Managing Certificates and kubeconfig Files

Anthony E. Nocentino
ENTERPRISE ARCHITECT @ CENTINO SYSTEMS

@nocentino www.centinosystems.com

Course Overview

Kubernetes Security Fundamentals

Managing Certificates and kubeconfig Files

Managing Role Based Access Controls

Summary

Certificates and PKI in Kubernetes

Creating and managing certificates

Configuring and Managing kubeconfig files for accessing clusters

Certificates and PKI in Kubernetes

TLS Encryption

User and System Component authentication

`kubeadm`-based clusters

- Creates a self-signed Certificate Authority
- Generates certificates for System Components
- `kubernetes-admin` user

Can use an external/trusted CA

- https://bit.ly/39KLm9j

Certificates and PKI in Kubernetes

Single self-signed Certificate Authority

`/etc/kubernetes/pki/`

`ca.key` - this is the private key

`ca.crt` - CA Certificate

Certificates and PKI in Kubernetes - ca.crt

Distribute to clients to trust your self-signed CA

Copied to Nodes in the cluster during build

kubeconfig files

ServiceAccount

kubeconfig Files and Certificate Based Authentication

Cluster Location

Client authentication

Users or system components

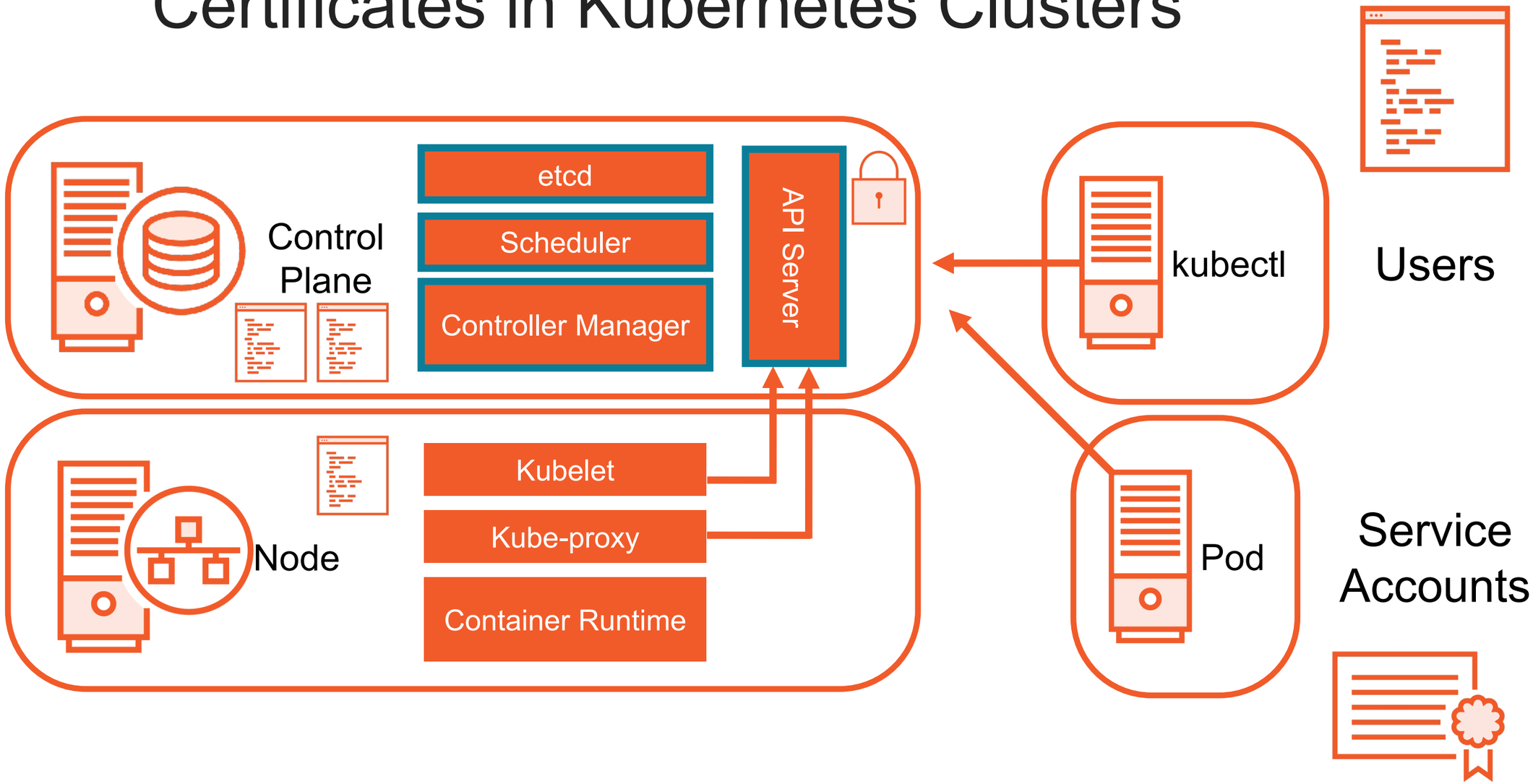
CA Certificate

ca.crt

Client Certificate

Client Private Key

Certificates in Kubernetes Clusters

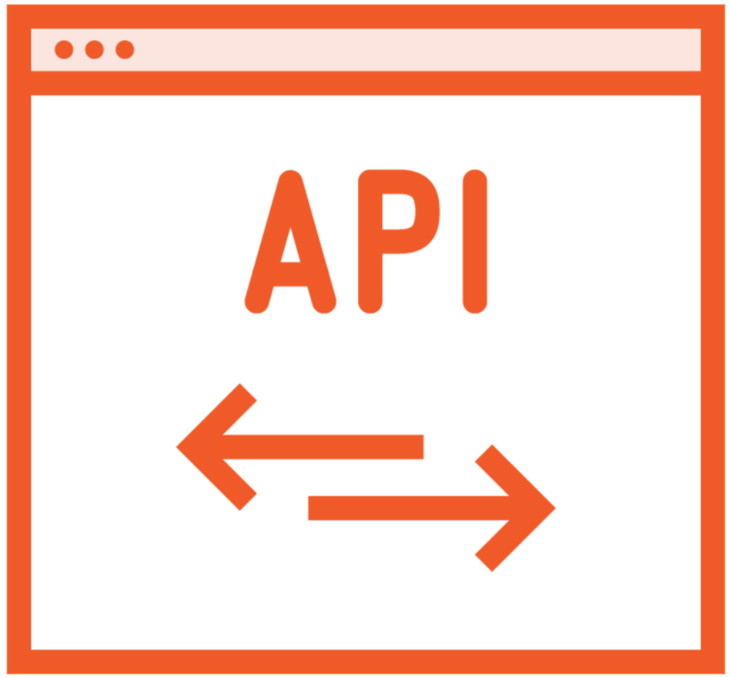


Demo

Investigating the PKI setup on the Control Plane Node

- Certificate authority
- Control Plane Pod kubeconfig configuration

Creating Certificates with the Certificate API



Submit and sign Certificate Signing Requests (CSR) via the API Server

Encryption and authentication in the cluster

Programmatic interface

Creating a New Certificate

Create a Private Key with openssl or cfssl

Create a Certificate Signing Request with openssl or cfssl

Create and submit `CertificateSigning Request` Object

Approve the `CertificateSigning Request`

Retrieve the Certificate

This process is used to create new certificates for new users

Creating a Certificate Signing Request in openssl

```
#Create a private key
openssl genrsa -out demouser.key 2048


#Generate a CSR
#CN (Common Name) is your username, O (Organization) is the Group
openssl req -new -key demouser.key -out demouser.csr -subj “/CN=demouser"


#The CertificateSigningRequest needs to be base64 encoded
#And also have the header and trailer pulled out.
cat demouser.csr | base64 | tr -d "\n" > demouser.base64.csr
```

Creating a CertificateSigningRequest Object

```
cat <<EOF | kubectl apply -f -
