
KODEKLOUD

# Course Objectives

- Core Concepts
  - Cluster Architecture
  - API Primitives
  - Services & Other Network Primitives
- Scheduling
- Logging Monitoring
- Application Lifecycle Management
- Cluster Maintenance
- Security
- Storage
- Networking
- Installation, Configuration & Validation
- Troubleshooting

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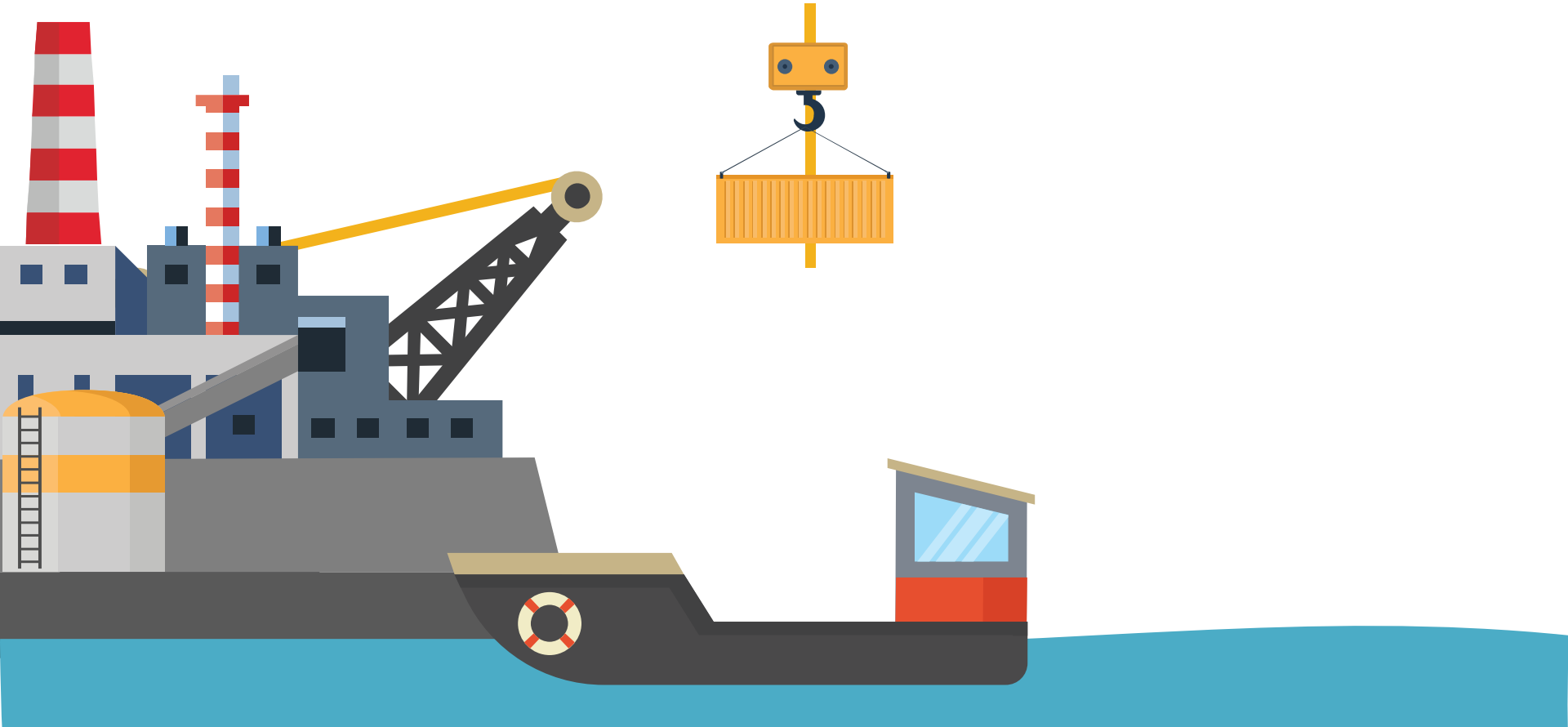
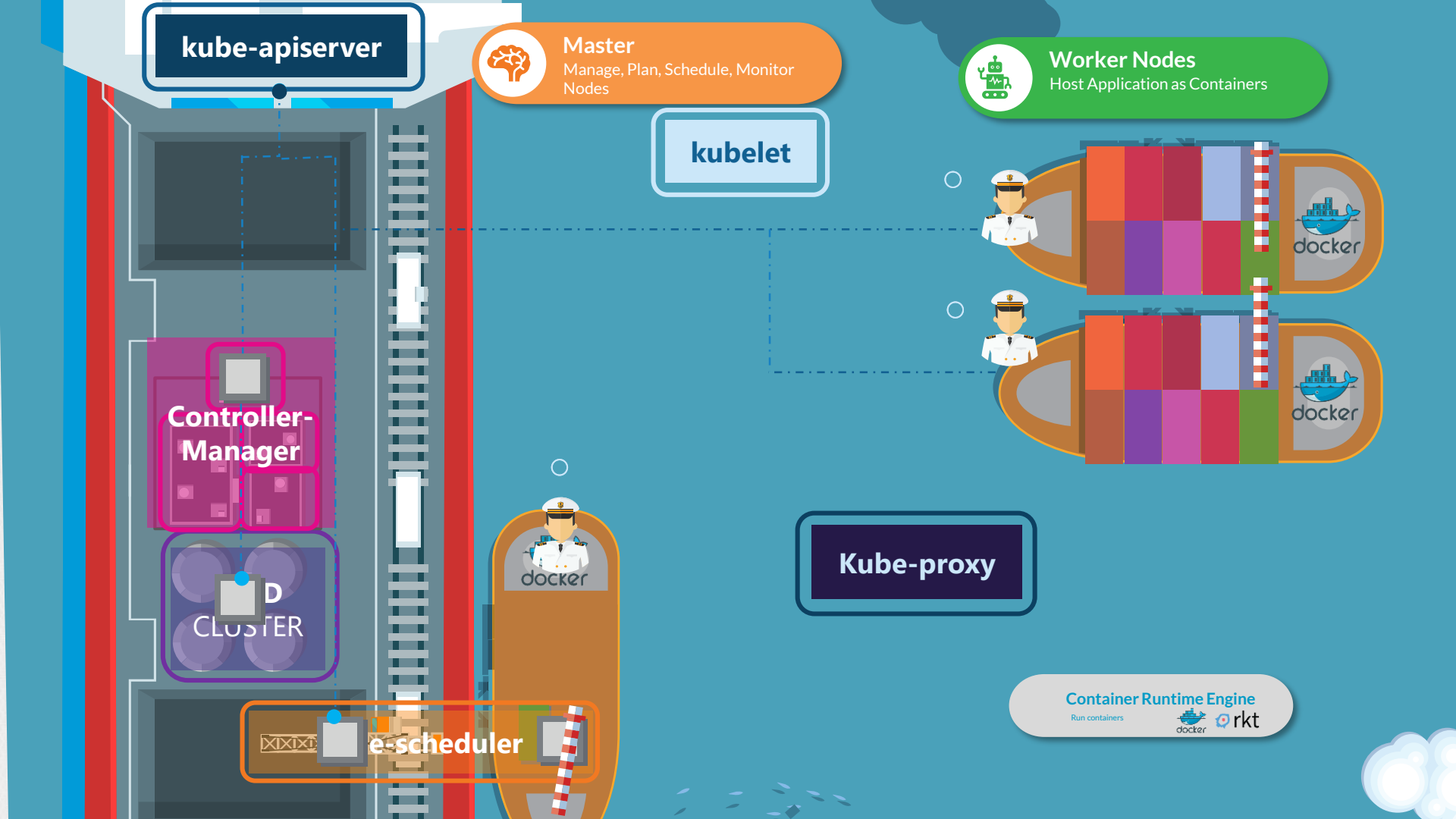
# Cluster Architecture

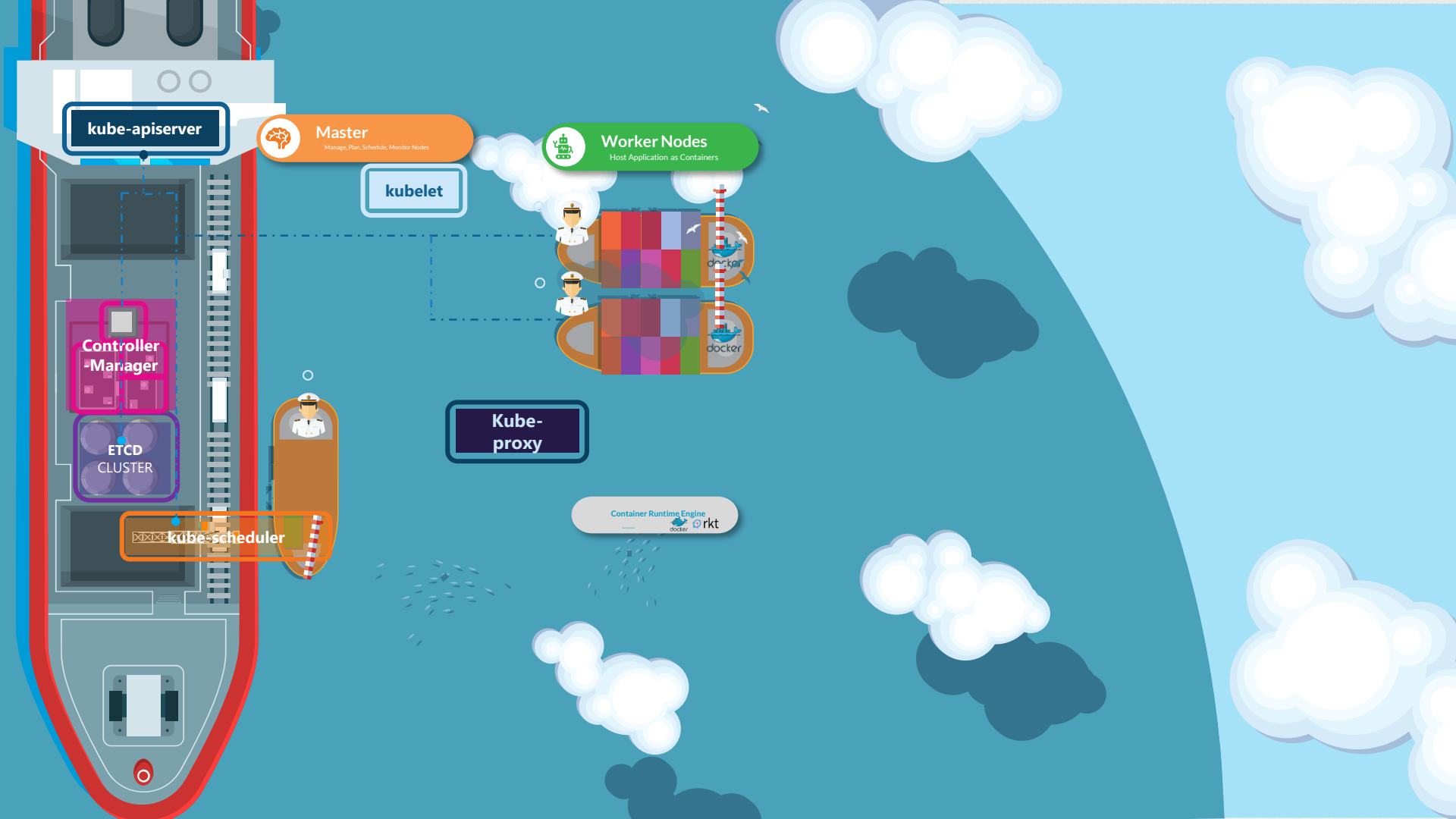
- ❑ Kubernetes Architecture
- ❑ ETCD For Beginners
- ❑ ETCD in Kubernetes
- ❑ Kube-API Server
- ❑ Controller Managers
- ❑ Kube Scheduler
- ❑ Kubelet
- ❑ Kube Proxy

