure HTTP you should configure SSL as described in Appendix C.

For details about REST API with HTTP basic authentication, please see here: https://www.ibm.com/support/knowledgecenter/SSFKSJ_9.1.0/com.ibm.mq.sec.doc/q128710_.htm

3.2. *Configuration of the MQ user*

To configure MQ user, perform the following actions on the Windows system where the MQ Server had been installed:

(1) Create a new Windows user (or select existing one);

(2) Make created user known to MQ Server (add a user to the MQ manager queue you are interested in);

(3) Configure a user registry and a user role.

The detailed actions description is below.

For more information about MQ users and roles, please see here: https://www.ibm.com/support/knowledgecenter/SSFKSJ_9.1.0/com.ibm.mq.sec.doc/q127970_.htm

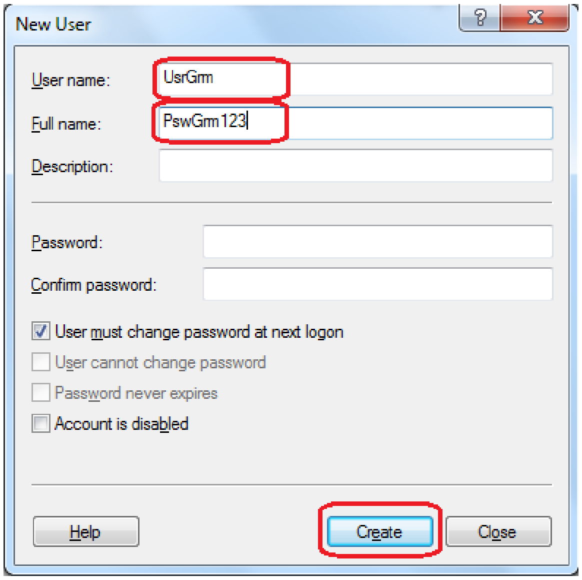
(1) Create a new Windows user:

1.1. Press `Start` on the Windows Taskbar and right-click on the `Computer`, then select `Manage` in the contextual menu;

1.2. Expand the list `Configuration` (on Windows server) or the list `System tools` (on Windows 7), thereupon expand the list `Local Users and Groups`;

1.3. Right-click on the `Users` item (the list `Local Users and Groups`) and select the `New user` in the contextual menu;

1.4. Enter user name and user password when prompted (for example, `UsrGrm` and `PswGrm123`), then press `Create`:



User name: UsrGrm

Full name: PswGrm123

Description:

Password:

Confirm password:

☑ User must change password at next logon

□ User cannot change password

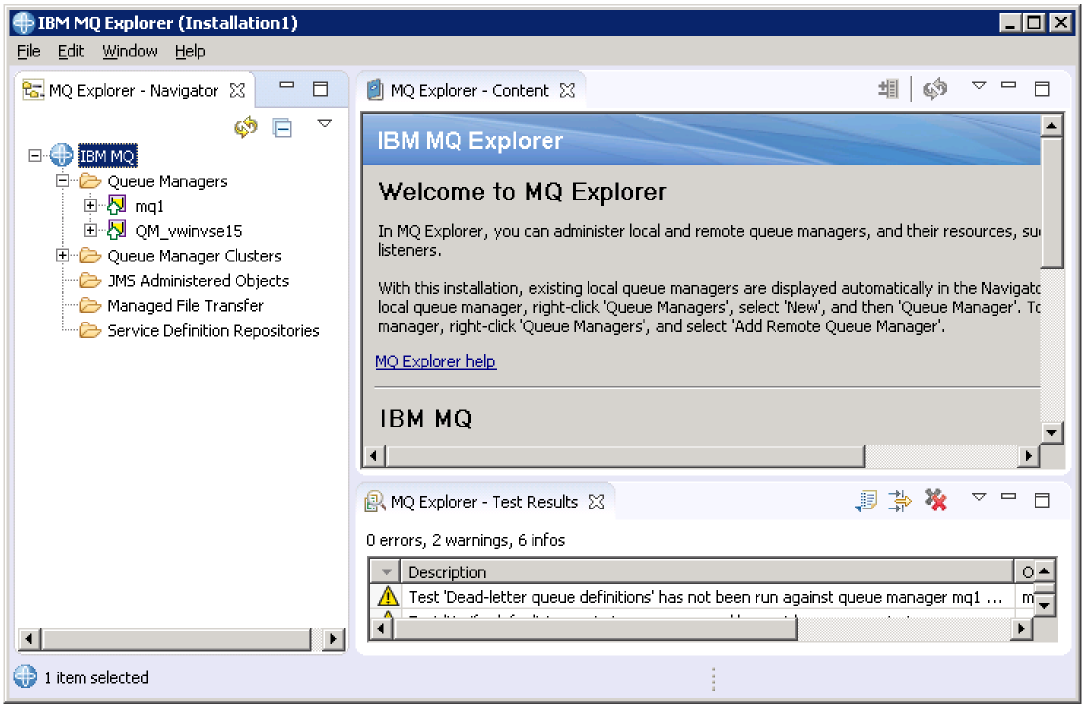
□ Password never expires

□ Account is disabled

(2) Add a new user to the MQ manager queue:

2.1. Start IBM MQ Explorer (if not started yet).

2.2. At the left of the IBM MQ Explorer window expand the `IBM MQ` list and then the `Queue Managers` list:



Welcome to MQ Explorer

In MQ Explorer, you can administer local and remote queue managers, and their resources, su
listeners.

With this installation, existing local queue managers are displayed automatically in the Navigatc
local queue manager, right-click 'Queue Managers', select 'New', and then 'Queue Manager'. Tc
manager, right-click 'Queue Managers', and select 'Add Remote Queue Manager'.

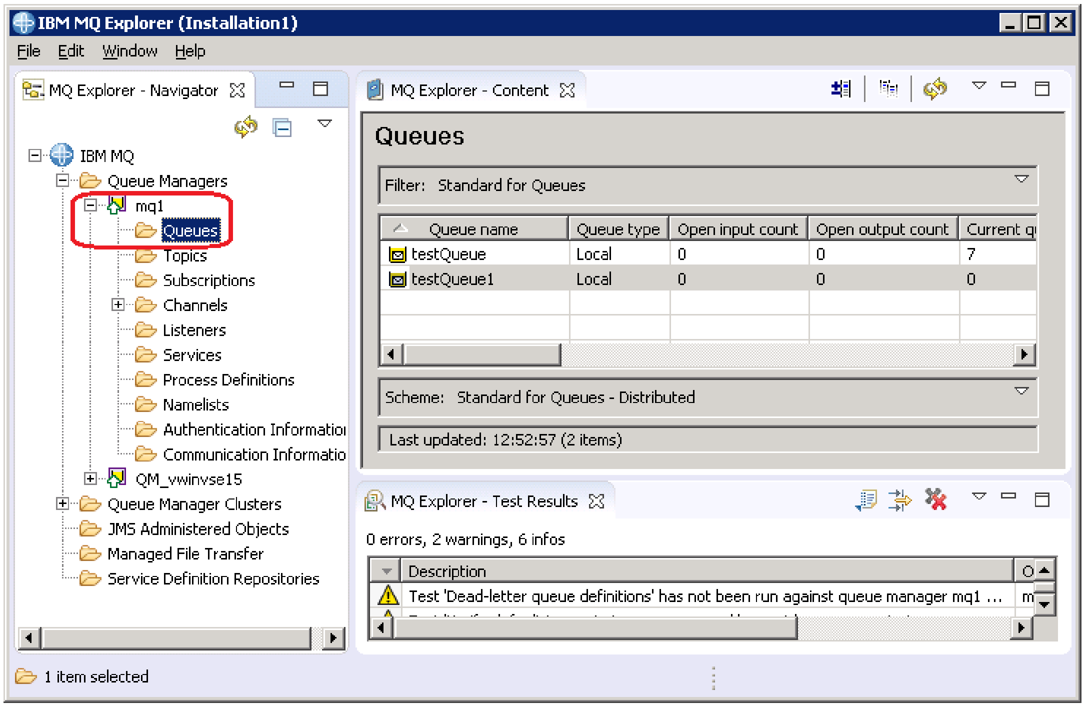
MQ Explorer help

IBM MQ

0 errors, 2 warnings, 6 infos

Description	O
Test 'Dead-letter queue definitions' has not been run against queue manager mq1 ...	m

2.3. Expand the `Queues` list (left click on it) of the queue manager you are interested in (for example, `mq1`): you will see the list of queues at the right of the MQ Explorer window:



Queues

Filter: Standard for Queues

Queue name	Queue type	Open input count	Open output count	Current q
testQueue	Local	0	0	7
testQueue1	Local	0	0	0

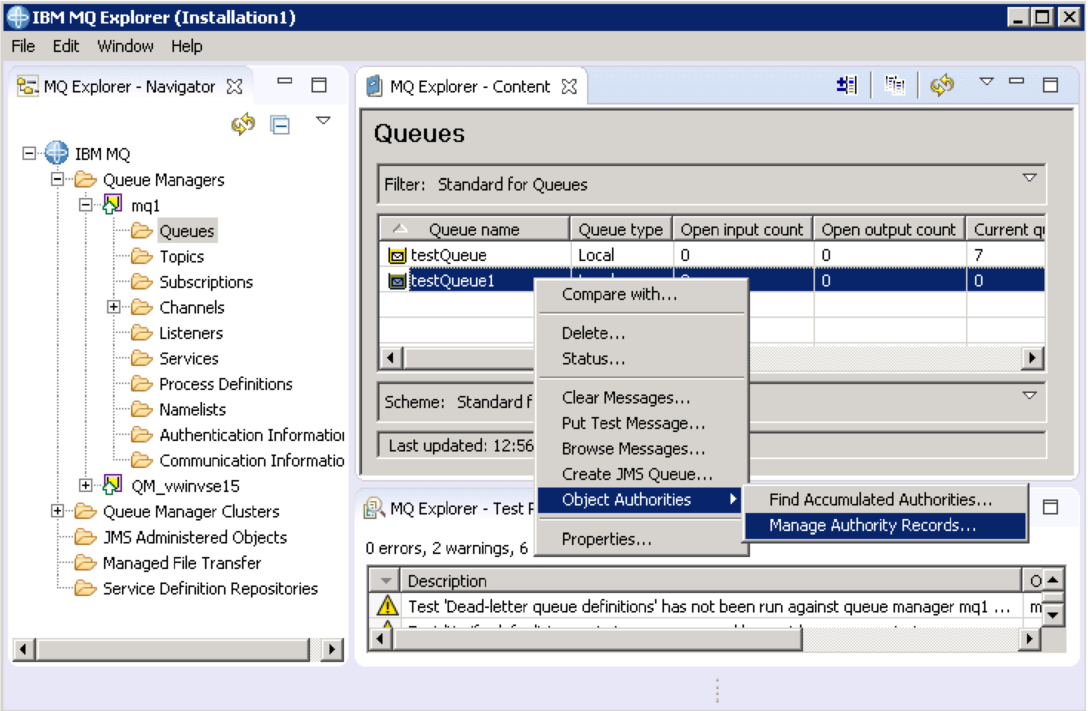
Scheme: Standard for Queues - Distributed

Last updated: 12:52:57 (2 items)

0 errors, 2 warnings, 6 infos

Description	O
Test 'Dead-letter queue definitions' has not been run against queue manager mq1 ...	m

2.4. Right-click on the name of queue you have created a new user for (for example, `testQueue1`), select `Object Authorities` in the contextual menu, and then select `Manager Authority Records...`:

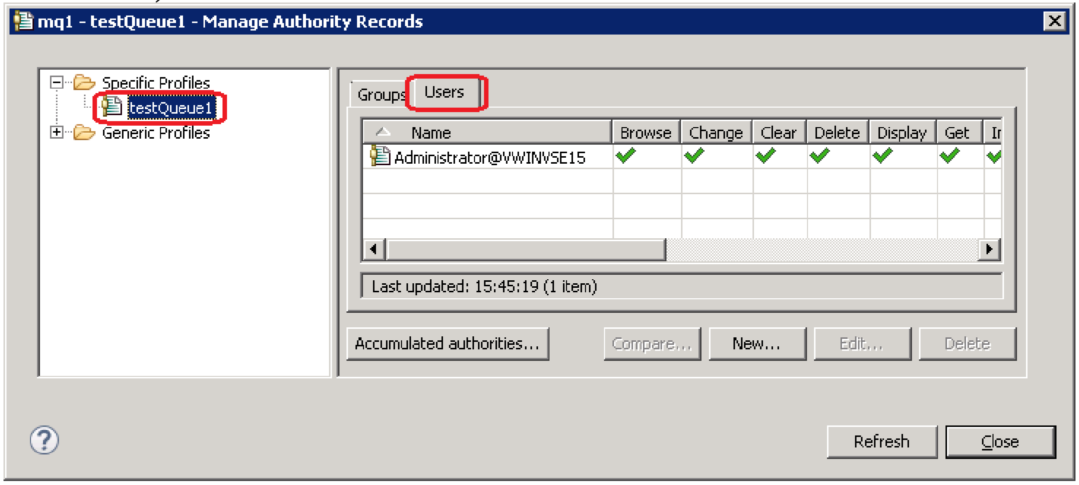


Queue name	Queue type	Open input count	Open output count	Current q
testQueue	Local	0	0	7
testQueue1			0	0

0 errors, 2 warnings, 6

Description	O
Test 'Dead-letter queue definitions' has not been run against queue manager mq1 ...	m

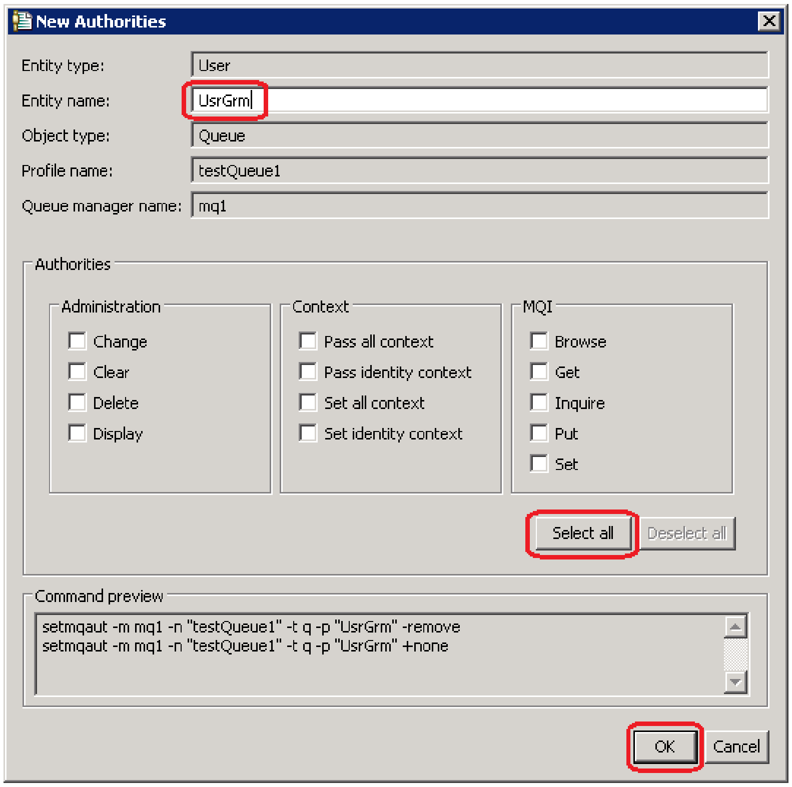
2.5. Now you see the pop-up window `Manager Authority Records` for the selected queue manager and queue (`mq1 – testQueue1 – Manage Authority Records`); expand the `Specific Profiles` list and left click on the queue name (`testQueue1`), then select the tab `Users` (at the right on the window):



