

# Day 2

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## What is Container Orchestration Platform ?

- Container Orchestration Platform offers the below features
    1. Provides an eco-system or environment to make your application Highly Available (HA)
    2. It has in-built monitoring features
      - It frequently monitors the health of the containerized application workloads
      - It frequently monitors the liveness of the containerized application workloads
      - When it detects the application is non-responsive or down, then it would replace with another containerized application
    3. It supports scale up/down based on user-traffic to your application workloads
    4. Rolling update
      - We can upgrade the application from one version to other without any downtime
      - We can also rollback when the newly upgraded version of your application is found to be faulty
    5. Supports in-built Load Balancing to containerized application workloads
    6. Also supports using external load balancers in private, public and Hybrid cloud environments
    7. Supports exposing the application workloads internally or externally
    8. We can run one time activities like backup as Jobs
    9. We can schedule repetitive Jobs every day, week a particular time CronJobs
  - Cluster of Servers work together to form the Orchestration Platform
  - Two Types of Servers
    1. Master
    2. Worker
  - In a production grade setup, many Master Nodes will be available to ensure if one Master stops responding other Master would be available to keep the cluster responsive
  - Self-healing Platform
    - It not only observes instability in user application workloads, it is also capable of repairing its own components when they are non-responsive or when they crash Examples:-
1. Docker SWARM
  2. Kubernetes
  3. Red Hat OpenShift

## Docker SWARM

- it is native orchestration platform developed and maintained by Docker Inc organization
- it only supports managing docker containers
- it is not production-grade, hence not many companies use them in production, they are good for learning and prototypes or testing in Dev/QA environment
- it is very light-weight, hence can be easily installed even on a normal laptop
- It is free for personal and commercial use

## Kubernetes

- it is developed by Google and donated to open source community
- it is still backed by Google along with many opensource contributers
- it is developed in Go lang
- it is opensource
- supports command-line
- there is a web based Dashboard, but it is not production grade, it is not secure
- it is time tested, as Google internally used this several years before they made it opensource
- it is production grade
- it is used by many companies of different size in different domainin
- highly stable, capable of handling complex, resource hungry applications without any hassle
- It also supports extending Kubernetes features via Custom Resource Definitions (CRD)
- The container orchestration features are implemented as REST API
- Kubernetes supports many different Container Engines and Container Runtimes that supports/implemented Container Runtime Interface(CRI)
- Installing Kubernetes is relatively easier compared to Red Hat OpenShift
- The below are some of the Kubernetes Resources
  - Deployment
  - ReplicaSet
  - Pod
  - Job
  - CronJob
  - DaemonSet
  - StatefulSet
  - Services
    1. ClusterIP
    2. NodePort
    3. Load Balancer
  - Custom Resource Definition (CRD)
  - Ingress

## Red Hat OpenShift

- Red Hat OpenShift is developed on top of Google Kubernetes
- it is an enterprise product, we need buy license to use it
- Red Hat(an IBM company) provides world-wide support
- supports all features of Kubernetes
- also supports many additional features
- the additional features are added by using Kubernetes Custom Resource Definition (CRD)
- it is production grade
- it supports both command-line and Web Console
- it supports User Management
- We could even deploy Jenkins within OpenShift
- Older version of OpenShift upto 3.x supported Docker, starting from OpenShift 4.x support for Docker was removed
- Only supports Podman Container Engine with CRI-O Container Runtime
- Installing Red Hat OpenShift is very complex compared to Kubernetes

- Starting from OpenShift 4.x, the operating system supported with Nodes/Servers is limited to Red Hat Enterprise Linux or Red Hat Enterprise Core OS
- Master Nodes only supports Red Hat Enterprise Core OS
- Worker Nodes have two choices
  - They could either use Red Hat Enterprise Linux (RHEL) or Red Hat Enterprise Core OS (RHCOS)

## CI/CD with Kubernetes/OpenShift

- Tekton is a cloud-native server-less CI/CD framework that works within Kubernetes/OpenShift
- It is a competing product, which is alternate for Jenkins/Cloudbees/Team City/Bamboo/TFS, etc.,

## Kubernetes/OpenShift tools

- kubelet - Container Agent that interacts with CRI-O Runtime via Container Runtime Interface (CRI)
- kubeadm - administrative tool used to bootstrap master node and add/remove worker nodes to the OpenShift cluster
- kubectl - Kubernetes client tool also supported in OpenShift
- oc - OpenShift native client tool used by users to interact with OpenShift cluster to manage containerized application workloads

## What is a Kubernetes/OpenShift Controller?

- Controller is a application that monitors a particular type of Kubernetes/OpenShift resource
- Controller ensures the desired count and actual count of resources are same
- Controller are the one which provides monitoring functionality to the Container Orchestration Platform
- To manage every of Kuberentes/Openshift resource there is one type of Controller
- Examples
  - Deployment Controller
  - ReplicaSet Controller
  - Endpoint Controller
  - DaemonSet Controller
  - StatefulSet Controller
  - Job Controller

## What is Deployment Controller?

- Deployment Controller receives notification events anytime something changes in Deployment
  - New Deployment Created
  - Deployment updated
  - Deployment deleted
- Deployment Controller is the one that manages ReplicaSet resource

## What is ReplicatSet Controller?

- ReplicaSet Controller receives notification events anytime something changes in ReplicaSet
  - New ReplicaSet created
  - ReplicaSet updated

- ReplicaSet deleted
- ReplicaSet Controller is the one that manages the Pod resources

## What is a Deployment?

- when application are deployed in Kubernetes/OpenShift, they are deployed as Deployment
- Deployment resources contains the following
  - name of the deployment
  - the container image that must be used in the Pod
  - the number of Pod instances that be created as part of the deployment

## What is a ReplicaSet?

- is a configuration that tells how many Pod instances are supposed to be running as part of a application deployment
- There would be
  - desired count of Pods
  - actual count of Pods
  - ReplicaSet is referred by ReplicaSet controller to create/manage the number of Pod instances
  - The ReplicaSet controller keeps monitors the number of actual Pods vs desider count of Pods, whenever it sees a different it acts to match the number of desired pod count with the actual count

## What is a Pod?

- Pod is a group of related containers
- one Pod represents one application
- In Kubernetes/OpenShift IP address is assigned on the Pod level
- Containers in the same Pod shares the IP address
- As per Best practices, only one main application should part of one Pod
- One Container per Pod is the recommended practice
- User application will be running in one of the container within Pod
- Pods are managed by ReplicaSet Controller
- the smallest unit that can be deployed and managed is Pod
- generally deploying a Pod directly is not the recommended practice but is possible

## Control Plane Components

Control Plane components runs only in the master node

1. API Server
2. etcd data-store
3. Scheduler
4. Controller Managers

## OpenShift commands

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### Lab - Creating a Pod in Docker

```
docker pull google/pause:latest
docker images
docker run -d --name nginx_pause --hostname nginx google/pause:latest
docker ps
docker inspect nginx_pause | grep IPA

docker run -d --name nginx --network=container:nginx_pause nginx:latest
docker ps
docker exec -it nginx sh
hostname
hostname -i
exit
```

## Things to notice

- the IP address of nginx\_pause container and nginx containers are same.
- though we never assigned a hostname for the nginx container, the nginx container's hostname is nginx
- the reason is, nginx container shares the network of nginx\_pause container
- every Pod created in Kubernetes/OpenShift, there is always a secret infra-container called pause container apart from the main application container

## Best Practices

- though technically only one Pod many have many main application containers, ideally we should only create one main application per Pod
- the reason is, if we allow many main application containers per Pod, we won't be able to scale up/down one main application container independent of other main application containers
- ideally we should create two separate pod for two main applications, so that we scale them independent of each other

## Lab - Listing OpenShift nodes

```
oc get nodes
oc get nodes -o wide
oc version
```

## Expected output

```
jegan@tektutor: ~/openshift-sep-2023
[jegan@tektutor.org] - [~/openshift-sep-2023]
$ oc get nodes
NAME STATUS ROLES AGE VERSION
master-1.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d3h v1.26.7+0ef5eae
master-2.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d3h v1.26.7+0ef5eae
master-3.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d3h v1.26.7+0ef5eae
worker-1.ocp.tektutor-ocp-labs Ready worker 5d3h v1.26.7+0ef5eae
worker-2.ocp.tektutor-ocp-labs Ready worker 5d3h v1.26.7+0ef5eae

[jegan@tektutor.org] - [~/openshift-sep-2023]
$ oc get nodes -o wide
NAME STATUS ROLES KERNEL-VERSION AGE VERSION INTERNAL-IP EXTERNAL-IP OS-IMAGE
E
master-1.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d3h v1.26.7+0ef5eae 192.168.122.62 <none> Red Hat
Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) 5.14.0-284.28.1.el9_2.x86_64 cri-o://1.26.4-3.rhaos4.13.git615a02c.el9
master-2.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d3h v1.26.7+0ef5eae 192.168.122.171 <none> Red Hat
Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) 5.14.0-284.28.1.el9_2.x86_64 cri-o://1.26.4-3.rhaos4.13.git615a02c.el9
master-3.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d3h v1.26.7+0ef5eae 192.168.122.196 <none> Red Hat
Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) 5.14.0-284.28.1.el9_2.x86_64 cri-o://1.26.4-3.rhaos4.13.git615a02c.el9
worker-1.ocp.tektutor-ocp-labs Ready worker 5d3h v1.26.7+0ef5eae 192.168.122.178 <none> Red Hat
Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) 5.14.0-284.28.1.el9_2.x86_64 cri-o://1.26.4-3.rhaos4.13.git615a02c.el9
worker-2.ocp.tektutor-ocp-labs Ready worker 5d3h v1.26.7+0ef5eae 192.168.122.42 <none> Red Hat
Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) 5.14.0-284.28.1.el9_2.x86_64 cri-o://1.26.4-3.rhaos4.13.git615a02c.el9

[jegan@tektutor.org] - [~/openshift-sep-2023]
$ oc version
Client Version: 4.13.0-202308221627.p0.g17b7acc.assembly.stream-17b7acc
Kustomize Version: v4.5.7
Server Version: 4.13.11
Kubernetes Version: v1.26.7+0ef5eae

[jegan@tektutor.org] - [~/openshift-sep-2023]
```