# KUBERNETES ARCHITECTURE

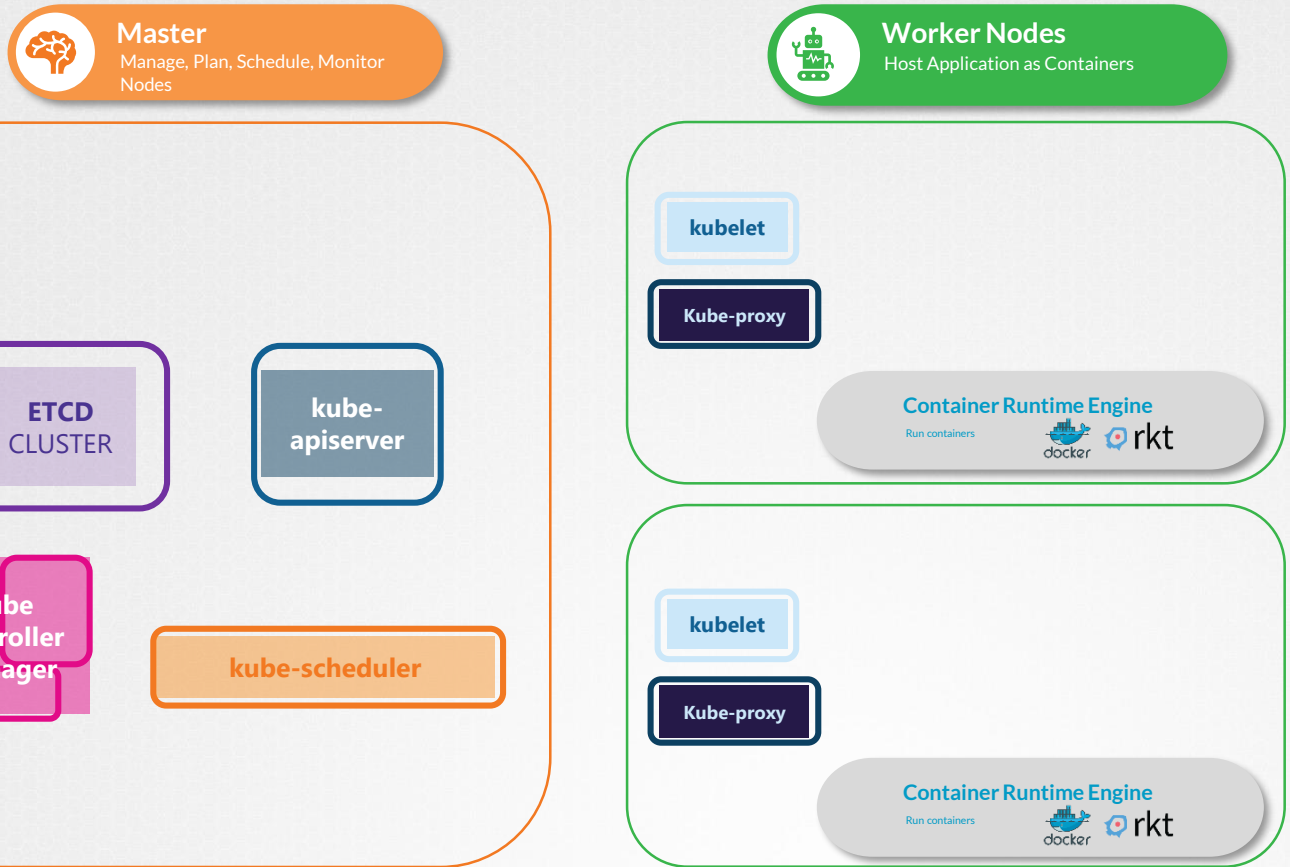



Master
Manage, Plan, Schedule, Monitor Nodes
Worker Nodes
Host Application as Containers


kube-apiserver
Master
Manage, Plan, Schedule, Monitor Nodes
Worker Nodes
Host Application as Containers
kubelet
Controller-Manager
D
CLUSTER
e-scheduler
docker
docker
docker
Kube-proxy
Container Runtime Engine
Run containers
docker
rkt


kube-apiserver
Master
Manage, Plan, Schedule, Monitor Nodes
kubelet
Worker Nodes
Host Application as Containers
Controller -Manager
ETCD CLUSTER
kube-scheduler
Kube-proxy
Container Runtime Engine
docker
rkt

# Kubernetes Architecture

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# ETCD

## FOR BEGINNERS

# Objectives

- What is ETCD?
- What is a Key-Value Store?
- How to get started quickly?
- How to operate ETCD?
- What is a distributed system?
- How ETCD Operates
- RAFT Protocol
- Best practices on number of nodes


ETCD is a distributed reliable key-value store that is Simple, Secure & Fast

# key-value store

Tabular/Relational Databases

| Name | Age | Location | Salary | Grade |
|---|---|---|---|---|
| John Doe | 45 | New York | 5000 | |
| Dave Smith | 34 | New York | 4000 | |
| Aryan Kumar | 10 | New York | | A |
| Lauren Rob | 13 | Bangalore | | C |
| Lily Oliver | 15 | Bangalore | | B |

# key-value store

| Key | Value |
|---|---|
| Name | John Doe |
| Age | 45 |
| Location | New York |
| Salary | 5000 |

| Key | Value |
|---|---|
| Name | Dave Smith |
| Age | 34 |
| Location | New York |
| Salary | 4000 |
| Organization | ACME |

| Key | Value |
|---|---|
| Name | Aryan Kumar |
| Age | 10 |
| Location | New York |
| Grade | A |

| Key | Value |
|---|---|
| Name | Lauren Rob |
| Age | 13 |
| Location | Bangalore |
| Grade | C |

| Key | Value |
|---|---|
| Name | Lily Oliver |
| Age | 15 |
| Location | Bangalore |
| Grade | B |

# key-value store

```
{
  "name": "John Doe",
  "age": 45,
  "location": "New York",
  "salary": 5000
}
```

```
{
  "name": "Dave Smith",
  "age": 34,
  "location": "New York",
  "salary": 4000,
  "organization": "ACME"
}
```

```
{
  "name": "Aryan Kumar",
  "age": 10,
  "location": "New York",
  "Grade": "A"
}
```

```
{
  "name": "Lily Oliver",
  "age": 15,
  "location": "Bangalore",
  "Grade": "B"
}
```

```
{
  "name": "Lauren Rob",
  "age": 13,
  "location": "Bangalore",
  "Grade": "C"
}
```

# Install ETCD

1. Download Binaries

```
curl -L https://github.com/etcd-io/etcd/releases/download/v3.3.11/etcd-v3.3.11-linux-amd64.tar.gz -o etcd-v3.3.11-linux-amd64.tar.gz
```

2. Extract

```
tar xzvf etcd-v3.3.11-linux-amd64.tar.gz
```

3. Run ETCD Service

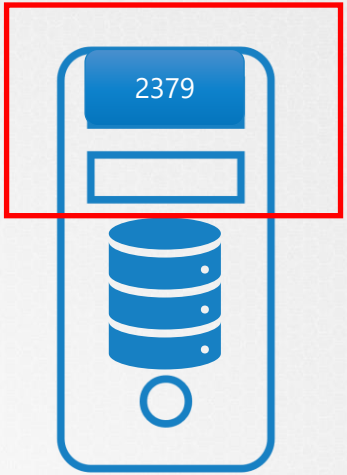
```
./etcd
```

# Operate ETCD

## 3. Run ETCD Service

```
./etcd
```

ETCD service start on port 2379




```
./etcdctl set key1 value1
```

```
./etcdctl get key1
value1
```

```
./etcdctl
NAME:
   etcdctl - A simple command line client for etcd.

COMMANDS:
     backup          backup an etcd directory
     cluster-health  check the health of the etcd cluster
     mk              make a new key with a given value
     mkdir           make a new directory
     rm              remove a key or a directory
     rmdir           removes the key if it is an empty directory or a key-value pair
     get             retrieve the value of a key
```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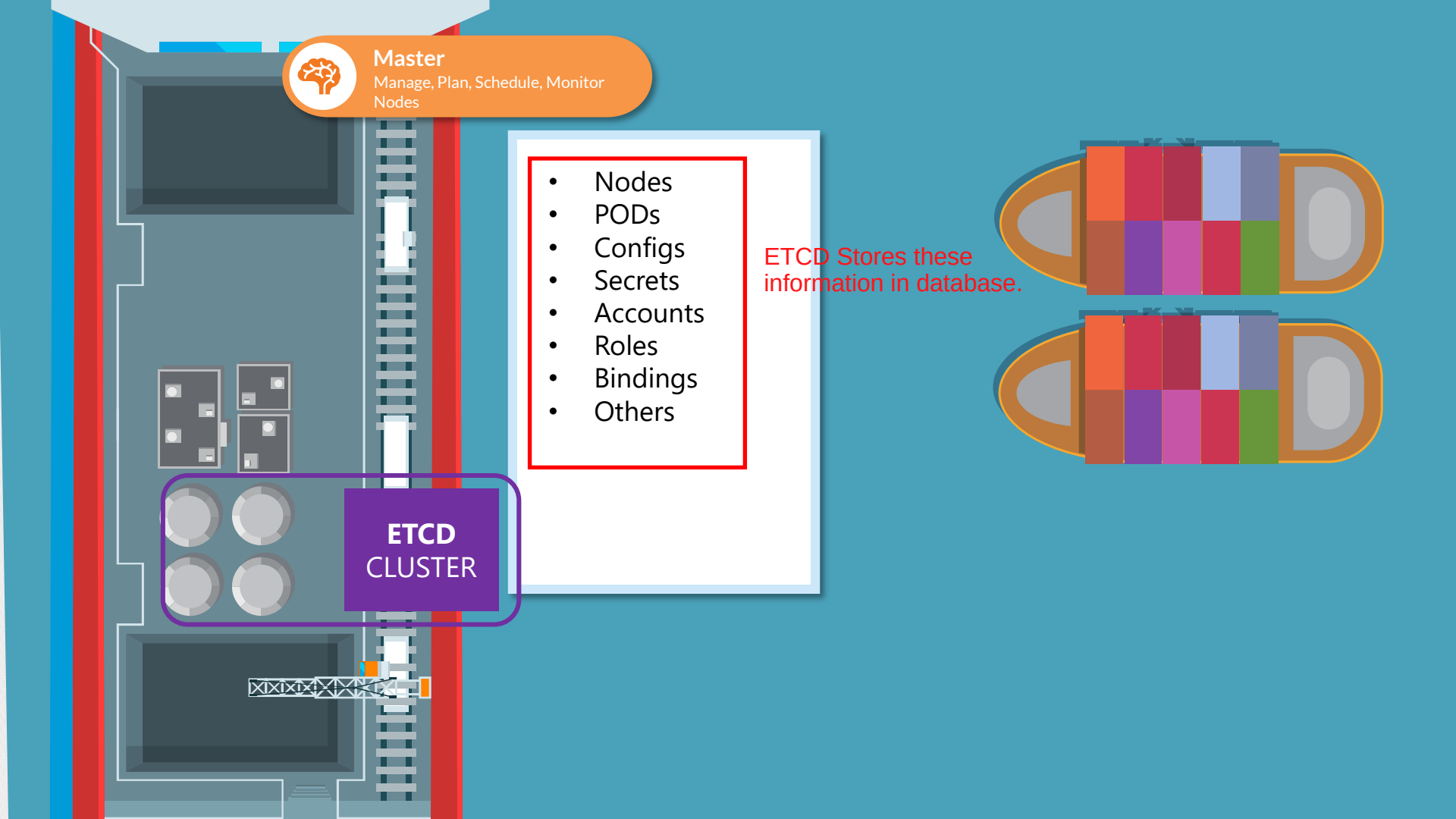
# ETCD

## In Kubernetes


Master
Manage, Plan, Schedule, Monitor Nodes
Nodes
PODs
Configs
Secrets
Accounts
Roles
Bindings
Others
ETCD Stores these information in database.
ETCD
CLUSTER

