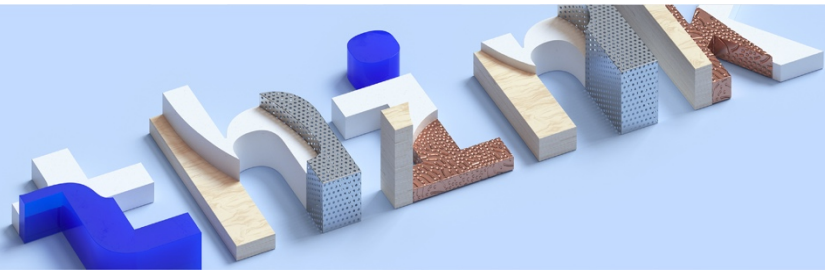


think 2018



Lab Center – Hands-on Lab

Session 3370

**Session Title Kubernetes on IBM Power Systems
with IBM Cloud Private**

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Introduction

The Kubernetes project grew out of the world of online micro-services-based applications as an orchestration framework for containerized applications. With the explosive momentum of Docker containers, Kubernetes has become the de-facto standard for orchestrating and managing containerized apps in production environments. In this workshop we will demonstrate how Kubernetes can run on Power systems, using IBM Cloud Private, a Kubernetes based container management stack.

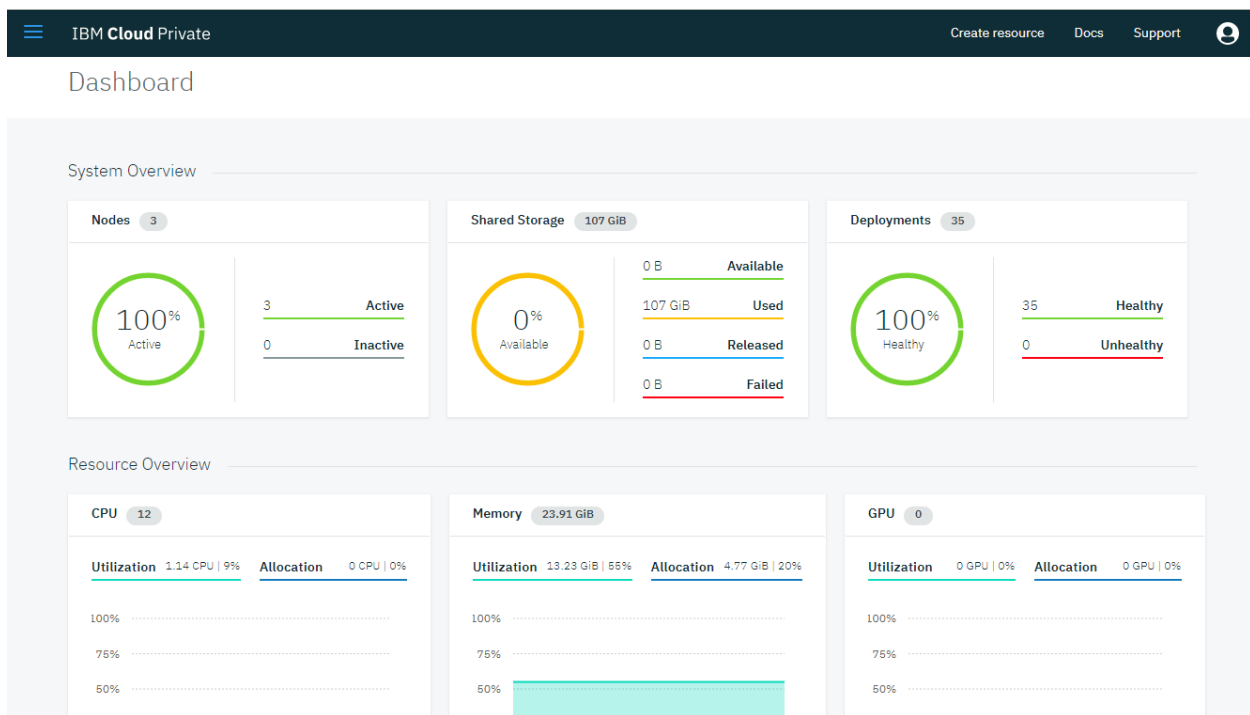
You will gain access to IBM Cloud Private on Power-based systems on the cloud as well as on a developer laptop. You will also get a chance to onboard a sample application to Kubernetes and learn about features of IBM Cloud Private through hands on training.

IBM Cloud Private and Kubernetes

Part 1: Overview

IBM Cloud Private is a server platform for developing and managing on-premises, containerized applications.

It is an integrated environment for managing containers that includes the container orchestrator Kubernetes, a private image repository, a management console, and monitoring frameworks.



Part 2: Setting up or accessing your cluster

Instructions on setting up or accessing your cluster will be provided by your lab instructor.

Managing deployments in an IBM Cloud Private cluster

Part 3: Creating deployments

- __ 1. Log in to the IBM Cloud Private management console.
- __ 2. From the navigation menu, select **Catalog > Helm charts**.
- __ 3. From the Helm charts catalog, locate the **ibm-websphere-liberty** deployment.
- __ 4. Review the readme for requirements and configuration settings.
- __ 5. Click **Configure**.
- __ 6. Provide a **Release name**. For example, “demo”.
- __ 7. Select the namespace that matches your username. For example, if you are user1, use the namespace1 namespace.
- __ 8. Accept the license agreements.
- __ 9. Click **Install**.
- __ 10. Click **View Helm release**. Then click on **demo**. Review information about the services, deployments and pods that are created.
- __ 11. From the navigation menu, select **Workloads > Deployments > demo-ibm-websphere-liberty**. Review additional information about the deployment including details about pods, metrics, logs, and events.