## Lab - Finding more details about a node

```
oc get nodes
oc describe node master-1.ocp.tektutor-ocp-labs
```

## Expected output

```
jegan@tektutor: ~/openshift-sep-2023
[jegan@tektutor.org] - [~/openshift-sep-2023]
$ oc get nodes
NAME STATUS ROLES AGE VERSION
master-1.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d5h v1.26.7+0ef5eae
master-2.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d5h v1.26.7+0ef5eae
master-3.ocp.tektutor-ocp-labs Ready control-plane,master,worker 5d5h v1.26.7+0ef5eae
worker-1.ocp.tektutor-ocp-labs Ready worker 5d5h v1.26.7+0ef5eae
worker-2.ocp.tektutor-ocp-labs Ready worker 5d5h v1.26.7+0ef5eae

[jegan@tektutor.org] - [~/openshift-sep-2023]
$ oc describe node master-1.ocp.tektutor-ocp-labs
Name: master-1.ocp.tektutor-ocp-labs
Roles: control-plane,master,worker
Labels: beta.kubernetes.io/arch=amd64
        beta.kubernetes.io/os=linux
        kubernetes.io/arch=amd64
        kubernetes.io/hostname=master-1.ocp.tektutor-ocp-labs
        kubernetes.io/os=linux
Annotations: machineconfiguration.openshift.io/controlPlaneTopology: HighlyAvailable
            machineconfiguration.openshift.io/currentConfig: rendered-master-89cb2fa6f2aa7109f9b50140352d2b32
            machineconfiguration.openshift.io/desiredConfig: rendered-master-89cb2fa6f2aa7109f9b50140352d2b32
            machineconfiguration.openshift.io/desiredDrain: uncordon-rendered-master-89cb2fa6f2aa7109f9b50140352d2b32
            machineconfiguration.openshift.io/lastAppliedDrain: uncordon-rendered-master-89cb2fa6f2aa7109f9b50140352d2b32
            machineconfiguration.openshift.io/lastSyncedControllerConfigResourceVersion: 445315
            machineconfiguration.openshift.io/reason:
            machineconfiguration.openshift.io/state: Done
            volumes.kubernetes.io/controller-managed-attach-detach: true
CreationTimestamp: Thu, 07 Sep 2023 06:32:26 +0530
Taints: <none>
Unschedulable: false
Lease:
  HolderIdentity: master-1.ocp.tektutor-ocp-labs
  AcquireTime: <unset>
  RenewTime: Tue, 12 Sep 2023 11:45:47 +0530
Conditions:
  Type Status LastHeartbeatTime LastTransitionTime Reason Message
  ---- ---- ----- ----- ----- -----

```

```
jegan@tektutor: ~/openshift-sep-2023
jegan@tektutor: ~/ansible-sep-2023
jegan@tektutor: ~/openshift-sep-2023
jegan@tektutor: ~/openshift-sep-2023/Day1
jegan@tektutor: ~/openshift-sep-2023

Lease:
  HolderIdentity: master-1.ocp.tektutor-ocp-labs
  AcquireTime: <unset>
  RenewTime: Tue, 12 Sep 2023 11:45:47 +0530
Conditions:
  Type      Status  LastHeartbeatTime          LastTransitionTime        Reason           Message
  ----      -----  -----                      -----                  -----           -----
  MemoryPressure  False   Tue, 12 Sep 2023 11:42:17 +0530 Thu, 07 Sep 2023 06:32:26 +0530 KubeletHasSufficientMemory kubelet has sufficient memory available
  DiskPressure   False   Tue, 12 Sep 2023 11:42:17 +0530 Thu, 07 Sep 2023 06:32:26 +0530 KubeletHasNoDiskPressure kubelet has no disk pressure
  PIDPressure    False   Tue, 12 Sep 2023 11:42:17 +0530 Thu, 07 Sep 2023 06:32:26 +0530 KubeletHasSufficientPID kubelet has sufficient PID available
  Ready        True    Tue, 12 Sep 2023 11:42:17 +0530 Thu, 07 Sep 2023 06:34:49 +0530 KubeletReady kubelet is posting ready status
Addresses:
  InternalIP: 192.168.122.62
  Hostname: master-1.ocp.tektutor-ocp-labs
Capacity:
  cpu:           4
  ephemeral-storage: 51837932Ki
  hugepages-1Gi: 0
  hugepages-2Mi: 0
  memory:        15980276Ki
  pods:          250
Allocatable:
  cpu:           3500m
  ephemeral-storage: 46700096229
  hugepages-1Gi: 0
  hugepages-2Mi: 0
  memory:        14829300Ki
  pods:          250
System Info:
  Machine ID: 1cec88506fb6430794c1fafdc1ce49ea
  System UUID: 1cec8850-6fb6-4307-94c1-fafdc1ce49ea
  Boot ID: 16099ec0-faba-4654-8133-6fcfedb99961
  Kernel Version: 5.14.0-284.28.1.el9_2.x86_64
  OS Image: Red Hat Enterprise Linux CoreOS 413.92.202308210212-0 (Plow)
  Operating System:
    Architecture: amd64
    Container Runtime Version: cri-o://1.26.4-3.rhaos4.13.git615a02c.e19
    Kubelet Version: v1.26.7+0ef5eae
    Kube-Proxy Version: v1.26.7+0ef5eae
Non-terminated Pods: (48 in total)

jegan@tektutor: ~/openshift-sep-2023
```

|  |   |            | CPU Requests | CPU Limits  | Memory Requests | Memory |
|--|---|------------|--------------|-------------|-----------------|--------|
| Kube-Proxy Version:                    | v1.26.7+0ef5eae                                     |            |              |             |                 |        |
| Non-terminated Pods:                   | (48 in total)                                       |            |              |             |                 |        |
| Namespace                              | Name  |            |              |             |                 |        |
| Limits Age                             |   |            |              |             |                 |        |
| -----                                  | -----   | -----      | -----        | -----       | -----           | -----  |
| openshift-apiserver                    | apiserver-7bbc55ddf9-hph14                          | 110m (3%)  | 0 (0%)       | 250Mi (1%)  | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-authentication               | oauth-openshift-7c9d4c5587-phhwf                    | 10m (0%)   | 0 (0%)       | 50Mi (0%)   | 0 (0%)          |        |
| 5d4h                                   |   |            |              |             |                 |        |
| openshift-cluster-node-tuning-operator | tuned-h84pj   | 10m (0%)   | 0 (0%)       | 50Mi (0%)   | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-cluster-storage-operator     | csi-snapshot-controller-547864ff95-g52pg            | 10m (0%)   | 0 (0%)       | 50Mi (0%)   | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-cluster-storage-operator     | csi-snapshot-webhook-69dbbdcf64-ztlvn               | 10m (0%)   | 0 (0%)       | 20Mi (0%)   | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-cluster-version              | cluster-version-operator-86467b78b6-wmtkh           | 20m (0%)   | 0 (0%)       | 50Mi (0%)   | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-console                      | downloads-5f6995b598-rd955                          | 10m (0%)   | 0 (0%)       | 50Mi (0%)   | 0 (0%)          |        |
| 5d4h                                   |   |            |              |             |                 |        |
| openshift-controller-manager           | controller-manager-58d66b5b85-d5bnc                 | 100m (2%)  | 0 (0%)       | 100Mi (0%)  | 0 (0%)          |        |
| 4d5h                                   |   |            |              |             |                 |        |
| openshift-dns                          | dns-default-cwftf                                   | 60m (1%)   | 0 (0%)       | 110Mi (0%)  | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-dns                          | node-resolver-cwwpt                                 | 5m (0%)    | 0 (0%)       | 21Mi (0%)   | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-etcd                         | etcd-guard-master-1.ocp.tektutor-ocp-labs           | 10m (0%)   | 0 (0%)       | 5Mi (0%)    | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-etcd                         | etcd-master-1.ocp.tektutor-ocp-labs                 | 360m (10%) | 0 (0%)       | 910Mi (6%)  | 0 (0%)          |        |
| 5d4h                                   |   |            |              |             |                 |        |
| openshift-image-registry               | image-registry-69f67fdcfcd-4kxfp                    | 100m (2%)  | 0 (0%)       | 256Mi (1%)  | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-image-registry               | node-ca-tk48w                                       | 10m (0%)   | 0 (0%)       | 10Mi (0%)   | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-ingress-canary               | ingress-canary-fvq65                                | 10m (0%)   | 0 (0%)       | 20Mi (0%)   | 0 (0%)          |        |
| 5d5h                                   |   |            |              |             |                 |        |
| openshift-ingress                      | router-default-6cc68b858c-bhl6                      | 100m (2%)  | 0 (0%)       | 256Mi (1%)  | 0 (0%)          |        |
| 5d4h                                   |   |            |              |             |                 |        |
| openshift-kube-apiserver               | kube-apiserver-guard-master-1.ocp.tektutor-ocp-labs | 10m (0%)   | 0 (0%)       | 5Mi (0%)    | 0 (0%)          |        |
| 5d4h                                   |   |            |              |             |                 |        |
| openshift-kube-apiserver               | kube-apiserver-master-1.ocp.tektutor-ocp-labs       | 290m (8%)  | 0 (0%)       | 1224Mi (8%) | 0 (0%)          |        |
| 4d5h                                   |   |            |              |             |                 |        |

```
jegan@tektutor: ~          jegan@tektutor: ~/ansible-sep-2023          jegan@tektutor: ~/openshift-sep-2023          jegan@tektutor: ~/openshift-sep-2023/Day1          jegan@tektutor: ~/openshift-sep-2023
openshift-monitoring      prometheus-operator-54f9b9b7df-pbccb          6m (0%)    0 (0%)    165Mi (1%)    0 (0%)
5d5h                      prometheus-operator-admission-webhook-6544cf6574-bgcg6          5m (0%)    0 (0%)    30Mi (0%)     0 (0%)
openshift-monitoring      thanos-querier-65485c8478-5rwmj          15m (0%)   0 (0%)    92Mi (0%)     0 (0%)
5d5h                      multus-additional-cni-plugins-9q6bd          10m (0%)   0 (0%)    10Mi (0%)     0 (0%)
openshift-multus         multus-admission-controller-69ccb4fdc7-7vp6p          20m (0%)   0 (0%)    70Mi (0%)     0 (0%)
2d6h                      multus-g6fpp          10m (0%)   0 (0%)    65Mi (0%)     0 (0%)
openshift-multus         network-metrics-daemon-blqpz          20m (0%)   0 (0%)    120Mi (0%)   0 (0%)
5d5h                      network-check-target-5cq2v          10m (0%)   0 (0%)    15Mi (0%)     0 (0%)
openshift-network-diagnostics 5d5h          apiserver-7976f99c69-trp9j          150m (4%)  0 (0%)    200Mi (1%)   0 (0%)
openshift-oauth-apiserver 5d5h          packageserver-7bbf4489d-grt29          10m (0%)   0 (0%)    50Mi (0%)     0 (0%)
openshift-operator-lifecycle-manager 5d5h          route-controller-manager-756d74cc8-sxvk4          100m (2%)  0 (0%)    100Mi (0%)   0 (0%)
openshift-route-controller-manager 4d5h          sdn-controller-6nxbb          20m (0%)   0 (0%)    70Mi (0%)     0 (0%)
openshift-sdn             5d5h          sdn-cp6k4          110m (3%)  0 (0%)    220Mi (1%)   0 (0%)
openshift-sdn             5d5h          service-ca-fcdb855d9-srpvq          10m (0%)   0 (0%)    120Mi (0%)   0 (0%)
Allocated resources:
(Total limits may be over 100 percent, i.e., overcommitted.)
Resource Requests Limits
-----
cpu        2023m (57%) 0 (0%)
memory    6343Mi (43%) 0 (0%)
ephemeral-storage 0 (0%) 0 (0%)
hugepages-1Gi 0 (0%) 0 (0%)
hugepages-2Mi 0 (0%) 0 (0%)
Events: <none>
```

(jegan@tektutor.org)-[~/openshift-sep-2023]

## Lab - Finding IP address of node, OS installed in node, Container Runtime installed in node with wide mode

```
oc get nodes -o wide
```

