Kubernetes 完全教程

Kubernetes 安装和运维

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Agenda

1. Kubernetes 的安装
2. Kubernetes 的组件和配置介绍
3. Kubernetes 的高可用
4. Kubernetes 的使用以及运维

Kubernetes 的安装 -- 条条大路通罗马

1. 云服务商托管 GCE(Google)，AWS，Azure，Bluemix，QingCloud 等。
2. 自定义安装 kops, ansible, salt, juju
3. kubeadm

准备基础的 VM 镜像

1. Ubuntu 16.04.3
2. 安装 docker 以及基础工具包

```
apt-get update
apt-get install -y ebtables socat apt-transport-https bash-completion ntp wget

apt-key adv --keyserver hkp://p80.pool.sks-keyservers.net:80 --recv-keys 58118E89F3A9128
apt-add-repository 'deb https://apt.dockerproject.org/repo ubuntu-xenial main'
apt-get update

apt-cache policy docker-engine
apt-get install -y docker-engine

DEBIAN_FRONTEND=noninteractive apt-get -y -o Dpkg::Options::="--force-confdef" -o Dpkg::
```

安装 kubelet, kubeadm

当前 kubelet 版本 1.7.6

```
curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | apt-key add -
cat <<EOF >/etc/apt/sources.list.d/kubernetes.list
deb http://apt.kubernetes.io/ kubernetes-xenial main
EOF
apt-get update
apt-get install -y kubelet kubeadm
# 安装 bash 自动提示
kubeadm completion bash >/etc/profile.d/kubeadm.sh
kubectl completion bash >/etc/profile.d/kubectl.sh
source /etc/profile
```

初始化 master

```
kubeadm init --pod-network-cidr=10.244.0.0/16
```

复制并保存 init token

查看 pod 状态

```
kubectl get pods --all-namespaces
```

查看 node 状态

```
kubectl get nodes
```

初始化网络

```
kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/master/Documentation/k
```

查看 pod 状态

```
kubectl get pods --all-namespaces
```

查看 node 状态

```
kubectl get nodes
```

新增节点

```
kubeadm join --token $init_token $apiserver-advertise-address:6443
```

查看 node 状态

```
kubectl get nodes
```

部署 helloworld

```
kubectl apply -f https://raw.githubusercontent.com/jolestar/kubernetes-complete-course/m
```

查看 pod 状态

```
kubectl get pods
```

测试 pod 之间以及 pod 和 apiserver 之间的网络

```
kubectl exec $podname -- nping $pod2ip
kubectl exec $podname -- curl -k https://kubernetes
```