From the **Expose details** section, you can find the endpoint link for accessing your deployment.

Note: Replace http with https in the endpoint link to access the **websphere-liberty** service.

Part 4: Scaling deployments

Manually scaling deployments

- __ 1. From the navigation menu, select **Workloads > Deployments**.
- __ 2. For the deployment that you want to scale, select **Action > Scale**. A Scale Deployment form displays.
- __ 3. Enter the number of pods required.

- If the number of pods entered is less than the current Desired Replica, a scale in action is triggered.
- If the number of pods entered is greater than the current Desired Replica, a scale-out action is triggered.

__ 4. Click **Scale Deployment**.

Optional: Creating Auto-scaling policies

__ 1. From the navigation menu, select **Configuration > Scaling Policies**.

__ 2. Click **Create Policy**.

__ 3. Enter the policy details. Policy details can be provided either in a JSON format or by completing the fields in the **Create Policy** form.

__ 4. To create a policy, the following parameters are required:

- A policy name
- A target - the name of the application that will use this policy
- Maximum number of replications - this value is the maximum number of replications that are allowed during a scale up

__ 5. You can also set the following optional parameters:

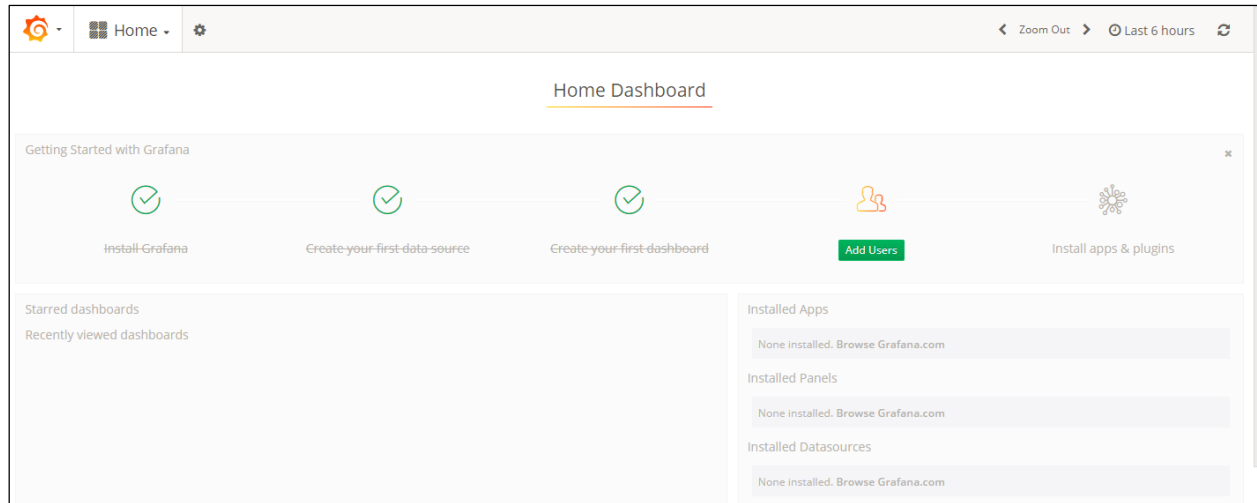
- Minimum number of replications, which has a default of 1, is optional.
- Specifying the resource limit for CPU is optional. If you do not specify the resource limits for your container, the values are set to unlimited.

__ 6. Click **Create**.

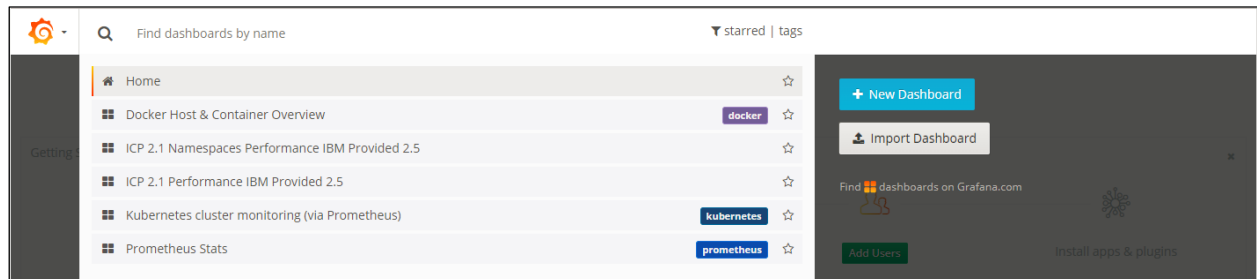
Monitoring the status of your cluster and applications

The monitoring dashboard uses Grafana and Prometheus to present detailed data about your cluster nodes and containers