# Setup - Manual

```
wget -q --https-only \
    "https://github.com/coreos/etcd/releases/download/v3.3.9/etcd-v3.3.9-linux-amd64.tar.gz"
```

etcd.service

```
ExecStart=/usr/local/bin/etcd \\
  --name ${ETCD_NAME} \\
  --cert-file=/etc/etcd/kubernetes.pem \\
  --key-file=/etc/etcd/kubernetes-key.pem \\
  --peer-cert-file=/etc/etcd/kubernetes.pem \\
  --peer-key-file=/etc/etcd/kubernetes-key.pem \\
  --trusted-ca-file=/etc/etcd/ca.pem \\
  --peer-trusted-ca-file=/etc/etcd/ca.pem \\
  --peer-client-cert-auth \\
  --client-cert-auth \\
  --initial-advertise-peer-urls https://${INTERNAL_IP}:2380 \\
  --listen-peer-urls https://${INTERNAL_IP}:2380 \\
  --listen-client-urls https://${INTERNAL_IP}:2379,https://127.0.0.1:2379 \\
  --advertise-client-urls https://${INTERNAL_IP}:2379 \\
  --initial-cluster-token etcd-cluster-0 \\
  --initial-cluster controller-0=https://${CONTROLLER0_IP}:2380,controller-1=https://${CONTROLLER1_IP}:2380 \\
  --initial-cluster-state new \\
  --data-dir=/var/lib/etcd
```

Address on which ETCD listens

# Setup - kubeadm

```
kubectl get pods -n kube-system
```

```
NAMESPACE     NAME                              READY     STATUS    RESTARTS   AGE
kube-system   coredns-78fcdf6894-prwvl          1/1       Running   0          1h
kube-system   coredns-78fcdf6894-vqd9w          1/1       Running   0          1h
kube-system   etcd-master                       1/1       Running   0          1h
kube-system   kube-apiserver-master             1/1       Running   0          1h
kube-system   kube-controller-manager-master    1/1       Running   0          1h
kube-system   kube-proxy-f6k26                  1/1       Running   0          1h
kube-system   kube-proxy-hnzsw                  1/1       Running   0          1h
kube-system   kube-scheduler-master             1/1       Running   0          1h
kube-system   weave-net-924k8                   2/2       Running   1          1h
kube-system   weave-net-hzfcz                   2/2       Running   1          1h
```

```
kubectl exec etcd-master -n kube-system etcdctl get / --prefix -keys-only
```

```
/registry/apiregistration.k8s.io/apiservices/v1.
/registry/apiregistration.k8s.io/apiservices/v1.apps
/registry/apiregistration.k8s.io/apiservices/v1.authentication.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1.authorization.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1.autoscaling
/registry/apiregistration.k8s.io/apiservices/v1.batch
/registry/apiregistration.k8s.io/apiservices/v1.networking.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1.rbac.authorization.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1.storage.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1beta1.admissionregistration.k8s.io
```

Run inside the etcd-master POD

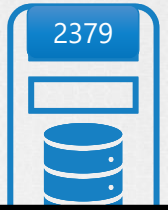
# Explore ETCD

```
kubectl exec etcd-master -n kube-system etcdctl get / --prefix -keys-only
/registry/apiregistration.k8s.io/apiservices/v1.
/registry/apiregistration.k8s.io/apiservices/v1.apps
/registry/apiregistration.k8s.io/apiservices/v1.authentication.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1.authorization.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1.autoscaling
/registry/apiregistration.k8s.io/apiservices/v1.batch
/registry/apiregistration.k8s.io/apiservices/v1.networking.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1.rbac.authorization.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1.storage.k8s.io
/registry/apiregistration.k8s.io/apiservices/v1beta1.admissionregistration.k8s.io
```

Run inside the etcd-master POD


Kubernetes stores data in specific structure

# ETCD in HA Environment




etcd.service

```
ExecStart=/usr/local/bin/etcd \\
  --name ${ETCD_NAME} \\
  --cert-file=/etc/etcd/kubernetes.pem \\
  --key-file=/etc/etcd/kubernetes-key.pem \\
  --peer-cert-file=/etc/etcd/kubernetes.pem \\
  --peer-key-file=/etc/etcd/kubernetes-key.pem \\
  --trusted-ca-file=/etc/etcd/ca.pem \\
  --peer-trusted-ca-file=/etc/etcd/ca.pem \\
  --peer-client-cert-auth \\
  --client-cert-auth \\
  --initial-advertise-peer-urls https://${INTERNAL_IP}:2380 \\
  --listen-peer-urls https://${INTERNAL_IP}:2380 \\
  --listen-client-urls https://${INTERNAL_IP}:2379,https://127.0.0.1:2379 \\
  --advertise-client-urls https://${INTERNAL_IP}:2379 \\
  --initial-cluster-token etcd-cluster-0 \\
  --initial-cluster controller-0=https://${CONTROLLER0_IP}:2380,controller-1=https://${CONTROLLER1_IP}:2380 \\
  --initial-cluster-state new \\
  --data-dir=/var/lib/etcd
```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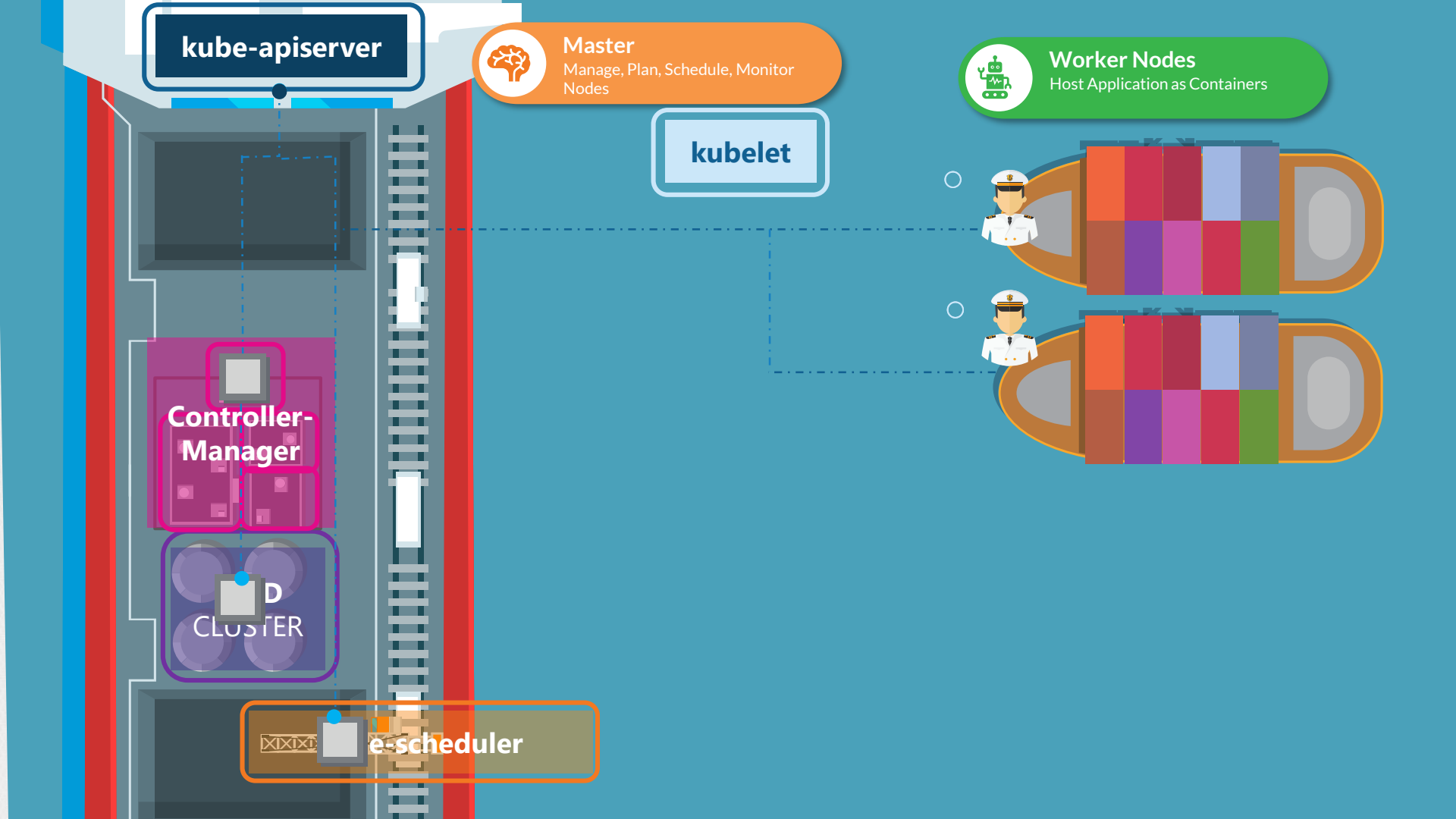
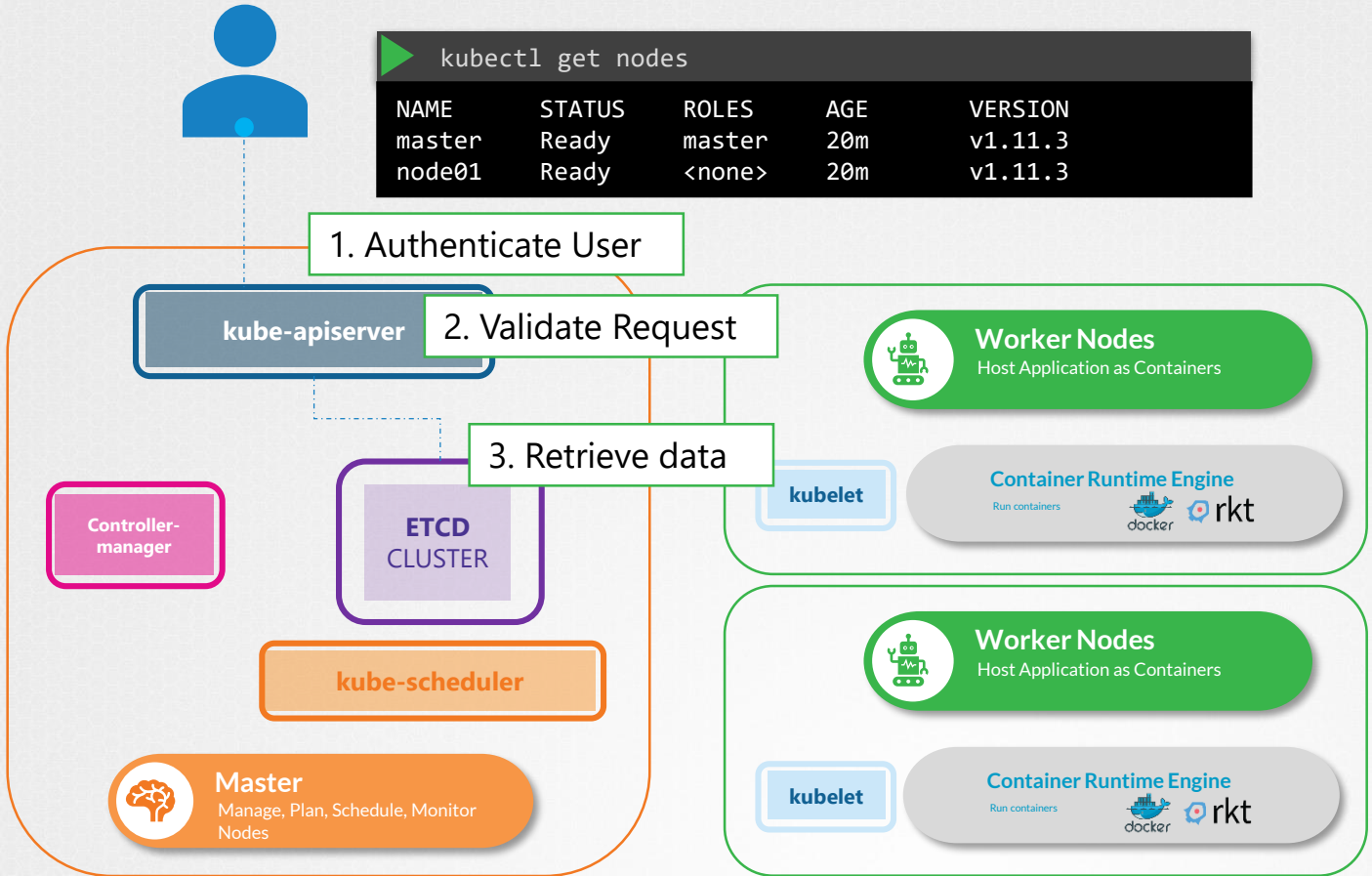
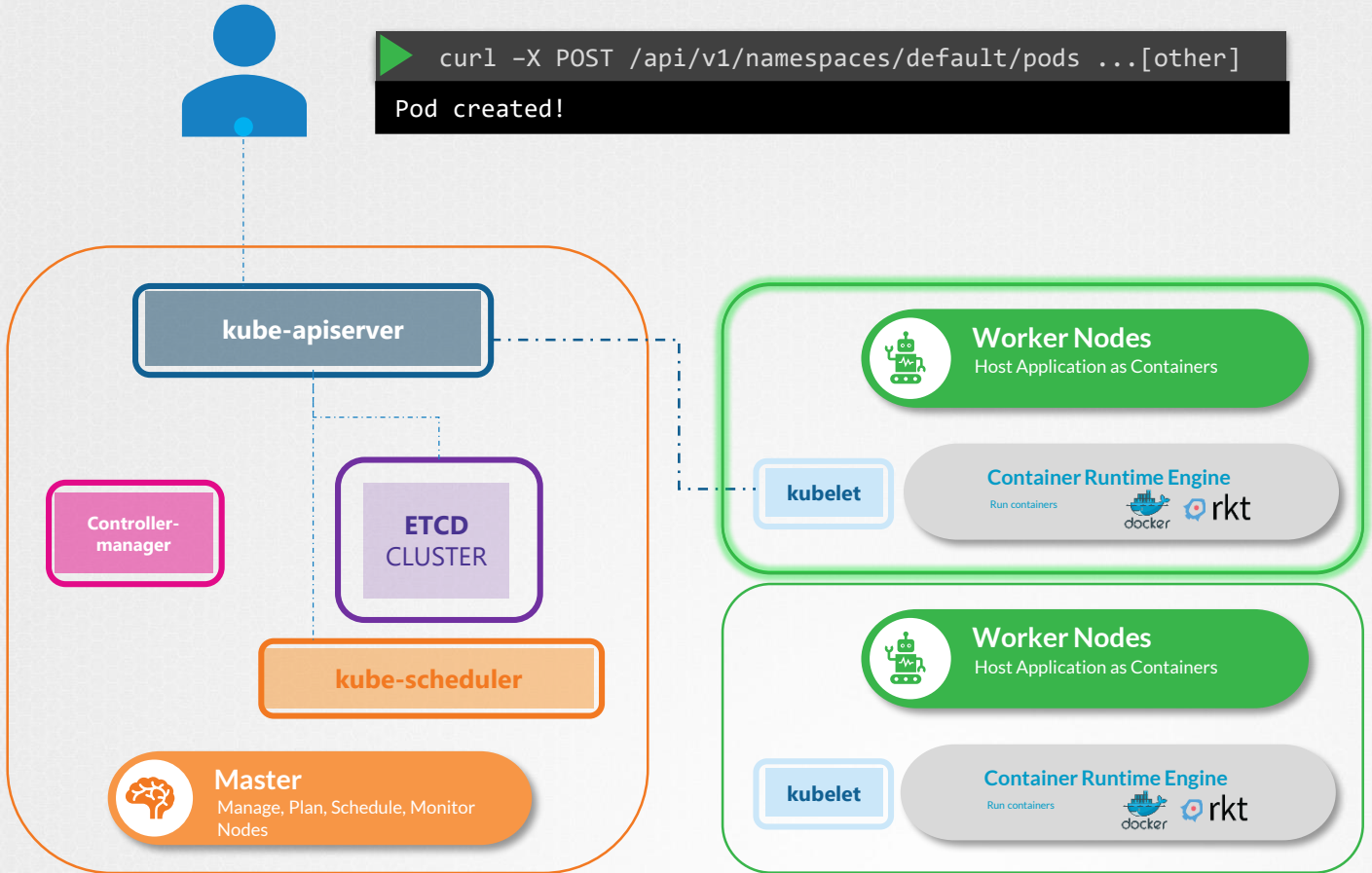
# kube-api server


