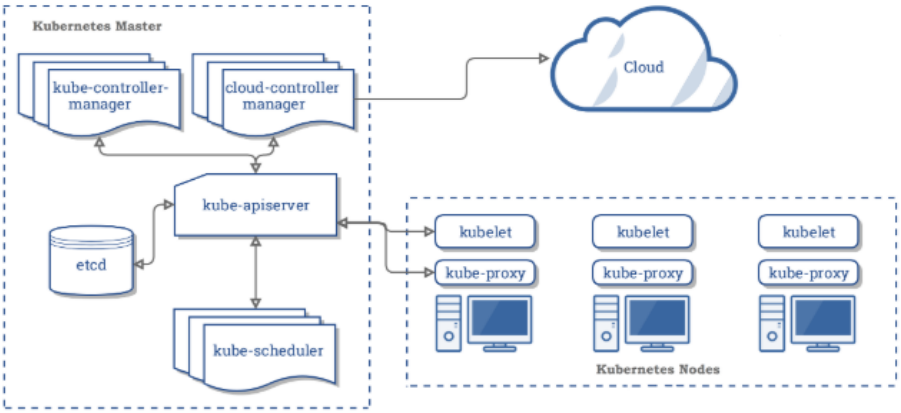
Contents

Kubernetes Architecture:



1. Master
    - Api Server: Gateway to the cluster. Also acts as a gatekeeper for authentication (to make sure that only authorized requests get through the cluster)
    - Cloud Controller Manager: Connects on-premise cluster to cloud
    - Controller Manager: detects cluster state changes & recovers cluster state ASAP.
    - Scheduler: Selects appropriate node to create the pod. Note here that Scheduler just decides on which node to schedule. It is **kubelet** that starts the pod.
    - ETCD: Cluster Database (the cluster state that Controller manager checks & resources that Scheduler decides based on them are all stored in etcd)
2. Worker
    - kubelet: used to deploy and start an object (like pod) on local nodes.
    - Kube-proxy: forwards requests from services to pods.

request → service → kube-proxy → pod

Terminology:

Node: Hosts that run Kubernetes applications
Containers: Units of packaging
Pods: Containers are not managed individually; instead, they are part of a larger object called a Pod. A Pod consists of one or more containers which share an IP address, access to storage and namespace.
Namespace: Kubernetes uses namespaces to keep objects distinct from each other, for resource control and multi-tenant considerations.
Service: Collection of pods exposed as an endpoint
Deployment: a deployment file can define the number of copies (or replicas, as they'r known in Kubernetes) of a given pod. Or a deployment can upgrade an existing pod to a new application version by updating the base container image.

CRI (Container Runtime Interface): CRI is an interface that k8s uses to talk to different container runtimes (docker, containerd, cri-o, ...). CRI is a set of tools that define what container runtime must implement & how it should be implemented to be pluggable to kubernetes as a container runtime.

Kubelet --> CRI --> Container Runtime

Docker did not implement CRI rules. K8s added dockershim layer to support docker:

kubelet --> CRI --> dockershim --> Docker

kubernetes Installation:

- To install on both master & worker: 1. Container runtime 2. Kubelet 3. Kube-proxy
- To install on master: api-server, scheduler, controller-manager, etcd (all master components are deployed as **static** pods)
- Certificates: we should generate a self-signed CA certificate for the whole cluster & sign all other component certificates with it.

Regular pod scheduling : **API Server** gets request → **scheduler** selects node → **kubelet** schedules pods
Static Pod Scheduling: **kubelet** directly schedules static pods (by watching a specific loc: "/etc/kubernetes/manifest")
Note1: kubelet (not controller manager) watches static pods & restarts if it fails
Note2: you can easily identify static pods by their names (names are suffixed with the node hostname)
Note3: Static pods are usually used for bootstrapping kubernetes itself. For example, kubeadm uses static pods to bring up control-plane components like api-server, controller-manager as static pods.

Kubeadm: (kubeadm is a command-line tool used for bootstrapping a best practice k8s cluster)
For this purpose, we need to 1. install kubeadm on each node first, 2. then run $kubeadm init command (only once on one of the master nodes)
Note: kubeadm does not install kubelet and kubectl for you.

#Kubeadm init phases:

1. **Preflight**:
   - checks to validate the system state before making changes.
   - Also pulling images for setting up k8s cluster
2. **Certs**:
   - Create /etc/kubernetes/pki directory.
   - generates a self-signed CA to setup identities for each component in the cluster.

   apiserver.crt: used for others to connect and authenticate to apiserver.
   ca.crt: self-signed CA of kubernetes. (signs other certificates)
   /etc/kubernetes/pki/etcd: contains etcd certificates. Note that like ApiServer, etcd has its own CA.
3. **Kubeconfig**:
   - Creates /etc/kubernetes dir (dir for config files).
   - for every client that needs to talk to apiserver, kubeconfig file will be generated (just like admin user). Creates admin.conf(kubeconfig file for admin user), kubelet.conf, controller-manager.conf, scheduler.conf in /etc/kubernetes dir.
4. **Kubelet-start**:
   - Creates /var/lib/kubelet/config.yaml folder
   - Writes kubelet settings (to above folder) and (re)start kubelet.
5. **Control-plane**:
   - Creates manifest folder /etc/kubernetes/manifest for static pods.
   - Creates static pod manifests. These pods will be scheduled by kubelet and will use kubeconfig files with certificates to talk to each other or apiserver.
6. **Add-ons**:
   - Installs DNS Server (CoreDNS)
   - Installs kube-proxy via apiserver

Access cluster after Configuration:

Access k8s cluster == access api-server (api-server is the entrypoint to the cluster)

To connect to the cluster, we need:

1. Install kubectl: command line to connect to the cluster
2. Kubeconfig file: to Authenticate with cluster

The kubeconfig file contains:

1. Api server Address
2. Admin's certificates & private key (users.user.client-certificate-data , users.user.client-key-data)

#kubectl precedence of kubeconfig file:

1. File passed with --kubeconfig flag ($kubectl get nodes --kubeconfig /etc/kubernetes/admin.conf)
2. KUBECONFIG environment variable ($export KUBECONFIG=/etc/kubernetes/admin.conf)
3. File located in "$HOME/.kube/config" folder (default loc where kubectl looks for)

Create a Yaml file: Note that this file consist of 4 basic instruction:

1. apiVersion: v1 # This should be find from the output of below command
   $ kubectl api-versions | grep -E "^apps/"
2. kind: Pod #**kind** of object we r creating.
3. metadata: #**data about data**, the name of object, namespace and label of object are defined in this part.
   name: firstpod
4. spec: #The data that is for **create** of object(deployment, service,…).
   containers:
   - image: nginx
     name: stan

#Pod yaml file:

```
apiVersion: v1
kind: Pod
metadata:
  name: firstpod      #name of pod
spec:
  containers:
  -image: nginx       #base image of container
   name: stan         #container name
```

Question: when does the cluster certificates expire & how to renew it?

$kubeadm certs --help
$kubectl certs check-expiration
$kubectl certs renew

Note: kubeadm renews certificates during cluster upgrades.

Kubectl Commands:

#debug commands:

Kubectl get:

```
$kubectl get object          E.g: kubectl get pod
$kubectl get pod podname -o yaml > mypod.yaml     #create yaml file from existing pod
$kubectl get pod podname -o wide                  #see detail of a pod
$kubectl get pod podname -w                       #see online updates
$kubectl get pods --all-namespaces                #see all pods in all namespaces
$kubectl get -f pod.yaml -o json       #List a pod identified by type and name specified in "pod.yaml" in JSON output format
```

Kubectl describe: Show details of a specific resource or group of resources.

```
$kubectl describe object
    E.g: Describe a node
        $kubectl describe nodes kubernetes-minion-emt8.c.myproject.internal
$kubectl describe pod <podname>
    E.g: Describe a pod identified by type and name in "pod.json"
        $kubectl describe -f pod.json
```

Kubectl logs:

Return snapshot logs from pod nginx with only one container

```
$kubectl logs nginx
```

Return snapshot of previous terminated ruby container logs from pod web-1

```
$kubectl logs -p -c ruby web-1
```

#kubectl version: print the client and server version information

```
$kubectl version
```

#kubectl api-versions: Print the supported API versions on the server, in the form of “group/version”.

```
$kubectl api-versions
```

#kubectl cluster-info: Display cluster info

```
$kubectl cluster-info
```

#kubectl explain: Documentation of resources

E.g: Get the documentation of the resource and its fields

```
$kubectl explain pods
```

#kubectl cordon: This will mark the node as unschedulable and prevent **new** pods from arriving

```
$kubectl cordon worker1
```

#kubectl uncordon:

```
$kubectl uncordon worker1
```

#kubectl drain: This will mark the node as unschedulable and also evict **existing** pods on the node

```
$kubectl drain worker1
```

E.g: Set the node labelled with name=**ek8s-node** as unavailable and reschedule all the pods running on it:

```
$kubectl drain ek8s-node --delete-local-data --ignore-daemonsets --force
```

Note: drain command, first cordons the node.

#kubectl run:

```
$kubectl run podname --image=image-name
```

#kubectl create (e.g. Deployment):

Imperative: $kubectl create deployment <dpname> --image=<imagenme>

Declarative: $kubectl create -f file.yml #there is a yaml file in this way

E.g: Create a pod based on the JSON passed into stdin.

```
$cat pod.json | kubectl create -f -
```

Debug deployment:

```
$kubectl get deployment dp1
$kubectl get deployment --all-namespaces
$kubectl describe deployment dp1
```

#kubectl Apply:

Note1: to make changes on an object that is created before.

Note2: If an object is not created before, it also creates the object.

Note3: difference with kubectl create: only in declarative mode.

