

# OpenShift

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# RHCA - EX180/EX280

## Red Hat Certified Specialist in Containers and Kubernetes

Notes, tips and tricks for the EX180 and EX280 exams.

### Podman host setup

```
dnf module install container-tools
```

```
dnf install -y buildah
```

### Podman basics

Registry file: */etc/containers/registries.conf*

Login to a registry

```
podman login registry.access.redhat.com
```

Search for images

```
podman search mariadb
```

Inspect images without downloading

```
skopeo inspect docker://registry.access.redhat.com/rhsc1/mariadb-102-rhel7
```

Download images

```
podman pull registry.access.redhat.com/rhsc1/mariadb-102-rhel7
```

List images

```
podman images
```

Inspect images. \*Useful for locating config.user

```
podman inspect registry.access.redhat.com/rhsc1/mariadb-102-rhel7:latest
```

## Configure container volume path

```
sudo mkdir /srv/mariadb
sudo chown -R 27:27 /srv/mariadb # UID found in podman inspect
sudo semanage fcontext -a -t container_file_t "/srv/mariadb(/.*)"
sudo restorecon -Rv /srv/mariadb
```

## Run image

-d detached

-e per variable

-p local\_port:container\_port

-v local/path:/path/in/pod

```
podman run -d -e MYSQL_USER=user \
-e MYSQL_PASSWORD=pass -e MYSQL_DATABASE=db \
-p 3306:3306 \
-v /srv/mariadb:/var/lib/mysql:Z \ # :Z isn't needed if SELinux manually configured
rhsc/mariadb-102-rhel7
```

## Basic pod status and names

```
podman ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
c917919d6745	registry.access.redhat.com/rhsc/mariadb-102-rhel7:latest	run-mysqld	5 minutes ago	Up 5 minutes ago	0.0.0.0:3306->3306/tcp	heuristic stonebraker

## Enter container in interactive shell

```
podman exec -it container-name /bin/bash
```

## Commit changes to running image

```
podman commit container-name image-name
```

## Export image

```
podman save image-name > /path/to/image.tar
```

## Remove images

```
podman rmi image-name --force
```

## Restore/Load image

```
podman load -i /path/to/image.tar
```

## Dockerfile Basics

Container for scanning a network.

```
# Start with a base image
FROM registry.access.redhat.com/ubi8

# Maintainer information
MAINTAINER ClusterApps <mail@clusterapps.com>

# Run commands to build the container
# Do as much with the fewest RUN lines
RUN yum --assumeyes update && \
    yum --assumeyes install \
    nmap iproute procps-ng && \
    bash && \
    yum clean all

# Entrypoint is the command that run when the ccontainer starts
ENTRYPOINT ["/usr/bin/nmap"]

# The arguments for the entrypoint
CMD ["-sn", "192.168.252.0/24"]
```

Build the image with a tag

```
podman build -t notes180 .
```

List images

```
podman images
```

Run the image

```
podman run localhost/notes180
```

## OpenShift Basics

Setup oc completion

```
source <(oc completion bash)
```

Create a new project

oc new-project nginx

Create a new application based on an image

oc new-app bitnami/nginx

Basic information about the project

oc status

```
In project nginx on server https://api.crc.testing:6443

svc/nginx - 10.217.5.45 ports 8080, 8443
deployment/nginx deploys istag/nginx:latest
deployment #2 running for 20 seconds - 1 pod
deployment #1 deployed 20 seconds ago
```

Get more detailed information about the project

oc get all

```
NAME                                READY   STATUS    RESTARTS   AGE
pod/nginx-84654f9574-9gpnt         1/1     Running   0           3m13s

NAME                                TYPE          CLUSTER-IP   EXTERNAL-IP   PORT(S)          AGE
service/nginx                       ClusterIP     10.217.5.45  <none>        8080/TCP,8443/TCP 3m13s

NAME                                READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/nginx              1/1     1             1           3m13s

NAME                                DESIRED   CURRENT   READY   AGE
replicaset.apps/nginx-65fbb4c68d    0         0         0       3m13s
replicaset.apps/nginx-84654f9574    1         1         1       3m13s

NAME                                IMAGE REPOSITORY                                  TAGS   UPDATED
imagestream.image.openshift.io/nginx default-route-openshift-image-registry.apps-crc.testing/nginx/nginx latest 3 minutes ago
```

Get full details about a pod

oc describe pod/nginx-84654f9574-9gpnt

Get full details about a deployment

oc describe deployment.apps/nginx

# Application deployments

Generate a YAML file to use as a base.