kube-apiserver
Master
Manage, Plan, Schedule, Monitor Nodes
kubelet
Worker Nodes
Host Application as Containers
Controller-Manager
D
CLUSTER
e-scheduler

# Kubernetes Architecture



# Kubernetes Architecture




1. Authenticate User
2. Validate Request
3. Retrieve data
4. Update ETCD
5. Scheduler
6. Kubelet

# Kube-api Server

performs following things.

1. Authenticate User
2. Validate Request
3. Retrieve data
4. Update ETCD
5. Scheduler
6. Kubelet

# Installing kube-api server

```
wget https://storage.googleapis.com/kubernetes-release/release/v1.13.0/bin/linux/amd64/kube-apiserver
```

kube-apiserver.service

```
ExecStart=/usr/local/bin/kube-apiserver \\
  --advertise-address=${INTERNAL_IP} \\
  --allow-privileged=true \\
  --apiserver-count=3 \\
  --authorization-mode=Node,RBAC \\
  --bind-address=0.0.0.0 \\
  --enable-admission-
plugins=Initializers,NamespaceLifecycle,NodeRestriction,LimitRanger,ServiceAccount,DefaultStorageClass,Reso
urceQuota \\
  --enable-swagger-ui=true \\
  --etcd-servers=https://127.0.0.1:2379 \\
  --event-ttl=1h \\
  --experimental-encryption-provider-config=/var/lib/kubernetes/encryption-config.yaml \\
  --runtime-config=api/all \\
  --service-account-key-file=/var/lib/kubernetes/service-account.pem \\
  --service-cluster-ip-range=10.32.0.0/24 \\
  --service-node-port-range=30000-32767 \\
  --v=2
```

This is how KubeAPI server connected to ETCD server.

# View api-server - kubeadm

```
kubectl get pods -n kube-system
```

```
NAMESPACE     NAME                              READY     STATUS    RESTARTS   AGE
kube-system   coredns-78fcdf6894-hwrq9          1/1       Running   0          16m
kube-system   coredns-78fcdf6894-rzhjr          1/1       Running   0          16m
kube-system   etcd-master                       1/1       Running   0          15m
kube-system   kube-apiserver-master             1/1       Running   0          15m
kube-system   kube-controller-manager-master    1/1       Running   0          15m
kube-system   kube-proxy-lzt6f                  1/1       Running   0          16m
kube-system   kube-proxy-zm5qd                  1/1       Running   0          16m
kube-system   kube-scheduler-master             1/1       Running   0          15m
kube-system   weave-net-29z42                   2/2       Running   1          16m
kube-system   weave-net-snmdl                   2/2       Running   1          16m    -
```

# View api-server options - kubeadm

```
cat /etc/kubernetes/manifests/kube-apiserver.yaml
```

```
spec:
  containers:
  - command:
    - kube-apiserver
    - --authorization-mode=Node,RBAC
    - --advertise-address=172.17.0.32
    - --allow-privileged=true
    - --client-ca-file=/etc/kubernetes/pki/ca.crt
    - --disable-admission-plugins=PersistentVolumeLabel
    - --enable-admission-plugins=NodeRestriction
    - --enable-bootstrap-token-auth=true
    - --etcd-cafile=/etc/kubernetes/pki/etcd/ca.crt
    - --etcd-certfile=/etc/kubernetes/pki/apiserver-etcd-client.crt
    - --etcd-keyfile=/etc/kubernetes/pki/apiserver-etcd-client.key
    - --etcd-servers=https://127.0.0.1:2379
    - --insecure-port=0
    - --kubelet-client-certificate=/etc/kubernetes/pki/apiserver-kubelet-client.crt
    - --kubelet-client-key=/etc/kubernetes/pki/apiserver-kubelet-client.key
    - --kubelet-preferred-address-types=InternalIP,ExternalIP,Hostname
    - --proxy-client-cert-file=/etc/kubernetes/pki/front-proxy-client.crt
    - --proxy-client-key-file=/etc/kubernetes/pki/front-proxy-client.key
    - --requestheader-allowed-names=front-proxy-client
    - --requestheader-client-ca-file=/etc/kubernetes/pki/front-proxy-ca.crt
    - --requestheader-extra-headers-prefix=X-Remote-Extra-
    - --requestheader-group-headers=X-Remote-Group
    - --requestheader-username-headers=X-Remote-User
```

Kubeadm setup

# View api-server options

Non Kubeadm setup.

```
cat /etc/systemd/system/kube-apiserver.service
```

```
[Service]
ExecStart=/usr/local/bin/kube-apiserver \\
  --advertise-address=${INTERNAL_IP} \\
  --allow-privileged=true \\
  --apiserver-count=3 \\
  --audit-log-maxage=30 \\
  --audit-log-maxbackup=3 \\
  --audit-log-maxsize=100 \\
  --audit-log-path=/var/log/audit.log \\
  --authorization-mode=Node,RBAC \\
  --bind-address=0.0.0.0 \\
  --client-ca-file=/var/lib/kubernetes/ca.pem \\
  --enable-admission-
plugins=Initializers,NamespaceLifecycle,NodeRestriction,LimitRanger,ServiceAccount,Defa
ultStorageClass,ResourceQuota \\
  --enable-swagger-ui=true \\
  --etcd-cafile=/var/lib/kubernetes/ca.pem \\
  --etcd-certfile=/var/lib/kubernetes/kubernetes.pem \\
  --etcd-keyfile=/var/lib/kubernetes/kubernetes-key.pem \\
  --etcd-
servers=https://10.240.0.10:2379,https://10.240.0.11:2379,https://10.240.0.12:2379 \\
  --event-ttl=1h \\
  --experimental-encryption-provider-config=/var/lib/kubernetes/encryption-config.yaml
\\
  --kubelet-certificate-authority=/var/lib/kubernetes/ca.pem \\
  --kubelet-client-certificate=/var/lib/kubernetes/kubernetes.pem \\
```

