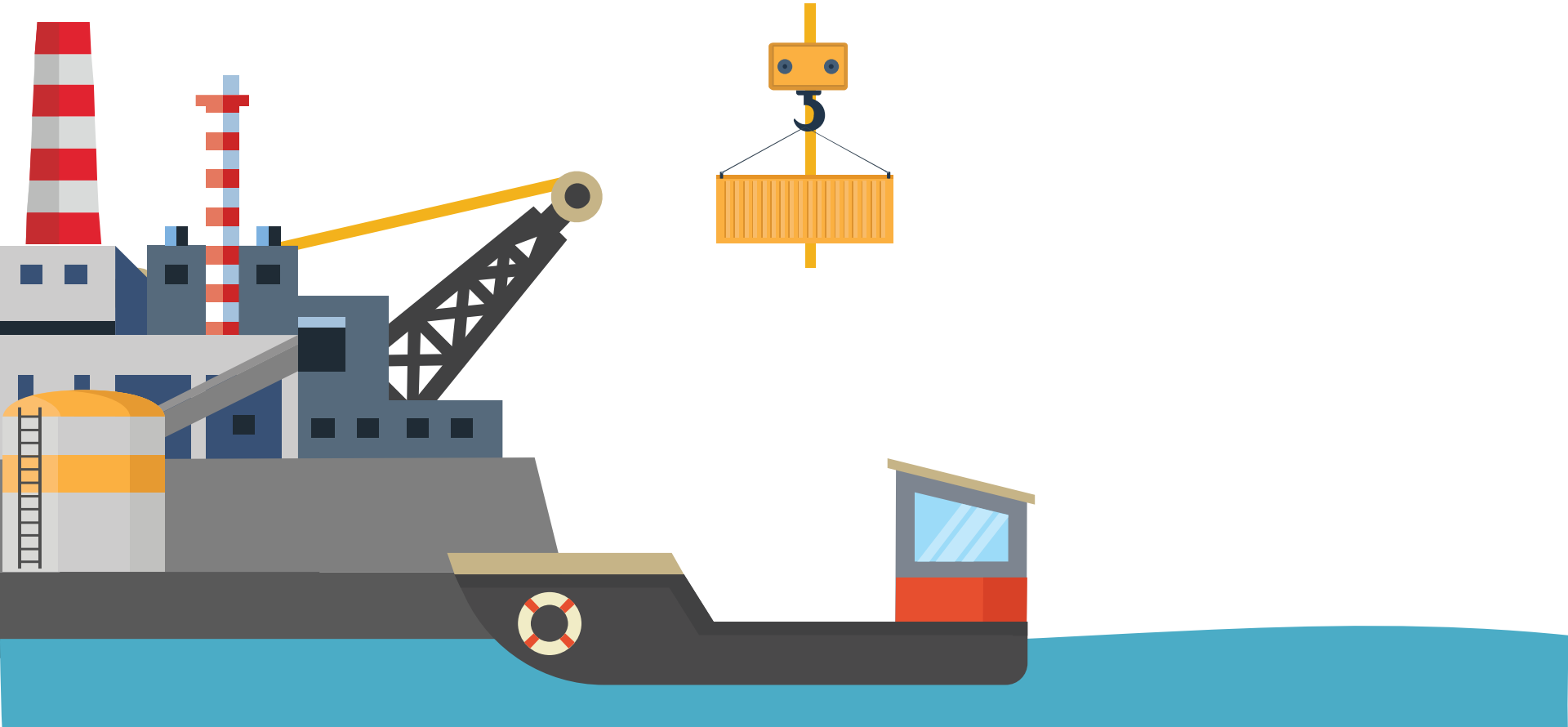
Course Objectives

- 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

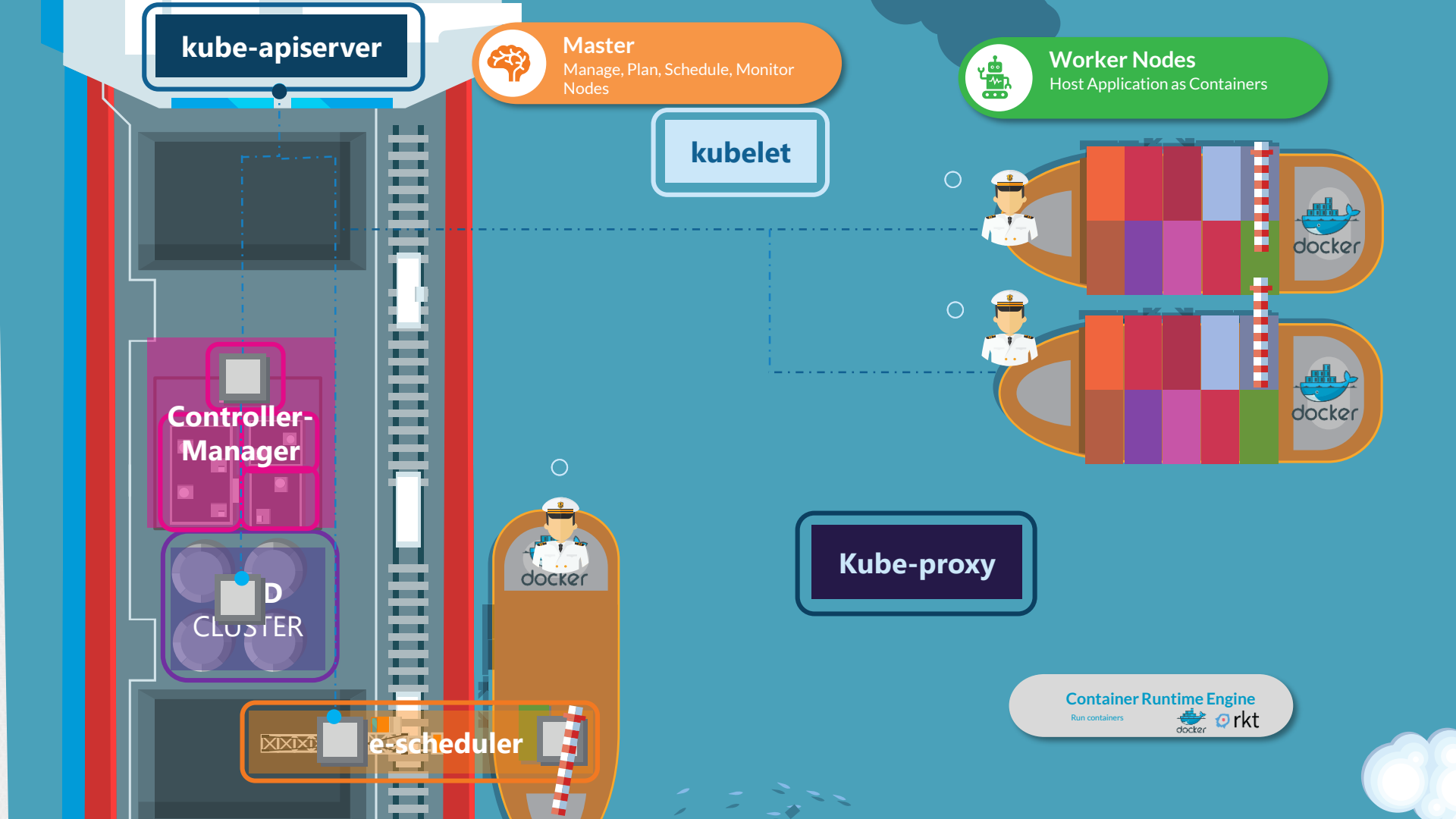
Cluster Architecture

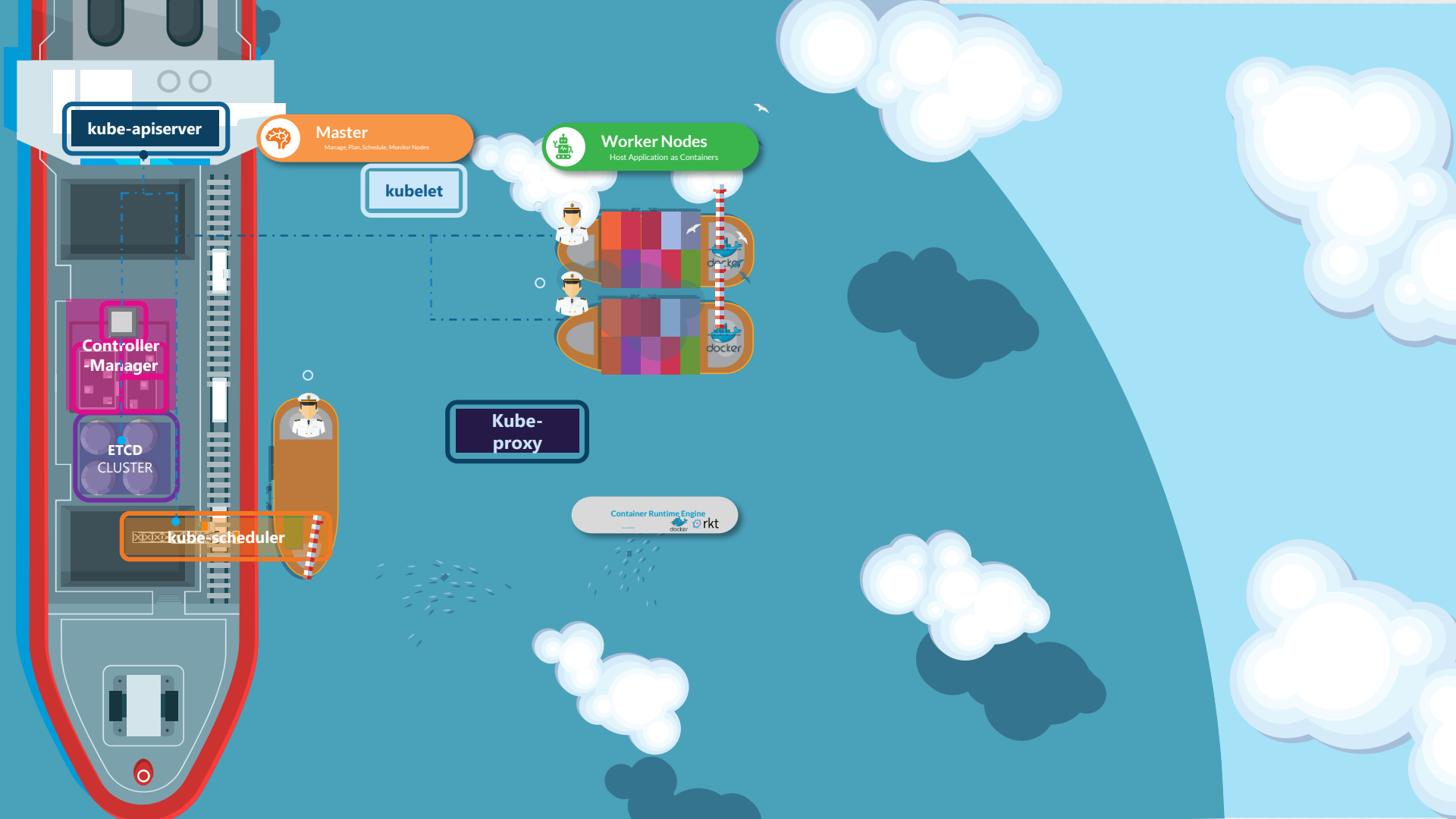
- ❑ Kubernetes Architecture
- ❑ ETCD For Beginners
- ❑ ETCD in Kubernetes
- ❑ Kube-API Server
- ❑ Controller Managers
- ❑ Kube Scheduler
- ❑ Kubelet
- ❑ Kube Proxy

KUBERNETES ARCHITECTURE