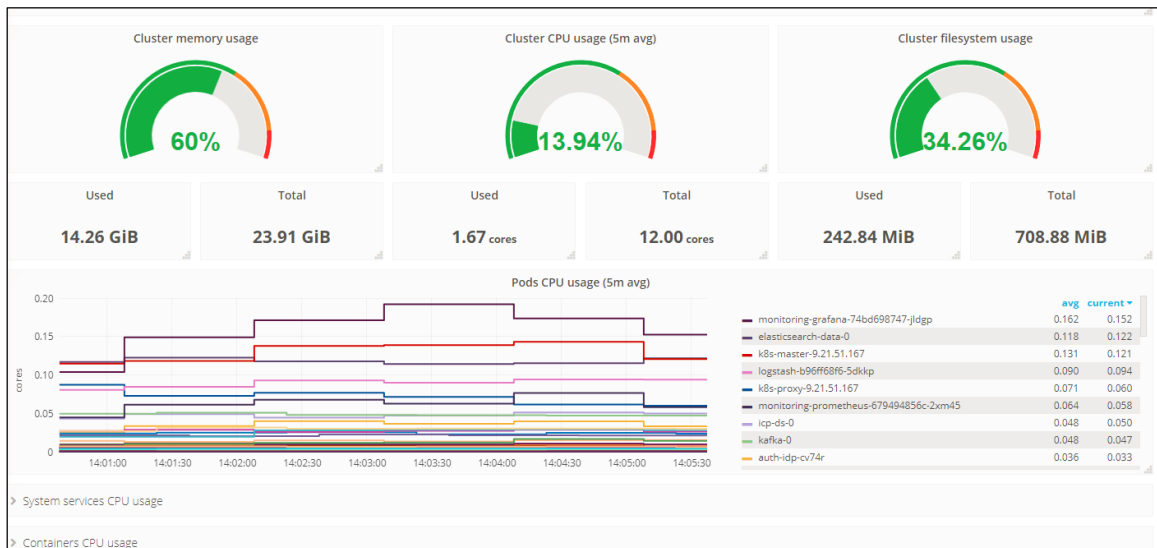
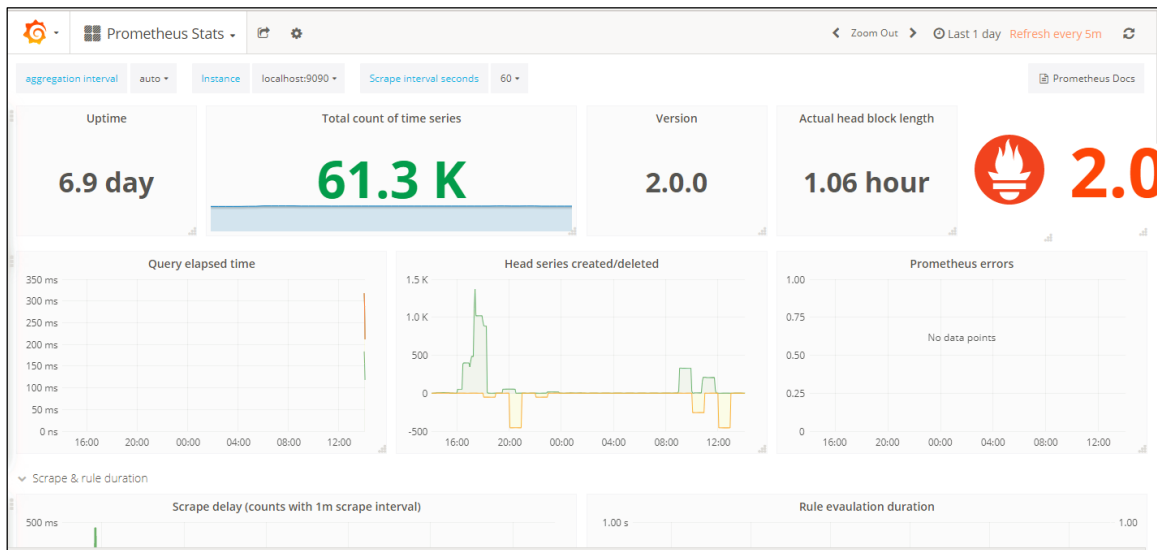
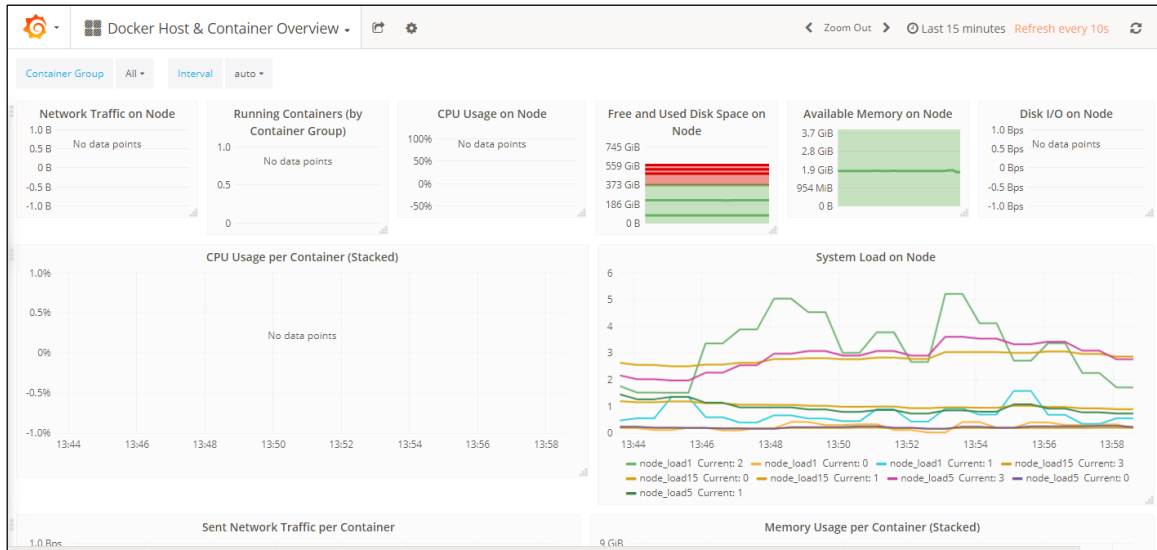
__ 1. From the navigation menu, select **Platform > Monitoring**.



