**Kubernetes Installation:**

Create 1 AWS **ubuntu** VM (**t2 medium** for master) and 1 more ec2 instance (**t2micro** for node)

Step 1. Run following command on Master and Node VM (VM1 & VM2), We need to install kubeadm,kubectl,kubelet and cni

apt-get update && apt-get install -y apt-transport-https

curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | apt-key add -

cat <<EOF >/etc/apt/sources.list.d/kubernetes.list

deb http://apt.kubernetes.io/ kubernetes-xenial main

EOF

apt-get update

apt-get install -y docker.io

apt-get install -y kubelet kubeadm kubectl kubernetes-cni

**(Some important process in kubernetes.**

kubeadm: command to bootstrap the cluster.

kubelet: component that runs on all of the machines in your cluster and does things like starting pods and containers.

kubectl: command line utility to talk to your cluster.

kubernetes-cni: used for kubernetes networking)

Step 2. Run following command on **Master** VM (VM1) only

kubeadm init

Copy kubeadm join output command in notepad

(It will look like... kubeadm join --token ef6acb.11b6129ab3a2fbe0 172.31.22.102:6443 --discovery-token-ca-cert-hash sha256:e83e2872f599eea6b13d42a7b4a01a55958a78c6439192c8d2bb4578797de686 )

Step 3. Run following command on Master VM (VM1)

sudo cp /etc/kubernetes/admin.conf $HOME/

sudo chown $(id -u):$(id -g) $HOME/admin.conf

export KUBECONFIG=$HOME/admin.conf

kubectl apply -f <https://git.io/weave-kube> (it will create a service account)

Step 4. To Docker cgroup driver matches the kubelet config (VM1)

docker info | grep -i cgroup

cat /etc/systemd/system/kubelet.service.d/10-kubeadm.conf

Step 5. If the Docker cgroup driver and the kubelet config don’t match, change the kubelet config to match the Docker cgroup drive (VM1)

**sed -i "s/cgroup-driver=systemd/cgroup-driver=cgroupfs/g" /etc/systemd/system/kubelet.service.d/10-kubeadm.conf**

Step 6. To restarting kubelet run following command (VM1)

systemctl daemon-reload

systemctl restart kubelet

mkdir -p $HOME/.kube

sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config

sudo chown $(id -u):$(id -g) $HOME/.kube/config

kubectl taint nodes --all node-role.kubernetes.io/master-

kubectl apply -f https://git.io/weave-kube-1.6

Step 7. Run kubeadm join output command on node VM (VM2) (copy output command from step 2).

Once you run kubeadm join command (Token) on Node VM, your VM will become part of Kubernetes cluster.

kubectl get node ----> run on Master VM

wait for some time status would get changed from Not Ready to Ready

Step 8. To change label, Run following command on master VM

**Syntax**: kubectl label nodes <node-name> <label-key>=<label-value> ---->Node label syntax

Ex: kubectl label nodes ip-172-31-21-230 node-role.kubernetes.io/node1=ip-172-31-21-230 ----> update your node name

kubectl label nodes ip-172-31-26-34 node-role.kubernetes.io/node2=ip-172-31-26-34

kubectl get nodes ----> to check nodes

kubectl get pods ----> to check running pods

## Step 9. Deploying and Accessing an Application

Let’s launch a simple Nginx web server and access its default web page, Execute below command to pull the [Nginx image](https://hub.docker.com/_/nginx/) from [Docker Hub](https://hub.docker.com/) and create a deployment called **myweb:**

**kubectl run --image=nginx:latest myweb (deprecated)**

**OR**

**kubectl run --generator=run-pod/v1 --image=nginx mynginx1**

 It packages and deploys the container in a Kubernetes-specific artifact called a Pod

To access the web server running inside the Pod, (here target pod is port of pod)

**kubectl expose pod <pod name> --port=80 --target-port=<pod port> --type=<NodePort for Service>**

ex:

**kubectl expose pod myweb-59d7488cb9-jvnwn --port=80 --target-port=80 --type=NodePort**

The Pod is now exposed on every Node of the cluster on an arbitrary port.