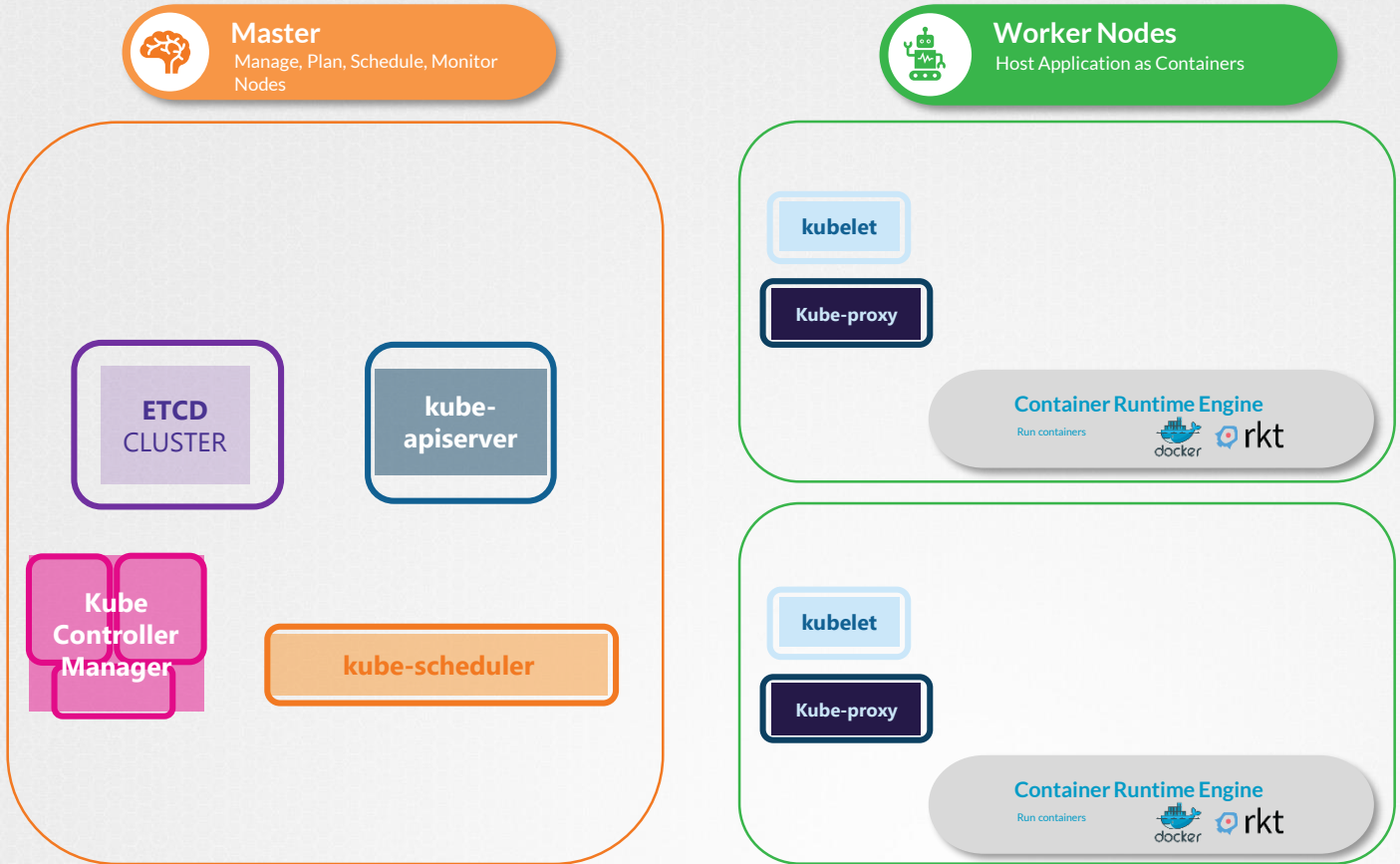



Master
Manage, Plan, Schedule, Monitor Nodes
Worker Nodes
Host Application as Containers


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



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
```

```
./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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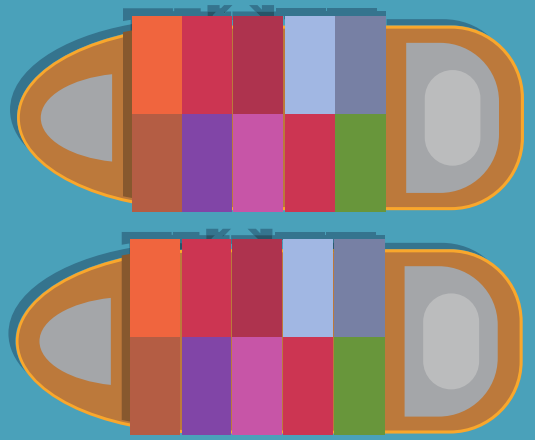
ETCD

