Securing Ingress Traffic Using the cert-manager Operator

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Module Outline

Learn how to configure TLS for ingress routes

Become familiar with the cert-manager operator

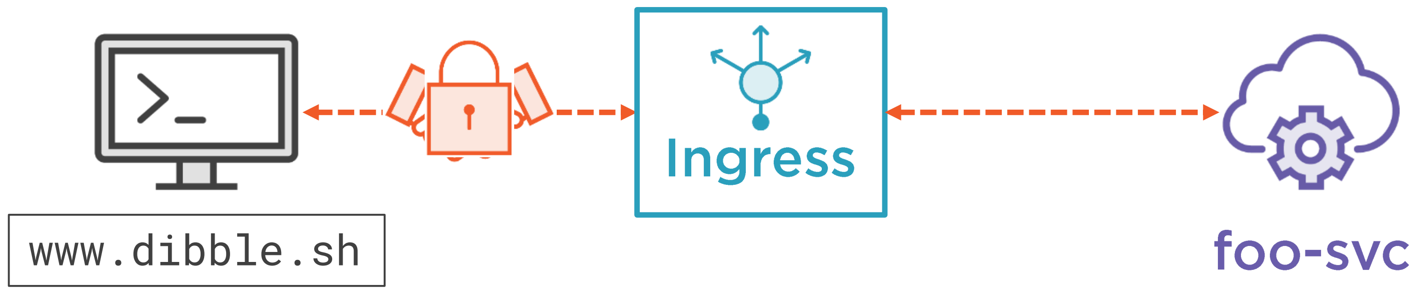
Configure custom resource definitions for certificate management

Demonstrate how to automate certificate acquisition and renewal

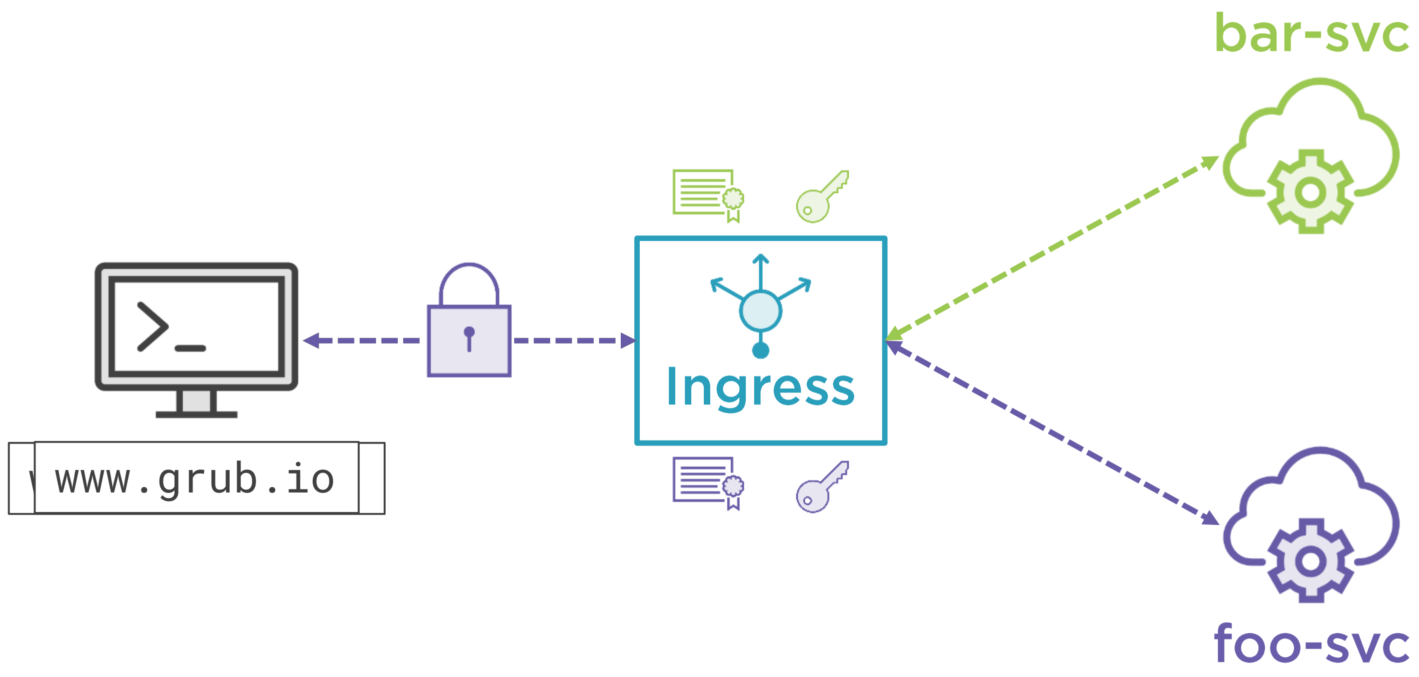
Secure Ingress

The Ingress API allows us to configure secure connections using Transport Layer Security (TLS)

