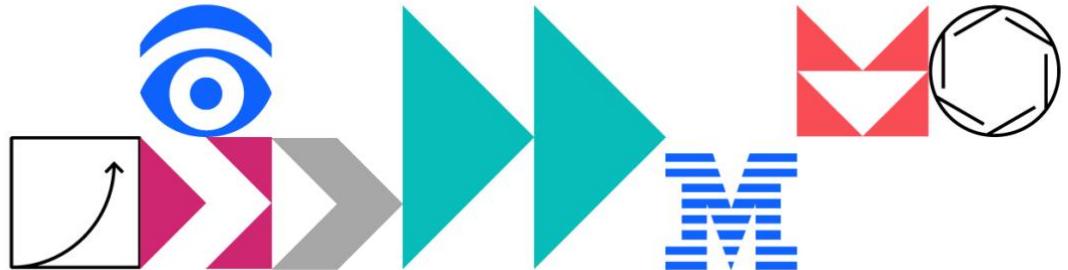




IBM TechXchange



# Horizontally scaling IBM MQ and your applications

Session 3277

Lab Exercise Guide v1

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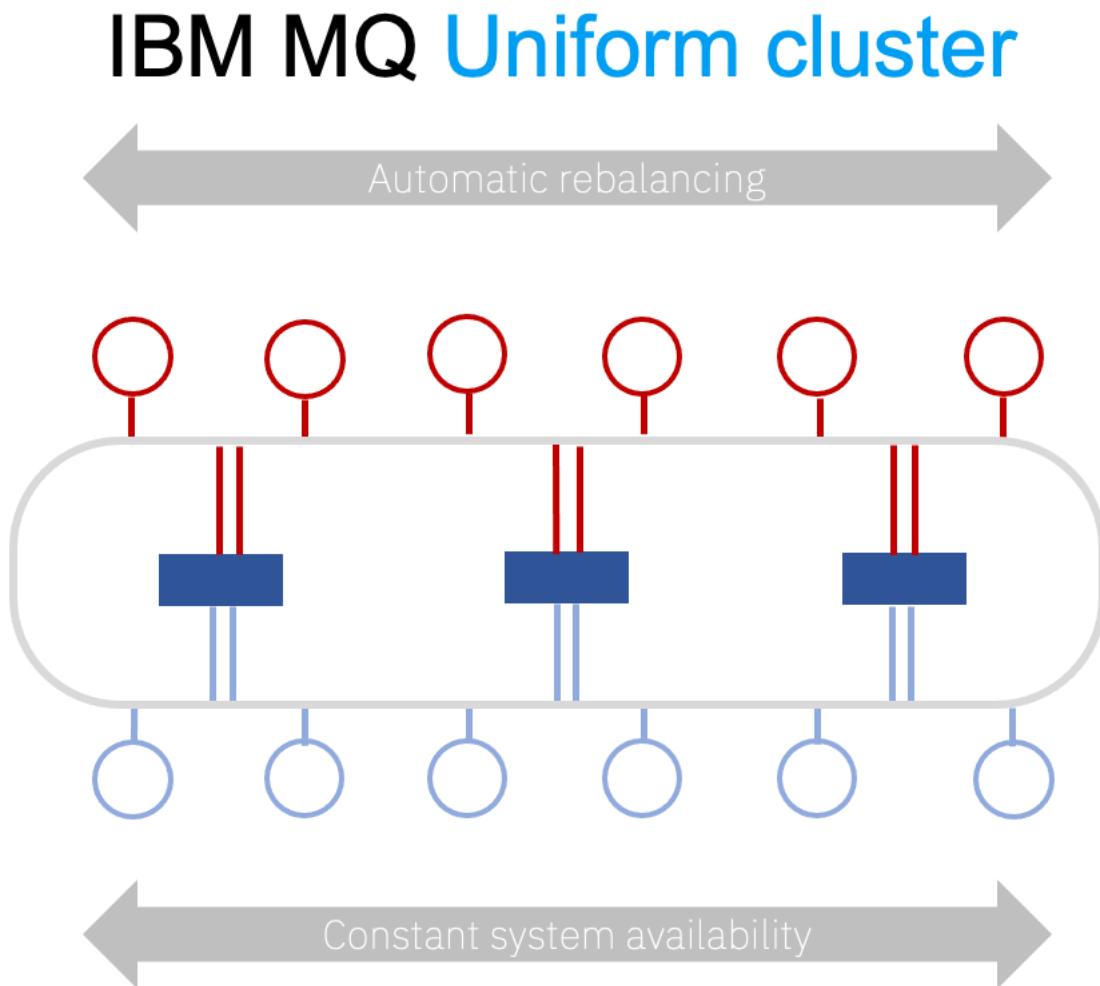
## 1 Introduction

This cookbook will walk you through the deployment process of a MQ Uniform Cluster using GitOps principles where each queue manager uses the Native HA functionality to provide high availability.

Then we will deploy an MQ application to demonstrate how it can take advantage of the Uniform Cluster when it scales.

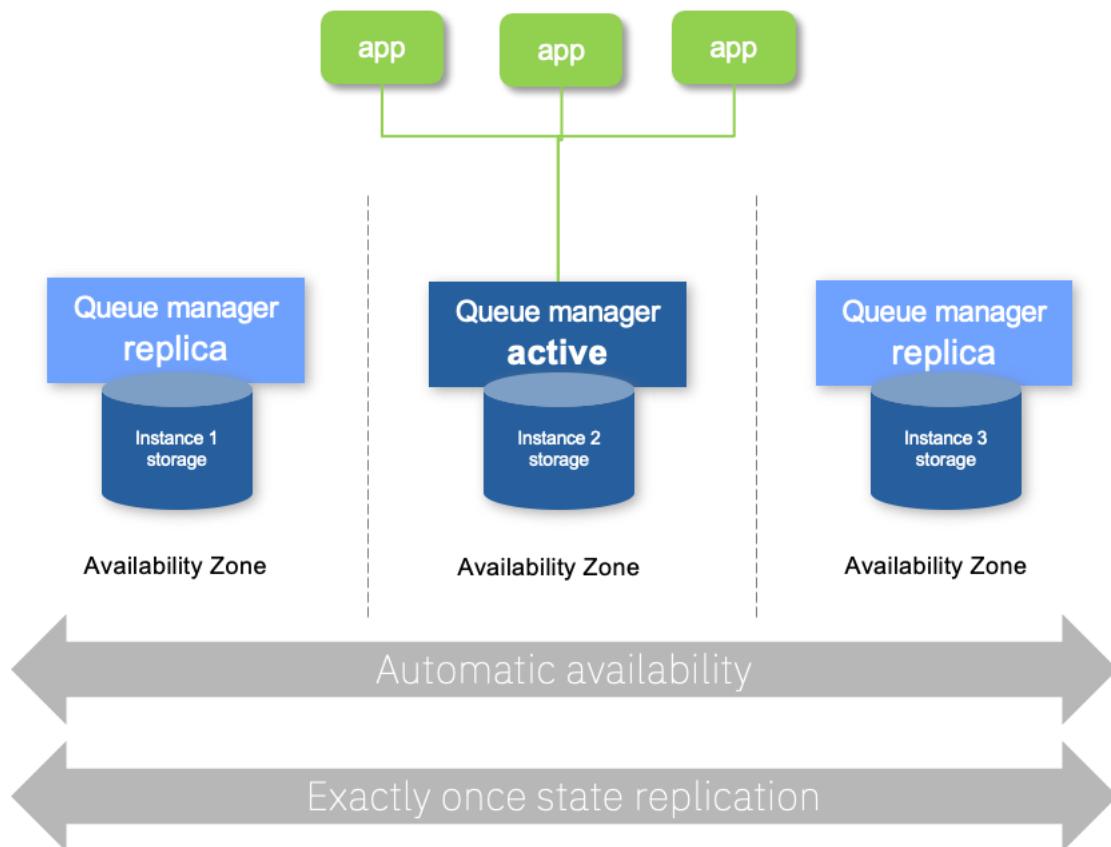
### 1.1 High Level Architecture

The high-level architecture for the environment described in this document may be summarized as follows:

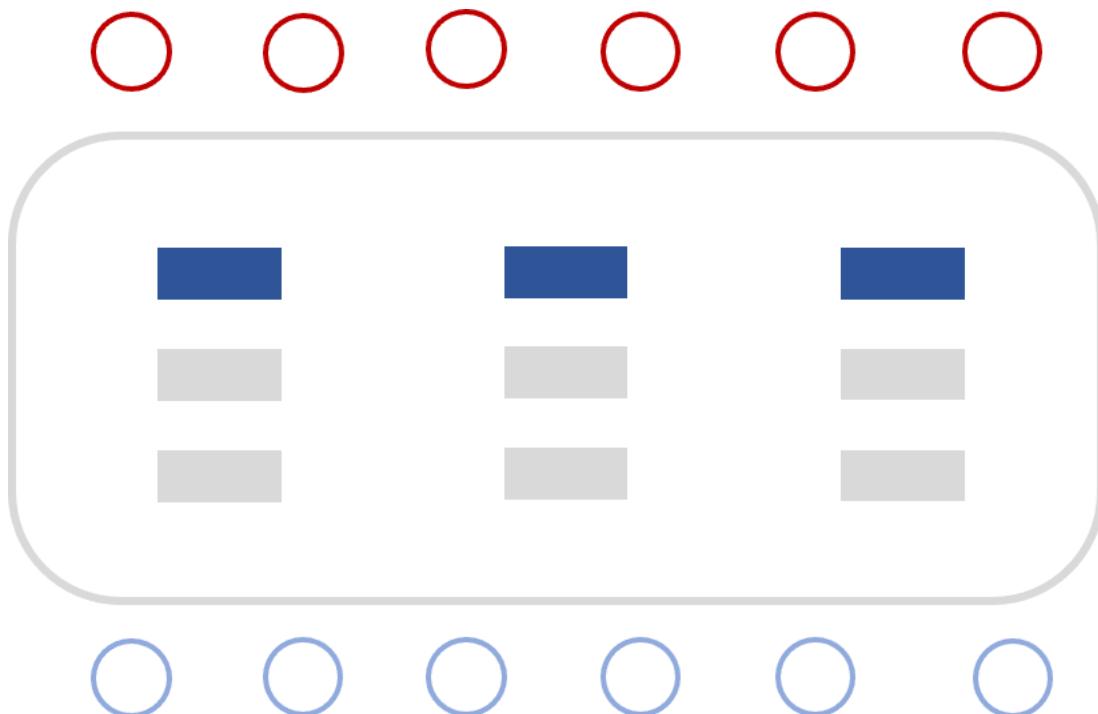


# IBM MQ Containers

## Native HA



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**Horizontal scaling**

**Active-active availability**

**Data resiliency with consistency**

## 1.2 Lab Overview

In this lab, your persona will be an Integration Specialist who will be deploying an MQ Cluster using GitOps principles, as well as an MQ Application with the OCP facilities. Your lab's computer will use a web browser to connect to the RedHat Openshift Cluster as well as the ArgoCD web UI to conduct the different activities.

The MQ Operator as well as an instance of RedHat OpenShift GitOps has been already installed, alongside with an instance of nginx to serve the CCDT that will be used by the MQ Application.

Happy Messaging!

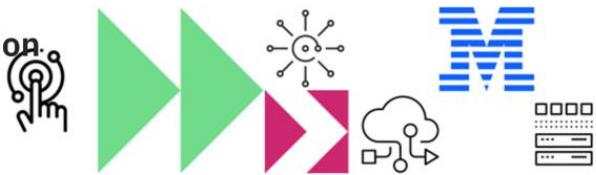
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## 2 Getting Started

The laptop you have been assigned you should have a screen.

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Las Vegas, NV | MGM Grand Conference Center

3277 | August 22 - September 1, 2023 | 4:15 PM - 5:00 PM (PDT UTC/GMT -07:00)



Harnessing the Power of Horizontal Scaling with IBM MQ and Your Applications

A screenshot of a registration form. At the top, a modal window titled "Register" with the instruction "Please enter your email address." has just been closed. Below it, there is a text input field labeled "E-mail:" containing "student1@ibm.edu". A note below the field says "be sure to spell/type correctly". At the bottom left is a blue "Register" button, and at the bottom right is a small black and white logo of a bee-like character with wings.

### 2.1 Login to the Lab Environment

In the Login form below, enter the e-mail that you used to register for TechXchange 2023 in the E-mail form and click on the Register button.

A screenshot of a login form. It features a text input field labeled "E-mail:" containing "student1@ibm.edu". Below the input field is a blue "Register" button. At the bottom left is a link "Your Data Privacy". In the center is a small black and white logo of a bee-like character with wings.

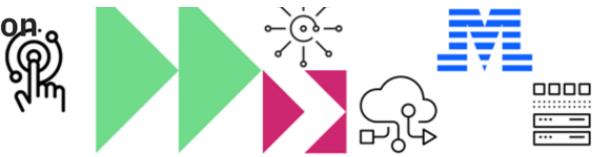
The Lab Home web page is displayed.

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### Harnessing the Power of Horizontal Scaling with IBM MQ and Your Applications

Hello student1@ibm.edu

[Logout](#)

#### Harnessing the Power of Horizontal Scaling with IBM MQ and Your Applications

(Integration)3277-M - S0001  
(TECHEXCHANGE)

Lab Guide

**Start:** 2023-08-22 4:15 PM (America/Los\_Angeles)

**End:** 2023-09-01 5:00 PM (America/Los\_Angeles)

**Assigned:** Student 1 on Cluster 1

Las Vegas

[Launch Lab](#)

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## 2.2 Launch the Lab Environment

[Launch Lab](#)

Click on the [Launch Lab](#)  button to launch the Lab Environment.

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Welcome 3277

Virtual Machines #: 1

TEV\_3277\_V\_01-student01

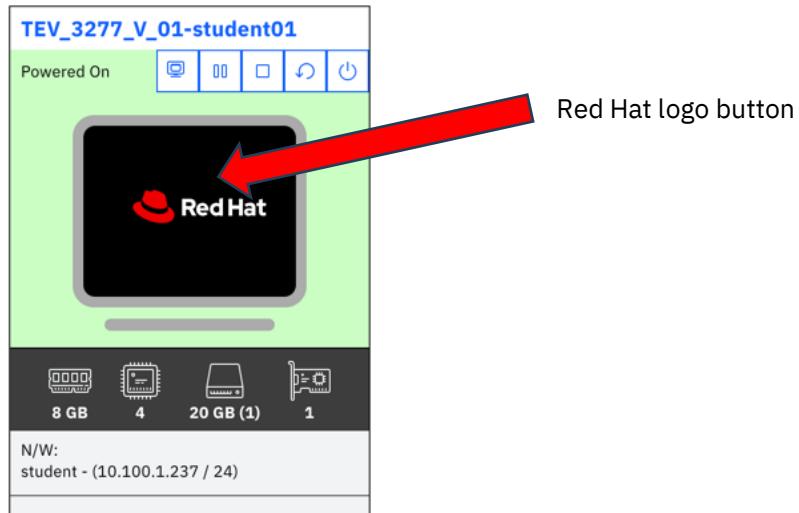
Powered On

Red Hat

8 GB 4 20 GB (1) 1

N/W: student - (10.100.1.237 / 24)

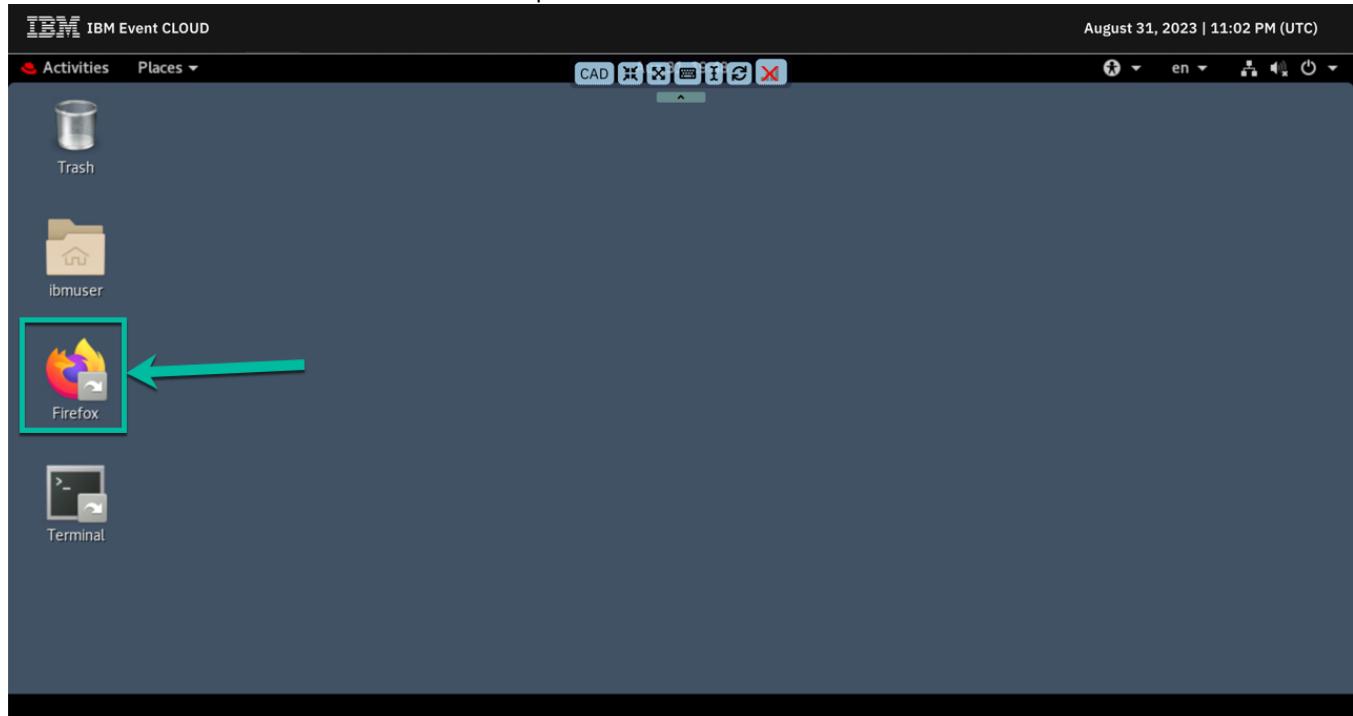
The VM should be named TEV\_3277\_V\_01-student<<Number>> where <<number>> is your student number.



Click on the Red Hat logo button. This will launch the Lab Environment.

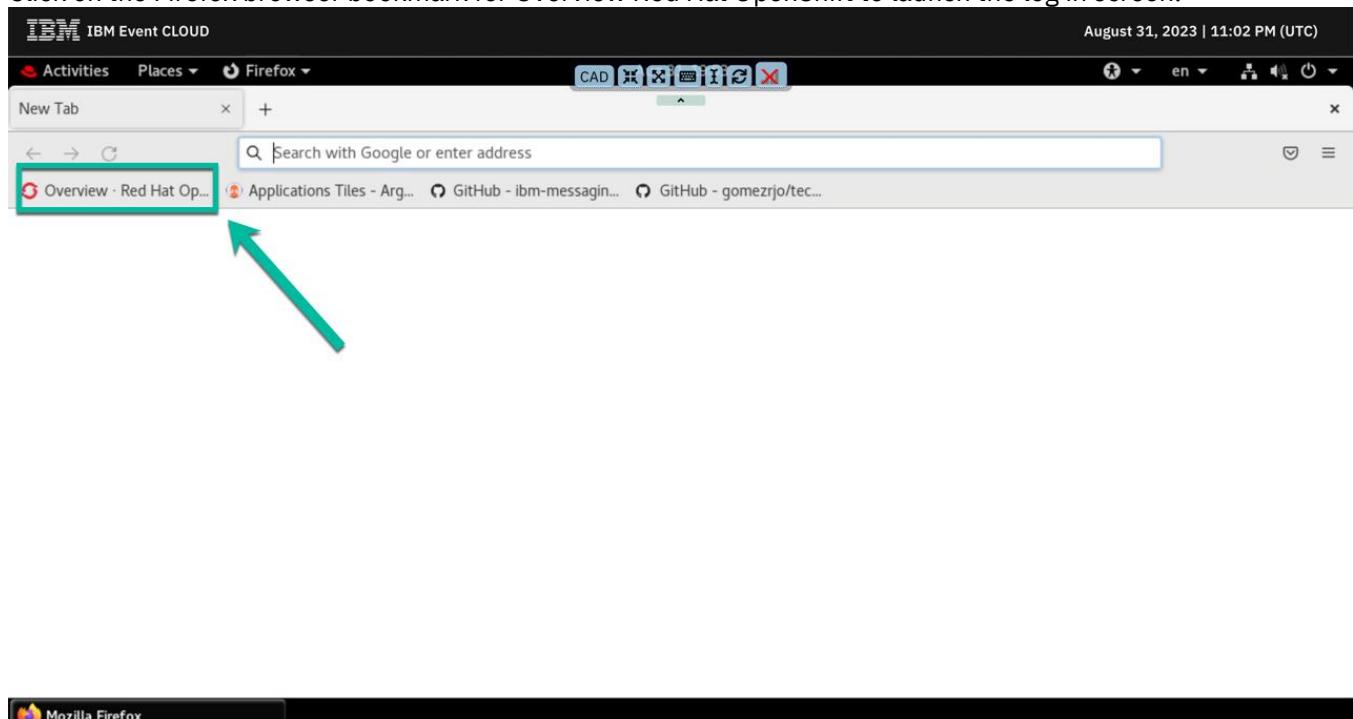
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Click on the Firefox icon on the Linux Desktop to start Firefox.