```
oc create deployment nginx --image=bitnami/nginx --dry-run=client -o yaml > newapp.yml
```

Create a temporary deployment using the YAML file,

```
oc create -f newapp.yml
```

Create the service by exposing the deployment

```
# dry run to add to YAML file
oc expose deployment --port=8080 --dry-run=client nginx -o yaml >> newapp.yml

# run to create the service
oc expose deployment --port=8080 nginx
```

Expose the service

```
oc expose svc nginx --dry-run=client -o yaml >> newapp.yml
```

New app with parameters, as a deployment-config, and with labels (app=database)

```
oc new-app --name mdb -l app=database -e MYSQL_USER=dbuser -e
MYSQL_PASSWORD=SuperAwesomePassword -e MYSQL_DATABASE=dbname bitnami/mysql --as-deployment-
config
```

Delete the temporary application

```
oc delete all --all
```

Edit the YAML file and break up the sections into proper YAML.

Add `---` at the beginning of a section

Add `...` at the end of a section.

The new nginx app YAML file.

```
---
apiVersion: apps/v1
kind: Deployment
metadata:
  creationTimestamp: null
```

```
labels:
  app: nginx
name: nginx
spec:
  replicas: 1
  selector:
    matchLabels:
      app: nginx
  strategy: {}
  template:
    metadata:
      creationTimestamp: null
      labels:
        app: nginx
    spec:
      containers:
        - image: bitnami/nginx
          name: nginx
          resources: {}
status: {}
...
```

---

```
apiVersion: v1
kind: Service
metadata:
  creationTimestamp: null
labels:
  app: nginx
  name: nginx
spec:
  ports:

    • port: 8080
      protocol: TCP
      targetPort: 8080
    selector:
```

```
app: nginx
status:
loadBalancer: {}
...
```

```
apiVersion: route.openshift.io/v1
kind: Route
metadata:
creationTimestamp: null
labels:
app: nginx
name: nginx
spec:
port:
targetPort: 8080
to:
kind: ""
name: nginx
weight: null
status: {}
...
```

Delete API resources defined by a YAML file.

```
oc delete -f newapp.yml
```

## Using Templates

Get a list of templates

```
oc get templates -n openshift
```

Get template details

Review the parameters section for a list of environment variables.

```
oc describe template -n openshift mariadb-persistent
```



## Create a new application from a template

```
oc new-app --template=mariadb-persistent \  
-p MYSQL_USER=jack -p MYSQL_PASSWORD=password \  
-p MYSQL_DATABASE=jack
```

Check the status of the deployment.

```
oc get all  
oc describe pod/mariadb-1-qlvrj
```

## Source 2 Image

Get a list of templates and streams

```
oc new-app -L
```

Deploy a new app from a git repo

```
oc new-app php~https://github.com/clusterapps/simpleapp.git
```

Watch the app get built

