

# IBM Cloud Pak for Business Automation Demos and Labs 2023

## Bring-up Lab

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# 1 Introduction

## 1.1 IBM Cloud Pak for Business Automation

IBM Cloud Pak for Business Automation (CP4BA) assembles certified software from the IBM Automation Platform for Digital Business on multiple cloud infrastructures. It offers design, build, run, and automation services to rapidly scale your programs and fully execute and operationalize an automation strategy.

You can read more about CP4BA here: <https://www.ibm.com/docs/en/cloud-paks/cp-biz-automation/21.0.3?topic=overview-what-is-cloud-pak-business-automation>

## 1.2 Lab Overview

In this Lab, you will learn how to **configure and install the CP4BA Production mode** on an OpenShift cluster using our **rapid deployment scripts**.

The rapid deployment scripts **simplify** the configuration and installation of CP4BA. They are available on **public GitHub** (<https://github.com/IBM/cp4ba-rapid-deployment>) and, therefore, can be used by customers, business partners, and IBMers.

They automate **parts** of the official **CP4BA planning and installation steps** that can be found here for CP4BA version 21.0.3:

- **Planning for a production deployment:** <https://www.ibm.com/docs/en/cloud-paks/cp-biz-automation/21.0.3?topic=planning-production-deployment>
- **Installing production deployments (on Red Hat OpenShift):** <https://www.ibm.com/docs/en/cloud-paks/cp-biz-automation/21.0.3?topic=openshift-installing-production-deployments>

The rapid deployment scripts are available for the following **CP4BA versions**: 21.0.1, 21.0.2, and 21.0.3. In this Lab, you will configure and install version **21.0.3**.

As part of this Lab, you will only **deploy DB2 and CP4BA**. All other required steps were already completed, so you can concentrate on the essential part: **Configure and Install IBM Cloud Pak for Business Automation version 21.0.3** on Red Hat OpenShift.

We have created a TechZone environment preconfigured with a bastion host and a three-worker node Red Hat OpenShift cluster. In addition, IBM Security Directory Server (SDS) was installed and configured on the bastion host required by CP4BA. To fit the size of the OpenShift cluster, we have pre-selected an appropriate template for use by the rapid deployment scripts. This template will install foundational services required by CP4BA and Filenet Content Manager components.

**IMPORTANT:** The primary use for those scripts and templates is for the rapid setup of CP4BA DEMO and ENABLEMENT environments, for example, to host the Client Onboarding Demo. Those scripts and templates should not be used to set up customer environments for development, test, pre-production,

or production as such installations might have more robust security requirements.<sup>1</sup> For such deployments, use the official CP4BA documentation that can be found here:

<https://www.ibm.com/docs/en/cloud-paks/cp-biz-automation>

During the first exercise, you will reserve an environment on TechZone, access it, and verify that your RedHat OpenShift cluster is working correctly.

As part of the second exercise, you will then deploy the DB2 Operator and cluster on your OpenShift environment. In addition, you will create all the needed databases.

The third exercise will guide you through configuring and installing CP4BA version 21.0.3.

Finally, a chapter with troubleshooting instructions is available for you to work through.

**Approximate Duration:** 8 hours

---

<sup>1</sup> Communication to the Database and to the LDAP server will for example require encrypted communication in such environments, whereas the scripts and templates might not encrypt all internal **communication**.

## 2 Exercise: Prepare yourself for this Bring-Up Lab

### 2.1 Introduction

This exercise will verify that you have all prerequisites in place and instruct you how to reserve your lab environment. The lab environment consists of a Bastion Host VM and three Red Hat OpenShift Container Platform (OCP) Cluster VMs.

#### 2.1.1 Bastion Host VM

A bastion host is a computer from which you access the OpenShift cluster through the command line to administrate the OCP cluster. Administration of an OCP cluster also includes the configuration and installation of new software such as CP4BA. Since the rapid deployment scripts and some scripts from the product will get executed on that bastion host, the bastion host must be one of RHEL, CentOS, or macOS. Finally, all commands these scripts need must be available on the bastion host, for example, the OpenShift CLI, Kubernetes CLI, and so on.

#### 2.1.2 Red Hat OpenShift Container Platform (OCP) Cluster VMs

The OpenShift cluster was configured using OCP version 4.8.46. It will host the DB2 and CP4BA containers which you will install later in this Lab. You can access your OCP cluster from the bastion host either by command line (oc command) or the OpenShift Web Console by Browser.

## 2.2 Exercise Instructions

Before you can start this Lab, you need the following prerequisites:

- an entitlement key, and
- an environment with a **bastion host** and **OpenShift cluster** from TechZone.

**Note:** All the tools such as podman and OpenShift command-line interface needed while the lab are already available on the provided bastion host.

#### 2.2.1 Get the Entitlement Key

To complete this Lab, you must have an entitlement key with access to pull CP4BA images from the IBM Container Software Library `cp.icr.io`.

1. Check that you have an entitlement key with the proper image access. For this, please **open** <https://myibm.ibm.com/products-services/containerlibrary> and log in with your **IBM ID**. IBMers can use their **w3 ID**.

Then, switch to the **Container software library** page. IBMers and some Business Partners will see the following, which means that they **do have such an entitlement key available**:



< My IBM

Container software and cloud  
Pak access management

Entitlement keys

Container software library

## Container software library (1)

Search product name

S

^ IBM SOFTWARE ACCESS 1 YEAR

Refer to the name(s) below when accessing your container software:

- all

**Business Partners** that do not see **all** here, before proceeding, **must verify that CP4BA is listed on the Container software library page**. If you don't see a CP4BA license listed, you can request here a CP4BA 60-day Trial license: <https://www.ibm.com/account/reg/us-en/signup?formid=urx-44505>. You cannot perform this bring-up Lab without a license and entitlement key.

Switch back to **Entitlement keys** page and leave this page open. You will require it multiple times during this Lab.

### 2.2.2 Reserve the OpenShift Tech Zone Envrioment

1. To get an **OpenShift cluster** from TechZone, access **IBM Technology Zone**:  
<https://techzone.ibm.com/>
2. To sign-in, either **use your IBM ID or your company credentials** if SSO is set up between your company and IBM. For example, if you have an IBM W3 or IBM Partnerworld ID, you should use this ID.

**Note:** Dependent on the IBM ID used to sign in, you may or may not be able to reserve a demo. If you can't reserve a demo with the current IBM ID, check if you have another IBM ID that is enabled for IBM Technology Zone reservations.

3. Once signed in, open the **lab resource page**:

<https://techzone.ibm.com/collection/ibm-cloud-pak-for-business-automation-demos-and-labs-bring-up-lab>

4. Scroll down to the **Environments** section and click on **Reserve**.

The screenshot shows a card-like interface for an environment. At the top left is the date "Jan 11, 2023". Below it is the title "CP4BA Bring-Up Lab". Underneath the title, there's a section labeled "Ibmcloud 2: us-south, eu-de, jp-tok" followed by "CP4BA Bring-Up Lab" and "Version 1.8.7". At the bottom left is the word "Visibility" and at the bottom right is "IBMers, Business Partners". A large blue button at the bottom is labeled "Reserve".

**Note:** If you don't see the tile, go back to step 1 and sign in with a different ID.

5. Select **Reserve now**.

This is a simple form with two main sections. The first section has a radio button icon and the text "Select a environment/infrastructure". The second section has a radio button icon and the text "Select a reservation type". Below these are instructions: "Select your reservation type. Do you need this now or later?" and "Single environment reservation options:". Underneath are two radio buttons: "Reserve now" and "Schedule for later". At the bottom are three buttons: "Cancel", "Reset", and "Submit".

6. On the next page, provide the necessary information: Provide the **Purpose**, e.g., "**Practice / Self-Education**", a **description**, select the **geography** closest to your location and select the **end time and date** for the reservation. Plan for at least 8 hours, maybe more. Then click **Submit**.

This is a detailed form for creating a reservation. It includes fields for "Name" (containing "CP4BA Bring-Up Lab"), "Purpose" (containing "Practice / Self-Education"), and "Sales Opportunity number" (with a placeholder "Enter an opportunity number"). There is also a note about using an IBM Sales Cloud opportunity number to extend the reservation date. The "Purpose description" field contains "Education". At the bottom, there is a question "What are you doing? Why do you need this? What are you trying to accomplish?"

Preferred Geography (required)

EUROPE - eu-de region - fra04 datacenter

End date and time

Select a date      Select a time

01/14/2023      4:01 PM      Europe/Berlin

Available for up to 3 days (72 hours)

VPN Access (required)

Disable

Notes

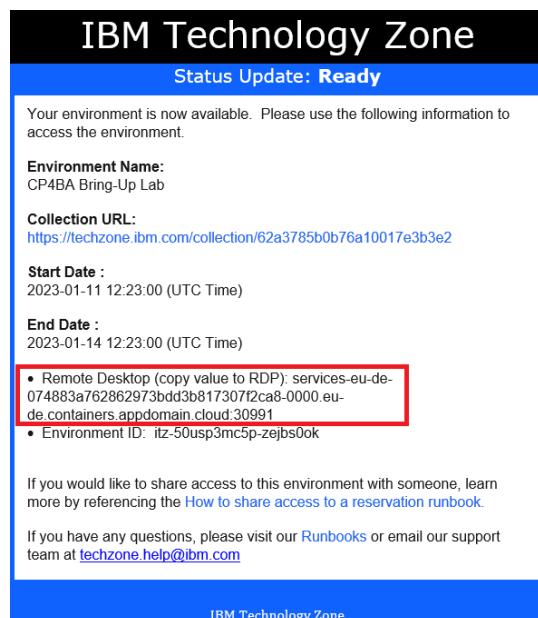
Enter any notes you would like to attach to this reservation

**Cancel**    **Reset**    **Submit**

- After you click **Submit**, you'll get some emails from IBM Technology Zone. Provisioning the environment will take about 15 minutes, then you should get the second email informing you that your environment is **Ready**. In that second email the **Remote Desktop address** will be contained to access your bastion host.

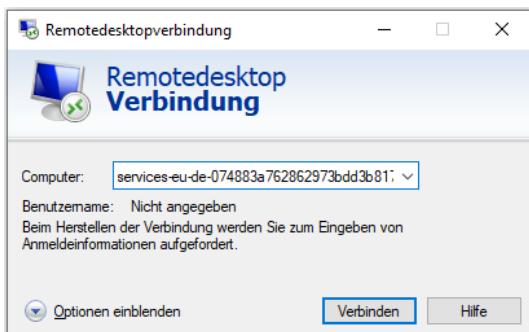
In case there was an issue provisioning the environment, delete the reservation and try again later.

Once you get the email informing you that your environment is Ready and providing you the RDP address, you can start your Lab.

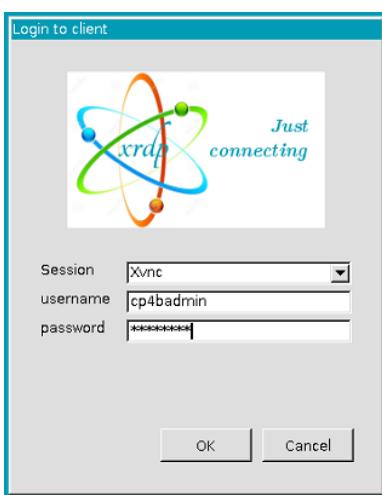


## 2.2.3 Access the OpenShift Tech Zone Envrioment

1. On your local machine, open the **RDP tool** of your choice, for example Windows **Remote Desktop Connection**.
2. Copy the value of the **Remote Desktop address** from the second email and open it with your RDP tool to access the **desktop of the bastion host**.



3. Log-in to the desktop of the bastion host using **cp4badmin / passw0rd** (where the third-last character is a zero).



**Note:** If you see the current time and date after login, **press the Space key**. If the screen is blank, **move the mouse**.

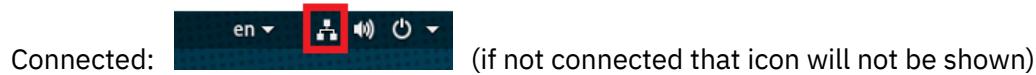
4. Your environment consists of the following VMs:

**VM 0 – Client:** This Red Hat Enterprise Linux (RHEL) Server VM is the bastion host and provides access to the Red Hat OpenShift Container Platform (OCP) master and infrastructure servers. In addition, a DNS server, IBM SDS (LDAP), and other required services are also running there.

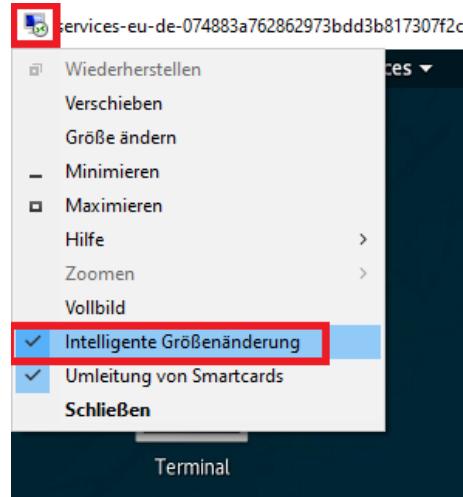
**VM 1 – master-0, VM 2 – master-1, and VM 3 – master-2:** On this Red Hat Enterprise Linux CoreOS (RHCOS) Server VMs, the Red Hat OpenShift Container Platform (OCP) master and infrastructure services are running. In addition, these VMs function as compute nodes. Here, any containers installed on top of OCP are running. These VMs do not have a desktop; they can't be accessed directly.

Now that you have your demo and lab environment available learn how to work with your environment before you start with the Lab.

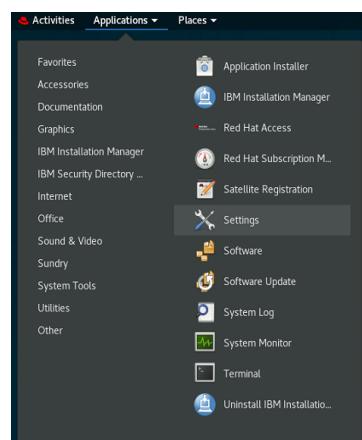
5. Once you logged in, you see the **Red Hat Enterprise Linux (RHEL) Server desktop** of your bastion host VM 0.
6. Next, ensure the **VM is connected** to the network before proceeding. Check that the network icon in the top right corner shows connected. The environment is not usable if the VM is not correctly connected to the network.



7. Change the **size and resolution of the desktop** to your liking. Some RDP tools provide intelligent size change, means when you change the size of your RDP window the desktop size is changed automatically.