__ 2. Click the drop-down icon located next to **Home**.



__ 3. Click on each available dashboard to review the status information on various system components and processes.



Managing and troubleshooting your cluster using the Kubernetes CLI

Part 5: Setting up the Kubernetes CLI

__1. Install kubectl for IBM Cloud Private.

```
docker run -e LICENSE=accept --net=host -v /usr/local/bin:/data ibmcom/icp-inception-ppc64le:2.1.0.1-ee cp /usr/local/bin/kubectl /data
```

__2. From the dashboard view, select **User Account > Configure Client**.

The user account tab can be found in the upper right corner of your screen. This tab displays the user name for the logged-on user.

__3. Copy and paste the configuration information to your command line and press **Enter**.

Part 6: Using the Kubernetes CLI

```
kubectl get nodes
kubectl describe node <node>
kubectl get pods
kubectl describe pod <pod>
kubectl get namespaces
kubectl describe namespace <ns>
```

For more information about using kubectl with IBM Cloud Private, see [Accessing your IBM® Cloud Private cluster by using the kubectl CLI](#).

Automating the build process for Docker images

A typical CI/CD pipeline uses the following process:

- Developers commit code to a SCM, which triggers a Jenkins build pipeline.
- Jenkins then builds the code and runs tests.
- If the tests pass, the code is deployed to various environments, such as a staging server and then fully tested and verified content is moved to a production server.

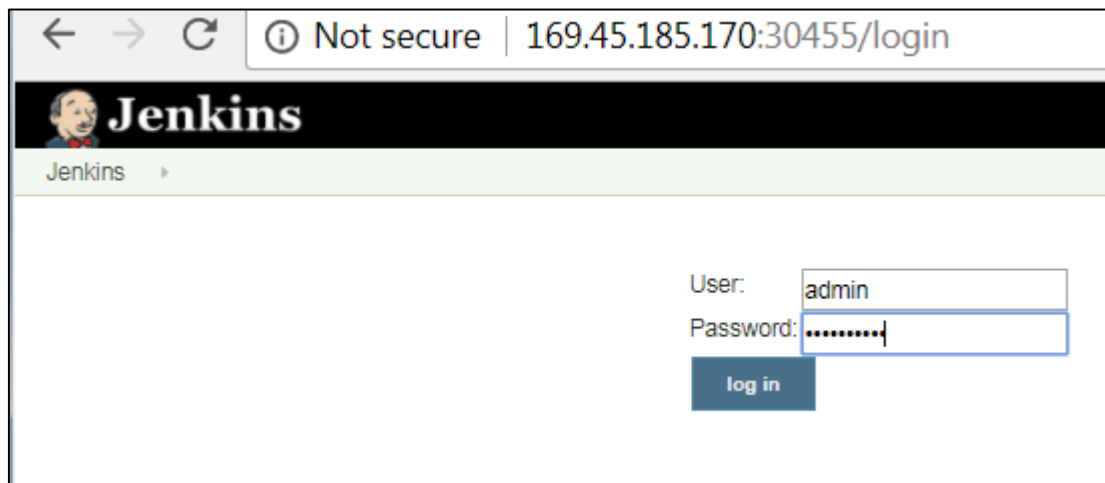
In this exercise, you will set up a pipeline to build and automatically push Docker images to the IBM Cloud Private image registry.

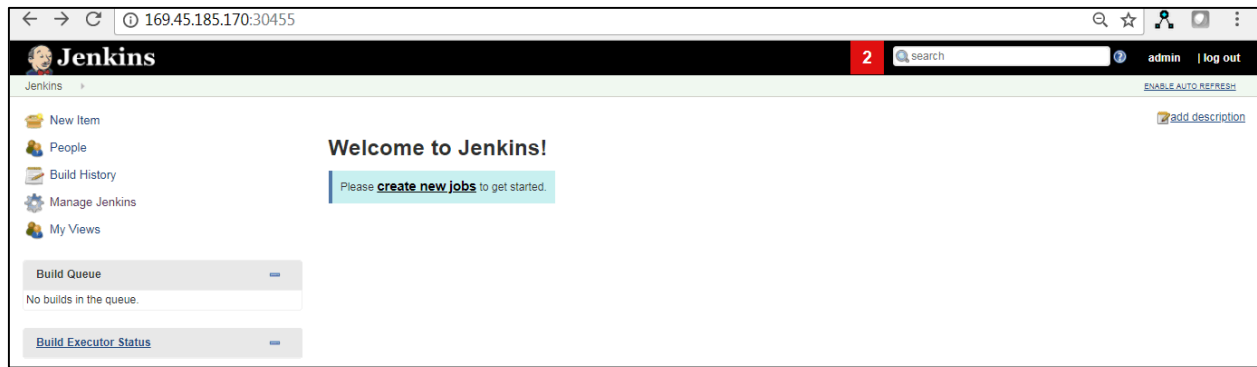
Jenkins is deployed, and the required plugins are installed on the available IBM Cloud Private cluster. You can now explore the system configuration and try to create a pipeline to build Docker images.

Note: DO NOT modify any settings on the **System Configuration** page.