In Kubernetes

Master
Manage, Plan, Schedule, Monitor Nodes

- Nodes
- PODs
- Configs
- Secrets
- Accounts
- Roles
- Bindings
- Others

ETCD
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
```

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
```

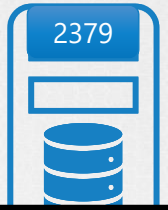
Run inside the etcd-master POD

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

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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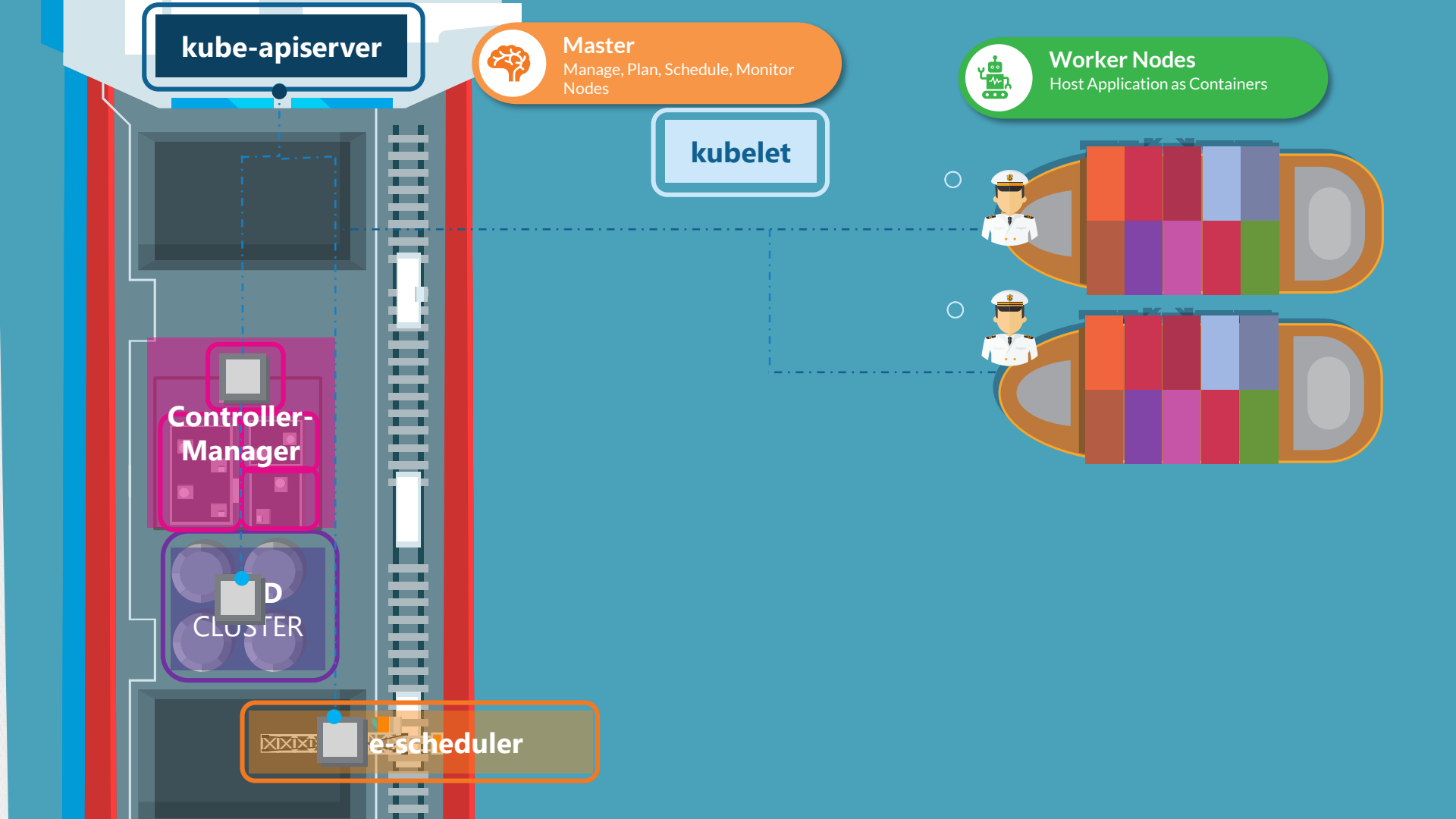
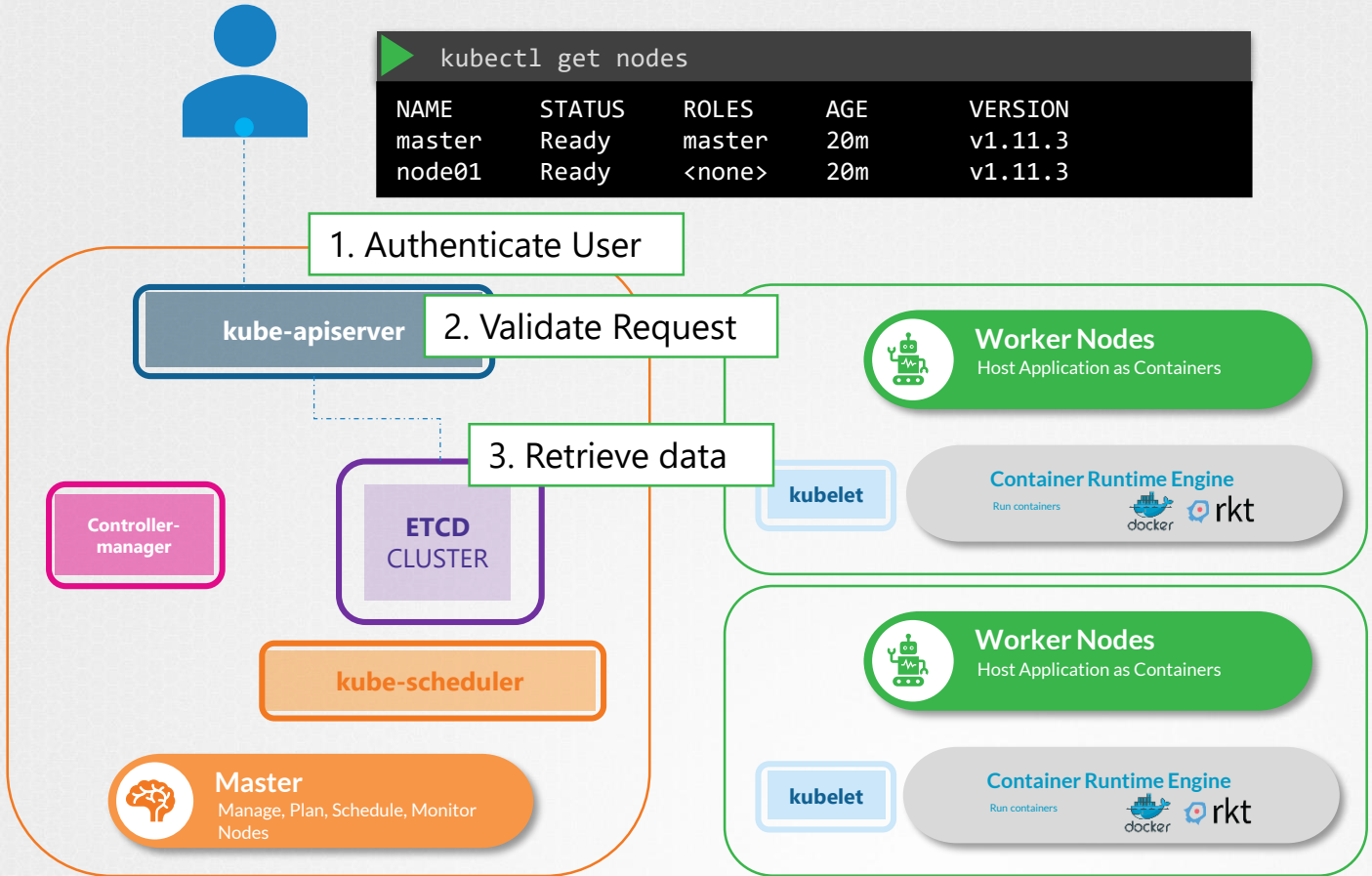
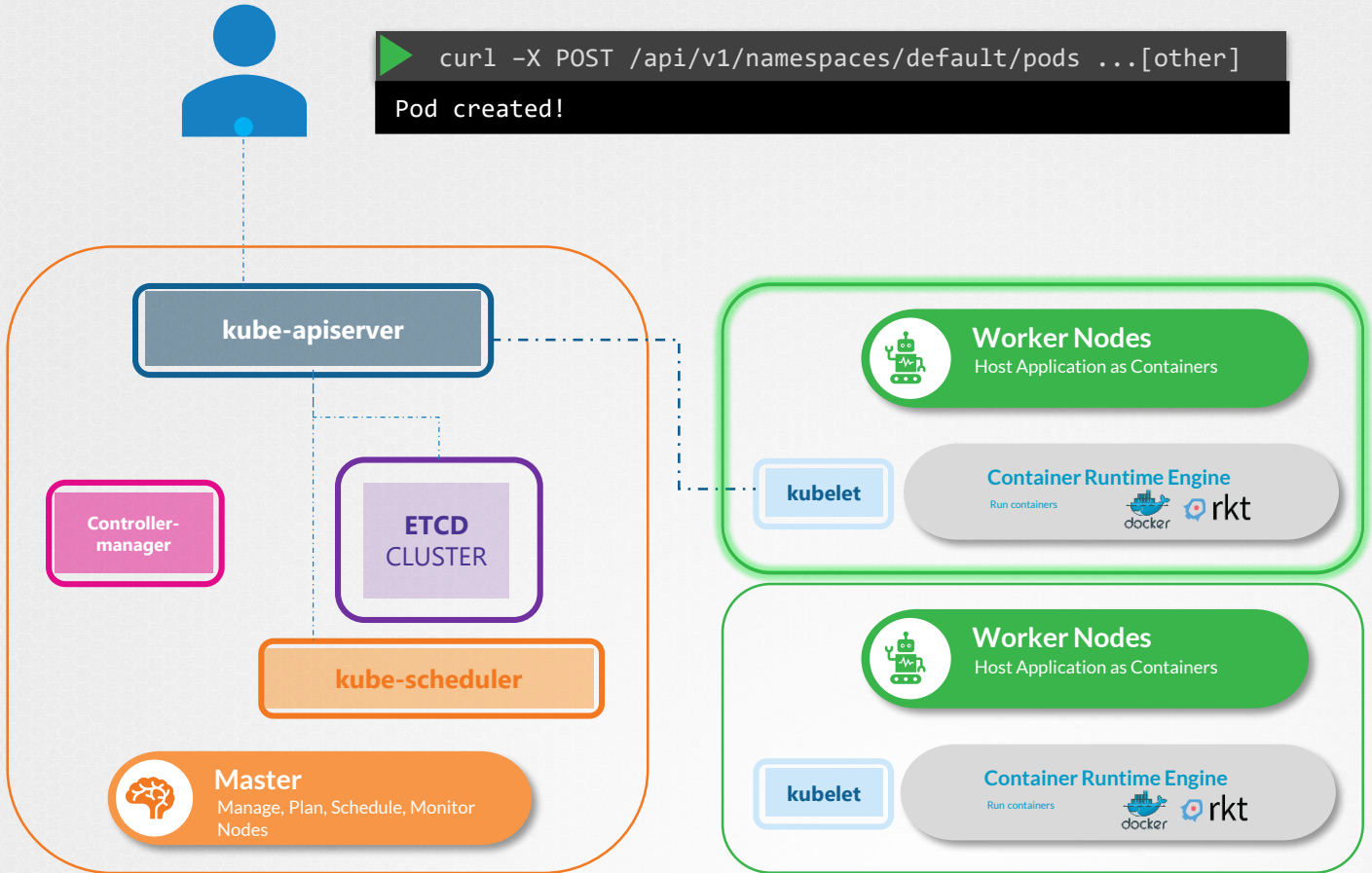
kube-api server