## 2.3 Launch RedHat OpenShift Console

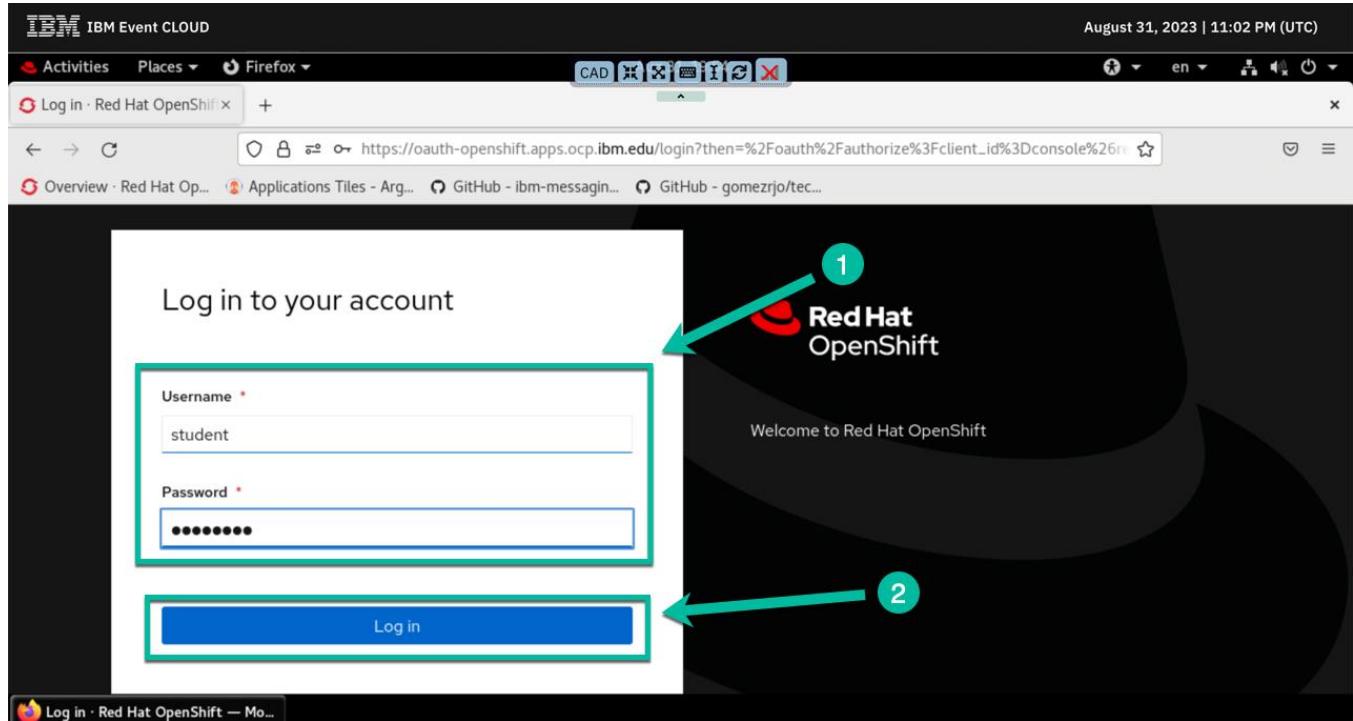
Click on the Firefox browser bookmark for Overview Red Hat OpenShift to launch the log in screen.



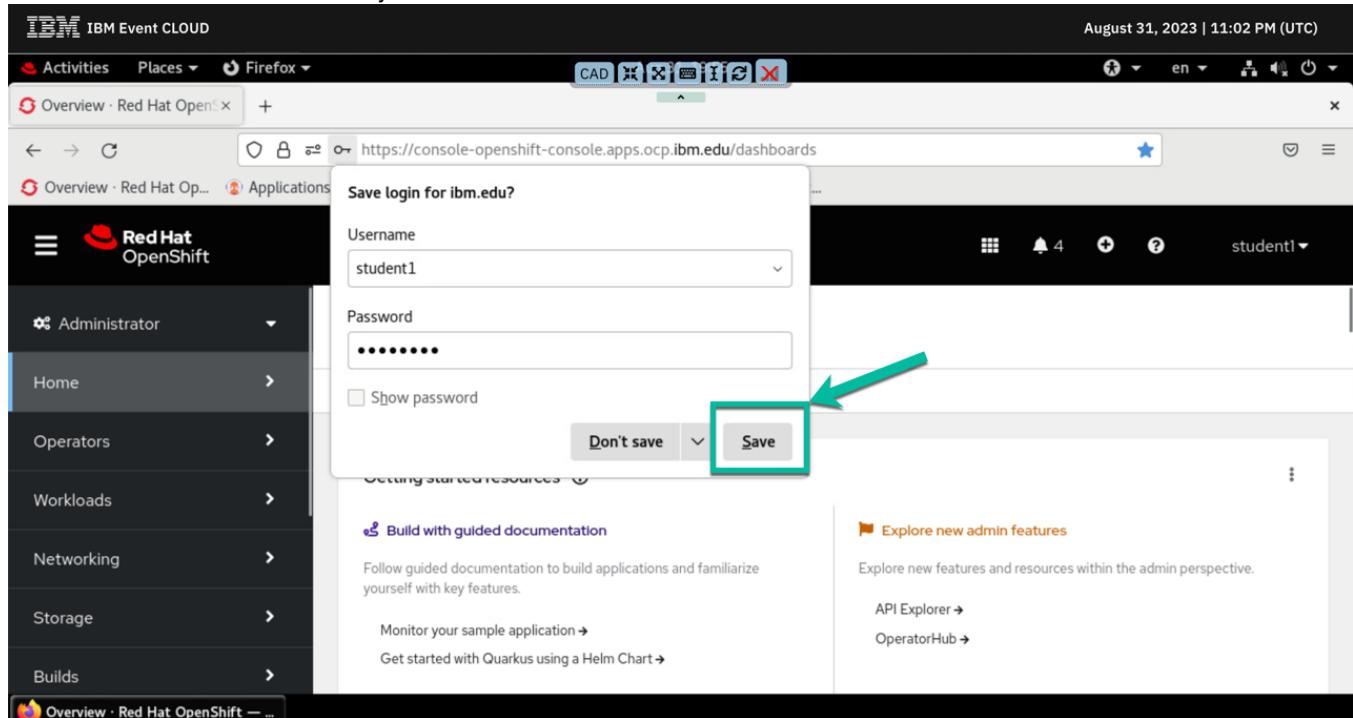
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## 2.4 Login into the RedHat OpenShift Console

- For the Username field, put your ID like “student#” with no quotes where # is your number
- For the Password field, put in “Passw0rd” with no quotes.



You can save the credentials if you want to.



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The OCP console is displayed. We will check that the MQ Operator is installed but no Queue Managers have been deployed yet.

First make sure you are in project “student#” (where # is your assigned student number), then navigate to the “Installed Operators” section and select “Queue Manager” as shown below and there are no queue managers displayed, which means no queue manager has been deployed in your project (aka namespace) yet.

The screenshot shows the Red Hat OpenShift interface within the IBM Event CLOUD OCP console. The top navigation bar includes 'Activities', 'Places', 'Firefox', 'CAD', 'Applications Tiles - Argo', and system status indicators. The URL is https://console-openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/operators.coreos.com~v1alpha1~ClusterService. The main content area is titled 'Queue Managers' under the 'ibm-mq.v2.3.3' operator details. A callout with three numbered steps highlights the process:

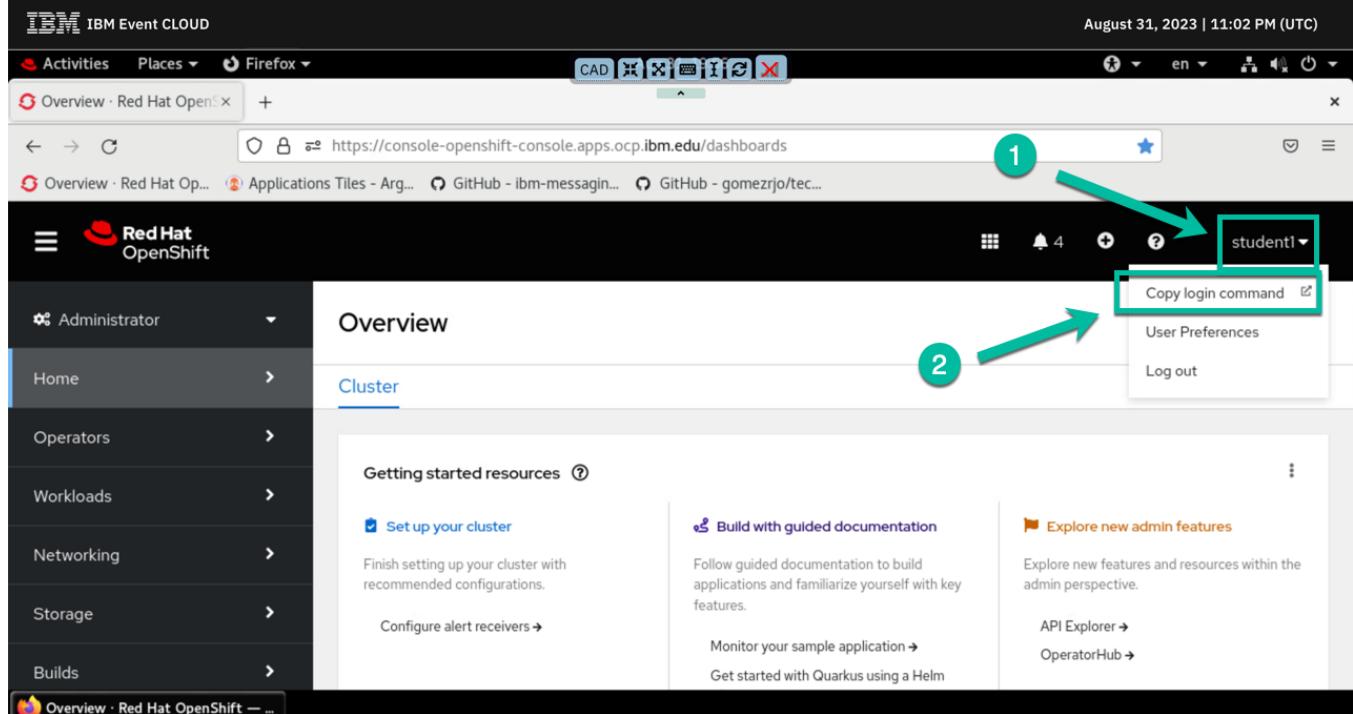
- Step 1: A red box highlights the 'Project: student1' dropdown menu.
- Step 2: A red box highlights the 'Installed Operators' link in the sidebar.
- Step 3: A red box highlights the 'Queue Manager' tab in the navigation bar.

The interface also shows 'No operands found' and a note about declarative components. The bottom status bar shows 'ibm-mq.v2.3.3 - Details - Red Hat ...' and 'ibmuser@student:~/Documents'.

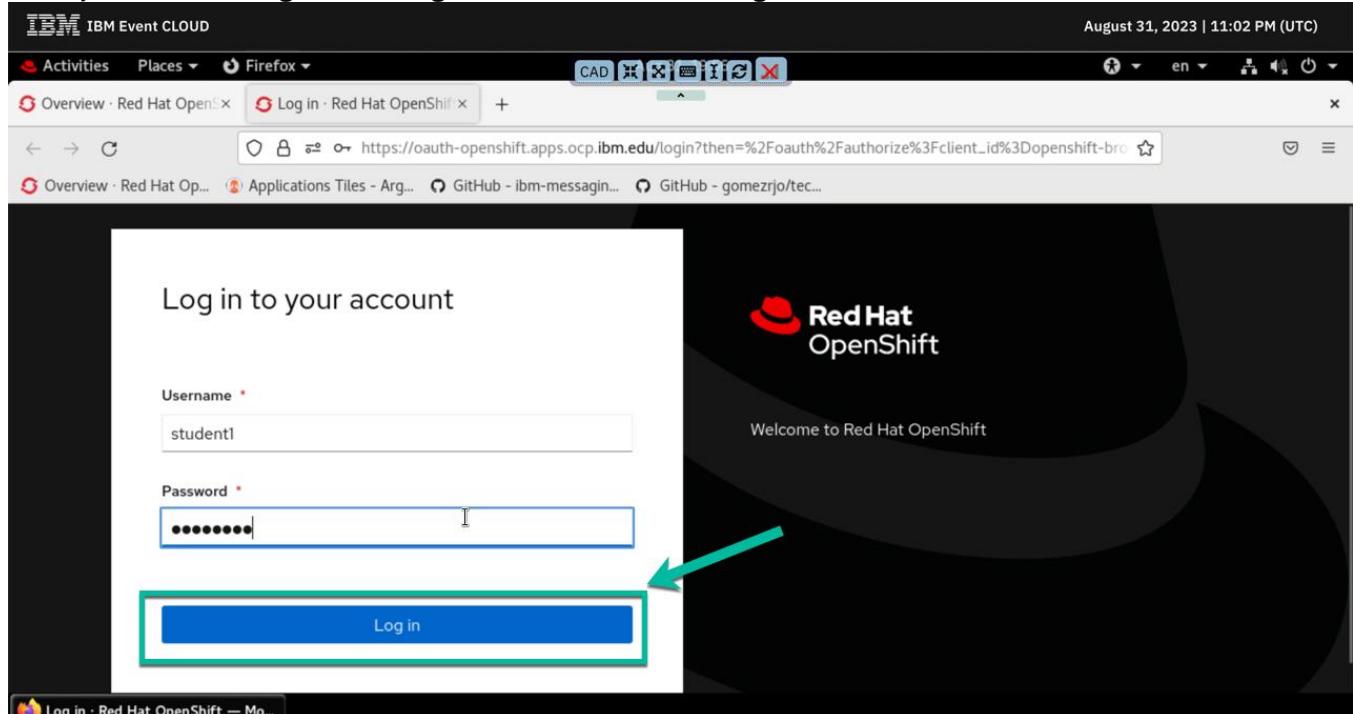
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## 3 Create ArgoCD App to deploy MQ Uniform Cluster

We will deploy the application using the oc cli. For that we need to get an OCP token via the “login command”. Navigate to the username in the upper right corner of the browser and click on the drop down button to get the menu and then click on “Copy Login command” as shown below.



Enter your credential again in the login screen and click the “log in” button.

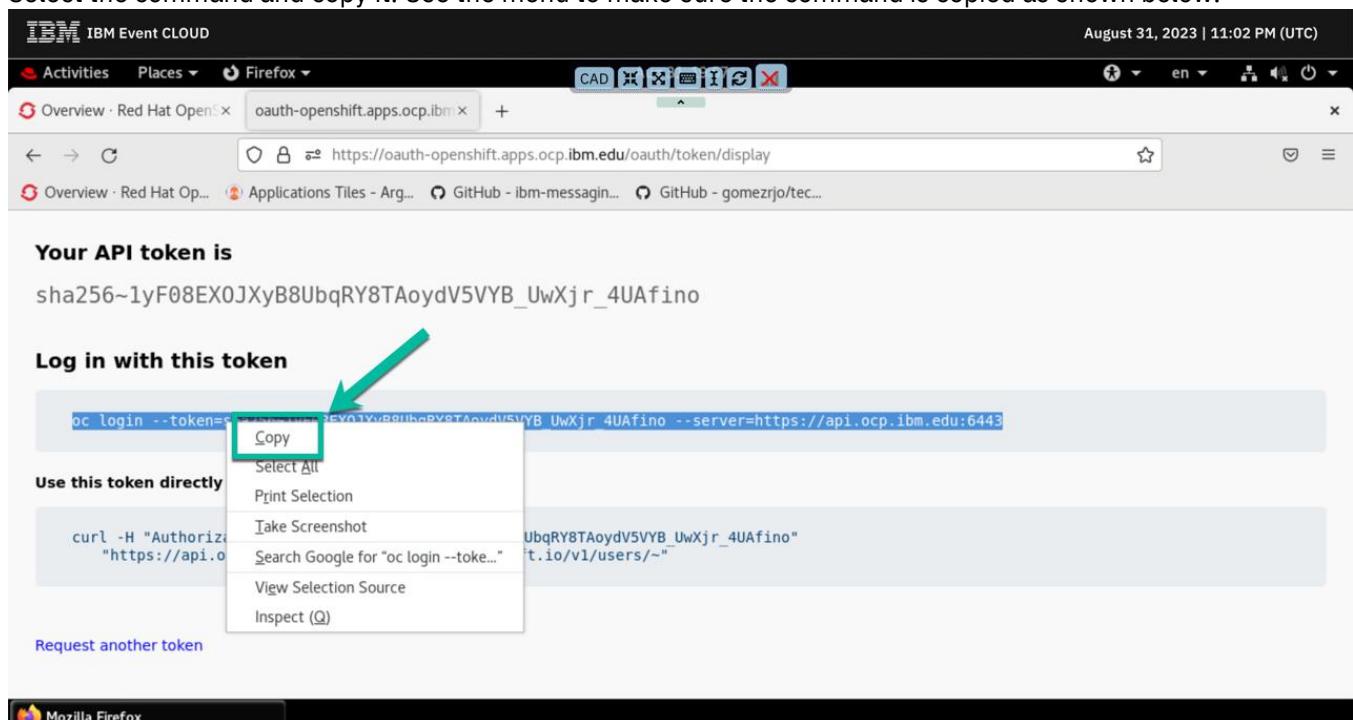


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Click on the “Display Token” link.

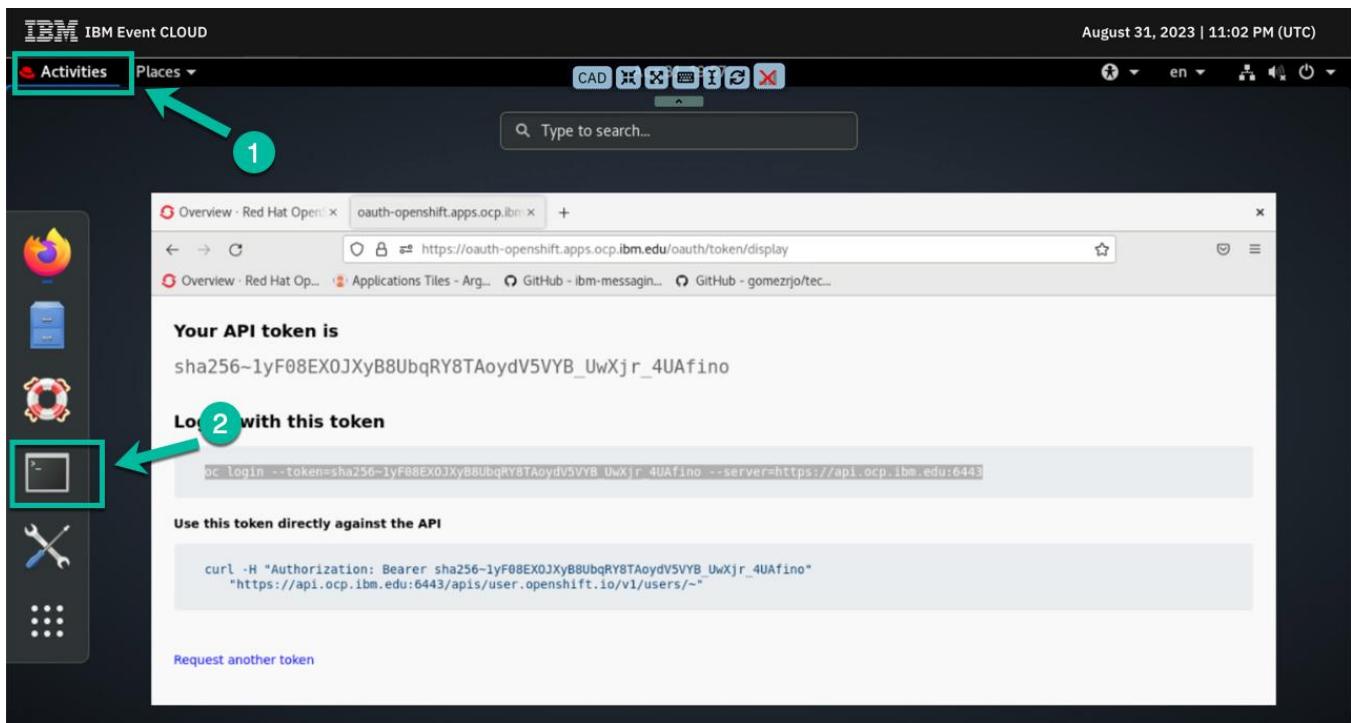


Select the command and copy it. Use the menu to make sure the command is copied as shown below.