解决 flannel 网络问题

```
iptables -P FORWARD ACCEPT
```

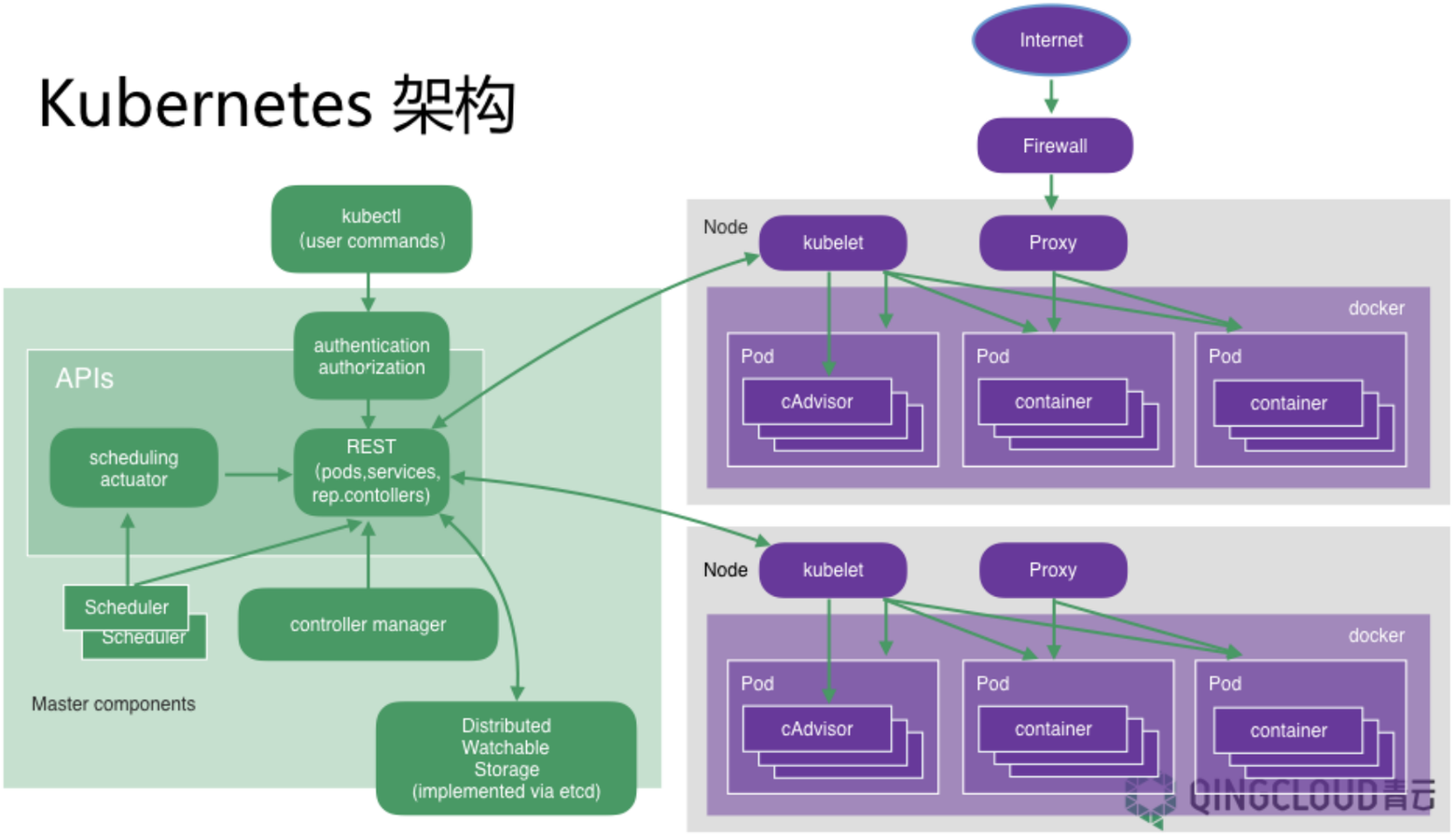
1. https://github.com/coreos/flannel/issues/799
2. https://docs.docker.com/engine/userguide/networking/default_network/container-communication/#container-communication-between-hosts

> For security reasons, Docker configures the iptables rules to prevent containers from forwarding traffic from outside the host machine, on Linux hosts. Docker sets the default policy of the FORWARD chain to DROP
> Note: In Docker 1.12 and earlier, the default FORWARD chain policy was ACCEPT. When you upgrade to Docker 1.13 or higher, this default is automatically changed for you

重新测试 pod 之间以及 pod 和 apiserver 之间的网络
关于 Kubernetes 网络以及网络故障的排查，将在后面的 Kubernetes 网络课程里介绍

Kubernetes 的组件

1. kubelet
2. kube-controller-manager
3. kube-scheduler
4. kube-apiserver
5. kube-proxy
6. kube-dns
7. etcd
8. flannel



Kubelet

1. 启动方式 系统进程
2. 配置文件
    - /lib/systemd/system/kubelet.service
    - /etc/systemd/system/kubelet.service.d/10-kubeadm.conf
3. 主要参数
    - kubeconfig bootstrap-kubeconfig
    - pod-manifest-path
    - allow-privileged(host-network-sources,host-pid-sources,host-ipc-sources)(file,http,api)
    - network-plugin
    - authorization-mod （Webhook、AlwaysAllow）
    - cluster-dns=10.96.0.10 --cluster-domain=cluster.local
    - feature-gates