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

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
```

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
```

View api-server options

```
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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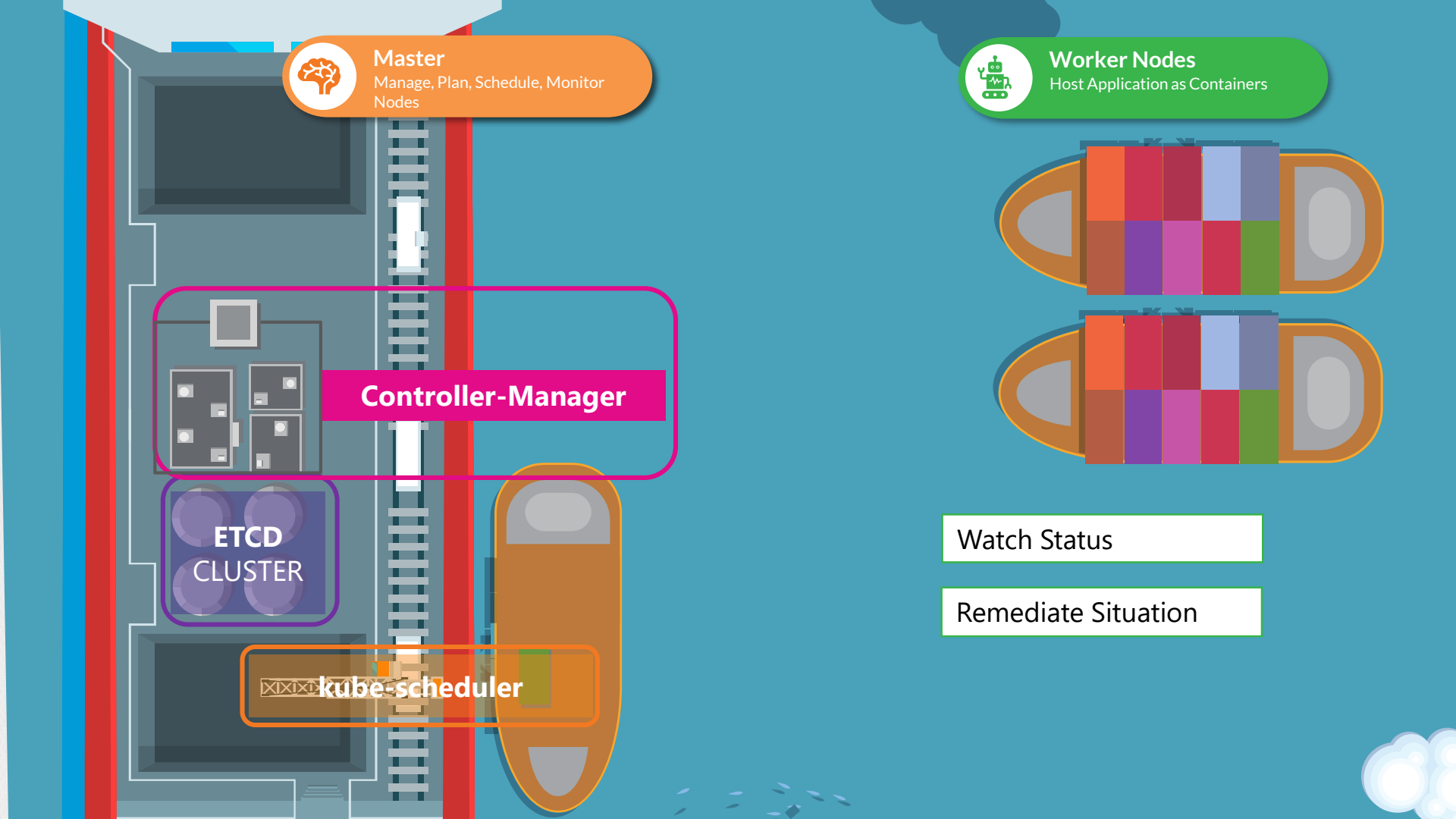
Kube Controller Manager


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

Controller

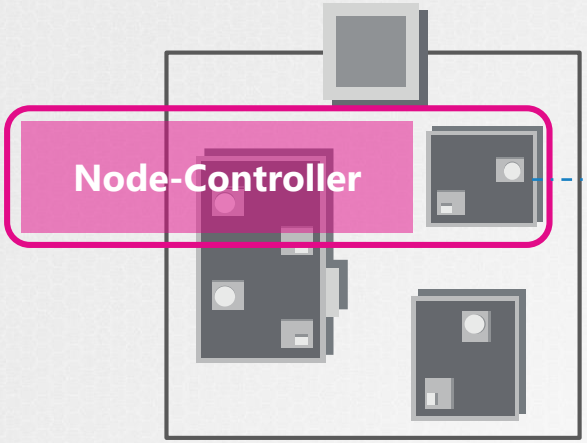
Watch Status

Remediate Situation

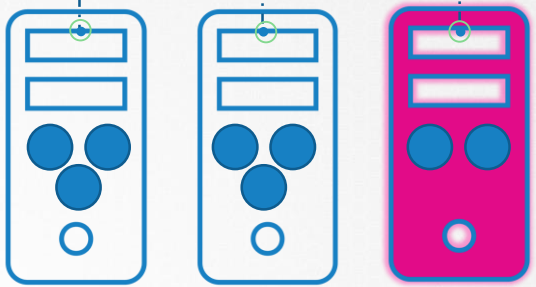
Node Monitor Period = 5s

Node Monitor Grace Period = 40s

POD Eviction Timeout = 5m



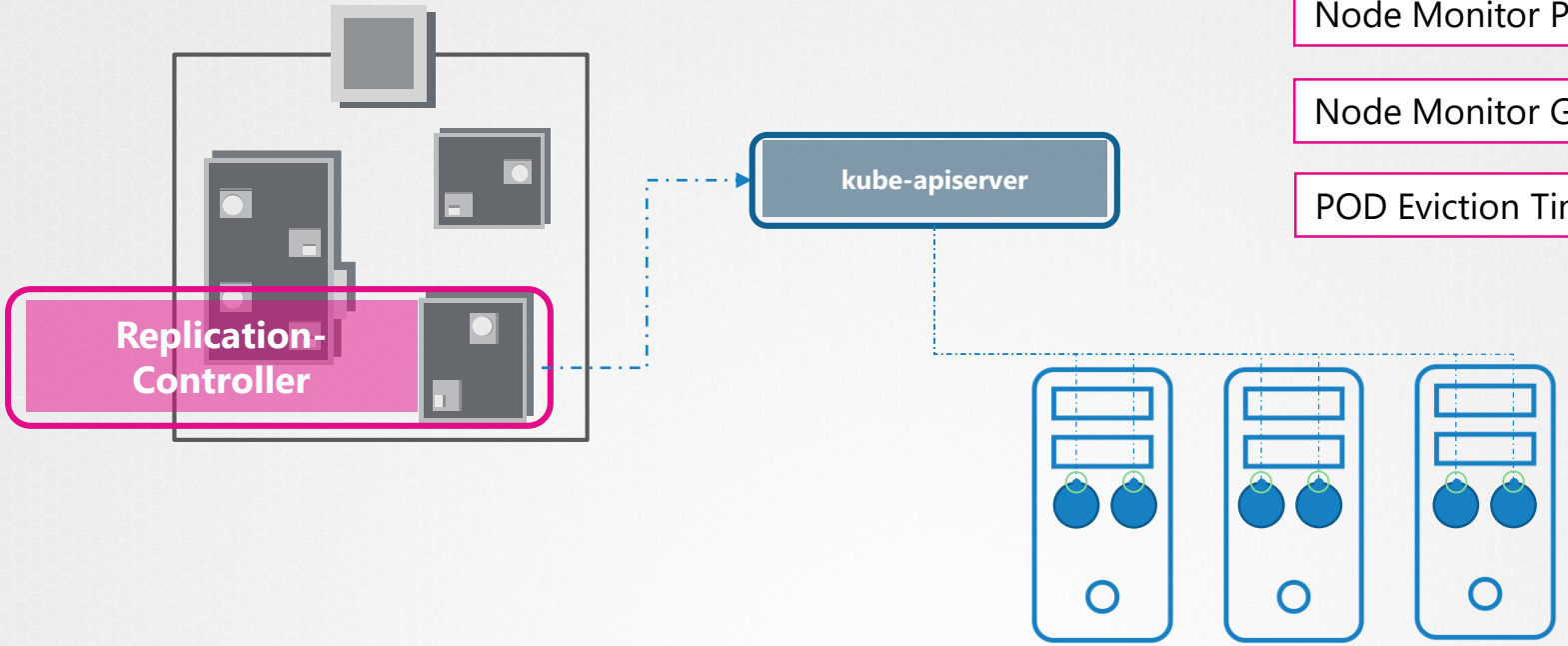
kube-apiserver



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



Watch Status

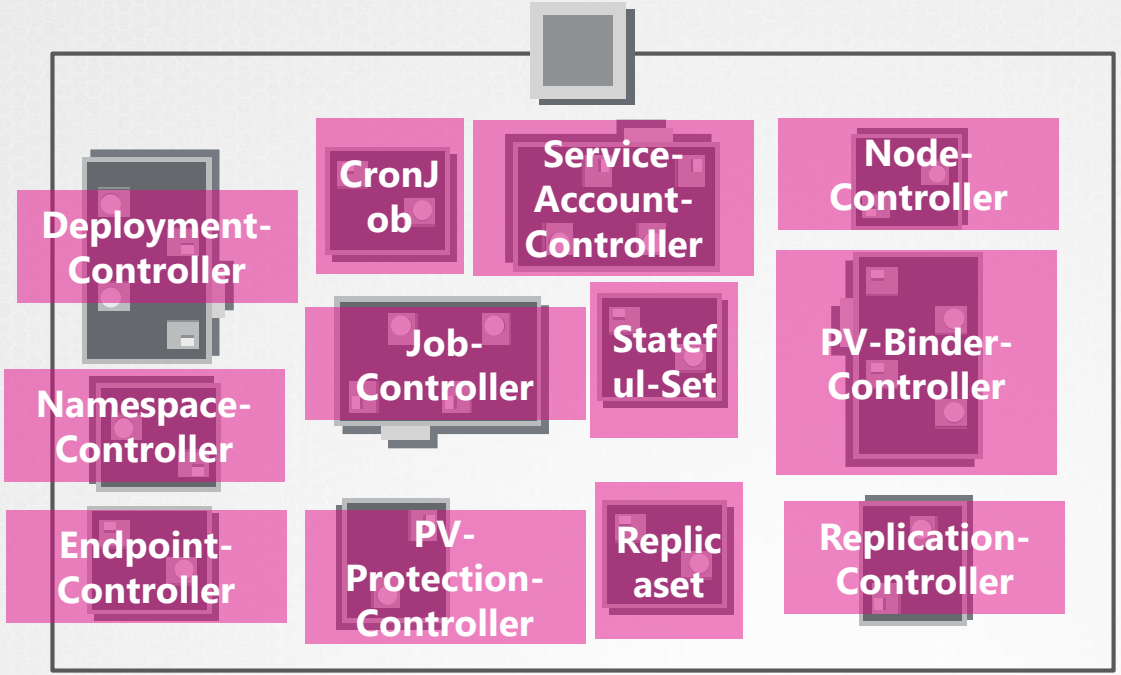
Remediate Situation

Node Monitor Period = 5s

Node Monitor Grace Period = 40s

POD Eviction Timeout = 5m

Controller



Watch Status

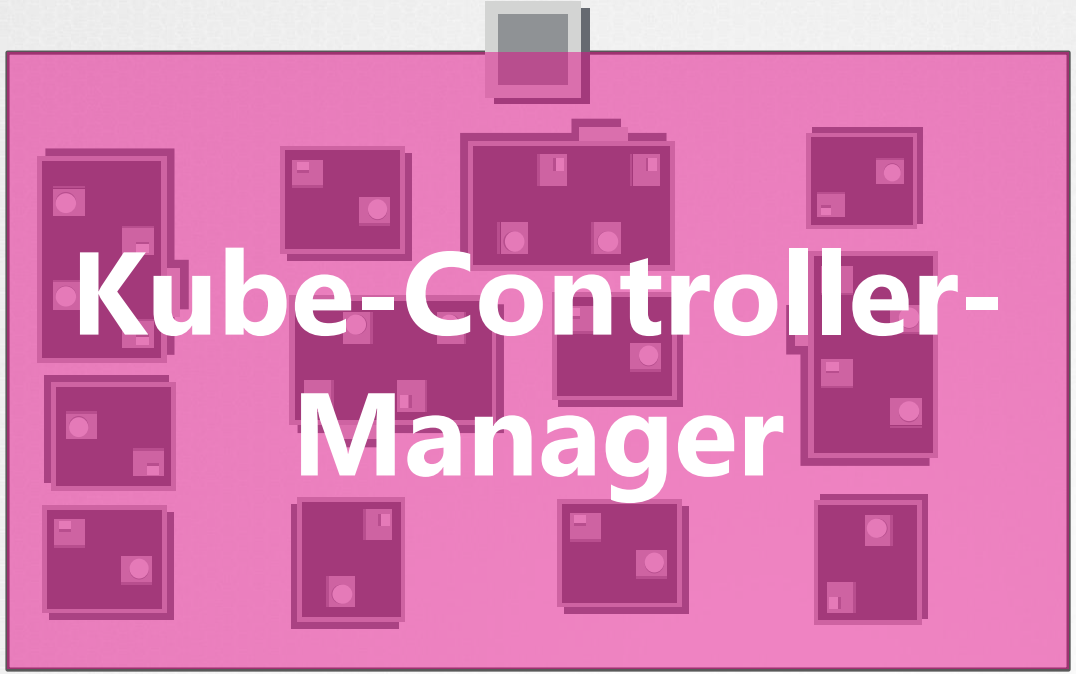
Remediate Situation

Node Monitor Period = 5s

Node Monitor Grace Period = 40s

POD Eviction Timeout = 5m

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