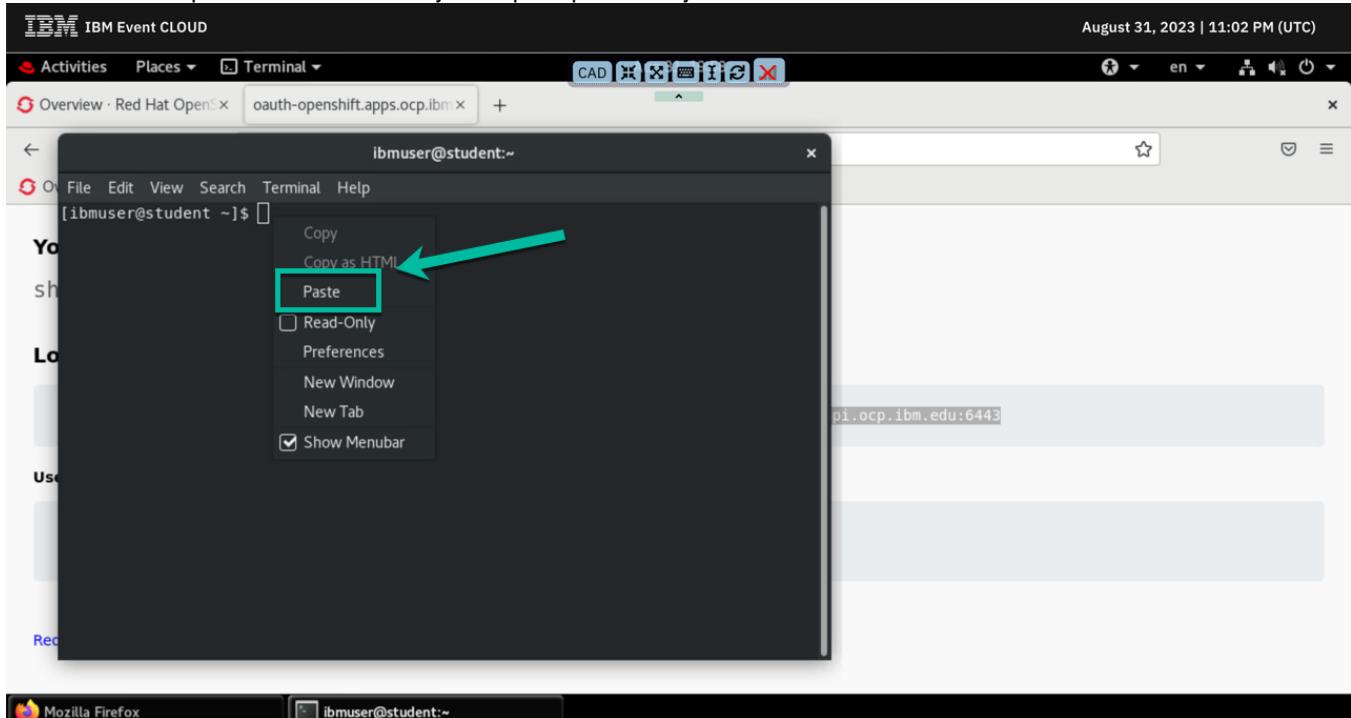


Now we will open a terminal to run the command. If you are not familiar with RHEL, select the “Activities” button in the upper left corner and then the terminal icon as shown below.

# IBM TechXchange

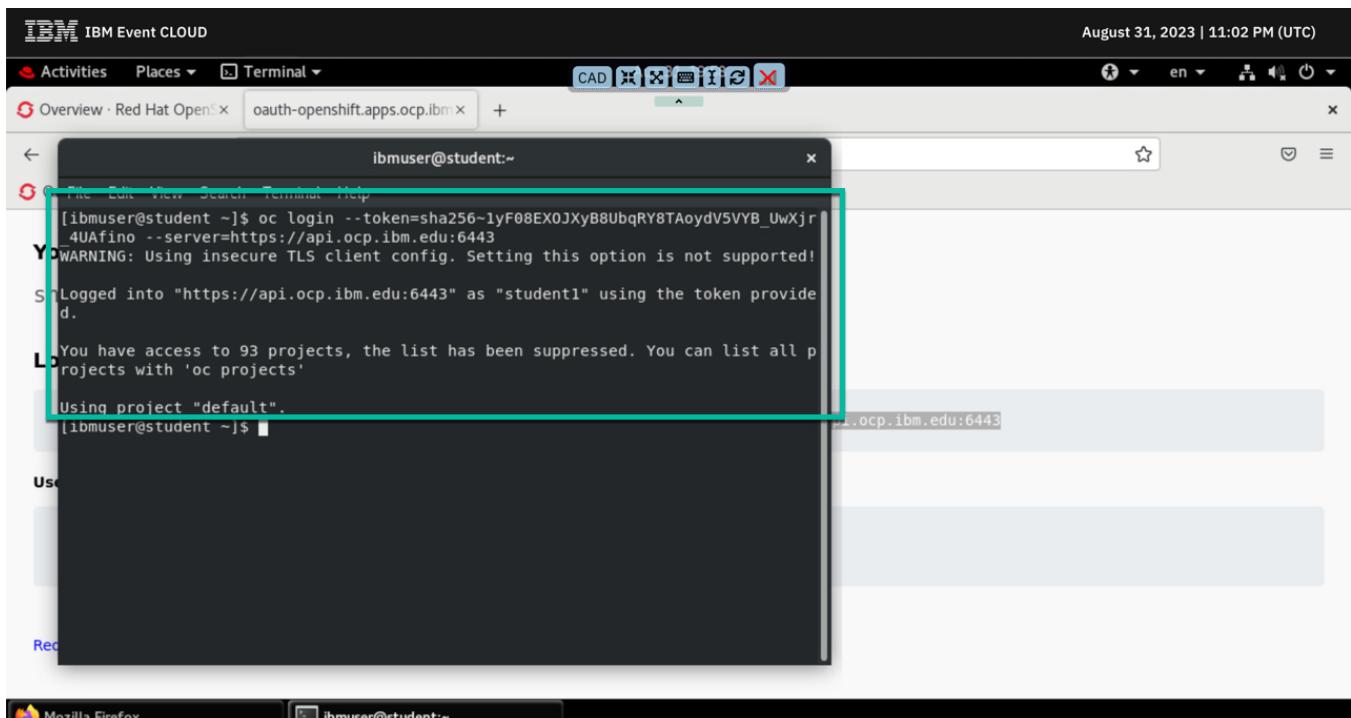


In the terminal paste the command you copied previously. Use the menu as shown below for better results.



You will get a message as shown below to confirm login was successful.

# IBM TechXchange

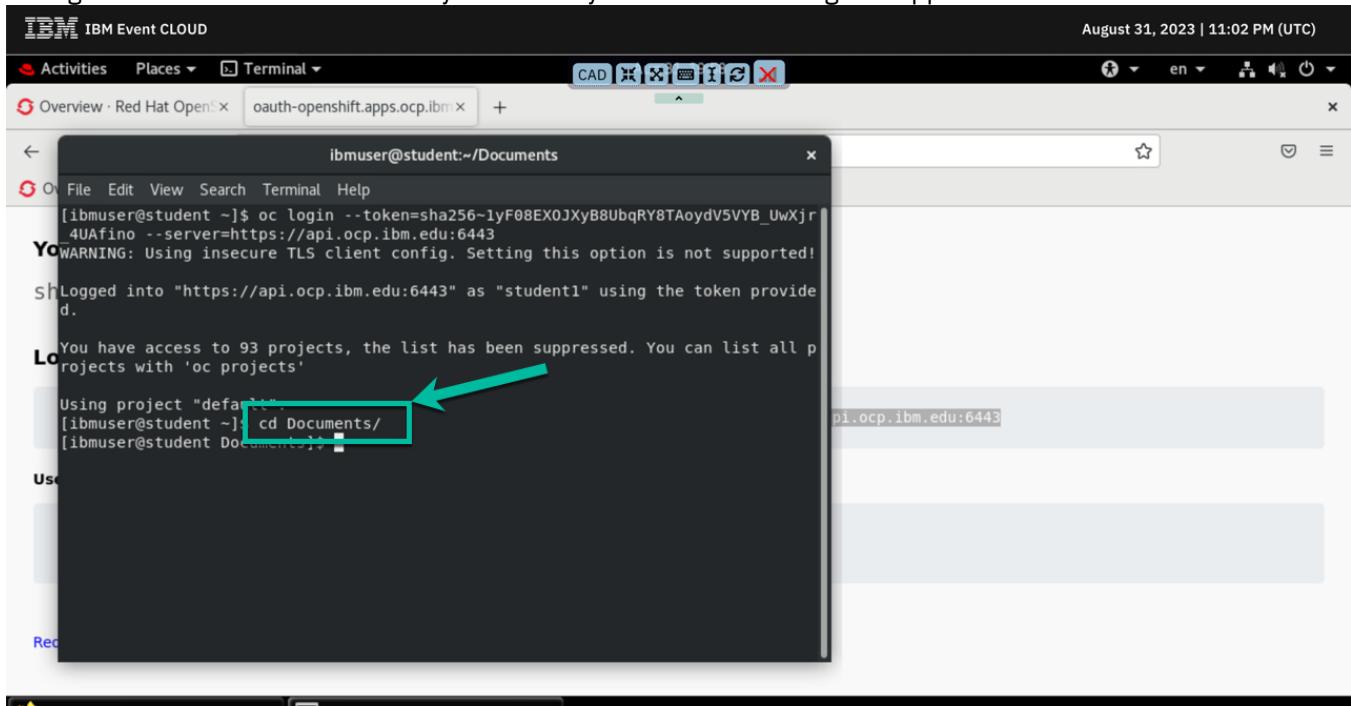


```
[ibmuser@student ~]$ oc login --token=sha256~1yF08EX0JXyB8UbqRY8TAoydV5VYB_UwXjr
4UAfino --server=https://api.ocp.ibm.edu:6443
WARNING: Using insecure TLS client config. Setting this option is not supported!
Logged into "https://api.ocp.ibm.edu:6443" as "student1" using the token provided.

You have access to 93 projects, the list has been suppressed. You can list all projects with 'oc projects'

Using project "default".
```

Change to the “Documents” directory where the yaml file with the ArgoCD App is located.

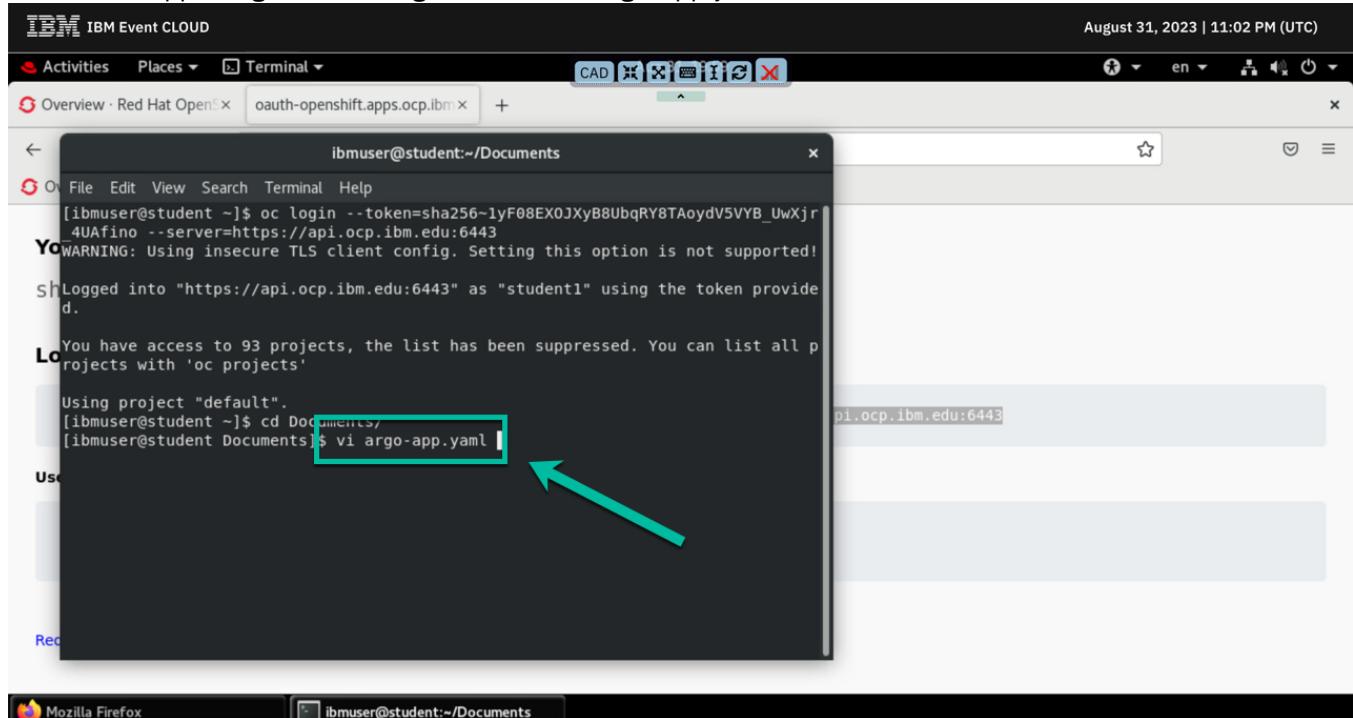


```
[ibmuser@student ~]$ cd Documents/
```

## 3.1 Review and Update GitOps App Definition

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Review the App using the following command “vi argo-app.yaml”.



The screenshot shows a terminal window titled "ibmuser@student:~/Documents". The terminal is displaying a command-line session. A red box highlights the command "vi argo-app.yaml" in the terminal window. An arrow points from the text above to this highlighted command.

```
[ibmuser@student ~]$ oc login --token=sha256-1yF08EX0JXyB8UbqRY8TAoydV5VYB_UwXjr4Ufino --server=https://api.ocp.ibm.edu:6443
WARNING: Using insecure TLS client config. Setting this option is not supported!
Logged into "https://api.ocp.ibm.edu:6443" as "student1" using the token provided.

You have access to 93 projects, the list has been suppressed. You can list all projects with 'oc projects'

Using project "default".
[ibmuser@student ~]$ cd Documents/
[ibmuser@student Documents]$ vi argo-app.yaml
```

Before we review the content note that “namespace” has a value of “studentX”, and you will need to replace the “X” for your student number before you deploy the app.

This is not an ArgoCD class, but the two main sections are “source” and “destination”. The “repoURL” is pointing to the github repo that contains all the artifacts used by ArgoCD to deploy the queue managers. There is a bookmark in the browser if you want to explore.

The “destination” section is the location where the app and all the associated resources will be deployed. This is why you need to make sure it points to your assigned namespace.

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The screenshot shows the IBM Event CLOUD interface. On the left, there's a terminal window titled 'ibmuser@student:~/Documents' containing a YAML configuration file for an Argo Project. A red arrow points from the text 'namespace: studentX' in the configuration file to the 'namespace' field in the terminal window. On the right, there's an 'APPLICATION DETAILS TREE' panel showing a hierarchical structure of services and endpoints.

```
apiVersion: argoproj.io/v1alpha1
kind: Application
metadata:
  name: dev
  namespace: openshift-gitops
spec:
  destination:
    name: ''
    namespace: studentX
    server: 'https://kubernetes.default.svc'
  source:
    path: queue-manager-deployment/queue-managers
    repoURL: 'https://github.com/ibm-messaging/mq-gitops-samples'
    targetRevision: main
  project: default
```

Don't forget to change the namespace and save the file.

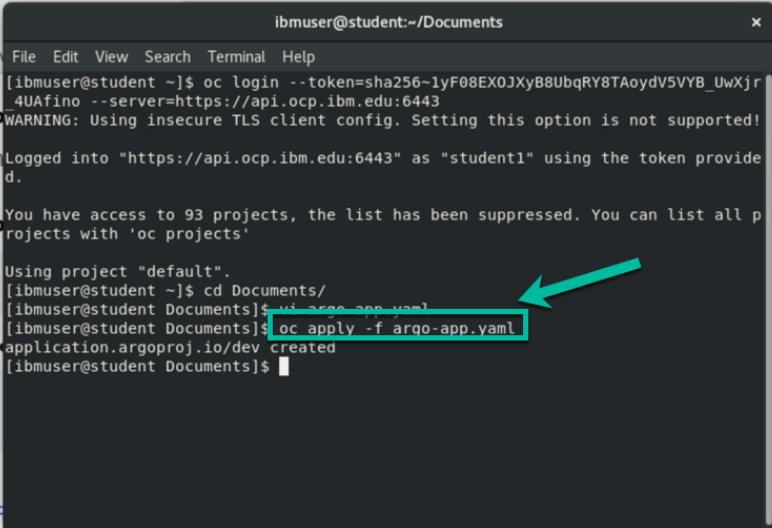
The screenshot shows the IBM Event CLOUD interface. On the left, there's a terminal window titled 'ibmuser@student:~/Documents' containing the same YAML configuration file. The 'namespace' field has been changed to 'student1'. On the right, there's a status bar showing the URL 'pi.ocp.ibm.edu:6443'.

```
apiVersion: argoproj.io/v1alpha1
kind: Application
metadata:
  name: dev
  namespace: openshift-gitops
spec:
  destination:
    name: ''
    namespace: student1
    server: 'https://kubernetes.default.svc'
  source:
    path: queue-manager-deployment/queue-managers
    repoURL: 'https://github.com/ibm-messaging/mq-gitops-samples'
    targetRevision: main
  project: default
```

## 3.2 Create and Review GitOps App

Now you can create the GitOps App using the following command “`oc apply -f argo-app.yaml`”, as shown below.

# IBM TechXchange

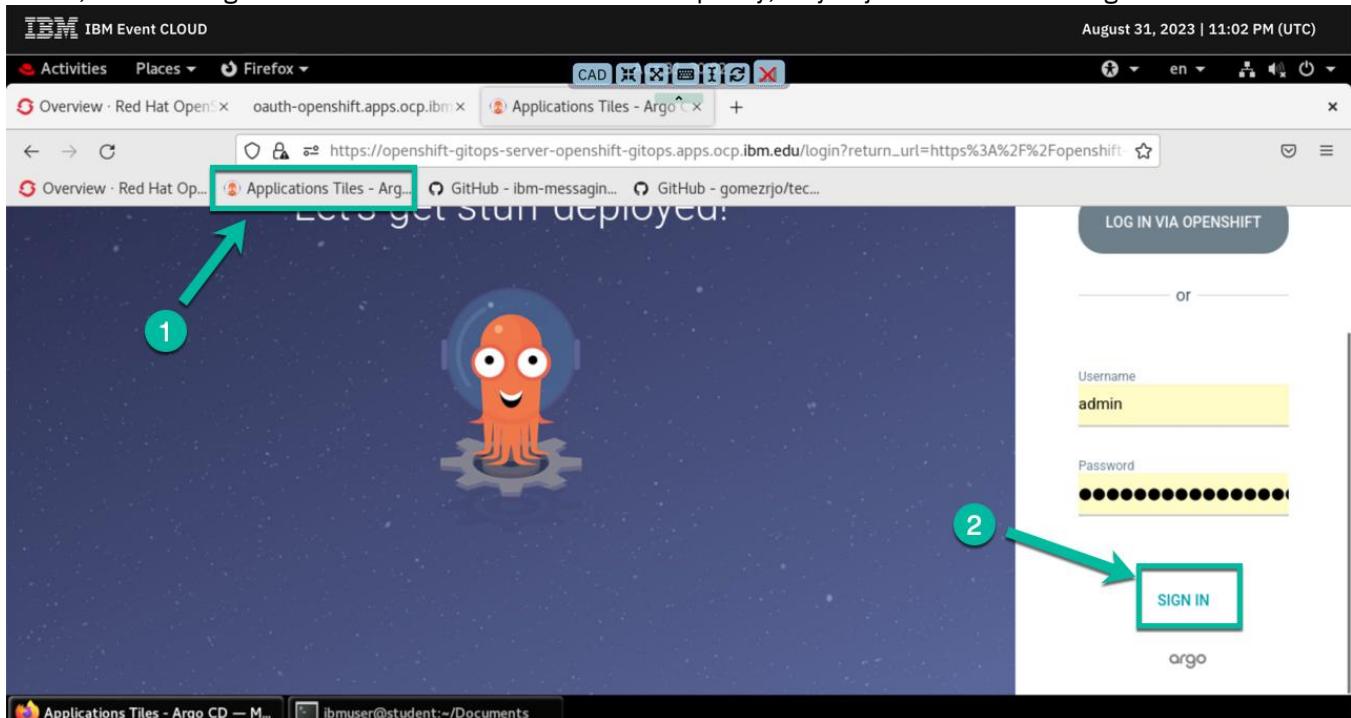


```
ibmuser@student:~/Documents
[ibmuser@student ~]$ oc login --token=sha256-1yF08EX0JXyB8UbqRY8TAoydV5VYB_UwXjr
4UAfino --server=https://api.ocp.ibm.edu:6443
WARNING: Using insecure TLS client config. Setting this option is not supported!
Logged into "https://api.ocp.ibm.edu:6443" as "student1" using the token provided.

You have access to 93 projects, the list has been suppressed. You can list all projects with 'oc projects'

Using project "default".
[ibmuser@student ~]$ cd Documents/
[ibmuser@student Documents]$ vi argo-app.yaml
[ibmuser@student Documents]$ oc apply -f argo-app.yaml
Use application.argoproj.io/dev created
[ibmuser@student Documents]$
```

Navigate to the ArgoCD web UI clicking in the “Application Tiles – ArgoCD” bookmark in the browser and shown below, and then sign in. The credentials are stored for simplicity, so you just have to click “sign in”.