Part 7: Accessing the Jenkins dashboard

__1. Using the provided URL, access the Jenkins dashboard.



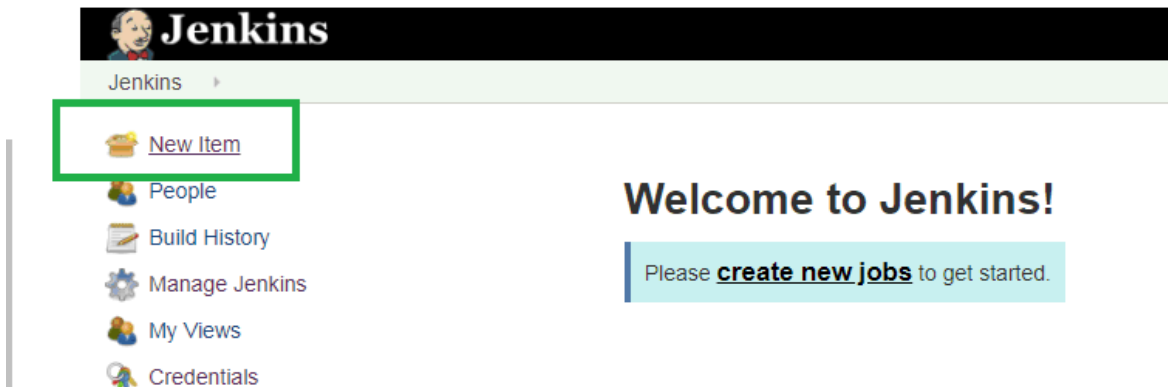


__2. View the system configuration. Select **Manage Jenkins** > **Configure System**.

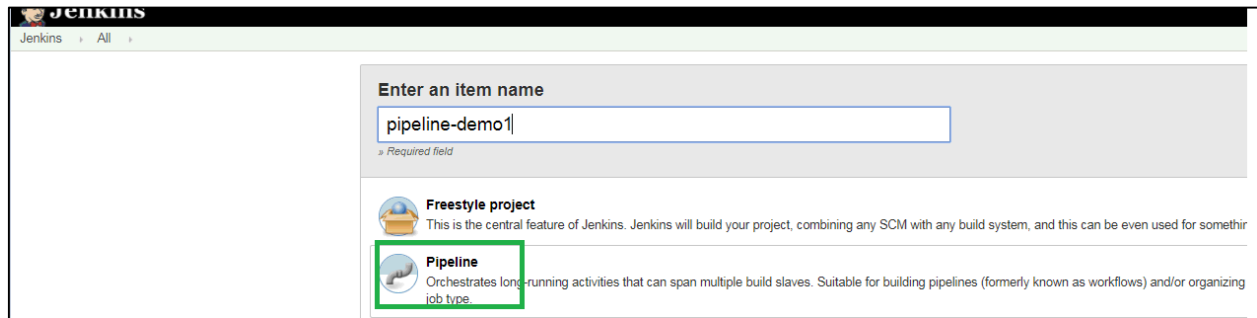


Part 8: Setting up task automation with Jenkins

__1. Click **New Item**.



__2. Enter an item name and select **Pipeline**.



__3. In the pipeline definition field input the following script.

```
pipeline {
  agent none
  stages {
    stage('Checkout Code') {
      parallel {

        stage('Build ppc64le') {
          agent {
            label "jenkins-demo3"
          }
          steps {
            script{
              checkout([$class: 'GitSCM', branches: [[name:
                '*/master']], doGenerateSubmoduleConfigurations: false, extensions: [[$class:
                'RelativeTargetDirectory', relativeTargetDir: 'src'], [$class:
                'CleanBeforeCheckout']], submoduleCfg: [], userRemoteConfigs: [[url:
                'https://github.com/sudeeshjohn/sampleflaskapp.git']]])
              appName = "default/flask-app-user1"
              registryHost = "mycluster.icp:8500/"
              imageName =
                "${registryHost}${appName}:${env.BUILD_ID}-ppc64le"
              env.BUILDIMG=imageName
              docker.withRegistry('https://mycluster.icp:8500/'
, 'docker'){
                def pcImg =
docker.build("mycluster.icp:8500/default/flask-app-user1:${env.BUILD_ID}", "--
f src/Dockerfile.ppc64le src/")
                sh "cp /root/.dockercfg
/home/jenkins/.dockercfg"
                pcImg.push()
                pcImg.withRun{springboot ->
git
'https://github.com/sudeeshjohn/sampleflaskapp.git'
                sh "ls"
                }
              }
            }
          }
        }
      }
    }
  }
}
```

```

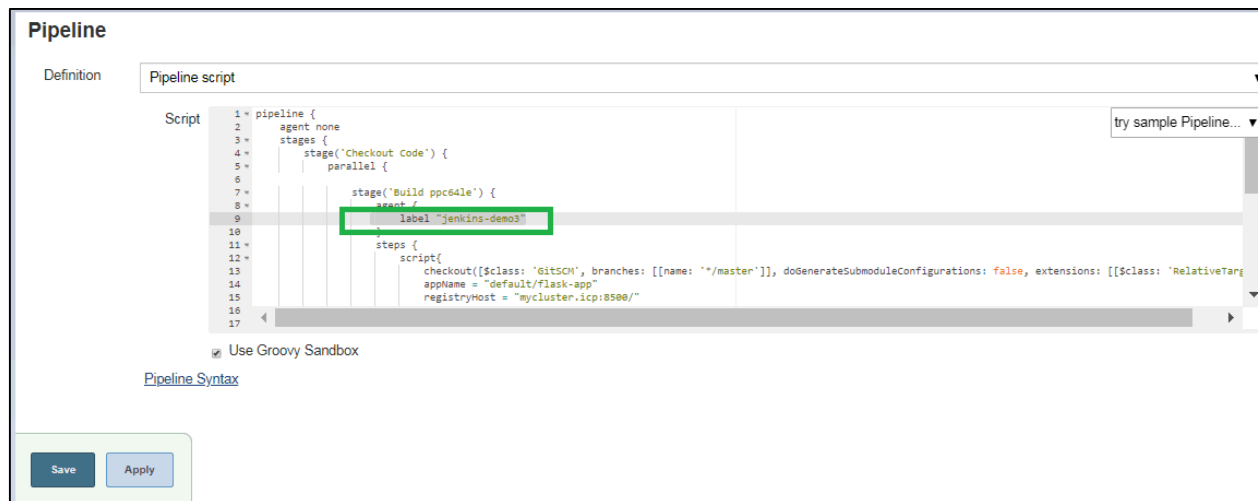
    }
  }
}

}

}