```
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

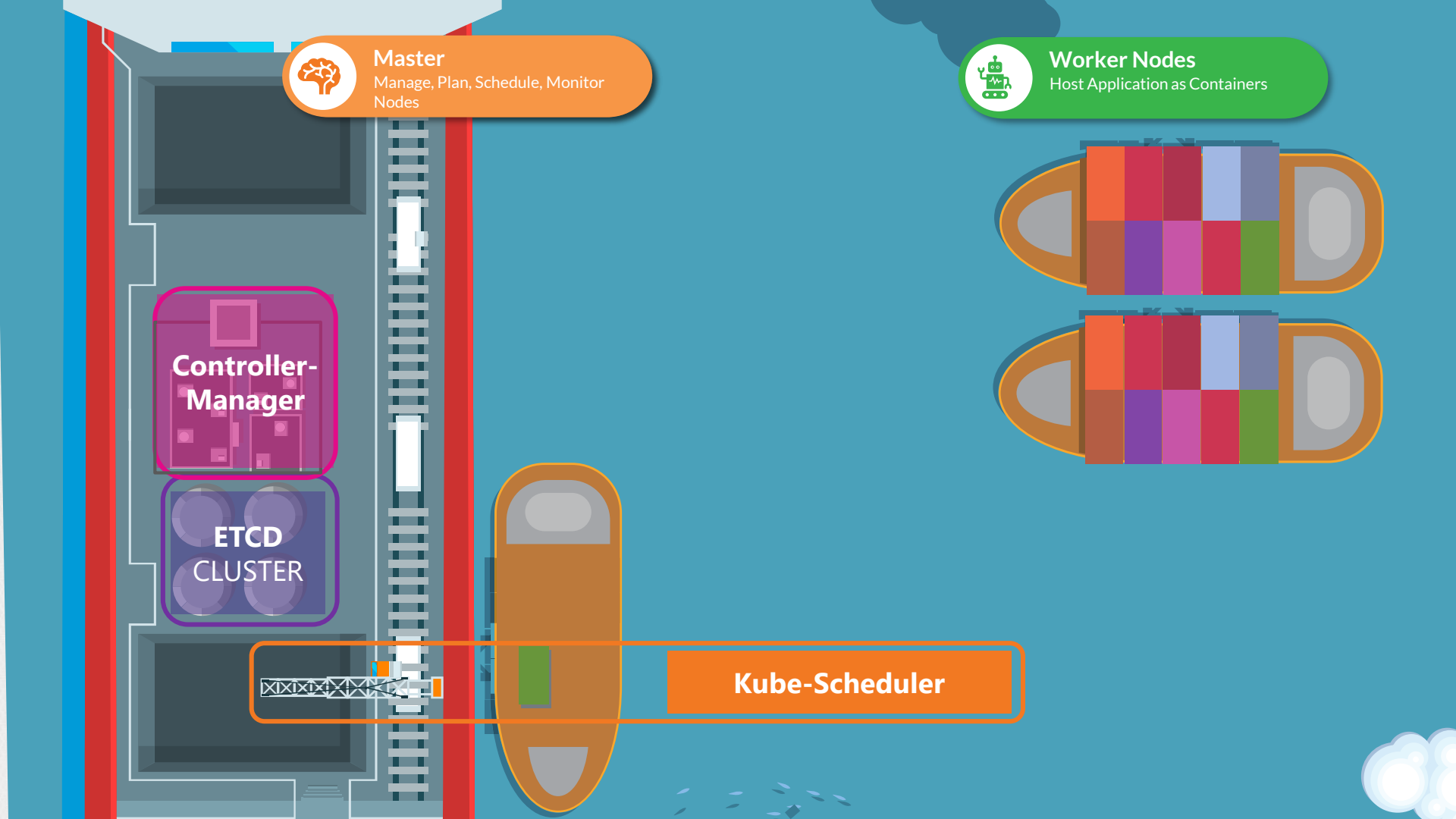
```
ps -aux | grep kube-controller-manager
```

```
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
```