Note we are sharing a single account with the whole group so make sure you only work with your app since you may see other applications. The best way to identify yours is by the namespace where it is running. Click on the tile that represents your app to review the details.

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The screenshot shows the IBM Event CLOUD interface with the title "IBM Event CLOUD" at the top right. The date "August 31, 2023 | 11:02 PM (UTC)" is also at the top right. The main area is titled "APPLICATIONS TILES". On the left, there's a sidebar with icons for Applications (v2.3.174), Sync Apps, Refresh Apps, and a search bar. Below the sidebar are filters for Favorites Only, Sync Status (Unknown: 0, Synced: 0, OutOfSync: 1), and Health Status (Unknown: 0). The central area displays a card for an application named "dev". The card contains the following details:

- Project: default
- Labels:
- Status: Healthy (green circle) OutOfSync (yellow circle)
- Repo: https://github.com/ibm-messagin...
- Target: main
- Path: queue-manager-deployment
- DestL: in-cluster
- Name: student1

At the bottom of the card are three buttons: "SYNC" (highlighted with a green arrow), "C", and "D".

## 3.3 Synchronize GitOps App

Note the status of the app is “OutOfSync”. This is on purpose because we have configured manual synchronization to have full control, but in a production environment you can configure automatic synchronization as soon as a discrepancy is identified.

The screenshot shows the IBM Event CLOUD interface with the title "IBM Event CLOUD" at the top right. The date "August 31, 2023 | 11:02 PM (UTC)" is also at the top right. The main area is titled "APPLICATION DETAILS TREE". On the left, there's a sidebar with icons for Applications (v2.3.174), Sync Apps, Refresh Apps, and a search bar. Below the sidebar are buttons for APP DETAILS, APP DIFF, SYNC (highlighted with a green arrow), SYNC STATUS, HISTORY AND ROLLBACK, DELETE, and REFRESH. The central area displays the "dev" application details. The "CURRENT SYNC STATUS" is shown as "OutOfSync" (yellow circle). Below this, there's a "From main (3d44d4a)" message with "MORE" and "Author: martinevansibm <93322732+martinevansibm@u... Comment: Update README.md". At the bottom, there's a tree view of configuration maps: "qm01-dynamic-mqsc-configmap", "qm01-mqsc-configmap", and "qm01-qm-ini-configmap".

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Click the “Synchronize” button in the new window to start the process. We will use the default values but feel free to review the different options available.

The screenshot shows the IBM Event CLOUD interface. In the center, there's a modal dialog titled "Synchronizing application manifests from https://github.com/ibm-messaging/mq-gitops-samples". The "SYNC STATUS" section shows "OutOfSync" status with a "From main (3d44d4a)" message. Below it, a "Revision" dropdown is set to "main". On the right side of the modal, there are several sync options with checkboxes: PRUNE, DRY RUN, APPLY ONLY, FORCE, SKIP SCHEMA VALIDATION, PRUNE LAST, RESPECT IGNORE DIFFERENCES, AUTO-CREATE NAMESPACE, and APPLY OUT OF SYNC ONLY. At the bottom, the "PRUNE PROPAGATION POLICY" is set to "foreground". A large green arrow points to the "Synchronize" button at the top right of the modal. The background shows the main application details page with tabs like APP DETAILS, APP DIFF, SYNC, SYNC STATUS, and HISTORY AND ROLLBACK.

After a few seconds the status will change to “Synced” and the queue managers with the corresponding configuration will be created.

The screenshot shows the IBM Event CLOUD interface after the sync process has completed. The "CURRENT SYNC STATUS" is now "Synced" with a green checkmark and the message "To main (3d44d4a)". The "LAST SYNC RESULT" shows a "Sync OK" status with a green checkmark, indicating success a few seconds ago. Below the sync status, there's a diagram illustrating the creation of queue manager configurations. It shows three "cm" (queue manager) nodes with "qm01-dynamic-mqsc-configmap", "qm01-mqsc-configmap", and "qm01-qm-ini-configmap" attached, each with a "a few seconds" timestamp. To the right, a "qm01-qm-ibm-mq" service node is shown with its own "a few seconds" timestamp. The background shows the main application details page with tabs like APP DETAILS, APP DIFF, SYNC, SYNC STATUS, and HISTORY AND ROLLBACK.

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## 3.4 Review the Queue Managers Deployment

Navigate to the OCP Console in the other tab and go to the MQ Operator. Making sure first you are in the right project then selecting the “Installed Operators” section and finally clicking in the “IBM MQ Operator” row as shown below.

The screenshot shows the Red Hat OpenShift interface within the IBM Event CLOUD OCP Console. The left sidebar has 'Installed Operators' selected (circled with 2). The main area shows the 'IBM MQ' operator listed under 'All Namespaces' with status 'Succeeded Up to date'. The 'Project: student1' dropdown is open (circled with 3), and the 'IBM MQ' entry is highlighted with a green box and circled with 1. A green arrow points from the 'Installed Operators' menu to the 'IBM MQ' entry. Another green arrow points from the 'Project' dropdown to the 'IBM MQ' entry.

Then select “Queue Manager” and you will see two queue managers deployed. Both queue managers conform a Uniform Cluster.

The screenshot shows the Queue Managers page for the 'student1' project. The 'Queue Manager' tab is selected (circled with 1). The 'QueueManagers' table lists two entries: 'QM qm01-qm' and 'QM qm02-qm', both of which are 'QueueManager' type objects in the 'student1' namespace and are 'Running'. A green arrow points from the 'Queue Managers' heading to the 'QM qm01-qm' entry in the list. Another green box highlights the 'Queue Manager' tab.

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Additionally, each queue manager was configured with Native HA availability, so if you navigate to the “Pods” section in your own namespace you will see each queue manager is composed of 3 pods, but only one of them is active. You can identify it with the “1/1” value. The other two are “0/1” which means they are in standby mode waiting to take over in case there is an issue with the primary pod. If you look deeper, you will notice that each pod is located in a different worker node to increase resiliency.

The screenshot shows the IBM Event CLOUD interface with the Red Hat OpenShift application running in a Firefox browser window. The URL is https://console-openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/core~v1~Pod. The sidebar on the left has 'Workloads' expanded, with 'Pods' selected and highlighted by a red box and arrow (labeled 1). The main area shows a table of pods for project student1. One pod, 'qm01-qm-ibm-mq-0', is active (1/1) and located on node 'bcb77974d'. Two other pods, 'qm01-qm-ibm-mq-1' and 'qm01-qm-ibm-mq-2', are in standby mode (0/1) and located on nodes 'bcb77974d' and 'bcb77974e' respectively. A red box and arrow (labeled 2) highlights the active pod's row.

Name	Status	Replicas	Available	Nodes
qm01-qm-ibm-mq-0	Running	1/1	0	bcb77974d
qm01-qm-ibm-mq-1	Running	0/1	0	bcb77974d
qm01-qm-ibm-mq-2	Running	0/1	0	bcb77974e
qm02-qm-ibm-mq-0	Running	1/1	0	bcb77974e

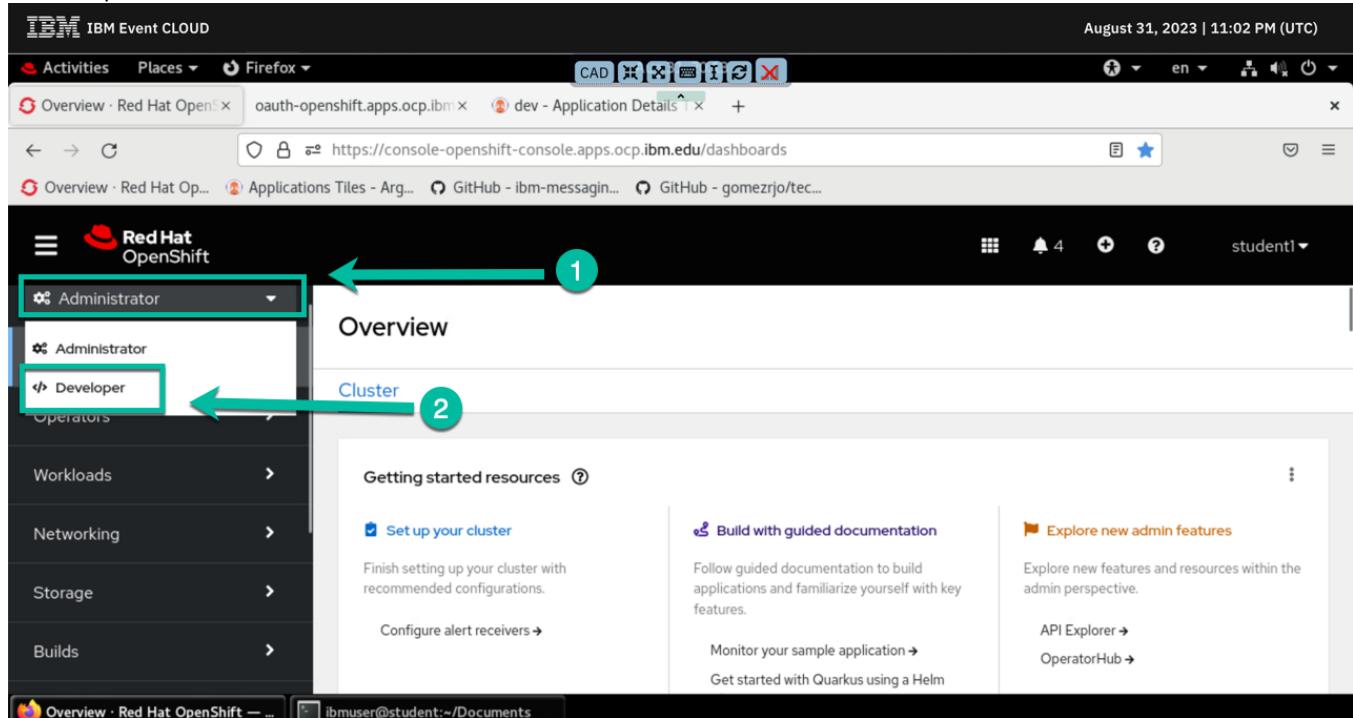
# IBM TechXchange

# IBM TechXchange

## 4 Deploy MQ Application

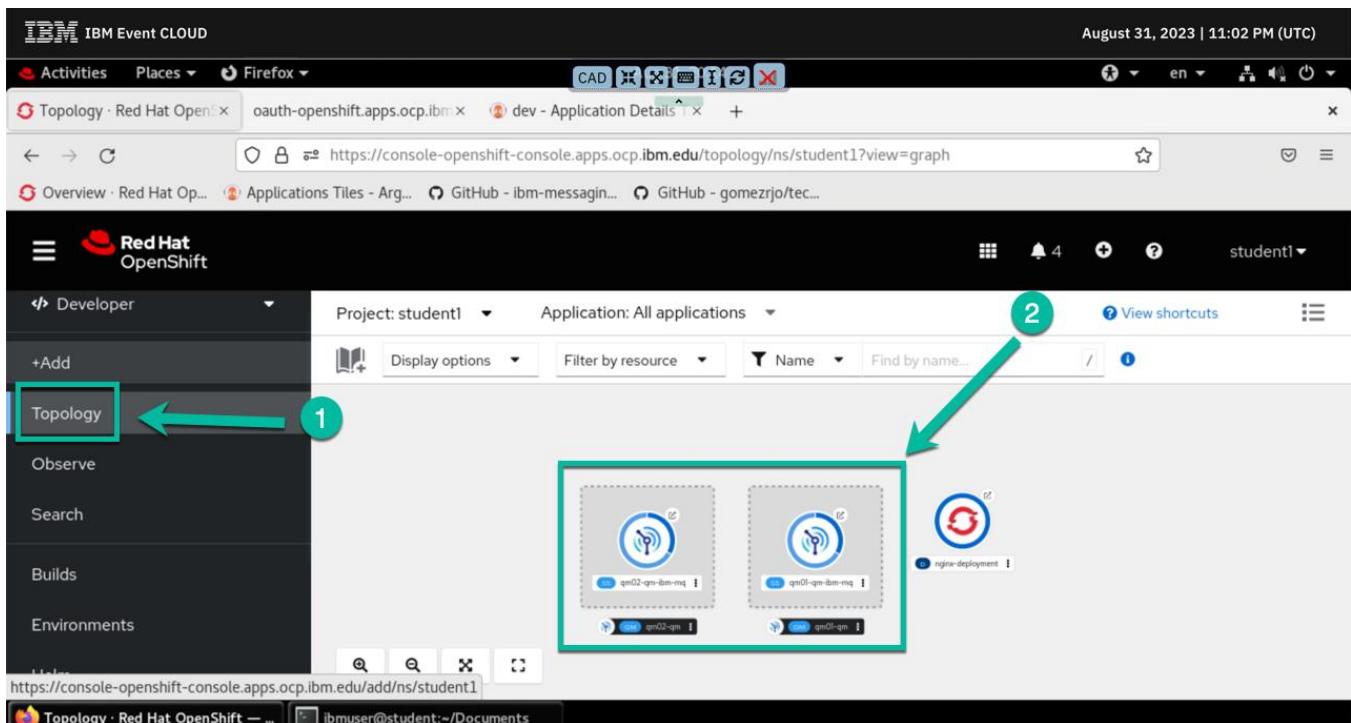
Now that the uniform cluster is running, we can proceed to deploy the application that will be interaction with the queue managers.

First, we will switch to the “Developer” perspective. To do so, click on the “Administrator” option and select “Developer” as shown below.



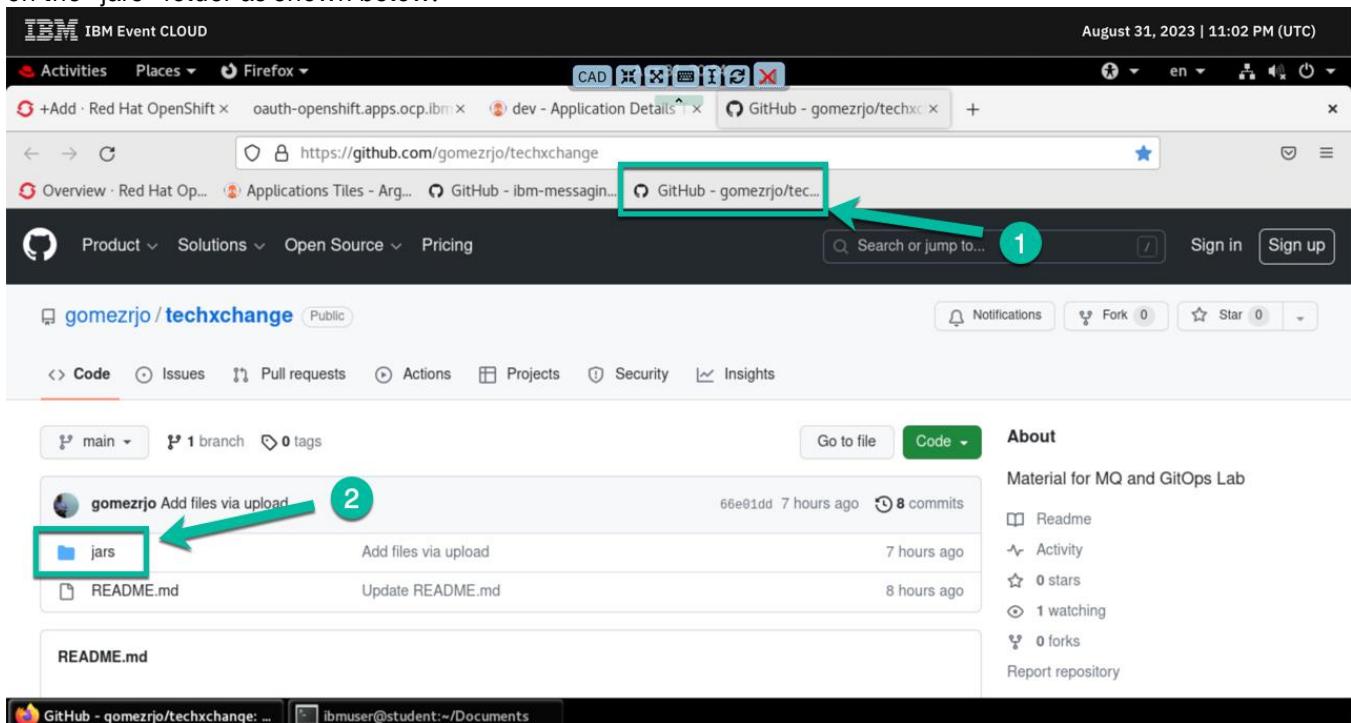
In this perspective you can view the queue managers. Select the topology section and you will see the tiles representing each queue manager.

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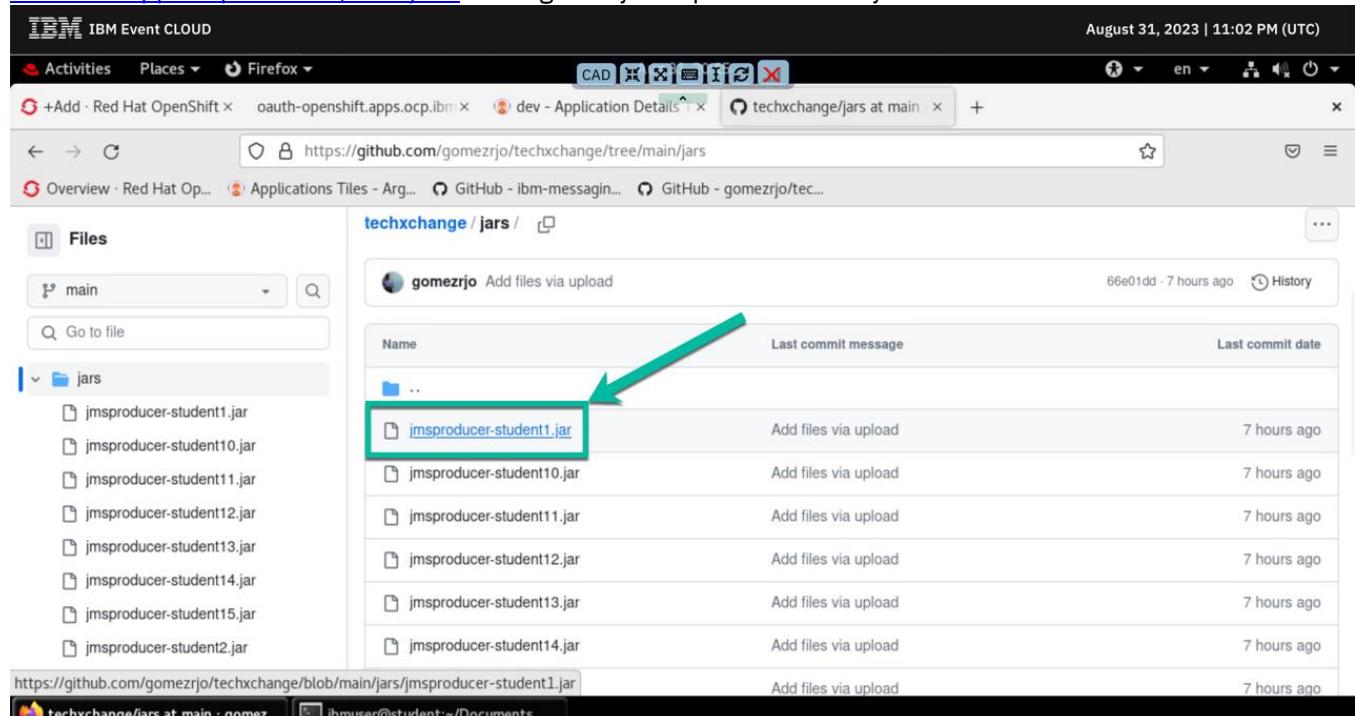
## 4.1 Get jar file

For demo purposes we have created the application for you, and it is available in a public repo. Open a new tab in the browser and use the bookmark “GitHub – gomezrjo/TechXchange” to navigate to the repo and then click on the “jars” folder as shown below.