```

__5. Change the label field to your deployment name. For example, **jenkins-demo3**.



__6. To avoid conflicts in the image name that is pushed to the registry, you need to change the image name (appName parameter) in the script to match your user name.

For example,

appName="default/flask-app-user1" (for user1)

appName="default/flask-app-user2" (for user2)

__7. Click **Save**.


__8. Build the pipeline.

Jenkins

Jenkins > pipeline-demo1 >

[Back to Dashboard](#)
[Status](#)
[Changes](#)
[Build Now](#)
[Delete Pipeline](#)
[Configure](#)
[Full Stage View](#)
[Pipeline Syntax](#)

Pipeline pipeline-demo1

 [Recent Changes](#)

Stage View

Average stage times:

| Checkout Code | Build ppc64le |
|---------------|---------------|
| 316ms | 4min 44s |

#1 Mar 17, 2018 3:43 PM

RSS for all RSS for failures

Permalinks

- Last build (#1), 1 hr 21 min ago

Jenkins > pipeline-demo1 > #1

[Back to Project](#)
[Status](#)
[Changes](#)
[Console Output](#)
[View as plain text](#)
[Edit Build Information](#)
[Git Build Data](#)
[No Tags](#)
[Docker Fingerprints](#)

Console Output

Started by user [admin](#)

Running in Durability level: MAX_SURVIVABILITY

```
[Pipeline] stage
[Pipeline] { (Checkout Code)
[Pipeline] parallel
[Pipeline] [Build ppc64le] { (Branch: Build ppc64le)
[Pipeline] [Build ppc64le] stage
[Pipeline] [Build ppc64le] { (Build ppc64le)
[Pipeline] [Build ppc64le] node
[Build ppc64le] Still waiting to schedule task
[Build ppc64le] jnlp-9pbhn is offline
[Build ppc64le] Running on jnlp-9pbhn in /home/jenkins/works
```

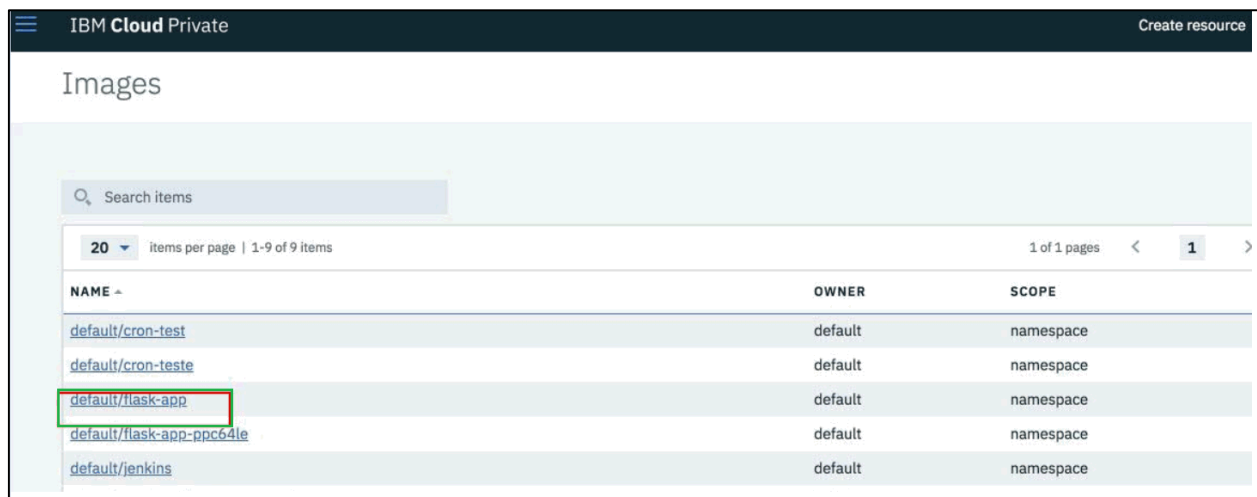


```
Jenkins  ▶ pipeline-demo1  ▶ #2

[Build ppc64le] + is
[Build ppc64le] Dockerfile
[Build ppc64le] Dockerfile.ppc64le
[Build ppc64le] Jenkinsfile
[Build ppc64le] README.md
[Build ppc64le] app
[Build ppc64le] conf
[Pipeline] [Build ppc64le] // script
[Pipeline] [Build ppc64le] }
[Pipeline] [Build ppc64le] // node
[Pipeline] [Build ppc64le] }
[Pipeline] [Build ppc64le] // stage
[Pipeline] [Build ppc64le] }
[Pipeline] // parallel
[Pipeline] }
[Pipeline] // stage
[Pipeline] End of Pipeline
Finished: SUCCESS
```

__ 9. When the job successfully completes, locate the newly built image in IBM Cloud Private dashboard.

From the IBM Cloud Private navigation menu, select **Catalog -> Images**.



| NAME ^ | OWNER | SCOPE |
|---|---------|-----------|
| default/cron-test | default | namespace |
| default/cron-teste | default | namespace |
| default/flask-app | default | namespace |
| default/flask-app-ppc64le | default | namespace |
| default/jenkins | default | namespace |

Deploying a microservices based application on a Kubernetes cluster

Microservices allow a large application to be decomposed into independent constituent parts, with each part having its own realm of responsibility. To serve a single user or API request, a microservices-based application can call many internal microservices to compose its response.