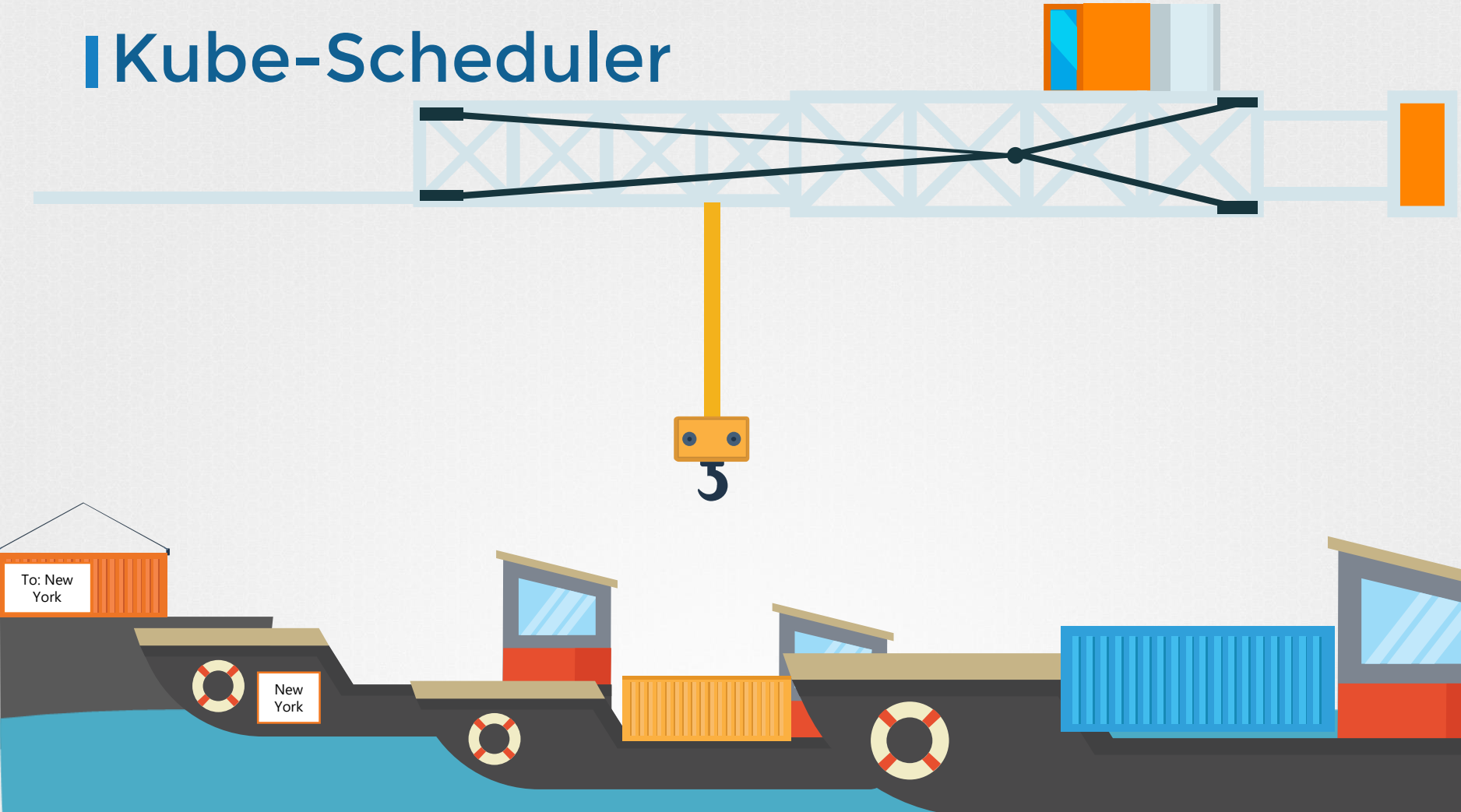
Course Objectives

- 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

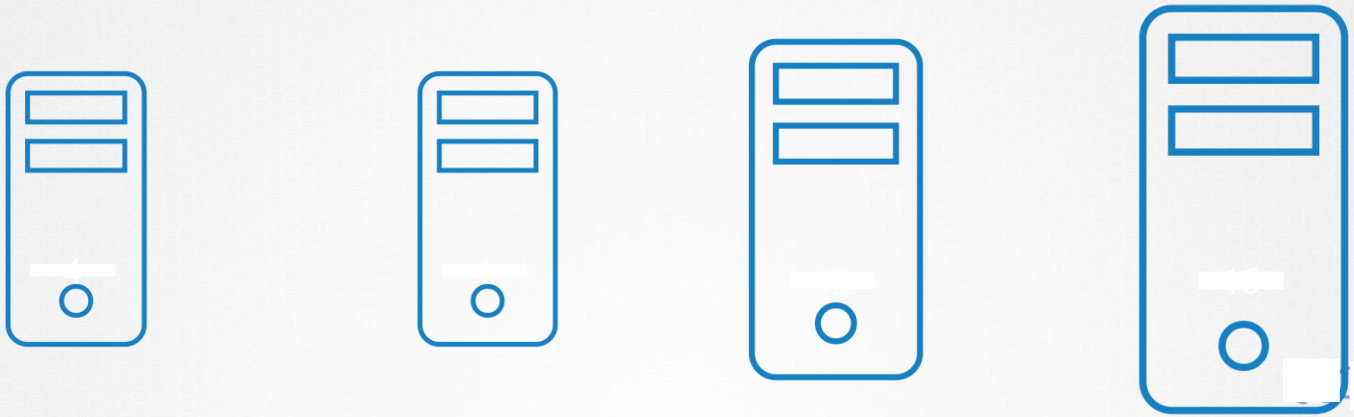
Kube Scheduler


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

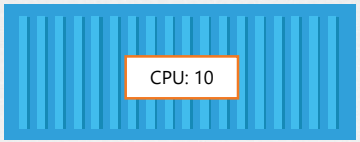
Kube-Scheduler



Kube-Scheduler

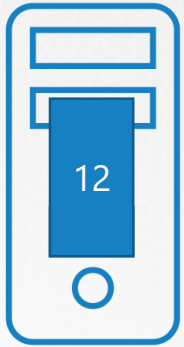


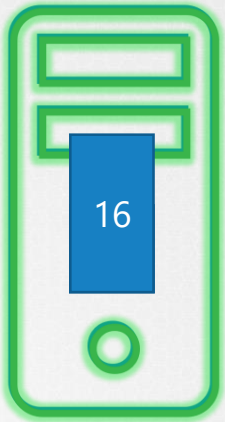
Kube-Scheduler