E.g: Apply the configuration in pod.json to a pod.

```
$kubectl apply -f ./pod.json
```

E.g: Apply the JSON passed into stdin to a pod.

```
$cat pod.json | kubectl apply -f -
```

#kubectl delete:

```
$kubectl delete pod <podname>
$kubectl delete -f <yaml file>
$kubectl delete pod <podname> --grace-period=0              #force delete of a pod in kubectl<=1.4
$ kubectl delete pod <podname> --grace-period=0 --force     #force delete of a pod in kubectl>=1.5
```

#kubectl exec: to execute a command inside a container

$kubectl exec <podname> -c <containername> --<command>

E.g:

```
$kubectl exec mypod -c busybox --echo “Hello!”
$kubectl exec web-server2 -c redis2 -it -- bash
```

#kubectl replace: Replace a resource by filename. The replace command behaves kind of like a manual version of the edit command.

E.g: Replace a pod using the data in pod.json.

```
$kubectl replace -f ./pod.json
```

E.g: Force replace, delete and then re-create the resource

```
$kubectl replace --force -f ./pod.json
```

#kubectl edit: The edit command allows you to directly edit any API resource you can retrieve via the command line tools. It opens the yaml file of the running resource or object.

E.g: Edit the deployment named my-deployment and changes replicas from 3 to 15:

```
$kubectl edit deployment my-deployment
```

Now it opens the yml file of this running deployment and u can changes it live.

#kubectl attach: Attach to a running container

E.g: Get output from running pod 123456-7890, using the first container by default

```
$kubectl attach 123456-7890
```

E.g: Get output from ruby-container from pod 123456-7890

```
$kubectl attach 123456-7890 -c ruby-container
```

#kubectl expose: Take a replication controller, service or pod and expose it as a new Kubernetes Service

E.g: Create a service for a pod valid-pod, which serves on port 444 with the name "frontend"

$kubectl expose pod valid-pod --port=444 --name=frontend

E.g: Create a service based on nginx service already existing, exposing the container port 8443 as port 443 with the name "nginx-https"

$kubectl expose service nginx --port=443 --target-port=8443 --name=nginx-https

#kubectl label: Update the labels on a resource

E.g: Update pod 'foo' with the label 'unhealthy' and the value 'true'.

$kubectl label pods foo unhealthy=true

E.g: Update pod 'foo' with the label 'status' and the value 'unhealthy', overwriting any existing value.

$kubectl label --overwrite pods foo status=unhealthy

E.g: Update all pods in the namespace

$kubectl label pods --all status=unhealthy

E.g: Update pod 'foo' by removing a label named 'bar' if it exists. Does not require the --overwrite flag.

$kubectl label pods foo bar-

#kubectl scale: Set a new size for a Replication Controller, Job, or Deployment.

E.g: Scale replication controller named 'foo' to 3.

$kubectl scale --replicas=3 rc/foo

E.g: Scale a resource identified by type and name specified in "foo.yaml" to 3.

$kubectl scale --replicas=3 -f foo.yaml

E.g: If the deployment named mysql's current size is 2, scale mysql to 3.

$kubectl scale --current-replicas=2 --replicas=3 deployment/mysql

E.g: Scale multiple replication controllers.

$kubectl scale --replicas=5 rc/foo rc/bar rc/baz

E.g: Scale job named 'cron' to 3.

$kubectl scale --replicas=3 job/cron

#Note: we use option --**dry-run=client** to run an object without creating it! It can be combined with -**o yaml** to create a sample yaml file:

$kubectl run mybusybox --image=busybox --dry-run=client -o yaml > mybusybox.yaml

---

Label

By default, creating a Deployment with “kubectl create” adds a label with the name of deployment.

#Set label: in YAML file:

1. Imperative:

   $kubectl label pod <podName> image=nginx # label is image=nginx

2. Declarative:

   Labels:

   app:test00

#view pods with a Label:

$kubectl get pod -l app=test00 #pods with app=test00 label

$kubectl get pod -L app #pods with app label

#view labels of all pods

$kubectl get pods --show-labels

Namespace :

is a virtual cluster. When you create a pod related to USSD product for example, it should be created in USSD namespace.

Question: How to use kubectl to switch between multiple clusters? → Answer: Define a *Context* for each cluster & using those contexts you can switch between Clusters. There is an attribute called "*current-context*" in *kubeconfig* file which tells when you run *kubectl* command, which user in which cluster is using the command.

Context:

When a user logs in to the namespace of a cluster, It's called Context. Context is a user in the namespace of a cluster.

$vi .kube/config:

```
apiVersion: v1
kind: Config

clusters:
- name: production
  cluster:
    certificate-authority: ca.crt
    server: https://172.17.0.51:6443

contexts:
- name: admin@production
  context:
    cluster: production
    user: admin
    namespace: finance

users:
- name: admin
  user:
    client-certificate: admin.crt
    client-key: admin.key
```

Namespace commands:

#Create namespace:

Imperative: $kubectl create ns test1

declarative:

$kubectl create ns test2 --dry-run=client -o yaml > test2.yaml

$kubectl create -f test2.yaml

#List namespaces:

$kubectl get ns

List all pods in all namespace:

$kubectl get pods --all-namespaces

Start a Pod in a namespace:

$kubectl run nginx5 --image=nginx -n test1

List Pods in a namespace:

$kubectl get pod --namespace test1

$kubectl get pod -n test1

#list all the resources that are not bound to a namespace

$kubectl api-resources –namespaced=false

#to change the context and namespace both

$kubectl config set-context --current --namespace=kube-system

#NameSpace yaml file:

```
apiVersion: v1
kind: Namespace
metadata:
  name: ns1
```

Deployment

Deployment has benefits over pod:

1. Scale up & down: with “replica” argument.

#Two ways to make scale a deployment:

1. Imperative:
   $ kubectl scale deployment.v1.apps/my-deployment --replicas=5
2. Declarative: in the YAML file:
   spec:
   replicas: 5

2. Rolling Update & RollBack: We have two Upgrade strategies: 1. Recreate (causes downtime) 2. Rolling updat

#Two ways to Upgrade a deployment:

1. Imperative:
   $ kubectl set image deployment <dpName> nginx=nginx:1.9.1
2. Declarative: in the YAML file:
   containers:
   -image:nginx:1.9.1

#Check history of deployments:

$kubectl rollout history deployment <dpName>

#Rollback to the previous deployment

$ kubectl rollout undo deployment test

#Rollback to a specific revision

$ kubectl rollout undo deployment test --to-revision=2

#Mark the nginx deployment as paused. Any current state of the deployment will continue its function, new updates to the deployment will not have an effect as long as the deployment is paused.

$kubectl rollout pause deployment/nginx

#Resume an already paused deployment

$kubectl rollout resume deployment/nginx

#Max Surge: Deployment ensures that only a certain number of Pods are created above the desired number of Pods. By default, it ensures that at most 125% of the desired number of Pods are up (25% max surge).

#Max Unavailable: Deployment ensures that only a certain number of Pods are down while they are being upated. By default, it ensures that at least 75% of the desired number of Pods are up (25% max unavailable).

#Deployment yml file: (Note: Template is the config of a Pod inside a deployment.(it has its own labels, …))

```
apiVersion: apps/v1
kind: Deployment
metadata:
 name: nginx-deployment
 labels:                    #deployment label
  app: nginx
spec:
 replicas: 3
 selector:
  matchLabels:
   app: nginx
 template:
  metadata:
   labels:                  #container label
    app: nginx
  spec:
   containers:
   - name: nginx
    image: nginx:1.14.2
    ports:
    - containerPort: 80
```

#ReplicaSet yaml file (same as deployment yaml file):

```
apiVersion: v1
kind: ReplicaSet
metadata:
  name: rs-example
spec:
  replicas: 3                          #how many copies?
  selector:
    matchLabels:
      app: nginx                       #select pods with label: app:nginx & env: prod
      env: prod
  template:                 #like yaml of pod. Image & other info about pod
    <pod template>
```

DaemonSet

A DaemonSet makes sure that all of the Nodes in the Kubernetes Cluster run a copy of a Pod.

Some typical uses of a DaemonSet are:

- running a logs collection daemon on every node
- running a node monitoring daemon on every node

Note: you only can create daemonset in declarative mode.

#DaemonSet yaml file:

```
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: my-daemonset
spec:
  selector:
    matchLabels:
      app: my-daemonset
  template:
    metadata:
      labels:
        app: my-daemonset
    spec:
      containers:
      - name: nginx
        image: nginx:1.19.1
```

Metric Server

In order to view metrics about the resources pods and containers are using, we need an add-on to collect and provide that data. such add-on is Kubernetes Metrics Server.

Installation:

```
$vim metric.yaml
$kubectl apply -f metric.yaml
```

Commands:

```
$kubectl top pod <podname> --sort-by=cpu              #use --sort-by option to select resource
$kubectl top pod <> --sort-by=cpu --all-namespaces  #see pods in all namespaces
$kubectl top node --sort-by=memory                          #see nodes resource usage
$kubectl top pod <> --sort-by=cpu --selector name=app       #--selector to specify a label
```

Volumes

Kubernetes Storage Requirements:

- Storage that doesn't depend on the pod lifecycle.
- Storage must be available on all nodes.
- Storage needs to survive even if cluster crashes!

Note: Kubernetes doesn't care about your actual storage. It just gives u **PV** as an interface to your storage.

Persistent Volume(PV): A volume that its lifetime is about clusters lifetime and will not be destroyed after pod stops.
PV is connected to pod through PVC (Persistent Volume Claim). Note that PV is not namespaced.