Kube-controller-manager 和 kube-scheduler

1. 启动方式 StaticPod 或 系统进程
2. 配置文件
    - /etc/kubernetes/manifests/kube-controller-manager.yaml kube-scheduler.yaml
3. 主要参数（kube-controller-manager）
    - kubeconfig
    - allocate-node-cidrs
    - cluster-cidr=10.244.0.0/16
    - service-cluster-ip-range=10.96.0.0/12
    - leader-elect
    - feature-gates

Kube-apiserver

1. 启动方式 StaticPod 或 系统进程
2. 配置文件
    - /etc/kubernetes/manifests/kube-apiserver.yaml
3. 主要参数
    - kubeconfig
    - insecure-port insecure-bind-address
    - allow-privileged
    - kubelet-preferred-address-types=InternalIP,Hostname
    - authorization-mode=Node,RBAC
    - etcd-servers
    - experimental-bootstrap-token-auth=true
    - service-cluster-ip-range=10.96.0.0/12
    - feature-gates

Kube-proxy

1. 启动方式 系统进程 或 DaemonSet
2. 配置文件
    - kubernetes ds yaml
3. 主要参数
    - kubeconfig
    - masquerade-all
    - feature-gates

feature-gates

```
Accelerators=true|false (ALPHA - default=false)
AdvancedAuditing=true|false (ALPHA - default=false)
AffinityInAnnotations=true|false (ALPHA - default=false)
AllAlpha=true|false (ALPHA - default=false)
AllowExtTrafficLocalEndpoints=true|false (default=true)
AppArmor=true|false (BETA - default=true)
DynamicKubeletConfig=true|false (ALPHA - default=false)
DynamicVolumeProvisioning=true|false (ALPHA - default=true)
ExperimentalCriticalPodAnnotation=true|false (ALPHA - default=false)
ExperimentalHostUserNamespaceDefaulting=true|false (BETA - default=false)
LocalStorageCapacityIsolation=true|false (ALPHA - default=false)
PersistentLocalVolumes=true|false (ALPHA - default=false)
RotateKubeletClientCertificate=true|false (ALPHA - default=false)
RotateKubeletServerCertificate=true|false (ALPHA - default=false)
StreamingProxyRedirects=true|false (BETA - default=true)
TaintBasedEvictions=true|false (ALPHA - default=false)
```

Kube-dns

1. 启动方式 Deployment
2. 配置文件
    - kubernetes deployment yaml
3. 主要参数(参看配置文件)