(**For a NodePort service, Kubernetes allocates a port from a configured range (default is 30000-32767), and each node forwards that port, which is the same on each node, to the service. It is possible to define a specific port number, but you should take care to avoid potential port conflicts**.)

kubectl get pods -o wide --------> it will let you know that how many pods are running on which node VMs or Get the status of the service

kubectl get pods --all-namespaces --------> list all the nodes

To get the NodePort of the myweb deployment, run the following command.

kubectl get svc <pod name>

ex: kubectl get svc myweb-59d7488cb9-jvnwn

**Step 10. Go to Node VM and run**

docker ps

--------------------------------------------------------------------------------------------------------------------------------------

**Useful Kubectl commands**

**kubectl exec -it <pod> -- /bin/bash**

**kubectl describe pod <Pod name> 🡪**Describe pod

**kubeadm token create --print-join-command** ->Regenerate kubeadm join token

**kubectl get deployments** ---🡪Get info on current deployments

**kubectl get rs** ---🡪 get info about the replica sets

**kubectl get pods --show-labels** ---🡪Get pods and show the labels attached to those pods.

**kubectl rollout status deployment/myweb** --🡪get deployment status

**kubectl set image deployment/helloworld-deployment k8s-demo=k8s-demo2** - -🡪run the k8s-demo with the image label version2

**kubectl edit deployment/helloworld-deployment** ->Edit deployment object

then check status of deployment and number of pod.

**kubectl rollout status deployment/helloworld-deployment** -> get the status of the rollout

**kubectl rollout history deployment/helloworld-deployment - get the rollout history** ->useful for rollback to a specific version.

**kubectl rollout undo deployment/helloworld-deployment** ->rollback to previous version

**kubctl rollout undo deployment/helloworld-deployment --to-revision=N** ->roll back to a specific version.

**kubectl delete rc <replicationcontoller deployment name>** ->to delete replication controller deployment

**kubectl get pods redis-master --template='{{(index (index .spec.containers 0).ports 0).containerPort}}{{"\n"}}'** -> Verify that the Redis server is running in the pod and listening on port:

LAB:

In a two-node cluster, a web application has in-memory cache such as redis. We want the web-servers to be co-located with the cache as much as possible

==========================================================================

Deployments, pods, and services can also be created using yaml/json file.

**Assignment1: Deploy Jenkins on Kubernetes?**

Kubectl run –image=Jenkins myjenkins

kubectl expose pod <pod name> --port=8080 --target-port=8080 --type=NodePort

kubectl get svc

then browse <VM IP>:<Port>

to get password: login to pod

kubectl exec -it <pod> -- /bin/bash

**Assignment 2: Deployment of redis**

vi redisdeployment.yml

**apiVersion: apps/v1**

**kind: Deployment**

**metadata:**

**name: redis-cache**

**spec:**

**selector:**

**matchLabels:**

**app: store**

**replicas: 2**

**template:**

**metadata:**

**labels:**

**app: store**

**spec:**

**affinity:**

**podAntiAffinity:**

**requiredDuringSchedulingIgnoredDuringExecution:**

**- labelSelector:**

**matchExpressions:**

**- key: app**

**operator: In**

**values:**

**- store**

**topologyKey: "kubernetes.io/hostname"**

**containers:**

**- name: redis-server**

**image: redis:3.2-alpine**

The below yaml snippet of the webserver deployment This will also ensure that each web-server replica does not co-locate on a single node.

vi nginxprakash.yml

**apiVersion: apps/v1**

**kind: Deployment**

**metadata:**

**name: nginx-deployment**

**labels:**

**app: nginx**

**spec:**

**replicas: 3**

**selector:**

**matchLabels:**

**app: nginx**

**template:**

**metadata:**

**labels:**

**app: nginx**

**spec:**

**containers:**

**- name: nginx**

**image: nginx:1.7.9**

**ports:**

**- containerPort: 80**

kubectl create -f <yml file name>.yml 🡪(Create a pod using file name redisprakash.yml)

kubectl create -f nginxprakash.yml

kubectl get pods

kubectl get pods -o wide

kubectl get services

kubectl get deployments

kubectl

delete deployments <deployment name>

(The create command can be used to create a pod directly, or it can create a pod or pods through a Deployment. It is highly recommended that you use a Deployment to create your pods. It watches for failed pods and will start up new pods as required to maintain the specified number. If you don’t want a Deployment to monitor your pod (e.g. your pod is writing non-persistent data which won’t survive a restart, or your pod is intended to be very short-lived), you can create a pod directly with the create command.