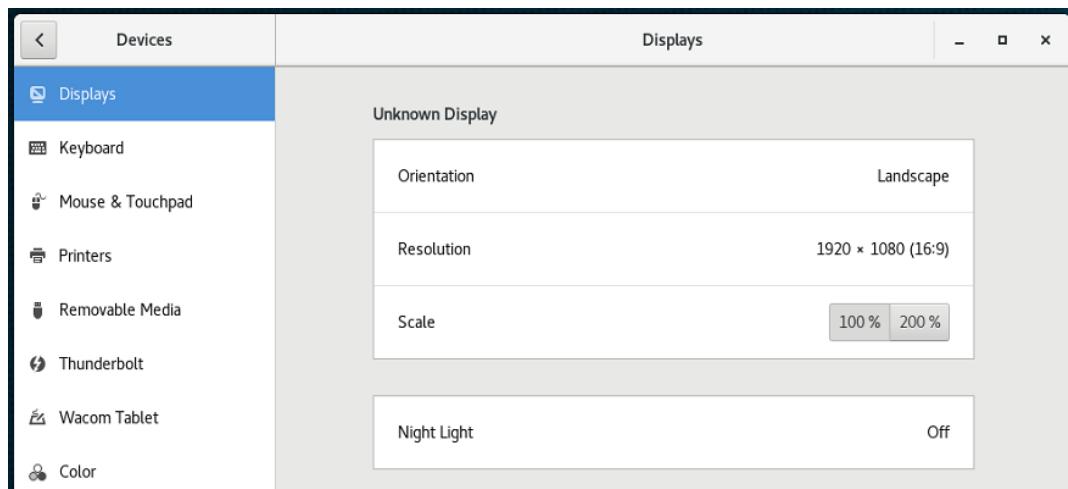


Alternatively open **Applications → System Tools → Settings**.

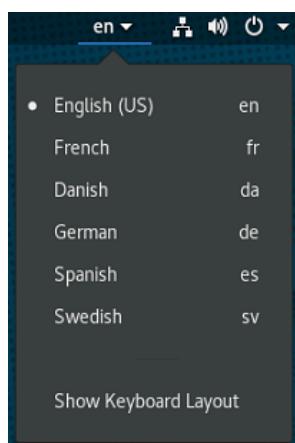


Scroll down and click **Devices**.

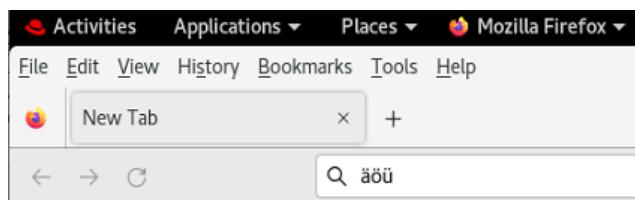
Change the **Display settings** to your liking.



- Finally, to change the keyboard to your liking, click the **en** icon **in the top right corner of the desktop** and select your preferred keyboard layout.



To check that your keyboard works as expected, open Firefox and enter some special language characters in the URL field.



- Depending on the RDP tool selected, you should be able to **Copy&Paste text between your local machine and the bastion host**. As part of this lab this will be needed multiple times, so please test that this works for you. In case not, try a different RDP tool.
- To access your OpenShift cluster through a Browser, **open Firefox** first (shortcut on the desktop).

11. In Firefox, open bookmark **OpenShift Web Console**.

**Note:** In case you get the **Warning: Potential Security Risk Ahead**, click **Advanced...** and then click **Accept the Risk and Continue**. This is needed two times to finally get to the OCP log-in screen.

12. Log in with **ocpadmin / passw0rd** (where the third-last character is a zero).

At this point, it might be that you get errors logging in or that the log-in page occurs again. Other error situations might be that certificate is not trusted, or that the page is not showing up. The cause is, that after start up of the environment from its shut-down mode, OpenShift might need to renew some internal certificates, which takes a while to happen. We found that first login succeeded **half an hour after the environment became ready**, but can take up to an hour to complete. Means, if the log-in page does not occur for you, or the log-in with correct credentials does not work, just wait for a while and try again.

13. Once logged in, verify that the OpenShift Web Console opens and that you have **Administrator** access.

The screenshot shows the Red Hat OpenShift Container Platform Web Console. The top navigation bar includes the Red Hat logo, 'Red Hat OpenShift Container Platform', and a user dropdown set to 'Administrator'. The left sidebar has a dropdown menu and links for Home, Overview, Projects, Search, API Explorer, Events, Operators, Workloads, Networking, Storage, and Builds. The 'Overview' link is currently selected. The main content area is titled 'Overview' and 'Cluster'. It shows 'Details' and 'View settings' for the cluster. Under 'Status', there are green checkmarks for Cluster, Control Plane, Operators, and a yellow warning icon for Insights (2 issues found). A 'Cluster utilization' section shows CPU and Memory usage over the last hour. The right sidebar shows 'Activity' with no ongoing events and a list of recent events, all of which are marked with a red exclamation point.

14. Automatic OCP updates have been paused to speed up the initial cluster startup. To prevent the OCP environment from becoming unusable, you must resume updates as a first step.

**Note:** While a typical production OCP cluster is running 24/7, the lab cluster you are using was shut down for an extended period; hence no updates could have been installed for a while.

15. On the left-hand side, scroll down to **Compute** and select **MachineConfigPools**.

The screenshot shows the 'Compute' menu in the OpenShift Web Console. The menu items are: Nodes, Machines, MachineSets, MachineAutoscalers, MachineHealthChecks, MachineConfigs, and MachineConfigPools. The 'MachineConfigPools' item is highlighted with a red box.

16. For both **master** and **worker**, resume the updates.

MachineConfigPools

Name	Configuration	Updated	Updating	Paused	Degraded
MCP master	MO rendered-master-584151c17b3083993a19aef1d1ec3c07	True	False	True	False
MCP worker	MO rendered-worker-3e5e6faa5f3bc8944dcac7f6ea0d978c	True	False	True	False

Create MachineConfigPool

Resume updates

Edit labels

17. On the left-hand side, scroll up to **Home** and select **Overview**.

18. Wait until the Status of **Cluster**, **Control Plane** and **Operators** is green, that should happen automatically after a while. In this environment, one of the operators is stuck in Pending state and you might see this reflected under the **Operators** status. This issue is caused by an expired certificate for the cluster operator `operator-lifecycle-manager-packageserver`. We will work on renewing the certificate later on in this section.

Status

View alerts

Cluster Control Plane Operators Insights  
3 issues found

19. On the Overview page, the main page, scroll down and verify that the **Cluster inventory** shows no errors.

Cluster inventory

3 Nodes

181 Pods

1 StorageClass

0 PersistentVolumeClaims

**Note:** The number of pods shown here could be different to what you will see.

For Pods, you might see **one pod in error** and / or **one to multiple progressing pods**:

255 Pods    1 !    1 :

The progressing icon should disappear automatically after a while.

To get rid of the pods in error **click on the red icon** behind Pods. You'll now see a list of pods that are in error, for example:

Project: All Projects ▾

Pods Create Pod

Search by name...

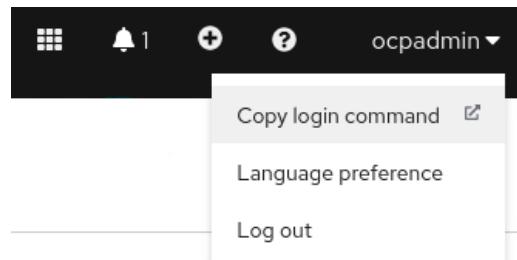
Status CrashLoopBackOff   Clear all filters

Name	Namespace	Status	Ready	Restarts	Owner	Memory	CPU	Created	More
ip-reconciler-27890745-wkvm9	openshift-multus	Error	0/1	0	ip-reconciler-27890745	-	-	Jan 11, 2023, 5:45 AM	<input type="button" value="More"/>

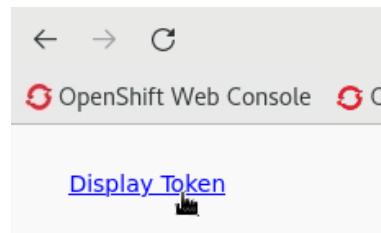
If you only see such an **ip-reconciler pod** in the list, click the three dots at the end and delete that pod.

In case of other **errors, warnings, or pending indicators**, consult the Troubleshooting section to resolve those.

20. To log in through the **oc command line interface**, expand **ocpadmin** in the top right corner and select **Copy login command**.



21. A new tab opens. Log in again with **ocpadmin / passw0rd** (where the third-last character is a zero) and select **Display Token**.



22. Copy the entire **oc login** command to the clipboard.

**Log in with this token**

```
oc login --token=XXXXXXXXXXXXXXXXXXXXXX --server=https://api.ocp.example.com:6443
```

23. Switch to your Terminal window within VM 0, paste the clipboard's content, and hit Enter.

```
[cp4admin@client ~]$ oc login --token=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--server=https://api.ocp.example.com:6443
Logged into "https://api.ocp.example.com:6443" as "admin" using the token provided.
You have access to 64 projects, the list has been suppressed. You can list all projects with 'oc projects'
Using project "default".
[cp4admin@client ~]$
```

24. Verify that you successfully logged in.

If you have skipped the steps since step 12 above, waiting for login to be possible, you might still be getting an error message: “error: The token provided is invalid or expired.”. This should become possible once Openshift updated the certificates correctly. You might need to wait a bit more.

25. Next, run this command:

```
oc version
```

```
[cp4admin@client ~]$ oc version
Client Version: 4.8.0-202205121606.p0.g41ff67e.assembly.stream-41ff67e
Server Version: 4.8.46
Kubernetes Version: v1.21.11+6b3cbdd
```

26. Verify that Server Version is **4.8.x**. This ensures that the oc command-line interface and OCP cluster **version** are compatible

27. Now that we are able to use the oc command-line interface we can go ahead and fix the expired certificate issue identified earlier. To refresh the expired certificate, run the following commands from the same terminal you used in the previous steps.

- Recreate the service secret associated with cluster operator operator-lifecycle-manager-packageserver:

```
oc delete secret catalog-operator-serving-cert olm-operator-serving-
cert packageserver-service-cert -n openshift-operator-lifecycle-
manager
```

```
[cp4admin@client ~]$ oc delete secret catalog-operator-serving-cert olm-operator-serving-cert packageserver-service-
cert -n openshift-operator-lifecycle-manager
secret "catalog-operator-serving-cert" deleted
secret "olm-operator-serving-cert" deleted
secret "packageserver-service-cert" deleted
```

- Recerate the pods associated with cluster operator operator-lifecycle-manager-packageserver:

```
oc delete pod -l 'app in (catalog-operator, olm-operator,
packageserver, package-server-manager)' -n openshift-operator-
lifecycle-manager
```

```
[cp4badmin@client ~]$ oc delete pod -l 'app in (catalog-operator, olm-operator, packageserver, package-server-manag  
er)' -n openshift-operator-lifecycle-manager  
pod "catalog-operator-769d846-htm2s" deleted  
pod "olm-operator-6597866d47-hcvss" deleted  
pod "packageserver-b484b67fd-746nb" deleted  
pod "packageserver-b484b67fd-sr6kw" deleted
```

- c. Check if all pods came back up. All pods are back up with they show 1/1 in the READY column and Running in the STATUS column.

```
oc get pods -n openshift-operator-lifecycle-manager
```

```
[cp4badmin@client ~]$ oc get pods -n openshift-operator-lifecycle-manager  
NAME           READY   STATUS    RESTARTS   AGE  
catalog-operator-769d846-qfxwh  1/1     Running   0          2m21s  
olm-operator-6597866d47-wgcpb  1/1     Running   0          2m21s  
packageserver-b484b67fd-fncfc  1/1     Running   0          2m21s  
packageserver-b484b67fd-189xh  1/1     Running   0          2m21s
```

- d. Delete the existing API service:

```
oc delete apiservice v1.packages.operators.coreos.com
```

```
[cp4badmin@client ~]$ oc delete apiservice v1.packages.operators.coreos.com  
apiservice.apiregistration.k8s.io "v1.packages.operators.coreos.com" deleted
```

You have now successfully accessed and updated your environment and are ready to install DB2.

# 3 Exercise: Deploy DB2 and Create Databases

## 3.1 Introduction

A CP4BA production mode deployment requires you to provide the databases needed by the CP4BA components. In this exercise, you'll first **deploy the DB2 Operator and containers** on the OpenShift cluster. Other databases are also supported, for example, Oracle, SQL Server, or PostgreSQL. See **Detailed system requirements:** <https://www.ibm.com/docs/en/cloud-paks/cp-biz-automation/21.0.3?topic=ppd-system-requirements>

The database can run on OpenShift, but CP4BA also supports on-premises installations. We will be using OpenShift to install the database.

In this exercise, you will run scripts to install DB2 Operator, run the Operator to create a DB2 instance, and create three databases that are required CP4BA template we have selected.

## 3.2 Exercise Instructions

1. On your bastion host **VM 0** use the **Terminal** to switch to a directory prepared for you to contain the rapid deployment and other scripts.

```
cd /cp4ba
```

2. **Clone** the rapid deployment git repository onto your bastion host and copy the deployment scripts.

**Note:** As part of this doc, we assume you copy the deployment scripts into directory mycluster. If you select a different directory, you must change some of the commands in the steps below; otherwise, you can copy/paste them as is.

```
git clone https://github.com/IBM/cp4ba-rapid-deployment.git  
cd /cp4ba/cp4ba-rapid-deployment/cp4ba-21-0-3  
cp -r scripts mycluster  
cd mycluster/deployment-db2-cp4ba
```

Sample output of the previous commands:

```
[cp4badmin@client ~]$ cd /cp4ba  
[cp4badmin@client cp4ba]$ git clone https://github.com/IBM/cp4ba-rapid-deployment  
Cloning into 'cp4ba-rapid-deployment'...  
remote: Enumerating objects: 1022, done.  
remote: Counting objects: 100% (14/14), done.  
remote: Compressing objects: 100% (13/13), done.  
remote: Total 1022 (delta 3), reused 3 (delta 1), pack-reused 1008  
Receiving objects: 100% (1022/1022), 85.17 MiB | 30.08 MiB/s, done.  
Resolving deltas: 100% (526/526), done.  
[cp4badmin@client cp4ba]$ cd /cp4ba/cp4ba-rapid-deployment/cp4ba-21-0-3  
[cp4badmin@client cp4ba-21-0-3]$ cp -r scripts mycluster  
[cp4badmin@client cp4ba-21-0-3]$ cd mycluster/deployment-db2-cp4ba  
[cp4badmin@client deployment-db2-cp4ba]$
```

3. **Open** the parameters file for DB2, 01-parametersForDb2OnOCP.sh, with gedit.

```
gedit 01-parametersForDb2OnOCP.sh
```

4. **Apply** the following changes:

- cp4baTemplateToUse – Name of CP4BA deployment template that will be used

set the value to ibm\_cp4a\_cr\_template.002.ent.FoundationContent.yaml

**Note:**

The rapid deployment scripts provide multiple CP4BA templates from which you can choose. For example, this "FoundationContent" template deploys the foundation and the content patterns of CP4BA. Other templates deploy different patterns and thus can be used when other components are needed.