Name	Browse	Change	Clear	Delete	Display	Get	Ir
Administrator@VWINVSE15	✓	✓	✓	✓	✓	✓	✓

Last updated: 15:45:19 (1 item)

2.6. Press the button `New...` in the tab `Users` of above pop-up window: the `New Authorities` window appears with the entity type `User`; enter the entity name (the name of the new user created above, that is `UsrGrm` in our case), press `Select all` button within `Authorities` group (for selecting all authorities for the user), and after that press `OK` for the finishing the new user creation:



Entity type: User
Entity name: UsrGrm
Object type: Queue
Profile name: testQueue1
Queue manager name: mq1

```
setmqaut -m mq1 -n "testQueue1" -t q -p "UsrGrm" -remove
setmqaut -m mq1 -n "testQueue1" -t q -p "UsrGrm" +none
```

(3) Configure a user registry (for user authentication) and a user role (to grant him authorization). These settings are controlled by the mqwebuser.xml file, located in the *MQ_DATA_DIRECTORY*\web\installations\installationName\servers\mqweb directory. Please perform the following actions:

3.1. Copy the sample basic_registry.xml from the directory *MQ_INSTALLATION_PATH*\web\mq\samp\configuration (e.g. “C:\Program Files\IBM\MQ\web\mq\samp\configuration”) into above destination directory. This sample contains configuration that grants some roles and enables HTTP basic authentication;

3.2. Rename the basic_registry.xml file to the mqwebuser.xml (keep existing copy of the mqwebuser.xml);

3.3. Add a new user name and a user password (Windows user `UsrGrm` and password `PswGrm123`) to the sections `enterpriseApplication` and `basicRegistry` respectively as follows:

```
   <enterpriseApplication id="com.ibm.mq.rest">
         <application-bnd>
   . . .
            <security-role name="MQWebUser">
                <special-subject
type="ALL_AUTHENTICATED_USERS"/>
                <user name="UsrGrm"
realm="defaultRealm"/>
            </security-role>
   . . .
```

```
            </application-bnd>
        </enterpriseApplication>
       . . .
        <basicRegistry id="basic" realm="defaultRealm">
       . . .
            <user name="UsrGrm" password="PswGrm123"/>
       . . .
        </basicRegistry>
```

3.4. When you are modifying the mqwebuser.xml file, also make the following:

- Enable the server for listening HTTP requests on all IP addresses by uncommenting the following line:
  `<variable name="httpHost" value="*"/>`
- Enable HTTP on the port 9080 and HTTPS on port 9443 by inserting the lines:
  ```
  <variable name="httpPort" value="9080"/>
  <variable name="httpsPort" value="9443"/>
  ```
  (these are “just in case”: ports 9080 and 9443 are used for HTTP and HTTPS request respectively by default; however, you can configure other ports numbers).
- Comment (or remove) the line:
  `<sslDefault sslRef="mqDefaultSSLConfig"/>`
  (it is required for enabling of the secure HTTP connection from z/VSE; see Disabling the default SSL configuration on MQ Server).

3.3. *Verification of the MQ Server accessibility*

To be sure that the MQ server is accessible with HTTP basic authentication for the configured user and password (`UsrGrm` and `PswGrm123`), send the request POST to the messaging REST API by means of the cURL facility:

```
curl -k -X POST
http://localhost:9080/ibmmq/rest/v1/messaging/qmgr/mq1/queue/test
Queue/message -d "Basic auth: test message" -H "Content-
Type:text/plain" -u UsrGrm:PswGrm123 -H "ibm-mq-rest-csrf-
token:value"
```

This command should result in creating the message `Basic auth: test message` on the existing queue `testQueue`.

To verify that the new message has been created, send the request DELETE:

```
curl -k -X DELETE
http://localhost:9080/ibmmq/rest/v1/messaging/qmgr/mq1/queue/test
Queue/message -u UsrGrm:PswGrm123 -H "ibm-mq-rest-csrf-
token:value"
```

In normal case, the DELETE request response will show the retrieved message body as follows:

```
Basic auth: test message
```

To verify the HTTP basic authentication, you can use the Postman tool as well.

3.4. *Samples of programs*

The samples POST_HTTP_BA and DELETE_HTTP_BA show the basic technique of COBOL programming for REST API with HTTP basic authentication (to obtain samples see Appendix D).
For such authentication:

- A HTTP request must be provided with "ibm-mq-rest-csrf-token" header (with any value);
- A user name and a user password must be specified in fields REST-REQ-AUTH-USER and REST-REQ-AUTH-PASSWORD of the REST COMMAREA respectively;
- The REST-REQ-AUTH-TYPE field must be set to '1'.

These samples repeat the scenarios of messages creating and retrieving implemented in the samples POST_HTTP(s)_NA and DELETE_HTTP(s)_NA.

Before samples running, please update the server URLs with actual IP addresses, port number, queue manager name and queue name.

The samples use insecure protocol (HTTP) for accessing MQ server; however, you can update them easy to HTTPS by changing port number and protocol notation in the constant MQ-SERVER-URL.

4. Using REST API with token-based authentication

4.1. *Overview*

With the token-based authentication:

(1) An application program (REST API user) starts the token-based authentication session (logs in): sends a user name and a user password to the REST API resource `login` (https://*host*:*port*/ibmmq/rest/v1/login) with the POST request;
(2) The MQ server generates the LTPA token and returns it to an application program as a cookie;
(3) An application program keeps the LTPA token within its internal storage to authenticate future requests;
(4) An application program creates message(s) on or retrieves message(s) from the MQ server by sending the request(s) POST or DELETE to the messaging REST API (https://*host*:*port*/ibmmq/rest/v1/messaging/qmgr/*QueueManagerName*/queue/*QueueName*/message) with the cookie that contains the LTPA token;

(5) An application program stops the token-based authentication session (logs out): sends the DELETE request to the REST API resource `login`.

For details about REST API with token-base authentication, please see here: https://www.ibm.com/support/knowledgecenter/SSFKSJ_9.1.0/com.ibm.mq.sec.doc/q128720_.htm

For using the token-base authentication you need:

- Configure MQ user and enable HTTP basic authentication (refer to Configuration of the MQ user);
  So, for token-base authentication, the same security configuration (mqwebuser.xml file) is used as for basic authentication.
- Verify token-base authentication.

Also (if you are planning to use secure HTTP protocol), the SSL should be configured as described in the Appendix C.

4.2. *Verification of the MQ Server accessibility*

For verifying that MQ Server is accessible with token-based authentication, you can involve the Postman tool according to the following scenario:

(1) Start the token-based authentication session:
- Select `POST` request;
- Specify the REST API `login` resource as URL;
- Select `No Auth` as the authorization type;
- Specify the request body:
  - Select `raw` for the body;
  - Choose `Json(application/json)` in the drop-down list;
  - Enter the user name and the user password (as the request body) in the JSON format:
    ```
    {
          "username" : "User_name",
          "password" : "User_password"
    }
    ```
    When the `JSON (application/json)` has been selected, the header `Content-Type` with the value `application/json` will be generated (or overwritten) automatically;
- Press `Send` for sending the request to the MQ server.

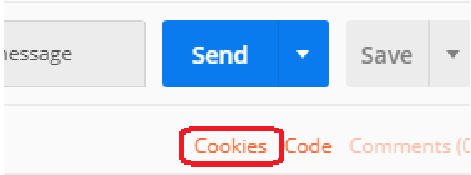
(2) Verify the request response, that is be sure:
- The status is `204 No content`;
- The returned LtpaToken2 cookie looks like to the following:
  ```
  LtpaToken2    pC00RPBXCcjlBbj
                EQFoOcXHPUJrpc
                k5TCnQhmIIxkIm
                cCA6+h/qr1WouR
                3a3QdFeoJrQtA
  ```

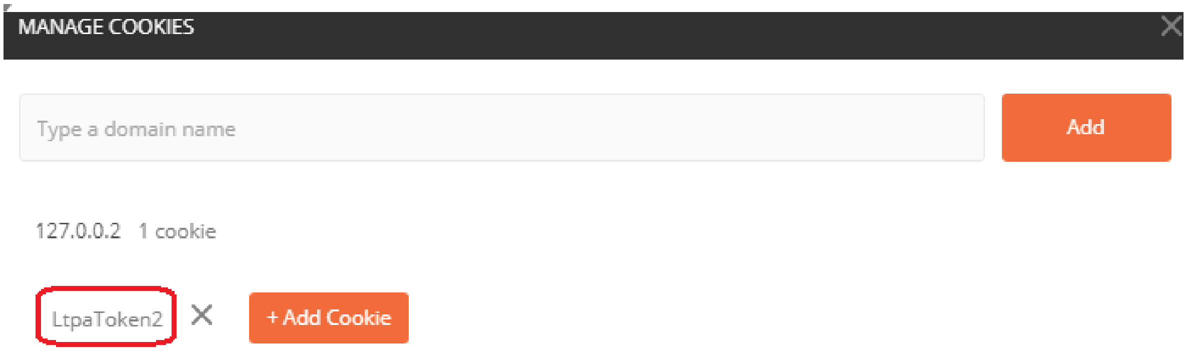
```
D8XepHlFhX7sxZ
GW7uNA0gfqzJGl
rpVhGMohJvp8lK
nJvOCgM9G0fYPT
XIDhhb4MrK2oFn
cxP3Ifq1ScAc+Sx1
QlyZlzZqMjp1Nzl
0Bppb1JCwRkupt
aMwzy61Urw6r9
m5yRSgBqAOb4L
R7sWJZVo5KNP8+
658tDbIyB2E3md
IDUY0JinKMDn9D
kCuxeek531QoDT
179qJJTp2mSq5hJ
NH14txEt9+W+E0
L0+nWqgqmjbhyJ
zwyxdq4BX
```

(3) Keep the returned cookie LtpaToken2 “as is” (don’t remove it from next sending requests);

(4) Send some requests POST and DELETE to the messaging REST API for creating message(s) on and for retrieving message(s) from the MQ server.
When sending a request:

- Be sure that the cookie LtpaToken2 is present in the request (when token-based authentication session logged in, the cookie should be attached to next requests by default):





- Specify the header `ibm-mq-rest-csrf-token` with any value (if not specified);
- For the request POST select `raw` for the body and choose `Text (text/plain)` in the drop-down list.

When request is done, verify that:

- The status is `201 Created` for the request POST and is `200 OK` for the DELETE;

- The returned message body is as expected (for the request DELETE).

(5) Stop the token-based authentication session by sending the request DELETE to the REST API resource `login`.
When sending the request:
- Be sure that the cookie LtpaToken2 is present in the request;
- Specify the header `ibm-mq-rest-csrf-token` with any value (if not specified);

When request is done, verify that:
- The status is `204 No Content`.

You can use the cURL facility for the verification of the MQ Server accessibility as well.

4.3. *Samples of programs*

The samples POST_HTTP_TBA and DELETE_HTTP_TBA demonstrate the basic of COBOL programming for REST API with token-based authentication (here, the REST-REQ-AUTH-TYPE field of the REST COMMAREA is set to ‘0’, that means “no authentication” actually). To obtain the samples refer to the Appendix D.

Before these samples running you should update the server URLs with actual IP addresses, port number, queue manager name and queue name.

The samples reproduce procedures of messages creating and retrieving using all available options (like to the samples for another authentication types).

The insecure protocol (HTTP) is used in these samples; however, you can update samples for using HTTPS by changing port number in the MQ server URLs MQ-SERVER-URL and MQ-SERVER-URL-T and changing protocol notation in these URLs.

5. Using REST API with client certificate authentication

5.1. *Overview*

With the authentication of this type, the certificate is used in place of a user name and a user password in a sending request. The certificate must be provided for each REST API request to the MQ Server.

Only the secure HTTP can be used with the authentication of this type.

For more information about REST API with client certificate authentication, please see here:
https://www.ibm.com/support/knowledgecenter/SSFKSJ_9.1.0/com.ibm.mq.sec.doc/q127940_.htm

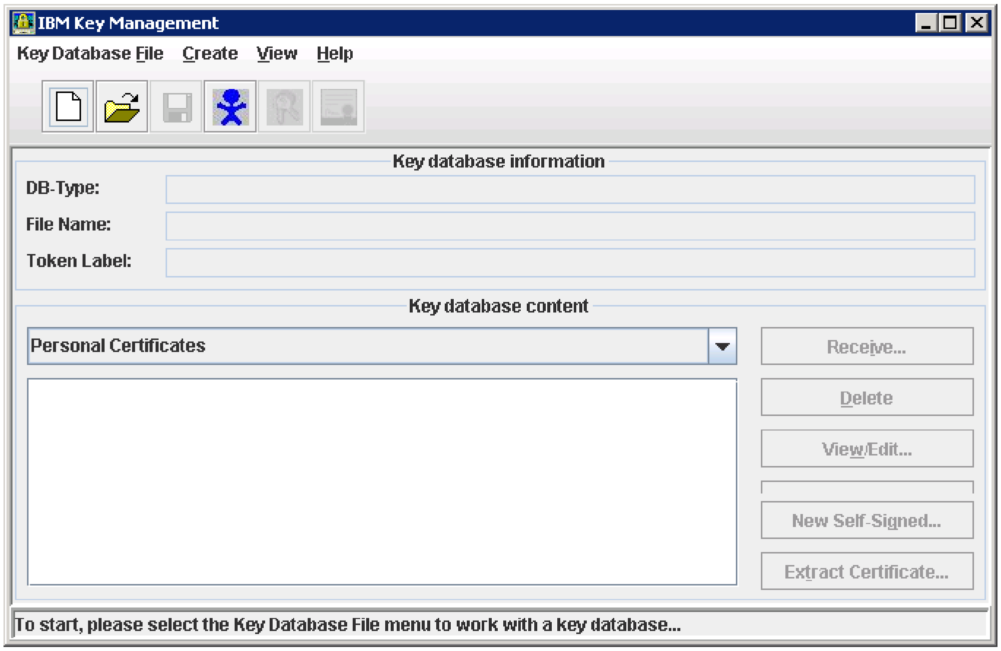
For using REST API with a client certification authentication, you need:

- Configure a new MQ user and role for basic authentication (as described in the Configuration of the MQ user).
- Setup SSL using configured MQ user (as described in the Appendix C).
- Extract the public part of the z/VSE certificate.
- Import the public part of z/VSE certificate into the MQ server Trust KeyStore.
- Enable client certificate authentication by the MQ Server.
- Verify the client certificate authentication.