### Expected output

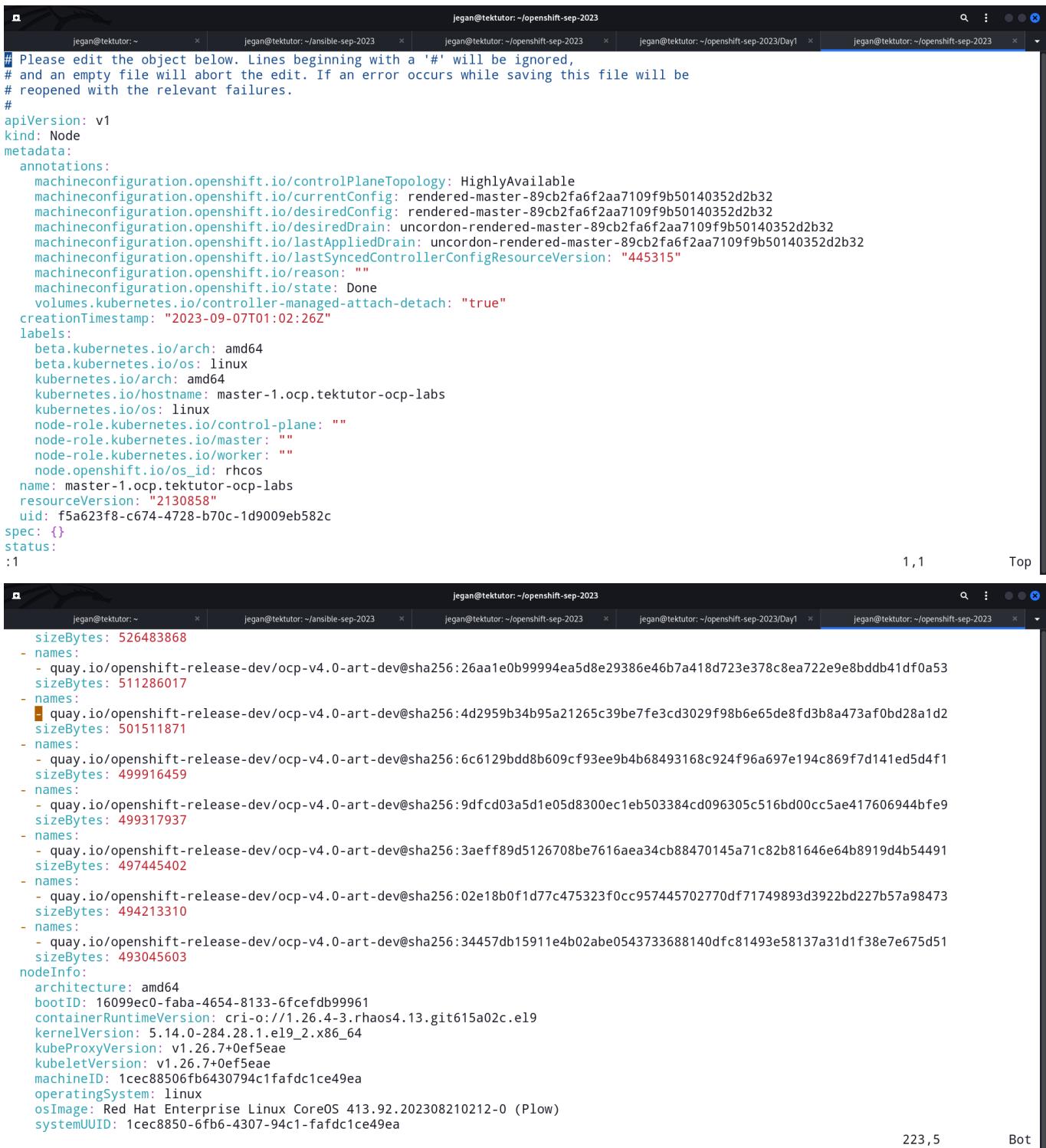
| NAME                           | KERNEL-VERSION               | STATUS | ROLES                       | AGE  | VERSION         | INTERNAL-IP     | EXTERNAL-IP | OS-IMAGE   |
|--------------------------------|------------------------------|--------|-----------------------------|------|-----------------|-----------------|-------------|--|
| master-1.ocp.tektutor-ocp-labs | 5.14.0-284.28.1.el9_2.x86_64 | Ready  | control-plane,master,worker | 5d5h | v1.26.7+0ef5eae | 192.168.122.62  | <none>      | Red Hat Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) |
| master-2.ocp.tektutor-ocp-labs | 5.14.0-284.28.1.el9_2.x86_64 | Ready  | control-plane,master,worker | 5d5h | v1.26.7+0ef5eae | 192.168.122.171 | <none>      | Red Hat Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) |
| master-3.ocp.tektutor-ocp-labs | 5.14.0-284.28.1.el9_2.x86_64 | Ready  | control-plane,master,worker | 5d5h | v1.26.7+0ef5eae | 192.168.122.196 | <none>      | Red Hat Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) |
| worker-1.ocp.tektutor-ocp-labs | 5.14.0-284.28.1.el9_2.x86_64 | Ready  | worker                      | 5d5h | v1.26.7+0ef5eae | 192.168.122.178 | <none>      | Red Hat Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) |
| worker-2.ocp.tektutor-ocp-labs | 5.14.0-284.28.1.el9_2.x86_64 | Ready  | worker                      | 5d5h | v1.26.7+0ef5eae | 192.168.122.42  | <none>      | Red Hat Enterprise Linux CoreOS 413.92.202308210212-0 (Plow) |

(jegan@tektutor.org)-[~/openshift-sep-2023]

## Lab - Editing node details

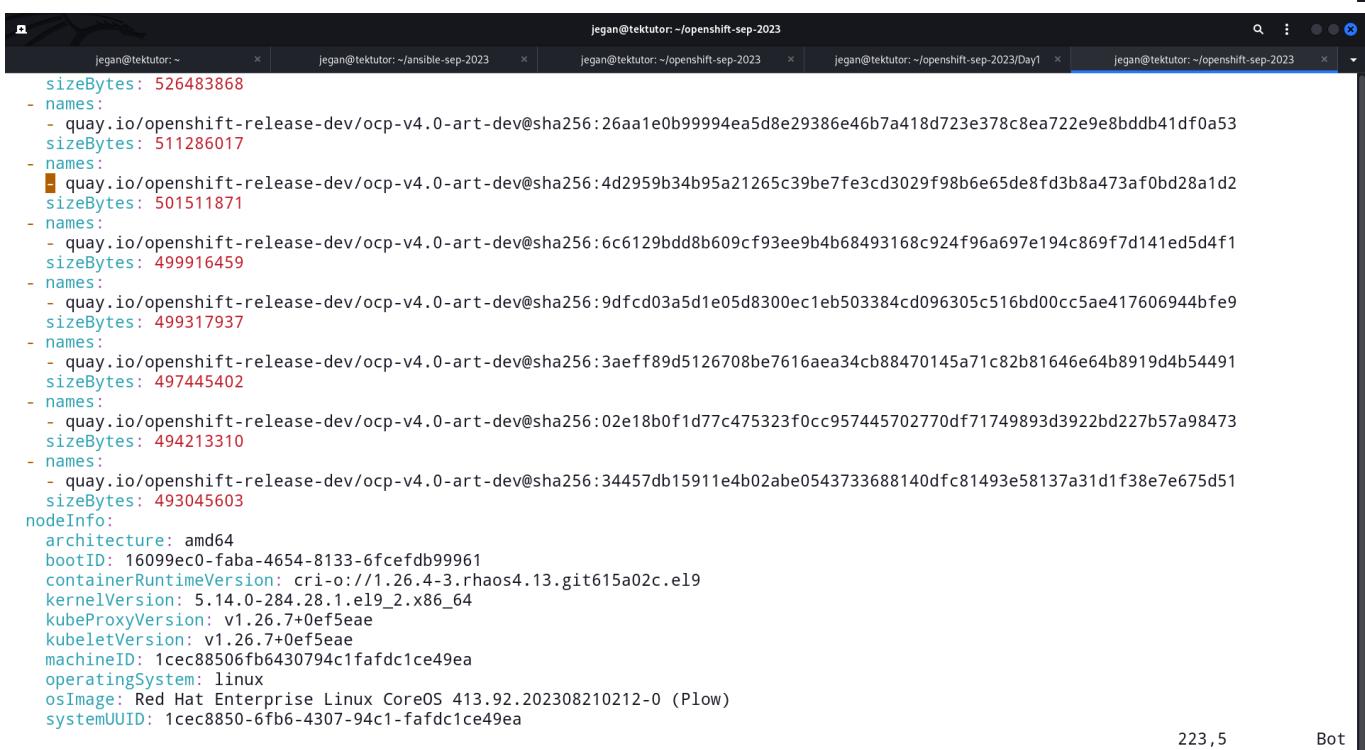
```
oc edit node/master-1.ocp.tektutor-ocp-labs
```

### Expected output



```
jegan@tektutor: ~/openshift-sep-2023
jegan@tektutor: ~/ansible-sep-2023
jegan@tektutor: ~/openshift-sep-2023
jegan@tektutor: ~/openshift-sep-2023/Day1
jegan@tektutor: ~/openshift-sep-2023

# Please edit the object below. Lines beginning with a '#' will be ignored,
# and an empty file will abort the edit. If an error occurs while saving this file will be
# reopened with the relevant failures.
#
apiVersion: v1
kind: Node
metadata:
  annotations:
    machineconfiguration.openshift.io/controlPlaneTopology: HighlyAvailable
    machineconfiguration.openshift.io/currentConfig: rendered-master-89cb2fa6f2aa7109f9b50140352d2b32
    machineconfiguration.openshift.io/desiredConfig: rendered-master-89cb2fa6f2aa7109f9b50140352d2b32
    machineconfiguration.openshift.io/desiredDrain: uncordon-rendered-master-89cb2fa6f2aa7109f9b50140352d2b32
    machineconfiguration.openshift.io/lastAppliedDrain: uncordon-rendered-master-89cb2fa6f2aa7109f9b50140352d2b32
    machineconfiguration.openshift.io/lastSyncedControllerConfigResourceVersion: "445315"
    machineconfiguration.openshift.io/reason: ""
    machineconfiguration.openshift.io/state: Done
    volumes.kubernetes.io/controller-managed-attach-detach: "true"
  creationTimestamp: "2023-09-07T01:02:26Z"
  labels:
    beta.kubernetes.io/arch: amd64
    beta.kubernetes.io/os: linux
    kubernetes.io/arch: amd64
    kubernetes.io/hostname: master-1.ocp.tektutor-ocp-labs
    kubernetes.io/os: linux
    node-role.kubernetes.io/control-plane: ""
    node-role.kubernetes.io/master: ""
    node-role.kubernetes.io/worker: ""
    node.openshift.io/os_id: rhcos
  name: master-1.ocp.tektutor-ocp-labs
  resourceVersion: "2130858"
  uid: f5a623f8-c674-4728-b70c-1d9009eb582c
spec: {}
status:
:1
1,1
Top
```

```
jegan@tektutor: ~/openshift-sep-2023
jegan@tektutor: ~/ansible-sep-2023
jegan@tektutor: ~/openshift-sep-2023
jegan@tektutor: ~/openshift-sep-2023/Day1
jegan@tektutor: ~/openshift-sep-2023

sizeBytes: 526483868
names:
- quay.io/openshift-release-dev/ocp-v4.0-art-dev@sha256:26aa1e0b99994ea5d8e29386e46b7a418d723e378c8ea722e9e8bddb41df0a53
sizeBytes: 511286017
names:
- quay.io/openshift-release-dev/ocp-v4.0-art-dev@sha256:4d2959b34b95a21265c39be7fe3cd3029f98b6e65de8fd3b8a473af0bd28a1d2
sizeBytes: 501511871
names:
- quay.io/openshift-release-dev/ocp-v4.0-art-dev@sha256:6c6129bdd8b609cf93ee9b4b68493168c924f96a697e194c869f7d141ed5d4f1
sizeBytes: 499916459
names:
- quay.io/openshift-release-dev/ocp-v4.0-art-dev@sha256:9dfcd03a5d1e05d8300ec1eb503384cd096305c516bd00cc5ae417606944bf9
sizeBytes: 499317937
names:
- quay.io/openshift-release-dev/ocp-v4.0-art-dev@sha256:3aeff89d5126708be7616aea34cb88470145a71c82b81646e64b8919d4b54491
sizeBytes: 497445402
names:
- quay.io/openshift-release-dev/ocp-v4.0-art-dev@sha256:02e18b0f1d77c475323f0cc957445702770df71749893d3922bd227b57a98473
sizeBytes: 494213310
names:
- quay.io/openshift-release-dev/ocp-v4.0-art-dev@sha256:34457db15911e4b02abe0543733688140dfc81493e58137a31d1f38e7e675d51
sizeBytes: 493045603
nodeInfo:
  architecture: amd64
  bootID: 16099ec0-faba-4654-8133-6fcfdb99961
  containerRuntimeVersion: cri-o://1.26.4-3.rhaos4.13.git615a02c.el9
  kernelVersion: 5.14.0-284.28.1.el9_2.x86_64
  kubeProxyVersion: v1.26.7+0ef5eae
  kubeletVersion: v1.26.7+0ef5eae
  machineID: 1cec88506fb6430794c1fafdc1ce49ea
  operatingSystem: linux
  osImage: Red Hat Enterprise Linux CoreOS 413.92.202308210212-0 (Plow)
  systemUUID: 1cec8850-6fb6-4307-94c1-fafdc1ce49ea
223,5
Bot
```