The ClientOnboardingDemo pattern, for example, also deploys the Application, Decisions\_ads, and Workflow patterns and brings with it most components needed to run the Client Onboarding Demo.<sup>2</sup>

Due to the available OpenShift cluster size, other templates can't be used for this bring-up Lab. Of course, if you later deploy on your own OCP cluster that provides more CPU and memory, you would also be able to deploy larger templates.

The template name is important at this point as it defines the needed databases and the CPU and memory needed for the DB2 container. It also contains a definition of the databases that need to be generated by the scripts.

- db2OnOcpProjectName – Project/namespace where DB2 should be installed, for example, ibm-db2 (you could specify any project name here, if that does not exist yet, it will be created by the scripts)

set the value to ibm-db2

- db2AdminUserPassword – Password that will be assigned to the db2 instance user.

set the value to passw0rd

- db2StandardLicenseKey – A DB2 Standard License key to assign to DB2 to allow for larger use of CPU and memory

remove the default value REQUIRED, and leave this parameter empty

**Note:** The CP4BA template you are deploying as part of this Lab requires three databases. DB2 community edition (installed when you don't specify a DB2 Standard License key) allows for enough CPU and memory for those three databases. Only when selecting a larger CP4BA template, would this key be needed.

- db2Cpu – Number of CPUs for DB2 pod according to the selected CP4BA template

set the value to **4**

---

<sup>2</sup> Newer versions of the Client Onboarding Demo also make use of the document-processing pattern, for example.

- db2Memory – Amount of memory for DB2 pod according to the selected CP4BA template  
set the value to **16Gi**
- The changes you made so far should look as shown below.

```
# Selected CP4BA template to use for deployment, for example ibm_cp4a_
# Available templates:
#   ibm_cp4a_cr_template.001.ent.Foundation.yaml
#   ibm_cp4a_cr_template.002.ent.FoundationContent.yaml
#   ibm_cp4a_cr_template.200.ent.ClientOnboardingDemoWithADP.yaml
cp4baTemplateToUse=ibm_cp4a_cr_template.002.ent.FoundationContent.yaml

# OCP Project Name for DB2, for example ibm-db2
db2OnOcpProjectName=ibm-db2

# Password for DB2 Admin User (Admin User name see below), for example
db2AdminUserPassword=passw0rd

# DB2 Standard license key base64 encoded
# If this key is not available, leave empty (but remove the value 'R'
# In that case, also update parameters db2Cpu and db2Memory below (t
db2StandardLicenseKey=|]

# CPUs to assign to DB2 pod (max with DB2 Standard license is 16, max
# If you selected CP4BA template    ibm_cp4a_cr_template.001.ent.Fo
# If you selected CP4BA template    ibm_cp4a_cr_template.002.ent.Fo
# If you selected CP4BA template    ibm_cp4a_cr_template.200.ent.Cl
db2Cpu=4

# RAM to assign to DB2 pod (max with DB2 Standard license is 128Gi, ma
# If you selected CP4BA template    ibm_cp4a_cr_template.001.ent.Fo
# If you selected CP4BA template    ibm_cp4a_cr_template.002.ent.Fo
# If you selected CP4BA template    ibm_cp4a_cr_template.200.ent.Cl
db2Memory=16Gi
```

- Scroll further down to the property named cp4baDeploymentPlatform, which specifies the OpenShift deployment platform, ROKS and OCP are supported values

change the value from ROKS to **OCP**

- Scroll further down to the property named db2OnOcpStorageClassName, which specifies the name of the storage class to be used for dynamic storage provisioning

change the value from cp4a-file-delete-gold-gid to **cp4ba-storage**

#### Note:

CP4BA needs a storage class that supports read/write many (RWX) mode. Storage in RWX mode can be mounted on different OCP Workers at the same time. For more details, refer to <https://www.ibm.com/docs/en/cloud-paks/cp-biz-automation/21.0.3?topic=deployment-storage-considerations>

The Storage class cp4ba-storage we have created for you supports RWX mode based on this GitHub repo: <https://github.com/kubernetes-sigs/nfs-subdir-external-provisioner/tree/master/charts/nfs-subdir-external-provisioner>. The NFS server providing the storage for this storage class is running on VM 0, your bastion host. There, directory /nfs/cp4auto-storage will contain the directories created for the containers to store their files, for example, log files.

- The changes you made so far should look as shown below.

```
# Deployment platform, either ROKS or OCP
cp4baDeploymentPlatform=OCP

# Name of the storage class used for DB2's PVC
db2OnOcpStorageClassName=cp4ba-storage
```

- Leave all other properties at their default values
- Finally, save your changes and close the editor.

5. **Run** script 02-createDb2OnOCP.sh . This script will now install and configure DB2 for you based on the parameters previously specified in 01-parametersForDb2OnOCP.sh .

```
./02-createDb2OnOCP.sh
```

#### **Notes:**

To successfully run the script, you need the jq tool and podman installed on your bastion host. For this Lab, these tools are already available on your bastion host (VM 0).

This script will prompt you for various input. Please have a look at the sample script output provided below to see the answers you must use, they are marked in red.

You need your Entitlement Registry key handy, see also <https://myibm.ibm.com/products-services/containerlibrary>

When you paste your Entitlement Registry key, it will not be shown; therefore, paste it just once and hit the Enter key.

This script will exit if errors are hit during the installation.

If you get the error message:

```
error: unable to recognize "ibmOperatorCatalog.yaml": Unauthorized
```

Check whether you have successfully logged on to the OCP cluster on the command line.

#### Sample script output:

```
./02-createDb2OnOCP.sh
```

```
Found 01-parametersForDb2OnOCP.sh. Reading in variables from that script.
Reading 01-parametersForDb2OnOCP.sh ...
Done!
```

```
Installing DB instance for CloudPak.
```

This script installs Db2u on OCP into project ibm-db2. For this, you need the jq tool installed and your Entitlement Registry key handy.

```
Do you want to continue (Yes/No, default: No): Yes
```

```
Installing Db2U on OCP...
```

```
Installing the IBM Operator Catalog...
Warning: resource catalogsources/ibm-operator-catalog is missing the kubectl.kubernetes.io/last-applied-configuration annotation which is required by oc apply. oc apply should only be used on
```

```
resources created declaratively by either oc create --save-config or oc apply. The missing annotation will be patched automatically.  
catalogsource.operators.coreos.com/ibm-operator-catalog configured
```

```
Creating project ibm-db2...  
namespace/ibm-db2 created  
Now using project "ibm-db2" on server "https://api.ocp.example.com:6443".
```

```
Creating secret ibm-registry. For this, your Entitlement Registry key is needed.
```

```
You can get the Entitlement Registry key from here: https://myibm.ibm.com/products-services/containerlibrary
```

```
Enter your Entitlement Registry key: <paste your Entitlement Registry key here ONCE, it will not be shown, then hit the Enter key>
```

```
Verifying the Entitlement Registry key...
```

```
Login Succeeded!
```

```
Entitlement Registry key is valid.  
secret/ibm-registry created
```

```
Modifying the OpenShift Global Pull Secret (you need jq tool for that):  
secret/pull-secret data updated
```

```
Creating Operator Group object for DB2 Operator  
operatorgroup.operators.coreos.com/ibm-db2-group created
```

```
Creating Subscription object for DB2 Operator  
subscription.operators.coreos.com/db2u-operator created
```

```
Waiting up to 5 minutes for DB2 Operator install plan to be generated.  
<your current date and time>
```

```
Approving DB2 Operator install plan.  
installplan.operators.coreos.com/install-pbn59 patched
```

```
Waiting up to 15 minutes for DB2 Operator to install.  
<your current date and time>
```

```
Deploying the Db2u cluster.  
db2ucluster.db2u.databases.ibm.com/db2ucluster created
```

```
Waiting up to 15 minutes for c-db2ucluster-db2u statefulset to be created.  
<your current date and time>
```

```
Patching c-db2ucluster-db2u statefulset.  
statefulset.apps/c-db2ucluster-db2u patched (no change)
```

```
Waiting up to 20 minutes for c-db2ucluster-restore-morph job to complete successfully.  
<your current date and time>
```

```
Updating number of databases allowed by DB2 installation from 8 to 30.  
configmap/c-db2ucluster-db2dbmconfig replaced
```

```
Updating database manager running configuration.  
DB20000I The UPDATE DATABASE MANAGER CONFIGURATION command completed successfully.
```

```
Restarting DB2 instance.  
Wolverine HA management state was disabled successfully.  
<your current date and time> 0 0 SQL1064N DB2STOP processing was successful.  
SQL1064N DB2STOP processing was successful.  
<your current date and time> 0 0 SQL1063N DB2START processing was successful.  
SQL1063N DB2START processing was successful.  
Wolverine HA management state was enabled successfully.
```

```
*****  
***** Installation and configuration of DB2 completed successfully! *****  
*****
```

```
Removing BLUDB from system.  
DB20000I The FORCE APPLICATION command completed successfully.  
DB21024I This command is asynchronous and may not be effective immediately.
```

```
DB20000I The DEACTIVATE DATABASE command completed successfully.  
DB20000I The DROP DATABASE command completed successfully.
```

Existing databases are:

Use this hostname/IP to access the databases e.g. with IBM Data Studio.

Hostname: router-default.apps.ocp.example.com

Other possible addresses (If hostname not available above): 10.0.0.10, master-0

Use one of these NodePorts to access the databases e.g. with IBM Data Studio (usually the first one is for legacy-server (Db2 port 50000), the second for ssl-server (Db2 port 50001)).

"nodePort": <your legacy-server node port>,

"nodePort": <your ssl-server node port>,

Use "db2inst1" and password "passw0rd" to access the databases e.g. with IBM Data Studio.

Db2u installation complete! Congratulations. Exiting...

6. While the script is running, you optionally can review the changes applied:

- a. First, the IBM Operator Catalog is deployed, see `ibmOperatorCatalog.yaml` in folder `/cp4ba/cp4ba-rapid-deployment/cp4ba-21-0-3/mycluster/deployment-db2-cp4ba`. An operator catalog gives you access to a set of operators, for example the D2 operator.
- b. A new project in OCP is created using a by the O2 script generated file named `db2-namespace.yaml`. This file gets generated from template file `db2-namespace.template.yaml` by injecting some of the parameters from `01-parametersForDb2OnOCP.sh`, for example parameter `db2OnOcpProjectName` that is set to value `ibm-db2`.
- c. A new secret is created in the new project using your Entitlement Registry key named `ibm-registry`. How exactly this secret is created is documented in detail here:  
<https://www.ibm.com/docs/en/db2/11.5?topic=operator-installing-from-command-line>

**Note:** A dummy email is used by the scripts.

- d. The OpenShift Global Pull Secret is modified to ensure you can pull the container images for DB2.
- e. An Operator Group object for DB2 Operator is created. The O2 script generated a file named `db2-operatorgroup.yaml`. This file gets generated from template file `db2-operatorgroup.template.yaml` by injecting some of the parameters from `01-parametersForDb2OnOCP.sh`.
- f. A Subscription for the DB2 Operator is created. The O2 script generated a file named `db2-subscription.yaml`. This file gets generated from template file `db2-subscription.template.yaml` by injecting some of the parameters from `01-parametersForDb2OnOCP.sh`. For example, the namespace (project name), channel and startingCSV are set.

Applying this Subscription causes the DB2 operator to install. As you can see in the definition, `installPlanApproval` is set to Manual. This is to avoid DB2 operator to automatically update to latest version as this can cause issues while the DB2 instance deployment. Therefore, the script has to approve the first DB2 Operator install plan to allow

the version provided under startingCSV to install. Install plans generated afterwards should not get approved by you manually to avoid issues while the creation of the DB2 instance.

- g. Once the DB2 Operator is installed, the script is deploying the Db2u cluster. For this, the 02 script generated a file named `db2.yaml`. This file gets generated from template file `db2.template.yaml` by injecting some of the parameters from `01-parametersForDb2OnOCP.sh`. For example, the namespace, license, admin user password and instance version are set.

Applying this resource causes the Db2u cluster to be installed using the specified parameters.

Between the applied files there are multiple dependencies, for example between DB2 Operator version installed (startingCSV) and Db2u cluster version installed. For example, newer DB2 Operators will not install older Db2u cluster versions and vice versa. Due to the rapid deployment scripts and the set of default values provided by them, beginners don't need to care about such dependencies. Advanced users could modify these properties as well to deploy newer DB2 versions, for example also on a newer OpenShift version. But, in some cases changing the parameters in `01-parametersForDb2OnOCP.sh` is not sufficient, further changes in the `.template` files will most likely be needed, too.

- h. Once the Db2u cluster is up and running, the 02 script waits till the job `c-db2ucluster-restore-morph` completes, which is the last step in deploying the cluster. Then, the script does also apply some further configuration changes to the Db2u cluster, performs a full re-start of DB2 and drops the default database BLUDB as this one is not needed for your CP4BA deployment. Last but not least some useful information is provided in case you want to connect to this DB2 cluster with for example IBM Data Studio.
7. Once the script completed, **review** the output and ensure there are no errors and that it is completed as shown in the sample script output. Primarily, make sure you see the banner:

```
*****  
***** Installation and configuration of DB2 completed successfully! *****  
*****
```

If you don't see this banner, use the Troubleshooting section to learn how to troubleshoot DB2 and delete the DB2 cluster, Operator, and the created namespace. Then, run the script `02-createDb2OnOCP.sh` again.

After this banner is displayed, the script can fail on some post-deployment cleanup work. Failing the cleanup work does not impact the successful deployment and configuration of DB2, in the next step you will cover that.

8. Look at the output of your script and **verify** that the deletion of **BLUDB** was successful. If this is not the case, use the Troubleshooting section to delete it manually, see [Delete Single Database Manually](#).

```
Removing BLUDB from system.  
DB20000I The FORCE APPLICATION command completed successfully.  
DB21024I This command is asynchronous and may not be effective immediately.  
  
DB20000I The DEACTIVATE DATABASE command completed successfully.  
DB20000I The DROP DATABASE command completed successfully.
```

**Note:** This database is created out of the box by DB2 but is not needed for the CP4BA deployment.

9. Run this command and verify that you see two completed pods and four pods Running and Ready (1/1).

```
oc get pods
```

```
[cp4badmin@client deployment-db2-cp4ba]$ oc get pods  
NAME          READY   STATUS    RESTARTS   AGE  
c-db2ucluster-db2u-0   1/1     Running   0          30m  
c-db2ucluster-etcd-0  1/1     Running   0          31m  
c-db2ucluster-instdb-nb7tf  0/1     Completed  0          31m  
c-db2ucluster-ldap-58846f7c46-c544s  1/1     Running   0          31m  
c-db2ucluster-restore-morph-4nf69   0/1     Completed  0          28m  
db2u-operator-manager-5768b9bf79-97s5x  1/1     Running   0          33m  
[cp4badmin@client deployment-db2-cp4ba]$
```

10. **Run** script `03-createCp4baDBs4Db2OnOCP.sh` to create the databases needed for the CP4BA template that you selected.

```
./03-createCp4baDBs4Db2OnOCP.sh
```

**Note:** You can ignore the following warning:

SQL1363W One or more of the parameters submitted for immediate modification were not changed dynamically. For these configuration parameters, the database must be shutdown and reactivated before the configuration parameter changes become effective.