You need a **deployment** object - or other Kubernetes API objects like a **replication controller** or **replicaset** - that needs to keep the **replicas** (pods) alive (that's kind of the point of using kubernetes).

What you will use in practice for a typical application are:

1. **Deployment object** (where you will specify your apps container/containers) that will host your app's container with some other specifications.
2. **Service object** (that is like a grouping object and gives it a so-called virtual IP (cluster IP) for the pods that have a certain label - and those pods are basically the app containers that you deployed with the former **deployment** object).

You need to have the **service** object because the pods from the deployment object can be killed, scaled up and down, and you can't rely on their IP addresses because they will not be persistent.

So you need an object like a **service**, that gives those pods a stable IP.

)

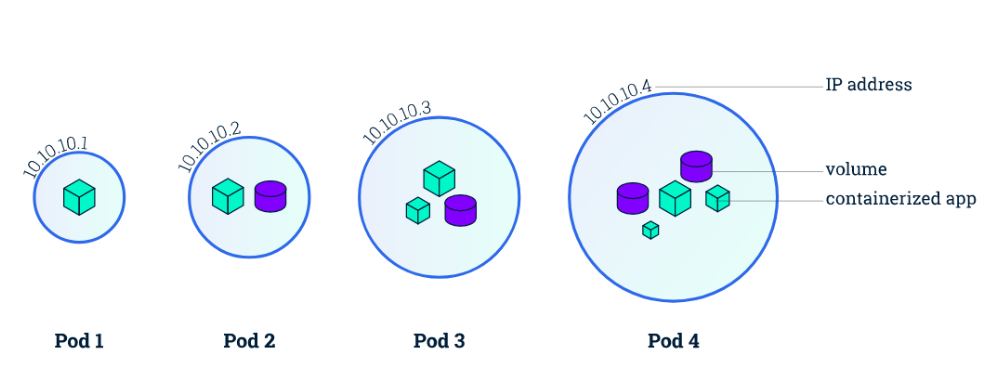
**Replicaset and Replication Controller:**

The major difference is that the rolling-update command works with Replication Controllers, but won’t work with a Replica Set.  This is because Replica Sets are meant to be used as the backend for Deployments

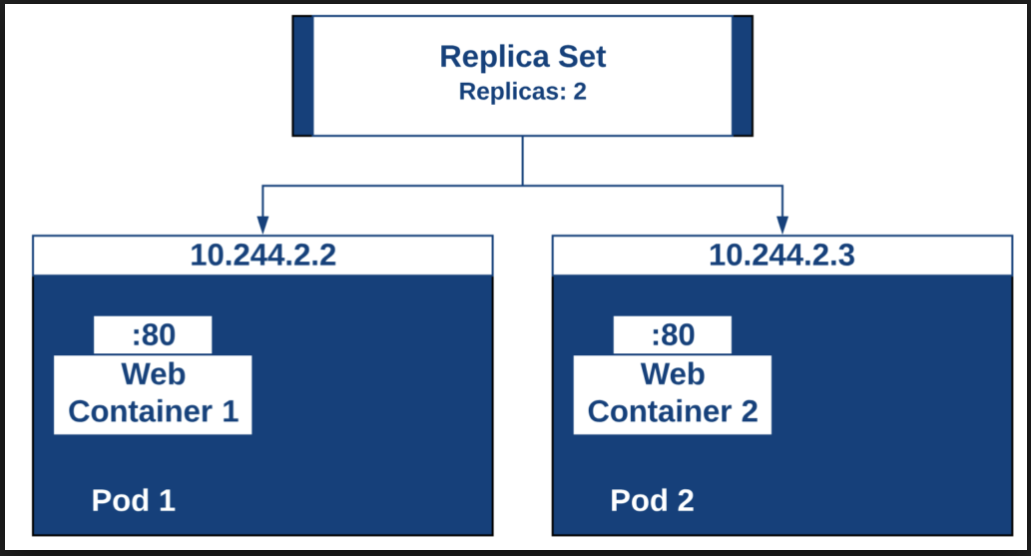
(Installations Stepe: <https://kubernetes.io/docs/setup/independent/install-kubeadm/>

Access Dashboard through GCP: <https://cloud.google.com/kubernetes-engine/docs/how-to/exposing-apps>)

**Pods**: Pods are nothing but they are the smallest deployable unit. Its small group of tightly coupled containers it shared network and data within It's router table.