Securing Connections with TLS



Securing Multiple Backend Services



```yaml
spec:
  tls:
  - hosts:
    - dibble.sh
    secretName: dibble-sh-tls
  - hosts:
    - grub.io
    secretName: grub-io-tls
```

Configuring TLS for Ingress Traffic

The `tls` key defines one or more TLS configurations

TLS Secret Considerations

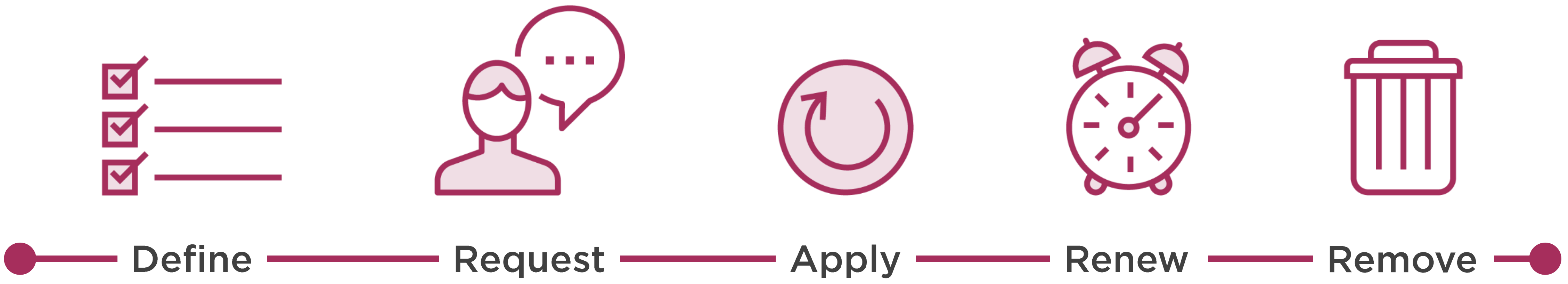
Secret must contain a PEM encoded certificate and a private key

Intermediate certificates must be bundled with public key certificate

TLS secrets are referenceable by ingress objects in same namespace

Managing X.509 Certificates

cert-manager



cert-manager

An application that automates the management of the lifecycle of TLS certificates within a Kubernetes cluster