```
oc logs -f buildconfig/simpleapp
```

Review the deployment with `oc get all`

NAME	READY	STATUS	RESTARTS	AGE
pod/mariadb-1-deploy	0/1	Completed	0	16m
pod/mariadb-1-qlvrj	1/1	Running	0	16m
pod/simpleapp-1-build	0/1	Completed	0	2m10s
pod/simpleapp-fb5554fd9-4kgnb	1/1	Running	0	89s

NAME	DESIRED	CURRENT	READY	AGE
replicationcontroller/mariadb-1	1	1	1	16m

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
service/mariadb	ClusterIP	10.217.5.246	<none>	3306/TCP	16m
service/simpleapp	ClusterIP	10.217.4.16	<none>	8080/TCP,8443/TCP	2m11s

NAME	READY	UP-TO-DATE	AVAILABLE	AGE
deployment.apps/simpleapp	1/1	1	1	2m11s

NAME	DESIRED	CURRENT	READY	AGE
replicaset.apps/simpleapp-75c686cbb8	0	0	0	2m11s
replicaset.apps/simpleapp-fb5554fd9	1	1	1	89s

NAME	REVISION	DESIRED	CURRENT	TRIGGERED BY
deploymentconfig.apps.openshift.io/mariadb	1	1	1	config,image(mariadb:10.3-el8)

NAME	TYPE	FROM	LATEST
buildconfig.build.openshift.io/simpleapp	Source	Git	1

NAME	TYPE	FROM	STATUS	STARTED	DURATION
build.build.openshift.io/simpleapp-1	Source	Git@26e2f16	Complete	2 minutes ago	41s

NAME	IMAGE REPOSITORY	TAGS	UPDATED
imagestream.image.openshift.io/simpleapp	default-route-openshift-image-registry.apps-		
crc.testing/nginx2/simpleapp	latest	About a minute ago	

# Using oc to manage OpenShift

## The Basics

Examples of the basic need to know oc commands to deploy and manage containers on OpenShift. Set a few variables to prevent sensitive information in the terminal history.

```
export REGISTRY_USERNAME=YourUsername
export REGISTRY_PASSWORD=SomePassword
export REGISTRY_HOST=quay.io
export REGISTRY_EMAIL=mail@example.com
export OSU=developer
export OSP=SuperAw3SomePassrd
```

## Pods

Using `oc explain` it is simple to get the documentation for the running version of OpenShift. Here are a few basics.

Get built-in documentation for Pods

```
oc explain pod
```

Get the pod spec

```
oc explain pod.spec
```

Details on the pod's containers

```
oc explain pod.spec.containers
```

Details about the pod's containers images

```
oc explain pod.spec.containers.image
```

## Example of a pod file

```
apiVersion: v1
kind: Pod
metadata:
  name: hello-world-pod
  labels:
    app: hello-world-pod
spec:
  containers:
  - env:
    - name: MESSAGE
      value: Hi there! You've run a pod.
    image: docker.io/mcleary/helloworld-go
    imagePullPolicy: Always
    name: hello-world-override
    resources: {}
```

## Create a Pod on OpenShift based on a file

```
oc create -f pod.yaml
```

Use `oc get` to information from OpenShift

## Get pods

```
oc get pods
```

## Watch pods deploy

```
oc get pods --watch
```

## Get all resources

```
oc get all
```

Access the shell of a running container. Use `oc get pods` to get the pod name.

```
oc rsh <pod-name>
```

Use port forwards to interact with the pod on the local machine. Get the pod name from the `oc get pods`.

```
oc port-forward <pod-name> <local_port>:pod_port>
```

Delete OpenShift resources use the following syntax

```
oc delete <resource type> <resource name>
```

Delete a pod

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

# Deployments

Deploy an existing image based on its tag

```
oc new-app mcleary/helloworld-go:latest --as-deployment-config
```

Deploy an application from Git

```
oc new-app https://github.com/clusterapps/helloworld-go.git --as-deployment-config
```

Follow build progress when using

```
oc logs -f bc/helloworld-go
```

Set the name for the DeploymentConfig

```
oc new-app mcleary/helloworld-go --name hello-app --as-deployment-config
```

DeploymentConfig with a parameter

```
oc new-app MESSAGE="This is a parameter" mcleary/helloworld-go --name hello-app --as-deployment-config
```

DeploymentConfig with many parameters

```
oc new-app mysql MYSQL_USER=user MYSQL_PASSWORD=pass MYSQL_DATABASE=testdb -l db=mysql
```

Get information about a DeploymentConfig

Describe the DC to get its labels

```
oc describe dc/hello-app
```

Get the full YAML definition

```
oc get -o yaml dc/hello-app
```

Roll out the latest version of the application

```
oc rollout latest dc/hello-app
```

Roll back to the previous version of the application

```
oc rollback dc/hello-app
```

## Scaling

General Syntax `oc scale dc/<dc name> --replicas=<desired replicas>`

Manual scale to 3 pods