This sample microservices application simulates a fictional airline company called – Acme Air and consists of the following services:

- acmeair-mainapp: The Front End and the main service
- acmeair-as: The Authentication service
- acmeair-cs: The Customer service
- acmeair-fs: The Flight service
- acmeair-bs: The Booking service
- acmeair-ss: The Support service

Each of the service also depends on a database. Mongodb is used as the database. In this setup, all the services run on Power nodes.

The code used in this article is available here – <https://github.com/bpradipt/acmeair>

Optional: You can build the Acme air helm chart, or you can deploy the chart that is already available in your cluster. To build the Acme air helm chart, see [Part 13](#).

Part 9: Deploying the Acme air app

- __ 1. From the navigation menu, select **Catalog > Helm charts**. In the search field, type “acmeair”.
- __ 2. Click **Configure**.
- __ 4. Provide a **Release name**. For example, “acme-demo”.
- __ 5. Select the namespace that matches your username. For example, if you are user1, use the namespace1 namespace.

Docs user1

IBM Cloud Private Create resource Support

[← View all](#)

Configure acmeair V 0.0.1

Configuration

A Sample and Benchmark (wasperf version) application Edit these parameters for configuration

| | |
|----------------|--------------------|
| Release name ⓘ | Target namespace ⓘ |
| acme-demo | namespace1 |

__6. Replace clusterIngress- host with the dummy DNS host name of the proxy node.

In this environment, the proxy node is the same as the master node. For example,

- user 1: “user1-cluster-1519122384897-master.openpowercontainer.com”
- user 2: “user2-cluster-1519122384897-master.openpowercontainer.com”
-
- user 30: “user30-cluster-1519122384897-master.openpowercontainer.com”

IBM Cloud Private Create resource Support

clusterIngress

host

user1-cluster-1519122384897-master.openpowercontainer.com

bookingDB

| | |
|---------------------------------|-------------------|
| name | dbName |
| booking-db1 | acmeair_bookingdb |
| image | port |
| jjacobso/mongodb-ppc64le:latest | 27017 |

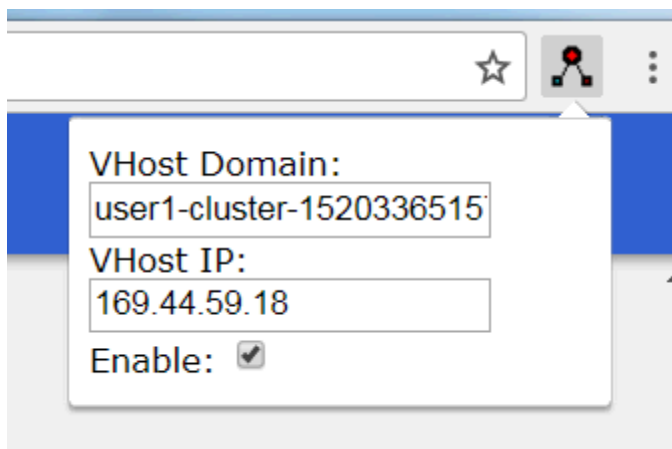
__ 8. Click **Install**.

__9. Click **View Helm release**. Locate your acme-air release. Review information about the services, deployments and pods that are created.

Part 10: Accessing the Acme air app

Note: Dummy hostnames are used in the ingress config file, each user must add a chrome extension for a virtual host. This allow you to map the dummy hostname to the proxy/master node's IP address.

For more details, see [Virtual Host \(Chrome web store\)](#).



__1. When the application is in a deployed state, you can access the service by using the following link: http://<DNS_HOST_NAME_OF_PROXY_NODE>/acmeair

For example, <http://user1-cluster-1519122384897-master.openpowercontainer.com/acmeair/>

__2. Click on the **Configure the Acmeair environment** link at the bottom of the home page to configure the environment and to populate the database.



Once the database is populated, you can use the menu options for performing various operations such as login, search for available flights, book flights, cancel bookings and logging out of the application.

Part 11: (Optional) Building the Acme air Helm chart

These instructions are for building the Acme air Helm chart on IBM Cloud Private environments that are running on Power systems.