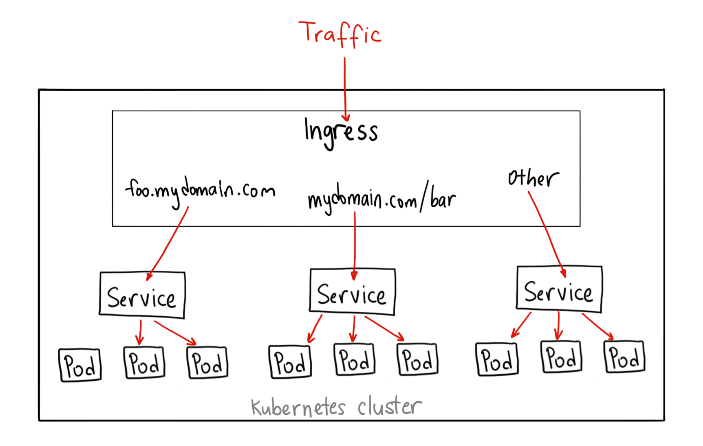


**Replica Sets**: It runs those copies replicas of pods. It starts to kill pods if necessary. It handles pods failures and it does help check as needed.

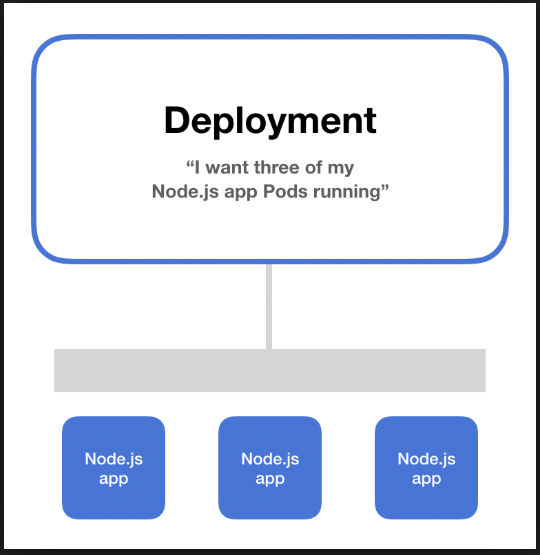


**Ingress**: It exposes services to outside the world, it map your url to the services. You configure access by creating a collection of rules that define which inbound connections reach which services.

Ingress is actually NOT a type of service. Instead, it sits in front of multiple services and act as a “smart router” or entrypoint into your cluster.



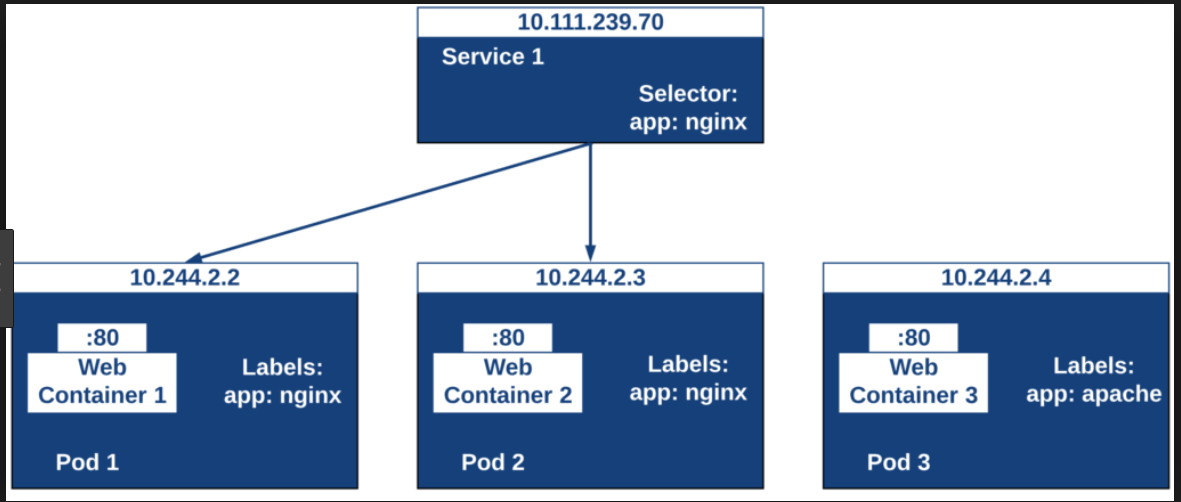
**Deployments**: It can be used for declaration of your application which contain the image tag etc, and environmental variables data volumes.