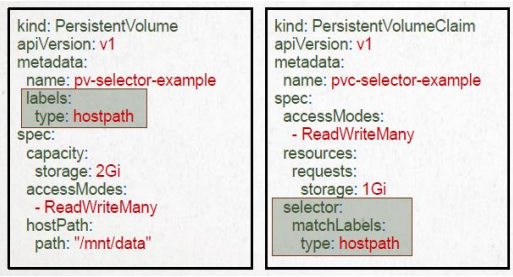
PV yaml file:

```
apiVersion: v1
kind: PersistentVolume
metadata:
  name: task-pv-volume
  labels:
    type: local
spec:
  storageClassName: standard
  capacity:
    storage: 100Mi                          #capacity.storage: The total amount of available storage.
  volumeMode: Filesystem                    #The type of volume, this can be either Filesystem or Block.
  persistentVolumeReclaimPolicy: Retain  #The behaviour for PVC s that have been deleted. Options include:Retain=manual clean up,Delete=storage asset deleted by provider.
  storageClassName: slow                 #Optional name of the storage class that PVC s can reference. If provided, ONLY PVC s referencing the name consume use it.
  accessModes:                           #A list of the supported methods of accessing the volume. Options include:
    - ReadWriteOnce  #RWO means only a single pod will be able to (through a PVC) mount this. ROM means volume is Read-Only by many pods. RWM means, well, many pods can mount and write.
  mountOptions:                          #Optional mount options for the PV.
    - hard
    - nfsvers=4.1
  hostPath:
    path: "/mnt/"
```

#PVC yaml file:

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: pv-volume
spec:
  storageClassName: standard
  resources:
    requests:
      storage: 10Mi              #resources.requests.storage : The desired amount of storage for the claim (can be <= capacity of PV)
  accessModes:                   #This MUST be a subset of what is defined on the target PV or Storage Class.
    - ReadWriteOnce
  volumeMode: Filesystem
```

Note: **PVs and PVCs with Selectors**: The PV is using the hostPath volume type, and thus they have a label of type: hostpath. The PVC is looking for 1 Gi of storage and is looking for a PV with a label of type: hostpath.
They will match and bind because the labels match, the access modes match, and the PVC storage capacity is <= PV storage capacity.



PV, PVC & Pod yaml:

Note that to define volume in a pod u have to 1. Define volumes on pod level (**volumes:**). It is in the form of **Name+Type**
2. Mount volume into container(**volumeMounts:**)

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: my-db
  labels:
    app: my-db
spec:
  replicas: 1
  selector:
    matchLabels:
      app: my-db
  template:
    metadata:
      labels:
        app: my-db
    spec:
      containers:
      - name: mysql
        image: mysql:8.0
        volumeMounts:
        - name: db-data
          mountPath: "/var/lib/mysql"

      volumes:
      - name: db-data
        persistentVolumeClaim:
          claimName: mysql-data-pvc
```

```yaml
apiVersion: v1
kind: PersistentVolume
metadata:
  name: data-pv
spec:
  hostPath:
    path: "/mnt/data"
  capacity:
    storage: 10Gi
  accessModes:
  - ReadWriteMany
```

```yaml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: mysql-data-pvc
spec:
  resources:
    requests:
      storage: 5Gi
  accessModes:
  - ReadWriteMany
```

Common Types of volumes: Ephemeral, Persistent Volume(PV), Emptydir, hostPath, StorageClass

TYPE OF VOLUME	LIFETIME
VOLUME(EPHEMERAL VOLUME)	Pod lifetime
PV	Cluster lifetime
CONTAINER FILE SYSTEM	Container lifetime

Ephemeral Volume: for apps that need storages that is not important after restart. E.g: *cache server*

#Types of Ephemeral Volumes: emptydir, configMap, Secret

#Advantage: pods can restart or stop without dependency to storage.

EmptyDir: In pod yaml file, **spec.volumeMounts** is about containers spec, and **spec.volumes** is about pod spec. We specify types of volumes (emptyDir, hostPath,…) in spec.volume.

EmptyDir yaml file:

```yaml
apiVersion: v1
kind: Pod
metadata:
 name: test-pd
spec:
 containers:
 - image: registry.k8s.io/test-webserver
   name: test-container
   volumeMounts:              #volumeMount is about container & u can see its under spec.container
   - mountPath: /cache                  #path of volume in containers of the pod
     name: cache-volume
 volumes:                               #volume is about Pod
 - name: cache-volume                   #this name should match the name parameter
under
   emptyDir: {}
```

hostPath: mounts a file or directory from host to your pod.
NOTE: hostPath volumes have many security risks and it's better not to use them.
#hostPath yaml file:

```
apiVersion: v1
kind: Pod
metadata:
 name: web-server
spec:
 containers:
  -name: nginx
   image:nginx
   volumeMounts:
   -mountPath: "/usr/share/nginx/html"      #volume path in containers
    name: pv-volume
 volumes:
  -name: pv-volume                          #names should match (name in volumes and name in volumeMounts)
   hostPath:
    path: /data                                     #volume path in host
```

Storage Class: Creates and Provisions Persistent Volumes *dynamically* in the background whenever PVC claims it.
Storage Class Yaml file:

```
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
 name: storage-class-name
provisioner: kubernetes.io/aws-ebs    #which provisioner(external or internal(kubernetes.io is internal)) to create PV out of it.
parameters:
 type: io1
 iopsPerGB: "10"
 fsType: ext4
```

#PVC for Storage Class:

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
 name: mypvc
spec:
 accessModes:
 - ReadWriteOnce
 resources:
  requests:
            storage: 100Gi
 storageClassName: storage-class-name
```

#kubectl get pv

Status:

Available: PV is ready and available to use.
Bound: PV has been bound to a claim.
Released: the binding PVC is deleted, and PV is pending reclamation.
Failed: an error has been encountered.

#PVC looks to match a PV with following parametes:

1. Access Mode 2. StorageClassName 3. Capacity of PVC<=PV

NOTE: kubernetes uses two objects to separate config from app or container: ConfigMap & Secret
Secret is for sensitive config data while configmap is for regular config data. ConfigMap & Secret r local volumes but not created via PV & PVC.

ConfigMap

There are 3 ways to define configMap:

1. Command line (using environment variable):
   $kubectl create configmap literal-example --from-literal="city=Ann Arbor" --from-literal=state=Michigan
   configmap "literal-example" created
2. Pass as Environment variables:
   $ cat info/city
   Ann Arbor
   $ cat info/state
   Michigan
   $ kubectl create configmap dir-example **--from-file=info/**
   configmap "dir-example" created
3. As Config file (using volume):

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: myconfigMap
data:                    #data: Contains key value pairs of ConfigMap contents.(key: state, value: Michigan)
  state: Michigan
  city: Ann Arbor
```

#Two ways of using configMap in a pod
Note that in the second way (mounting as volumes), first we define volumes on pod level, then we mount volume into container.

1.using configMap as key value

```
spec:
  containers:
  -image: mysql:5.5
   env:
   -name: MYSQL_ROOT_PASSWORD
    valueFrom:
      configMapKeyRef:
        name: myconfigMap
        key: state
```

2.mounting configMap as volumes

```
  volumeMounts:
   -mountPath: /configmapdir
     name: my-configMap
volumes:
-name: my-configMap
  configMap:
    name: myconfigMap
```

#List configMaps:

$kubectl get cm
$kubectl describe cm cm1

Secret

Pods access local data through volumes. But sometimes the data should not be local!

#Two ways of creating a secret object:

1. yaml file

```
apiVersion: v1
kind: Secret
metadata:
  name: mysec
data:
  password: QWRtaW5AMTEwCg==
```

2. command line

$kubectl create secret generic mysec #generic: creates secret from a local file/directory

$kubectl create secret generic mysec --from-literal=password=root #--from-literal sends parametes

#Two ways of using secret in a pod

Note that in the second way (mounting as volumes), first we define volumes on pod level, then we mount volume into container.

1. **using secrets via environment variables**

```
spec:
  containers:
  -image: mysql:5.5
   env:
   -name: MYSQL_ROOT_PASSWORD
    valueFrom:
      secretKeyRef:
        name: mysec
        key:password
```

2. **mounting secrets as volumes**

```
  volumeMounts:
  -mountPath: /mysqlpassword
    name: mysql
volumes:
-name: mysql
  secret:
    secretName: mysec
```

$kubectl exec -it busybox --cat /mysqlpassword/password

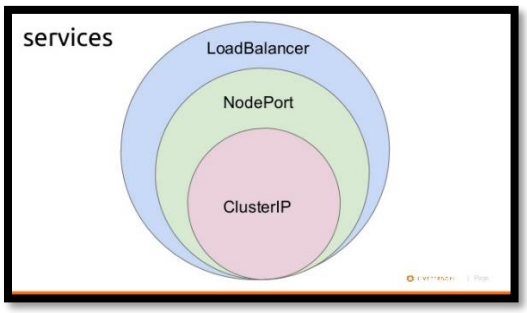
#List secrets:

$kubectl get secret

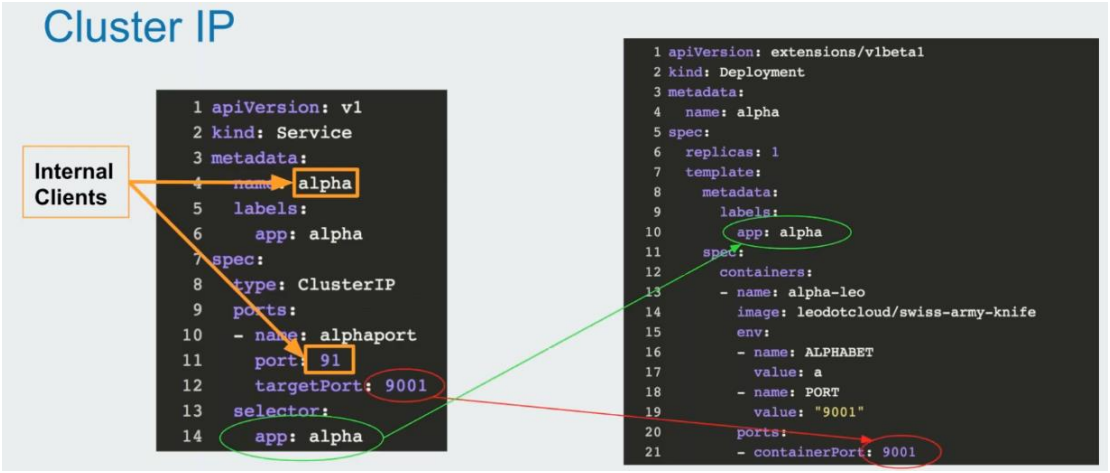
Services

service provides a way to expose an application running a set of pods. Clients make request to a service, which routes traffic to its pods load-balanced. **There isn't really any physical concept of a service in a cluster.**

#Service Types: 1. ClusterIP (accessible within k8s cluster)
2. NodePort (accessible outside k8s cluster)
3.LoadBalancer



#ClusterIP: we only have port (to access pods) and targetport(to access containers).