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
```

Course Objectives

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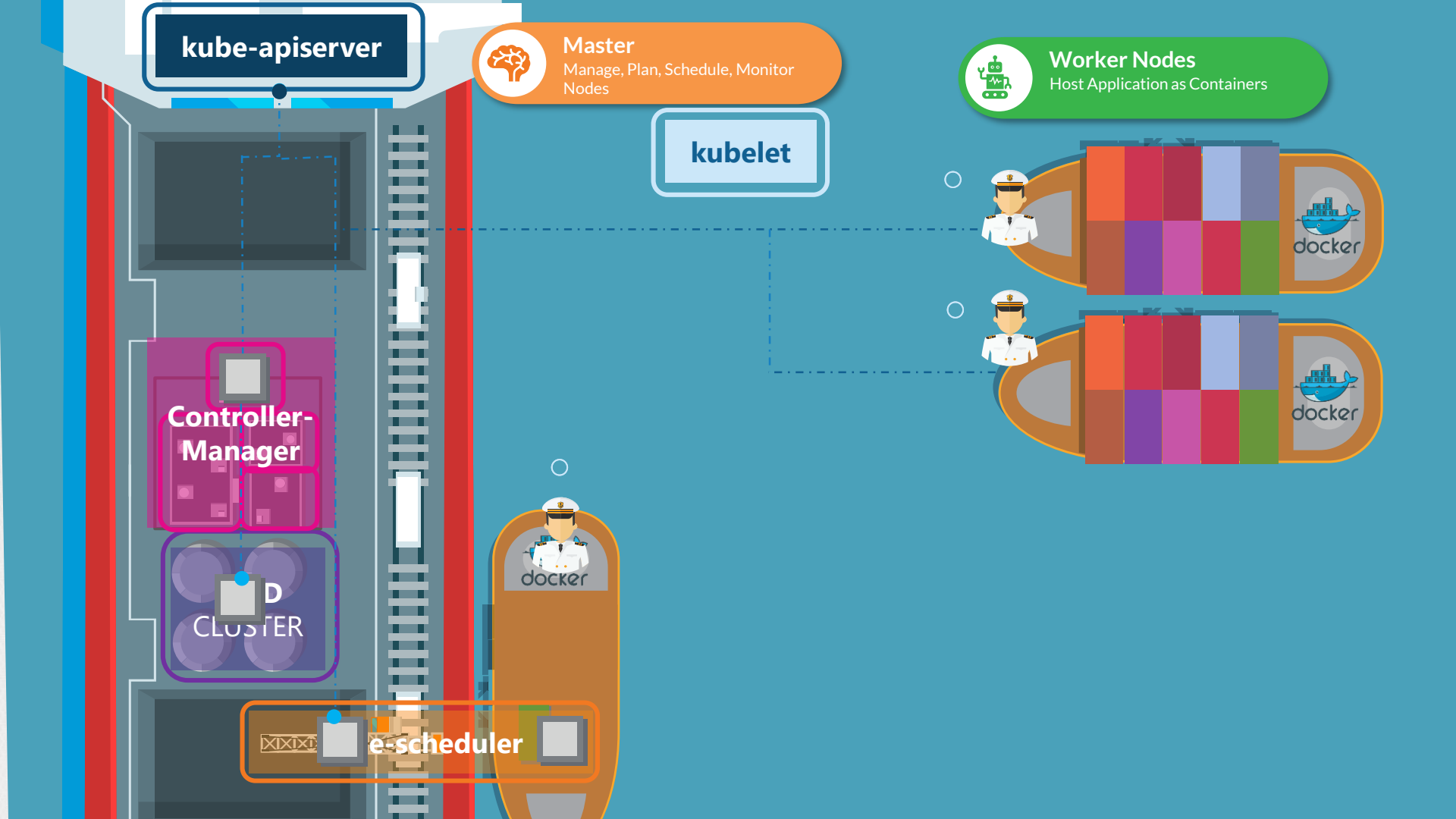
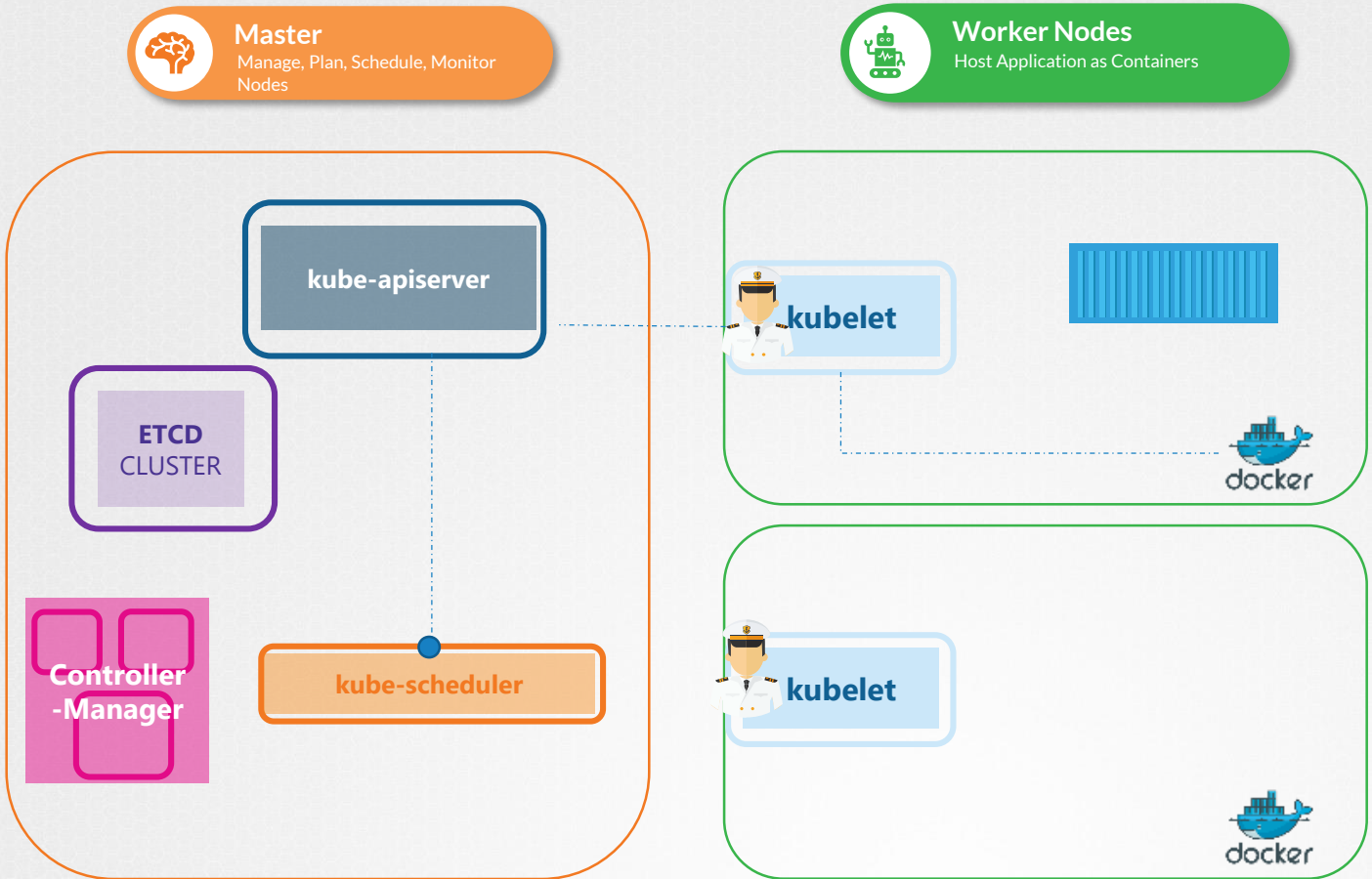
- Storage
- Networking
- Installation, Configuration & Validation
- Troubleshooting

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



- Register Node
- Create PODs
- Monitor Node & PODs

Installing kubelet