## Lab - Creating a project in OpenShift

You need to replace 'jegan' with your name to avoid conflicts the lab machine.

```
oc new-project jegan
oc project
```

## Expected output

```
jegan@tektutor: ~/openshift-sep-2023
$ oc new-project jegan
Now using project "jegan" on server "https://api.ocp.tektutor-ocp-labs:6443".
You can add applications to this project with the 'new-app' command. For example, try:
  oc new-app rails-postgresql-example
to build a new example application in Ruby. Or use kubectl to deploy a simple Kubernetes application:
  kubectl create deployment hello-node --image=registry.k8s.io/e2e-test-images/agnhost:2.43 -- /agnhost serve-hostname

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc project
Using project "jegan" on server "https://api.ocp.tektutor-ocp-labs:6443".

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ 
```

## Lab - Creating our first application deployment into OpenShift

```
oc project jegan
oc create deployment nginx --image=nginx:latest
oc get deployments
oc get replicasesets
oc get pods
```

## Expected output

```
jegan@tektutor: ~/openshift-sep-2023
$ oc project jegan
Already on project "jegan" on server "https://api.ocp.tektutor-ocp-labs:6443".

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc create deployment nginx --image=nginx:latest
deployment.apps/nginx created

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get deployments
NAME      READY  UP-TO-DATE   AVAILABLE   AGE
nginx    0/1     1           0           9s

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get replicasesets
NAME      DESIRED  CURRENT  READY   AGE
nginx-654975c8cd  1        1        0       14s

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get pods
NAME          READY  STATUS      RESTARTS   AGE
nginx-654975c8cd-rjxlg  0/1   CrashLoopBackOff  1 (7s ago)  17s

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ 
```

You would observed that the Pod keeps crashing and OpenShift is keep attempting to repair it by restarting the Pod.

Let us check pod log to understand the root cause of the Pod crash

```
oc get pods
oc logs nginx-654975c8cd-rjxlg
```

## Expected output

```
(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get pods
NAME      READY   STATUS    RESTARTS   AGE
nginx-654975c8cd-rjxlg  0/1     Error    4 (65s ago)  2m3s

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get pods
NAME      READY   STATUS          RESTARTS   AGE
nginx-654975c8cd-rjxlg  0/1     CrashLoopBackOff  4 (33s ago)  2m24s

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get pods -w
NAME      READY   STATUS          RESTARTS   AGE
nginx-654975c8cd-rjxlg  0/1     CrashLoopBackOff  4 (56s ago)  2m47s
^C

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc logs nginx-654975c8cd-rjxlg
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: can not modify /etc/nginx/conf.d/default.conf (read-only file system?)
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2023/09/12 07:25:47 [warn] 1#1: the "user" directive makes sense only if the master process runs with super-user privileges, ignored in
/etc/nginx/nginx.conf:2
nginx: [warn] the "user" directive makes sense only if the master process runs with super-user privileges, ignored in /etc/nginx/nginx.conf:2
2023/09/12 07:25:47 [emerg] 1#1: mkdir() "/var/cache/nginx/client_temp" failed (13: Permission denied)
nginx: [emerg] mkdir() "/var/cache/nginx/client_temp" failed (13: Permission denied)

(jegan@tektutor.org)-[~/openshift-sep-2023]
```

From the above log, we can understand that the container image nginx:latest from Docker Hub portal is attempting to create a folder under /var folder, which isn't allowed in Red Hat Enterprise Core OS. Hence, we can't use the nginx:latest container image to deploy nginx in OpenShift, but the same image will work perfectly in Kubernetes Orchestration Platform.

Let's delete the nginx deployment

```
oc delete deploy/nginx
```

## Expected output

```
(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get deployments
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
nginx     0/1       1           0           12m

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc delete deploy/nginx
deployment.apps "nginx" deleted

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get deployments
No resources found in jegan namespace.

(jegan@tektutor.org)-[~/openshift-sep-2023]
```

Let's try to create nginx deployment with bitnami/nginx:latest docker image.

```
oc create deployment/nginx --image=bitnami/nginx:latest
oc get deployments/replicaset,pods
oc get all
```

### Expected output

```
(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get deployments
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
nginx    0/1       1           0           12m

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc delete deploy/nginx
deployment.apps "nginx" deleted

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get deployments
No resources found in jegan namespace.

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc create deployment nginx --image=bitnami/nginx:latest
deployment.apps/nginx created

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get deployments,replicaset,pods
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/nginx    0/1       1           0           8s

NAME          DESIRED   CURRENT   READY   AGE
replicaset.apps/nginx-5bccb79775  1         1         0         8s

NAME      READY   STATUS        RESTARTS   AGE
pod/nginx-5bccb79775-hlvzg  0/1     ContainerCreating   0          8s

(jegan@tektutor.org)-[~/openshift-sep-2023]
$
```

```
(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get deployments
No resources found in jegan namespace.

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc create deployment nginx --image=bitnami/nginx:latest
deployment.apps/nginx created

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get deployments,replicaset,pods
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/nginx    0/1       1           0           8s

NAME          DESIRED   CURRENT   READY   AGE
replicaset.apps/nginx-5bccb79775  1         1         0         8s

NAME      READY   STATUS        RESTARTS   AGE
pod/nginx-5bccb79775-hlvzg  0/1     ContainerCreating   0          8s

(jegan@tektutor.org)-[~/openshift-sep-2023]
$ oc get all
NAME      READY   STATUS        RESTARTS   AGE
pod/nginx-5bccb79775-hlvzg  1/1     Running      0          107s

NAME      READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/nginx    1/1       1           1           107s

NAME          DESIRED   CURRENT   READY   AGE
replicaset.apps/nginx-5bccb79775  1         1         1         107s

(jegan@tektutor.org)-[~/openshift-sep-2023]
$
```

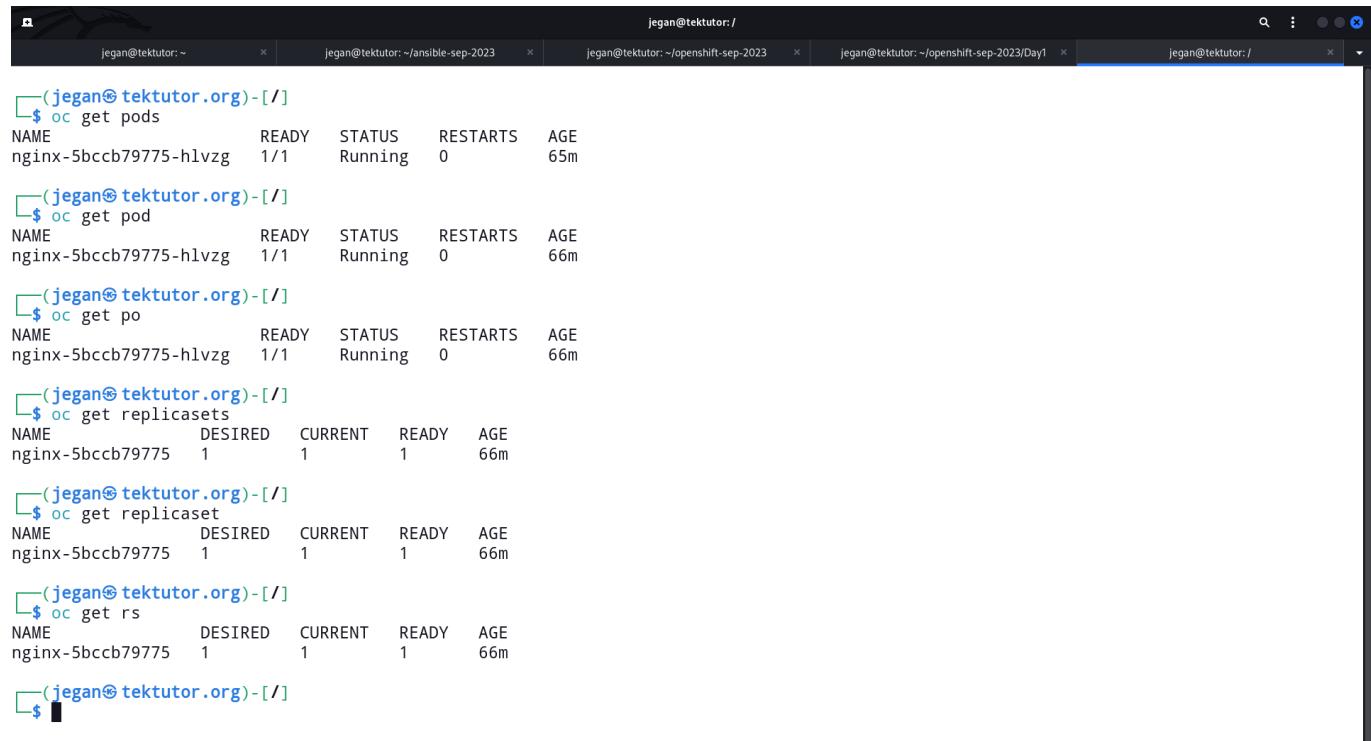
## Lab - Using plural form, singular form and short form Kubernetes/OpenShift commands

```
oc get pods
oc get pod
oc get po

oc get replicsets
oc get replicaset
oc get rs

oc get deployments
oc get deployment
oc get deploy
```

## Expected output



The screenshot shows a terminal window with five tabs open, all titled 'jegan@tektutor:/'.