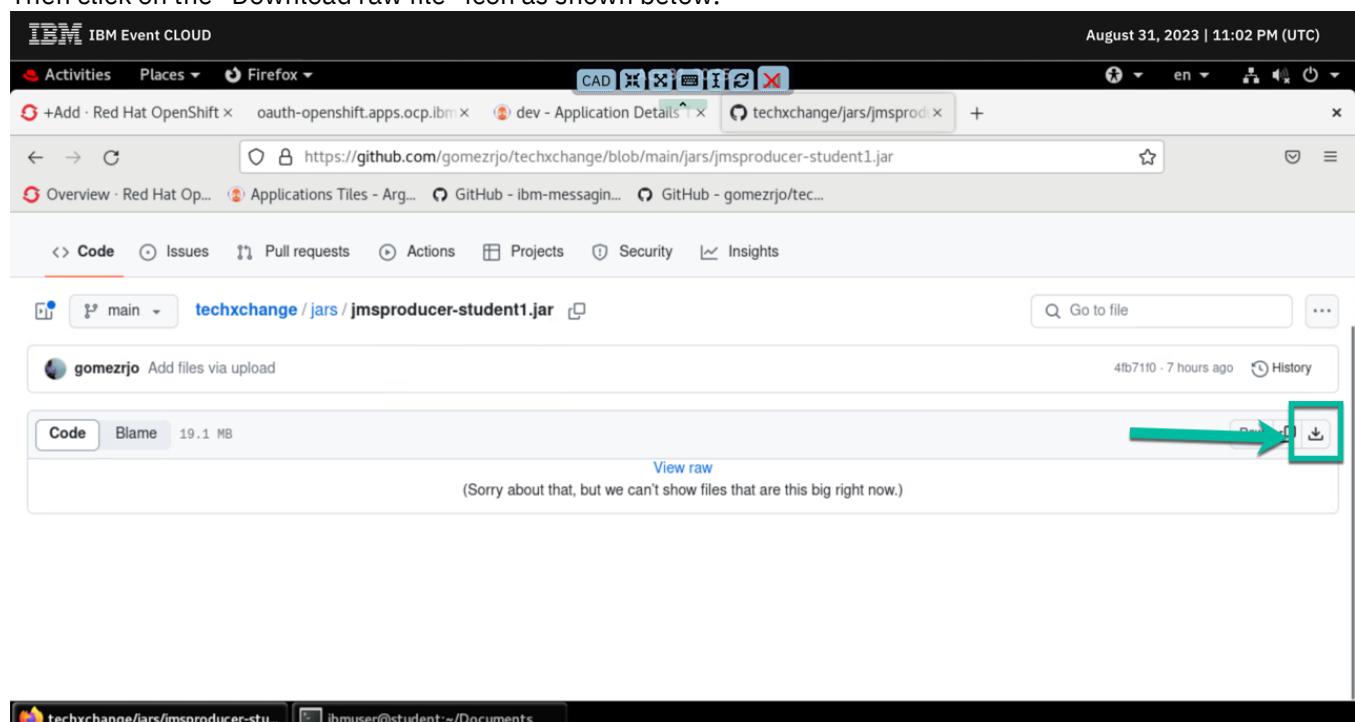
# IBM TechXchange

Click on the jar file associated with your student number. Each jar file is unique because it is using the local nginx located in the same namespace to get the CCDT that includes the information to connect to the Uniform Cluster. If you want to see the content of the CCDT open a new tab and use the following URL: <http://example-studentX.apps.ocp.ibm.edu/ccdt.json> making sure you replace the X for your student number.



The screenshot shows the IBM Event Cloud interface with a browser window displaying a GitHub repository. The left sidebar shows a tree view of files under 'main' and 'jars'. The 'jars' folder contains several 'jmsproducer-studentX.jar' files. One specific file, 'imsproducer-student1.jar', is highlighted with a red box and has a green arrow pointing to it from the top right. The main content area shows a list of commits for this file, with the first commit by 'gomezrjo' being the most recent. The commit message is 'Add files via upload' and it was made 7 hours ago. The URL for the file is <https://github.com/gomezrjo/techxchange/blob/main/jars/jmsproducer-student1.jar>.

Then click on the “Download raw file” icon as shown below.

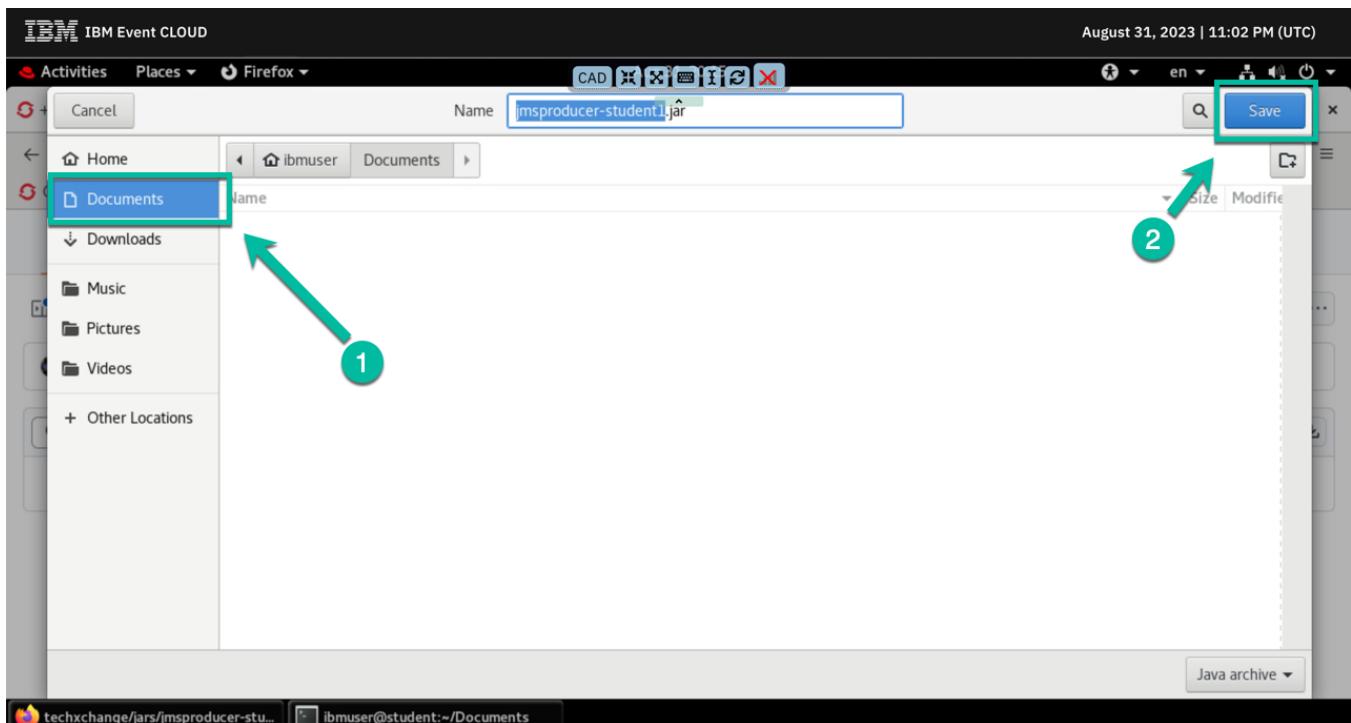


The screenshot shows the IBM Event Cloud interface with a browser window displaying the details of the 'imsproducer-student1.jar' file. The top navigation bar shows the URL <https://github.com/gomezrjo/techxchange/blob/main/jars/jmsproducer-student1.jar>. The main content area shows the file details: 'Code' (19.1 MB), 'Blame', and a note '(Sorry about that, but we can't show files that are this big right now.)'. Below this, there is a 'View raw' link. To the right of the file details, there is a 'Download raw file' icon, which is highlighted with a red box and has a green arrow pointing to it from the top right.

In the new dialog select “Documents” as the destination folder and then click “Save”.

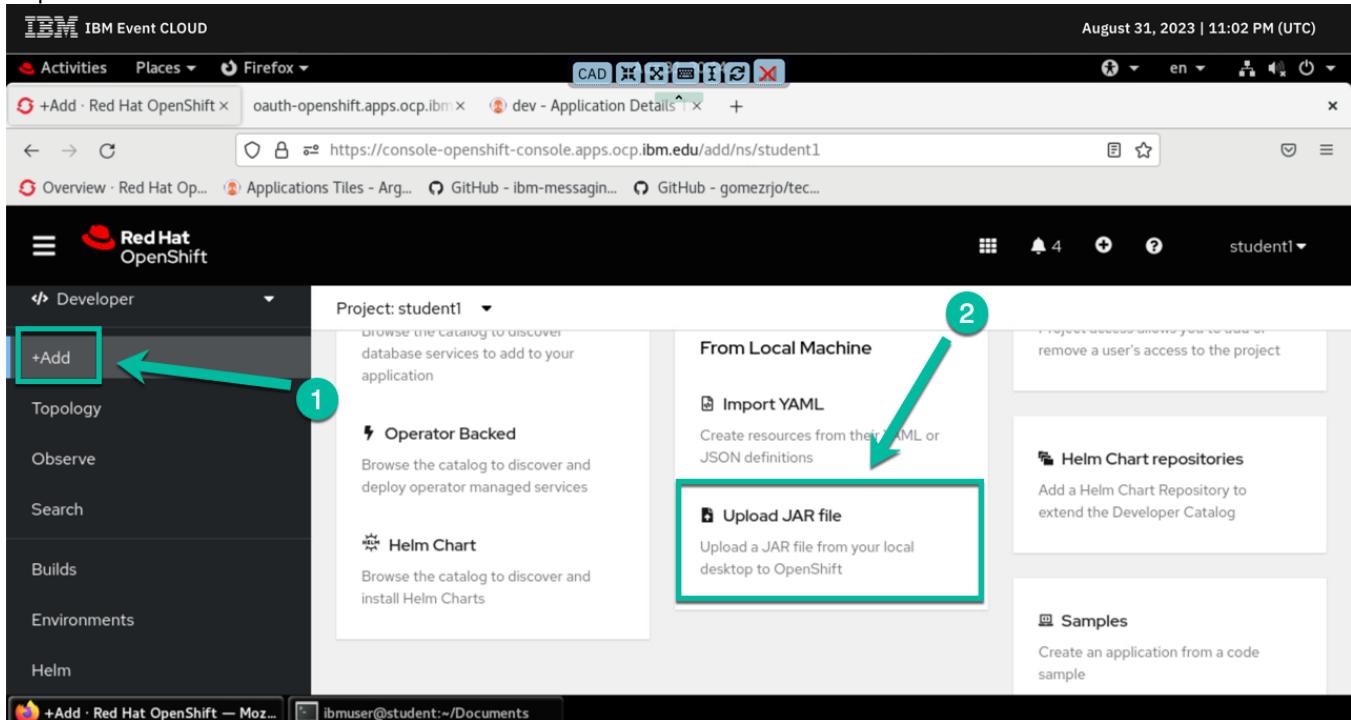
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# IBM TechXchange



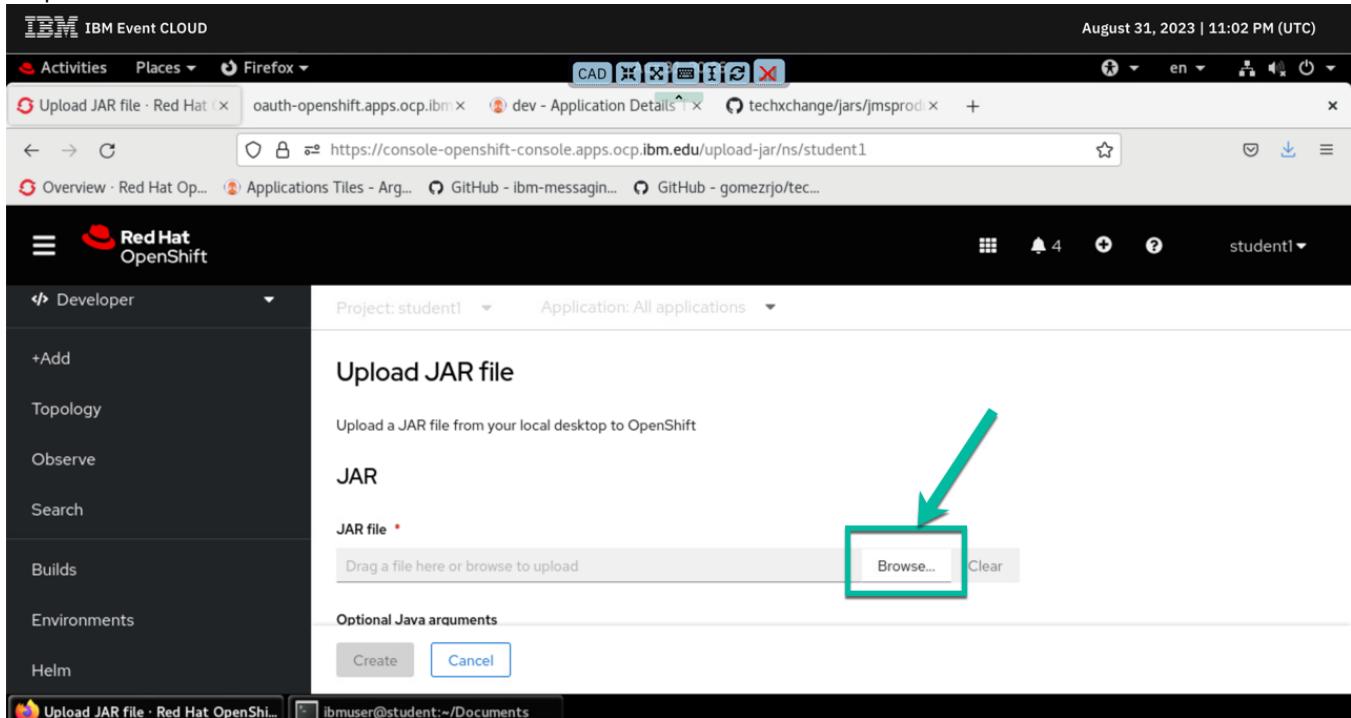
## 4.2 Deploy jar file

Once the jar file is in your local file system navigate to the “+Add” section in the OCP Console and select the “Upload JAR file” tile.



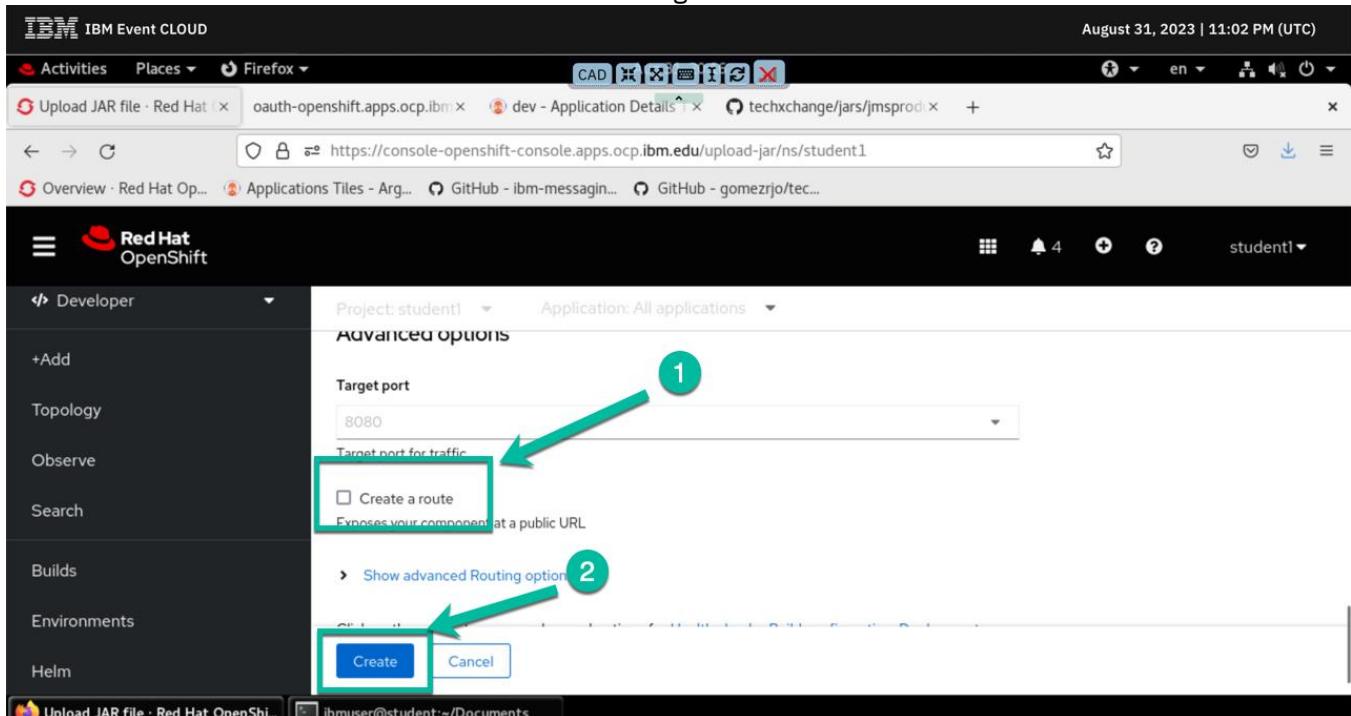
# IBM TechXchange

In the new window select “Browse” and follow the dialogs to select the jar file we downloaded in the previous step.



The screenshot shows the Red Hat OpenShift developer interface. On the left, a sidebar lists 'Developer', '+Add', 'Topology', 'Observe', 'Search', 'Builds', 'Environments', and 'Helm'. The main area is titled 'Upload JAR file' with the sub-instruction 'Upload a JAR file from your local desktop to OpenShift'. It has sections for 'JAR' and 'Optional Java arguments'. A 'JAR file \*' input field contains the placeholder 'Drag a file here or browse to upload', with a 'Browse...' button highlighted by a green box and an arrow. Below this are 'Create' and 'Cancel' buttons. The top navigation bar shows tabs like 'Activities', 'Places', and 'Firefox', and the URL is https://console-openshift-console.apps.ocp.ibm.edu/upload-jar/ns/student1.

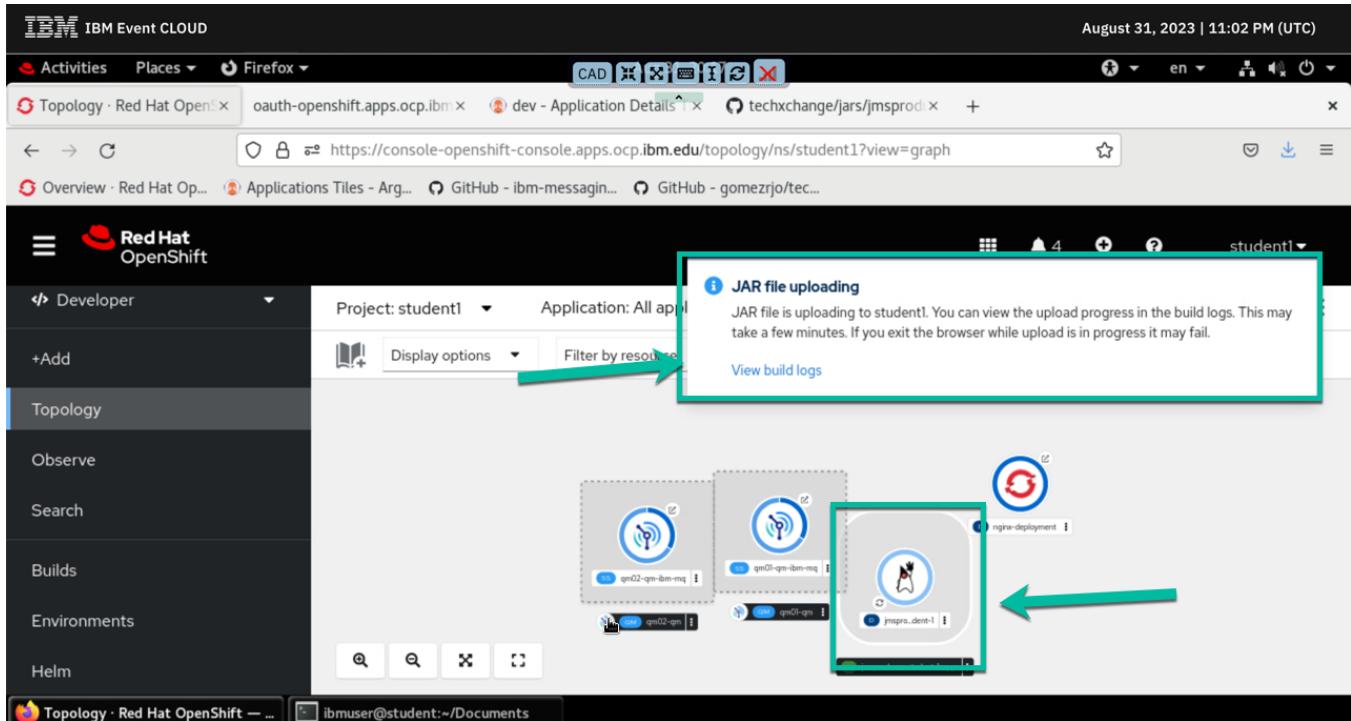
Scroll down and uncheck “Create a route” before clicking the “Create” button as shown below.