```
oc scale dc/helloworld-go --replicas=3
```

Scale down to one

```
oc scale dc/helloworld-go --replicas=1
```

General Syntax to create a HorizontalPodAutoscaler

```
oc autoscale dc/<dc name> \  
  --min <desired minimum pods> \  
  --max <desired maximum pods> \  
  --cpu-percent=<desiredTargetCPU>
```

Auto scaling between 1 and 10 pods with an 80% CPU target

```
oc autoscale dc/helloworld-go \  
  --min 1 \  
  --max 10 \  
  --cpu-percent=80
```

Show the HPA

```
oc get hpa
```

## Information on the HPA

```
oc describe hpa/helloworld-go
```

## YAML for the HPA

```
oc get -o yaml hpa/helloworld-go
```

## Deleting resources

### Delete a single resource

```
oc delete <resource> <name>
oc delete dc hello-app # Delete deployment config
oc delete svc hello-app # Delete a service
```

### Delete all application resources using labels (get labels from oc describe)

```
oc delete all -l app=app=hello-app
```

### Delete everything in a project

```
oc delete all --all
```

# Templates

### Get a list of templates

### Templates in the working namespace

```
oc get template
```

### Get built-in templates

```
oc get templates -n openshift
```

### Get template details

### Full details of the template.

```
oc describe template -n openshift mariadb-persistent
```

Get just the parameters for a template.

```
oc process --parameters mysql-persistent -n openshift
```

Create a new application from a template

```
oc new-app --template=mariadb-persistent \  
-p MYSQL_USER=jack -p MYSQL_PASSWORD=password \  
-p MYSQL_DATABASE=jack
```

Check the status of the deployment and get the pod name

```
oc get all
```

Full details of a pod from a template.

```
oc describe pod/mariadb-1-qlvrj
```

# Networking

Access `oc explain` documentation

```
oc explain service
```

Get information about Service spec

```
oc explain service.spec
```

Get YAML definition for a service

```
oc get -o yaml service/hello-world
```

Get YAML definition for a route

```
oc get -o yaml route/hello-world
```

## Creating services

Create a service for a single pod

```
oc expose --port 8080 pod/hello-world-pod
```



## Create a service for a DeploymentConfig

```
oc expose --port 8080 dc/hello-world
```

## Check that the service and pod are connected properly

```
oc status
```

## Using Pod environment variables to find service Virtual IPs

Log into a pod. Get pod name from `oc get pods`

```
oc rsh pod/helloworld-2
```

## Inside the pod, get all environment variables

```
env
```

## Testing connectivity using environment variables with wget

```
wget -qO- $HELLOWORLD_GO_PORT_8080_TCP_ADDR:$HELLOWORLD_GO_PORT_8080_TCP_PORT
```

## Creating Routes

Create a Route based on a Service. Get the service name from `oc get svc`

```
oc expose svc/helloworld-go
```

## Get the Route URL

```
oc status
```

## Check the route

```
curl helloworld-go-lab1.apps.okd4.example.com
```

# ConfigMaps

## Create a ConfigMap using literal command line arguments

```
oc create configmap helloconfig --from-literal KEY="VALUE"
```

## Create from a file

```
oc create configmap helloconfig --from-file=MESSAGE.txt
```

## Create from a file with a key override

```
oc create configmap helloconfig --from-file=MESSAGE=MESSAGE.txt
```

## Create using `--from-file` with a directory

```
oc create configmap helloconfig --from-file pods
```

## Verify

```
oc get -o yaml configmap/helloconfig
```

## Consuming ConfigMaps as Environment Variables

### Set environment variables

```
oc set env dc/hello-app --from cm/helloconfig
```

# Secrets

Secrets use similar syntax as ConfigMaps. Secrets are base64 encoded ConfigMaps

There are a few main types.

- Opaque
- Service Account Tokens
- Registry Authentication
- Simple Auth Types

A simple generic (Opaque) Secret. Key-Value pairs

```
oc create secret generic <secret-name> --from-literal KEY="VALUE"
```

## Check the Secret

```
oc get -o yaml secret/<secret-name>
```

Consume the Secret as Environment Variables the same as ConfigMaps

```
oc set env dc/<dc-name> --from secret/<secret-name>
```

## Create a default registry secret