Build the Docker image

__ 1. As root user, log on to the master node and run the following commands:

```
$ sudo su -
```

Install pre-req packages

```
$ sudo apt-get install git gradle openjdk-8-jdk
```

Set JAVA_HOME

```
$ export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-ppc64el
```

```
$ export PATH=$JAVA_HOME/bin:$PATH
```

Build the packages

```
$ git clone https://github.com/bpradipt/acmeair.git
```

```
$ cd acmeair
```

```
$ gradle build
```

__2. Build the Docker images

```
$ for i in acmeair-fs acmeair-as acmeair-cs acmeair-bs acmeair-ss  
acmeair-mainapp; do cd $i && sudo docker build -t $i -f  
Dockerfile.ppc64le . && cd .. ; done
```

__3. View the Docker images

```
$ docker images | grep acmeair
```

Load Docker images on the worker nodes

__4. On the master node, save the images on to a tar file.

```
sudo docker save -o <path to image tar file> <image name:tag> <image  
name:tag>..
```

For example,

```
sudo docker save -o ./acmeair-images.tar acmeair-mainapp:latest  
acmeair-ss:latest acmeair-bs:latest acmeair-cs:latest acmeair-  
as:latest acmeair-fs:latest
```

```
gzip acmeair-images.tar
```

__5. On each worker node, copy the tar.gz file.

```
scp <tar.gz file name> <target path on worker node>
```

For example,

```
scp acmeair-images.tar.gz cluster-1519122384897-worker1:/root/
```

```
scp acmeair-images.tar.gz cluster-1519122384897-worker2:/root/
```

__6. On each worker node, load the images.

```
ssh <worker node name>
```

```
sudo docker load -i <path to image tar.gz file>
```

```
sudo docker images | grep acme
```

For example,

```
root@cluster-1519122384897-worker1:~# sudo docker load -i ./acmeair-images.tar.gz
```

```
root@ cluster-1519122384897-master.openpowercontainer.com:~# docker images | grep acme
```

| | | | |
|-----------------|----------------|-------|--------|
| acmeair-mainapp | | | latest |
| 642a6e34058e | 25 minutes ago | 534MB | |
| acmeair-ss | | | latest |
| 0c5505e5a1e1 | 25 minutes ago | 533MB | |
| acmeair-bs | | | latest |
| d70580d2a9db | 25 minutes ago | 535MB | |
| acmeair-cs | | | latest |
| 8469561c0267 | 25 minutes ago | 535MB | |
| acmeair-as | | | latest |
| 9e6dc0c2973c | 26 minutes ago | 535MB | |
| acmeair-fs | | | latest |
| eb23816d51d5 | 26 minutes ago | 535MB | |

```
root@ cluster-1519122384897-master.openpowercontainer.com:~#
```

Package the helm chart

For more details, see

https://www.ibm.com/support/knowledgecenter/en/SSBS6K_2.1.0.1/app_center/add_package.html#package_chart

__7. Setup Helm CLI

For information on how to setup the helm CLI, see

https://www.ibm.com/support/knowledgecenter/en/SSBS6K_2.1.0.1/app_center/create_helm_cli.html.

__i. On the master node, go to the location where the acmeair project is cloned. Navigate to the `helm_chart` directory.

```
cd helm_chart
```

__ii. Package your chart and confirm that the package was added.

```
helm package acmeair; ls -l
```

If the package was added, the output of the command lists the `acmeair-0.0.1.tgz` file.

__8. Add the chart to the internal repository that is provided with IBM Cloud Private.

__i. Install the IBM Cloud Private CLI, see [Installing the IBM® Cloud Private CLI](#).

__ii. Log in to your cluster from the IBM Cloud Private CLI and access the Docker private image registry.

```
bx pr login -a https://<cluster_CA_domain>:8443 --skip-ssl-validation
```

For example,

```
$ bx pr login -a https://169.44.59.18:8443 --skip-ssl-validation
```

```
Login method invokedAPI endpoint: https://169.44.59.18:8443
```

```
Username> admin
```

```
Password>
```

```
Authenticating...
```

```
OK
```

```
Select an account:
```

```
1. ICP Account (id-icp-account)
```


Enter a number> 1

Targeted account: ICP Account (id-icp-account)

\$

__iii. Install the Helm chart.

```
bx pr load-helm-chart --archive <helm_chart_archive> [--  
clustername <cluster_CA_domain>]
```

For example,

```
$ scp -i <keyfile> ubuntu@169.44.59.18:/home/ubuntu/acmeair-  
0.0.1.tgz .
```

```
acmeair-0.0.1.tgz          100%      3912      3.8KB/s   00:01
```

```
IBM@mjulie MINGW64 ~
```

```
$ bx pr load-helm-chart --archive ./acmeair-0.0.1.tgz --  
clustername 169.44.59.18
```

Loading helm chart

```
{ "url": "https://169.44.59.18:8443/helm-repo/charts/index.yaml" }
```

OK

__iv. Update the package repository by using the IBM Cloud Private cluster management console.

__a. From the navigation menu, select **Manage > Helm Repositories**.

__b. Click **Sync Repositories**.

__c. From the navigation menu, select **Catalog > Helm Charts**.

The new Helm chart is loaded into the IBM Cloud Private catalog.

The screenshot displays the IBM Cloud Private console interface. On the left, a sidebar menu contains the following items: Dashboard, Catalog, Workloads, Network Access, Configuration, Platform, Manage (highlighted with a green box), Authentication, Helm Repositories (highlighted with a green box), and Namespaces. The main content area is titled 'Repositories' and includes a search bar, a 'Sync repositories' button (highlighted with a green box), and an 'Add repository' button. Below these, a table lists the configured repositories:

| NAME | URL | ACTION |
|--------------|---|--------|
| ibm-charts | https://raw.githubusercontent.com/IBM/charts/master/rep/stable/ | ⋮ |
| kube-repo | https://kubernetes-charts.storage.googleapis.com | ⋮ |
| local-charts | https://169.44.59.18:8443/helm-repo/charts | ⋮ |

Next: Deploy the Acme air app, see [Part 11](#).

Appendix – useful links

- Developer Works community – <http://ibm.biz/cloud-private>
- IBM Cloud Private on IBM Knowledge Center – https://www.ibm.com/support/knowledgecenter/SSBS6K/product_welcome_cloud_private.html

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