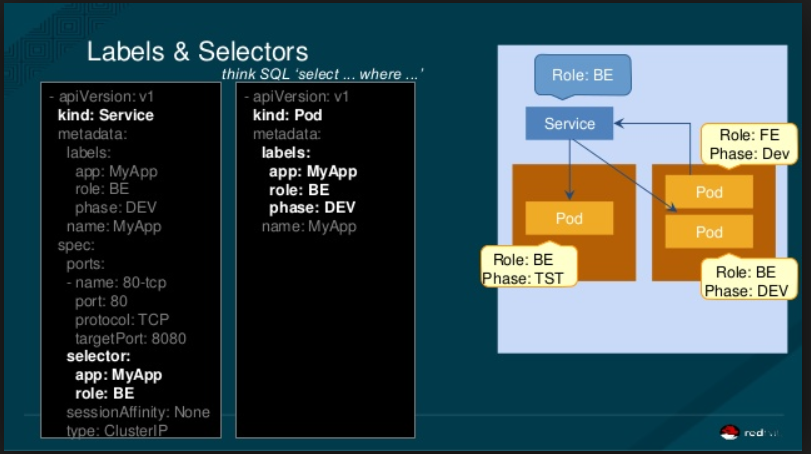


**Namespaces**: created namespaces for your environments example test, staging, production,

**Services:** Pods can be exposed internally or externally through services, services enable that discovery of pod by associating a set of pods to a specific criteria.

**Selector** : Pods are associated to services via key value pair called labels and selectors, and in any pod the labels that matches the selector will automatically be discovered by the services.





**Labels:**

Labels are key-value pairs which are attached to pods, replication controller and services. They are used as identifying attributes for objects such as pods and replication controller. They can be added to an object at creation time and can be added or modified at the run time.

**Selectors:**

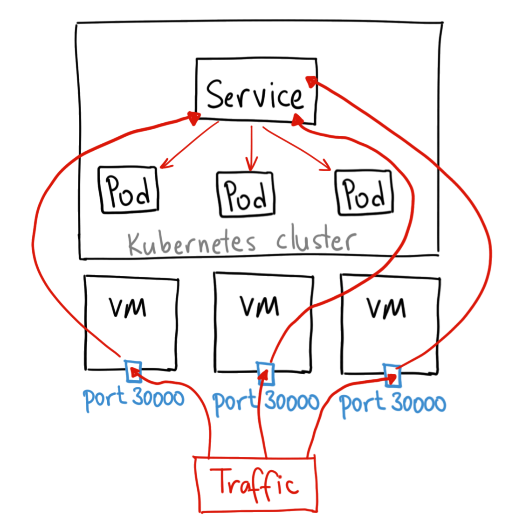
Labels do not provide uniqueness. In general, we can say many objects can carry the same labels.

**ClusterIP:**

A ClusterIP service is the default Kubernetes service. It gives you a service inside your cluster that other apps inside your cluster can access. There is no external access.

**NodePort**

A NodePort service is the most primitive way to get external traffic directly to your service. NodePort, as the name implies, opens a specific port on all the Nodes (the VMs), and any traffic that is sent to this port is forwarded to the service.