```
oc create secret docker-registry secret_name  
--docker-server=$REGISTRY_HOST \  
--docker-username=$REGISTRY_USERNAME \  
--docker-password=$REGISTRY_PASSWORD \  
--docker-email=$REGISTRY_EMAIL
```

## Link the secret to the service account named "default"

```
oc secrets link default secret_name --for=pull
```

## Check that the service account has the secret associated

```
oc describe serviceaccount/default
```

## Decoding secrets. First get the hash.

- mysecret = name of secret
- password = is the entry to decode

```
oc get secret mysecret -o yaml |grep password
```

Result simalar to `password: cGFzc3dvcmQ=`

## Decode as base64

```
echo "cGFzc3dvcmQ=" |base64 -d
```

# Images

## ImageStreams

### List ImageStreams

```
oc get is
```

### List tags

```
oc get istag
```

Create the ImageStream but don't deploy

```
oc import-image --confirm quay.io/clearyme/helloworld-go
```

Importing any new images from the repository using the same command as importing a new.

```
oc import-image --confirm quay.io/clearyme/helloworld-go
```

Creating a new local tag : `oc tag <original> <destination>`

```
oc tag $REGISTRY_HOST/$REGISTRY_USERNAME/helloworld-go:latest helloworld-go:local-1
```

Deploy an application based on your new ImageStream (lab1 is the name of the oc project with the newly tagged image)

```
oc new-app lab1/helloworld-go:local-1
```

## Build a custom image

From within the directory where the `Dockerfile` is, build the image and tag it for the registry.

```
podman build -t $REGISTRY_HOST/$REGISTRY_USERNAME/helloworld-go:latest .
```

Log into a registry

```
podman login $REGISTRY_HOST
```

Push the image to the registry

```
podman push $REGISTRY_HOST/$REGISTRY_USERNAME/helloworld-go
```

# Builds and BuildConfigs

Create a new BuildConfig from a Git repository URL

```
oc new-build <git URL>
```

Example

```
oc new-build https://github.com/clusterapps/helloworld-go.git
```

Example new build from s branch

```
oc new-build https://github.com/clusterapps/helloworld-go.git#update
```

Example using `--context-dir` to build from a subdirectory

```
oc new-build https://github.com/clusterapps/openshift-playing.git --context-dir hello-world-go
```

## Working with existing BuildConfigs

Get a list of BuildConfigs

```
oc get bc
```

Start a build

```
oc start-build bc/helloworld
```

Get the list of builds

```
oc get build
```

Get logs for a single build

```
oc logs -f build/helloworld-go-1
```

Get logs for the latest build for a BuildConfig

```
oc logs -f bc/helloworld-go
```

Use `oc cancel-build` to stop a build ``

```
oc cancel-build build/helloworld-go-1
```

## Working with WebHooks

Get the secret token

```
oc get -o yaml buildconfig/helloworld-go
```

```
triggers:
- github:
    secret: G_eQdWP67Sa8y38qlo4l
    type: GitHub
- generic:
    secret: P7oPRT3IoSbo6D6Ey_hU
    type: Generic
- type: ConfigChange
- imageChange: {}
  type: ImageChange
```

Export the secret as a variable

```
export GENERIC_SECRET=G_eQdWP67Sa8y38qlo4l
```

Get the webhook URL

```
oc describe buildconfig/helloworld-go
```

```
Webhook GitHub:
  URL: https://api.okd4-snc.okd.manor.one:6443/apis/build.openshift.io/v1/namespaces/lab1/buildconfigs/helloworld-go/webhooks/<secret>/github
Webhook Generic:
  URL: https://api.okd4-snc.okd.manor.one:6443/apis/build.openshift.io/v1/namespaces/lab1/buildconfigs/helloworld-go/webhooks/<secret>/generic
  AllowEnv: false
Builds History Limit:
  Successful: 5
  Failed: 5
```

Copy the webhook URL and replace `<secret>` with `$GENERIC_SECRET`

```
curl -X POST -k <webhook URL with secret replaced with $GENERIC_SECRET>
```

## Set build hooks

Set a post-commit hook