Benefits of Automated X.509 Certificates

Better Automation

Allows us to focus on other important tasks

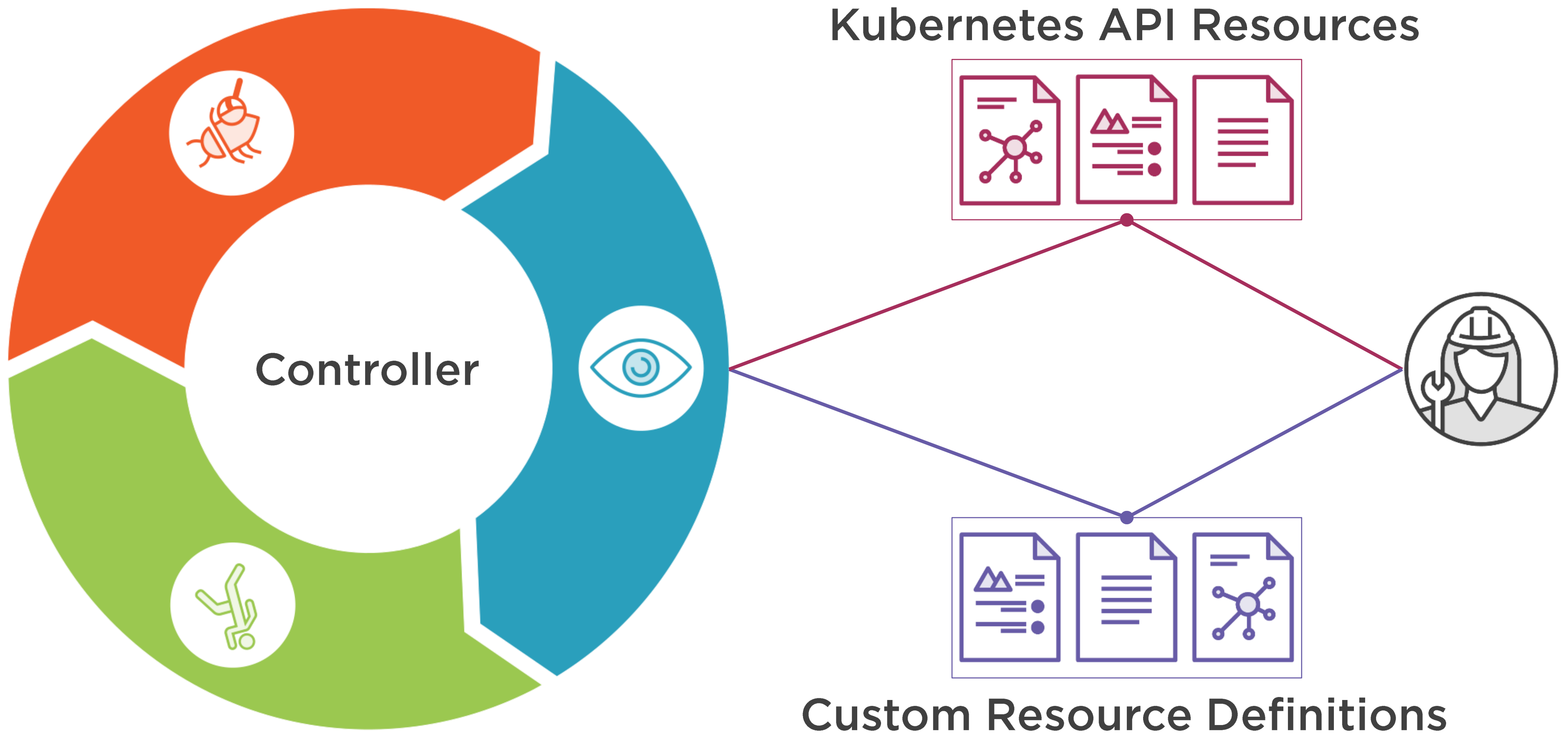
Minimize Risk

Removing human element reduces risk

Reliable Outcomes

Increases confidence in achieving our goals

The Operator Pattern



Custom Resource Definitions

Issuer

Represents a certificate authority from which X.509 certificates can be obtained

Certificate

Defines the attributes of an X.509 certificate to be retrieved from the CA associated with an Issuer

Order

Used to manage the order process for an X.509 certificate placed on an ACME server

Challenge

Manages the lifecycle of the challenge presented by an ACME server for authorization

Secret

The repository for the TLS private key and X.509 certificate obtained from the CA

Issuer Types

Self-Signing

Creates self-signed certificates

CA

Backed by a signing key pair

Vault

Uses Vault's PKI Secrets Engine

ACME

Defines a remote ACME server

```yaml
apiVersion: certmanager.k8s.io/v1alpha1
kind: Issuer
metadata:
  name: letsencrypt
```

Defining an Issuer

An Issuer object is scoped to a namespace …

… whilst a ClusterIssuer is scoped cluster wide

```
spec:
  acme:
    server: https://acme-v02.api.letsencrypt.org/directory
    email: bette@dibble.sh
    privateKeyRef:
      name: acme-letsencrypt
    http01: {}
```

Configuring an ACME Issuer

The ACME challenge can be either `http01` **or** `dns01`

- https://letsencrypt.org/how-it-works/

ACME Account Registration

```
$ kubectl describe issuer letsencrypt

[...]

Status:
  Acme:
    Uri:  https://acme-v02.api.letsencrypt.org/acme/acct/8292286
  Conditions:
    Last Transition Time:  2019-02-19T16:02:00Z
    Message:               The ACME account was registered with
                           the ACME server
    Reason:                ACMEAccountRegistered
    Status:                True
    Type:                  Ready
```

```
apiVersion: certmanager.k8s.io/v1alpha1
kind: Certificate
metadata:
  name: dibble-sh
```

Defining a Certificate

A Certificate object is scoped to a namespace

Mapping Certificate to Issuer

```
apiVersion: certmanager.k8s.io/v1alpha1
kind: ClusterIssuer
metadata:
  name: letsencrypt
spec:
  acme:
    server: https://acme ......
    email: bette@dibble.sh
    privateKeyRef:
      name: acme-letsencrypt
    http01: {}
```

Issuer Object

```
apiVersion: certmanager.k8s.io/v1alpha1
kind: Certificate
metadata:
  name: dibble-sh
spec:
  secretName: dibble-sh-tls
  issuerRef:
    kind: ClusterIssuer
    name: letsencrypt
  dnsNames:
  - www.dibble.sh
  acme:
    config:
    - http01:
        ingressClass: nginx
      domains:
      - dibble.sh
```