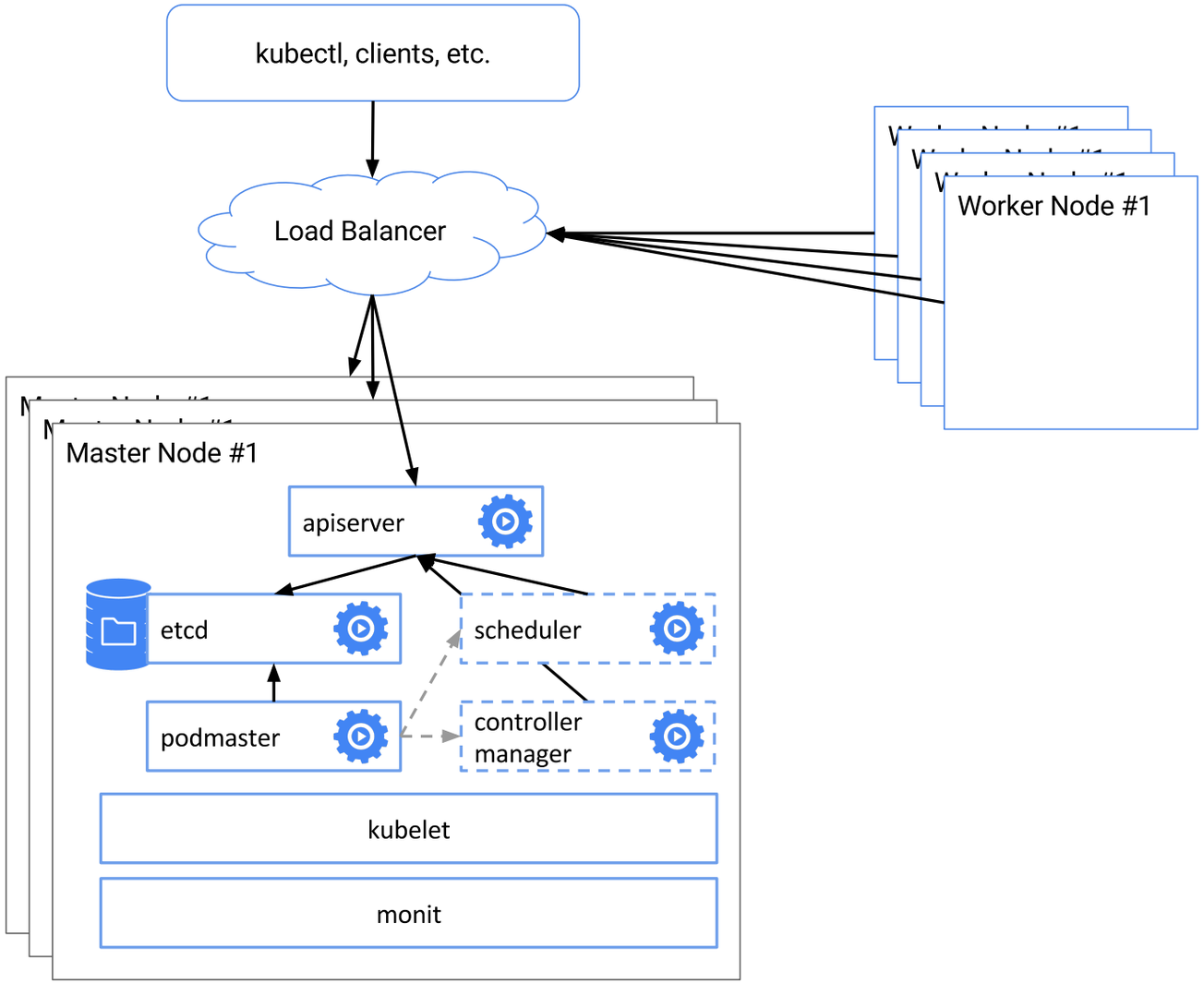
Etcd

1. 启动方式 StaticPod 或 外部集群
2. 配置文件
    - /etc/kubernetes/manifests/etcd.yaml
3. 主要参数(参看配置文件)

Kube-addon-manager

1. 启动方式 StaticPod
2. 作用 确保系统组件一直存在
3. 配置文件
    - https://github.com/kubernetes/kubernetes/blob/master/cluster/saltbase/salt/kube-addons/kube-addon-manager.yaml
    - https://github.com/kubernetes/kubernetes/tree/master/cluster/addons/addon-manager

Kubernetes 高可用



https://kubernetes.io/docs/admin/high-availability/

Kubernetes 高可用

1. Etcd -- Cluster
2. Apiserver -- LoadBalancer
3. kube-controller-manager kube-scheduler -- Master elected
    - https://github.com/kubernetes/contrib/tree/master/election
    - http://jolestar.com/kubernetes-and-microservice/

Kubernetes selfhosting

kubeadm selfhosting.go 源码

1. Load the Static Pod specification from disk (from /etc/kubernetes/manifests)
2. Extract the PodSpec from that Static Pod specification
3. Mutate the PodSpec to be compatible with self-hosting (add the right labels, taints, etc. so it can schedule correctly)
4. Build a new DaemonSet object for the self-hosted component in question. Use the above mentioned PodSpec
5. Create the DaemonSet resource. Wait until the Pods are running.
6. Remove the Static Pod manifest file. The kubelet will stop the original Static Pod-hosted component that was running.
7. The self-hosted containers should now step up and take over.
8. In order to avoid race conditions, we're still making sure the API /healthz endpoint is healthy
9. Do that for the kube-apiserver, kube-controller-manager and kube-scheduler in a loop