This screenshot shows the 'Advanced options' dialog for creating an application. The 'Target port' is set to 8080. A checkbox labeled 'Create a route' is present, with a green arrow pointing to it and a circled '1'. Below the checkbox, a note says 'Exposes your component at a public URL'. At the bottom of the dialog, there are 'Create' and 'Cancel' buttons, with a green arrow pointing to the 'Create' button and a circled '2'.

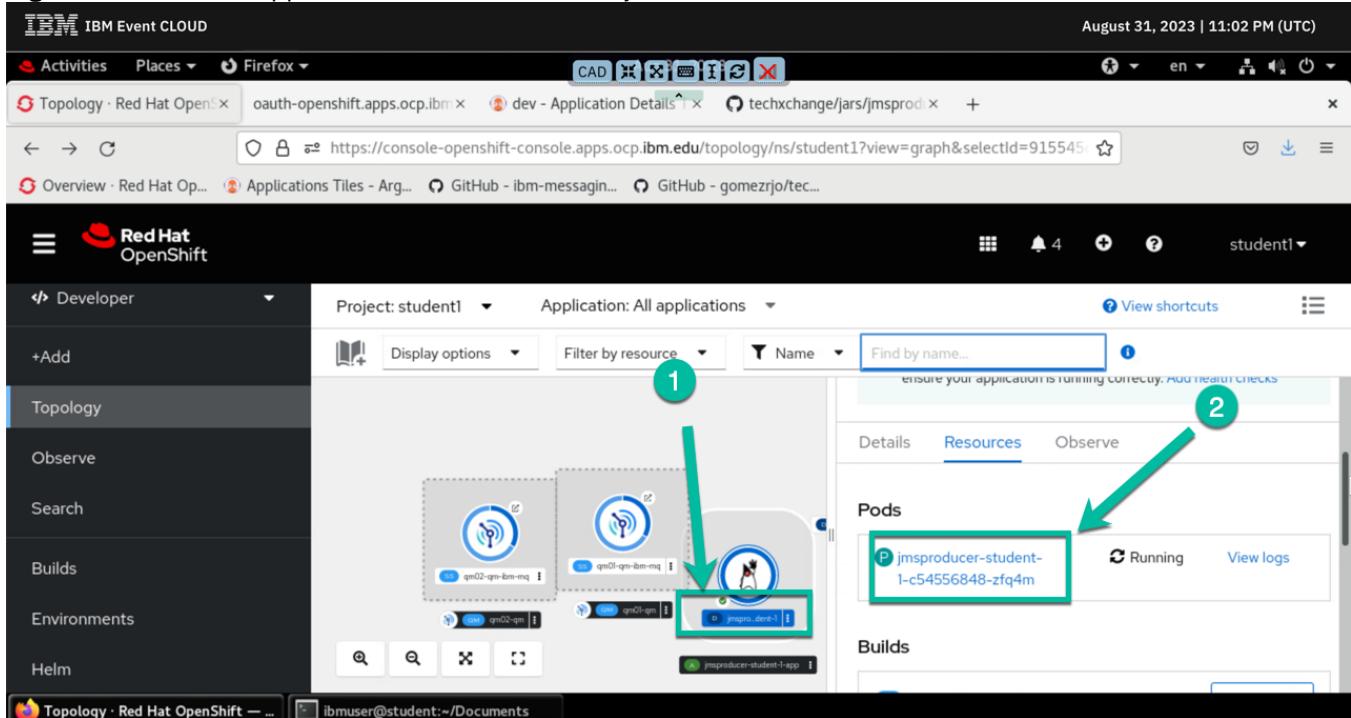
An informative message appears stating the jar file is being uploaded, and a tile representing the deployment is created as well.

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## 4.3 Review deployment

After a few second click on the tile representing the deployment to display the pod and click on it to review the logs and check if the application started successfully.



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In the pod page go to the “Logs” tab and click “expand” to get a full view of the log.

The screenshot shows the IBM Event CLOUD interface. In the top navigation bar, the URL is https://console-openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/pods/jmsproducer-student-1-c54556848-zfa1m. The top right corner shows the date August 31, 2023 | 11:02 PM (UTC). The main area displays the Red Hat OpenShift interface for a pod named 'jmsproducer-student-1-c54556848-zfa1m' which is 'Running'. On the left sidebar, there are several tabs: Developer, Topology, Observe, Search, Builds, Environments, and Helm. The 'Logs' tab is highlighted with a red box and a circled '1'. Below the pod name, there are buttons for Log streaming..., Current log, Wrap lines, Raw, Download, and Expand. The 'Expand' button is also highlighted with a red box and a circled '2'. A large black bar at the bottom contains the pod name 'jmsproducer-student-1-c5455684...' and the user 'ibmuser@student:~/Documents'.

Take your time reviewing the log, and at the bottom you will find a message saying “Sending...” confirming the application was able to connect to a queue manager and it is sending messages.

The screenshot shows the log output for the pod 'jmsproducer-student-1-c54556848-zfa1m'. The log window has a header with 'Log streaming...', 'Current log', and other controls. At the bottom right, there is a 'Collapse' button highlighted with a red box and circled '2'. The log itself shows several lines of configuration parameters, followed by the message 'Starting Producer... creating connection...'. This message is highlighted with a red box and circled '1'. Below it, the message 'Creating session...' is also highlighted with a red box.

```
80  || XMSC_WMQ_SEND_EXIT ::= <null>
81  || XMSC_WMQ_SEND_EXIT_INIT ::= <null>
82  || XMSC_WMQ_SHARE_CONV_ALLOWED ::= 1
83  || XMSC_WMQ_SPARSE_SUBSCRIPTIONS ::= false
84  || XMSC_WMQ_SSL_CERT_STORES_COL ::= <null>
85  || XMSC_WMQ_SSL_CERT_STORES_STR ::= <null>
86  || XMSC_WMQ_SSL_CIPHER_SUITE ::= <null>
87  || XMSC_WMQ_SSL_FIPS_REQUIRED ::= false
88  || XMSC_WMQ_SSL_KEY_RESETCOUNT ::= 0
89  || XMSC_WMQ_SSL_PEER_NAME ::= <null>
90  || XMSC_WMQ_SSL_SOCKET_FACTORY ::= sun.security.ssl.SSLSocketFactoryImpl@3023df74
91  || XMSC_WMQ_STATUS_REFRESH_INTERVAL ::= 60000
92  || XMSC_WMQ_SUBSCRIPTION_STORE ::= 1
93  || XMSC_WMQ_SYNCPOINT_ALL_GETS ::= false
94  || XMSC_WMQ_TARGET_CLIENT_MATCHING ::= true
95  || XMSC_WMQ_TEMPORARY_MODEL ::= SYSTEM.DEFAULT.MODEL.QUEUE
96  || XMSC_WMQ_TEMP_Q_PREFIX ::-
97  || XMSC_WMQ_TEMP_TOPIC_PREFIX ::-
98  || XMSC_WMQ_USE_CONNECTION_POOLING ::= true
99  || brokerVersion ::= -1
100 || failIfQuiesce ::= 1
101 || multicast ::= 0
102 || version ::= 7
103 || wildcardFormat ::= 0
104 Starting Producer... creating connection...
105 Creating session...
106 Sending...
```

# IBM TechXchange

## 5 Validate Uniform Cluster connectivity

Now that the mq application is deployed let's check the behavior with the Uniform Cluster.

### 5.1 Go to Queue Manager 2

Navigate back to the browser window with the Developer Perspective and in the “Topology” section select the tile that represent QM02 and then the pod ending with 0 that by default is the active instance.

The screenshot shows the Red Hat OpenShift Developer Perspective interface. On the left, there is a sidebar with options: 'Developer' (selected), '+Add', 'Topology' (highlighted with a green circle '1'), 'Observe', 'Search', 'Builds', and 'Environments'. The main area is titled 'Topology' and shows a network diagram with several nodes. One node is highlighted with a green border and has a green arrow labeled '1' pointing to it. This node is labeled 'qm02-qm'. To the right, under the heading 'Managed by qm02-qm', there is a table titled 'Pods' with three entries:

Pod	Status	Action
qm02-qm-ibm-mq-2	Running	View logs
qm02-qm-ibm-mq-1	Running	View logs
qm02-qm-ibm-mq-0	Running	View logs

A green arrow labeled '2' points from the 'qm02-qm' node icon to the 'qm02-qm-ibm-mq-0' pod entry in the 'Pods' list.

This will take you to the pod view.

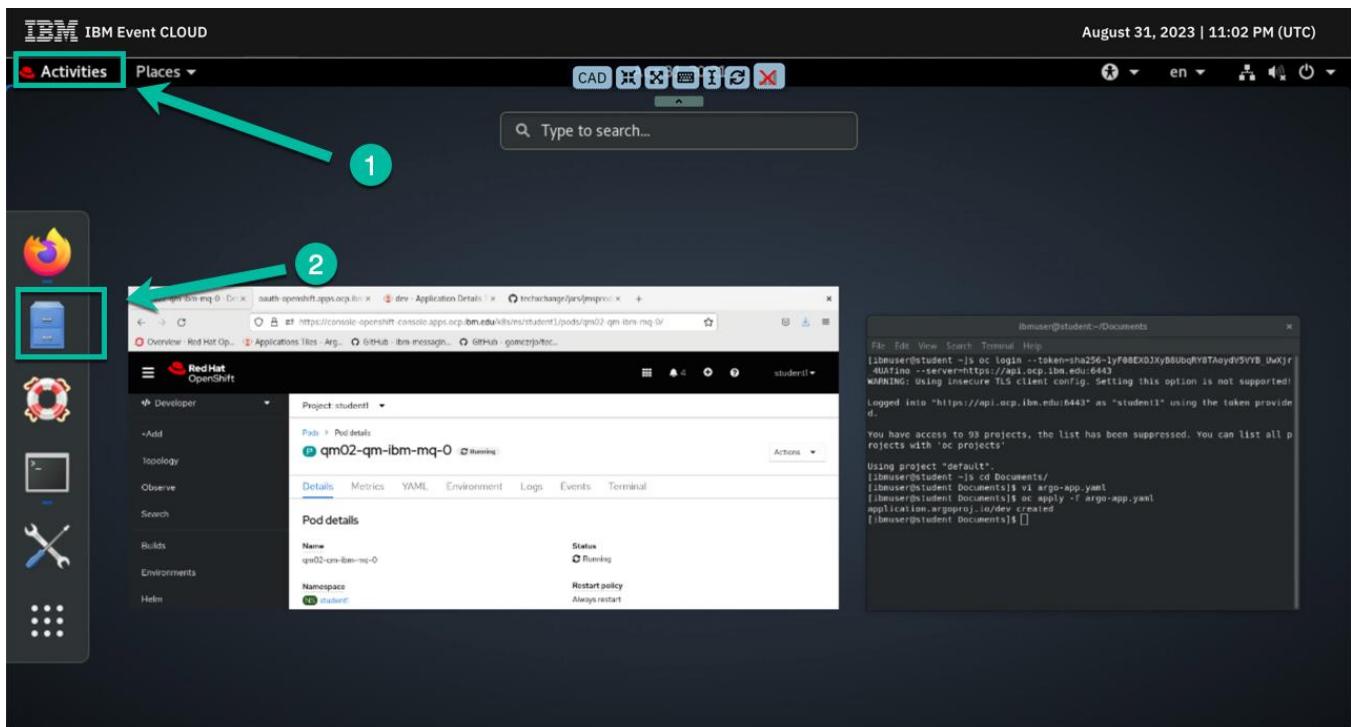
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The screenshot shows the IBM Event CLOUD interface with the Red Hat OpenShift pod details for qm02-qm-ibm-mq-0. The pod is listed as 'Running'. The 'Details' tab is selected, showing the pod's name, status, namespace, and restart policy. The URL https://console-openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/pods/qm02-qm-ibm-mq-0/terminal is visible at the bottom of the page.

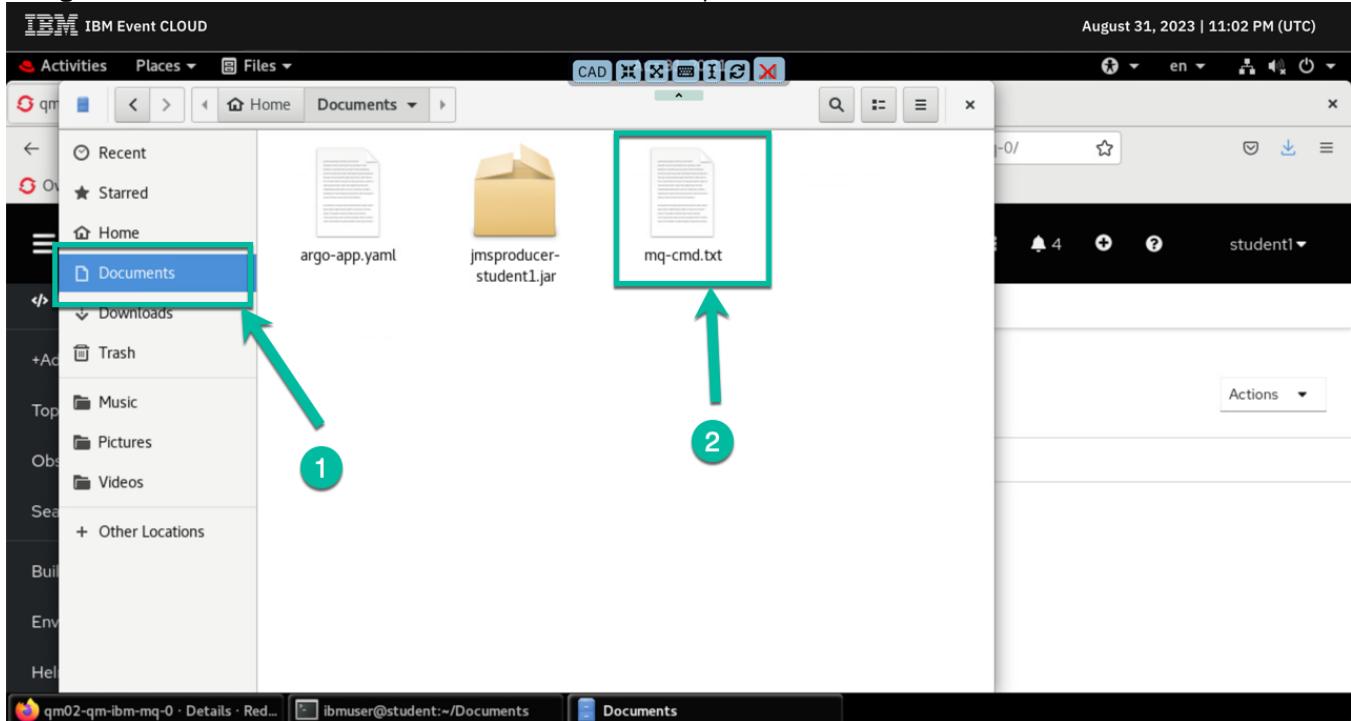
## 5.2 Review connections to QM02

In order to check the connection status we will use the command “display connections” and we will filter by the MQ App named that is “MY-PRODUCER”. We will execute the command directly from the terminal in each MQ pod. The exact command we will use is the following: “echo 'dis conn(\*)' all | runmqsc | grep -i my”. The command is not complex, but to minimize typo issues we have provided a text file with the command inside the workstation in case you want to copy and paste the command. To do so, click on the “Activities” menu and then the “Files” icon as shown below.

# IBM TechXchange

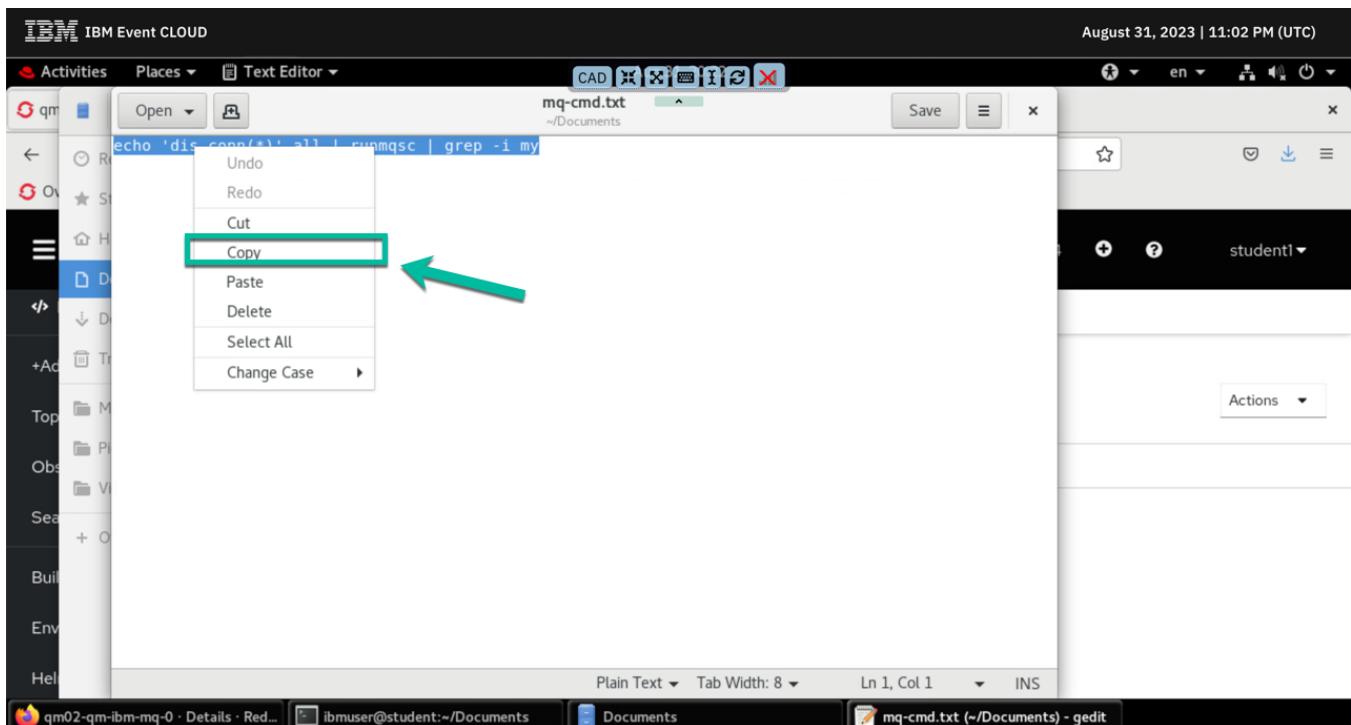


Navigate to the “Documents” folder and select the file “mq-cmd.txt” file.