Certificate Object

```yaml
spec:
  commonName: dibble.sh
  dnsNames:
  - www.dibble.sh
  secretName: dibble-sh-tls
  issuerRef:
    name: letsencrypt
    kind: ClusterIssuer
```

Configuring the Certificate Request

The issuerRef field assumes an Issuer kind …

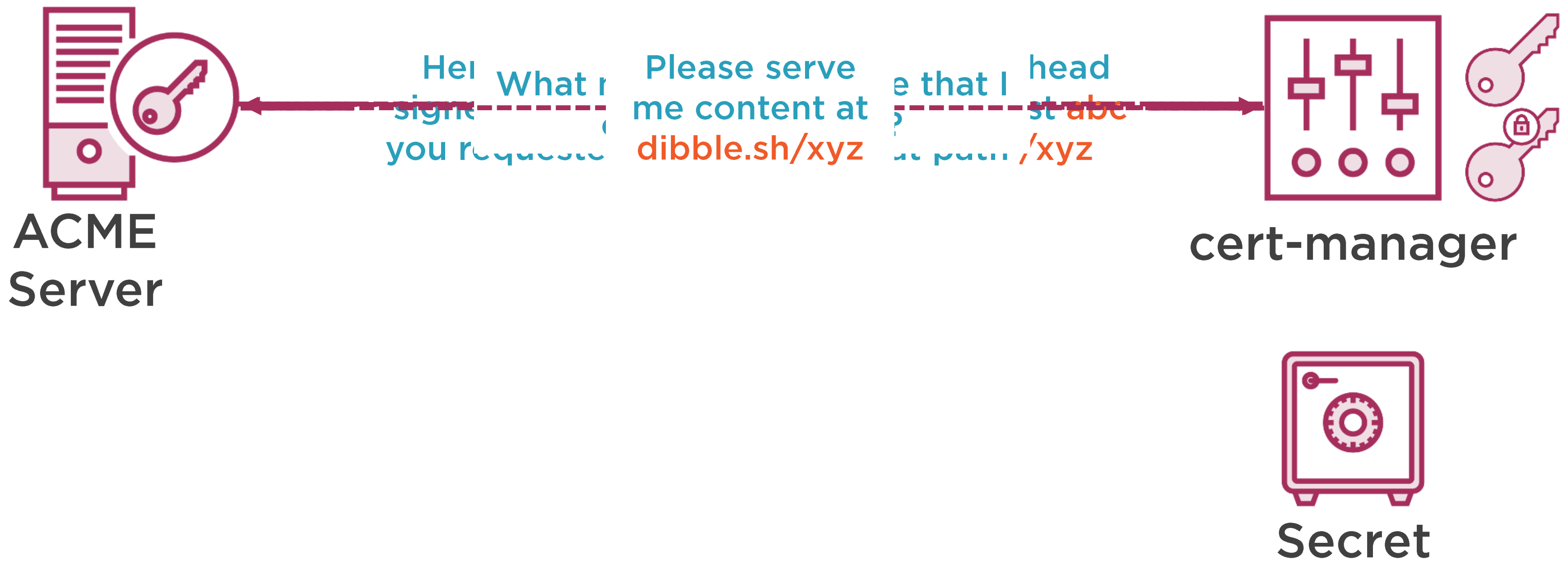
… and a ClusterIssuer kind must be explicitly defined

```
spec:
  [...]
  acme:
    config:
    - http01:
        ingressClass: nginx
      domains:
      - dibble.sh
```

Providing ACME Challenge Details

ACME challenges which use HTTP, rely on an ingress controller

The ACME Challenge



ingress-shim

Watches Ingress objects, and for those that have the appropriate annotations, will automatically provision X.509 certificates

```
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: nginxhello-ingress
  annotations:
    certmanager.k8s.io/issuer: letsencrypt
```

Simplifying ACME Certificate Acquisition

Required annotation:

- `certmanager.k8s.io/issuer`, or
- `certmanager.k8s.io/cluster-issuer`

Certificate Renewals

A period of certificate validity can be specified when configuring a Certificate object (`duration`)

A renewal window can be defined by specifying time before expiration to attempt renewal (`renewBefore`)

Default certificate validity is 90 days, with renewals attempted 30 days before expiration

Demo

- Deploy cert-manager to a cluster
- Configure an ACME Issuer object for Let’s Encrypt
- Define a Certificate object
- Set up automatic certificate acquisition using ingress annotations

Module Summary

Ingress supports configuration of secure routes

Cert-manager operator provides in-cluster certificate management

Certificate lifecycles can be automated with ingress and cert-manager