- Tab 1:** Shows the output of `oc get pods`. It lists a single pod named 'nginx-5bccb79775-hlvzg' with status 'READY' (1/1), 'STATUS' 'Running', 'RESTARTS' 0, and 'AGE' 65m.
- Tab 2:** Shows the output of `oc get pod`. It lists the same pod 'nginx-5bccb79775-hlvzg' with status 'READY' (1/1), 'STATUS' 'Running', 'RESTARTS' 0, and 'AGE' 66m.
- Tab 3:** Shows the output of `oc get po`. It lists the same pod 'nginx-5bccb79775-hlvzg' with status 'READY' (1/1), 'STATUS' 'Running', 'RESTARTS' 0, and 'AGE' 66m.
- Tab 4:** Shows the output of `oc get replicsets`. It lists a single replicset named 'nginx-5bccb79775' with 'DESIRED' and 'CURRENT' count of 1, 'READY' status of 1, and 'AGE' 66m.
- Tab 5:** Shows the output of `oc get replicaset`. It lists the same replicset 'nginx-5bccb79775' with 'DESIRED' and 'CURRENT' count of 1, 'READY' status of 1, and 'AGE' 66m.
- Tab 6:** Shows the output of `oc get rs`. It lists the same replicset 'nginx-5bccb79775' with 'DESIRED' and 'CURRENT' count of 1, 'READY' status of 1, and 'AGE' 66m.
- Tab 7:** An empty tab.

```
jegan@tektutor: ~ | jegan@tektutor: ~/ansible-sep-2023 | jegan@tektutor: ~/openshift-sep-2023 | jegan@tektutor: ~/openshift-sep-2023/Day1 | jegan@tektutor: /  
nginx-5bccb79775-hlvzg 1/1 Running 0 66m  
└─(jegan@tektutor.org)-[ ]$ oc get replicaset  
NAME DESIRED CURRENT READY AGE  
nginx-5bccb79775 1 1 1 66m  
└─(jegan@tektutor.org)-[ ]$ oc get replicaset  
NAME DESIRED CURRENT READY AGE  
nginx-5bccb79775 1 1 1 66m  
└─(jegan@tektutor.org)-[ ]$ oc get rs  
NAME DESIRED CURRENT READY AGE  
nginx-5bccb79775 1 1 1 66m  
└─(jegan@tektutor.org)-[ ]$ oc get deployments  
NAME READY UP-TO-DATE AVAILABLE AGE  
nginx 1/1 1 1 67m  
└─(jegan@tektutor.org)-[ ]$ oc get deployment  
NAME READY UP-TO-DATE AVAILABLE AGE  
nginx 1/1 1 1 67m  
└─(jegan@tektutor.org)-[ ]$ oc get deploy  
NAME READY UP-TO-DATE AVAILABLE AGE  
nginx 1/1 1 1 67m  
└─(jegan@tektutor.org)-[ ]$
```

## Lab - Scale up nginx deployment

```
oc scale deploy/nginx --replicas=5  
oc get po -w  
oc get po
```

### Expected output

```
jegan@tektutor: ~ | jegan@tektutor: ~/ansible-sep-2023 | jegan@tektutor: ~/openshift-sep-2023 | jegan@tektutor: ~/openshift-sep-2023/Day1 | jegan@tektutor: /  
└─(jegan@tektutor.org)-[ ]$ oc get po  
NAME READY STATUS RESTARTS AGE  
nginx-5bccb79775-hlvzg 1/1 Running 0 68m  
└─(jegan@tektutor.org)-[ ]$ oc scale deploy/nginx --replicas=5  
deployment.apps/nginx scaled  
└─(jegan@tektutor.org)-[ ]$ oc get po -w  
NAME READY STATUS RESTARTS AGE  
nginx-5bccb79775-h42vx 0/1 ContainerCreating 0 5s  
nginx-5bccb79775-hlvzg 1/1 Running 0 68m  
nginx-5bccb79775-hn9qn 0/1 ContainerCreating 0 5s  
nginx-5bccb79775-t2z5f 0/1 ContainerCreating 0 5s  
nginx-5bccb79775-v9mft 0/1 ContainerCreating 0 5s  
└─
```

```
jegan@tektutor:~          jegan@tektutor:~/ansible-sep-2023      jegan@tektutor:~/openshift-sep-2023      jegan@tektutor:~/openshift-sep-2023/Day1      jegan@tektutor:/
(jegan@tektutor.org)-[~]
$ oc get po
NAME        READY   STATUS    RESTARTS   AGE
nginx-5bccb79775-hlvzg  1/1     Running   0          68m

(jegan@tektutor.org)-[~]
$ oc scale deploy/nginx --replicas=5
deployment.apps/nginx scaled

(jegan@tektutor.org)-[~]
$ oc get po -w
NAME        READY   STATUS          RESTARTS   AGE
nginx-5bccb79775-h42vx  0/1    ContainerCreating  0          5s
nginx-5bccb79775-hlvzg  1/1     Running   0          68m
nginx-5bccb79775-hn9qn  0/1    ContainerCreating  0          5s
nginx-5bccb79775-t2z5f  0/1    ContainerCreating  0          5s
nginx-5bccb79775-v9mft  0/1    ContainerCreating  0          5s
nginx-5bccb79775-hn9qn  1/1     Running   0          13s
nginx-5bccb79775-t2z5f  1/1     Running   0          17s
nginx-5bccb79775-h42vx  1/1     Running   0          18s
nginx-5bccb79775-v9mft  1/1     Running   0          18s
```

```
jegan@tektutor:~          jegan@tektutor:~/ansible-sep-2023      jegan@tektutor:~/openshift-sep-2023      jegan@tektutor:~/openshift-sep-2023/Day1      jegan@tektutor:/
(jegan@tektutor.org)-[~]
$ oc scale deploy/nginx --replicas=5
deployment.apps/nginx scaled

(jegan@tektutor.org)-[~]
$ oc get po -w
NAME        READY   STATUS          RESTARTS   AGE
nginx-5bccb79775-h42vx  0/1    ContainerCreating  0          5s
nginx-5bccb79775-hlvzg  1/1     Running   0          68m
nginx-5bccb79775-hn9qn  0/1    ContainerCreating  0          5s
nginx-5bccb79775-t2z5f  0/1    ContainerCreating  0          5s
nginx-5bccb79775-v9mft  0/1    ContainerCreating  0          5s
nginx-5bccb79775-hn9qn  1/1     Running   0          13s
nginx-5bccb79775-t2z5f  1/1     Running   0          17s
nginx-5bccb79775-h42vx  1/1     Running   0          18s
nginx-5bccb79775-v9mft  1/1     Running   0          18s
^C

(jegan@tektutor.org)-[~]
$ oc get po
NAME        READY   STATUS    RESTARTS   AGE
nginx-5bccb79775-h42vx  1/1     Running   0          40s
nginx-5bccb79775-hlvzg  1/1     Running   0          69m
nginx-5bccb79775-hn9qn  1/1     Running   0          40s
nginx-5bccb79775-t2z5f  1/1     Running   0          40s
nginx-5bccb79775-v9mft  1/1     Running   0          40s
```

## Lab - Scale down nginx deployment

```
oc scale deploy/nginx --replicas=3
oc get po -w
```

## Expected output

```
jegan@tektutor:~ x jegan@tektutor:~/ansible-sep-2023 x jegan@tektutor:~/openshift-sep-2023 x jegan@tektutor:~/openshift-sep-2023/Day1 x jegan@tektutor:/
nginx-5bccb79775-hn9qn 1/1 Running 0 13s
nginx-5bccb79775-t2z5f 1/1 Running 0 17s
nginx-5bccb79775-h42vx 1/1 Running 0 18s
nginx-5bccb79775-v9mft 1/1 Running 0 18s
^C

[jegan@tektutor.org]-[~]
$ oc get po
NAME READY STATUS RESTARTS AGE
nginx-5bccb79775-h42vx 1/1 Running 0 40s
nginx-5bccb79775-hlvzg 1/1 Running 0 69m
nginx-5bccb79775-hn9qn 1/1 Running 0 40s
nginx-5bccb79775-t2z5f 1/1 Running 0 40s
nginx-5bccb79775-v9mft 1/1 Running 0 40s

[jegan@tektutor.org]-[~]
$ oc scale deploy/nginx --replicas=3
deployment.apps/nginx scaled

[jegan@tektutor.org]-[~]
$ oc get po -w
NAME READY STATUS RESTARTS AGE
nginx-5bccb79775-h42vx 1/1 Running 0 117s
nginx-5bccb79775-hlvzg 1/1 Running 0 70m
nginx-5bccb79775-v9mft 1/1 Running 0 117s
^C

[jegan@tektutor.org]-[~]
```

## Lab - Pods are managed by ReplicaSetController

```
oc describe rs/nginx-5bccb79775
```

## Expected output

```
jegan@tektutor:~ x jegan@tektutor:~/ansible-sep-2023 x jegan@tektutor:~/openshift-sep-2023 x jegan@tektutor:~/openshift-sep-2023/Day1 x jegan@tektutor:/
activate-global-python-argcomplete mtvtoppm
acyclic mtype
add-repository multibit2john

[jegan@tektutor.org]-[~]
$ oc describe rs/nginx-5bccb79775
Name: nginx-5bccb79775
Namespace: jegan
Selector: app=nginx,pod-template-hash=5bccb79775
Labels: app=nginx
pod-template-hash=5bccb79775
Annotations: deployment.kubernetes.io/desired-replicas: 3
deployment.kubernetes.io/max-replicas: 4
deployment.kubernetes.io/revision: 1
Controlled By: Deployment/nginx
Replicas: 3 current / 3 desired
Pods Status: 3 Running / 0 Waiting / 0 Succeeded / 0 Failed
Pod Template:
Labels: app=nginx
pod-template-hash=5bccb79775
Containers:
nginx:
  Image: bitnami/nginx:latest
  Port: <none>
  Host Port: <none>
  Environment: <none>
  Mounts: <none>
  Volumes: <none>
Events:
  Type Reason Age From Message
  ---- ---- - - -
  Normal SuccessfulCreate 77m replicaset-controller Created pod: nginx-5bccb79775-hlvzg
  Normal SuccessfulCreate 8m26s replicaset-controller Created pod: nginx-5bccb79775-hn9qn
  Normal SuccessfulCreate 8m26s replicaset-controller Created pod: nginx-5bccb79775-t2z5f
  Normal SuccessfulCreate 8m26s replicaset-controller Created pod: nginx-5bccb79775-h42vx
  Normal SuccessfulCreate 8m26s replicaset-controller Created pod: nginx-5bccb79775-v9mft
  Normal SuccessfulDelete 6m31s replicaset-controller Deleted pod: nginx-5bccb79775-t2z5f
  Normal SuccessfulDelete 6m31s replicaset-controller Deleted pod: nginx-5bccb79775-hn9qn
  Normal SuccessfulCreate 2m24s replicaset-controller Created pod: nginx-5bccb79775-8xnsv

[jegan@tektutor.org]-[~]
```