5.2. *Extraction of the public part of the z/VSE Certificate*

To extract the public part of the z/VSE certificate on the Windows system, where it was generated or where it had been transferred to, perform the following actions:

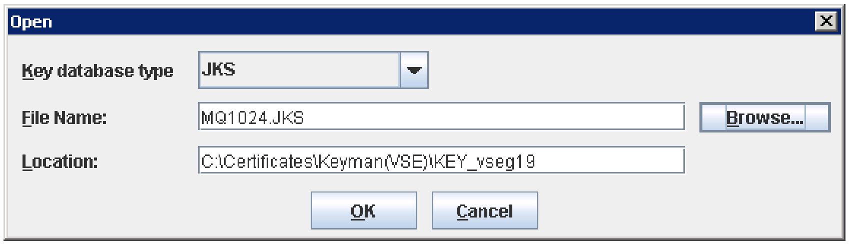
(1) Start the IBM Key management tool (enter `strmqikm.exe` on Windows command prompt or right-click on `IBM MQ` on MQ Explorer Window and select `Manage SSL certificate…` from the drop-down menu):



To start, please select the Key Database File menu to work with a key database...

(2) Select the Key database for opening:

- Press `Open a key database file` on Key Management window buttons menu or select `Open…` from the `Key Database File` drop-down menu;
- On the `Open` pop-up window (see the below sample), choose `JKS` as Key database type;
- Specify the Key database file by using the `Browse…` button or by entering file name and location into respective text fields directly, for example, as follows (the keyring file `MQ1024.JKS` was generated as described in the Generation of z/VSE certificates):



Open

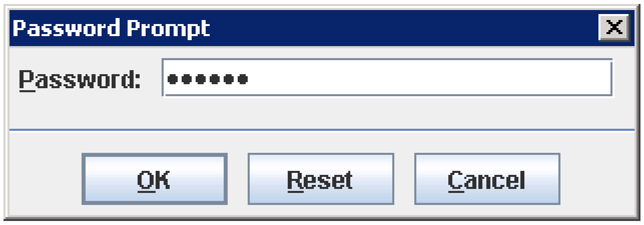
Key database type: JKS

File Name: MQ1024.JKS

Location: C:\Certificates\Keyman(VSE)\KEY_vseg19

- Press `OK` button.

(3) Enter the password for the file selected when prompted, press `OK`:

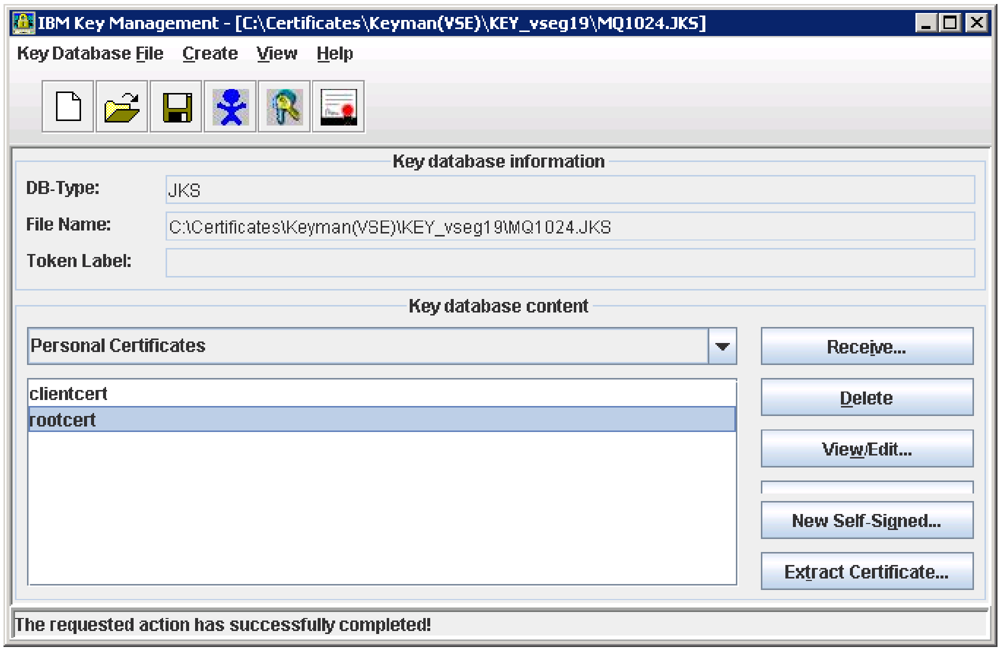


Password Prompt

Password: ●●●●●●

In normal case the specified file will be opened, or you will be notified that the file was not found, the file has invalid format, or invalid password was provided.

(4) Select `rootcert` in the `Personal Certificates` list and press `Extract Certificate`:



IBM Key Management - [C:\Certificates\Keyman(VSE)\KEY_vseg19\MQ1024.JKS]

Key database information

DB-Type: JKS

File Name: C:\Certificates\Keyman(VSE)\KEY_vseg19\MQ1024.JKS

Token Label:

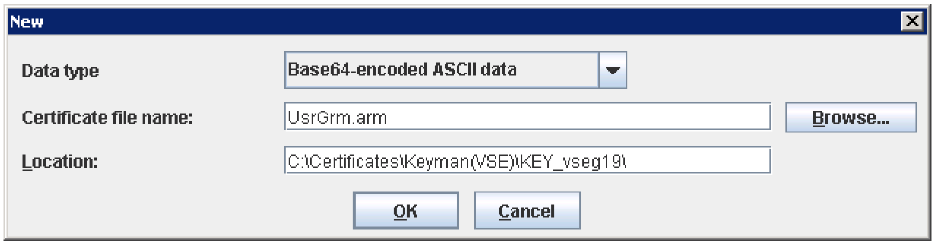
Key database content

Personal Certificates

clientcert
rootcert

The requested action has successfully completed!

(5) Enter the desired name of the certificate file (for example, `UsrGrm.arm`) and the file location into respective text fields; also, you can press `Browse…` button and navigate to needed file to be overwritten (selected file name and location can be modified in the text fields):



New

Data type: Base64-encoded ASCII data

Certificate file name: UsrGrm.arm

Location: C:\Certificates\Keyman(VSE)\KEY_vseg19\

Press OK.

(6) Verify that the desired file (`UsrGrm.arm`) has been created within the selected folder.

5.3. *Importing the public part of z/VSE Certificate into the MQ Server Trust KeyStore*

The MQ server Trust KeyStore is used for verifying credentials from a client during the SSL handshake.

Before importing, you should create a Trust KeyStore file, or open the existing one.

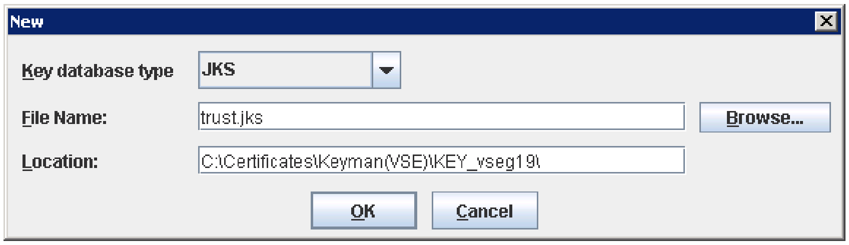
For *creating* the Trust KeyStore file:

(1) Start the IBM Key management tool (if not started yet);

(2) Specify the Key database for creating:

- Press the `Create a new key database file` on Key Management window buttons menu (of select `New…` from the `Key Database File` drop-down menu);
- On the `New` pop-up window, choose `JKS` as Key database type (see sample below);
- Enter the name and location of the Key database file into proper text fields; also, you can press `Browse…` button and navigate to the required file to be overwritten (selected file name and location can be modified in the text fields).

  Note. By default, the trust KeyStore file for MQ Server named as `trust.jks` and located within the directory *MQ_DATA_DIRECTORY*\web\installations\installationName\servers\mqweb\resources\security (for example, "C:\ProgramData\IBM\MQ\web\installations\Installation1\servers\mqweb\resources\security"). Don't change this name and location if not required. However, you can specify any name and location for trust KeyStore file as temporary "repository" and move it from here into desired destination after processing.
- Press `OK` on the `New` window:



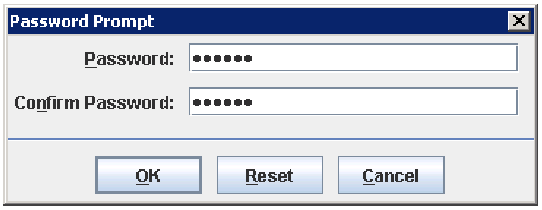
New

Key database type: JKS

File Name: trust.jks

Location: C:\Certificates\Keyman(VSE)\KEY_vseg19\

- Supply the password for Database file when prompted in a new pop-up window (for example, the `pswgrm`; keep the password in mind):



Password Prompt

Password: ••••••

Confirm Password: ••••••

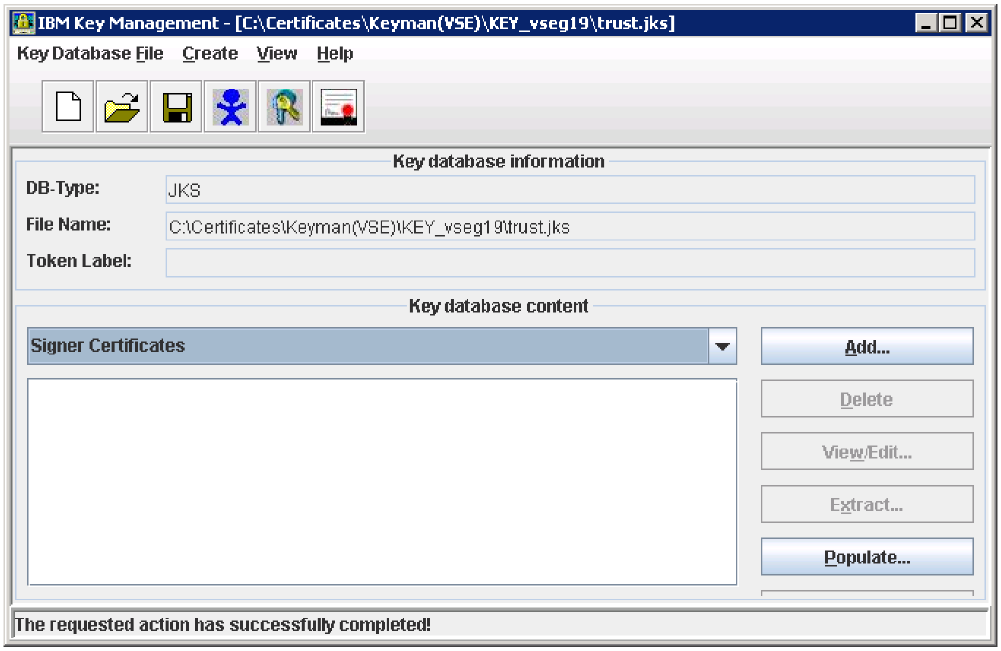
(3) Verify that the file trust.jks has been created in the selected folder. The created file is opened in the Key management tool.

For *opening* the existing Trust KeyStore file perform actions as described in the Extraction of the public part of the z/VSE Certificate (actions (1)-(3)).

For *importing* the public part of z/VSE Certificate:

(1) Be sure that the Trust KeyStore file is opened in the IBM Key management tool;

(2) Select `Signer Certificates` from drop-down menu in the `Key database content` group:



IBM Key Management - [C:\Certificates\Keyman(VSE)\KEY_vseg19\trust.jks]

Key database information

DB-Type: JKS

File Name: C:\Certificates\Keyman(VSE)\KEY_vseg19\trust.jks

Token Label:

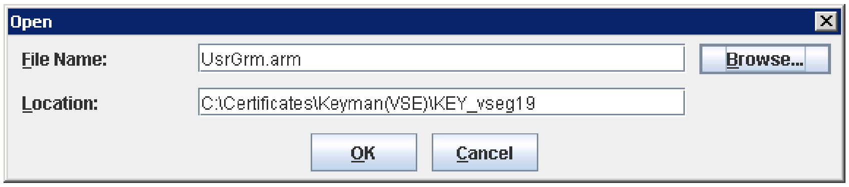
Key database content

Signer Certificates

The requested action has successfully completed!

(3) Press the button `Add` and select the file that represents the public part of z/VSE certificate (for example, the `UsrGrm.arm` located in the directory

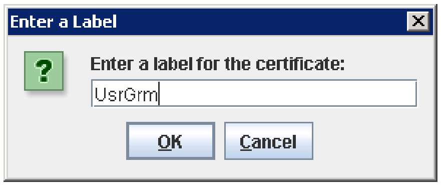
"C:\Certificates\Keyman(VSE)\KEY_vseg19"; see Extraction of the public part of the z/VSE Certificate):


Open

File Name: UsrGrm.arm

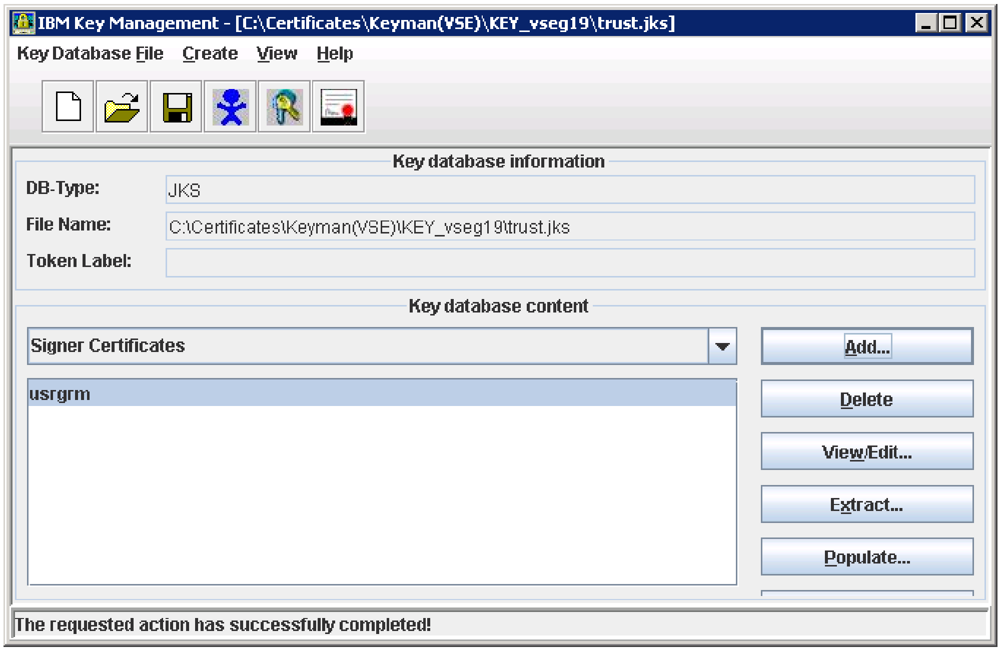
Location: C:\Certificates\Keyman(VSE)\KEY_vseg19

(4) Press `OK` and on new pop-up window enter the certificate label (as the label you should use the MQ user name the z/VSE certificate has been generated for):


Enter a Label

Enter a label for the certificate: UsrGrm

(5) Press `OK`: in normal case the certificate will appear in the `Signer Certificates` list (it is `UsrGrm` in our case):


IBM Key Management - [C:\Certificates\Keyman(VSE)\KEY_vseg19\trust.jks]

Key database information

DB-Type: JKS

File Name: C:\Certificates\Keyman(VSE)\KEY_vseg19\trust.jks

Token Label:

Key database content

Signer Certificates

usrgrm

The requested action has successfully completed!