# View api-server options

```
ps -aux | grep kube-apiserver
```

```
root      2348  3.3 15.4 399040 315604 ?       Ssl  15:46   1:22 kube-apiserver --authorization-mode=Node,RBAC --advertise-address=172.17.0.32 --allow-privileged=true --client-ca-file=/etc/kubernetes/pki/ca.crt --disable-admission-plugins=PersistentVolumeLabel --enable-admission-plugins=NodeRestriction--enable-bootstrap-token-auth=true --etcd-cafile=/etc/kubernetes/pki/etcd/ca.crt --etcd-certfile=/etc/kubernetes/pki/apiserver-etcd-client.crt --etcd-keyfile=/etc/kubernetes/pki/apiserver-etcd-client.key --etcd-servers=https://127.0.0.1:2379 --insecure-port=0 --kubelet-client-certificate=/etc/kubernetes/pki/apiserver-kubelet-client.crt --kubelet-client-key=/etc/kubernetes/pki/apiserver-kubelet-client.key --kubelet-preferred-address-types=InternalIP,ExternalIP,Hostname --proxy-client-cert-file=/etc/kubernetes/pki/front-proxy-client.crt --proxy-client-key-file=/etc/kubernetes/pki/front-proxy-client.key--requestheader-allowed-names=front-proxy-client --requestheader-client-ca-file=/etc/kubernetes/pki/front-proxy-ca.crt --requestheader-extra-headers-prefix=X-Remote-Extra- --requestheader-group-headers=X-Remote-Group --requestheader-username-headers=X-Remote-User --secure-port=6443 --service-account-key-file=/etc/kubernetes/pki/sa.pub --service-cluster-ip-range=10.96.0.0/12 --tls-cert-file=/etc/kubernetes/pki/apiserver.crt --tls-private-key-file=/etc/kubernetes/pki/apiserver.key
```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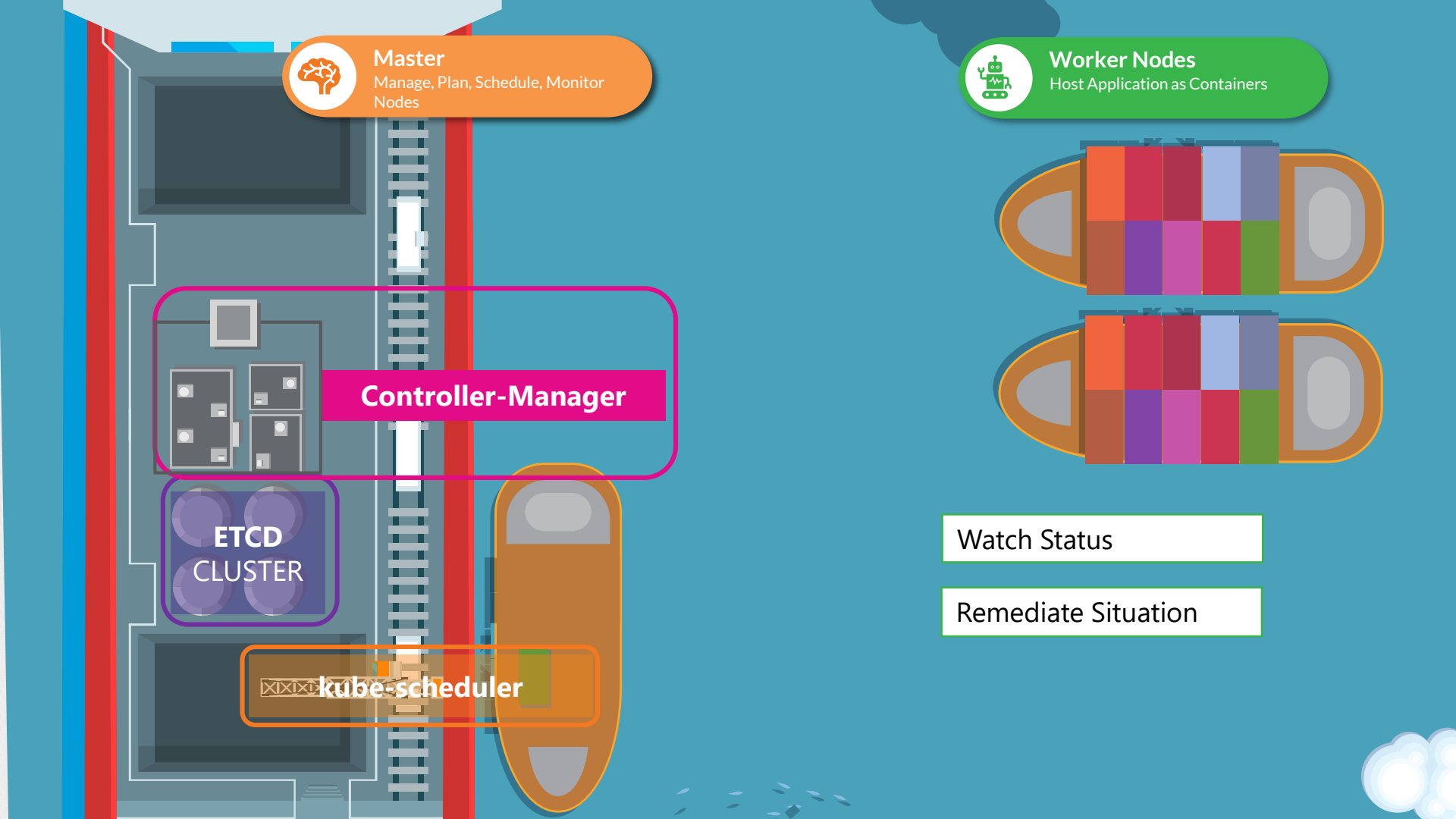
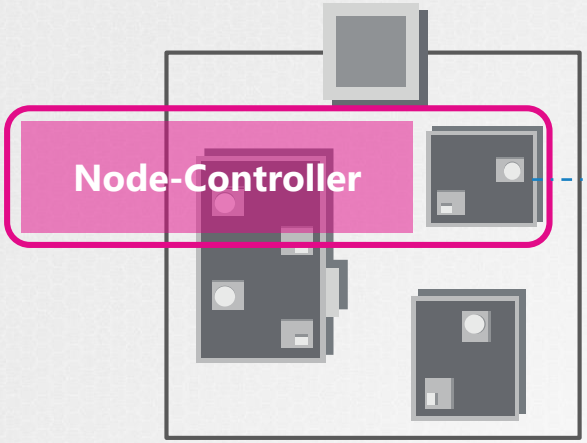
# Kube Controller Manager


Master
Manage, Plan, Schedule, Monitor Nodes
Worker Nodes
Host Application as Containers
Controller-Manager
ETCD
CLUSTER
kube-scheduler
Watch Status
Remediate Situation

# Controller

Node Controller




kube-apiserver

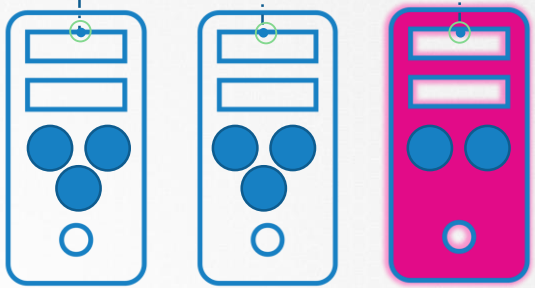
Watch Status

Remediate Situation

Node Monitor Period = 5s

Node Monitor Grace Period = 40s

POD Eviction Timeout = 5m

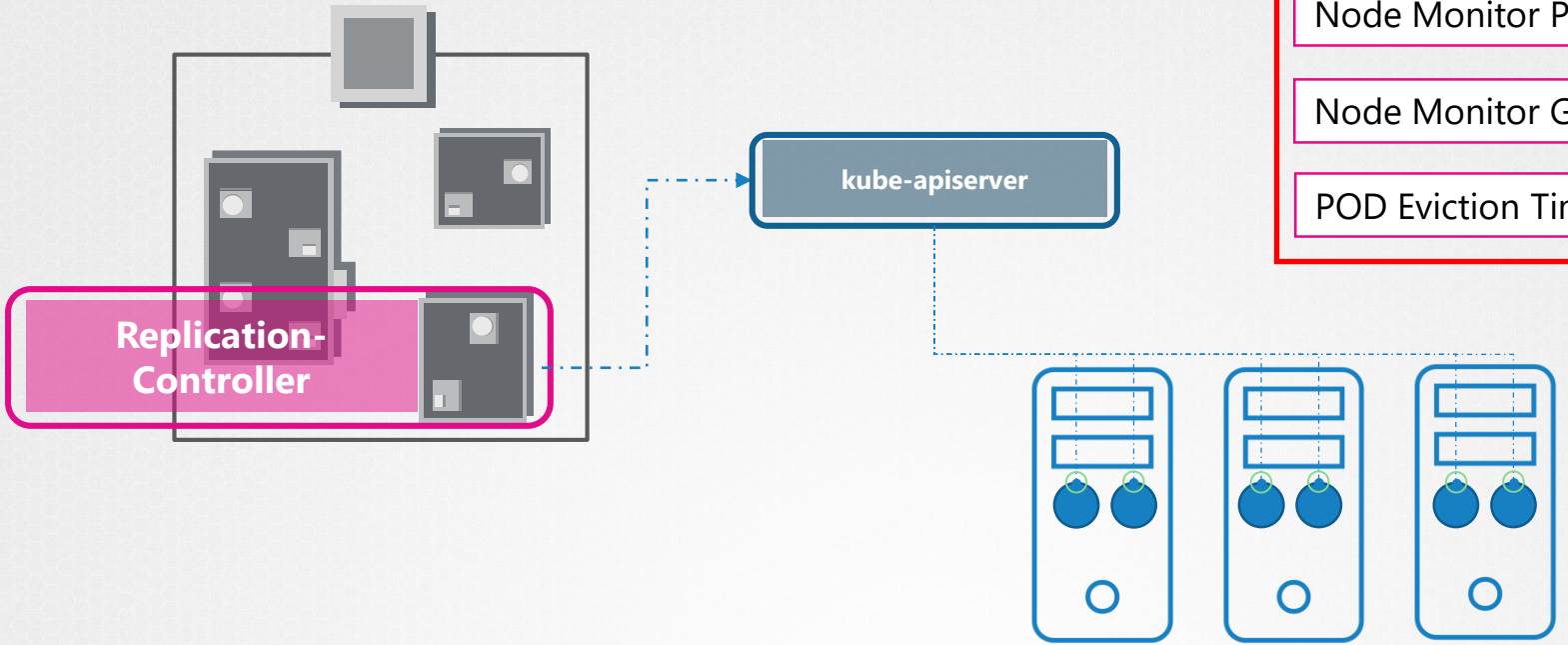


UNREACHABLE

```
kubectl get nodes
NAME       STATUS     ROLES    AGE    VERSION
worker-1   Ready      <none>   8d     v1.13.0
worker-2   NotReady   <none>   8d     v1.13.0
```