11. **Review** the output of the script and make sure there were no errors and that the following **three databases were created**:

```
Existing databases are:  
Database name      = CLOS  
Database name      = GCDDB  
Database name      = ICNDB
```

**Note:**

In case you got errors creating DBs, please use script `99-dropCp4baDBs4Db2OnOCP.sh` to drop all

DBs – then re-run script `03-createCp4baDBs4Db2OnOCP.sh`.

Many databases will be created when selecting a different CP4BA template for deployment.

**12. Verify** that the script also has **activated** these databases:

```
Activating databases...
ICNDB...
DB20000I  The ACTIVATE DATABASE command completed successfully.
CLOS...
DB20000I  The ACTIVATE DATABASE command completed successfully.
GCDDB...
DB20000I  The ACTIVATE DATABASE command completed successfully.
Done. Exiting...
```

**Note:**

If you got errors activating DBs, please use script 04-activateDBs.sh to try to activate them again – if your DB2 pod got enough memory assigned according to the template used, activation of all DBs must be successful.

You have successfully deployed the DB2 Operator and a DB2 cluster on your OpenShift cluster. In addition, you have generated three databases needed for the CP4BA deployment. You are now ready to start deploying CP4BA.

## 4 Exercise: Install IBM CP4BA (Production)

### 4.1 Introduction

We have completed **all prerequisites** for the CP4BA deployment: LDAP is automatically started on VM 0, DB2 is deployed on the OpenShift cluster, and the needed databases are created.

We are now ready to get started with the **deployment of CP4BA!**

The first step is to get access to the product scripts needed for deploying the CP4BA operator and **the Operator**.

The second step is to provide some more CP4BA-specific configuration parameters and then kick off the CP4BA deployment using the CP4BA Operator.

Finally, there are some **post-deployment** and **verification steps** to verify that the deployment is healthy and that all deployed components are accessible.

### 4.2 Deployment Instructions

#### 4.2.1 Install CP4BA Operator

1. On your bastion host, **download the Case package** by opening the following URL in the Browser:

[https://github.com/IBM/cloud-pak/raw/master/repo/case\(ibm-cp-automation/3.2.19/ibm-cp-automation-3.2.19.tgz](https://github.com/IBM/cloud-pak/raw/master/repo/case(ibm-cp-automation/3.2.19/ibm-cp-automation-3.2.19.tgz)

The archive is saved into the directory /home/cp4badmin/Downloads .

2. Using the **Terminal**, extract cert-kubernetes into directory /cp4ba .

```
cd /home/cp4badmin/Downloads  
tar -xvzf ibm-cp-automation-3.2.19.tgz  
cd ibm-cp-automation/inventory/cp4aOperatorSdk/files/deploy/crs  
tar -xvzf cert-k8s-21.0.3.tar -C /cp4ba
```

3. To install the **CP4BA operator and other needed operators**, from cert-kubernetes , execute script cp4a-clusteradmin-setup.sh

```
cd /cp4ba/cert-kubernetes/scripts/  
.cp4a-clusteradmin-setup.sh
```

Read these before you start completing the scrip prompts:

- You will need your Entitlement Registry key. Recall you saved this key at the beginning of this Lab.

- When you paste your Entitlement Registry key, it will not be shown. Therefore, paste it just once and hit the Enter key.
- This script will prompt you for various inputs. Please look at the sample script output below to see the answers you must provide; they are marked in red.<sup>3</sup>

### Sample script output

```
./cp4a-clusteradmin-setup.sh
creating temp folder

Select the cloud platform to deploy:
1) RedHat OpenShift Kubernetes Service (ROKS) - Public Cloud
2) Openshift Container Platform (OCP) - Private Cloud
3) Other ( Certified Kubernetes Cloud Platform / CNCF)
Enter a valid option [1 to 3]: 2

This script prepares the OLM for the deployment of some Cloud Pak for Business Automation
capabilities

What type of deployment is being performed?
1) Starter
2) Production
Enter a valid option [1 to 2]: 2

Do you want CP4BA Operator support 'All Namespaces'? (Yes/No, default: No) No

Where do you want to deploy Cloud Pak for Business Automation?
Enter the name for a new project or an existing project (namespace): ibm-cp4ba

The Cloud Pak for Business Automation Operator (Pod, CSV, Subscription) not found in cluster
Continue.....

Using project ibm-cp4ba...

Here are the existing users on this cluster:
1) ocpadmin
Enter an existing username in your cluster, valid option [1 to 1], non-admin is suggested: 1

Follow the instructions on how to get your Entitlement Key:
https://www.ibm.com/support/knowledgecenter/en/SSYHZ8\_21.0.x/com.ibm.dba.install/op\_topics/tsk\_images\_enterp\_entitled.html

Do you have a Cloud Pak for Business Automation Entitlement Registry key (Yes/No, default: No):
Yes

Enter your Entitlement Registry key: <paste your Entitlement Registry key here ONCE, it will not
be shown, then hit the Enter key>
Verifying the Entitlement Registry key...
Login Succeeded!
Entitlement Registry key is valid.

The existing storage classes in the cluster:
NAME          PROVISIONER          RECLAIMPOLICY  VOLUMEBINDINGMODE
ALLOWVOLUMEEXPANSION AGE
cp4ba-storage  k8s-sigs.io/nfs-subdir-external-provisioner Delete        Immediate
false          16d

To provision the persistent volumes and volume claims please enter the dynamic storage classname:
cp4ba-storage
Creating docker-registry secret for Entitlement Registry key in project ibm-cp4ba...
secret/admin.registrykey created
Done
Creating ibm-entitlement-key secret for IAF in project ibm-cp4ba...
secret/ibm-entitlement-key created
Done
```

---

<sup>3</sup> Even though the script is interactive in nature, it can be fully automated by setting environment variables, if needed. This is not done here, though.

```
Applying the persistent volumes for the Cloud Pak operator by using the storage classname: cp4ba-storage...
```

```
persistentvolumeclaim/operator-shared-pvc created
persistentvolumeclaim/cp4a-shared-log-pvc created
Done

Waiting for the persistent volumes to be ready...
Done
ibm-operator-catalog    IBM Operator Catalog    grpc    IBM          450d
Found existing ibm operator catalog source, updating it
catalogsource.coreos.com/ibm-operator-catalog configured
IBM Operator Catalog source updated!
Waiting for CP4A Operator Catalog pod initialization
Waiting for CP4A Operator Catalog pod initialization
CP4BA Operator Catalog is running ibm-operator-catalog-19hkw
1/1   Running      0      30s
operatorgroup.coreos.com/ibm-cp4a-operator-catalog-group created
CP4BA Operator Group Created!
subscription.coreos.com/ibm-cp4a-operator-catalog-subscription created
CP4BA Operator Subscription Created!
Waiting for CP4BA operator pod initialization
No resources found in ibm-cp4ba namespace.
Waiting for CP4BA operator pod initialization
No resources found in ibm-cp4ba namespace.
Waiting for CP4BA operator pod initialization
No resources found in ibm-cp4ba namespace.
Waiting for CP4BA operator pod initialization
Waiting for CP4BA operator pod initialization
Waiting for CP4BA operator pod initialization
CP4A operator is running ibm-cp4a-operator-7995f9b66-bbjbjl
Running      0      2m
1/1
```

```
Adding the user ocpadmin to the ibm-cp4a-operator role...Done!
```

```
Label the default namespace to allow network policies to open traffic to the ingress controller
using a namespaceSelector...namespace/default labeled
Done
```

```
Storage classes are needed to run the deployment script. For the Starter deployment scenario, you
may use one (1) storage class. For an Production deployment, the deployment script will ask for
three (3) storage classes to meet the slow, medium, and fast storage for the configuration of
CP4A components. If you don't have three (3) storage classes, you can use the same one for slow,
medium, or fast. Note that you can get the existing storage class(es) in the environment by
running the following command: oc get storageclass. Take note of the storage classes that you
want to use for deployment.
NAME           PROVISIONER           RECLAIMPOLICY   VOLUMEBINDINGMODE
ALLOWVOLUMEEXPANSION AGE
cp4ba-storage  k8s-sigs.io/nfs-subdir-external-provisioner Delete   Immediate
false          16d
```

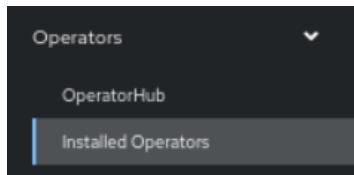
#### Note:

Currently, the rapid deployment scripts only support the deployment of CP4BA clusters in Production mode using images pulled from the IBM public container library. The Starter deployment mode or Air-Gapped environments are not (yet) supported.

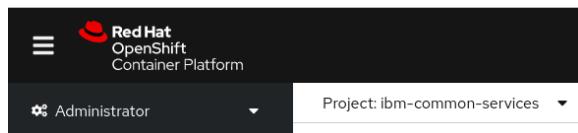
4. **Review** your script output and make sure there are no errors.

5. **Wait** until all Operators are installed. This might take a while.

To **verify** the operators' deployment, switch to your Browser tab with the OCP Web Console and select the menu entry **Installed Operators** on the left-hand side within **Operators**.



6. At the top left side of the main pane, switch to project **ibm-common-services**.

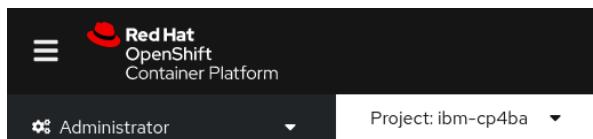


7. Verify that the following **five operators** show Status **Succeeded**.

Name	Managed Namespaces	Status
IBM Cert Manager 3.21.0 provided by IBM	(NS) ibm-common-services	✓ Succeeded Up to date
IBM Cloud Pak foundational services 3.19.0 provided by IBM	(NS) ibm-common-services	✓ Succeeded Up to date
IBM Licensing 1.16.0 provided by IBM	(NS) ibm-common-services	✓ Succeeded Up to date
IBM NamespaceScope Operator 1.13.0 provided by IBM	(NS) ibm-common-services	✓ Succeeded Up to date
Operand Deployment Lifecycle Manager 1.17.0 provided by IBM	(NS) ibm-common-services	✓ Succeeded Up to date

Note: In different CP4BA versions, you may see more operators.

8. Change project to **ibm-cp4ba**.

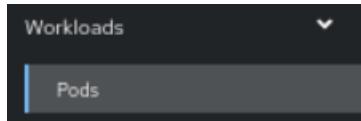


9. Verify that the following **six operators** show Status **Succeeded**.

Name	Managed Namespaces	Status
IBM Automation Foundation Core 1.3.7 provided by IBM	NS ibm-cp4ba	Succeeded Up to date
IBM Automation Foundation Insights Engine 1.3.6 provided by IBM	NS ibm-cp4ba	Succeeded Up to date
IBM Automation Foundation 1.3.7 provided by IBM	NS ibm-cp4ba	Succeeded Up to date
IBM Cloud Pak foundational services 3.19.0 provided by IBM	NS ibm-cp4ba	Succeeded Up to date
IBM Cloud Pak for Business Automation 21.3.10 provided by IBM	NS ibm-cp4ba	Succeeded Up to date
IBM CP4BA Workflow Process Service 22.1.0 provided by IBM	NS ibm-cp4ba	Succeeded Up to date

Note: In different CP4BA versions, you may see more operators.

10. Select on the left-hand side within **Workloads** the menu entry **Pods**.

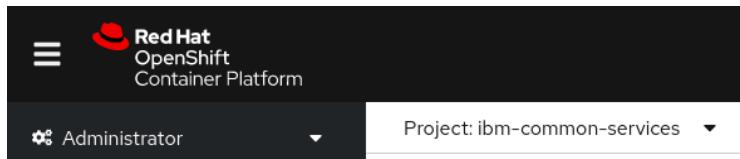


11. Verify that the following **9 pods** exist, all **Running** and **Ready 1/1**.

Name	Status	Ready
iaf-core-operator-controller-manager-6f49767cf5-wbprc	Running	1/1
iaf-eventprocessing-operator-controller-manager-5789cc9dc7kbndp	Running	1/1
iaf-flink-operator-controller-manager-74f8b777c7-b59xn	Running	1/1
iaf-insights-engine-operator-controller-manager-85696cc4fbpdk8d	Running	1/1
iaf-operator-controller-manager-5dd5794bcf-csrx4	Running	1/1
ibm-common-service-operator-55c4ccb4f8-28pvz	Running	1/1
ibm-cp4a-operator-5c6cc8dc76-j8ltg	Running	1/1
ibm-cp4a-wfps-operator-controller-manager-7956c4ddb-mlhm5	Running	1/1
ibm-elastic-operator-controller-manager-575bb4d4bc-9xsv6	Running	1/1

Note: In different CP4BA versions, You may see more pods.

12. Change project to **ibm-common-services**.

A screenshot of the Red Hat OpenShift web interface. At the top, the Red Hat logo and "Red Hat OpenShift Container Platform" are visible. Below the header, there is a navigation bar with a user icon labeled "Administrator" and a dropdown menu. To the right of the navigation bar, it says "Project: ibm-common-services". The main content area is currently empty.

13. Verify that the following **11 pods** exist, all **Running** and **Ready (1/1)**.

Name	Status	Ready
P cert-manager-cainjector-8675784bcf-2r5ps	Running	1/1
P cert-manager-controller-6755757b54-n2fit	Running	1/1
P cert-manager-webhook-646584664f-v2995	Running	1/1
P ibm-cert-manager-operator-5d86cc85fb-zz79j	Running	1/1
P ibm-common-service-operator-7bb9f65c87-rzvb5	Running	1/1
P ibm-common-service-webhook-cf485867d-9wmbz	Running	1/1
P ibm-licensing-operator-79f9dc8c5-2dzk4	Running	1/1
P ibm-licensing-service-instance-7d9c8b7cb6-djkn4	Running	1/1
P ibm-namespace-scope-operator-7c7775489c-9ddww	Running	1/1
P operand-deployment-lifecycle-manager-7689f57598-kk9s8	Running	1/1
P secretshare-56f74798db-84fnw	Running	1/1

**Note:** You may see more or less pods. Important is that all are Running and Ready, none is any kind of error status or can't become ready.

#### 4.2.2 Install CP4BA

Now that the Operators are deployed, you can proceed with installing CP4BA.