```
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
```

Kubeadm does not deploy Kubelets

View kubelet options

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

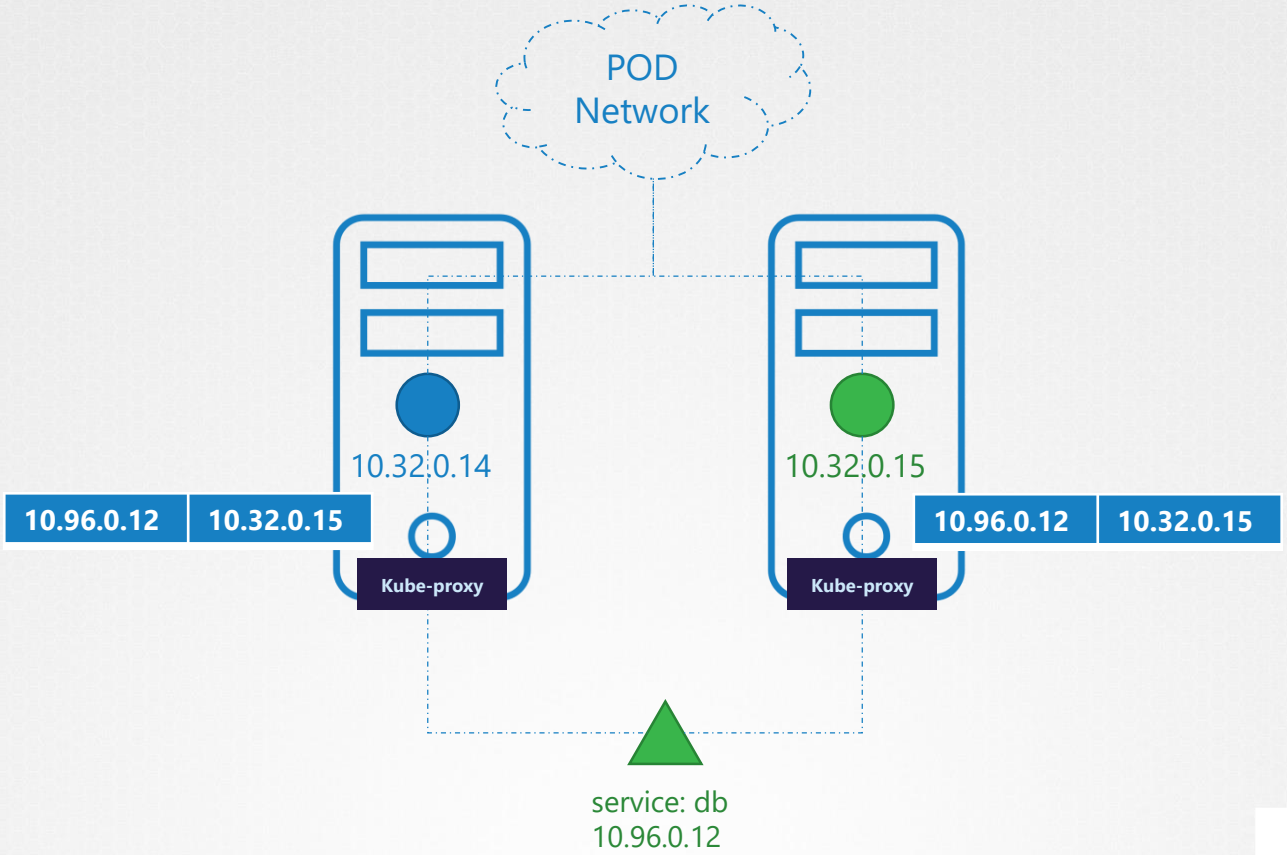
```
root      2095  1.8  2.4 960676 98788 ?        Ssl  02:32   0:36 /usr/bin/kubelet --bootstrap-kubeconfig=/etc/kubernetes/bootstrap-kubelet.conf --kubeconfig=/etc/kubernetes/kubelet.conf --config=/var/lib/kubelet/config.yaml --cgroup-driver=cgroupfs --cni-bin-dir=/opt/cni/bin --cni-conf-dir=/etc/cni/net.d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

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

Kube-proxy

Kube-proxy


POD
Network
10.32.0.14
10.96.0.12
10.32.0.15
Kube-proxy
10.32.0.15
10.96.0.12
10.32.0.15
Kube-proxy
service: db
10.96.0.12

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
```