(6) Now you can close the Key Management tool window and (if needed) move the trust KeyStore file from the temporary "repository" (C:\Certificates\Keyman(VSE)\KEY_vseg19\trust.jks) into the required destination (*MQ_DATA_DIRECTORY*\web\installations\installationName\servers\mqweb\resources\security\trust.jks).

(7) To make the new (or updated) file trust.jks active, restart MQ Server.

5.4. *Enabling the client certificate authentication by the MQ Server*

For enabling the client certificate authentication, you must:

(1) Make sure that the configuration file mqwebuser.xml had been adapted for HTTP Basic authentication (as described in the Configuration of the MQ user);

(2) Update the mqwebuser.xml as follows:

- Comment out (or remove) the line (see Disabling the default SSL configuration on MQ Server):

  `<sslDefault sslRef="mqDefaultSSLConfig"/>`;

- Uncomment and update the element `ssl` and two elements `KeyStore` (or simply add a new elements) as follows:

```
<ssl id="defaultSSLConfig"
     keyStoreRef="defaultKeyStore"
     trustStoreRef="defaultTrustStore"
     clientAuthenticationSupported="true"
/>
<!-- Psw = 'password' (default) -->
<keyStore id="defaultKeyStore"
          location="key.jks"
          type="JKS"
          password="{xor}Lz4sLCgwLTs="
/>
<!-- Psw = 'pswgrm' -->
<keyStore id="defaultTrustStore"
          location="trust.jks"
          type="JKS"
          password="{xor}LywoOC0y"
          serverKeyAlias="UsrGrm"
/>
```

  Notes.

  - The value of the `serverKeyAlias` attribute (within the element `keyStore id="defaultTrustStore"`) must match the name of the server certificate (it is `UsrGrm` in our case).
  - The above configuration assumes that the password (attribute `password`) for MQ Server KeyStore is `password` and the password for trust KeyStore is `pswgrm`. If you use another password(s), please encode it by the securityUtility.bat utility (that can be found in the *MQ_INSTALLATION_PATH*\web\mq\bin\ directory e.g. “C:\Program Files\IBM\MQ\web\bin\”).

5.5. *Verification of the MQ Server accessibility*

For verification of the MQ Server accessibility with the client certification authentication, you can involve the cURL facility with PEM certificate support.

For verification, enter the following command on the Windows prompt:

```
curl -k -X POST
https://localhost:9443/ibmmq/rest/v1/messaging/qmgr/mq1/queue/tes
tQueue/message -d "CE: test message" -H "Content-Type:text/plain"
--cert-type PEM --cert
C:\Certificates\Keyman(VSE)\KEY_vseg19\MQ1024.PEM:pswgrm -H "ibm-
mq-rest-csrf-token: value"
```

where `C:\Certificates\Keyman(VSE)\KEY_vseg19\MQ1024.PEM` is full path to the keyring file generated (as described in the Generation of z/VSE certificates).

As result, the message `CE: test message` should be created on the existing queue `testQueue`. To make sure the message had been created, try to retrieve it by the request DELETE:

```
curl -k -X DELETE
https://localhost:9443/ibmmq/rest/v1/messaging/qmgr/mq1/queue/tes
tQueue/message --cert-type PEM --cert
C:\Certificates\Keyman(VSE)\KEY_vseg19\MQ1024.PEM:pswgrm -H "ibm-
mq-rest-csrf-token: value"
```

In normal case the message body will be shown as the request response.

5.6. *Samples of programs*

The samples POST_CERT and DELETE_CERT implement COBOL programs using REST API with client certificate authentication. To obtain the samples refer to the Appendix D.

Before these samples running you should update the server URL (MQ-SERVER-URL) with actual IP addresses, port number, queue manager name and queue name.

The samples provide procedures of messages creating and retrieving with all available options (like to the samples for another authentication types).

6. Appendix A: Debugging facilities

6.1. *Socket functions trace*

If you are using **CSI TCP/IP stack**, you can invoke the $SOCKDBG trace. The source of the $SOCKDBG phase can be found in the PRD2.TCPIPC sub-library (the member $SOCKDBG.Z). To activate the trace, set options (in the $SOCKDBG.Z member) you are interested in, assembler and catalog the phase into PRD2.CONFIG sub-library; thereupon restart CICS (additional diagnostic messages will be written in the CICS LST output). For the trace deactivating, remove the $SOCKDBG.PHASE from the PRD2.CONFIG sub-library.

For getting more information about $SOCKDBG trace, please see the CSI documentation here: http://www.csi-international.com/support/doc/zVSE/TCP-IP/2.1/TCP-IP_for_VSE_2.1_Progmrs_Guide_201708.pdf

BSI TCP/IP stack and **CSI one with OpenSSL** (configured using the Socket API Multiplexer) allow to produce the OpenSSL and gsk-interface (SSL-related API functions) trace. To turn the debugging trace on, add the `// SETPARM SSL$DBG='YES'` statement to the CICS startup job and after that restart CICS: debug messages will be sent to the SYSLST (CICS listing).

To disable the trace, replace the above statement by the `// SETPARM SSL$DBG='NO'` or remove it at all (`'NO'` is default option).

Also, you can provide the trace with the system scope by adding the `// SETPARM SYSTEM SSL$DBG='YES'` statement to the system startup.

For details, please see here: https://www.ibm.com/support/knowledgecenter/SSB27H_6.2.0/fa2pr_using_open_ssl_trace.html

6.2. *REST trace*

To setup the REST trace, you need to generate the optional REST phase IESRESTO (skeleton SKRESTOP from the library 59). Set the flags TRSYSLOG or/and TRSYSLST for sending trace messages to the System Log or/ and to the CICS LST output.

7. Appendix B: Test tools

7.1. *cURL*

The cURL is the free and opensource command line facility for transferring data to URLs using different protocols (HTTP, HTTPS, FTP, POP3 etc.). For getting more information and for downloading the software, visit the cURL Web site https://curl.haxx.se/.

When the cURL is installed, you can get the brief information about facility usage by its invocation with the option `–help` (`cURL -help`); the option `–M` (or `–manual`) is intended to display the full manual (the huge help text).

In this document the facility applies for local testing of HTTP requests; in this case you enter `localhost` as URL in a HTTP request, for example:

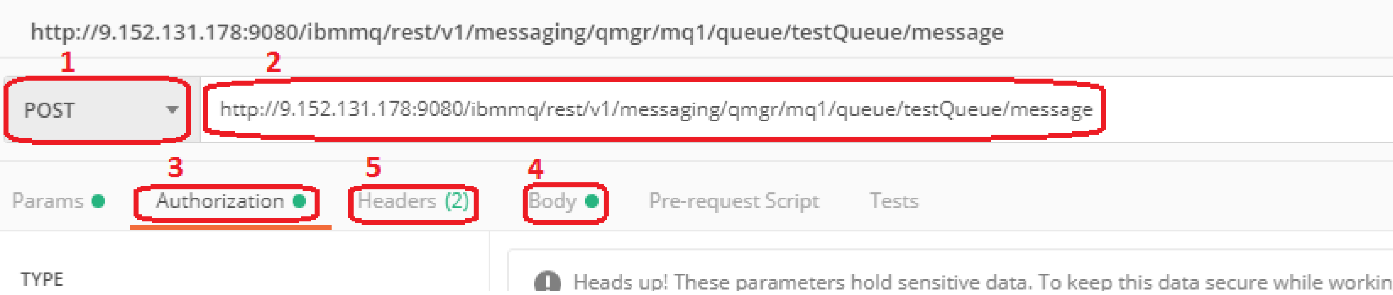
```
curl -k -X POST
http://localhost:9080/ibmmq/rest/v1/messaging/qmgr/mq1/queue/test
Queue/message -d "Message body"
-H "Content-Type:text/plain"
```

7.2. *Postman*

Postman is a Windows Application that supports sending a request to URL and receiving its response. Please see the Postman Web site for details: https://www.getPostman.com/

The brief description of Postman usage for testing REST API is below.

For sending a request to a REST API you are using the upper window of the Postman interface:



http://9.152.131.178:9080/ibmmq/rest/v1/messaging/qmgr/mq1/queue/testQueue/message

POST

http://9.152.131.178:9080/ibmmq/rest/v1/messaging/qmgr/mq1/queue/testQueue/message

TYPE

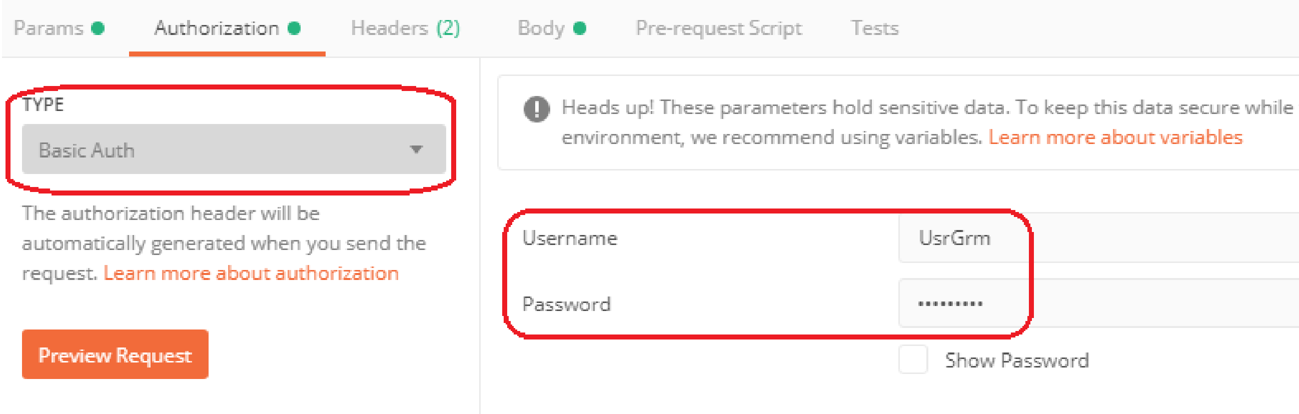
Heads up! These parameters hold sensitive data. To keep this data secure while workin

For sending request you should:

(1) Select a request type from the drop-down list (only POST and DELETE are allowed for the REST API);

(2) Enter the target URL (for Messaging REST API it is http://*host*:*port*/ibmmq/rest/v1/messaging/qmqr/*QueueManagerName*/*QueueName*/message);

(3) Select the authorization type from the drop-down list `TYPE`, for example:



TYPE

Basic Auth

The authorization header will be automatically generated when you send the request. Learn more about authorization

Heads up! These parameters hold sensitive data. To keep this data secure while environment, we recommend using variables. Learn more about variables

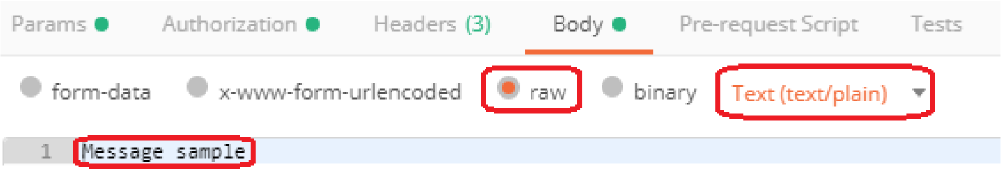
Username UsrGrm

Password •••••••••

□ Show Password

If the basic authorization (`Basic Auth`) have been selected, you also need to enter the user name and the user password; the header `Authorization` will be generated automatically when you send the request, or you can press the `Preview Request` for generating the header at once.

(4) For the request POST, enter the message body (`Message sample` on the below picture); also, you need to set `raw` for the message body (`Body`) and choose `Text (text/plain)` in the drop-down list:

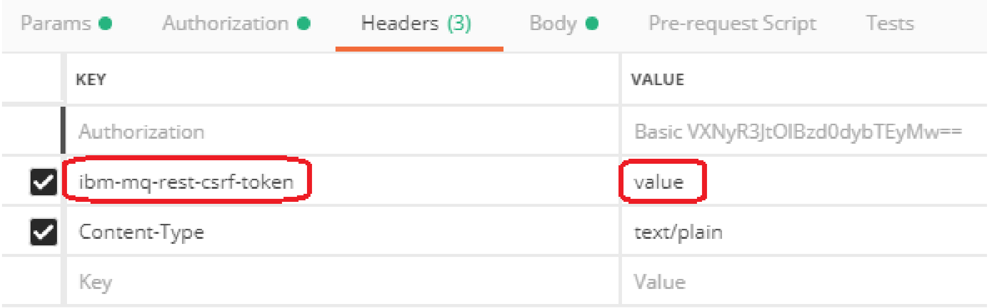


○ form-data ○ x-www-form-urlencoded ● raw ○ binary Text (text/plain)

```
Message sample
```

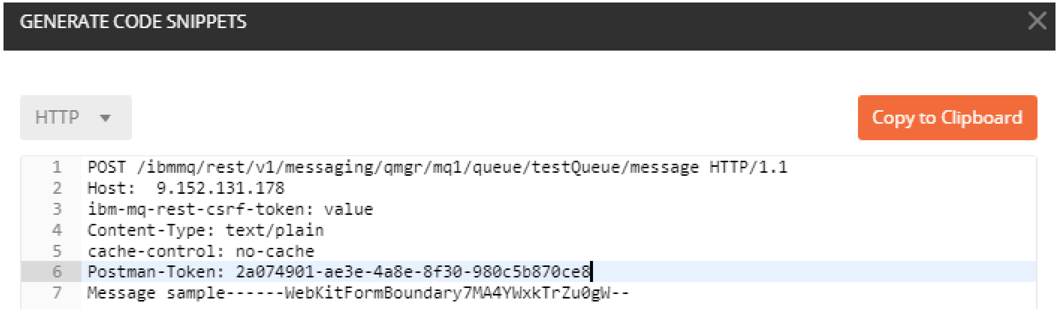
When the `Text (text/plain)` chosen, the header `Content-Type` will be generated (or overwritten) automatically with the value `text/plain`.