Kubernetes selfhosting

1. 更新 kubeadm

```
wget https://k8s-qingcloud.pek3a.qingstor.com/k8s%2Fv1.7.4%2Fbin%2Fkubeadm -O /usr/b
```

2. selfhosting

```
kubeadm alpha phase selfhosting
kubectl get pods -n kube-system
kubectl get ds -n kube-system
kubeadm alpha phase mark-master $node
kubectl get pods -n kube-system
kubectl get ds -n kube-system
```

Kops 和 Minikube

1. Kops
2. Minikube https://github.com/kubernetes/minikube

Kubernetes 使用以及运维

1. kubectl
2. kubectl proxy
3. node 相关操作

kubectl

```
Basic Commands (Beginner):
  create         Create a resource by filename or stdin
  run            Run a particular image on the cluster
  set            Set specific features on objects (image/resource/selector/subject)
  get            Display one or many resources
  edit           Edit a resource on the server
  delete         Delete resources by filenames, stdin, resources and names, or by resour

Deploy Commands:
  rollout        Manage the rollout of a resource
  rollingupdate  Perform a rolling update of the given ReplicationController
  scale          Set a new size for a Deployment, ReplicaSet, Replication Controller, or
  resize         Set a new size for a Deployment, ReplicaSet, Replication Controller, or
  autoscale      Auto-scale a Deployment, ReplicaSet, or ReplicationController

Cluster Management Commands:
  certificate    Modify certificate resources.
  clusterinfo    Display cluster info
  top            Display Resource (CPU/Memory/Storage) usage.
  cordon         Mark node as unschedulable
  uncordon       Mark node as schedulable
  drain          Drain node in preparation for maintenance
  taint          Update the taints on one or more nodes
```

kubectl

```
Troubleshooting and Debugging Commands:
  describe        Show details of a specific resource or group of resources
  logs            Print the logs for a container in a pod
  attach          Attach to a running container
  exec            Execute a command in a container
  port-forward    Forward one or more local ports to a pod
  proxy           Run a proxy to the Kubernetes API server
  cp              Copy files and directories to and from containers.
  auth            Inspect authorization

Advanced Commands:
  apply           Apply a configuration to a resource by filename or stdin
  patch           Update field(s) of a resource using strategic merge patch
  replace         Replace a resource by filename or stdin
  update          Replace a resource by filename or stdin
  convert         Convert config files between different API versions

Settings Commands:
  label           Update the labels on a resource
  annotate        Update the annotations on a resource
```

Kubectl proxy

安装 dashboard

```
kubectl apply -f https://raw.githubusercontent.com/kubernetes/dashboard/master/src/deplo
```

通过 kubectl proxy 在本地查看

```
kubectl proxy
```

维护或者删除节点

```
cordon          Mark node as unschedulable
uncordon        Mark node as schedulable
drain           Drain node in preparation for maintenance
taint           Update the taints on one or more nodes
```

总结

Kubernetes 安装本身并不复杂，但是

1. 镜像 (gcr.io/quay.io)
2. 网络
3. 安全
4. 扩展插件管理
5. 配置变更
6. 集群的伸缩
7. HA
8. 升级

作业

1. 手动通过 kubeadm 搭建一个 Kubernetes 集群，然后安装 kube-addon-manager，通过 kube-addon-manager 管理系统组件，比如 dashboard, kube-proxy, kubedns, heapster 等。
2. 在本地通过 minikube 搭建一个 Kubernetes 开发集群。
3. 通过云服务商部署一个托管 Kubernetes 集群，（推荐通过 QingCloud青云的 appcenter 进行部署。https://appcenter.qingcloud.com/apps/app-u0llx5j8） 研究 Kubernetes 的 CloudProvider 机制，以及网络和存储方案。

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个人博客: http://jolestar.com

课程 Github： https://github.com/jolestar/kubernetes-complete-course

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