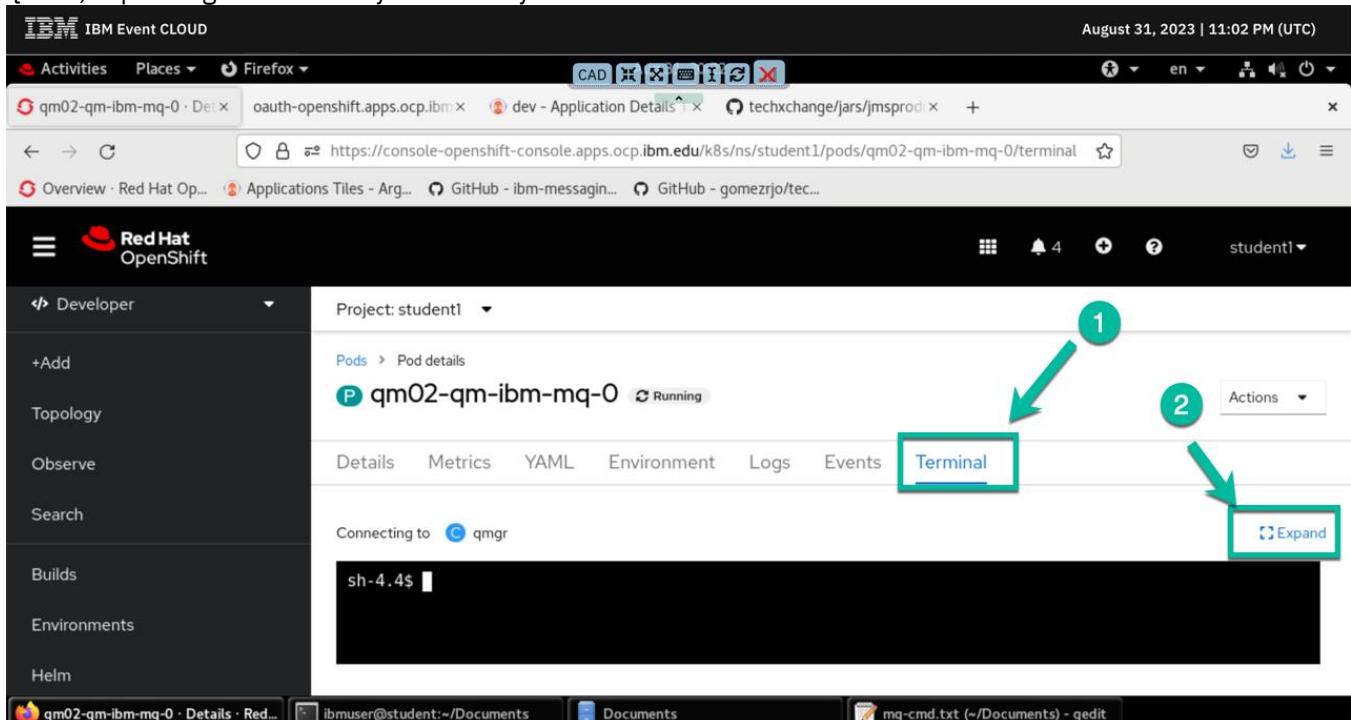


Select the content and copy it to the clipboard. Use the context menu for better results as shown below.

# IBM TechXchange

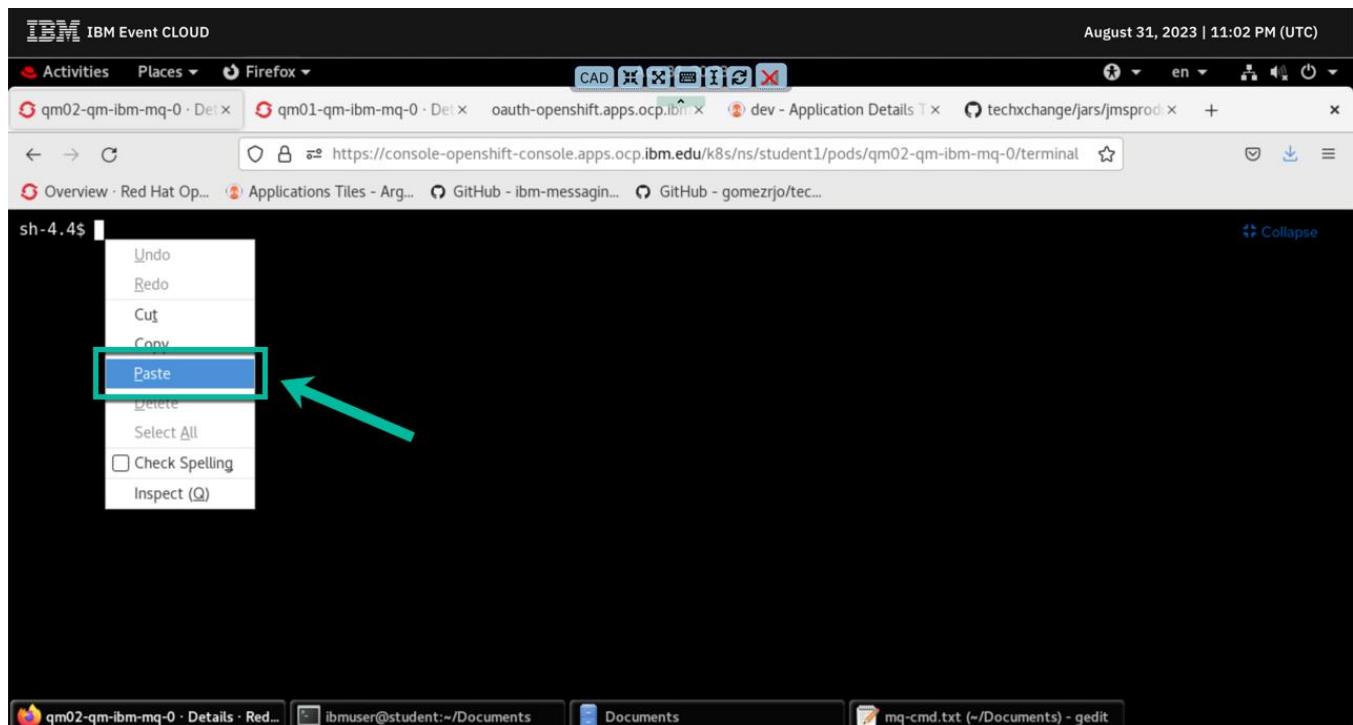


Now that we have the command, go back to the OCP console and navigate to the terminal of the active pod in QM02, expanding it if necessary to have any real state to work.

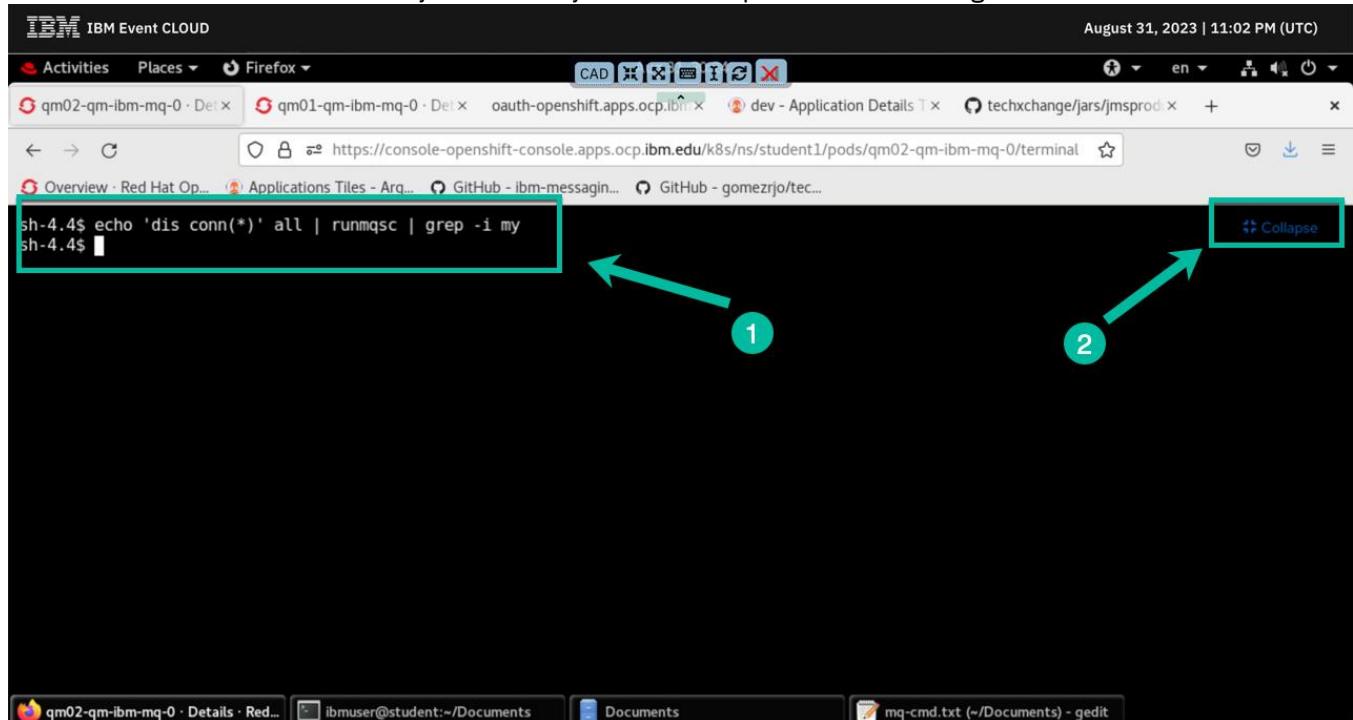


Paste the command into the terminal using the context menu.

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Hit <enter> to check how many active connections associated with our application are in this queue manager. Most likely you will have none as shown below, but in the next step we will get a better picture on how the connections are distributed. Once you are over you can “Collapse” the terminal again.



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## 5.3 Go to Queue Manager 1

Right click the “Topology” menu and select “Open Link in New Tab” to keep a window open for each queue manager since you may need to go back and forth.

The screenshot shows the IBM Event CLOUD interface. On the left, there is a sidebar with various options: Developer (+Add), Topology (highlighted with a red box and circled with a green arrow labeled 1), Observe, Search, Builds, Environments, and Inspect (Q). Below the sidebar, the URL is https://console.openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/pods/qm02-qm-ibm-mq-0/terminal. The main content area shows a pod named "qm02-qm-ibm-mq-0" which is "Running". It has tabs for Details, Metrics, YAML, Environment, Logs, Events, and Terminal (which is currently selected). A context menu is open over the "Topology" option in the sidebar, with the "Open Link in New Tab" option highlighted with a red box and circled with a green arrow labeled 2. Other options in the context menu include Open Link in New Window, Open Link in New Private Window, Bookmark Link, Save Link As..., Save Link to Pocket, Copy Link, and Search Google for "Topology". The status bar at the bottom shows mq-cmd.txt (~/Documents) - edit.

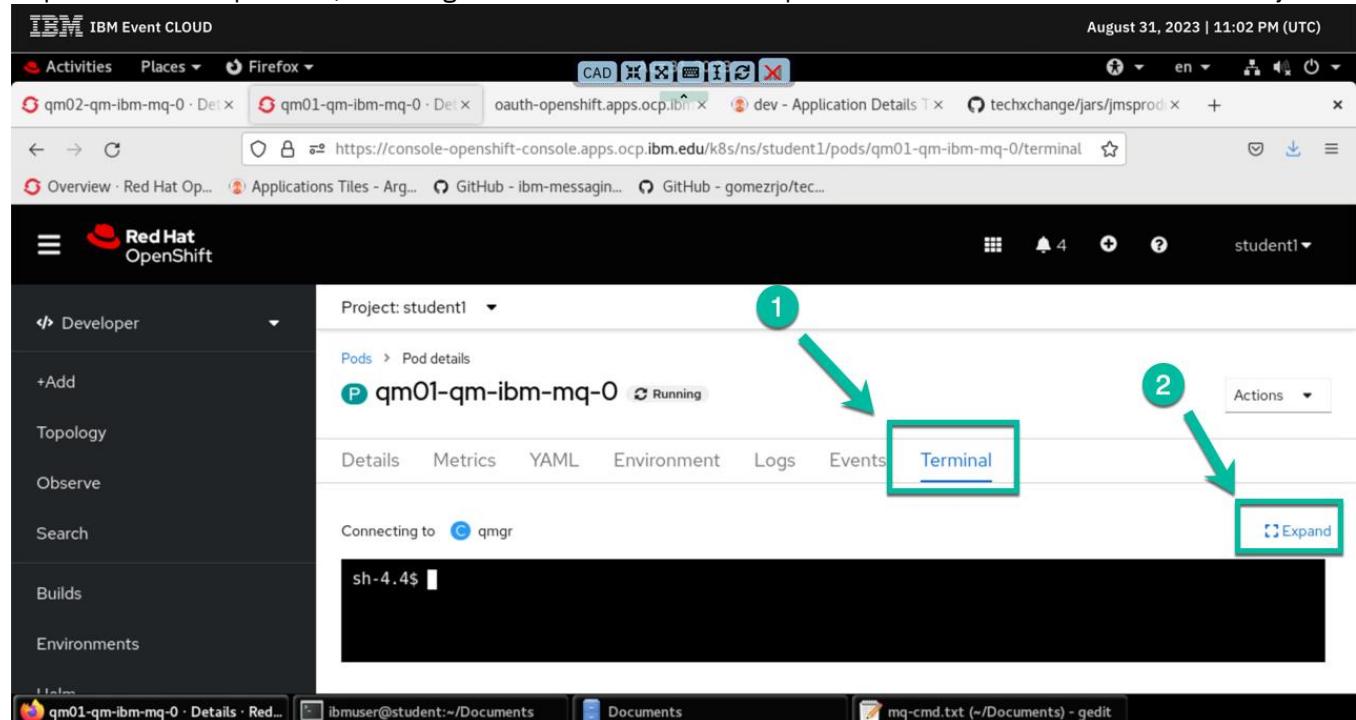
In the new window repeat the same procedure as before to select the active pod QM01.

The screenshot shows the IBM Event CLOUD interface with the "Topology" view selected. The sidebar remains the same. The main content area displays a topology graph with three nodes: "qm02-qm-ibm-mq" (highlighted with a red box and circled with a green arrow labeled 1), "qm01-qm-ibm-mq-2" (highlighted with a red box and circled with a green arrow labeled 2), and "qm01-qm-ibm-mq-0" (highlighted with a red box and circled with a green arrow labeled 2). To the right of the graph, there is a "Pods" section listing the three pods with their status (Running) and "View logs" link. Below the graph, there is a "Services" section listing a service named "qm01-qm-ibm-mq". The status bar at the bottom shows mq-cmd.txt (~/Documents) - edit.

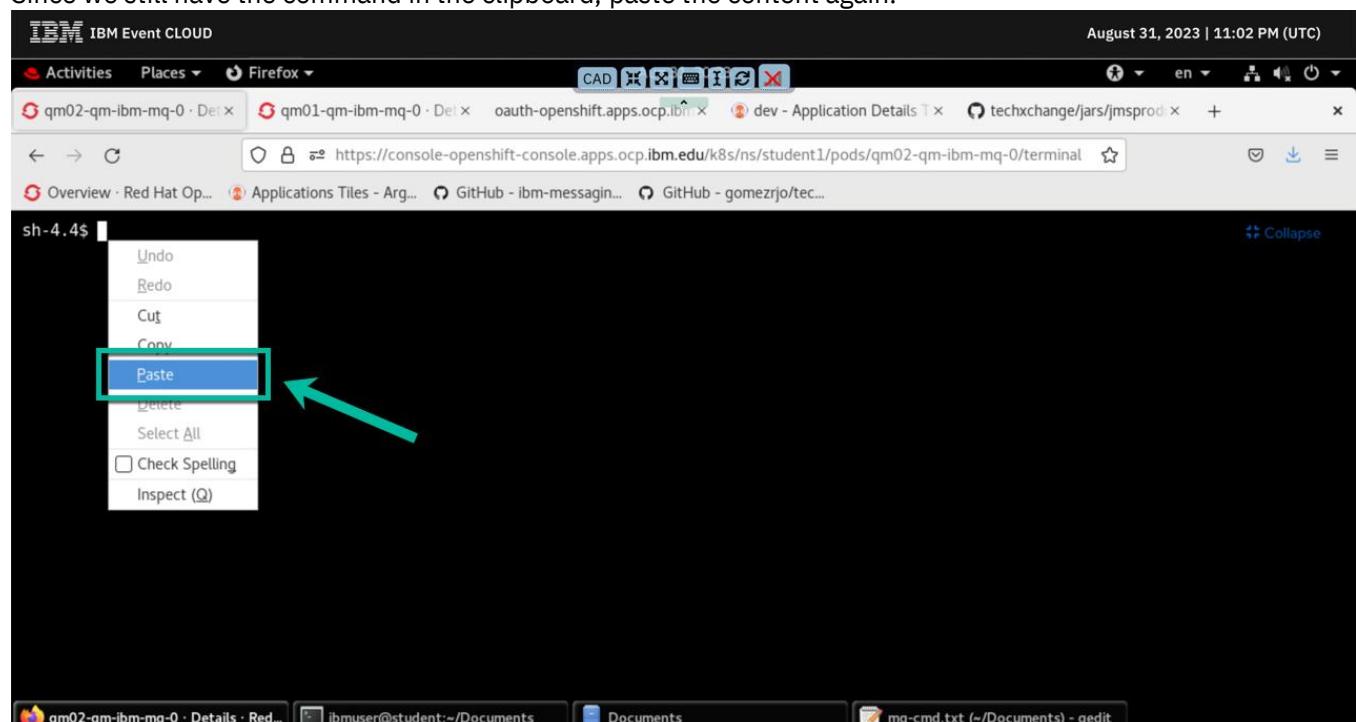
# IBM TechXchange

## 5.4 Review Connections to QM01

Repeat the same operation, selecting the “Terminal” tab and “Expand” the terminal to have better visibility.



Since we still have the command in the clipboard, paste the content again.



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This time you should see a couple of active connections, probing that the application we deployed is connected to the cluster. In your case the result could potentially be the opposite since we have no affinity defined and the application will connect to any queue manager, but since we only have one instance there will only be a connection to one queue manager at a time.

```
dis conn(*) all | runmqsc | grep -i my  
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)  
CONNTAG(MQCTA32BF16402360040DQM02_2023-09-01_00.09.00MY-PRODUCER)  
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)  
CONNTAG(MQCTA32BF16402360040DQM02_2023-09-01_00.09.00MY-PRODUCER)
```

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## 6 Scale MQ Application

At the moment our application is running in a single pod and therefore it is only connect to one of the queue managers, but what if the workload increases and I need to scale my app. Let's simulate the scenario and see how the connections are distributed.

### 6.1 Increase the number of instances (aka pods)

Navigate to the application deployment selecting the “Deployments” menu in the “Workloads” section and then clicking on the actual deployment.

The screenshot shows the IBM Event CLOUD interface with the URL <https://console-openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/apps~v1~Deployment>. The browser tabs include qm02-qm-lbm-mq-0, Deployments - Red H..., oauth-openshift.apps.ocp..., dev - Application Det..., and techxchange/jars/jms|. The page title is "Red Hat OpenShift". The left sidebar under "Workloads" has "Pods" and "Deployments" selected, with "Deployments" highlighted. The main content area is titled "Deployments" and shows a table with one row for "jmsproducer-student-1". The table columns are Name, Status, Labels, and Pod selector. The "Name" column shows "jmsproducer-student-1", the "Status" column shows "1 of 1 pods", and the "Labels" and "Pod selector" columns show "app=jmsproducer-student-1". A green arrow labeled "1" points from the "Deployments" link in the sidebar to the "jmsproducer-student-1" row in the table. Another green arrow labeled "2" points from the "jmsproducer-student-1" row in the table to the "Status" column. The bottom status bar shows "ibmuser@student:~/Documents" and "mq-cmd.txt (~/Documents) - eedit".

In the deployment details you will see there is only one pod. Click on the arrow up icon to increase the number of instances to two.

# IBM TechXchange

IBM Event CLOUD August 31, 2023 | 11:02 PM (UTC)

Activities Places Firefox CAD X X X X X X

qm02-qm-ibm-mq-0 x jmsproducer-student x qm01-qm-ibm-mq-0 x oauth-openshift.apps.oc x dev - Application Det x techxchange/jars/jms x + x

Overview · Red Hat Op... Applications Tiles - Arg... GitHub - ibm-messagin... GitHub - gomezrjo/tec...

Red Hat OpenShift student1

Administrator Home Operators Workloads Deployments DeploymentConfigs StatefulSets

Project: student1 Deployments > Deployment details jmsproducer-student-1

Actions Details Metrics YAML ReplicaSets Pods Environment Events

Deployment details

1 Pod

jmsproducer-student-1 - Details ibmuser@student:~/Documents Documents mq-cmd.txt (~/Documents) - gedit

After a moment you will see the number of pods is updated to two.

IBM Event CLOUD August 31, 2023 | 11:02 PM (UTC)

Activities Places Firefox CAD X X X X X X

qm02-qm-ibm-mq-0 x jmsproducer-student x qm01-qm-ibm-mq-0 x oauth-openshift.apps.oc x dev - Application Det x techxchange/jars/jms x + x

Overview · Red Hat Op... Applications Tiles - Arg... GitHub - ibm-messagin... GitHub - gomezrjo/tec...

Red Hat OpenShift student1

Administrator Home Operators Workloads Deployments DeploymentConfigs StatefulSets

Project: student1 Deployments > Deployment details jmsproducer-student-1

Actions Details Metrics YAML ReplicaSets Pods Environment Events

Deployment details

2 Pods

jmsproducer-student-1 - Details ibmuser@student:~/Documents Documents mq-cmd.txt (~/Documents) - gedit

## 6.2 Review connectivity

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Repeat the steps outlined in the previous section to check how many connections you have per queue manager. This time you should see that each queue manager has a couple of connections.