## Lab - Checking on which node the pods are running

```
oc get po -o wide
```

### Expected output

```
jegan@tektutor:~ x jegan@tektutor: ~/ansible-sep-2023 x jegan@tektutor: ~/openshift-sep-2023 x jegan@tektutor: ~/openshift-sep-2023/Day1 x jegan@tektutor:~/ x
(jegan@tektutor.org)-[ / ]
$ oc get po -o wide
NAME READY STATUS RESTARTS AGE IP NODE NOMINATED NODE READINESS GATES
nginx-5bccb79775-8xnsv 1/1 Running 0 4m7s 10.128.2.13 worker-1.ocp.tektutor-ocp-labs <none> <none>
nginx-5bccb79775-h42vx 1/1 Running 0 10m 10.131.0.13 worker-2.ocp.tektutor-ocp-labs <none> <none>
nginx-5bccb79775-hlvzg 1/1 Running 0 78m 10.128.0.254 master-3.ocp.tektutor-ocp-labs <none> <none>

(jegan@tektutor.org)-[ / ]
$ oc scale deploy/nginx --replicas=5
deployment.apps/nginx scaled

(jegan@tektutor.org)-[ / ]
$ oc get po -o wide
NAME READY STATUS RESTARTS AGE IP NODE NOMINATED NODE READINESS GATES
nginx-5bccb79775-8xnsv 1/1 Running 0 4m42s 10.128.2.13 worker-1.ocp.tektutor-ocp-labs <none> <none>
nginx-5bccb79775-h42vx 1/1 Running 0 10m 10.131.0.13 worker-2.ocp.tektutor-ocp-labs <none> <none>
nginx-5bccb79775-hlvzg 1/1 Running 0 79m 10.128.0.254 master-3.ocp.tektutor-ocp-labs <none> <none>
nginx-5bccb79775-wzmtw 0/1 ContainerCreating 0 2s <none> master-1.ocp.tektutor-ocp-labs <none> <none>
nginx-5bccb79775-xprr8 0/1 ContainerCreating 0 2s <none> master-2.ocp.tektutor-ocp-labs <none> <none>

(jegan@tektutor.org)-[ / ]
$
```

### Lab - Opening a terminal one a container running inside a Pod

```
oc rsh deploy/nginx
```

### Expected ouput

```
jegan@tektutor:~ x jegan@tektutor: ~/ansible-sep-2023 x jegan@tektutor: ~/openshift-sep-2023 x jegan@tektutor: ~/openshift-sep-2023/Day1 x jegan@tektutor:~/ x
(jegan@tektutor.org)-[ / ]
$ oc get po
NAME READY STATUS RESTARTS AGE
nginx-5bccb79775-8xnsv 1/1 Running 0 11m
nginx-5bccb79775-h42vx 1/1 Running 0 17m
nginx-5bccb79775-hlvzg 1/1 Running 0 86m
nginx-5bccb79775-wzmtw 1/1 Running 0 6m46s
nginx-5bccb79775-xprr8 1/1 Running 0 6m46s

(jegan@tektutor.org)-[ / ]
$ oc rsh deploy/nginx
$ ls
50x.html index.html
$ exit

(jegan@tektutor.org)-[ / ]
$
```

### Lab - Getting inside a particular Pod

```
oc get po
oc exec -it nginx-5bccb79775-hlvzg sh
ls
exit
kubectl exec -it nginx-5bccb79775-hlvzg sh
ls
cat index.html
exit
```

## Expected output



```
jegan@tektutor:~          jegan@tektutor:~/ansible-sep-2023      jegan@tektutor:~/openshift-sep-2023      jegan@tektutor:~/openshift-sep-2023/Day1      jegan@tektutor:/
50x.html index.html
$ exit

[jegan@tektutor.org]-[ ]
$ oc exec -it nginx-5bccb79775-hlvzg sh
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
$ ls
50x.html index.html
$ exit

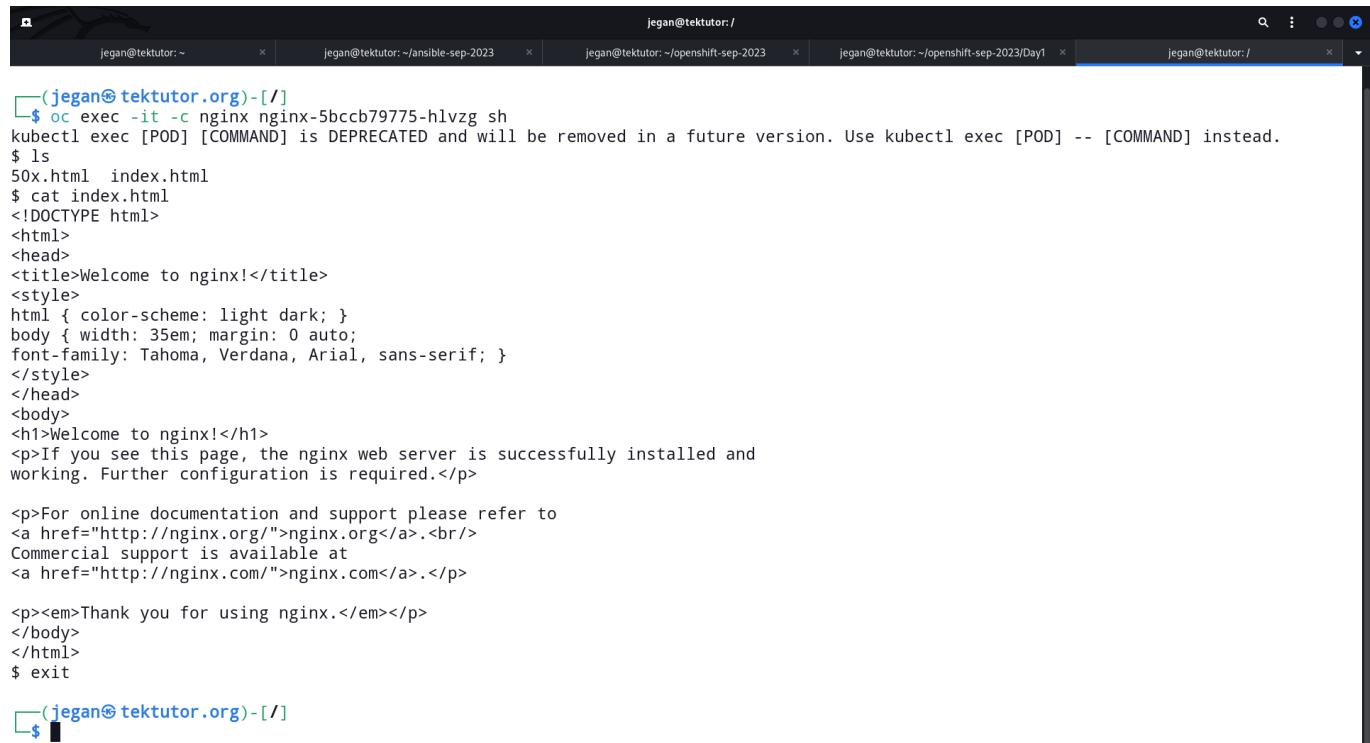
[jegan@tektutor.org]-[ ]
$ kubectl exec -it nginx-5bccb79775-hlvzg sh
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
$ ls
50x.html index.html
$ exit

[jegan@tektutor.org]-[ ]
$ kubectl exec -it nginx-5bccb79775-hlvzg sh
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
$ cat index.html
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>
<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>
<p><em>Thank you for using nginx.</em></p>
```

## Lab - Choosing a specific container while opening a shell in Pod

```
oc exec -it -c nginx nginx-5bccb79775-hlvzg sh
ls
cat index.html
exit
```

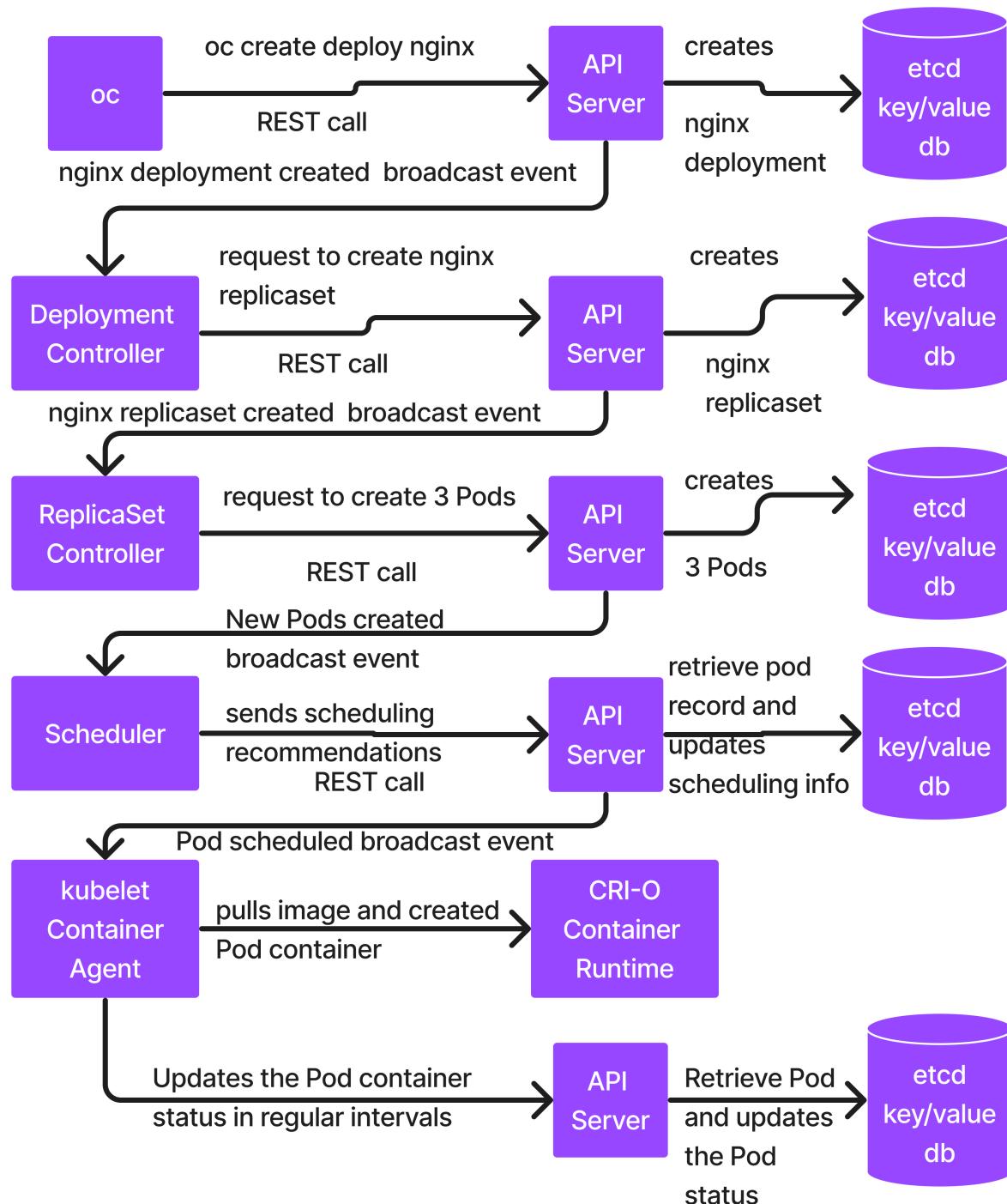
## Expected output



```
jegan@tektutor:~          jegan@tektutor: ~/ansible-sep-2023      jegan@tektutor: ~/openshift-sep-2023      jegan@tektutor: ~/openshift-sep-2023/Day1      jegan@tektutor:~/  
jegan@tektutor:~          jegan@tektutor: ~/ansible-sep-2023      jegan@tektutor: ~/openshift-sep-2023      jegan@tektutor: ~/openshift-sep-2023/Day1      jegan@tektutor:~/  
└─(jegan@tektutor.org)-[ / ]$ oc exec -it -c nginx nginx-5bccb79775-hlvzg sh  
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.  
$ ls  
50x.html  index.html  
$ cat index.html  
<!DOCTYPE html>  
<html>  
<head>  
<title>Welcome to nginx!</title>  
<style>  
html { color-scheme: light dark; }  
body { width: 35em; margin: 0 auto;  
font-family: Tahoma, Verdana, Arial, sans-serif; }  
</style>  
</head>  
<body>  
<h1>Welcome to nginx!</h1>  
<p>If you see this page, the nginx web server is successfully installed and  
working. Further configuration is required.</p>  
  
<p>For online documentation and support please refer to  
<a href="http://nginx.org/">nginx.org</a>.<br />  
Commercial support is available at  
<a href="http://nginx.com/">nginx.com</a>.</p>  
  
<p><em>Thank you for using nginx.</em></p>  
</body>  
</html>  
$ exit  
└─(jegan@tektutor.org)-[ / ]$
```