(5) Specify the request header(s) (if needed). For example, if you are using the basic authorization the header `ibm-mq-rest-csrf-token` must be specified with any value, for example:



	KEY	VALUE
	Authorization	Basic VXNyR3JtOlBzd0dybTEyMw==
☑	ibm-mq-rest-csrf-token	value
☑	Content-Type	text/plain
	Key	Value

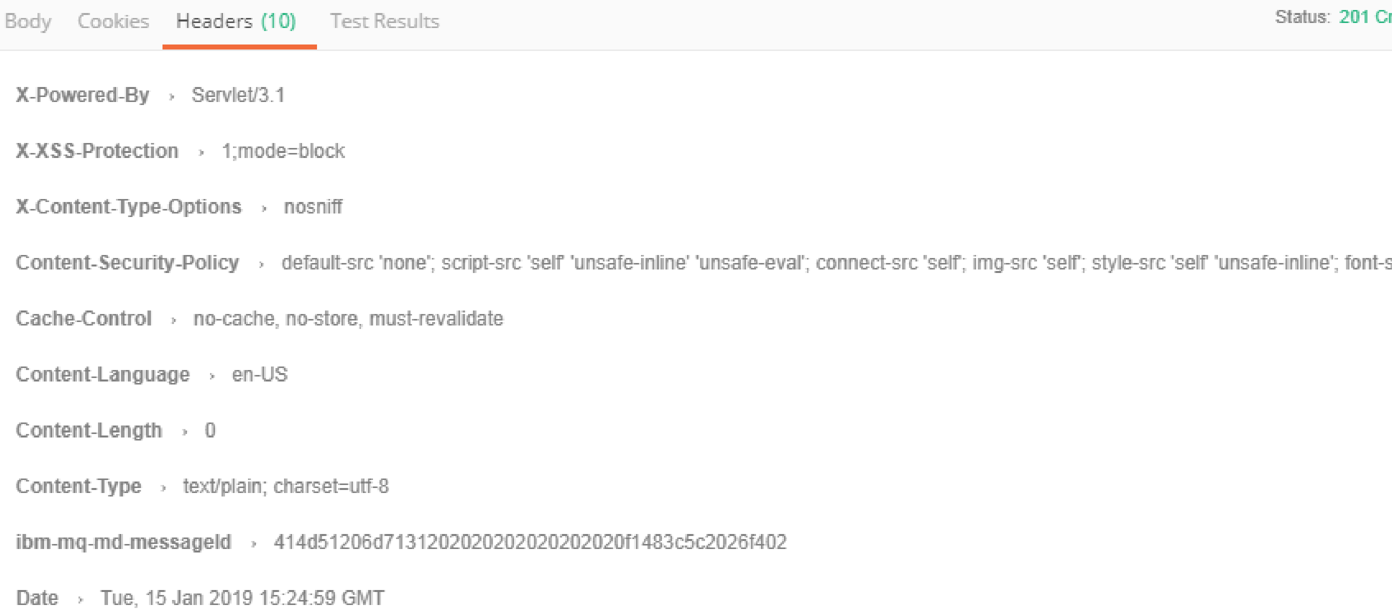
(6) Optionally, it might be helpful for you to look at the full code generated by the Postman for the request specified, for example:



```
POST /ibmmq/rest/v1/messaging/qmgr/mq1/queue/testQueue/message HTTP/1.1
Host:  9.152.131.178
ibm-mq-rest-csrf-token: value
Content-Type: text/plain
cache-control: no-cache
Postman-Token: 2a074901-ae3e-4a8e-8f30-980c5b870ce8
Message sample------WebKitFormBoundary7MA4YWxkTrZu0gW--
```

(7) Press `Send` button for sending the request to the URL.

A request response is displayed in the lower window of the Postman interface:



X-Powered-By › Servlet/3.1

X-XSS-Protection › 1;mode=block

X-Content-Type-Options › nosniff

Content-Security-Policy › default-src 'none'; script-src 'self' 'unsafe-inline' 'unsafe-eval'; connect-src 'self'; img-src 'self'; style-src 'self' 'unsafe-inline'; font-s

Cache-Control › no-cache, no-store, must-revalidate

Content-Language › en-US

Content-Length › 0

Content-Type › text/plain; charset=utf-8

ibm-mq-md-messageId › 414d51206d7131202020202020202020f1483c5c2026f402

Date › Tue, 15 Jan 2019 15:24:59 GMT

Here you can verify the response status (`201 Created` on above picture), response body (for the DELETE request), response headers and some other attributes.

8. Appendix C: Tailoring SSL connection between z/VSE and MQ Server

If you are planning to use SSL connection between z/VSE and IBM MQ Server, you need:

(1) Generate a new certificate for the MQ server KeyStore (this is optional).
(2) Disable the default SSL configuration on MQ Server.
(3) Generate z/VSE certificates.
(4) Enable SSL on z/VSE.

8.1. *Generation of a new certificate for MQ Server KeyStore*

The MQ Server KeyStore is used to provide credentials in SSL handshake.

During the MQ Server installing (or starting), if a KeyStore certificate could not be found, the “default” self-signed certificate is generated automatically. If this certificate doesn’t meet your requirements, you can invoke the IBM Key management tool (shipped as part of the IBM MQ Server) that allows to generate a new self-signed certificate and to create a new certificate request for sending to a certification authority.

The below scenario shows the generation of 1024 key length self-signed certificate that can be used on a *test* system (and that permits to exclude a crypto card exploiting). However, for a *production* system the 2048-bit (or higher) key with a crypto card is recommended (such self-signed certificate can be generated according to this scenario, too; for creating a request to a certification authority refer to:

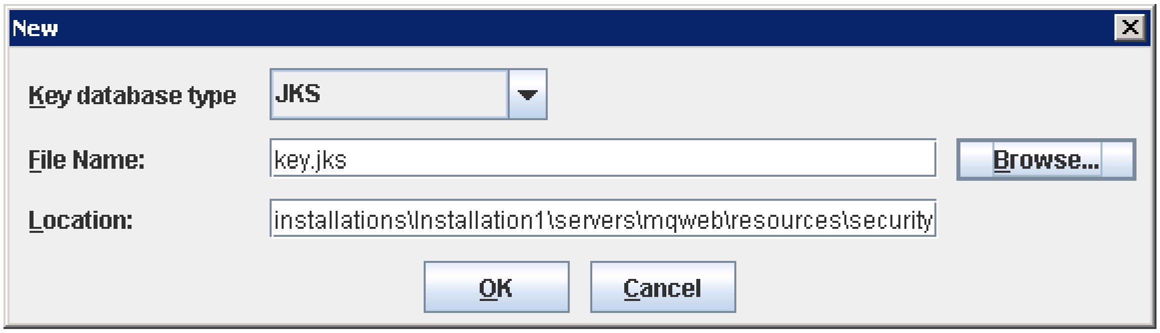
https://www.ibm.com/support/knowledgecenter/SSFKSJ_9.1.0/com.ibm.mq.sec.doc/q127940_.htm).

(1) Keep the backup copy of the existing MQ KeyStore file (key.jks) located in the directory *MQ_DATA_DIRECTORY*\web\installations\installationName\servers\mqweb\resources\security (e.g. in the "C:\ProgramData\IBM\MQ\web\installations\Installation1\servers\mqweb\resources\security").

(2) Start MQ WEB Server (enter `strmqweb.bat` on Windows command line prompt) – if not started yet.

(3) Start the IBM Key management tool: run the `strmqikm.exe` executable, or right-click on `IBM MQ` in the IBM MQ Explorer Window and select `Manage SSL certificate`… from the drop-down menu.

(4) Select the key database type (JKS), specify the Key store file name (`key.jks`) and location (as shown in the step (1) above), press `OK`:

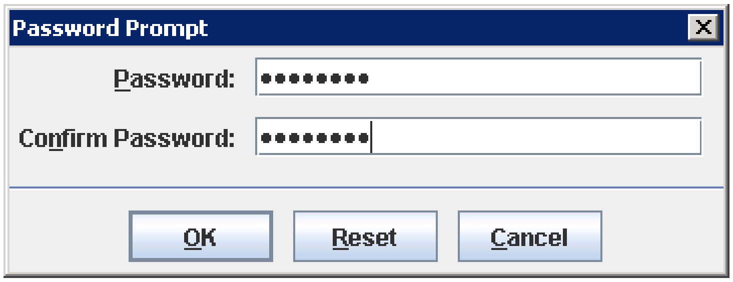


Key database type: JKS

File Name: key.jks

Location: installations\Installation1\servers\mqweb\resources\security

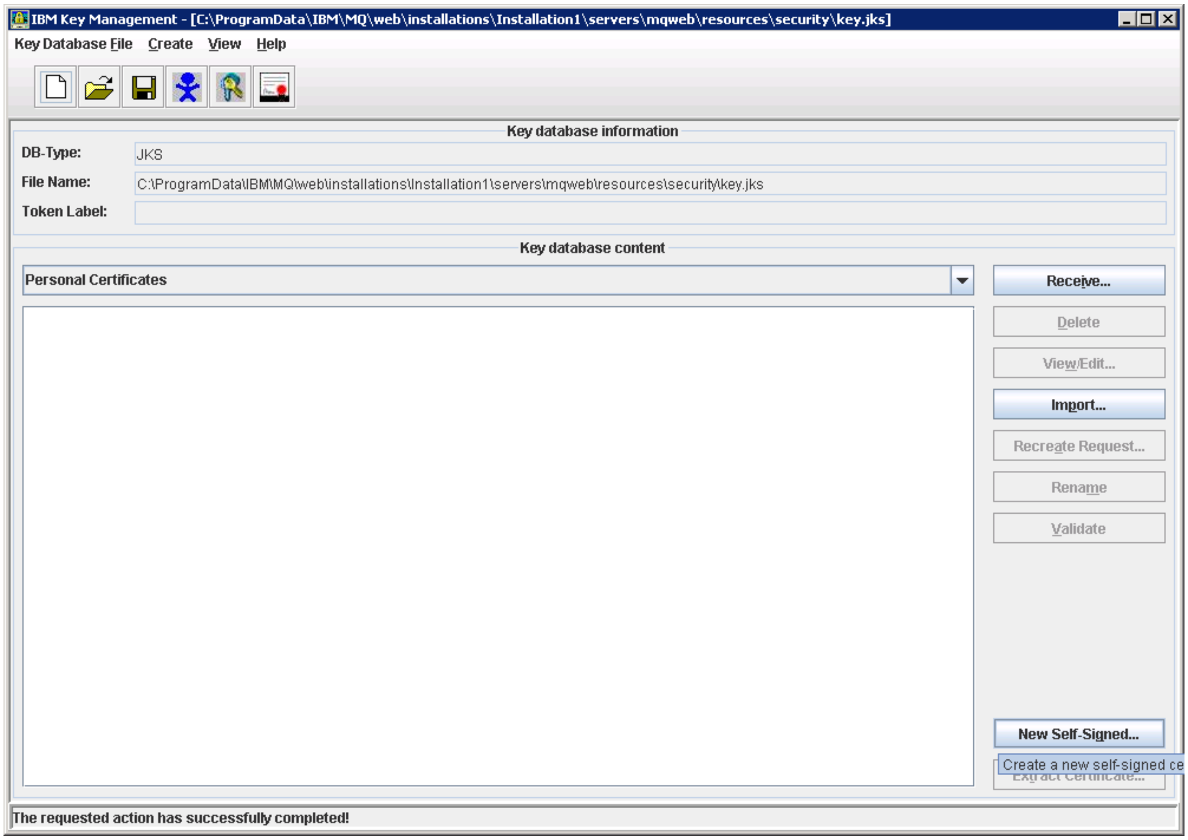
(5) Enter password when prompted (for example, the "default" password is `password`):



Password: ••••••••

Confirm Password: ••••••••

(6) Press `New Self-Signed`… button:



IBM Key Management - [C:\ProgramData\IBM\MQ\web\installations\Installation1\servers\mqweb\resources\security\key.jks]

Key database information

DB-Type: JKS

File Name: C:\ProgramData\IBM\MQ\web\installations\Installation1\servers\mqweb\resources\security\key.jks

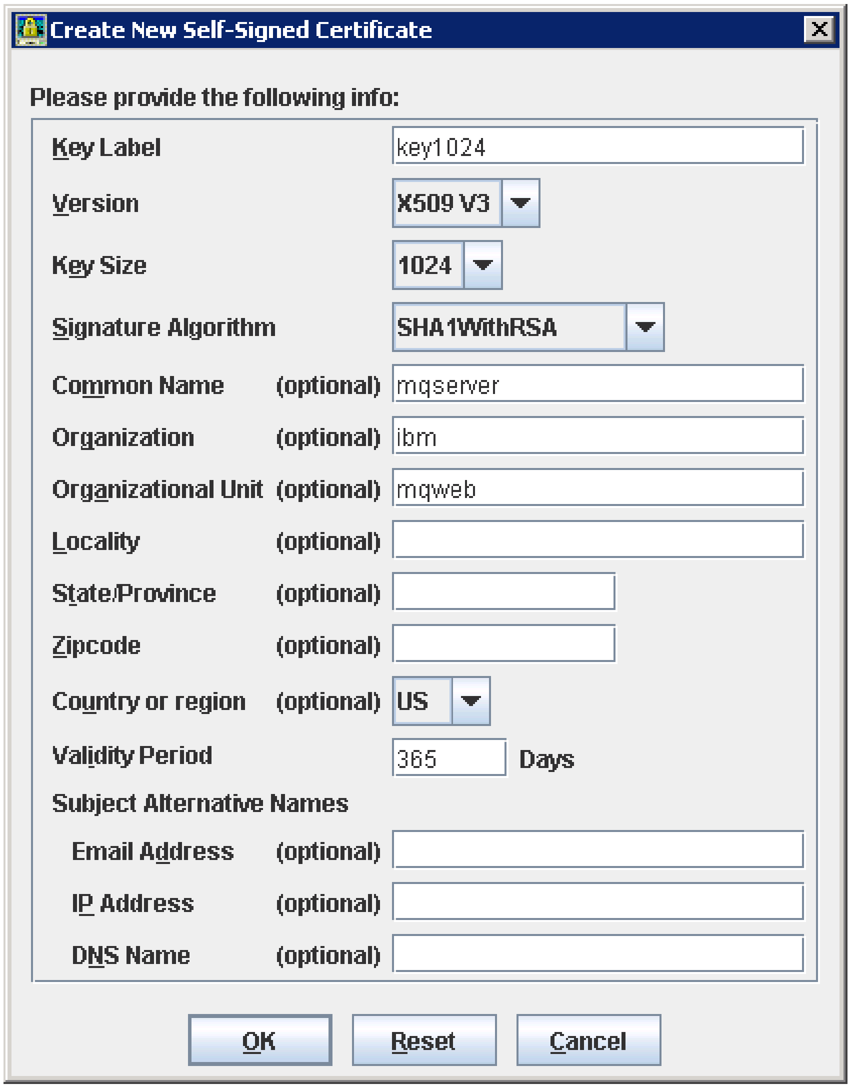
Token Label:

Key database content

Personal Certificates

The requested action has successfully completed!