1. Switch to the **Terminal** window
2. Open rapid deployment scripts `05-parametersForCp4ba.sh`, with `gedit`.

```
cd /cp4ba/cp4ba-rapid-deployment/cp4ba-21-0-3/mycluster/deployment-db2-cp4ba
```

```
gedit 05-parametersForCp4ba.sh
```

### 3. **Apply** the following changes:

- cp4baProjectName – Name of the project/namespace to use to deploy CP4BA, for example, ibm-cp4ba – make sure to use the same value as used before when running script cp4a-clusteradmin-setup.sh<sup>4</sup>

set the value to ibm-cp4ba

- cp4baTlsSecretName – Parameter for ROKS deployments on IBM Cloud only – as you are not deploying on ROKS, leave empty

remove the default value REQUIRED, and leave this parameter empty

- cp4baAdminPassword – Use the password for user cp4badmin (this user was for you created in the LDAP server).

set the value to passw0rd

- ldapAdminPassword – Use the password that was specified for cn=root when setting up LDAP

set the value to passw0rd

- ldapServer – The hostname or IP of the LDAP server

set the value to "10.0.0.5"

```
# OCP project name for CP4BA, for example ibm-cp4ba - make
cp4baProjectName=ibm-cp4ba

# TLS secret name - see also secret name in project ibm-ce
#   If this secret is not available, leave empty (but remove
cp4baTlsSecretName=

# Password for CP4BA Admin User (cp4baAdminName name see below)
cp4baAdminPassword=passw0rd

# Password for LDAP Admin User (ldapAdminName name see below)
ldapAdminPassword=passw0rd

# LDAP instance access information - hostname or IP
ldapServer="10.0.0.5"
```

- Scroll further down to the Storage Class Settings section and modify the storage classes to be used

change all four values to cp4ba-storage

---

<sup>4</sup> Please note that Kubernetes limits the name. So the name can only consist of lowercase characters, numbers and -, and it must not start or end with a -, so that it can also be used in URLs and hostnames.

```

# --- Storage Class Settings ---
cp4baScSlow=cp4ba-storage
cp4baScMedium=cp4ba-storage
cp4baScFast=cp4ba-storage
cp4baBlockScFast=cp4ba-storage

```

- Leave all other properties at their default values
- Save your changes and close the editor

**Note:** Before starting the deployment in the next step, we recommend checking whether the database and the LDAP server are reachable to avoid deployment problems. To do that, please refer to section [Checking the Availability of LDAP server and DB2](#).

4. Run script 07-createCp4baDeployment.sh. This script will now deploy CP4BA using the parameters you previously provided in 01-parametersForDb2OnOCP.sh and 05-parametersForCp4ba.sh .

```
./07-createCp4baDeployment.sh
```

#### Sample script output

```

./07-createCp4baDeployment.sh

Found 01-parametersForDb2OnOCP.sh.  Reading in variables from that script.
  Reading 01-parametersForDb2OnOCP.sh ...
Done!

Found 05-parametersForCp4ba.sh.  Reading in variables from that script.
  Reading 05-parametersForCp4ba.sh ...
Extracting OCP Hostname
OCPHostname set to apps.ocp.example.com
Done!

This script PREPARES and optionally CREATES the CP4BA deployment using template
ibm_cp4a_cr_template.002.ent.FoundationContent.yaml in project ibm-cp4ba.

Are 01-parametersForDb2OnOCP.sh and 05-parametersForCp4ba.sh up to date, and do you want to
continue? (Yes/No, default: No): Yes

Preparing the CP4BA deployment...

Switching to project ibm-cp4ba...
Already on project "ibm-cp4ba" on server "https://api.ocp.example.com:6443".

Collecting information for secret ibm-entitlement-key. For this, your Entitlement Registry key is
needed.

You can get the Entitlement Registry key from here: https://myibm.ibm.com/products-
services/containerlibrary

Enter your Entitlement Registry key: <paste your Entitlement Registry key here ONCE, it will not
be shown, then hit the Enter key>
Verifying the Entitlement Registry key...
Login Succeeded!
Entitlement Registry key is valid.

Copying jdbc for Db2 from Db2 container to local disk...
Now using project "ibm-db2" on server "https://api.ocp.example.com:6443".
tar: Removing leading '/' from member names
tar: Removing leading '/' from member names
Now using project "ibm-cp4ba" on server "https://api.ocp.example.com:6443".

Preparing the CP4BA secrets...

```

```

Preparing the CR YAML for deployment...

All artefacts for deployment are prepared.

Do you want to CREATE the CP4BA deployment in project ibm-cp4ba now? (Yes/No, default: No): Yes

Creating the CP4BA deployment...

Creating secret ibm-entitlement-key in project ibm-common-services...
Now using project "ibm-common-services" on server "https://api.ocp.example.com:6443".
secret/ibm-entitlement-key created
Now using project "ibm-cp4ba" on server "https://api.ocp.example.com:6443".
Done.

Copying the jdbc driver to ibm-cp4a-operator...
Done.

Creating CP4BA secrets...
secret/ldap-bind-secret created
secret/icp4a-shared-encryption-key created
secret/resource-registry-admin-secret created
secret/ibm-ban-secret created
secret/ibm-fncm-secret created
secret/icp4adeploy-bas-admin-secret created
secret/playback-server-admin-secret created
secret/icp4adeploy-workspace-aae-app-engine-admin-secret created
secret/ibm-adp-secret created
secret/ibm-bawaut-server-db-secret created
secret/ibm-pfs-admin-secret created
secret/ibm-bawaut-admin-secret created
Done.

Creating the CP4BA deployment...
icp4acluster.icp4a.ibm.com/icp4adeploy created
Done.

All changes got applied. Exiting...

```

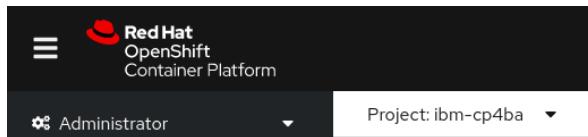
## 4.3 CP4BA Deployment Verification

The deployment of CP4BA might take some time, **usually about one hour**.

You can monitor the progress of the deployment either through the OpenShift Web Console in the Web Browser or by command line using the **oc get pods** command or monitor the Operator's logs to spot any potential issues, see the Troubleshooting section for more details about that.

**Note:** As part of the CP4BA deployment, additional operators are added to project ibm-common-services. Also, more pods are created there. You might see these new pods in various states indicating issues, but the operators usually resolve these issues automatically.

1. Change project to **ibm-cp4ba**.



2. You should see about **31 Running and Ready pods**, and about **10 Completed pods**, but no Pending / CrashLoopBackOff pods.

3. Change project to **ibm-common-services**.
4. You should see about **32 Running and Ready pods**, and about **5 Completed pods**, but no Pending / CrashLoopBackOff pods.

**Note:**

Some pods may be in Failed or Error state. For those, ensure another instance of that pod is in the Completed state. If this is the case, you can delete the Failed or Error pods. If there are pods in Failed or Error state where there is no other instance of that pod in a Completed state, the deployment is not healthy. Check the Troubleshooting chapter for help in resolving these issues.

In different CP4BA versions, You may see more pods.

## 4.4 Post Deployment Steps

Now that the CP4BA deployment is complete, you must apply some **post-deployment steps**.

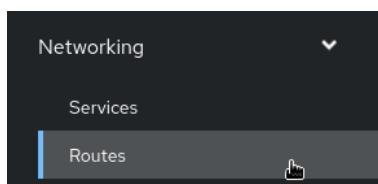
### 4.4.1 Enable log in with the users from LDAP

1. Get the user ID and password of the **zen admin user** by running those two commands:

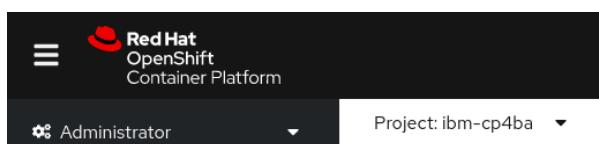
```
oc get secret ibm-iam-bindinfo-platform-auth-idp-credentials -o  
jsonpath='{.data.admin_username}' | base64 -d && echo  
  
oc get secret ibm-iam-bindinfo-platform-auth-idp-credentials -o  
jsonpath='{.data.admin_password}' | base64 -d && echo
```

**Note:** By default, the user id is **admin**.

2. Switch to your Web Browser tab with the OCP Web Console and select **Networking > Routes**.



3. If not on project **ibm-cp4ba**, switch to it.



## Routes

Name	Status	Location
cpd	Accepted	<a href="https://cpd-ibm-cp4ba.apps.ocp.example.com">https://cpd-ibm-cp4ba.apps.ocp.example.com</a>

4. In the **Location** column on the **cpd** Route, click on the URL to open the cpd route in a new tab.

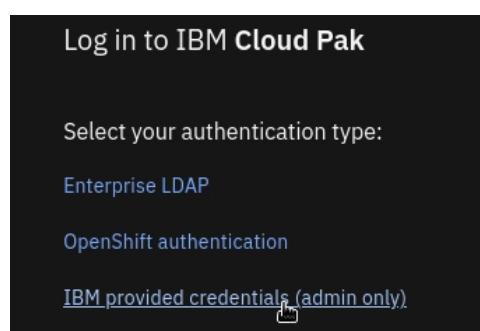
Name	Status	Location
cpd	Accepted	<a href="https://cpd-ibm-cp4ba.apps.ocp.example.com">https://cpd-ibm-cp4ba.apps.ocp.example.com</a>

5. Accept the self-signed certificates two times.

**Note:**

For deploying the CP4BA Cluster, properly signed certificates can be created, which don't raise security exceptions in the Web Browser. This requires having SSL Certificates from a Certificate Authority, which would be available, for example, in an OCP environment on IBM Cloud.

6. On the Log in to IBM Cloud Pak screen, select **IBM-provided credentials (admin only)**.



7. Log in using the **zen admin user credentials** you gathered in **Step 1**.

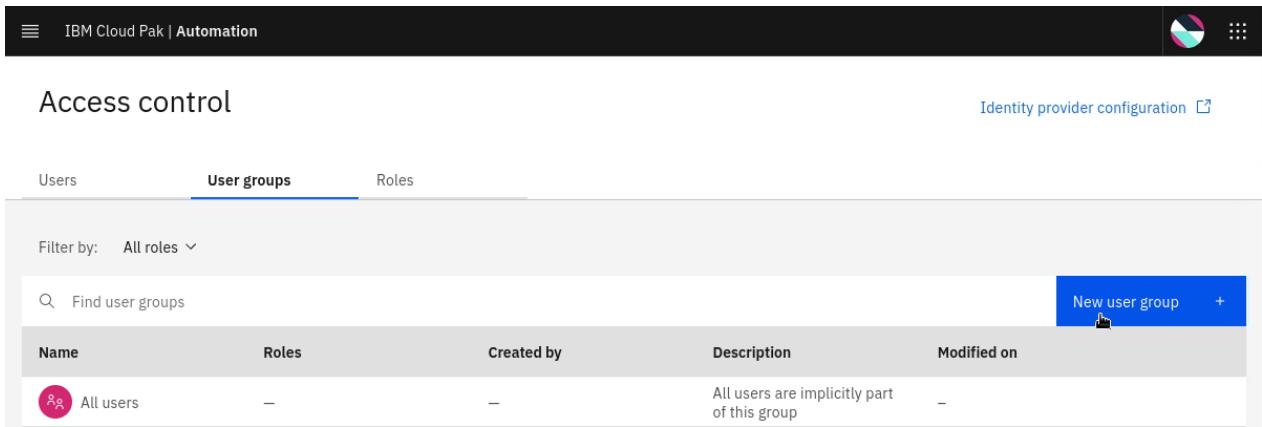
8. Click Manage users.

Welcome, admin!

**Manage users**   
Connect to your identity provider and specify who can access the platform.  
→

**Learn more**  
Explore documentation for the IBM Cloud Paks for Automation  


9. Select the **User groups** tab and click **New user group**.



The screenshot shows the 'Access control' section of the IBM Cloud Pak | Automation interface. The 'User groups' tab is active. At the top right, there is a 'New user group' button with a '+' icon. The main table lists one user group: 'All users'.

Name	Roles	Created by	Description	Modified on
All users	—	—	All users are implicitly part of this group	—

10. Enter the name **cp4bausers** and click **Next**.

11. On the Users page, select **Identity provider groups**, search for **cp4bausers**, select it and click **Next**.

**New user group**

Form groups of users to widely administer permissions.

<input type="radio"/> Details <input checked="" type="radio"/> <b>Users</b> <input type="radio"/> Roles <input type="radio"/> Summary	<p><b>Users</b></p> <p>Select users to be added to the user group. You can also add users or groups of users directly from your connected identity providers.</p> <p>Existing users      Identity provider users      <b>Identity provider grou...</b></p> <p>Selected 1 identity provider group</p> <p>Search for the identity provider groups you want to add to this user group.</p> <p>Find by group search field</p> <p>cn=cp4admins,dc=example,dc=com X</p>
<a href="#">Cancel</a> <a href="#">Back</a> <b>Next</b> 	

12. On the **Roles** page, select **Automation Developer** (needed for CP4BA, for example, to access BAStudio) and **User**, then click **Next**.

**New user group**

Form groups of users to widely administer permissions.