## Info - What happens in OpenShift cluster when we create a deployment

```
oc create deployment nginx --image=bitnami/nginx:latest --replicas=3
```



## Lab - Describe pod

```
oc describe po/nginx-5bccb79775-h42vx
```

## Expected output

```
jegan@tektutor: ~ x jegan@tektutor: ~/ansible-sep-2023 x jegan@tektutor: ~/openshift-sep-2023 x jegan@tektutor: ~/openshift-sep-2023/Day1 x jegan@tektutor: /
```

nginx-5bccb79775-h42vx 1/1 Running 0 35m  
 nginx-5bccb79775-hlvzg 1/1 Running 0 104m  
 nginx-5bccb79775-wzmtw 1/1 Running 0 25m  
 nginx-5bccb79775-xprrr8 1/1 Running 0 25m

(jegan@tektutor.org)-[ ]  
 \$ oc edit pod/nginx-5bccb79775-8xnsv  
 Edit cancelled, no changes made.

(jegan@tektutor.org)-[ ]  
 \$ oc describe po/nginx-5bccb79775-h42vx  
 Name: nginx-5bccb79775-h42vx  
 Namespace: jegan  
 Priority: 0  
 Service Account: default  
 Node: worker-2.ocp.tektutor-ocp-labs/192.168.122.42  
 Start Time: Tue, 12 Sep 2023 14:15:35 +0530  
 Labels: app=nginx  
 pod-template-hash=5bccb79775  
 Annotations: k8s.v1.cni.cncf.io/network-status:  
 [ { "name": "openshift-sdn", "interface": "eth0", "ips": [ "10.131.0.13" ], "default": true, "dns": {} } ]  
 openshift.io/scc: restricted-v2  
 seccomp.security.alpha.kubernetes.io/pod: runtime/default  
 Status: Running  
 IP: 10.131.0.13  
 IPs:  
 IP: 10.131.0.13  
 Controlled By: ReplicaSet/nginx-5bccb79775  
 Containers:  
 nginx:  
 Container ID: cri-o://50edfbf395c20388db7112f3cd8d62af994648f6bad5cf6b2138f963623f6504  
 Image: bitnami/nginx:latest  
 Image ID: docker.io/bitnami/nginx@sha256:5b9ced1c2cffea1a59d14ee01db27679f9282f8ed538aee27193afa0a78d3958  
 Port: <none>

```
jegan@tektutor: ~ x jegan@tektutor: ~/ansible-sep-2023 x jegan@tektutor: ~/openshift-sep-2023 x jegan@tektutor: ~/openshift-sep-2023/Day1 x jegan@tektutor: /
```

Image ID: docker.io/bitnami/nginx@sha256:5b9ced1c2cffea1a59d14ee01db27679f9282f8ed538aee27193afa0a78d3958  
 Port: <none>  
 Host Port: <none>  
 State: Running  
 Started: Tue, 12 Sep 2023 14:15:52 +0530  
 Ready: True  
 Restart Count: 0  
 Environment: <none>  
 Mounts:  
 /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-pb7nz (ro)  
 Conditions:  
 Type Status  
 Initialized True  
 Ready True  
 ContainersReady True  
 PodScheduled True  
 Volumes:  
 kube-api-access-pb7nz:  
 Type: Projected (a volume that contains injected data from multiple sources)  
 TokenExpirationSeconds: 3607  
 ConfigMapName: kube-root-ca.crt  
 ConfigMapOptional: <nil>  
 DownwardAPI: true  
 ConfigMapName: openshift-service-ca.crt  
 ConfigMapOptional: <nil>  
 QoS Class: BestEffort  
 Node-Selectors: <none>  
 Tolerations: node.kubernetes.io/not-ready:NoExecute op=Exists for 300s  
 node.kubernetes.io/unreachable:NoExecute op=Exists for 300s  
 Events:  
 Type Reason Age From Message  
 ---- ---- -- --  
 Normal Scheduled 36m default-scheduler Successfully assigned jegan/nginx-5bccb79775-h42vx to worker-2.ocp.tektutor-ocp-labs  
 Normal AddedInterface 36m multus Add eth0 [10.131.0.13/23] from openshift-sdn  
 Normal Pulling 36m kubelet Pulling image "bitnami/nginx:latest"  
 Normal Pulled 36m kubelet Successfully pulled image "bitnami/nginx:latest" in 14.110670381s (14.110685466s including waiting)  
 Normal Created 36m kubelet Created container nginx  
 Normal Started 36m kubelet Started container nginx

(jegan@tektutor.org)-[ ]  
 \$

## Lab - Port-forwarding a Pod to access the nginx web page ( Meant for Testing purpose )

```
oc port-forward pod/nginx-5bccb79775-8xnsv 8001:8080
```

## Expected output

The terminal window shows the command `oc port-forward nginx-5bccb79775-8xnsv 8001:8080` being run, followed by output indicating port forwarding is active. The browser window shows the 'Welcome to nginx!' page.

```
(jegan@tektutor.org)-[~]
$ oc port-forward nginx-5bccb79775-8xnsv 8001:8080
Forwarding from 127.0.0.1:8001 -> 8080
Forwarding from [::1]:8001 -> 8080
Handling connection for 8001
```

## Lab - Creating an internal ClusterIP service imperatively

```
oc get po -o wide
oc expose deploy/nginx --type=ClusterIP --port=8080
oc describe svc/nginx
```

## Expected output

The terminal window shows the creation of a ClusterIP service named 'nginx' with IP 172.30.51.194 and port 8080/TCP.

```
(jegan@tektutor.org)-[~]
$ oc get po -o wide
NAME          READY   STATUS    RESTARTS   AGE     IP           NODE      NOMINATED NODE   READINESS GATES
nginx-5bccb79775-8xnsv  1/1     Running   0          43m    10.128.2.13  worker-1.ocp.tektutor-ocp-labs  <none>        <none>
nginx-5bccb79775-h42vx  1/1     Running   0          49m    10.131.0.13  worker-2.ocp.tektutor-ocp-labs  <none>        <none>
nginx-5bccb79775-hlvzg  1/1     Running   0          118m   10.128.0.254 master-3.ocp.tektutor-ocp-labs  <none>        <none>
nginx-5bccb79775-wzmtw  1/1     Running   0          38m    10.129.1.26  master-1.ocp.tektutor-ocp-labs  <none>        <none>
nginx-5bccb79775-xprrr  1/1     Running   0          38m    10.130.0.51  master-2.ocp.tektutor-ocp-labs  <none>        <none>

(jegan@tektutor.org)-[~]
$ oc expose deploy/nginx --type=ClusterIP --port=8080
service/nginx exposed

(jegan@tektutor.org)-[~]
$ oc get services
NAME      TYPE      CLUSTER-IP      EXTERNAL-IP      PORT(S)      AGE
nginx    ClusterIP  172.30.51.194  <none>          8080/TCP   9s

(jegan@tektutor.org)-[~]
$ oc describe svc/nginx
Name:           nginx
Namespace:      jegan
Labels:         app=nginx
Annotations:    <none>
Selector:       app=nginx
Type:          ClusterIP
IP Family Policy: SingleStack
IP Families:   IPv4
IP:             172.30.51.194
IPs:            172.30.51.194
Port:           <unset>  8080/TCP
TargetPort:     8080/TCP
Endpoints:     10.128.0.254:8080,10.128.2.13:8080,10.129.1.26:8080 + 2 more...
Session Affinity: None
Events:         <none>
```

## Lab - Creating an external nodeport service imperatively

For Node Port Services, Kubernetes/OpenShift has reserved ports between 30000 to 32767, whichever node in that range is available on all your openshift nodes that will be randomly picked by OpenShift and assigned for your Node Port service.

```
oc delete svc/nginx
oc get services

oc expose deploy/nginx --type=NodePort --port=8080
```

### Expected output

```
jegan@tektutor:~          jegan@tektutor:~/ansible-sep-2023      jegan@tektutor:~/openshift-sep-2023      jegan@tektutor:~/openshift-sep-2023/Day1      jegan@tektutor:/
Events: <none>
(jegan@tektutor.org)-[~]
$ oc delete svc/nginx
service "nginx" deleted

(jegan@tektutor.org)-[~]
$ oc get services
No resources found in jegan namespace.

(jegan@tektutor.org)-[~]
$ oc expose deploy/nginx --type=NodePort --port=8080
service/nginx exposed

(jegan@tektutor.org)-[~]
$ oc get services
NAME    TYPE      CLUSTER-IP   EXTERNAL-IP   PORT(S)    AGE
nginx  NodePort  172.30.79.96  <none>        8080:30079/TCP  2s

(jegan@tektutor.org)-[~]
$ oc describe svc/nginx
Name:           nginx
Namespace:      jegan
Labels:         app=nginx
Annotations:   <none>
Selector:       app=nginx
Type:          NodePort
IP Family Policy: SingleStack
IP Families:   IPv4
IP:             172.30.79.96
IPs:            172.30.79.96
Port:           <unset> 8080/TCP
TargetPort:     8080/TCP
NodePort:       <unset> 30079/TCP
Endpoints:     10.128.0.254:8080,10.128.2.13:8080,10.129.1.26:8080 + 2 more...
Session Affinity: None
External Traffic Policy: Cluster
Events:         <none>

(jegan@tektutor.org)-[~]
$
```

### Accessing the external NodePort service

```
oc get nodes -o wide
curl http://192.168.122.62:30079
curl http://master-2.ocp.tektutor-ocp-labs:30079
curl http://worker-2.ocp.tektutor-ocp-labs:30079
```

In the above command, 30079 is the Node Port opened by OpenShift on every node in the openshift cluster. The 192.168.122.62 is the IP address of the master-1 node, we could access the node port service from any node in the cluster.