(7) On the pop-up window, select the Key size equal to 1024, enter Key label, Common Name and other options e.g. as follows:



Create New Self-Signed Certificate

Please provide the following info:

Key Label: key1024

Version: X509 V3

Key Size: 1024

Signature Algorithm: SHA1WithRSA

Common Name (optional): mqserver

Organization (optional): ibm

Organizational Unit (optional): mqweb

Locality (optional):

State/Province (optional):

Zipcode (optional):

Country or region (optional): US

Validity Period: 365 Days

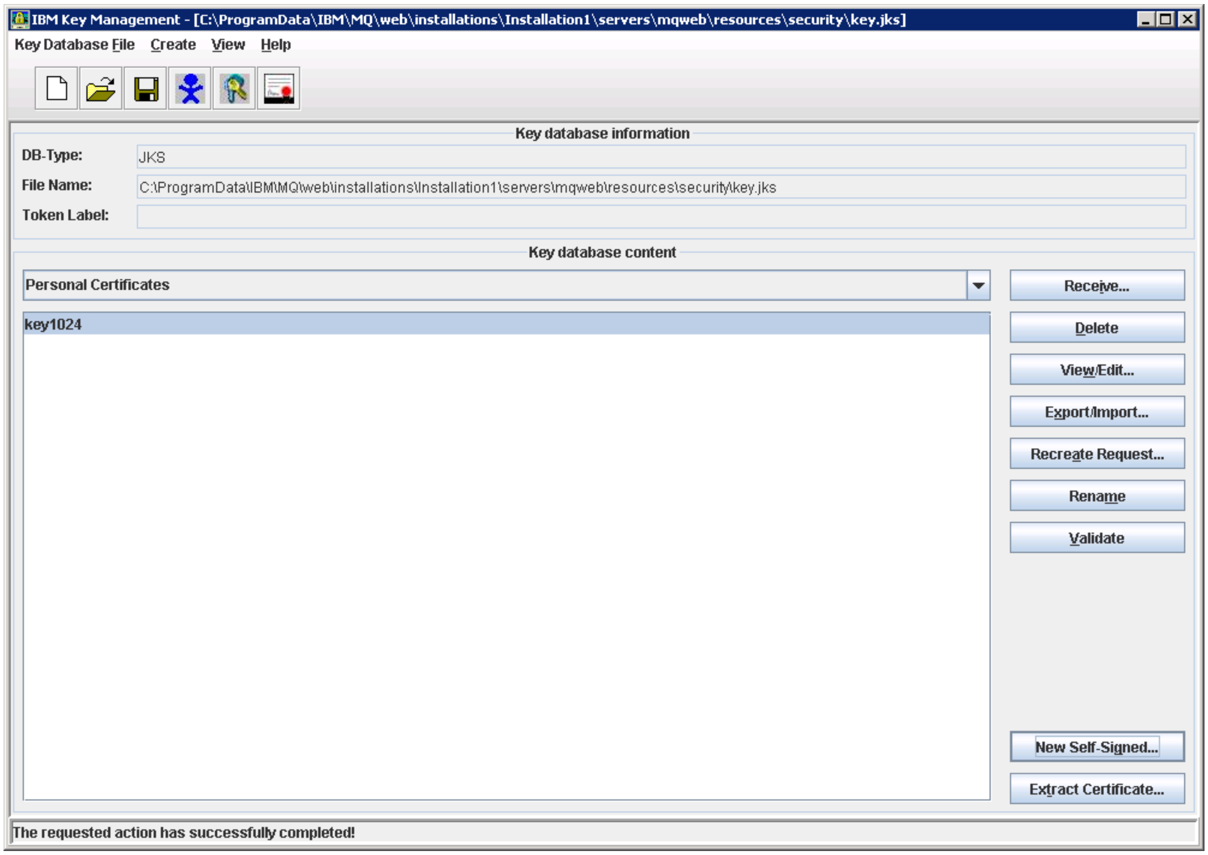
Subject Alternative Names

Email Address (optional):

IP Address (optional):

DNS Name (optional):

(8) Press `OK` on above pop-up window: the new certificate `key1024` should appear in the `Key database content` list:



IBM Key Management - [C:\ProgramData\IBM\MQ\web\installations\Installation1\servers\mqweb\resources\security\key.jks]

Key database information

DB-Type: JKS

File Name: C:\ProgramData\IBM\MQ\web\installations\Installation1\servers\mqweb\resources\security\key.jks

Token Label:

Key database content

Personal Certificates

key1024

The requested action has successfully completed!

This means that the certificate has been generated successfully, and you can close the IBM Key management tool window.

(9) Restart MQ Server for making the generated certificate active (run the `endmqweb.bat`, then `strmqweb.bat`).

(10) Verify that the new certificate is applied during the SSL connection handshake:

- Replace the MQ security configuration file (mqwebuser.xml) to the no_security.xml sample. The mqwebuser.xml file located in the directory *MQ_DATA_DIRECTORY*\web\installations\installationName\servers\mqweb (please keep its backup copy before replacing); the file no_security.xml can be found in the directory *MQ_INSTALLATION_PATH*\web\mq\samp\configuration.
- Query the MQ installation information by sending the following request to the administrative REST API using cURL facility:

```
curl -i -k
https://localhost:9443/ibmmq/rest/v1/admin/installation -
v
```

- Make sure that above command output shows correct MQ Server certificate information (compare output against data entered on the step (7)):

```
. . .
* Server certificate:
*  subject: C=US; O=ibm; OU=mqweb; CN=mqserver
*  start date: Nov 20 10:40:37 2018 GMT
*  expire date: Nov 20 10:40:37 2019 GMT
*  issuer: C=US; O=ibm; OU=mqweb; CN=mqserver
*  SSL certificate verify result: self signed certificate
(18), continuing anyway.
> GET /ibmmq/rest/v1/admin/installation HTTP/1.1
> Host: localhost:9443
> User-Agent: curl/7.61.0
> Accept: */*
. . .
<
{"installation": [{
  "name": "Installation1",
  "platform": "windows",
  "version": "9.1.0.0"
}]}* Connection #0 to host localhost left intact
```

Note. For a new certificate verification, you can use the Postman tool as well.

8.2. *Disabling the default SSL configuration on MQ Server*

Here you need to remove, or comment out, the following line (that specifies the default MQ SSL configuration) in the actual MQ Server security configuration file mqwebuser.xml (located in the directory *MQ_DATA_DIRECTORY*\web\installations\installationName\servers\mqweb):

```
<sslDefault sslRef="mqDefaultSSLConfig"/>
```

8.3. *Generation of z/VSE certificates*

For the z/VSE certificates generation, the Keyman/VSE tool should be installed on your Windows workstation. This tool provides most of facilities concerning TLS/SSL keys and certificates. The tool installation package can be found here: https://www.ibm.com/it-infrastructure/z/zvse-downloads. When the tool is installed you can look through the attached user's guide.

There is a special feature of generation procedure when you are planning to use certificate for a client authentication; this feature will be underlined.

To generate the z/VSE certificates, perform the following steps.

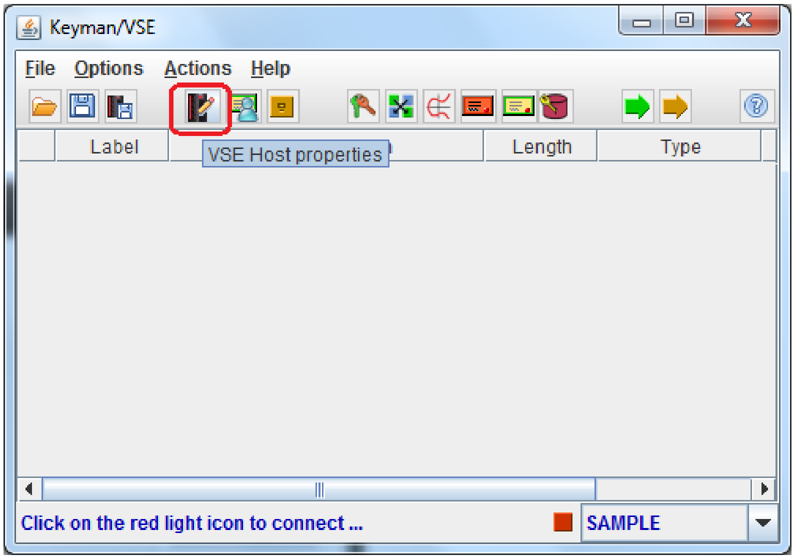
(1) Be sure that TCP/IP stack is started in non-SSL (insecure) mode (otherwise the Keyman/VSE tool can't be started on the step (3)).

(2) Start the z/VSE Connector Server by entering the command `R RDR,STARTVCS` on z/VSE console (the Connector Server should be configured in insecure mode).

(3) Start the Keyman/VSE.

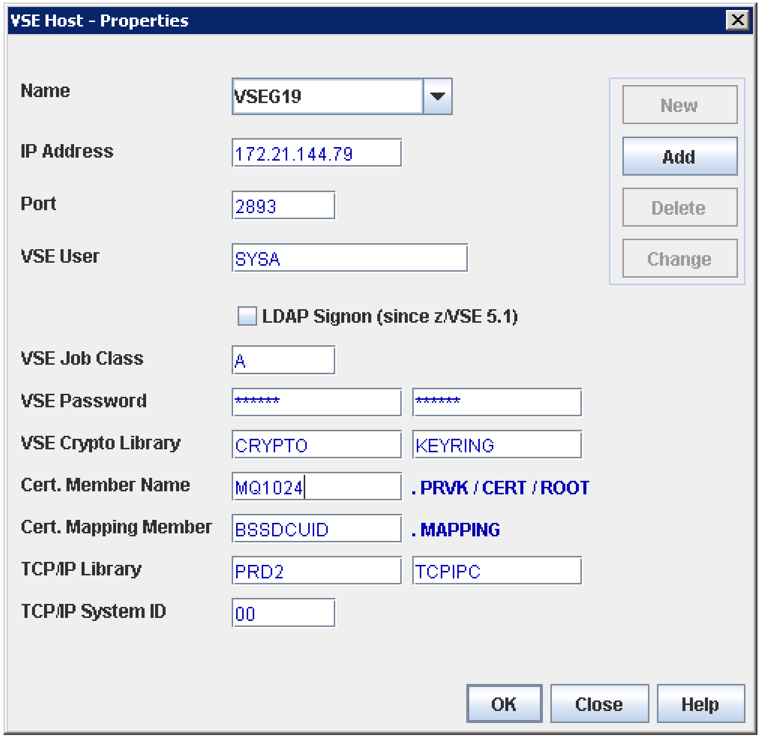
Note. Next steps (4) – (6) represents the procedure of configuration of a new z/VSE host (the Keyman/VSE should be connected to for uploading RSA key pairs and SSL certificates). You can skip these steps (move to the step (7) at once) if needed host had been configured before.

(4) Press the button `VSE Host properties`:



Click on the red light icon to connect ...

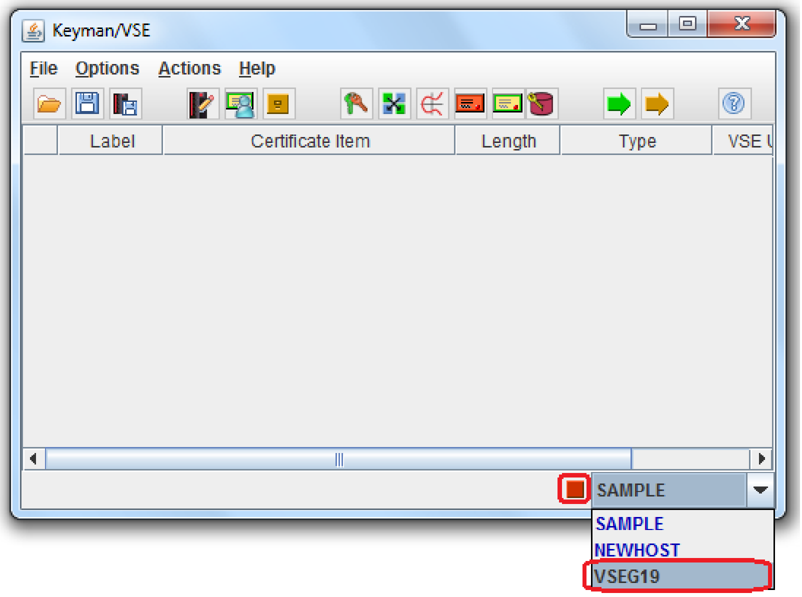
(5) When the `VSE Host - Properties` pop-up window is appeared, press the button `New` to define new z/VSE host: the host name, IP address, port, VSE user name and password and so on. Be sure that the `TCP/IP system ID` value matches the TCP/IP stack ID (default value is zero; update it if necessary):



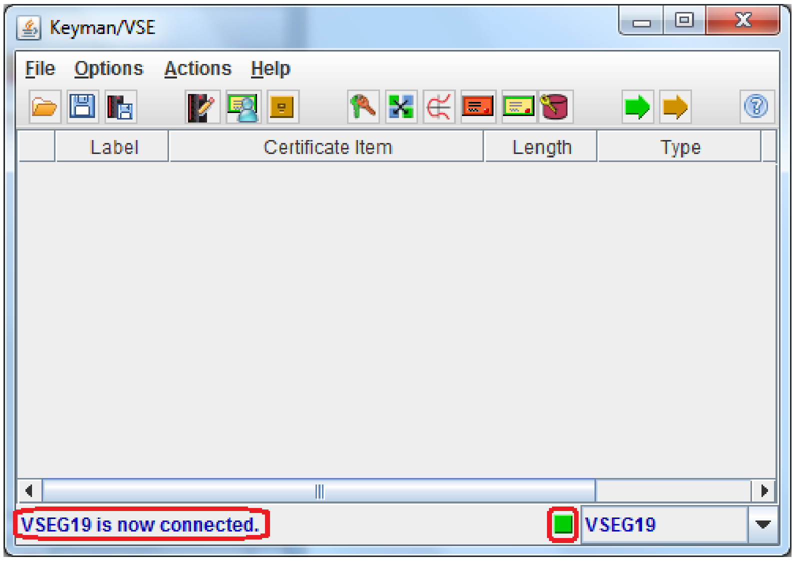
Name	VSEG19	
IP Address	172.21.144.79	
Port	2893	
VSE User	SYSA	
	☐ LDAP Signon (since z/VSE 5.1)	
VSE Job Class	A	
VSE Password	******	******
VSE Crypto Library	CRYPTO	KEYRING
Cert. Member Name	MQ1024	. PRVK / CERT / ROOT
Cert. Mapping Member	BSSDCUID	. MAPPING
TCP/IP Library	PRD2	TCPIPC
TCP/IP System ID	00	

(6) Press the button `Add` for adding this z/VSE host definition to the Keyman/VSE configuration and stay on the pop-up window, or press `OK` to add this definition and leave the dialog box.