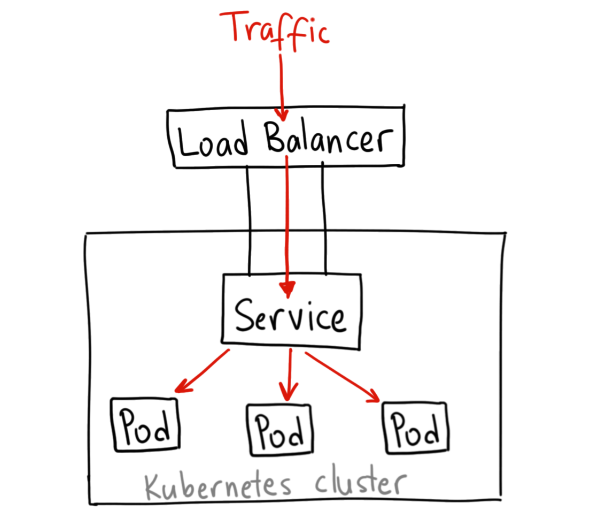


There are many downsides to this method:

1. You can only have once service per port
2. You can only use ports 30000–32767
3. If your Node/VM IP address change, you need to deal with that

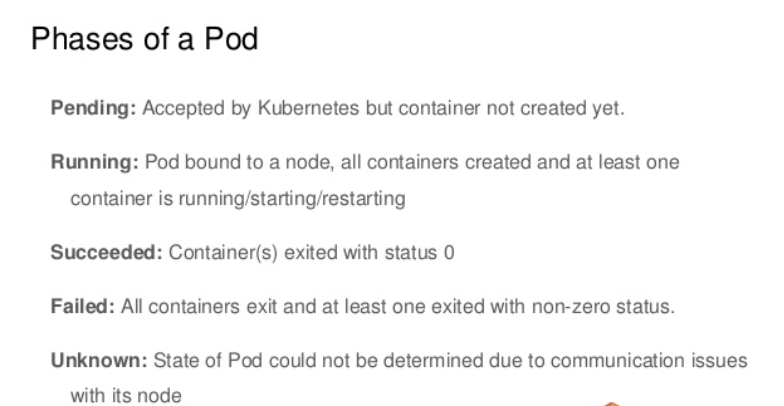
**LoadBalancer**

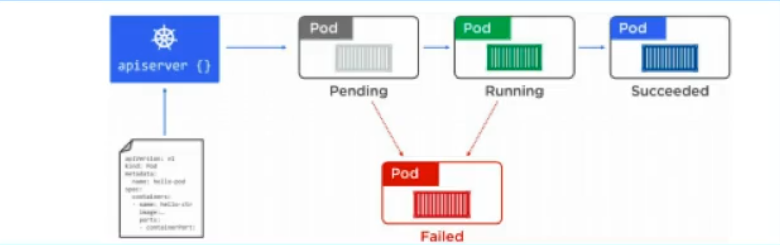
A LoadBalancer service is the standard way to expose a service to the internet. On GKE, this will spin up a Network Load Balancer that will give you a single IP address that will forward all traffic to your service.