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## 7 Rebalance connections

We observed how each instance will connect to a different queue manager trying to keep a homogenous distribution, but what would happen if one of the queue managers goes down? Let's find out.

Navigate to the MQ Operator again to check the status of our queue managers.

The screenshot shows the IBM Event CLOUD interface in a Firefox browser window. The URL is https://console-openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/operators.coreos.com~v1alpha1~CloudEventProcessor. The page title is "IBM Event CLOUD". The top right shows the date August 31, 2023 | 11:02 PM (UTC) and user information. The left sidebar has a "Red Hat OpenShift" logo and navigation links: Administrator, Home, Operators (selected), OperatorHub, Installed Operators (highlighted with a red box), Workloads, Pods, Deployments. The main content area shows a table of installed operators:

Name	Managed Namespaces	Status	Provided APIs
IBM Cloud Pak foundational services	All Namespaces	Succeeded Up to date	CommonService
IBM MQ	All Namespaces	Succeeded Up to date	Queue Manager
cert-manager Operator for Red Hat OpenShift	All Namespaces	Succeeded Up to date	CertificateRequest Certificate Challenge ClusterIssuer

Annotations with green arrows and numbers point to specific elements: 1 points to the "Project: student1" dropdown; 2 points to the "Operators" link in the sidebar; 3 points to the "IBM MQ" operator row.

### 7.1 Delete Queue Manager

We could kill one of the active pods for any of the queue managers, but since we have configured Native HA, one of the standby instances will take over and at the end each queue manager will keep a couple of connections, so in this case we will go ahead and fully delete the queue manager. This will also help to close the loop on GitOps.

Click on the hamburger menu for QM02 and select “Delete Queue Manager”.

# IBM TechXchange

IBM Event CLOUD August 31, 2023 | 11:02 PM (UTC)

Activities Places Firefox CAD X X X X X X

qm02-qm-ibm-mq-0 ibm-mq.v2.3.3 - Details oauth-openshift.apps.oc dev - Application Det techxchange/jars/jms

Overview · Red Hat Op... Applications Tiles - Arg... GitHub - ibm-messagin... GitHub - gomezrjo/tec...

Red Hat OpenShift student1

Administrator Home Operators Workloads Pods Deployments

Project: student1

Details YAML Subscription Events Queue Manager

QueueManagers Show operands in: All namespaces Current namespace only

Create QueueManager

Name	Kind	Namespace	Status
QM qm01-qm	QueueManager	NS student1	Phase: Running
QM qm02-qm	QueueManager	NS student1	Phase: Running

1 2 3

ibm-mq.v2.3.3 - Details - Red Hat ... ibmuser@student:~/Documents Documents mq-cmd.txt (~/Documents) - edit

Click the “Delete” button on the warning pop up window to confirm you want to delete the queue manager.

IBM Event CLOUD August 31, 2023 | 11:02 PM (UTC)

Activities Places Firefox CAD X X X X X X

qm02-qm-ibm-mq-0 ibm-mq.v2.3.3 - Details oauth-openshift.apps.oc dev - Application Det techxchange/jars/jms

Overview · Red Hat Op... Applications Tiles - Arg... GitHub - ibm-messagin... GitHub - gomezrjo/tec...

Red Hat OpenShift student1

Administrator Home Operators Workloads Pods Deployments

Project: student1

Details YAML Subscription Events Queue Manager

QueueManagers Show operands in: All namespaces Current namespace only

Create QueueManager

⚠ Delete QueueManager?

Are you sure you want to delete qm02-qm in namespace student1?

Cancel Delete

Name	Kind	Namespace	Status	Labels
QM qm01-qm	QueueManager	NS student1	Phase: Running	app.kubernetes.io/in...=d...
QM qm02-qm	QueueManager	NS student1	Phase: Running	app.kubernetes.io/in...=d...

ibm-mq.v2.3.3 - Details - Red Hat ... ibmuser@student:~/Documents Documents mq-cmd.txt (~/Documents) - edit

# IBM TechXchange

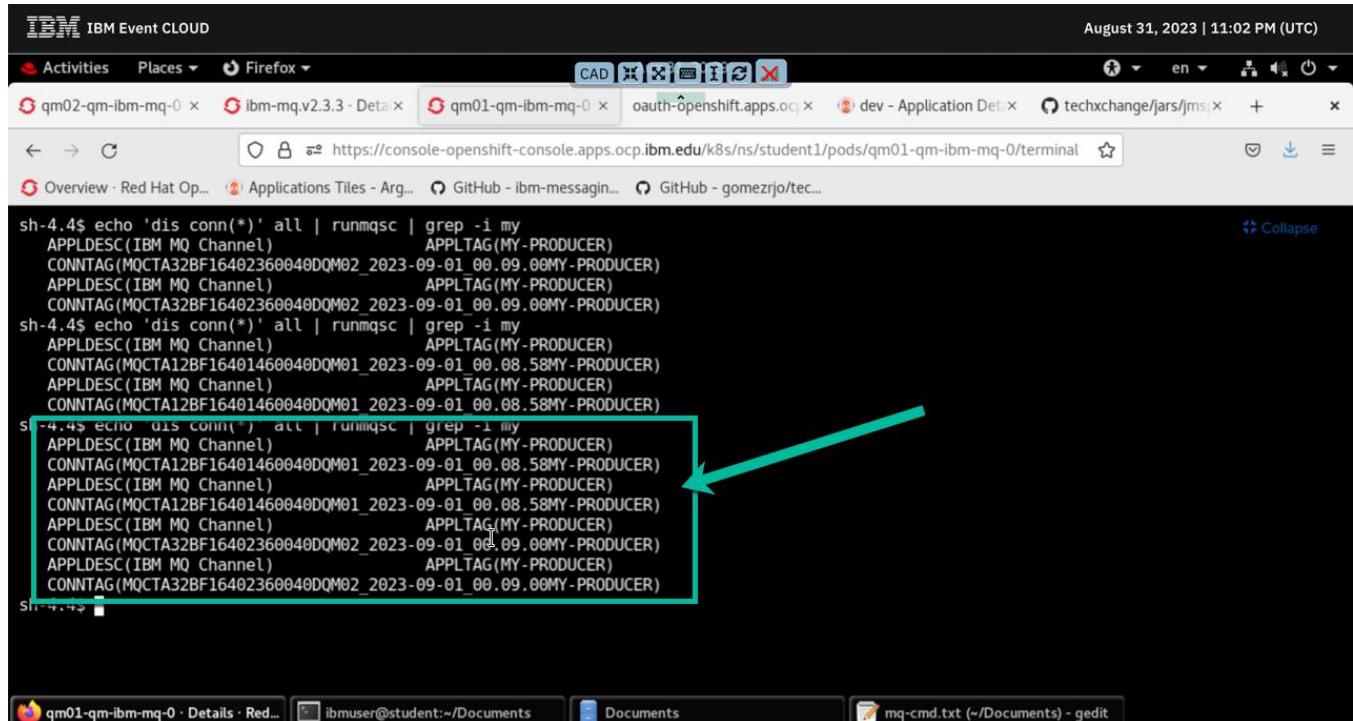
## 7.2 Review connectivity

If you try to navigate back to the active pod for queue manager 2 you will get a similar error as the one shown below since the queue manager and therefore its pods have been deleted already.

The screenshot shows the IBM Event CLOUD interface with a Red Hat OpenShift pod details page. The pod name is qm02-qm-ibm-mq-0, and it is marked as 'Terminating'. The 'Terminal' tab is selected, showing a terminal session. An error message is displayed: 'The terminal connection has closed.' with a 'Reconnect' button. Below the message, the terminal output shows: 'sh-4.4\$ command terminated with non-zero exit code: exit status 137'. The browser address bar at the top shows the URL <https://console-openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/pods/qm02-qm-ibm-mq-0/terminal>.

However, if you navigate to the active pod for queue manager one and submit the command to check the number of active connection you will see all the connections are directed to the active queue manager assuring the client application can continue sending messages.

# IBM TechXchange



IBM Event CLOUD August 31, 2023 | 11:02 PM (UTC)

Activities Places Firefox CAD X X X X X X X

qm02-qm-ibm-mq-0 ibm-mq.v2.3.3 - Data qm01-qm-ibm-mq-0 oauth-openshift.apps.oc dev - Application Det techxchange/jars/jms + x

Overview · Red Hat Op... Applications Tiles - Arg... GitHub - ibm-messagin... GitHub - gomezrjo/tec...

```
sh-4.4$ echo 'dis conn(*)' all | runmqsc | grep -i my
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA32BF16402360040DQM02_2023-09-01_00.09.00MY-PRODUCER)
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA32BF16402360040DQM02_2023-09-01_00.09.00MY-PRODUCER)
sh-4.4$ echo 'dis conn(*)' all | runmqsc | grep -i my
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA12BF16401460040DQM01_2023-09-01_00.08.58MY-PRODUCER)
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA12BF16401460040DQM01_2023-09-01_00.08.58MY-PRODUCER)
sh-4.4$ echo 'dis conn(*)' all | runmqsc | grep -i my
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA12BF16401460040DQM01_2023-09-01_00.08.58MY-PRODUCER)
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA12BF16401460040DQM01_2023-09-01_00.08.58MY-PRODUCER)
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA32BF16402360040DQM02_2023-09-01_00.09.00MY-PRODUCER)
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA32BF16402360040DQM02_2023-09-01_00.09.00MY-PRODUCER)
```

qm01-qm-ibm-mq-0 · Details · Red... ibmuser@student:~/Documents Documents mq-cmd.txt (~/Documents) - gedit

# IBM TechXchange

## 8 Review ArgoCD declarative model

One of the advantages of ArgoCD is its declarative model making sure the environment matches the desired state. When we deployed our ArgoCD application we established that the desired estate was to have two queue managers as part of the uniform cluster, but in the previous step we deleted one of the queue managers, so let's review what happens in this situation.

### 8.1 Review ArgoCd

Navigate to the ArgoCD web ui and check that status of the application. You will see that it is reported as out of sync because the current state (one queue manager) does not match the desired state (two queue managers).

The screenshot shows the IBM Event CLOUD Application Details Tree interface. The main area displays the 'APPLICATION DETAILS TREE' for the 'dev' application. In the center, there is a summary card for the 'qm01-qm-lbm-mq' component. The 'CURRENT SYNC STATUS' is highlighted with a green border and shows 'OutOfSync'. Below this, the 'LAST SYNC RESULT' is shown as 'Sync OK' with a green checkmark. The interface includes various tabs like APP DETAILS, APP DIFF, SYNC, SYNC STATUS, HISTORY AND ROLLBACK, DELETE, and REFRESH. On the left, there is a sidebar with icons for Applications, Places, and Firefox. At the bottom, there are several open tabs including 'dev - Application Det...', 'techxchange/jars/jms...', and 'mq-cmd.txt (~/Documents) - eedit'. The browser address bar shows the URL: https://openshift-gitops-server-openshift-gitops.apps.ocp.ibm.edu/applications/dev?view=tree&resource=qm01-qm-lbm-mq-0.

### 8.2 Synchronize GitOps App

If you look at the application, you will see that QM2 is the one showing out of sync. As mentioned before we have selected a manual approach for learning purposes so you can have time to review the status of the different components, otherwise the queue manager and all its components would be recreated automatically. To take the deployment to the desired state click the “Sync” button.

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The screenshot shows the IBM Event CLOUD interface for an application named "dev". The "SYNC" button is highlighted with a green box and a large green arrow pointing to it from below. The status bar indicates "OutOfSync". The "LAST SYNC RESULT" shows "Sync OK" with a green checkmark. The "APPLICATION DETAILS TREE" pane on the right shows various components like "qm02-qm-queuemanager", "qm02-qm-replica-1", and "qm02-qm-replica-2".

Accept the default values and click “Synchronize”.

The screenshot shows the "SYNC" button highlighted with a green box and a large green arrow pointing to it from below. A message at the bottom says "Synchronizing application manifest from https://github.com/ibm-messaging/mq-gitops-samples". Below the button are several sync options: PRUNE, DRY RUN, APPLY ONLY, FORCE, SKIP SCHEMA VALIDATION, PRUNE LAST, RESPECT IGNORE DIFFERENCES, AUTO-CREATE NAMESPACE, and APPLY OUT OF SYNC ONLY. The "Revision" field is set to "main".

After a few second the status will change back to “Synced”

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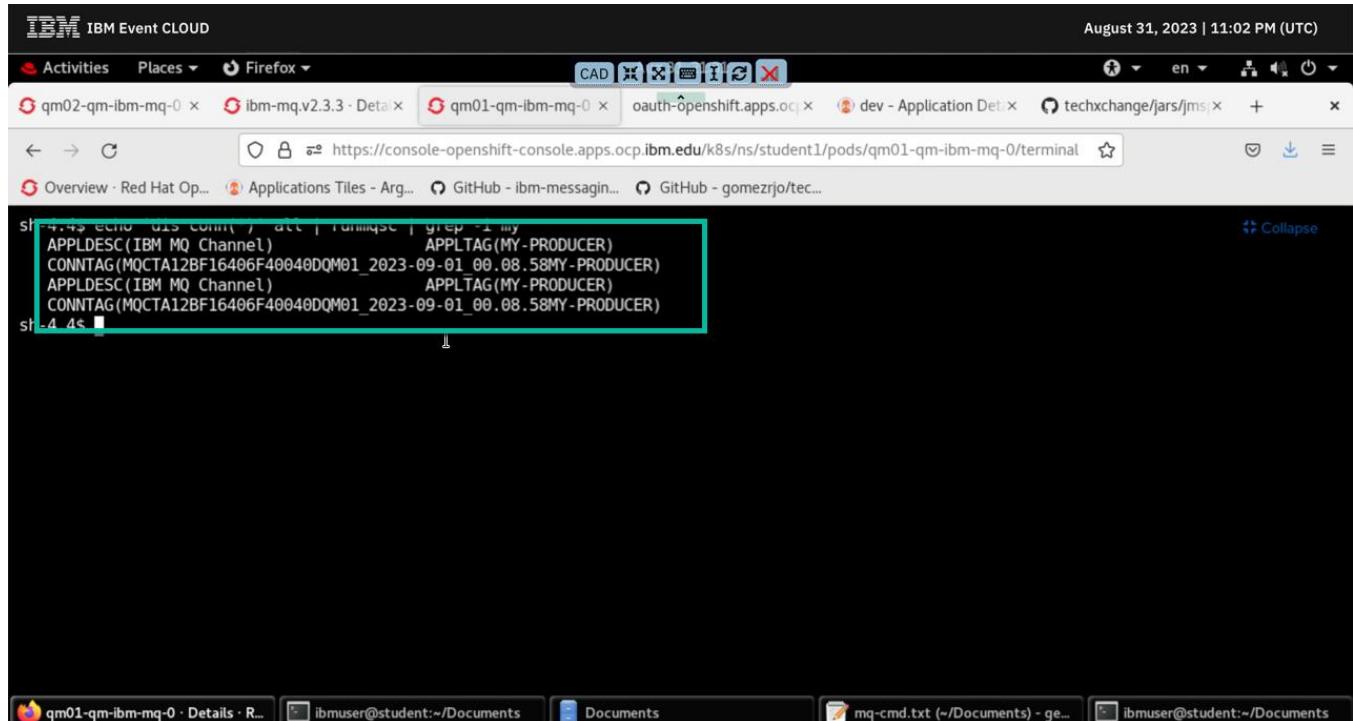
The screenshot shows the IBM Event CLOUD interface. In the center, there's a detailed view of an application named 'dev'. The 'APP DETAILS' tab is selected. Under 'APP HEALTH', it says 'Healthy' with a green heart icon. A box highlights the 'CURRENT SYNC STATUS' section, which shows 'Synced' with a green checkmark. Below it, the 'LAST SYNC RESULT' shows 'Sync OK' with another green checkmark. To the right, there's a diagram illustrating the application's architecture, showing various services like 'qm02-qm-ibm-mq' and 'qm02-qm-ibm-mq-metrics' connected via endpoints and endpointslices. The bottom of the screen shows a terminal window with the command 'mq>cmd.txt' and a file browser window showing 'Documents'.

You can go back to the OCP Console and the MQ Operator to confirm queue manager two is back.

## 8.3 Review connectivity

Once you confirm both queue managers are up and running you can go back to the terminal of the active pod for each queue manager to check the number of active connections and you should see an even distribution as shown below.

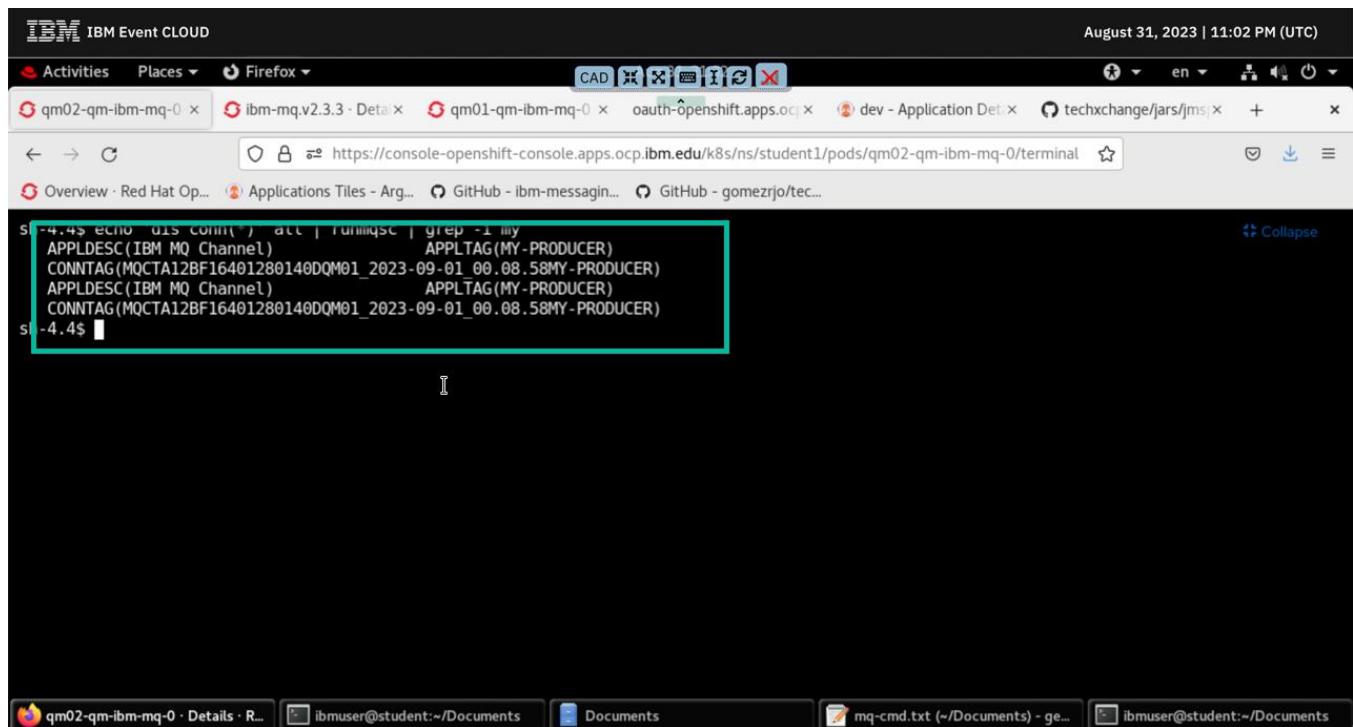
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The screenshot shows a Firefox browser window titled "IBM Event CLOUD" with the URL <https://console-openshift-console.apps.ocp.ibm.edu/k8s/ns/student1/pods/qm01-qm-ibm-mq-0/terminal>. The terminal window displays command-line output from a pod named "qm01-qm-ibm-mq-0". The output shows the results of the command `st -4.4s echo $IS Conn( ) | awk '{print $NF}' | grep -i my`, which lists connections to an IBM MQ Channel. The results are:

```
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA12BF16406F40040DQM01_2023-09-01_00.08.58MY-PRODUCER)
APPLDESC(IBM MQ Channel) APPLTAG(MY-PRODUCER)
CONNTAG(MQCTA12BF16406F40040DQM01_2023-09-01_00.08.58MY-PRODUCER)
```

Below the terminal window, there are several tabs and icons at the bottom of the browser interface.



The second screenshot is identical to the first, showing the same terminal output and browser interface for the pod "qm01-qm-ibm-mq-0".

If you want, you can add more instances to the MQ application to see how the connections are rebalances when you add or remove instances. A similar behavior would happen if additional queue manager are added to the uniform cluster and the connection would be rebalanced providing a way to scale horizontally.

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## **9 Congratulations**

Great job. You have completed the lab.