## Expected output

```
jegan@tektutor: ~      jegan@tektutor: ~/ansible-sep-2023      jegan@tektutor: ~/openshift-sep-2023      jegan@tektutor: ~/openshift-sep-2023/Day1      jegan@tektutor: /
05 413.92.202308210212-0 (Plow) 5.14.0-284.28.1.e19_2.x86_64 cri-o://1.26.4-3.rhaos4.13.git615a02c.e19
worker-1.ocp.tektutor-ocp-labs Ready worker 5d8h v1.26.7+0ef5eae 192.168.122.178 <none> Red Hat Enterprise Linux Core
05 413.92.202308210212-0 (Plow) 5.14.0-284.28.1.e19_2.x86_64 cri-o://1.26.4-3.rhaos4.13.git615a02c.e19
worker-2.ocp.tektutor-ocp-labs Ready worker 5d8h v1.26.7+0ef5eae 192.168.122.42 <none> Red Hat Enterprise Linux Core
05 413.92.202308210212-0 (Plow) 5.14.0-284.28.1.e19_2.x86_64 cri-o://1.26.4-3.rhaos4.13.git615a02c.e19

[jegan@tektutor.org]-[ ]
$ curl http://192.168.122.62:30079
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>
<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>
<p><em>Thank you for using nginx.</em></p>
</body>
</html>

[jegan@tektutor.org]-[ ]
$ curl http://master-2.ocp.tektutor-ocp-labs:30079
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
```

## Lab - Installing MetalLB Operator in Red Hat OpenShift Cluster

<https://medium.com/tektutor/using-metallb-loadbalancer-with-bare-metal-openshift-on-prem-4230944bfa35>

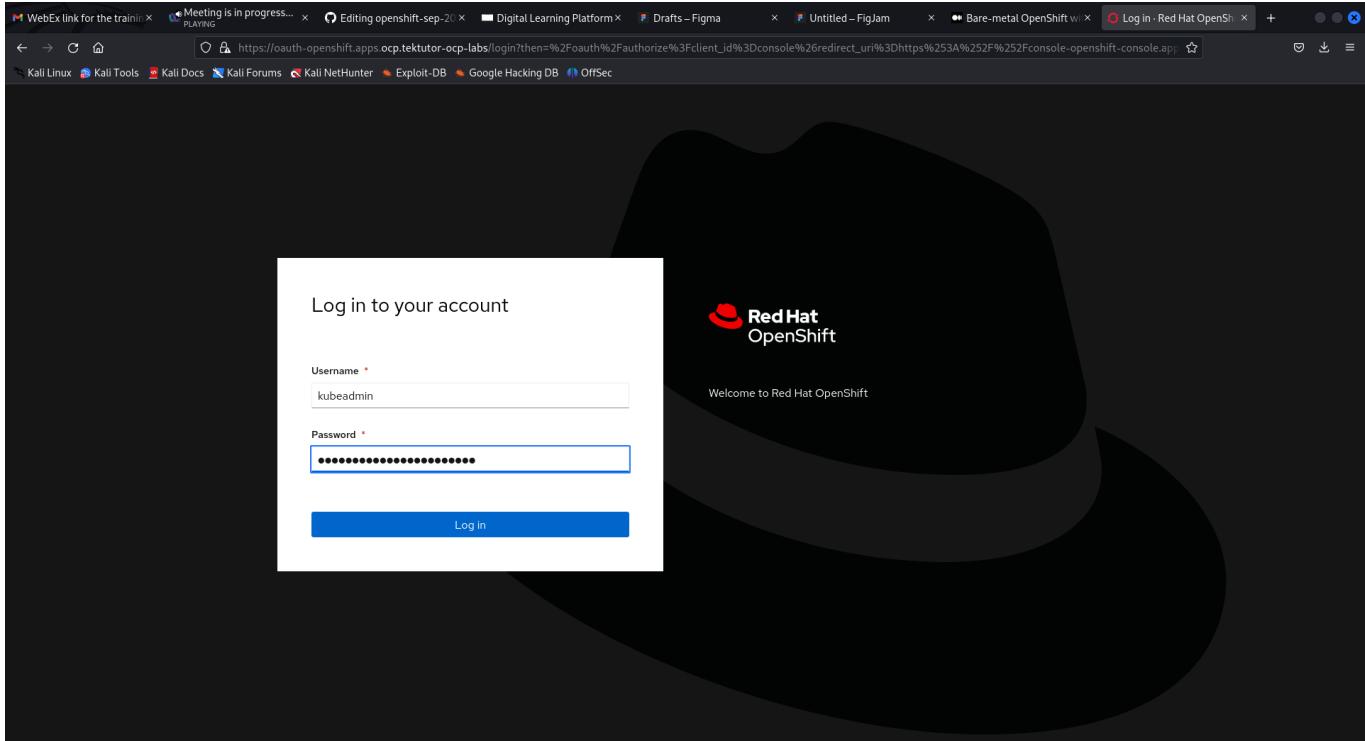
Login to your Red Hat OpenShift webconsole from CentOS web browser

```
jegan@tektutor: ~      jegan@tektutor: ~/ansible-sep-2023      jegan@tektutor: ~/openshift-sep-2023      jegan@tektutor: ~/openshift-sep-2023/Day1      jegan@tektutor: /
(jegan@tektutor.org)-[ ]
$ cat ~/openshift.txt
Red Hat OpenShift API Server Endpoint URL
+++++++++++++++++
https://api.ocp.tektutor-ocp-labs:6443

Red Hat OpenShift Webconsole URL
+++++++++++++++++
https://console-openshift-console.apps.ocp.tektutor-ocp-labs

Login Credentials
+++++
user: kubeadmin
password: AChs3-sgS8Z-Szmws-FoI2F

[jegan@tektutor.org]-[ ]
$
```



## Lab - Creating LoadBalancer external service

```
oc delete svc/nginx
oc get deploy
oc expose deploy/nginx --type=LoadBalancer --port=8080
oc get svc
oc describe svc/nginx
```

### Expected output

```
jegan@tektutor:~$ oc get svc
NAME      TYPE      CLUSTER-IP      EXTERNAL-IP      PORT(S)      AGE
nginx    LoadBalancer   172.30.87.227  192.168.122.50  8080:31660/TCP  29m

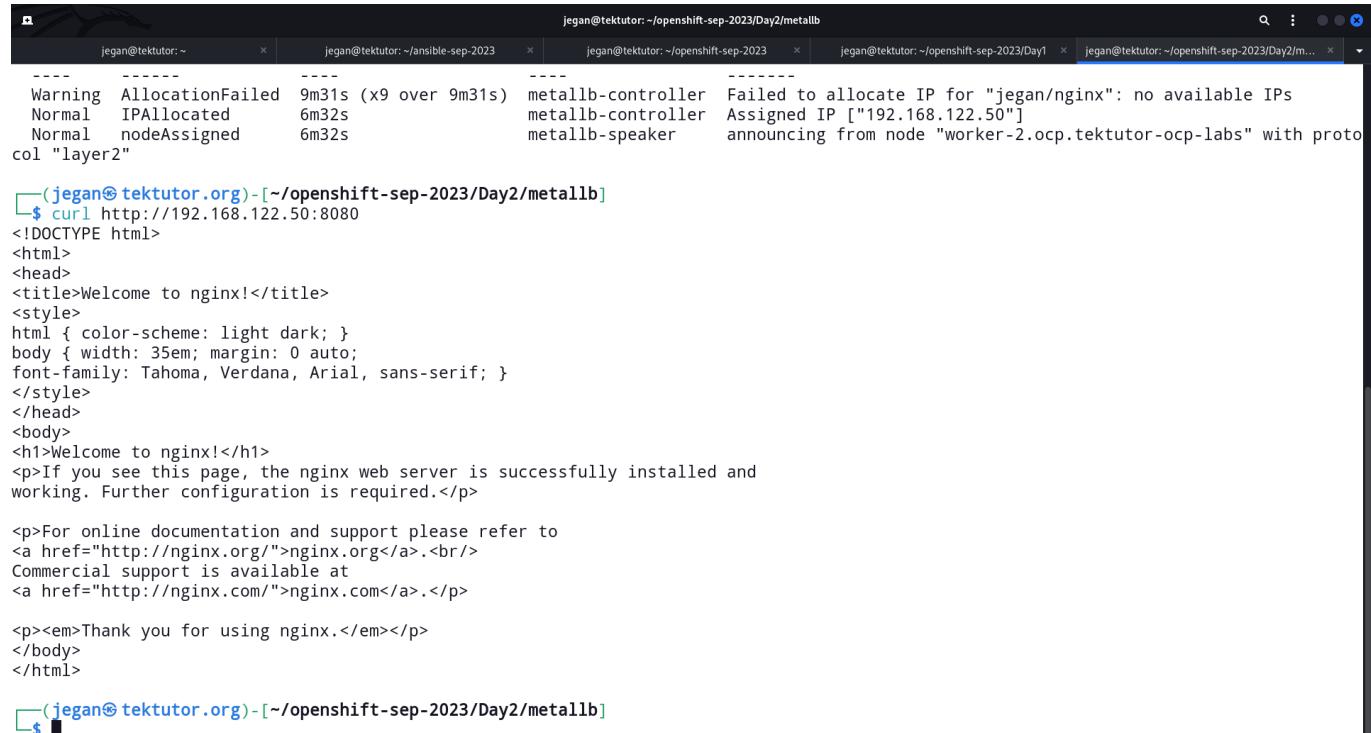
jegan@tektutor:~$ oc describe svc/nginx
Name:            nginx
Namespace:       jegan
Labels:          app=nginx
Annotations:    metallb.universe.tf/ip-allocated-from-pool: tektutor-metallb-addresspool
Selector:        app=nginx
Type:           LoadBalancer
IP Family Policy: SingleStack
IP Families:    IPv4
IP:             172.30.87.227
IPS:            172.30.87.227
LoadBalancer Ingress: 192.168.122.50
Port:           <unset>  8080/TCP
TargetPort:     8080/TCP
NodePort:       <unset>  31660/TCP
Endpoints:     10.128.0.254:8080,10.128.2.13:8080,10.129.1.26:8080 + 2 more...
Session Affinity: None
External Traffic Policy: Cluster
Events:
  Type      Reason      Age      From      Message
  ----      ----      --      ----      -----
  Warning  AllocationFailed  9m31s (x9 over 9m31s)  metallb-controller  Failed to allocate IP for "jegan/nginx": no available IPs
  Normal   IPAllocated   6m32s      metallb-controller  Assigned IP ["192.168.122.50"]
  Normal   nodeAssigned  6m32s      metallb-speaker   announcing from node "worker-2.ocp.tektutor-ocp-labs" with proto
```

### Accessing the nginx web page

```
curl http://<nginx-service-external-ip>:8080
```

```
curl http://192.168.122.50:8080
```

## Expected output



The screenshot shows a terminal window with five tabs open, all belonging to the user 'jegan@tektutor'. The active tab is titled 'jegan@tektutor: ~/openshift-sep-2023/Day2/metallb'. The terminal displays the following log entries:

```
Warning AllocationFailed 9m31s (x9 over 9m31s) metallb-controller Failed to allocate IP for "jegan/nginx": no available IPs
Normal IPAllocated 6m32s metallb-controller Assigned IP ["192.168.122.50"]
Normal nodeAssigned 6m32s metallb-speaker announcing from node "worker-2.ocp.tektutor-ocp-labs" with proto
col "layer2"
```

Below the logs, the terminal shows the output of a curl command:

```
(jegan@tektutor.org)-[~/openshift-sep-2023/Day2/metallb]
$ curl http://192.168.122.50:8080
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>
<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>
<p><em>Thank you for using nginx.</em></p>
</body>
</html>
```

The terminal prompt shows the user has typed a command and is awaiting further input.