apiVersion: certificates.k8s.io/v1
kind: CertificateSigningRequest
metadata:
  name: demouser
spec:
  groups:
  - system:authenticated
  request: $(cat demouser.base64.csr)
  signerName: kubernetes.io/kube-apiserver-client
  usages:
  - client auth
EOF
```

Approving a CSR and Retrieving a Certificate

```
#Approve the CSR
kubectl certificate approve demouser


#Retrieve the certificate from the CSR object, it's base64 encoded
kubectl get certificatesigningrequests demouser \
   -o jsonpath='{ .status.certificate }’ | base64 --decode > demouser.crt
```

Demo

Creating a new certificate for a new user

kubeconfig File Overview

Cluster access

Context is a cluster's location and credentials

Multiple configuration contexts

Multiple kubeconfig files

Users

System components

kubeconfig File Components

Users	Clusters	Contexts
Credentials	Network location of the API Server	Access parameters to the cluster
Username	Certificate Authority's Certificate (ca.crt)	Comprised of a Cluster and User in this kubeconfig file
Certificate/Token/Password		Set the namespace

kubeconfig Files - admin.conf

```
apiVersion: v1
clusters:
- cluster:
    certificate-authority-data: DATA+OMITTED
    server: https://172.16.94.10:6443
  name: kubernetes

users:
- name: kubernetes-admin
  user:
    client-certificate-data: REDACTED
    client-key-data: REDACTED
```

```
contexts:
- context:
    cluster: kubernetes
    user: kubernetes-admin
  name: kubernetes-admin@kubernetes
current-context: kubernetes-admin@kubernetes
```

Creating kubeconfig Files Manually

```
#Define a cluster
kubectl config set-cluster kubernetes-demo \
  --server=https://172.16.94.10:6443 \
  --certificate-authority=/etc/kubernetes/pki/ca.crt \
  --embed-certs=true \
  --kubeconfig=demouser.conf

#Define a credential
kubectl config set-credentials demouser \
  --client-key=demouser.key \
  --client-certificate=demouser.crt \
  --embed-certs=true \
  --kubeconfig=demouser.conf
```

```
#Define the context
kubectl config set-context demouser@kubernetes-demo
\
  --cluster=kubernetes-demo \
  --user=demouser \
  --kubeconfig=demouser.conf

#Set the context
kubectl config use-context \
  demouser@kubernetes-demo --
kubeconfig=demouser.conf
```

Demo

Working with kubeconfig files and contexts

Creating a kubeconfig file for a new user

Using a kubeconfig file for a new user

Review

Certificates in Kubernetes

Creating and managing certificates

Managing kubeconfig Files for accessing clusters

Up Next:
Managing Role Based Access Controls