```
oc set build-hook bc/helloworld-go \
  --post-commit \
  --script="echo Hello from build hook"
```

Check the logs output for "Hello from a build hook"

```
oc logs -f bc/helloworld-go
```

Check the events to see if it ran

```
oc get events
```

Remove a build hook

```
oc set build-hook bc/helloworld-go \  
--post-commit \  
--remove
```

## Source to Image

The syntax is the same as normal builds. OpenShift uses S2I to guess the language when there is no Dockerfile. A language can also be specified at build time during the `oc new-app`.

Works with Java, Ruby, Node, PHP, Python and PERL,

Overriding S2I Scripts Assemble and Run are the two main scripts Overrides go in your source at `.s2i/bin/assemble` or `.s2i/bin/run` They need to call the original scripts, which are at `/usr/libexec/s2i/assemble` or `/usr/libexec/s2i/run`

New app without a `Dockerfile`.

```
oc new-app https://github.com/clusterapps/openshift-playing.git --context-dir s2i/ruby
```

New app specifying the language by adding *language tilda* to the new-app command.

```
oc new-app ruby~https://github.com/clusterapps/openshift-playing.git --context-dir s2i/ruby
```

New app from a git branch

```
oc new-app https://github.com/clusterapps/helloworld-go.git#updates
```

# Volumes

Check out the built-in documentation

`oc explain persistentvolume.spec` or the The official [Kubernetes Documentation](#) for Volumes

Most deployment of k8s and OpenShift may have a dynamic storageclass. You can just the dynamic storage by specifying the mountpoint and size. For manual storage, here are some examples.

Storage basics for containers.

## Mount Volumes

### emptyDir

```
oc set volume dc/<dc name> --add --type emptyDir --mount-path <path inside container>
```

Example: Add an emptyDir volume. An emptyDir is ephemeral. It will survive a pod reboot, but will be deleted when the pod is deleted. Only good for testing.

```
oc set volume dc/helloworld-go --add \  
  --type emptyDir \  
  --mount-path /emptydir
```

View the DeploymentConfig to view the volume information. Look for container.volumeMounts and volumes.

```
oc get -o yaml dc/helloworld-go
```

```
terminationMessagePath: /dev/termination-log  
volumeMounts:  
- mountPath: /emptydir  
  name: volume-2gw8n
```

```
volumes:  
- emptyDir: {}  
  name: volume-2gw8n
```

### ConfigMaps

Basic example

```
oc set volume <DC name> --add --configmap-name <configmap name> --mount-path <path inside container>
```

Create the configmap to use as a Volume

```
oc create configmap volume-file --from-literal file.txt="Contents"
```

Mount the ConfigMap

```
oc set volume dc/helloworld-go --add --configmap-name volume-file --mount-path /configs/
```



## NFS

NFS is a very common storage method. It's cheap and easy to manage, but does have its own pitfalls.

Create an NFS persistent volume(PV) definition. A regular user cannot create PV.

```
cat > nfs.yml <<EOF
apiVersion: v1
kind: PersistentVolume
metadata:
  name: nfspv
spec:
  capacity:
    storage: 5Gi
  accessModes:
    - ReadWriteMany
  nfs:
    path: /nfsshare
    server: 172.20.255.2
  persistentVolumeReclaimPolicy: Retain
EOF
```

Map a PVC to a PV

Create the PVC YAML

```
cat > nfspvc.yml <<EOF
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: nfs001
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
  volumeName: nfspv
  storageClassName: ""
  volumeMode: Filesystem
```

```
EOF
```

Mount the pvc to a directory

```
oc set volume dc/helloworld-go --add --name=nfs001 -t pvc --claim-name=nfs001 -m /data
```

## Basic troubleshooting

Retrieve the logs from a build configuration

```
oc logs bc/<application-name>
```

If a build fails, after finding and fixing the issues, run the following command to request a new build:

```
oc start-build <application-name>
```

Deployment logs

```
oc logs dc/<application-name>
```

Temporarily access some of these missing commands is mounting the host binaries folders, such as `/bin`, `/sbin`, and `/lib`, as volumes inside the container

```
sudo podman run -it -v /bin:/bin image /bin/bash
```