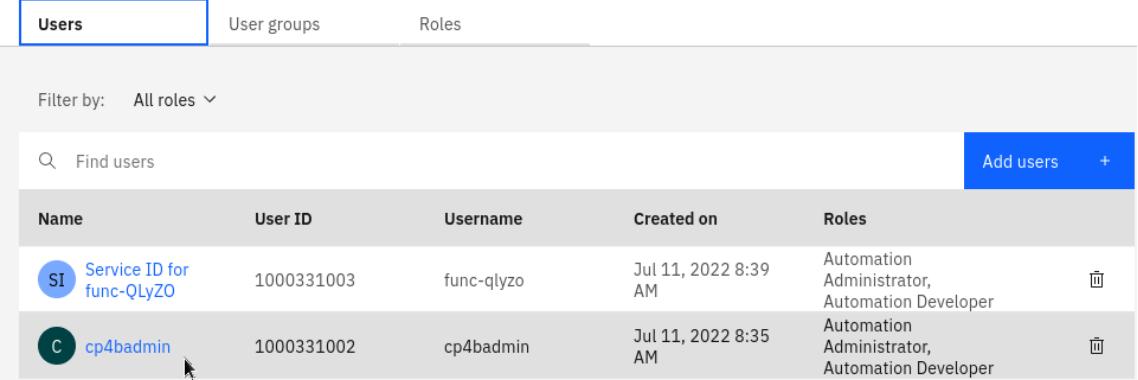
<input type="radio"/> Details <input type="radio"/> Users <input checked="" type="radio"/> <b>Roles</b> <input type="radio"/> Summary	<p><b>Roles</b></p> <p>Assign at least one role to this new user group. You can also <a href="#">create a new role</a> and return to this form.</p> <p>Find roles</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;"> <input type="checkbox"/> Administrator  <input type="checkbox"/> Automation Administrator  <input type="checkbox"/> Automation Analyst  <input checked="" type="checkbox"/> <b>Automation Developer</b>  <input type="checkbox"/> Automation Operator  <input checked="" type="checkbox"/> User         </td> <td style="padding: 5px;"> <b>Administrator</b>  <b>Description</b>            Administrator role  <b>Modified on</b>            Jul 11, 2022 8:23 AM  <b>2 permissions, 39 actions</b> <a href="#">Expand all</a>            Administer platform            Create service instances         </td> </tr> </table>	<input type="checkbox"/> Administrator <input type="checkbox"/> Automation Administrator <input type="checkbox"/> Automation Analyst <input checked="" type="checkbox"/> <b>Automation Developer</b> <input type="checkbox"/> Automation Operator <input checked="" type="checkbox"/> User	<b>Administrator</b> <b>Description</b> Administrator role <b>Modified on</b> Jul 11, 2022 8:23 AM <b>2 permissions, 39 actions</b> <a href="#">Expand all</a> Administer platform Create service instances
<input type="checkbox"/> Administrator <input type="checkbox"/> Automation Administrator <input type="checkbox"/> Automation Analyst <input checked="" type="checkbox"/> <b>Automation Developer</b> <input type="checkbox"/> Automation Operator <input checked="" type="checkbox"/> User	<b>Administrator</b> <b>Description</b> Administrator role <b>Modified on</b> Jul 11, 2022 8:23 AM <b>2 permissions, 39 actions</b> <a href="#">Expand all</a> Administer platform Create service instances		
<a href="#">Cancel</a> <a href="#">Back</a> <b>Next</b> 			

13. On the Summary page, review the selections and click **Create**.

14. Select the **Users** tab and click **cp4admin**.

## Access control

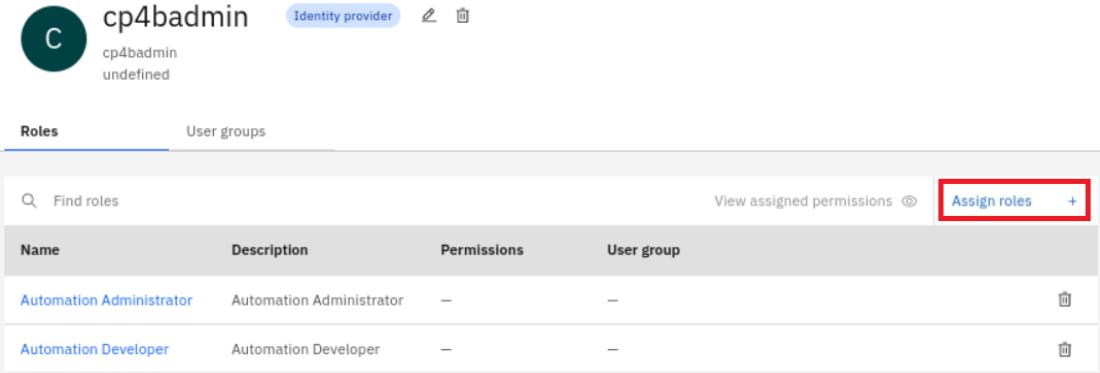
Identity provider configuration 



The screenshot shows the 'Users' tab selected in the top navigation bar. A search bar at the top right contains the placeholder 'Find users'. Below it is a table with columns: Name, User ID, Username, Created on, and Roles. Two users are listed:

Name	User ID	Username	Created on	Roles
SI Service ID for func-QLyZO	1000331003	func-qlzyo	Jul 11, 2022 8:39 AM	Automation Administrator, Automation Developer
cp4badmin	1000331002	cp4badmin	Jul 11, 2022 8:35 AM	Automation Administrator, Automation Developer

### 15. Click on Assign role

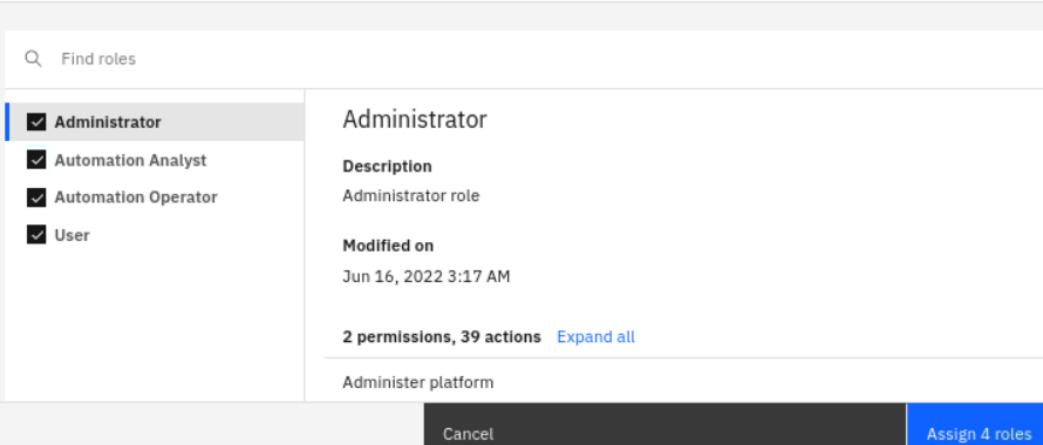


The screenshot shows the user profile for 'cp4badmin'. The 'Roles' tab is selected. At the top right, there is a 'View assigned permissions' link and a 'Assign roles' button, which is highlighted with a red box.

### 16. Select all roles and click **Assign 4 roles**.

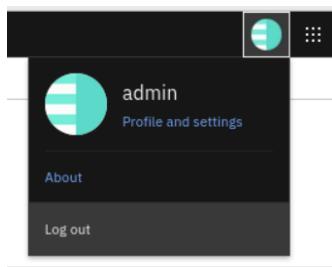
#### Assign roles

Extend this user's access by assigning additional roles.



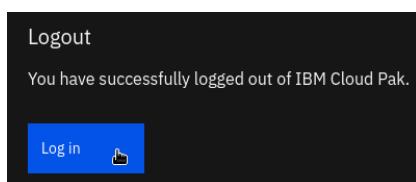
The screenshot shows the 'Assign roles' dialog. On the left, a sidebar lists roles with checkboxes:  Administrator,  Automation Analyst,  Automation Operator, and  User. The main area displays details for the 'Administrator' role, including its description ('Administrator role'), modified date ('Jun 16, 2022 3:17 AM'), and permission count ('2 permissions, 39 actions'). At the bottom, there are 'Cancel' and 'Assign 4 roles' buttons, with 'Assign 4 roles' also highlighted with a red box.

### 17. Log out with the zen admin user.

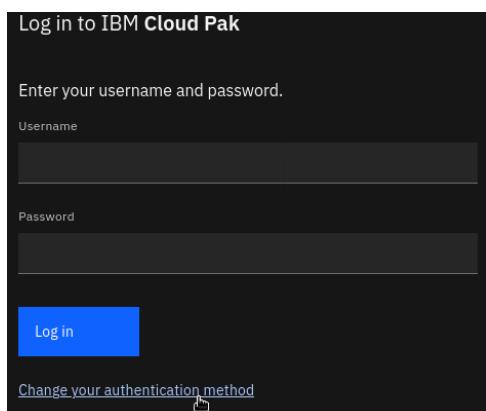


#### 4.4.2 Verify that LDAP users can log in

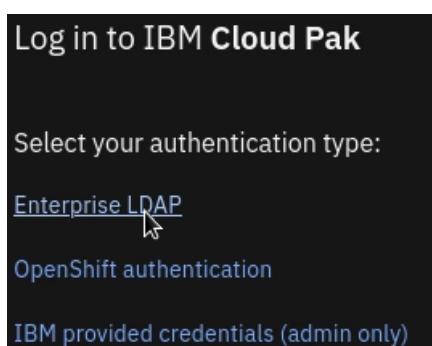
1. Click **Log in**.



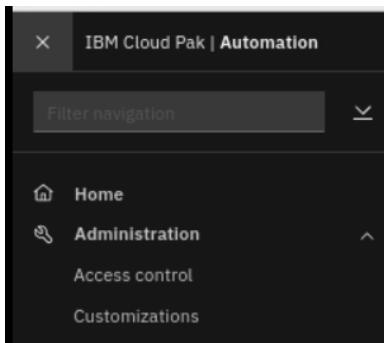
2. Select Change your authentication method



3. Select Enterprise LDAP.



4. Log in with **cp4badmin**, a user from LDAP. The password is **passw0rd**.
5. Verify that cp4admin now has full administrative access to zen: **cp4badmin** should also see the **Manage users** option and, in the hamburger menu, the entry **Administration**.

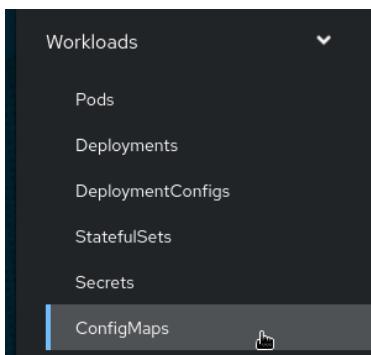


#### **4.4.3 Verify that the deployed CP4BA components function correctly**

We will gather the cluster's URLs from config map `icp4adeploy-cp4ba-access-info` and test that all URLs work.

1. Switch to the **OpenShift Web Console**

2. Select **Workloads > ConfigMaps**



3. Search for **icp4adeploy-cp4ba-access-info**.

Name
<a href="#">icp4adeploy-cp4ba-access-info</a>

4. Click **icp4adeploy-cp4ba-access-info** to open this config map.
5. Scroll down to the **Data > cpe-access-info** section.
6. In a new Web Browser tab, open the URL for **Content Platform Engine administration**

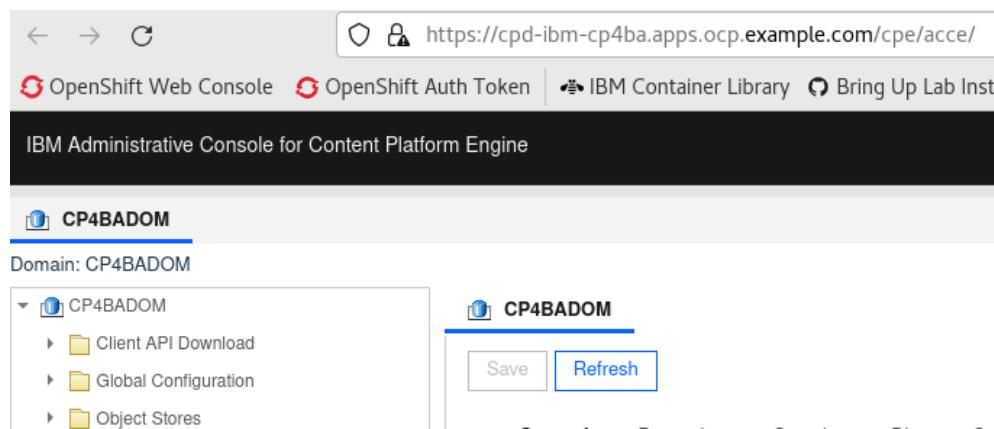
Project: ibm-cp4ba ▾

**cpe-access-info**

Content Platform Engine administration: <https://cpd-ibm-cp4ba.apps.ocp.example.com/cpe/acce/>  
Content Platform Engine health check: <https://cpe-ibm-cp4ba.apps.ocp.example.com/cpe/health>  
Content Platform Engine ping page: <https://cpe-ibm-cp4ba.apps.ocp.example.com/FileNet/Engine>

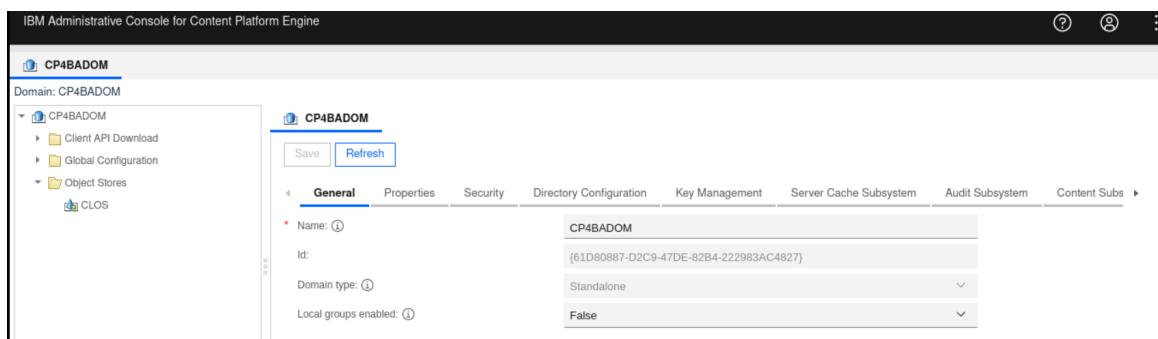


**Note:** As you are already logged in as **cp4badmin**, the **ACCE** will show up.



The screenshot shows the IBM Administrative Console for Content Platform Engine. The URL in the browser is <https://cpd-ibm-cp4ba.apps.ocp.example.com/cpe/acce/>. The page title is "IBM Administrative Console for Content Platform Engine". The left sidebar shows a tree view with "CP4BADOM" expanded, showing "Client API Download", "Global Configuration", and "Object Stores". The main panel shows "CP4BADOM" selected with "Save" and "Refresh" buttons. The right sidebar shows "Domain: CP4BADOM".

7. Expand **Object Stores** and verify **CLOS** is available.

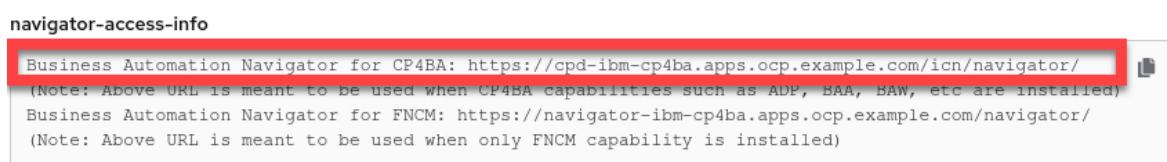


The screenshot shows the "General" tab of the "Object Stores" configuration for "CLOS". The "Name" field is set to "CP4BADOM". The "Id" field contains the value "(61D80887-D2C9-47DE-82B4-2229B3AC4827)". The "Domain type" is set to "Standalone". The "Local groups enabled" field is set to "False".