# Controller

Replication Controller




Watch Status

Remediate Situation

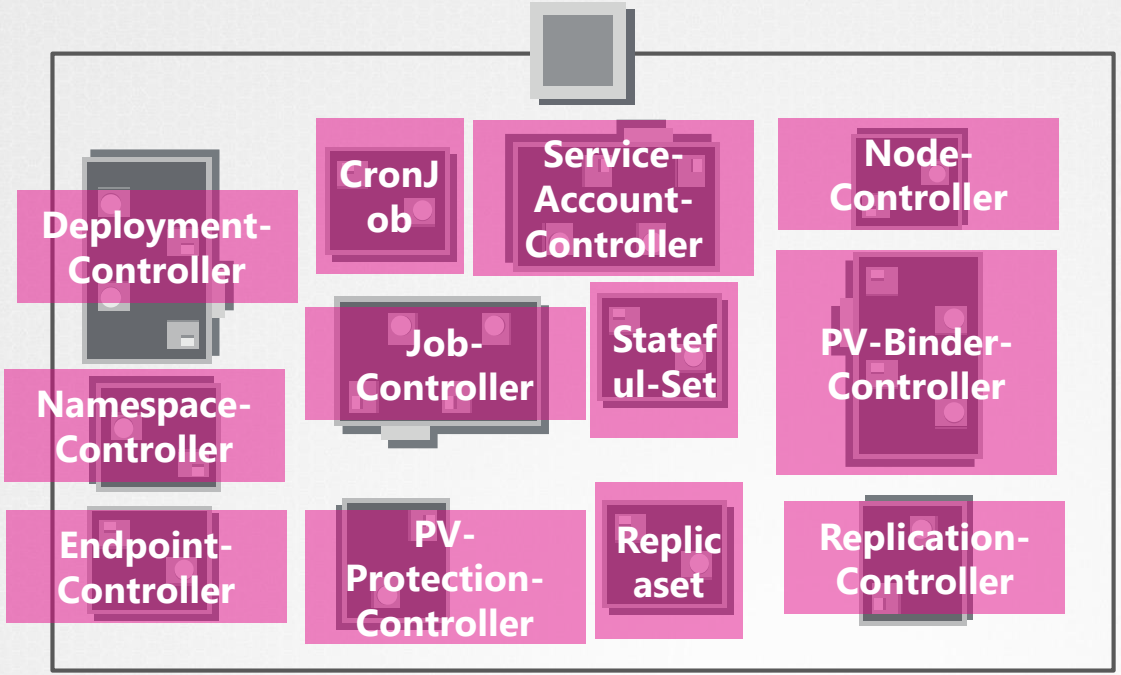
Node Monitor Period = 5s

Node Monitor Grace Period = 40s

POD Eviction Timeout = 5m

# Controller

Various types of Controller - components of Controller Manager




Watch Status

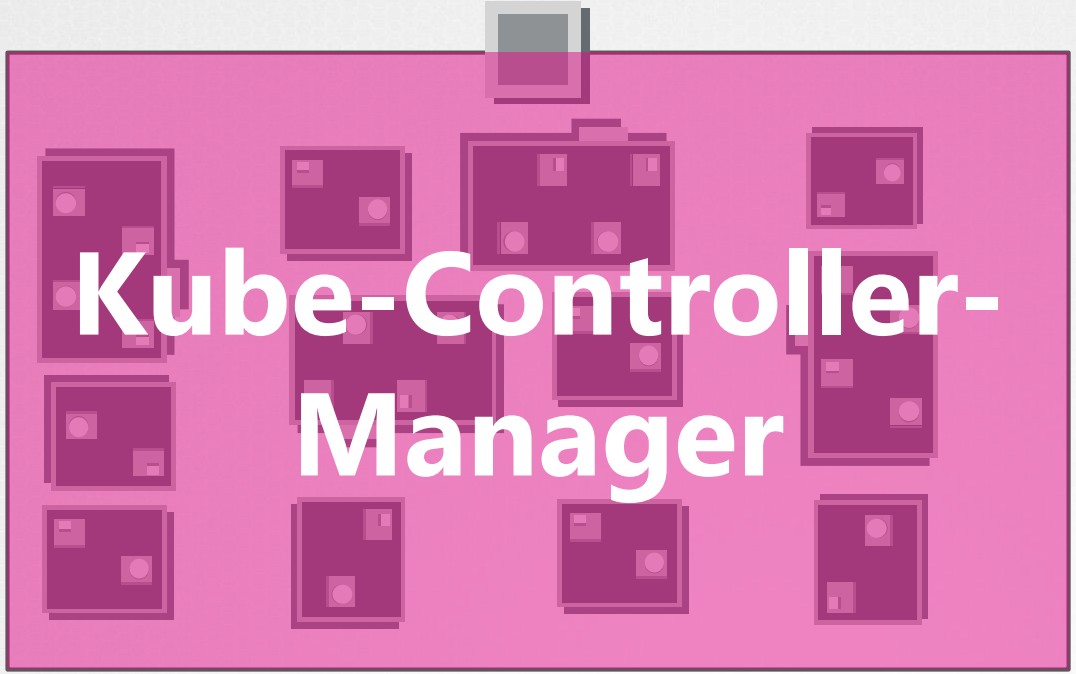
Remediate Situation

Node Monitor Period = 5s

Node Monitor Grace Period = 40s

POD Eviction Timeout = 5m

# Controller




- Watch Status
- Remediate Situation
- Node Monitor Period = 5s
- Node Monitor Grace Period = 40s
- POD Eviction Timeout = 5m

# Installing kube-controller-manager

```
wget https://storage.googleapis.com/kubernetes-release/release/v1.13.0/bin/linux/amd64/kube-controller-manager
```

kube-controller-manager.service

```
ExecStart=/usr/local/bin/kube-controller-manager \\
  --address=0.0.0.0 \\
  --cluster-cidr=10.200.0.0/16 \\
  --cluster-name=kubernetes \\
  --cluster-signing-cert-file=/var/lib/kubernetes/ca.pem \\
  --cluster-signing-key-file=/var/lib/kubernetes/ca-key.pem \\
  --kubeconfig=/var/lib/kubernetes/kube-controller-manager.kubeconfig \\
  --leader-elect=true \\
  --root-ca-file=/var/lib/kubernetes/ca.pem \\
  --service-account-private-key-file=/var/lib/kubernetes/service-account-key.pem \\
  --service-cluster-ip-range=10.32.0.0/24 \\
  --use-service-account-credentials=true \\
  --v=2
```

```
N --node-monitor-period=5s
```

```
d=40s
```

```
s
```

```
--controllers stringSlice     Default: [*]
A list of controllers to enable. '*' enables all on-by-default controllers, 'foo' enables the controller
named 'foo', '-foo' disables the controller named 'foo'.
All controllers: attachdetach, bootstrapsigner, clusterrole-aggregation, cronjob, csrapproving,
csrcleaner, csrsigning, daemonset, deployment, disruption, endpoint, garbagecollector,
horizontalpodautoscaling, job, namespace, nodeipam, nodelifecycle, persistentvolume-binder,
persistentvolume-expander, podgc, pv-protection, pvc-protection, replicaset, replicationcontroller,
```

# Installing kube-controller-manager

```
--controllers stringSlice     Default: [*]
A list of controllers to enable. '*' enables all on-by-default controllers, 'foo' enables the controller
named 'foo', '-foo' disables the controller named 'foo'.
All controllers: attachdetach, bootstrapsigner, clusterrole-aggregation, cronjob, csrapproving,
csrcleaner, csrsigning, daemonset, deployment, disruption, endpoint, garbagecollector,
horizontalpodautoscaling, job, namespace, nodeipam, nodelifecycle, persistentvolume-binder,
persistentvolume-expander, podgc, pv-protection, pvc-protection, replicaset, replicationcontroller,
resourcequota, root-ca-cert-publisher, route, service, serviceaccount, serviceaccount-token, statefulset,
tokencleaner, ttl, ttl-after-finished
Disabled-by-default controllers: bootstrapsigner, tokencleaner
```

# View kube-controller-manager - kubeadm

```
kubectl get pods -n kube-system
```

```
NAMESPACE     NAME                              READY     STATUS    RESTARTS   AGE
kube-system   coredns-78fcdf6894-hwrq9          1/1       Running   0          16m
kube-system   coredns-78fcdf6894-rzhjr          1/1       Running   0          16m
kube-system   etcd-master                       1/1       Running   0          15m
kube-system   kube-apiserver-master             1/1       Running   0          15m
kube-system   kube-controller-manager-master    1/1       Running   0          15m
kube-system   kube-proxy-lzt6f                  1/1       Running   0          16m
kube-system   kube-proxy-zm5qd                  1/1       Running   0          16m
kube-system   kube-scheduler-master             1/1       Running   0          15m
kube-system   weave-net-29z42                   2/2       Running   1          16m
kube-system   weave-net-snmdl                   2/2       Running   1          16m    -
```

# View kube-controller-manager options - kubeadm

```
cat /etc/kubernetes/manifests/kube-controller-manager.yaml
```

```
spec:
  containers:
  - command:
    - kube-controller-manager
    - --address=127.0.0.1
    - --cluster-signing-cert-file=/etc/kubernetes/pki/ca.crt
    - --cluster-signing-key-file=/etc/kubernetes/pki/ca.key
    - --controllers=*,bootstrapsigner,tokencleaner
    - --kubeconfig=/etc/kubernetes/controller-manager.conf
    - --leader-elect=true
    - --root-ca-file=/etc/kubernetes/pki/ca.crt
    - --service-account-private-key-file=/etc/kubernetes/pki/sa.key
    - --use-service-account-credentials=true
```

# View controller-manager options

Non Kubeadm setup

```
cat /etc/systemd/system/kube-controller-manager.service
```

```
[Service]
ExecStart=/usr/local/bin/kube-controller-manager \\
  --address=0.0.0.0 \\
  --cluster-cidr=10.200.0.0/16 \\
  --cluster-name=kubernetes \\
  --cluster-signing-cert-file=/var/lib/kubernetes/ca.pem \\
  --cluster-signing-key-file=/var/lib/kubernetes/ca-key.pem \\
  --kubeconfig=/var/lib/kubernetes/kube-controller-manager.kubeconfig \\
  --leader-elect=true \\
  --root-ca-file=/var/lib/kubernetes/ca.pem \\
  --service-account-private-key-file=/var/lib/kubernetes/service-account-key.pem \\
  --service-cluster-ip-range=10.32.0.0/24 \\
  --use-service-account-credentials=true \\
  --v=2
Restart=on-failure
RestartSec=5
```

# View controller-manager options

```
ps -aux | grep kube-controller-manager
```

```
root      1994  2.7  5.1 154360 105024 ?       Ssl  06:45   1:25 kube-controller-manager --address=127.0.0.1 --cluster-signing-cert-file=/etc/kubernetes/pki/ca.crt --cluster-signing-key-file=/etc/kubernetes/pki/ca.key --controllers=*,bootstrapsigner,tokencleaner --kubeconfig=/etc/kubernetes/controller-manager.conf --leader-elect=true --root-ca-file=/etc/kubernetes/pki/ca.crt --service-account-private-key-file=/etc/kubernetes/pki/sa.key --use-service-account-credentials=true
```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# Course Objectives

- Core Concepts
  - Cluster Architecture
  - API Primitives
  - Services & Other Network Primitives
- Scheduling
- Logging Monitoring
- Application Lifecycle Management
- Cluster Maintenance
- Security
- Storage
- Networking
- Installation, Configuration & Validation
- Troubleshooting