#create clusterIP service:

1. Yaml file
2. Command line:

   $kubectl run pod1 --image=nginx

   $kubectl expose pod pod1 --name=service1 --port=80 --target-port=80 --type=clusterIP

   #debug

   $kubectl describe service service1

   $kubectl get services

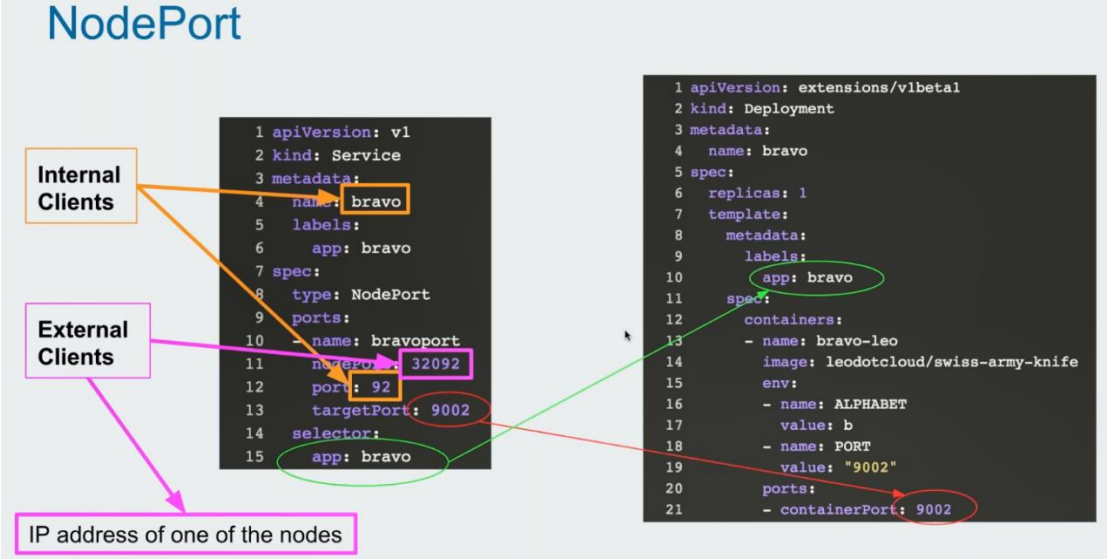
#nodePort: just like clusterIP object with different of spec.type = nodePort

Downsides:

1. U can only expose one single service per port
2. U can pnly use ports in this range: 30000-32767
3. If the k8s node IP changes, u have to deal with it

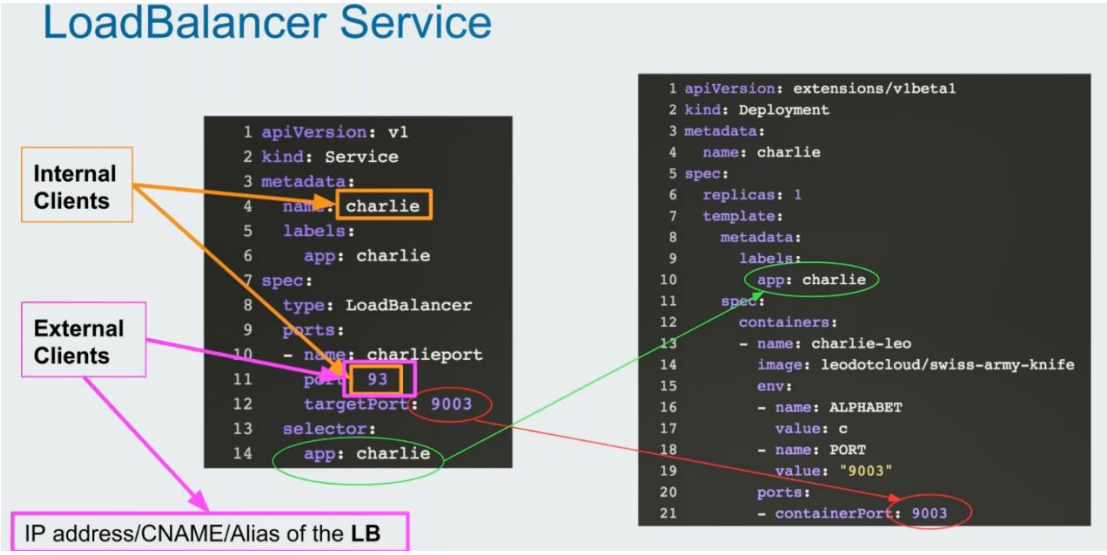
nodeport is not recommended to use in production. Cuz it opens a huge security hole in cluster. We have to access the service from an IP of a node in the cluster associated with a port(30000-32767). And we do not wish to use our node IP as endpoint to our application. And if we r running thousands of services we can't keep track of all the ports we open in our nodes.

So a much better way is to have a separate IP for every service--> service type *LoadBalancer*
Load Balancer IP addresses r in the range of k8s nodes.

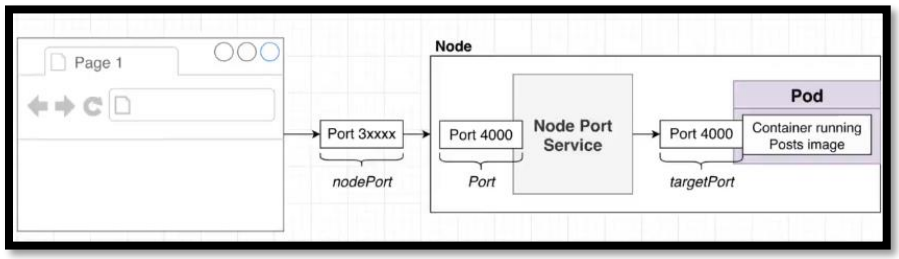


#loadBalancer: exposes apps outside cluster, but use an external cloud loadbalancer to do so.

Downside: u need to create a service of type load balancer for each service (meaning u need a IP for each service u want to expose. Note that k8s is not responsible for Service type loadBalancer's IP. It is an external IP.)



#Types of Ports:



Ingress:

History of ingress:

Service in k8s offers u : 1. Service discovery 2. Load Balancing 3. Expose apps

But the problem of service was that services did not have:

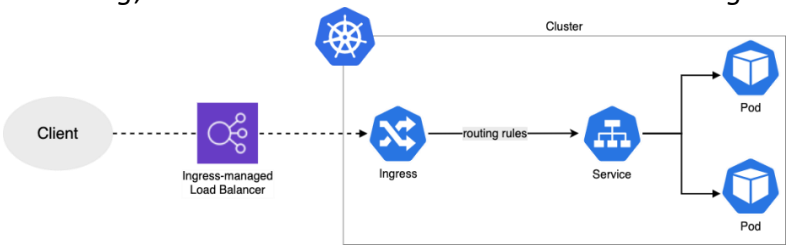
1. Capabilities of enterprise load balancers like nginx, haproxy, F5, … (e.g the service type Load Balancer only supports round-robin)
2. When u create a service of type *Load Balancer*, and u have a thousand services, the cloud provider charges u with 1000 IPs.(downside of service type *LoadBalancer*)

Ingress was added to k8s as a load balancer that solves above problems.(first openshift solved this problem using *openshift routes*.)

an API object that allows access to your Kubernetes services from outside the Kubernetes cluster. Traffic routing is controlled by rules defined on the Ingress resource. An ingress does not expose arbitrary ports (just 80 & 443).

Ingress only works with web application (http, https). If you have some else app like mongodb and u want to expose it outside of the cluster, u need to have node port running to expose your app.

Ingress may provide *load balancing*, *SSL termination* & *name-based virtual hosting*.



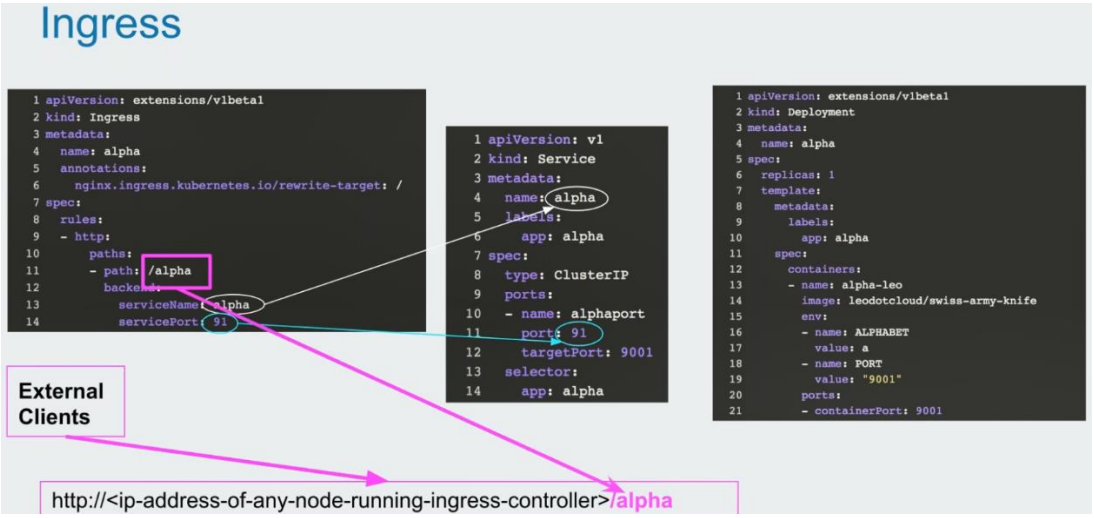
#Ingress Controller: A controller uses Ingress Rules to handle traffic to and from outside the cluster, usually with a load balancer. Ingress Contoller is a load balancer or API Gateway(api gateway offers u additional capabalities).