(7) From the drop-down list, select the z/VSE host for connecting (if not selected yet), and click on the nearby red-light icon:

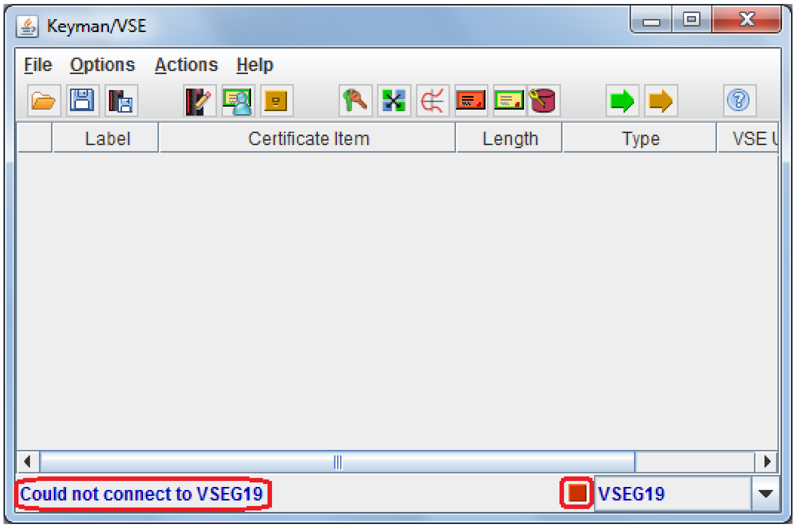


When light icon turned to the green, the z/VSE is connected (you will see the notification next to the icon):



VSEG19 is now connected.

If light icon stays in red, then the z/Keyman tool couldn't connect to the host:



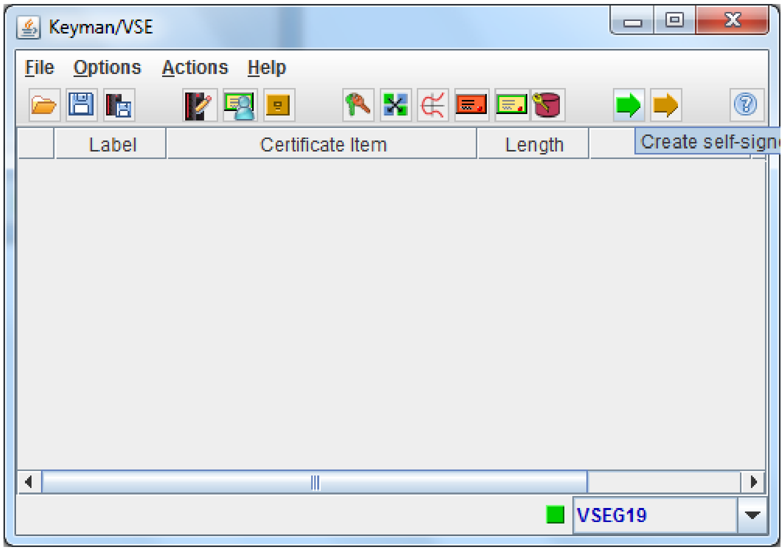
Could not connect to VSEG19

In this case you need to verify the connection options for making sure that the z/VSE Connector Server has been started properly and try to start connection again.

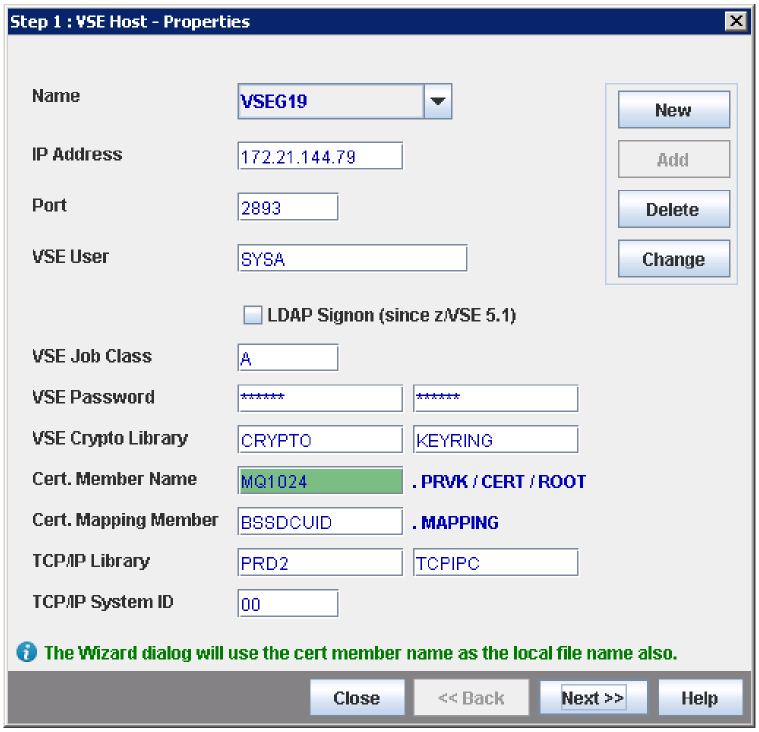
(8) When the VSE/Keyman tool connected to the host, you can start creating VSE key ring by using wizard dialogs.

The below actions show the procedure to create the self-sign certificate.

(9) Press the button `Create self-signed keyring` (or select `Create the self-signed keyring`... from the drop-down menu `Actions`):



(10) Enter the certificate member name in the field `Cert. Member Name` (for example, `MQ1024`), and press `Next`:



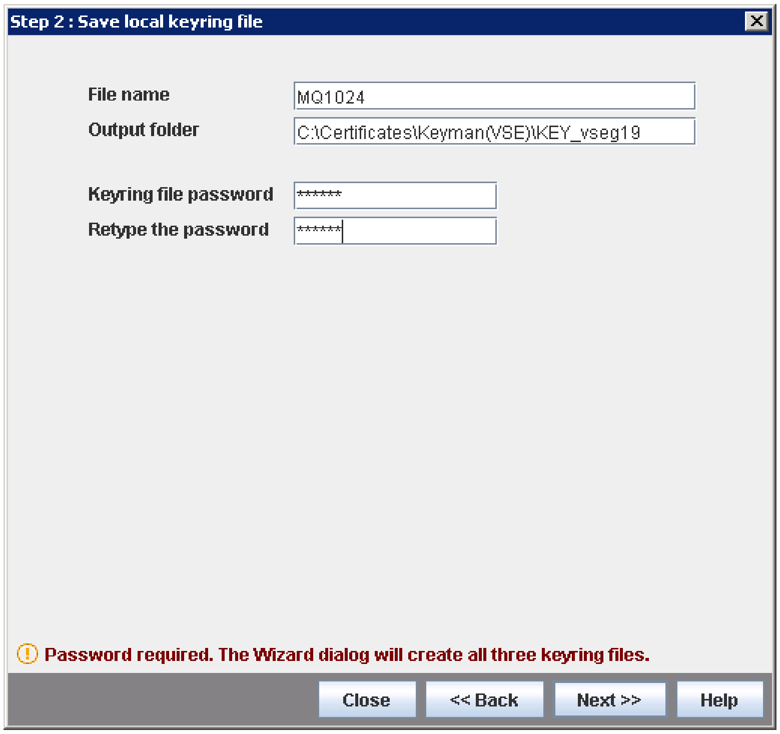
Step 1 : VSE Host - Properties

Name	VSEG19	
IP Address	172.21.144.79	
Port	2893	
VSE User	SYSA	
	□ LDAP Signon (since z/VSE 5.1)	
VSE Job Class	A	
VSE Password	******	******
VSE Crypto Library	CRYPTO	KEYRING
Cert. Member Name	MQ1024	. PRVK / CERT / ROOT
Cert. Mapping Member	BSSDCUID	. MAPPING
TCP/IP Library	PRD2	TCPIPC
TCP/IP System ID	00	

The Wizard dialog will use the cert member name as the local file name also.

(11) On the next screen:

- Keep the file name as is (it is MQ1024 in our case);
- Enter the name of folder for saving the local keyring file into the field Output folder (the folder must be created in advance!);
- Enter the keyring file password (keep the password in mind);
- Press Next>>:



Step 2 : Save local keyring file

File name: MQ1024

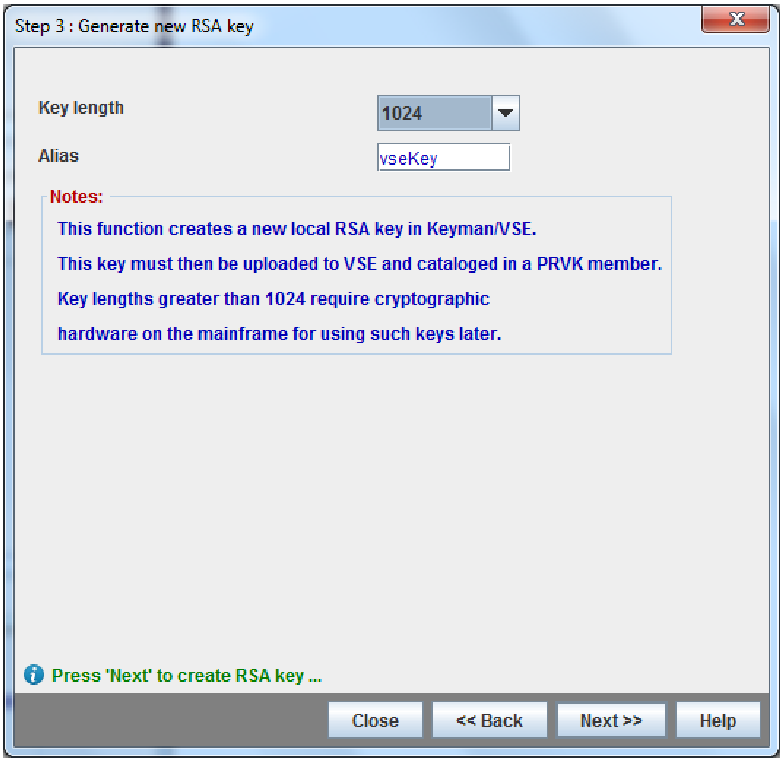
Output folder: C:\Certificates\Keyman(VSE)\KEY_vseg19

Keyring file password: ******

Retype the password: ******

Password required. The Wizard dialog will create all three keyring files.

(12) Select the key length equal to 1024 on the next screen, press `Next>>`:



Step 3 : Generate new RSA key

Key length: 1024

Alias: vseKey

Notes:

This function creates a new local RSA key in Keyman/VSE.

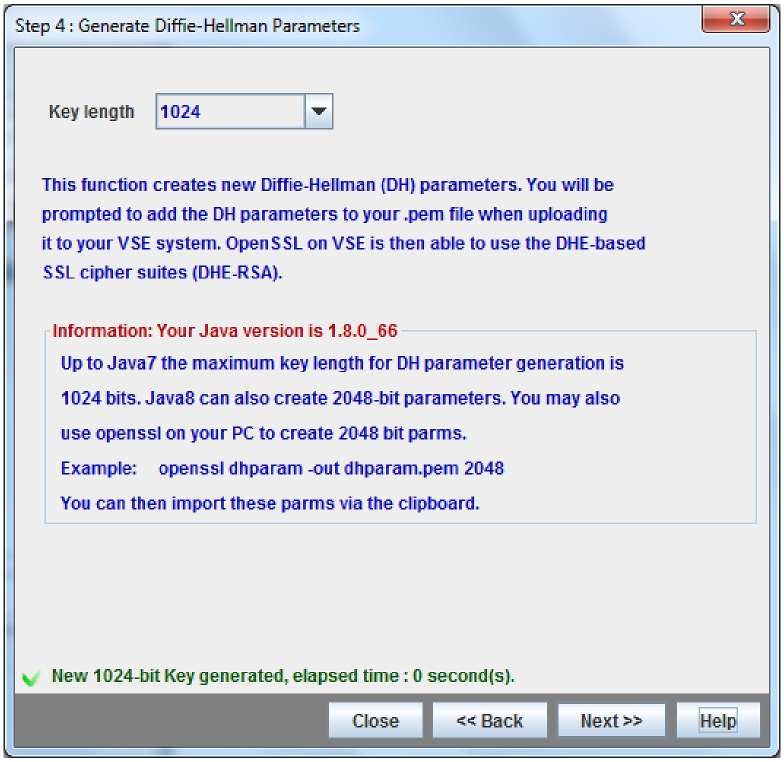
This key must then be uploaded to VSE and cataloged in a PRVK member.

Key lengths greater than 1024 require cryptographic

hardware on the mainframe for using such keys later.

Press 'Next' to create RSA key ...

(13) Verify on the next screen that the key length is set equal to 1024:



Step 4 : Generate Diffie-Hellman Parameters

Key length 1024

This function creates new Diffie-Hellman (DH) parameters. You will be prompted to add the DH parameters to your .pem file when uploading it to your VSE system. OpenSSL on VSE is then able to use the DHE-based SSL cipher suites (DHE-RSA).

Information: Your Java version is 1.8.0_66

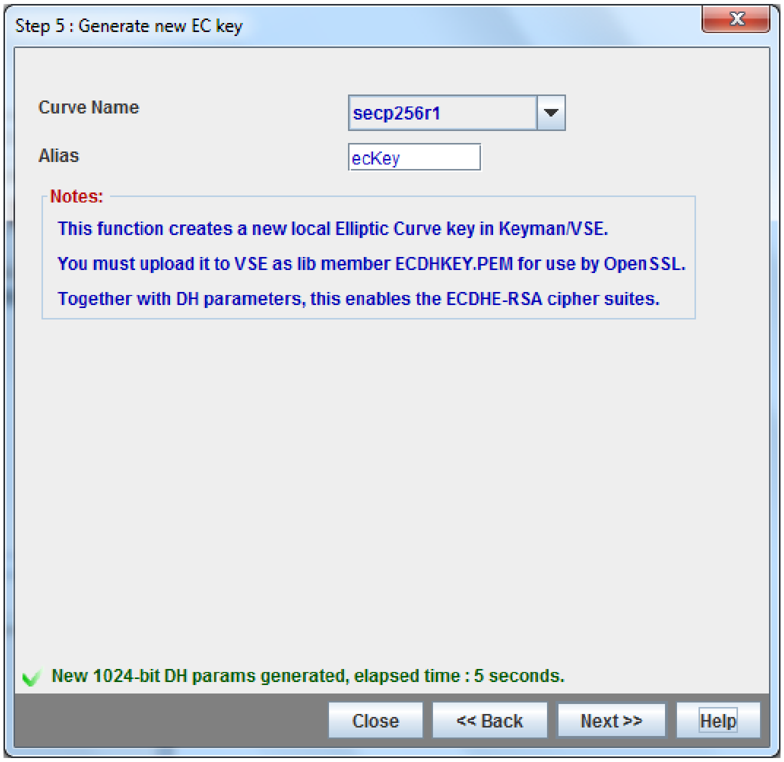
Up to Java7 the maximum key length for DH parameter generation is 1024 bits. Java8 can also create 2048-bit parameters. You may also use openssl on your PC to create 2048 bit parms.

Example: openssl dhparam -out dhparam.pem 2048

You can then import these parms via the clipboard.