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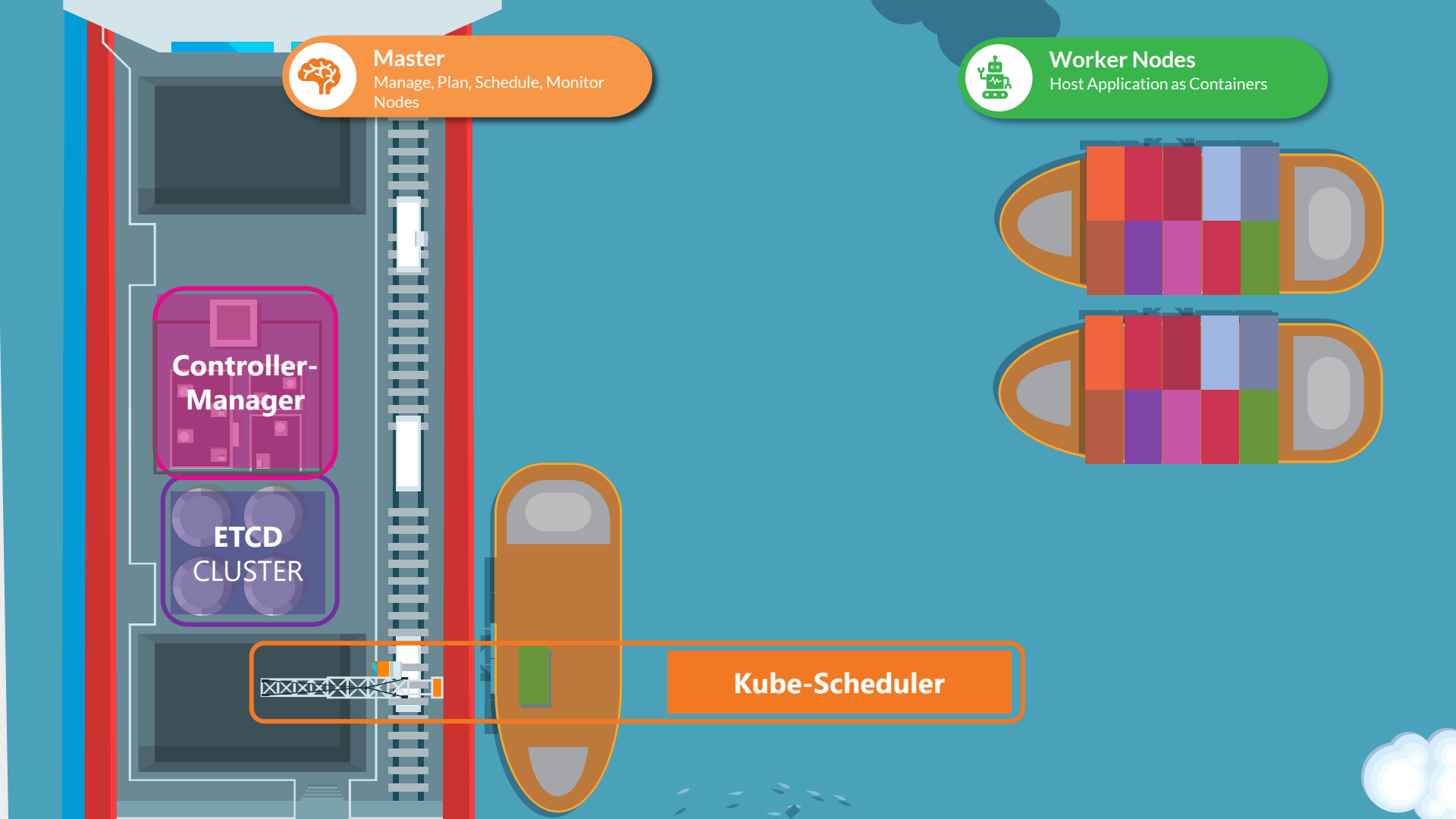
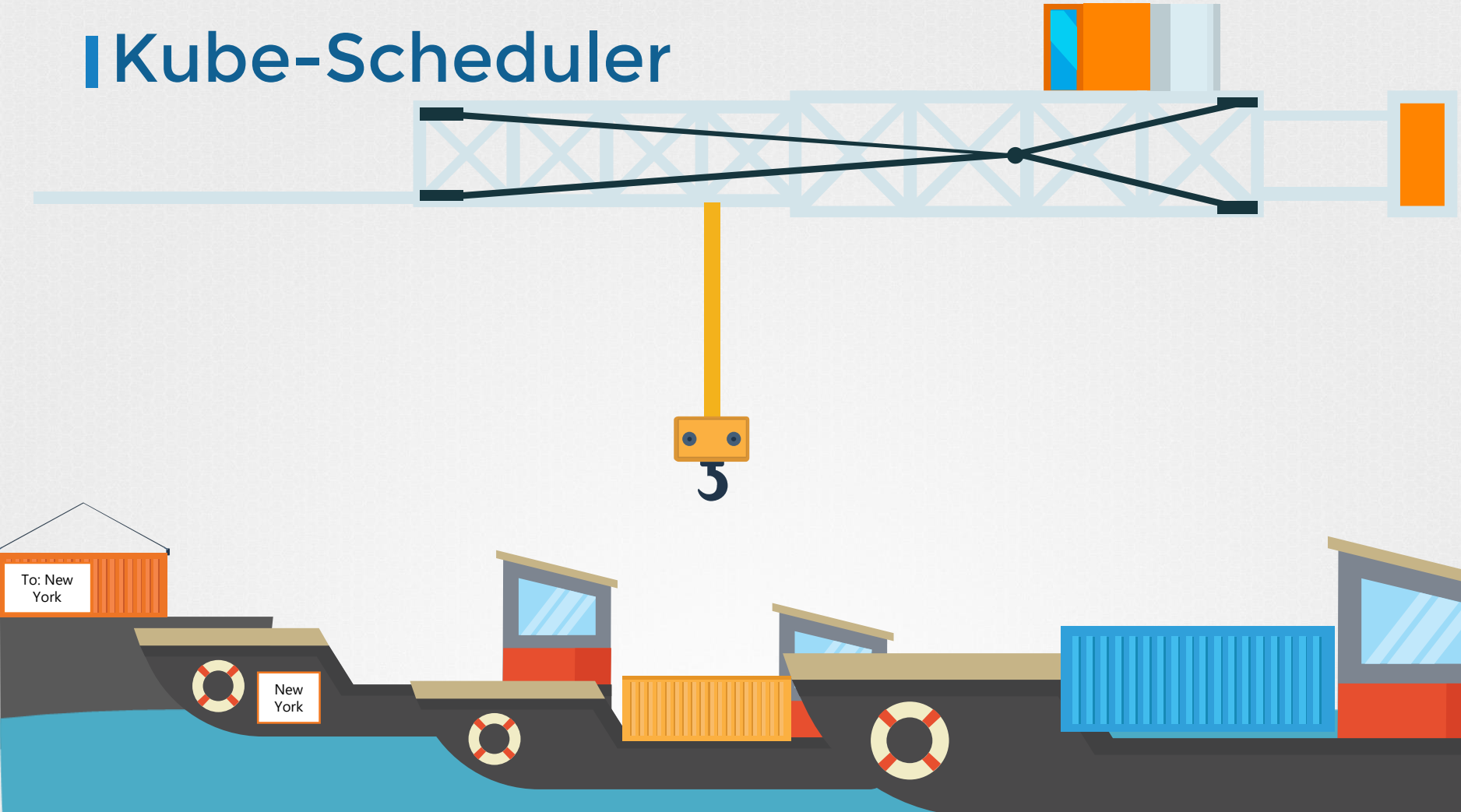
# Kube Scheduler

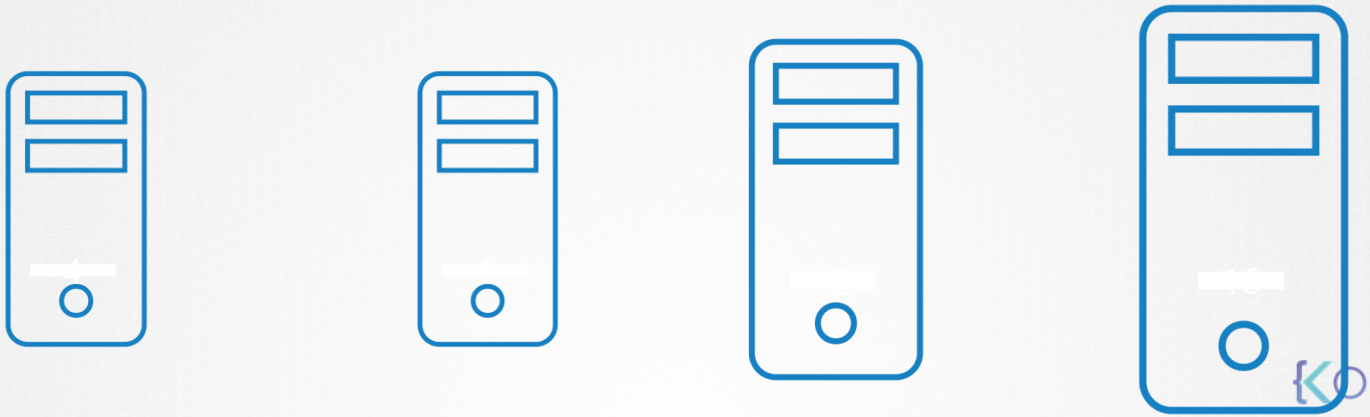
Kube Scheduler decides which POD goes on which nodes, it doesn't actually places the POD's on the nodes.


Master
Manage, Plan, Schedule, Monitor Nodes
Worker Nodes
Host Application as Containers
Controller-Manager
ETCD CLUSTER
Kube-Scheduler

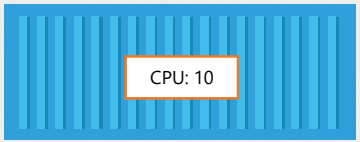
# Kube-Scheduler



# Kube-Scheduler

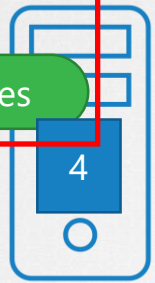



# Kube-Scheduler

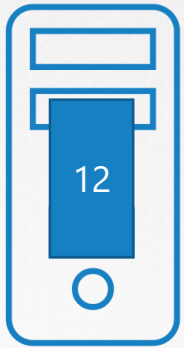


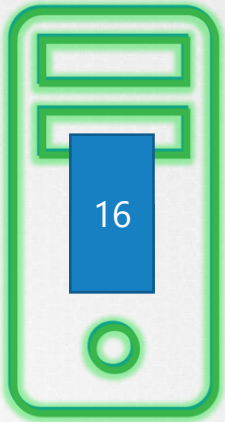

1. Filter Nodes

2. Rank Nodes







# More Later...

- Resource Requirements and Limits
- Taints and Tolerations
- Node Selectors/Affinity

# Course Objectives

- Scheduling
  - Labels & Selectors
  - Resource Limits
  - Manual Scheduling
  - Daemon Sets
  - Multiple Schedulers
  - Scheduler Events
  - Configure Kubernetes Scheduler
- Logging Monitoring
- Application Lifecycle Management
- Cluster Maintenance
- Security
- Storage
- Troubleshooting

# Installing kube-scheduler

```
wget https://storage.googleapis.com/kubernetes-release/release/v1.13.0/bin/linux/amd64/kube-scheduler
```

kube-scheduler.service

```
ExecStart=/usr/local/bin/kube-scheduler \\
  --config=/etc/kubernetes/config/kube-scheduler.yaml \\
  --v=2
```

# View kube-scheduler options - kubeadm

```
cat /etc/kubernetes/manifests/kube-scheduler.yaml
```

```
spec:
  containers:
  - command:
    - kube-scheduler
    - --address=127.0.0.1
    - --kubeconfig=/etc/kubernetes/scheduler.conf
    - --leader-elect=true
```

# View kube-scheduler options

```
ps -aux | grep kube-scheduler
```

```
root      2477  0.8  1.6  48524 34044 ?        Ssl  17:31   0:08 kube-scheduler --
address=127.0.0.1 --kubeconfig=/etc/kubernetes/scheduler.conf --leader-elect=true
```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# Course Objectives