**Preper Ingress over NodePort and LoadBalancer**

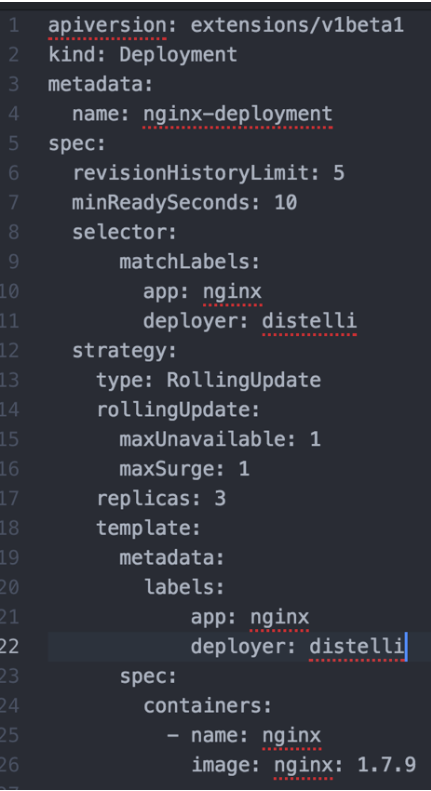
**Life Cycle of Pod:**







<https://files.acrobat.com/a/preview/5f7379e6-8331-4b90-ac64-691190c06ad3>



* replicas – Tells Kubernetes how many pods to create during a deployment. Modifying this field is an easy way to scale a containerized application.
* spec.strategy.type – Suppose there is another version of the application that needs to be deployed, and during the deployment phase, we need to update without facilitating an outage. The [Rolling Update strategy](https://kubernetes.io/docs/tutorials/kubernetes-basics/update/update-intro/) allows Kubernetes to update a service without facilitating an outage by proceeding to update pods one at a time.
* spec.strategy.rollingUpdate.maxUnavailable – The maximum number of pods that can be unavailable during the Rolling update.
* spec.strategy.rollingUpdate.maxSurge – The maximum number of pods that can be scheduled above the desired number of pods.
* spec.minReadySeconds – An optional Integer that describes the minimum number of seconds, for which a new pod should be ready without any of its containers crashing for it to be considered available.
* spec.revisionHistoryLimit – An optional integer attribute that you can use to tell Kuberneres explicitly how many old ReplicaSets to retain at any given time.
* spec.template.metadata.labels – Adds labels to a deployment specification
* spec.selector – An optional object that tells the Kubernetes deployment controller to only target pods that match the specified labels. Thus, to only target pods with the labels “app” and “deployer” we can make the following modification to our deployment yaml.

**Kubernetes Dashboard:**

(for linux <https://8gwifi.org/docs/kube-dash.jsp>)

(**for docker for windows** <http://collabnix.com/kubernetes-dashboard-on-docker-desktop-for-windows-2-0-0-3-in-2-minutes/>)

**For Ubuntu VM:**

passwd ubuntu                  ------>reset ubuntu password

sudo apt-get install xrdp

sudo apt-get install mate-core mate-desktop-environment mate-notification-daemon

sudo sed -i.bak '/fi/a #xrdp multiple users configuration \n xfce-session \n' /etc/xrdp/startwm.sh

sudo ufw allow 3389/tcp

kubectl create -f https://raw.githubusercontent.com/kubernetes/dashboard/v1.10.1/src/deploy/recommended/kubernetes-dashboard.yaml

(Please find the current link [here](https://github.com/kubernetes/dashboard) <https://raw.githubusercontent.com/kubernetes/dashboard/master/aio/deploy/recommended/kubernetes-dashboard.yaml> )

kubectl create clusterrolebinding dashboard-admin -n default --clusterrole=cluster-admin

press windows+R then type mstsc , paste public ip of your Kubernetes master and login as ubuntu user.

Once you logged in open browser then paste below url

<http://127.0.0.1:8001/api/v1/namespaces/kube-system/services/https:kubernetes-dashboard:/proxy/>

**Assigning Pods to Specific Node**

You can constrain a pod to only be able to run on particular nodes or to prefer to run on particular nodes

The recommended approaches all use label selectors to make the selection. Generally such constraints are unnecessary, as the scheduler will automatically do a reasonable placement (e.g. spread your pods across nodes, not place the pod on a node with insufficient free resources, etc.) but there are some circumstances where you may want more control on a node where a pod lands, e.g. to ensure that a pod ends up on a machine with an SSD attached to it, or to co-locate pods from two different services that communicate a lot into the same availability zone.

**kubectl label nodes <node-name> <label-key>=<label-value>**

**ex:**

**kubectl label nodes kubernetes-foo-node-1.c.a-robinson.internal disktype=ssd**

**Verify:** kubectl get nodes --show-labels

**Where:** Node name is ‘kubernetes-foo-node-1.c.a-robinson.internal

And label is “disktype=ssd”

**Demo**: Add a nodeSelector field to your pod configuration,

vi pod-nginx.yaml

apiVersion: v1

kind: Pod

metadata:

name: nginx

labels:

env: test

spec:

containers:

- name: nginx

image: nginx

imagePullPolicy: IfNotPresent

**nodeSelector**:

**disktype: ssd**

Verify: kubectl get pods -o wide