✓ New 1024-bit Key generated, elapsed time : 0 second(s).

(14) Press `Next>>` on the next screen:



Step 5 : Generate new EC key

Curve Name secp256r1

Alias ecKey

Notes:

This function creates a new local Elliptic Curve key in Keyman/VSE.

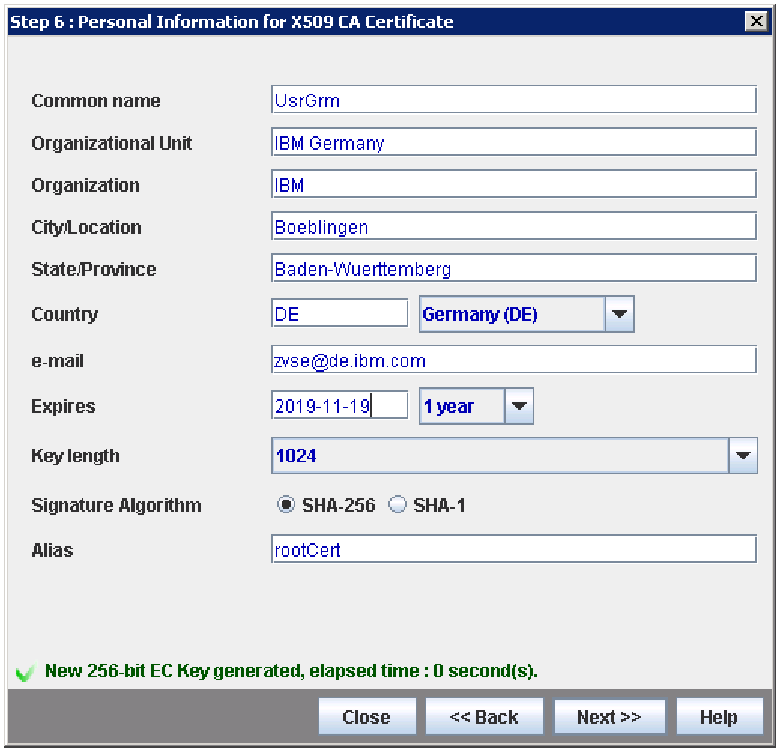
You must upload it to VSE as lib member ECDHKEY.PEM for use by OpenSSL.

Together with DH parameters, this enables the ECDHE-RSA cipher suites.

✓ New 1024-bit DH params generated, elapsed time : 5 seconds.

(15) On next three screens enter the MQ user name into the field `Common name` and fill other fields (as shown on the below sample).

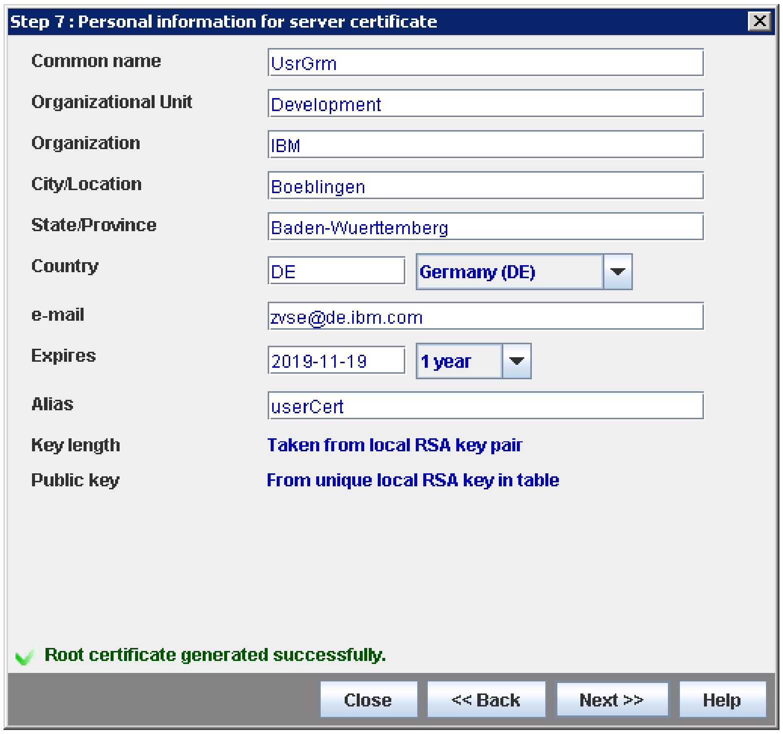
Important: when the certificate is generating for the Client authentication in accessing MQ Server, the Common name must match the name of the configured MQ user (for example, `UsrGrm`); for another authentication types the Common name may be any.



Step 6 : Personal Information for X509 CA Certificate

Common name	UsrGrm
Organizational Unit	IBM Germany
Organization	IBM
City/Location	Boeblingen
State/Province	Baden-Wuerttemberg
Country	DE Germany (DE)
e-mail	zvse@de.ibm.com
Expires	2019-11-19 1 year
Key length	1024
Signature Algorithm	● SHA-256 ○ SHA-1
Alias	rootCert

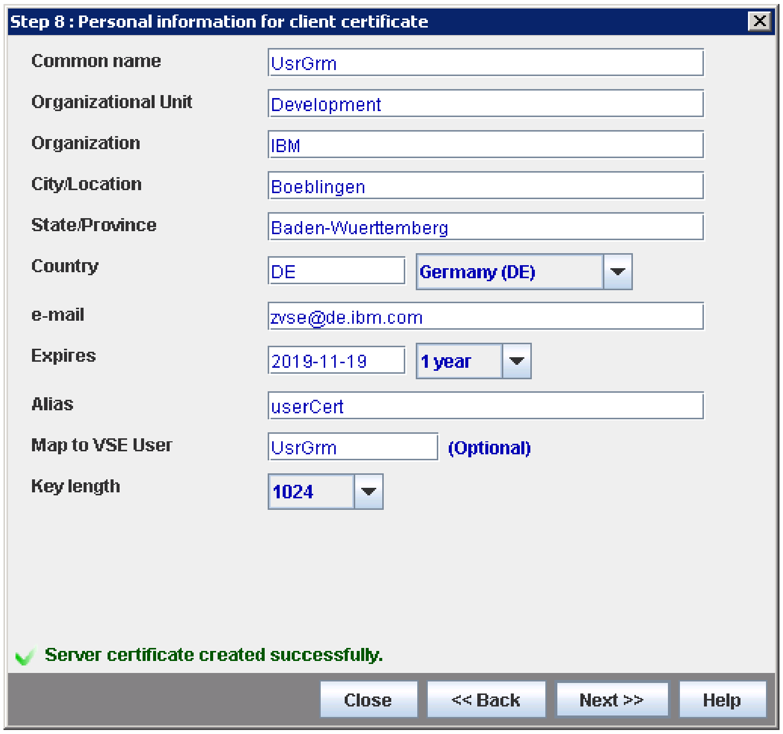
✓ New 256-bit EC Key generated, elapsed time : 0 second(s).



Step 7 : Personal information for server certificate

Common name	UsrGrm
Organizational Unit	Development
Organization	IBM
City/Location	Boeblingen
State/Province	Baden-Wuerttemberg
Country	DE Germany (DE)
e-mail	zvse@de.ibm.com
Expires	2019-11-19 1 year
Alias	userCert
Key length	Taken from local RSA key pair
Public key	From unique local RSA key in table

✓ Root certificate generated successfully.

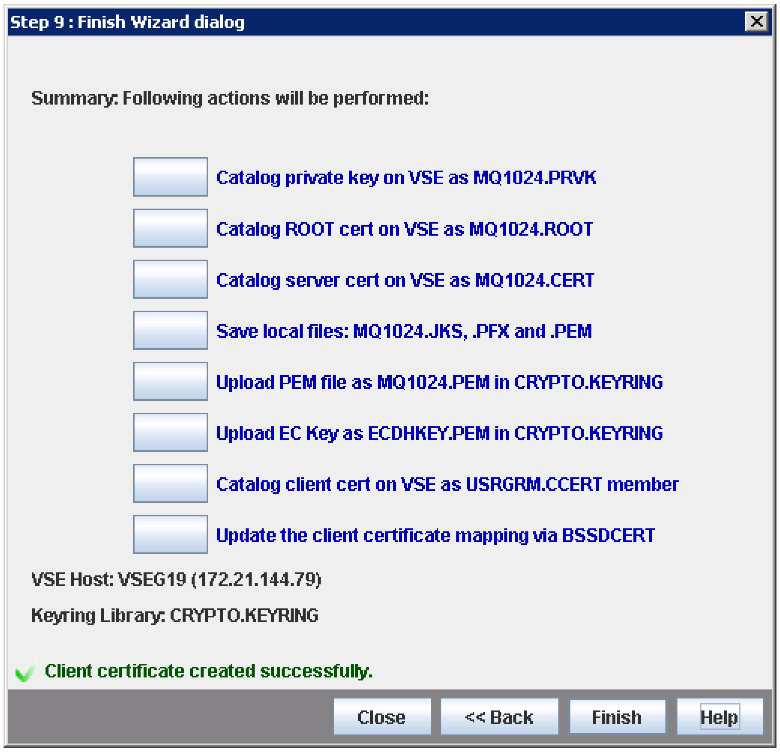


Step 8 : Personal information for client certificate

Common name	UsrGrm
Organizational Unit	Development
Organization	IBM
City/Location	Boeblingen
State/Province	Baden-Wuerttemberg
Country	DE Germany (DE)
e-mail	zvse@de.ibm.com
Expires	2019-11-19 1 year
Alias	userCert
Map to VSE User	UsrGrm (Optional)
Key length	1024

✓ Server certificate created successfully.

(16) Press `Finish` on the next screen:



Step 9 : Finish Wizard dialog

Summary: Following actions will be performed:

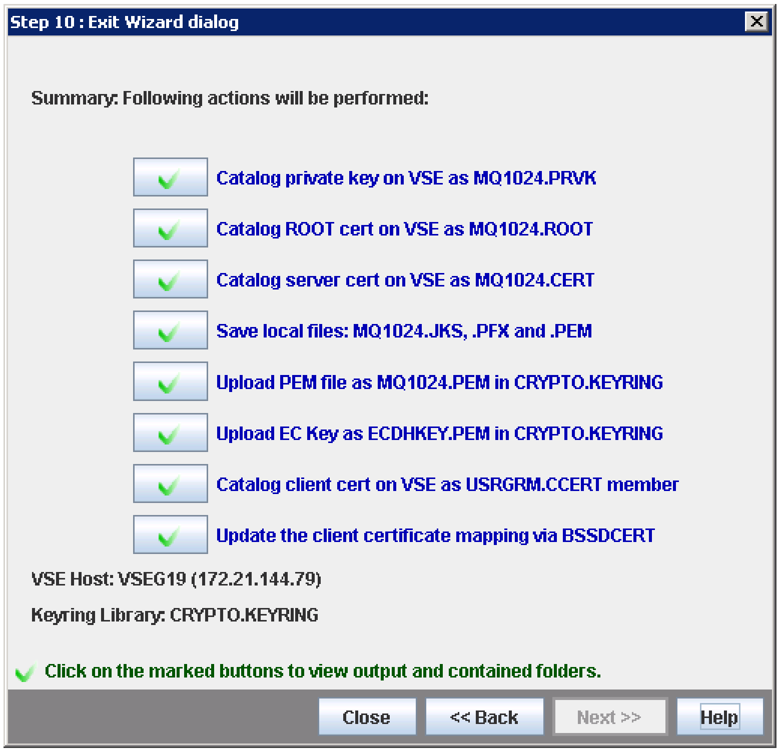
- Catalog private key on VSE as MQ1024.PRVK
- Catalog ROOT cert on VSE as MQ1024.ROOT
- Catalog server cert on VSE as MQ1024.CERT
- Save local files: MQ1024.JKS, .PFX and .PEM
- Upload PEM file as MQ1024.PEM in CRYPTO.KEYRING
- Upload EC Key as ECDHKEY.PEM in CRYPTO.KEYRING
- Catalog client cert on VSE as USRGRM.CCERT member
- Update the client certificate mapping via BSSDCERT

VSE Host: VSEG19 (172.21.144.79)

Keyring Library: CRYPTO.KEYRING

✓ Client certificate created successfully.

You get an indication how above actions performed. In normal case you see:



Summary: Following actions will be performed:

- ✓ Catalog private key on VSE as MQ1024.PRVK
- ✓ Catalog ROOT cert on VSE as MQ1024.ROOT
- ✓ Catalog server cert on VSE as MQ1024.CERT
- ✓ Save local files: MQ1024.JKS, .PFX and .PEM
- ✓ Upload PEM file as MQ1024.PEM in CRYPTO.KEYRING
- ✓ Upload EC Key as ECDHKEY.PEM in CRYPTO.KEYRING
- ✓ Catalog client cert on VSE as USRGRM.CCERT member
- ✓ Update the client certificate mapping via BSSDCERT

VSE Host: VSEG19 (172.21.144.79)

Keyring Library: CRYPTO.KEYRING

✓ Click on the marked buttons to view output and contained folders.

(17) Verify that:

- The local folder `C:\Certificates\Keyman(VSE)\KEY_vseg19` contains keyring files:
  - MQ1024.JKS
  - MQ1024.PEM
  - MQ1024.PFX

  (`MQ1024` is certificate name entered on action (10));
- The z/VSE keyring library CRYPTO.KEYRING contains the following members:
  - USRGRM CCERT
  - MQ1024 CERT
  - BSSDCUID MAPPING
  - ECDHKEY PEM
  - MQ1024 PEM
  - MQ1024 PRVK
  - MQ1024 ROOT

8.4. *Enabling SSL on z/VSE*

To enable SSL for connection of z/VSE to IBM MQ Server, you should produce the REST engine option phase IESRESTO:

(1) Copy the skeleton SKRESTOP from the ICCF library 59 into the private library 10;

(2) Set z/VSE certificate name within the part `SSL specific settings` of the skeleton, for example:

```
*
* Keyname for SSL
*
SSLKEYNM DC     CL8'MQ1024'
```

Note. If you are enabling SSL for accessing MQ Server with Client certificate authentication, then:

- The specified certificate (it is `MQ1024` in the above example) must be generated for a user configured to MQ Server (see Generation of z/VSE certificates);
- This setting guarantees that each HTTPS request to MQ Server will be provided with the specified certificate.

(3) Keep default values for all other options of the phase.
(4) Submit the SKRESTOP skeleton to z/VSE.
(5) Verify that job return code is zero (okay).
(6) Activate the produced phase by setting its new copy (by means of the CICS transaction `CEMT SET PROG(IESRESTO) NEWCOPY`).

9. Appendix D: Obtaining the programming samples

You can download the programming samples archive from the FTP server: ftp://public.dhe.ibm.com/eserver/zseries/zos/vse/download/xmps/MQ_via_REST.zip.

The samples contain JCL and JECL statements to compile, link-edit and catalog the programs in the PRD2.CONFIG sub-library. When a sample has been cataloged, you need to define it to the CICS and set its new copy. Also, you should define a CICS transaction for a sample running.