#Install Ingress Controller:

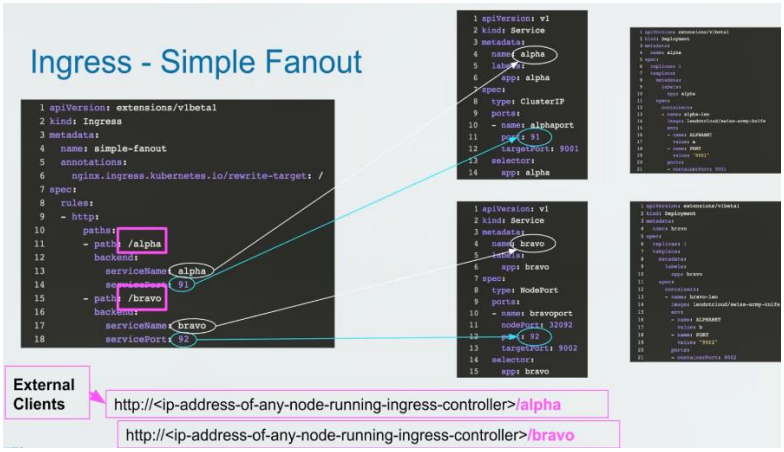
```
$helm install my-release bitnami/nginx-ingress-controller
$helm ls
$kubectl get pod --all-namespaces |grep -I ingress
```

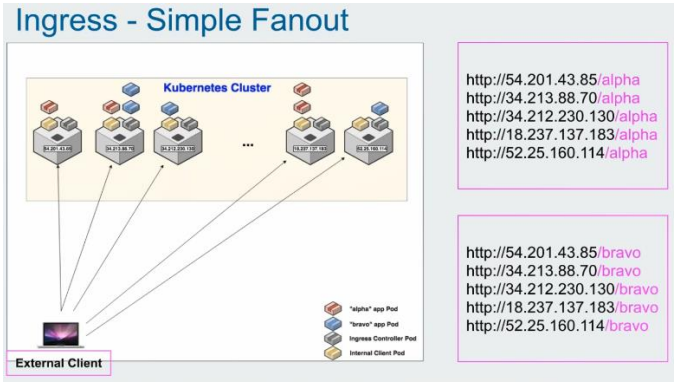
#Types of Ingress:

1. Single service: This is Ingress backed by a single service where a single service is exposed. To define this, specify a **default backend** without any rules.

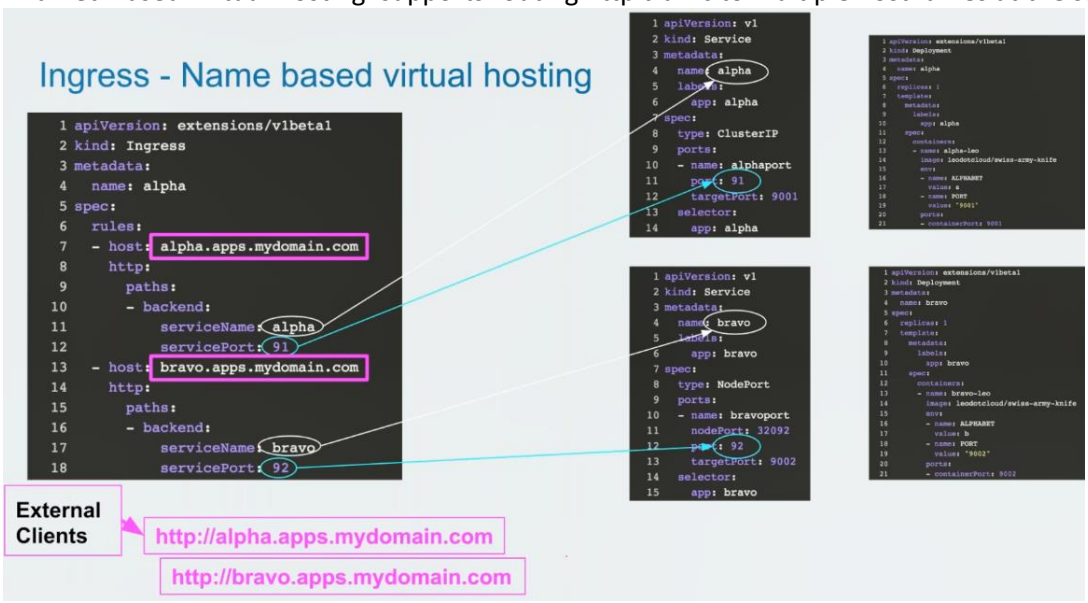


2. Simple fanout: a single entrypoint (IP Address) is used to expose multiple services (based on the http URL being requested).





3. Named Based Virtual Hosting: supports routing http traffic to multiple hostnames at the same IP.



Helm:

kubernetes package manager | packages are called “Chart”
Helm is a way for packaging kubernetes yaml files & distribute them in public or private registries.

#Install:

```
$curl -fsSL -o get_helm.sh https://raw.githubusercontent.com/helm/helm/main/scripts/get-helm-3
$chmod 700 get_helm.sh
$./get_helm.sh
```

#check helm version

```
$helm version
```

#Add a chart repo:

```
$helm repo add bitnami https://charts.bitnami.com/bitnami
```

#Get the latest list of charts:

```
$helm repo update
```

#List the charts you can Install:

```
$helm search repo nginx
```

#Install a chart using Helm:

```
$helm install bitnami/mariadb --generate-name
```

list currently deployed repositories:

```
$helm repo lis
```

#List currently deployed charts:

```
$helm ls
```

#Uninstall a release:

```
$helm uninstall mariadb-1645460340
```

#See info about a release:

```
$helm status mariadb-1645460340
```

Scheduling:

#Two mechanisms to select a node by scheduler:

1. **Filtering**: find nodes that are capable of scheduling → nodes that suit pods requirements.
2. **Scoring**: score nodes selected in the previous step.

#Ways to assign a node to a pod:

1. NodeName: in pod spec.nodename we define name of the node we want directly. Note that if the node doesn't exist, then the pod will not run.

   # NodeName yaml example:

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  containers:
  - name: nginx
    image: nginx
  nodeName: kube-01
```

2. NodeSelector:

   Step1: label the node:

   $kubectl label node worker1 ntype=html #ntype=key , html= value

   Step2: in spec.nodeSelector of pod we define: ntype: html

   #NodeSelector yaml example:

```
apiVersion: v1
kind: Pod
metadata:
  name: nodeselector-pod
spec:
  nodeSelector:
    ntype: html
  containers:
  - name: nginx
    image: nginx:1.19.1
```

   Step3: to debug:

   $kubectl get node --show-labels

   Step4: to delete label of a node:

   $kubectl label node worker1 ntype-

3. NodeAffinity: Node Affinity is a more flexible expression to schedule pods on node (over nodeName & …)

   #two types of nodeAffinity: (required: hard, preferred: soft)

   - requiredDuringSchedulingIgnoredDuringExecution:
     -requiredDuringScheduling : It says firmly to run pod if the following operator (In, NotIn , Exists, DoesNotExist) is true.
     -IgnoredDuringExecution: when the affinity of a node changes, the pods will continue to run.
   - preferredDuringSchedulingIgnoredDuringExecution:
     -preferredDuringScheduling : if no matching found, go with the default mechanism of scheduler.

NodeAffinity yaml example:

```
apiVersion: v1
kind: Pod
metadata:
  name: with-node-affinity
spec:
  affinity:
    nodeAffinity:
      requiredDuringSchedulingIgnoredDuringExecution:
        nodeSelectorTerms:
        - matchExpressions:
          - key: ntype
            operator: In
            values:
            - virus
```

4. Taint & toleration: for instance, we want to have reserved nodes in the cluster. Toleration allows to run pods on taint nodes.

   #Three taint effects of a node:

   1. NoSchedule: pod will not be scheduled on rejected nodes.
   2. PreferNoSchedule: system tries to avoid scheduling pods, but doesn't guarantee it.
   3. NoExecute: even pod that is running will be evicted.

To make a node schedulable or UnSchedulable:

$kubectl taint node <NodeName> key=value:<tainteffect>

e.g. taint worker1 with label hold=virus and NoSchedule tainteffect:

$kubectl taint nodes worker1 hold=virus:NoSchedule

Yaml file of Pod that tolerates tainted node:

```
kind: pod
metadata:
  name: nginx
spec:
  toleration:
  - key: "hold"
    operator: "Equal"
    value: "virus"
```

Make above node schedulable (untaint):

$kubectl taint nodes worker1 hold=virus:NoSchedule -

Retrieve schedulable nodes:

$kubectl describe node <nodename> | grep -i taint

Taints: <none>

OR:

Taints: node-role.kubernetes.io/master:NoSchedule

Retreieve taint state of all nodes:

$kubectl describe node | grep -i taint

T-Shoot:

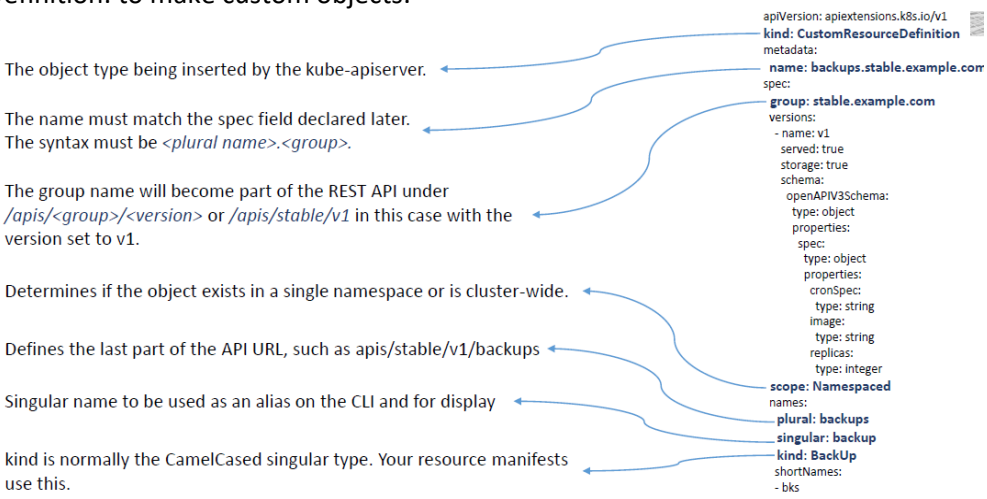
- If the k8s API Server is down, we get following error:
  $kubectl get nodes
  The connection to the server localhost:6443 was refused - did you specify the right host or port?

  #T-Shoot:
  1. Is docker service and kubelet running on all nodes of cluster?
  2. Check whether the API server is down in /etc/kubernetes/manifests/kube-apiserver.yaml
- Check system pods:
  $kubectl get pods -n kube-system
- Read logs:
  $journalctl -u kubelet #see kubelet logs
  $journalctl -u docker
- See /var/logs directory:
  /var/logs/kube-apiserver.log
  /var/logs/kube-scheduler.log
  /var/logs/kube-controller-manager.log
- See logs inside a container:
  $kubectl logs podName -c ContainerName
- Check DNS and kube-proxy: there is an image named nicolaka/netshoot that have tools for network tshoot:
  $kubectl run tmp-shell --rm -i --tty --labels "app=test00" --image nicolaka/netshoot --/bin/bash

---

CRD

Custom Resource Definition: to make custom objects.



1. New Object configuration:

```
apiVersion: "stable.example.com/v1"
kind: BackUp
metadata:
  name: a-backup-object
spec:
  timeSpec: "* * * * */5"
  image: linux-backup-image
replicas: 5
```

2. Create and Test Object:
   $kubectl create -f obj.yaml --validate=false
   $kubectl get bks

DNS in Kubernetes

CoreDNS: CoreDNS is the DNS Server in kubernetes cluster. creates a record for a **service** so each pod "in the cluster" can reach the **service** by its name. CoreDNS has 2 replica pods in “kube-system” namespace for redundancy.

Note: when a client wants to call a pod, the client wants to call the service’s pod. It does that by doing a DNS lookup. And that’s where the load-balancing comes in.

T-shoot DNS issues in cluster:

$kubectl get pods -n kube-system --show-labels #to see CoreDNS labels

$kubectl logs -n kube-system -l k8s-app=kube-dns #to see logs of both coreDNS pods (k8s-app=kube-dns is the coreDNS label)

test coreDNS:

1. kubectl get svc -n kube-system | grep dns #the result shows the service of coreDNS pods and its IP.

2. go to the container of the pod & check : /etc/resolve.conf ---> the IP address of the nameserver is equal to ip address above.

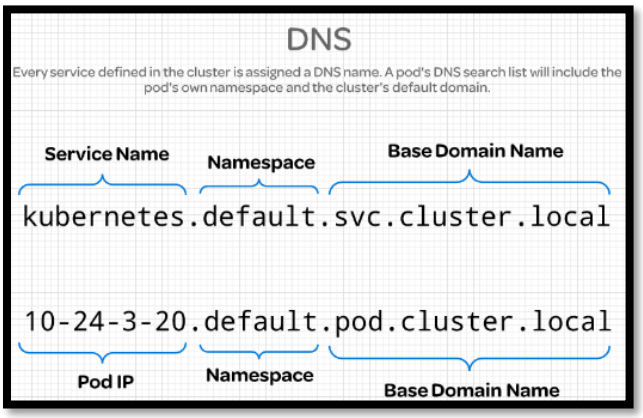
Note: It is duty of *kubelet* to put ip addr of coreDNS inside resolve.conf of pods. You can check ip addr of clusterDNS inside kubelet config file (/var/lib/kubelet/config.yaml)

FQDN : Fully Qualified Domain Name

When we want to talk to services in the same namespace: only name of service is required (e.g: myservice)

When we want to talk to services in the different namespace: we must include namespace as well (e.g myservice.default)

Note: there is an entry in /etc/resolve.conf of pods (search default.svc.cluster.lcoal) which makes it possible for services to reach each other w/o mentioning the BaseDomainName.



Health Checking

Note that health checking happens until the pod is up and running in ur K8s cluster.
Note: with using update strategies along with health checking(probes), we can have zero-downtime apps.

Pod Lifecycle

1. Running: The Pod has been bound to a node, and all of the containers have been created. At least one container is still running, or is in the process of starting or restarting.
2. Terminate: the pod's goal is to change a configFile or create a directory or etc then it gets terminated.
3. Succeed: All containers in the Pod have terminated in success, and will not be restarted.
4. Failed: All containers in the Pod have terminated, and at least one container has terminated in failure. That is, the container either exited with non-zero status or was terminated by the system.

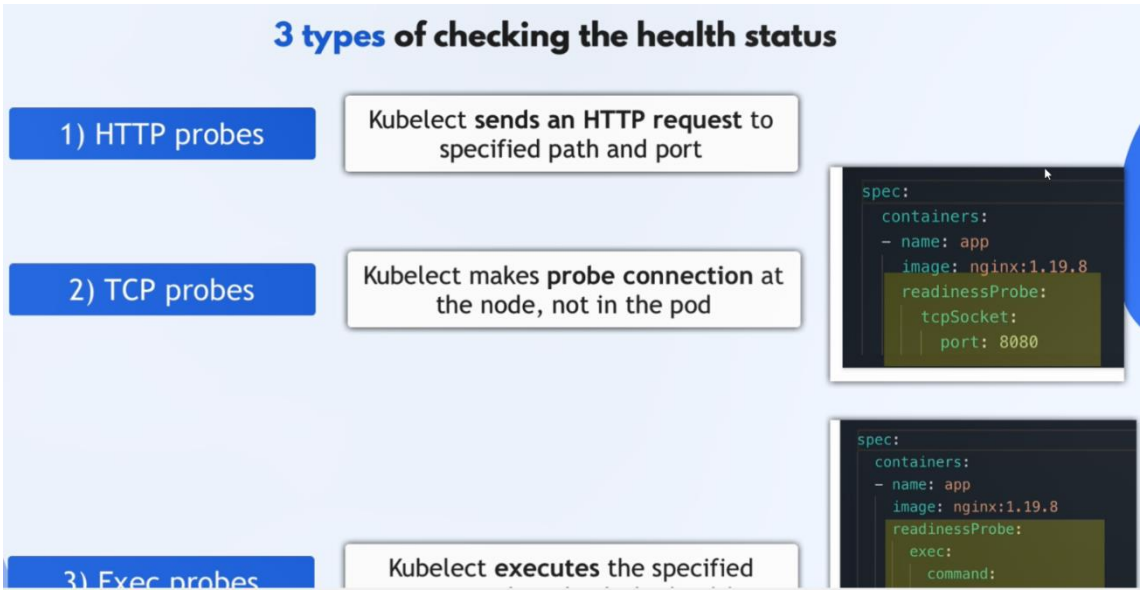
Probes in k8s

There are three types of probes to check if the pod is started and succeeded correctly.

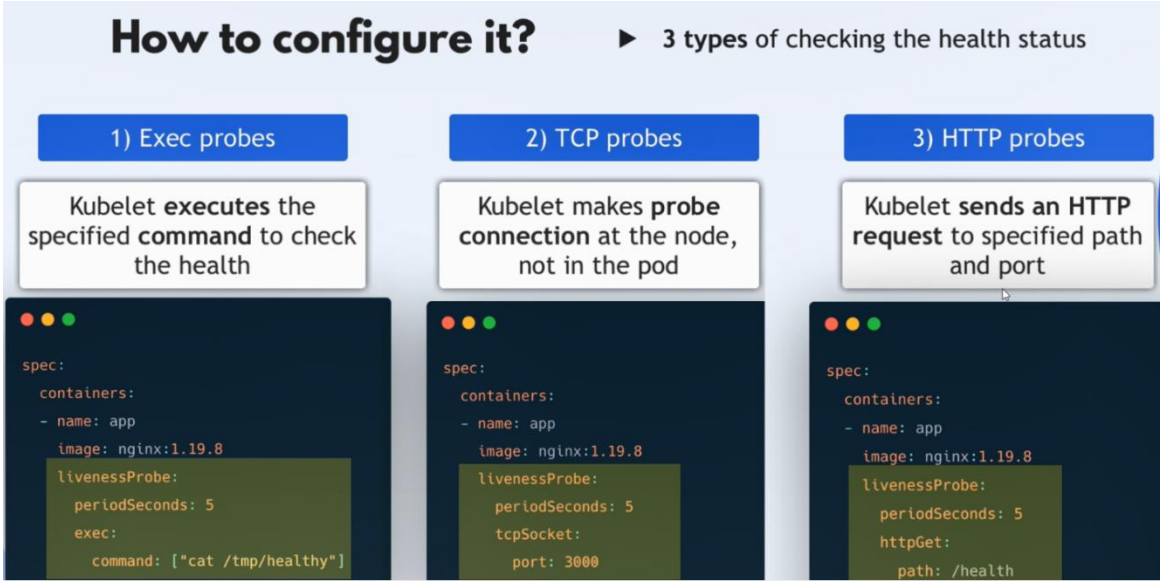
1. Readiness: to check inside my pod if the Entrypoint or CMD commands r working correctly.

to check inside Pod, we have 3 types of apps:

- HTTP or HTTPS apps: they serve something based on HTTP (or HTTPS). we then receive 200 or 300. (the URL called returns 2XX or 3XX status code). This all means that the app inside pod is run correctly.
- my apps are TCP: they listen on a port. (they r not HTTP). K8s will telnet the port (inside Pod) and if it can telnet, it means the port is open and app inside Pod is working correctly.
- The app is not HTTP or TCP: (for instance its UDP). we can run a command inside the container and expect to return 0 (exit status).



2. Liveness: check containers status (Readiness checks Pod status). When something is wrong with liveness Probe, it means that the app has a problem in container layer.



3. Startup: Startup probes were introduced for Java apps first. But now it has a different definition. It is used when time for starting your app is unusual(e.g Java apps, that jar file take a long time to start).

Note: Readiness and liveness are not started until startup probe reaches its first success threshold.

Check Health Parameters

- Check Interval: every what second should I call URL? (url for HTTP apps)
- Initial Delay: time needed to start up container until calling my app. time for all processes needed to start your app.
- Success Threshold: In your check Interval, if your app succeeded 1 time(if set to 1), my app is started correctly. now kubeproxy can route network to new Pod.
- Failed Threshold: when my app is failed up to Failed Threshold times (3 for example), it is in Failed State.

Note: Difference between stateful and Deployment: if a stateful has 5 replicas, the second replica will be created if the first was successful. and the numbering is from zero. Therefore, in updating we don't have max surge and max unavailable. (Think twice)
Creation is from zero and updating from 4 (the last pod).

Job: my pod lifecycle is meant to finish in Terminate state. It may have exit code 0 or non-zero. In case non-zero, it means failure and the pod goes to Restart Policy.
The history of the job will remain for a short time in K8s cluster. (we may have no access to logs of the container or Pod).

Difference between Job and CronJob: we have a scheduler like crontab in linux. we also have the history of pods and containers despite Job.

ETCD

Backup ETCD