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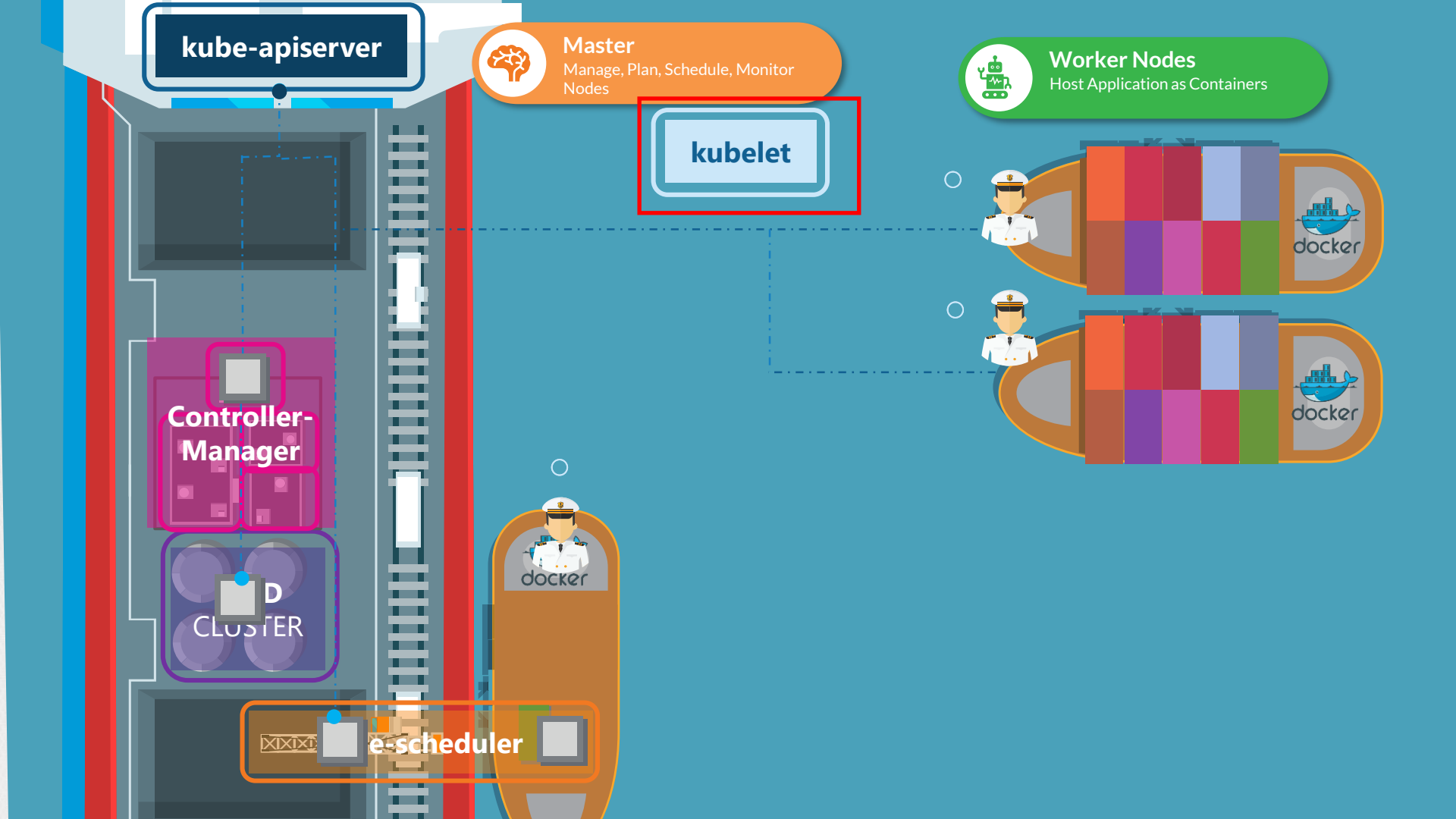
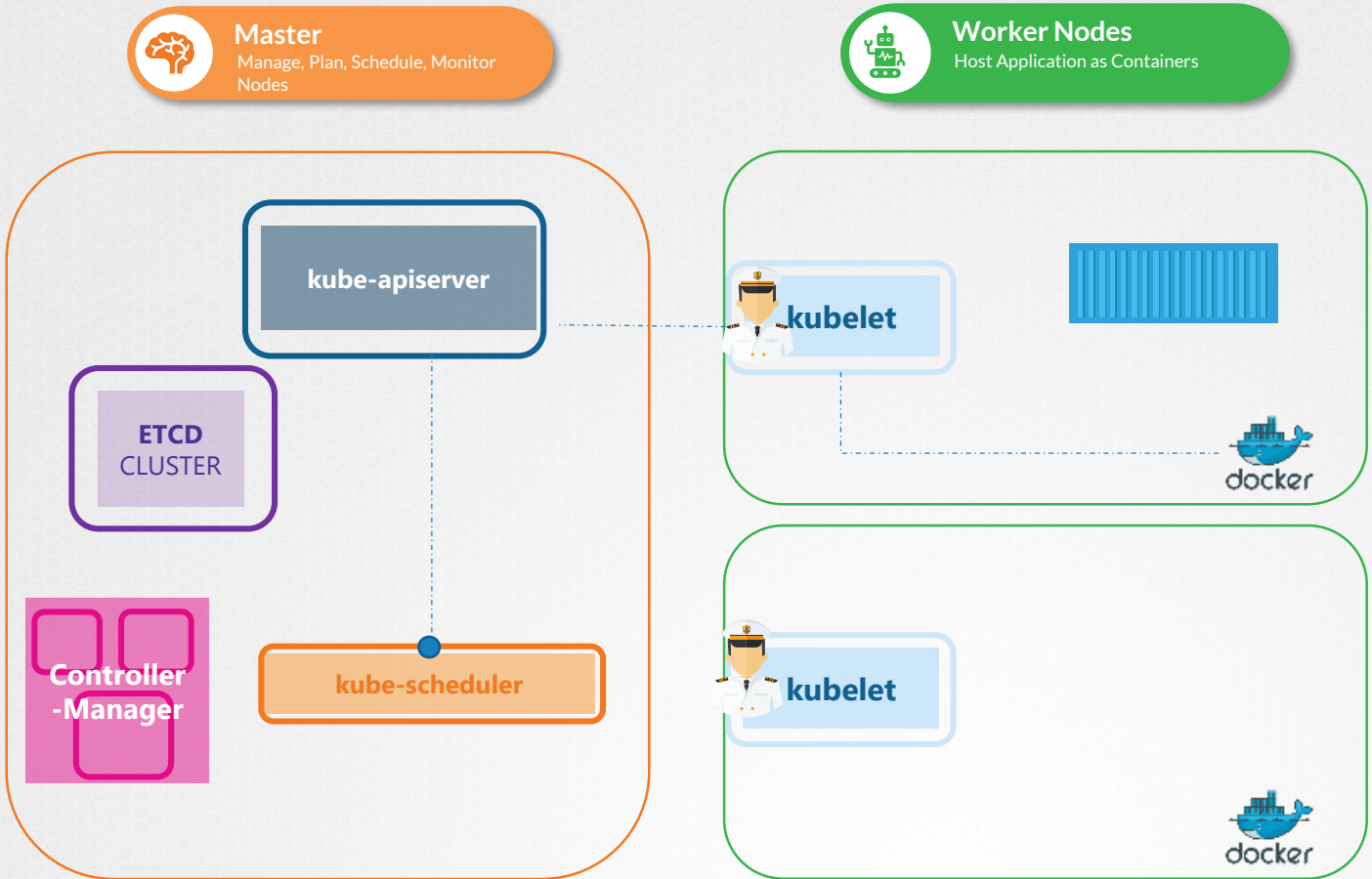
# Kubelet


kube-apiserver
Master
Manage, Plan, Schedule, Monitor Nodes
kubelet
Worker Nodes
Host Application as Containers
docker
docker
Controller-Manager
D
CLUSTER
docker
e-scheduler

# Kubernetes Architecture




Role of a Kubelet

- Register Node
- Create PODs
- Monitor Node & PODs

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# Installing kubelet

Must always manually install Kubelet in the worked node.

```
wget https://storage.googleapis.com/kubernetes-release/release/v1.13.0/bin/linux/amd64/kubelet
```

kubelet.service

```
ExecStart=/usr/local/bin/kubelet \\
  --config=/var/lib/kubelet/kubelet-config.yaml \\
  --container-runtime=remote \\
  --container-runtime-endpoint=unix:///var/run/containerd/containerd.sock \\
  --image-pull-progress-deadline=2m \\
  --kubeconfig=/var/lib/kubelet/kubeconfig \\
  --network-plugin=cni \\
  --register-node=true \\
  --v=2
```

Must always manually deploy kubelet --->>

Kubeadm does not deploy Kubelets

# View kubelet options

```
ps -aux | grep kubelet
```

```
root      2095  1.8  2.4 960676 98788 ?        Ssl  02:32   0:36 /usr/bin/kubelet --bootstrap-kubeconfig=/etc/kubernetes/bootstrap-kubelet.conf --kubeconfig=/etc/kubernetes/kubelet.conf --config=/var/lib/kubelet/config.yaml --cgroup-driver=cgroupfs --cni-bin-dir=/opt/cni/bin --cni-conf-dir=/etc/cni/net.d --network-plugin=cni
```


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# Course Objectives

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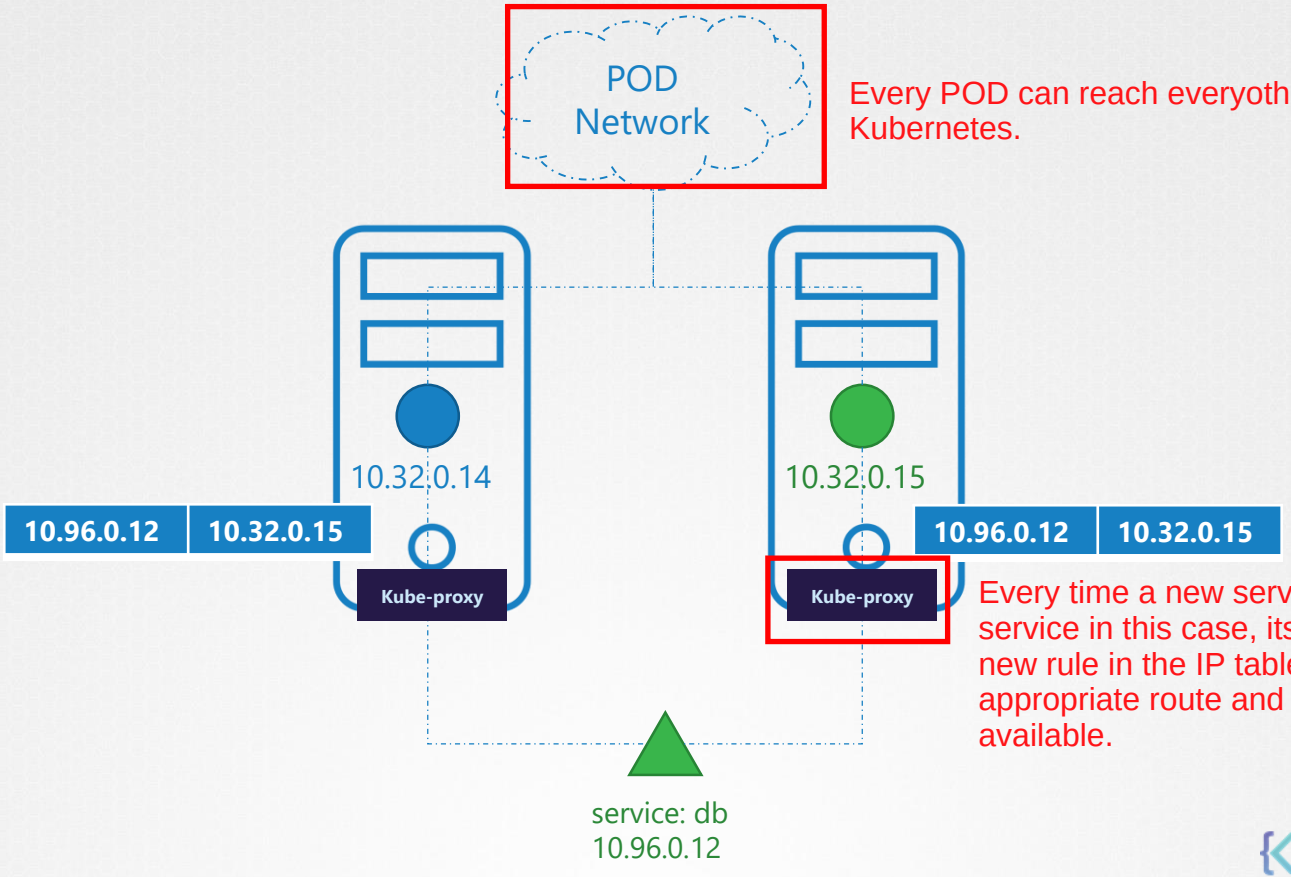
# Kube-proxy

# Kube-proxy




Every POD can reach everyother POD in Kubernetes.

Every time a new service is created like DB service in this case, its job is to create a new rule in the IP tables and make appropriate route and make that service available.

# Installing kube-proxy

```
wget https://storage.googleapis.com/kubernetes-release/release/v1.13.0/bin/linux/amd64/kube-proxy
```

kube-proxy.service

```
ExecStart=/usr/local/bin/kube-proxy \\
  --config=/var/lib/kube-proxy/kube-proxy-config.yaml
Restart=on-failure
RestartSec=5
```

# View kube-proxy - kubeadm

```
kubectl get pods -n kube-system
```

```
NAMESPACE     NAME                              READY     STATUS    RESTARTS   AGE
kube-system   coredns-78fcdf6894-hwrq9          1/1       Running   0          16m
kube-system   coredns-78fcdf6894-rzhjr          1/1       Running   0          16m
kube-system   etcd-master                       1/1       Running   0          15m
kube-system   kube-apiserver-master             1/1       Running   0          15m
kube-system   kube-controller-manager-master    1/1       Running   0          15m
kube-system   kube-proxy-lzt6f                  1/1       Running   0          16m
kube-system   kube-proxy-zm5qd                  1/1       Running   0          16m
kube-system   kube-scheduler-master             1/1       Running   0          15m
kube-system   weave-net-29z42                   2/2       Running   1          16m
kube-system   weave-net-snmdl                   2/2       Running   1          16m    -
```

```
kubectl get daemonset -n kube-system
```

```
NAME         DESIRED   CURRENT   READY     UP-TO-DATE   AVAILABLE   NODE SELECTOR                   AGE
kube-proxy   2         2         2         2            2           beta.kubernetes.io/arch=amd64   1h
```