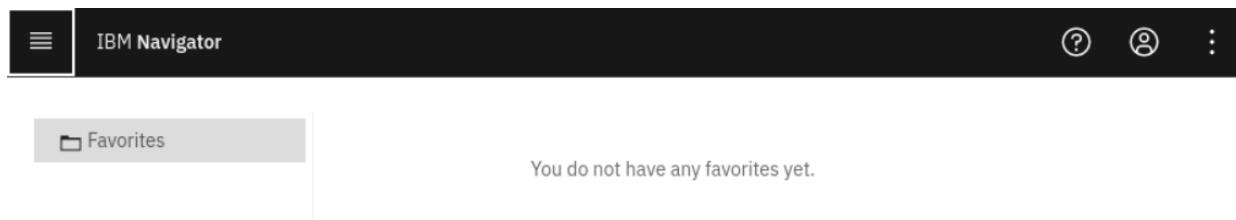
8. Switch back to OpenShift Web Console
9. Locate Business Automation Navigator for CP4BA URL in navigator-access-info section

**navigator-access-info**

Business Automation Navigator for CP4BA: <https://cpd-ibm-cp4ba.apps.ocp.example.com/icn/navigator/>  
(Note: Above URL is meant to be used when CP4BA capabilities such as ADP, BAA, BAW, etc are installed)  
Business Automation Navigator for FNMC: <https://navigator-ibm-cp4ba.apps.ocp.example.com/navigator/>  
(Note: Above URL is meant to be used when only FNMC capability is installed)



10. In a new tab, open Business Automation Navigator for CP4BA URL



The screenshot shows the IBM Navigator interface. At the top, there is a dark header bar with the "IBM Navigator" logo on the left and three icons on the right: a question mark, a user profile, and a three-dot menu. Below the header is a light gray navigation bar with a folder icon and the text "Favorites". To the right of the navigation bar, a message states "You do not have any favorites yet.".

**Note:** The hamburger menu provides you access to some other desktops.

11. Similarly, verify the following two URL pages

- Content Management Interoperability Services for CP4BA (log in with cp4badmin / passw0rd)
- Content Services GraphQL

## 5 Summary

You have completed this exercise and learned how to leverage the CP4BA rapid deployment scripts to install CP4BA on an OCP cluster.

**Congratulations on completing this Lab!**

### 5.1 About CP4BA Rapid Deployment Scripts

The CP4BA rapid deployment scripts (<https://github.com/IBM/cp4ba-rapid-deployment>) are accessible by customers, business partners, and IBMers. The IBM Automation SWAT team continuously maintains them. Feel free to use them.

If you like to deploy one of the larger templates on your cluster, the differences from what you have just done are:

- Planning: Check out Step 0 (<https://github.com/IBM/cp4ba-rapid-deployment/blob/main/cp4ba-21-0-3/00selectTemplate.md>) to understand which templates are available and what their requirements in terms of the number of workers and resources are. Larger templates will require a larger OpenShift cluster with more worker nodes, CPU, and memory. Creating your template is also possible.
- If you want to create a cluster on IBM Cloud, make sure you have or create an account there (<https://github.com/IBM/cp4ba-rapid-deployment/blob/main/cp4ba-21-0-3/01createIBMCLOUDAccount.md>).
- You will need your own Red Hat OpenShift cluster, for example, on IBM Cloud, with funding for hosting the infrastructure. Check out how easy it is to create a new ROKS cluster on IBM Cloud here: <https://github.com/IBM/cp4ba-rapid-deployment/blob/main/cp4ba-21-0-3/02createRedHatOpenShiftCluster.md>.
- You need your LDAP. If there is no existing one, to set up your own LDAP on IBM Cloud is documented here: <https://github.com/IBM/cp4ba-rapid-deployment/blob/main/cp4ba-21-0-3/03createVMForLDAP.md>.
- If required, you will need to get for DB2 the DB2 Standard Edition license key (PPA or XL SW, search for part number CC36WML), and you need to assign more resources to your DB2 deployment (see additional parameters in **01-parametersForDb2OnOCP.sh**).
- After the CP4BA deployment, there are more post-deployment steps to be applied. Also, you might want to install other components like IBM Process Mining and the ADS ML Service... and scale up your deployment for High Availability. All this is documented in the rapid deployment GitHub.
- Once the installation is complete and you have selected the ClientOnboarding template, you might want to import the Client Onboarding Solution. See also <https://github.com/IBM/cp4ba-client-onboarding-scenario>

### 5.2 Optional Exercises

If you like, you can also complete the Troubleshooting CP4BA exercise.

# 6 Troubleshooting CP4BA

## 6.1 Introduction

When you finish the previous exercise, you are ready for deployment. However, you might have run into troubles or might be interested in how to further troubleshooting can be made for the deployment of a Cloud Pak 4 Business Automation deployment. Also, during the exercises above, you might have been referred to one or more of the sections in this chapter for troubleshooting problems, or checking the availability of components.

## 6.2 Determining Deployment Status of the CP4BA Cluster

This section shows how you can check the correct installation of the various parts of the CP4A deployment steps. Use it as a guide to check where you are with the deployment and whether anything failed to install.

First, performing any action while the Openshift cluster is being upgraded should be avoided. Therefore, before running any other task, determine if the Openshift cluster is currently being upgraded, and perform the following steps:

1. Open the Browser and use the bookmark to log in to the Openshift Web Console. Login using **ocpadmin / passw0rd**.
2. On the left navigation bar open the section **Compute** and select **Machine Config Pools**.
3. Verify on the right side if you see **true** on the column **Updating**.

MachineConfigPools						<a href="#">Create MachineConfigPool</a>
Name	Configuration	Updated	Updating	Paused	Degraded	
MCP master	MC rendered-master-584151c17b3083993a19ae1f1de c3c07	True	False	False	False	⋮
MCP worker	MC rendered-worker-3e5e6faa5f3bc8944dcac7f6ea 0d978c	True	False	False	False	⋮

To determine if the DB2 Operator is currently being installed or the DB2 cluster is being configured to the following:

1. Open the Browser and use the bookmark to log in to the Openshift Web Console. Login using **ocpadmin / passw0rd**.
2. On the left navigation bar, open the **Operators** section and select **Installed Operators**.

3. Then select the project **ibm-db2**. The IBM DB2 Operator should be there and show **Status Succeeded**. If that's not the case, it might still be installed.

Name	Managed Namespaces	Status	Last updated	Provided APIs
IBM Db2	NS ibm-db2	<span>✓ Succeeded</span> <a href="#">Upgrade available</a>	3 minutes ago	Db2u Cluster Db2u Hadr Db2u Helm Migration

4. Then open the DB2 Operator, and scroll to the bottom of the **Details** tab. At the bottom of it you should see the following if the Operator is already fully installed:

Installing	True	⌚ 6 minutes ago	InstallSucceeded	waiting for install components to report healthy
Installing	True	⌚ 6 minutes ago	InstallWaiting	installing: waiting for deployment db2u-operator-manager to become ready: deployment "db2u-operator-manager" waiting for 1 outdated replica(s) to be terminated
Succeeded	True	⌚ 4 minutes ago	InstallSucceeded	install strategy completed with no errors

5. When the DB2 Operator is completely installed, the next step would be to install a DB2 database server. To check the DB2 Status using the DB2 Operator, go to the **All instances** tab and verify the Status of the db2 cluster. When the DB2cluster is deployed, the state should show as **Ready**, as here:

Project: ibm-db2

Installed Operators > Operator details

IBM Db2 1.1.9 provided by IBM Actions ▾

Details YAML Subscription Events All instances Db2u Cluster Db2u Hadr Db2u Helm Migration

Create new ▾

Filter ▾ Name ▾ Search by name... ▾

Name	Kind	Status	Labels	Last updated
DC db2cluster	Db2uCluster	State: ✓ Ready	No labels	⌚ Jun 23, 2022, 9:25 AM

6. When the db2cluster is successfully deployed, the DB2 installation script `02-createDb2OnOCP.sh` will not terminate immediately, as it is still configuring the database server and removing the default BLUDB database. Before you suspend the cluster, wait for that to complete too.
7. The next step is the database creation script. That's not completed as long as the script is still running.

After the setup of the DB2 Operator, the DB2 Cluster, and the DB2 Databases, you can deploy CP4BA Operator using the clusteradmin-setup script. When the clusteradmin script terminates, the CP4BA Operators might not yet be fully installed. Please check:

1. Open the Web Browser and use the bookmark to log in to the Openshift Web Console. Login using **ocpadmin / passw0rd**.
2. On the left navigation bar, open the **Operators** section and select **Installed Operators**. Then select the project **ibm-cp4ba**.
3. Check that all of the operators show Status **Succeeded** as indicated below:

Project: ibm-cp4ba ▾

Installed Operators are represented by ClusterServiceVersions within this Namespace. For more information, see the [Understanding Operators documentation](#). Or create an Operator and ClusterServiceVersion using the [Operator SDK](#).

Name	Managed Namespaces	Status	Last updated	Provided APIs
 IBM Automation Foundation Core 1.3.7 provided by IBM	NS ibm-cp4ba	 Succeeded Up to date	8 minutes ago	Automation UIConfig Cartridge
 IBM Automation Foundation Insights Engine 1.3.6 provided by IBM	NS ibm-cp4ba	 Succeeded Up to date	Jun 23, 2022, 10:08 AM	InsightsEngine
 IBM Automation Foundation 1.3.7 provided by IBM	NS ibm-cp4ba	 Succeeded Up to date	8 minutes ago	AutomationBase CartridgeRequirement
 IBM Cloud Pak foundational services 3.19.0 provided by IBM	NS ibm-cp4ba	 Succeeded Up to date	Jun 23, 2022, 10:06 AM	CommonService
 IBM Cloud Pak for Business Automation 21.3.9 provided by IBM	NS ibm-cp4ba	 Succeeded Up to date	Jun 23, 2022, 10:05 AM	CP4BA deployment

4. Then switch to the **ibm-common-services** project, and check there too, that all of the installed operators are completely deployed too.

After you start the deployment of the CP4BA cluster by running the script `07-createCp4baDeployment.sh`, the deployment of the OpenShift cluster will be performed by the Cloud Pak for Business Automation Operator. You can determine if the Operator finished the deployment by checking as follows:

1. Open the Browser and use the bookmark to log in to the Openshift Web Console. Login using **ocpadmin / passw0rd**.
2. On the left navigation bar, open the **Home** section and select **Search**. Then select the project **ibm-cp4ba**. Click on the **Resources** to get a pull-down menu for selecting the Kubernetes Resource to search for.

Project: ibm-cp4ba ▾

Search

Resources  Label app=frontend

Select Resource

-  APIS config.openshift.io/v1
-  APIS

3. Type **ICP4ACluster** into the textbox, and click on the name once it appears. The search should show one result object named **icp4adeploy**. This is the resource representing the installed CP4BA cluster. Click on the name, and scroll to the bottom of the **Details** tab. The CP4BA deployment is complete when it shows the following:

Type	Status	Updated	Reason	Message
Running	True	Jun 14, 2023, 11:11 AM	Running	Running reconciliation
ReconciliationSuccess	True	Jun 14, 2023, 11:11 AM	Successful	-

When you reach this state, you can continue with the post-deployment steps.

## 6.3 Check Health of CP4BA Installation

During the installation of CP4BA you can check the health of various resources created by the CP4BA operator to understand the installation's state better and help you triage issues found along the way. These steps should be run from the bastion host.

1. Go to the OpenShift project where CP4BA is installed. This is the same project specified in the `cp4baProjectName` variable inside the `05-parametersForCp4ba.sh` script.

```
# If you use a project name other than ibm-cp4ba you must use that instead of ibm-cp4ba
oc project ibm-cp4ba
```

2. Check the Status of the Automation Foundation Core services. These services must be deployed before any of the CP4BA components are deployed. If the deployment of these services fails, the overall CP4BA installation will fail. First, we can check the `AutomationUIConfig` resource. This resource can help you determine if Zen services, the services responsible for providing UI capabilities for CP4BA, have been deployed correctly.

```
# Check AutomationUIConfig Status
oc get AutomationUIConfig iaf-system
```

Output:  
NAME READY  
iaf-system True

Zen services were deployed correctly if the command output shows `True` under the `READY` column. If the output shows `False` under the `READY` column, either the services are still being deployed or there are issues with the deployment. You can gain additional insight on the deployment by getting the complete details for the `AutomationUIConfig` resource.

```
# Get details of AutomationUIConfig
oc describe AutomationUIConfig iaf-system
```

If the `READY` state for this resource gets stuck on `False`, the first thing to look at are the logs produced by the Zen Operator located in the `ibm-common-services` project.

```
# Get full logs for Zen operator
oc logs -n ibm-common-services $(oc get pods -n ibm-common-services | grep zen-operator | awk '{print $1}')

# If you rather you can follow the Zen operator logs
oc logs -f -n ibm-common-services $(oc get pods -n ibm-common-services | grep zen-operator | awk '{print $1}')
```

3. Check the Cartridge resource status. This is another way to get the Status of the Automation Foundation Core services. A cartridge is a module or extension required by CP4BA. The Status of the base Cartridge resource can be checked with the following commands:

```
# Check Cartridge status
oc get Cartridge icp4ba
```

Output:  
NAME READY  
icp4ba True

When the Automation Foundation Core services deploy properly, the READY Status for this resource is set to True. You can gain additional insights into the Cartridge resource by running the following command:

```
# Check Cartridge status  
oc describe Cartridge icp4ba
```

On successful deployments the Conditions section of this resource should show three different checks all with a Status set to True.

If the Status of this resource remains False during the installation or if error messages are available, the automation foundation core operator logs are an excellent place to start looking for answers.

```
# Get automation foundation core logs  
oc logs $(oc get pods | grep iaf-core-operator | awk '{print $1}')
```

4. Check the Status of the ICP4ACluster resource. The CP4BA Operator manages this custom resource. It contains the overall Status of the CP4BA installation and the individual deployment status for each of the CP4BA components deployed. To get the details on the ICP4ACluster resource, run the following command:

```
# Get details of ICP4ACluster resource  
oc describe icp4acluster icp4adeploy
```

The individual deployment status for CP4BA components can be found under the Status section of the command output. For example, to see the deployment status of the Content Platform Engine, which is part of the template installed in this Lab, look for the Cpe stanza. Components that have been properly deployed show as Ready or Successful, as listed in the snippet below.

```
Cpe:  
  Cpe Deployment:      Ready  
  Cpe JDBC Driver:    Ready  
  Cpe Route:          Ready  
  Cpe Service:        Ready  
  Cpe Storage:        Ready  
  Cpe Zen Integration: Ready
```

It is essential to understand that the Status section is dynamically populated as the CP4BA operator makes progress with the installation. Hence the Status section for specific components of CP4BA will not be populated until the Operator tries to install the specific component.

When failures occur during the deployment of CP4BA components, errors are reported via the component-specific status section of the ICP4ACluster resource. In those cases, you should look at the pods and logs for the failing component to better understand the failure. You can also inspect the CP4BA Operator Logs. See the Inspect CP4BA Operator Logs for additional details.

## 6.4 Inspect CP4BA Operator Logs

The following steps show you how to inspect the CP4BA Operator logs. These logs are the first place to look when problems are found during the CP4BA Installation. The CP4BA Operator produces two types of log: the standard out/error from the Oprstopr itself and by the operator framework. Both are stored in the container's filesystem. In our experience, the second type of log is more useful, but we will show you how to look at both. These steps should be run from the bastion host.