```
ETCDCTL_API=3 etcdctl --endpoints=https://127.0.0.1:2379 \
  --cacert=<trusted-ca-file> --cert=<cert-file> --key=<key-file> \
  snapshot save <backup-file-location>
```

use above certificates from below command:
$cat /etc/kubernetes/manifests/etcd.yaml | grep /etc/kubernetes/pki/

Example of backup from etcd:

$ETCDCTL_API=3 etcdctl --endpoints="https://192.168.4.42:2379" --cacert=/etc/kubernetes/pki/etcd/ca.crt --cert=/etc/kubernetes/pki/etcd/server.crt --key=/etc/kubernetes/pki/etcd/server.key snapshot save /etc/data/etcd-snapshot.db

Verify the Snapshot:
note that we don't need authentication for below command:
ETCDCTL_API=3 etcdctl --write-out=table snapshot status <backup-file-location>

Restore ETCD

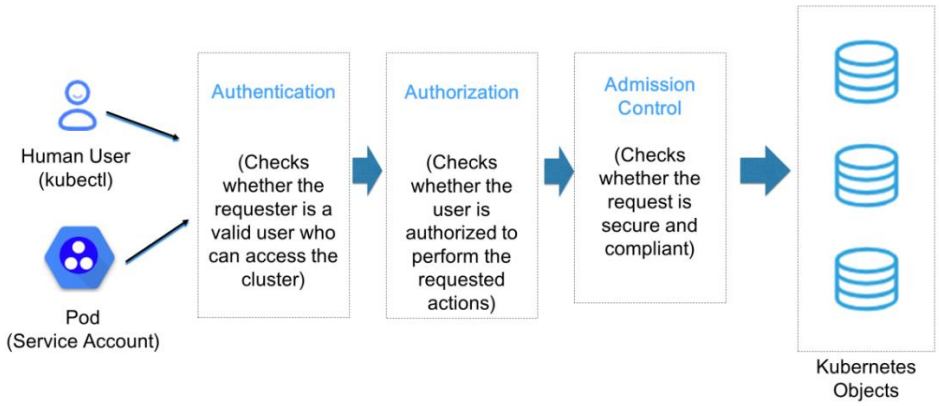
Example of restore from etcd:

```
sudo ETCDCTL_API=3 etcdctl snapshot restore /home/cloud_user/etcd_backup.db \
--initial-cluster etcd-restore=https://10.0.1.101:2380 \
--initial-advertise-peer-urls https://10.0.1.101:2380 \
--name etcd-restore \
--data-dir /var/lib/etcd
```

Verify Restore:
kubectl get all

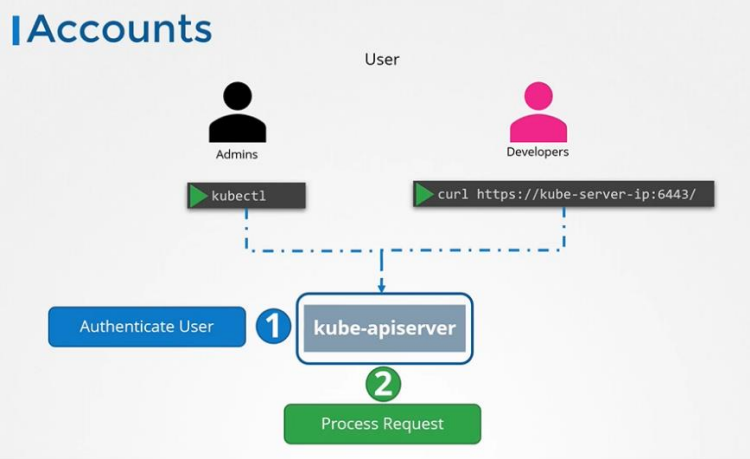
Security (CKS)

###Access to K8s API:



Authentication

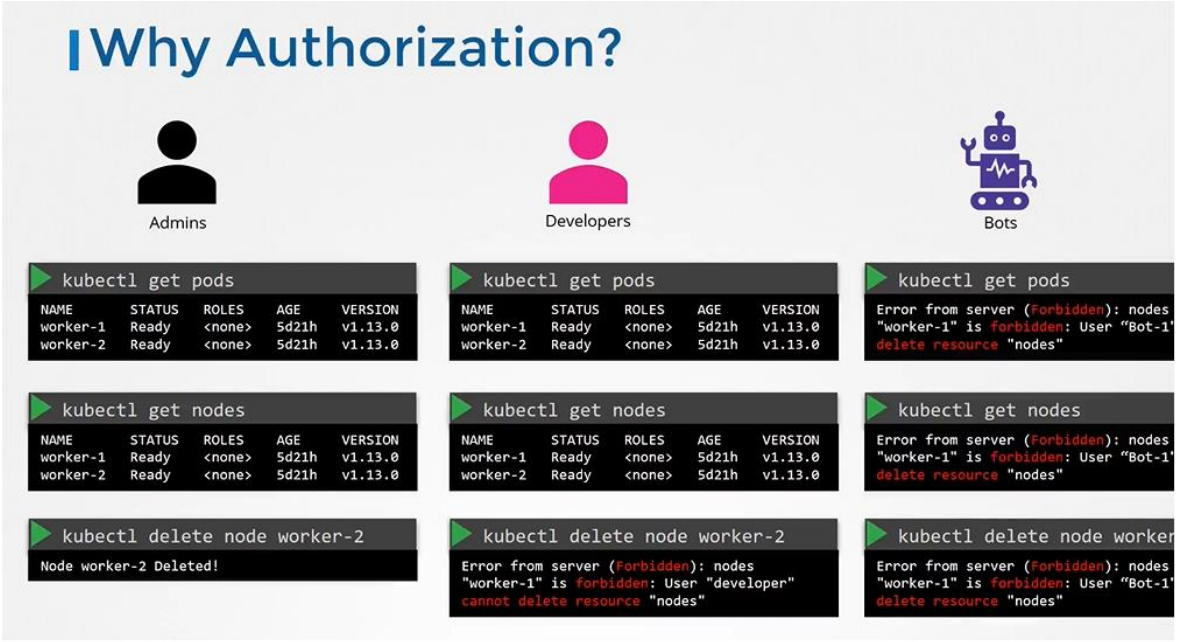
Both human users and Kubernetes service accounts can be authorized for API access.
Whenever we call API (with kubectl command), we are authenticated.
the API serves on port 443, and all k8s components are protected by **TLS** with API.



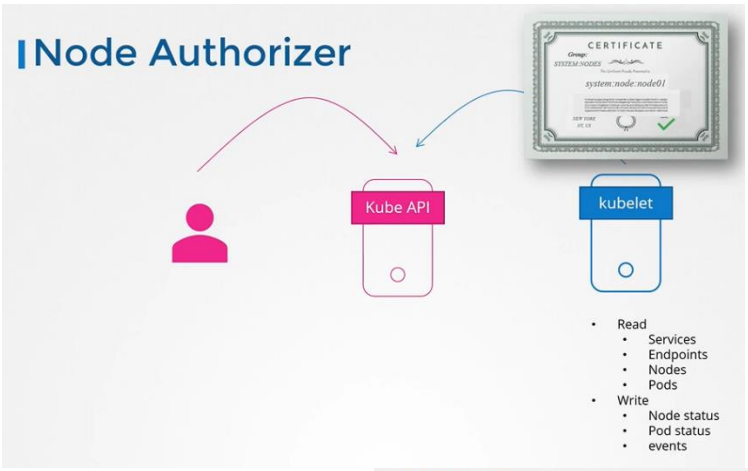
#Authentication Mechanisms: There are different authentication mechanisms that can be configured: certificates, password, and plain tokens, bootstrap tokens, and JSON Web Tokens (used for service accounts). each one is tried in sequence, until one of them succeeds. If the request cannot be authenticated, it is rejected with HTTP status code **401**.

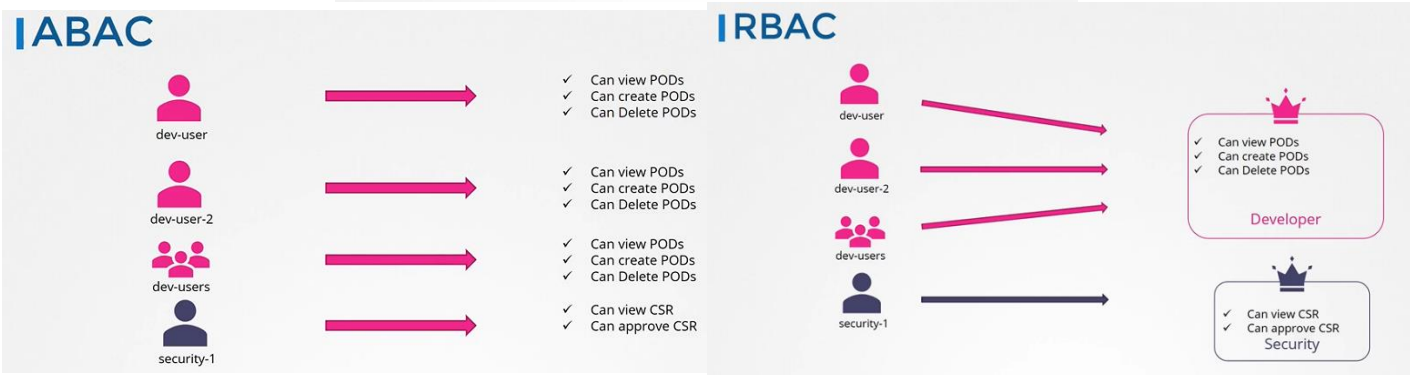
Authorization

After the request is authenticated as coming from a specific user, the request must be authorized.
A request must include the username of the requester, the requested action, and the object affected by the action. The request is authorized if an existing policy declares that the user has permissions to complete the requested action.



##Authorization Mechanisms: Node Authorization, Attribute-based Authorization (ABAC), Role-Based Authorization (RBAC)





Note: we can check which authorization mode is used in apiserver configuration:

$cat /etc/kubernetes/manifest/kube-apiserver.yaml

--authorization-mode=RBAC

TLS Certificates

TLS Certificate is a way to establish secure communication between client & server using SSL/TLS protocol. Certificates are used within a cryptographic system known as a public key infrastructure (PKI).
Asymmetric encryption: we have a key pair (public,private) to encrypt & decrypt data.
Certificate: there is an organization called *Certificate Authority (CA)* which gives website owners a certificate that certifies the ownership of website. The owner of website asks CA to prove that their public key is really for the website. And this CA issues a certificate which has: public key, name of the website & subdomains and the signature of the CAs.
OpenSSL: with this tool we have public & private key but we want the public key to be certified by a trusted CA. this whole process is called **PKI** (Public Key Infrastructure).

In kubernetes, every component that talks to API-Server needs to provide a certificate to authenticate itself with API-Server. we generate a self-signed CA Certificate for k8s. we use it to sign all the client & server certificates with it (all these certificates r stored in /etc/kubernetes/pki)

RBAC

Role-Based Access Control. RBAC is one of the multiple Authorization methods. RBAC is a mechanism that enables you to configure set of permissions that define how a user can interact with any k8s object in cluster or particular namespace.
It consists of 3 parts: 1.Service Account 2.Role 3.RoleBinding

##Service Account: Provides an Identity for processes that run in a Pod.
Note: Service Account vs. **User Account**: When you (a human) access the cluster (kubectl …) you are authenticated by apiserver as a User Account(usually admin, unless your cluster administrator has customized your cluster). Processes inside pods can also contact the apiserver. They are authenticated as a Service Account(for example: default).

ServiceAccount yaml file:

```
apiVersion: v1
kind: ServiceAccount
metadata:
  name: my-serviceaccount
```

#List SAs in current namespace:
	$kubectl get sa
#List SAs in all namespaces:
	$kubectl get sa --all-namespaces
#Create an SA in Imperative mode:
	$kubectl create sa p1
#Create an SA in declarative mode:
	$kubectl create sa sa-test1 --dry-run=client -o yaml

##Role vs. ClusterRole: They are k8s objects that define set of permissions. Role is in the scope of a Namespace. ClusterRole is in the scope of cluster.
Ex:
	$ kubectl create clusterrole pvviewer-role --resource=pods --verb=list
Note: --resource specifies resources that are restricted with permissions and --verb is permissions.

$kubectl get clusterrole
$kubectl get role

##RoleBinding vs. ClusterRoleBinding: objects that Connect roles or ClusterRoles to users.

Ex:

$ kubectl create clusterrolebinding pvviewer-role-binding --clusterrole=pvviewer-role --serviceaccount=test1:p1
$kubectl get rolebinding
$kubectl get clusterrolebinding

Note: u can check API Access with auth can-i subcommand:

$kubectl auth can-i create deployments -n my-namespace

#Role yaml file:

```
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  namespace: default                    #namespace where the role belongs to
  name: pod-reader
rules:
- apiGroups: [""]    # "" indicates the core API group(there r other apiGroups like apps including pods,deployments,... e.g deployments.apps)
  resources: ["pods"]                   #indicates the resources that this role are for
  verbs: ["get", "watch", "list"]       #verbs that we can do on above resources
```

#RoleBinding yaml file:

```
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding               # This role binding allows "jane" to read pods in the "default" namespace.
metadata:
  name: read-pods
  namespace: default
subjects:                               # You can specify more than one "subject"
- kind: User
  name: jane                             #"name" is case sensitive
  apiGroup: rbac.authorization.k8s.io
roleRef:                                #"roleRef" specifies the binding to a Role / ClusterRole
  kind: Role                            #this must be Role or ClusterRole
  name: pod-reader                      # this must match the name of the Role or ClusterRole you wish to bind to
  apiGroup: rbac.authorization.k8s.io
```

Admission Control

Admission Control modules are software modules that can modify or reject requests.
There is a flag in API Server called enable-admission-plugins. This flag calls a list of admission control plugins before modifying objects in k8s cluster.

##Admission Control plugins:

AlwaysAdmit #all pods come inside cluster
AlwaysPullImage #all new pods are modified to imagePullPolicy: Always

#commands:

$kube-apiserver --enable-admission-plugins=LimitRanger #enable limitRanger admission control plugin
$grep admission /etc/kubernetes/manifests/kube-apiserver.yaml #view current admission controller setting

Security Context

Pods and containers within pods can be given specific security constraints to limit what processes running in containers can do.

Example: in the below example, we force a policy that containers can`t run as root users:

```
apiVersion: v1
kind: Pod
metadata:
  name: nginxseccontext
spec:
  securityContext:
    runAsNonRoot: true
containers:
  - image: nginx
    name: nginx
```

Network Policy

- By default, all pods can reach each other (all ingress and egress traffic is allowed).
- We had ingress object before, but the NetworkPolicy objects define rules for both ingress and egress.
- In fact, NetworkPolicy configures CNI application (weavenet, canal, calico).
- Note that not all plugins support NetworkPolicies(e.g: flannel)

As mentioned in the introduction, Kubernetes network policies identify traffic sources and destinations by label selector only – there is no provision (as yet) to specify IP addresses or masks.
ingress is incoming traffic to the pod, and egress is outgoing traffic from the pod.

#Create Ingress Policy: Policies can include one or more ingress rules. To specify which pods in the namespace the network policy applies to, use a **pod selector**. Within the ingress rule, use another pod selector to define which pods allow incoming traffic, and the ports field to define on which ports traffic is allowed.

Example: Allow ingress traffic from pods in the same namespace

In the following example, incoming traffic to pods with label **color=blue** are allowed only if they come from a pod with **color=red**, on port **80**.

```
kind: NetworkPolicy
apiVersion: networking.k8s.io/v1
metadata:
  name: allow-same-namespace
  namespace: default
spec:
  podSelector:                    #if empty, NetworkPolicy is applied to all pods in defined namespace.
    matchLabels:
      color: blue
  ingress:
  - from:
    - podSelector:
        matchLabels:
          color: red
    ports:
      - port: 80
```

Example2: Allow ingress traffic from pods in a different namespace

In the following example, incoming traffic is allowed only if they come from a pod with label **color=red**, in a namespace with label **shape=square**, on port **80**.

```
kind: NetworkPolicy
apiVersion: networking.k8s.io/v1
metadata:
  name: allow-same-namespace
  namespace: default
spec:
  podSelector:
    matchLabels:
      color: blue
  ingress:
  - from:
    - podSelector:
        matchLabels:
          color: red
      namespaceSelector:
        matchLabels:
          shape: square
    ports:
    - port: 80
```

Note: Namespace selectors can be used only in policy rules. The spec.podSelector applies to pods only in the same namespace as the policy.

#Create egress policy:

Example: Allow egress traffic from pods in the same namespace

The following policy allows pod outbound traffic to other pods in the same namespace that match the pod selector. In the following example, outbound traffic is allowed only if they go to a pod with label **color=red**, on port **80**.

```
kind: NetworkPolicy
apiVersion: networking.k8s.io/v1
metadata:
  name: allow-egress-same-namespace
  namespace: default
spec:
  podSelector:
    matchLabels:
      color: blue
  egress:
  - to:
    - podSelector:
        matchLabels:
          color: red
    ports:
    - port: 80
```

Example2: Allow egress traffic to IP addresses or CIDR range

Egress policies can also be used to allow traffic to specific IP addresses and CIDR ranges. Typically, IP addresses/ranges are used to handle traffic that is external to the cluster for static resources or subnets.

The following policy allows egress traffic to pods in CIDR, 172.18.0.0/24.

```
kind: NetworkPolicy
apiVersion: networking.k8s.io/v1
metadata:
  name: allow-egress-external
  namespace: default
spec:
  podSelector:
    matchLabels:
      color: red
  egress:
  - to:
    - ipBlock:
        cidr: 172.18.0.0/24
```

Example3: Create deny-all default ingress and egress network policy

```
kind: NetworkPolicy
apiVersion: networking.k8s.io/v1
metadata:
  name: default-deny
  namespace: default
spec:
  podSelector:
    matchLabels: {}
  policyTypes:
  - Ingress
  - Egress
```

#kubectl exec frontend-7d7b59633m4-g4kb5 --sh -c ‘nc -v 100.44.0.1 6379’ #using netcat command to c who can talk to who