To get the logs produced by the standard out/error of the CP4BA operator, do the following:

1. Go to the OpenShift project where CP4BA is installed. This is the same project specified in the cp4baProjectName variable inside the 05-parametersForCp4ba.sh script.

```
# If you use a project name other than ibm-cp4ba you must use that instead of ibm-cp4ba
oc project ibm-cp4ba
```

2. Use the oc logs command to get the standard out/error from the operator pod.

```
# Get full set of log entries from CP4BA operator pod
oc logs $(oc get pods | grep cp4a-operator | awk '{print $1}')

# If you rather follow the logs
oc logs -f $(oc get pods | grep cp4a-operator | awk '{print $1}')
```

To get logs produced by the operator framework:

1. Carefully inspect the date and time of each file, all called stdout, listed by the command below, and copy the full path of the file you want to inspect. Typically, you want to look at the Operator's current file, the file with the latest date and time in the list. This step can be a little cumbersome if the stdout file generated by the operator framework has rolled over multiple times.

```
oc exec $(oc get pods | grep cp4a-operator | awk '{print $1}') -- sh -c "ls -ltrR /tmp/ansible-operator/runner/icp4a.ibm.com/v1/ICP4ACluster/ibm-cp4ba/icp4adeploy/artifacts/*/stdout"
```

2. Once you have the full path of the stdout file to be inspected, use it to copy or inspect the file's content.

```
# Set the value of the STDOUT_PATH variable to the path of the stdout file that you want to inspect
STDOUT_PATH=<stdout path here>

# Copy the file to the bastion host if you want the full log
oc cp $(oc get pods | grep cp4a-operator | awk '{print $1}'): ${STDOUT_PATH}/cp4a-operator.log

# If you rather follow the file
oc exec $(oc get pods | grep cp4a-operator | awk '{print $1}') -- tail -f ${STDOUT_PATH}
```

When trailing the stdout file, you can see color-coded messages. Look out for red as a sign of trouble. You can also search for "error" or "fail" strings (make the search case insensitive) when looking for errors.

## 6.5 Inspecting and Restarting Jobs on Error

As previously stated in the lab instructions, all pods responsible for executing job tasks should go into Completed Status. Sometimes these pods might end up in an Error state, but eventually, another pod instance is automatically created to retry the failed task. When a subsequent pod for the same job goes to the Completed state, the task required by the job is completed, and the previous pod in the Error state can be deleted. There are times when every automatic attempt to complete a job fails. In these situations, you can look at the logs for the failing pod, correct the issues when possible, and manually restart the job so that the required installation task can be completed. The following steps show you how to inspect the logs of a failed pod and restart the job. These steps must be run from the bastion host.

1. Get the logs from the failed pod. You will need the name of the pod to run this command.

```
# Replace <pod-name> with the name of the failing pod.  
oc logs <pod-name>
```

2. Once you have corrected the issue, you can restart the job with the following commands:

```
# Replace <pod-name> with the name of the failing pod.  
export POD_NAME=<pod-name>  
  
# Get name of the job that initialized the pod.  
export JOB_NAME=$(oc get pod $POD_NAME -  
o=jsonpath='{.metadata.ownerReferences[?(@.kind=="Job")].name}')  
  
# Restart the job  
oc get job $JOB_NAME -o json | jq 'del(.spec.selector)' | jq  
'del(.spec.template.metadata.labels)' | oc replace --force -f -
```

## 6.6 Inspecting Individual Pod Health

All pods, other than pods that run job tasks, deployed by the CP4BA operator should go into a Running state, and all containers running within should report as ready. When issues arise during installation, you might find one or more pods stuck on Pending, Init, Error, or other states. These pods might require further inspection to determine issues. To determine the pod's health and find the root cause of the problem, you can run the commands listed below. These steps must be run from the bastion host.

1. Verify the current state of the pod

```
# Replace <pod-name> with the name of the pod you are inspecting.  
oc get pod <pod-name>
```

If the STATUS column shows Running and the READY column shows 1/1, 2/2, or 3/3, etc., the pod is in a healthy state. If the pod STATUS column is stuck in any other state than Running or if the READY column never goes to an equal number above and below the / character, then the pod might be having trouble starting or staying up, and you need to inspect the pod further.

2. Look at the details of the pod to see if any events might be showing errors. This could happen, for example, when a pod is waiting for storage to be provisioned, but OpenShift cannot obtain it from the storage providers. You can see the events associated with a pod by inspecting the Events section available in the full description of the pod.

```
# Replace <pod-name> with the name of the pod you are inspecting.  
oc describe pod <pod-name>
```

3. If further analysis is needed, you might have to look at the logs for each container running as part of the pod.

```
# If the pod is running a single container, you can run the following command.
```

```
# Replace <pod-name> with the name of the pod you are inspecting.  
oc logs <pod-name>
```

```
# If the pod is running more than one container use the -c option to specify the container.
```

```
# Replace <pod-name> with the name of the pod you are inspecting.
```

```
# Replace <container-name> with the name of the container to get the logs from.
```

```
# To get the container names by first running the command without the -c option
```

```
oc logs <pod-name> -c <container-name>
```

4. Sometimes restarting a pod fixes the problem without having to make any changes.

```
# Restart a pod. Replace <pod-name> with the name of the pod you want to restart.
```

```
oc delete pod <pod-name>
```

After running this command, the pod will restart automatically or, in rare cases will be eventually recreated by the CP4BA operator.

## 6.7 Clean CP4BA Failed Installation

Follow the steps below to clean up a failed CP4BA installation. These steps should be run from the bastion host. Depending on where the failure occurred, one or more of the following commands might fail because the removed resource does not exist. Failures stating that resource does not exist are OK.

1. Go to the OpenShift project where CP4BA is installed. This is the same project specified in the cp4baProjectName variable inside the 05-parametersForCp4ba.sh script.

```
# If you use a project name other than ibm-cp4ba you must use that instead  
ibm-cp4ba  
oc project ibm-cp4ba
```

2. Run the 98-deleteCp4baDeployment.sh script to clean up the installation. This script will remove all the resources deployed by the CP4BA installation.

```
# Go to your rapid deployment scripts directory  
cd /cp4ba/cp4ba-rapid-deployment/cp4ba-21-0-3/mycluster/deployment-db2-  
cp4ba  
  
# Run script  
./98-deleteCp4baDeployment.sh
```

If you are planning to install the CP4BA again, make sure that you have dropped and recreated the Databases by running the 99-dropCp4baDBs4Db2OnOCP.sh and 03-createCp4baDBs4Db2OnOCP.sh found on the rapid deployment scripts directory.

## 6.8 Clean Failed DB2 installation

Follow the steps below to clean up a failed DB2 installation. These steps should be run from the bastion host. Depending on where the failure occurred, one or more of the commands provided below might fail because the resource being removed does not exist. Failures stating that resource does not exist are OK.

1. Go to the OpenShift project where DB2 is installed. This is the same project specified in the db2OnOcpProjectName variable inside the 01-parametersForDb2OnOCP.sh script.

```
# If you use a project name other than ibm-db2 you must use that instead  
ibm-db2  
oc project ibm-db2
```

2. Delete the instance of the DB2 cluster created.

```
oc delete Db2uCluster db2ucluster
```

Expected output:

```
db2ucluster.db2u.databases.ibm.com "db2ucluster" deleted
```

3. Delete the instance of the DB2 operator subscription created

```
oc delete subscription db2u-operator
```

Expected output:

```
subscription.operators.coreos.com "db2u-operator" deleted
```

4. Delete the instance of the DB2 Operator created

```
oc delete csv $(oc get csv --no-headers | awk '{print $1}')
```

Expected output:

```
clusterserviceversion.operators.coreos.com "db2u-operator" deleted
```

5. Wait for all PODs to be removed from the DB2 project.

```
oc get pods
```

Expected output:

```
No resources found in ibm-db2 namespace.
```

6. Delete the project where DB2 was installed. This step could take a couple of minutes.

```
# If you use a project name other than ibm-db2 you must use that instead ibm-db2  
oc delete namespace ibm-db2
```

Expected output:

```
namespace "ibm-db2" deleted
```

Once these steps are completed, you can try the DB2 installation once again.

## 6.9 Delete Single Database Manually

The following steps show how you can gain access to the container where DB2 is running and delete a database manually using the DB2 command line. These steps should be run from the bastion host. This section will show you how to delete the sample database that comes with the DB2 installation called BLUDB.

1. Go to the OpenShift project where DB2 is installed. This is the same project specified in the db2OnOcpProjectName variable inside the `01-parametersForDb2OnOCP.sh` script.

```
# If you use a project name other than ibm-db2 you must use that instead ibm-db2
oc project ibm-db2
```

2. Use the oc command to access the container where DB2 is running.

```
# Access DB2 container
oc rsh -c db2u c-db2ucluster-db2u-0
```

You should see the following command prompt (or similar) once inside the container:  
sh-4.2\$

3. Change user to db2inst1, the default DB2 user created by the install scripts.

```
# Run the su command inside of the db2 container
su - db2inst1
```

4. Use the DB2 command line to delete the BLUDB

```
db2 drop database BLUDB
```

Expected output:

```
DB20000I  The DROP DATABASE command completed successfully.
```

5. Exit the session as db2inst1

```
# Run exit command to go back to DB2 container as default user
exit
```

6. Exit the DB2 container

```
# Run exit command to exit the DB2 container and go back to bastion
exit
```

## 6.10 Checking the Availability of LDAP server and DB2

This step can be done to verify that the automatically started LDAP and the DB2 server can be reached from the CP4BA cluster. You can apply the step after the `cp4ba-clusteradmin-setup.sh` script has been completed, and the Cloud Pak for Business Automation operator is running. To prepare, use the following steps:

1. In a **Terminal** window, run this command to determine the **IP address** and **port number** of the LDAP server, note down the values obtained for later:

```
cd /cp4ba/cp4ba-rapid-deployment/cp4ba-21-0-3/mycluster/deployment-db2-cp4ba  
egrep -i 'ldapServer|ldapPort' 05-parametersForCp4ba.sh
```

2. Open **Firefox** and use the bookmark to log in to the **OpenShift Web Console**. Login using **ocpadmin / passwOrd**.
3. In the navigation bar, open **Workloads** and select **Pods**. Set the Project name to **ibm-cp4ba**, then write **ibm-cp4a-operator** into the filter box below the project name. That should narrow down the pods to just one or two. Click on the pod name, which starts with **ibm-cp4a-operator**.

The screenshot shows the OpenShift Web Console interface. At the top, there's a dropdown menu with a red circle '1' over it, set to 'ibm-cp4ba'. Below it is a search bar with a red circle '2' over it, containing the text 'ibm-cp4a-operator'. Underneath the search bar is a filter button and a 'Clear all filters' link. The main area is titled 'Pods' and lists two pods in a table. The first pod, 'ibm-cp4a-operator-7995f9b66-7cvv5', has a red circle '3' over its name. The second pod, 'ibm-cp4a-wfps-operator-controller-manager-dcb5bb677-ctpnj', is also listed.

Name	Status	Read
ibm-cp4a-operator-7995f9b66-7cvv5	Running	1/1
ibm-cp4a-wfps-operator-controller-manager-dcb5bb677-ctpnj	Running	1/1

4. On the resulting window with information about the cp4a operator pod, click on the **Terminal** tab. To check for the availability of the LDAP server, run this command. Please replace <ldap server name> and <ldap server port> with the information obtained earlier:

```
curl -v telnet://<ldap server name>:<ldap server port>
```

```
sh-4.4$ curl -v telnet://10.0.0.5:389  
* Rebuilt URL to: telnet://10.0.0.5:389/  
*   Trying 10.0.0.5...  
* TCP_NODELAY set  
* Connected to 10.0.0.5 (10.0.0.5) port 389 (#0)  
^C  
sh-4.4$
```

5. When it shows **Connected**, the LDAP server can be reached from inside the OpenShift cluster. If you get nothing, then no connection can be made. For example, that might be the case if the LDAP server could not be automatically started properly when bastion host started. Abort the command by pressing **CTRL-C**. The CTRL key might have a different caption on your keyboard.
6. An alternative method would, e.g., run a different command like **ldapsearch**. The form stated below would use anonymous access to the LDAP server. Take attention as it would list the complete content of the LDAP server, which might be very long in a production LDAP with many users and groups:

```
ldapsearch -x -b dc=example,dc=com -H ldap://<ldap server ip address> | tail
```

```
sh-4.4$ ldapsearch -x -b dc=example,dc=com -H ldap://10.0.0.5 | tail
objectclass: groupOfNames
objectclass: top
member: cn=cp4badmin,dc=example,dc=com

# search result
search: 2
result: 0 Success

# numResponses: 205
# numEntries: 204
```

7. If you have issues connecting to SDS, use the following procedure to **manually stop and start it again**:
8. On VM 0, start a Terminal and then stop SDS using command:

```
sudo /opt/ibm/ldap/V6.4/sbin/idsslapd -I ldap1 -k
```

When prompted to enter the password, enter **passw0rd** (where the third-last character is a zero)

9. Switch to user **ldap1** and stop DB2:

```
su - ldap1
```

When prompted to enter the password, enter **passw0rd** (where the third-last character is a zero)

```
db2stop
```

10. Start DB2 again and exit user **ldap1**:

```
db2start
```

```
exit
```

11. Start SDS again using command:

```
sudo /opt/ibm/ldap/V6.4/sbin/idsslapd -I ldap1
```

12. Once the LDAP server is started, repeat the above steps to verify you can connect from the CP4BA operator to SDS.

13. Testing connection to the **DB2 server** can be useful, as network policies might inhibit the connection between the pods in the OCP cluster. For addressing the DB2 server, the OCP service name of DB2 would be **c-db2ucluster-db2u-engn-svc**. After that comes the **OCP project name** and the keyword **svc**. The name is resolved to an IP address by a name server which is part of the OCP cluster.

```
curl -v telnet://c-db2ucluster-db2u-engn-svc.ibm-db2.svc:50000
```

```
sh-4.4$ curl -v telnet:// c-db2ucluster-db2u-engn-svc.ibm-db2.svc:50000
* Bad URL
* Closing connection -1
curl: (3) Bad URL
* Rebuilt URL to: c-db2ucluster-db2u-engn-svc.ibm-db2.svc:50000/
*   Trying 172.30.201.118...
* TCP_NODELAY set
* Connected to c-db2ucluster-db2u-engn-svc.ibm-db2.svc (172.30.201.118) port 50000 (#0)
> GET / HTTP/1.1
> Host: c-db2ucluster-db2u-engn-svc.ibm-db2.svc:50000
> User-Agent: curl/7.61.1
> Accept: */*
```

Again, when you see **Connected**, the connection to the DB2 server can be made. Press CTRL+C to stop the command.