Istio Service Mesh

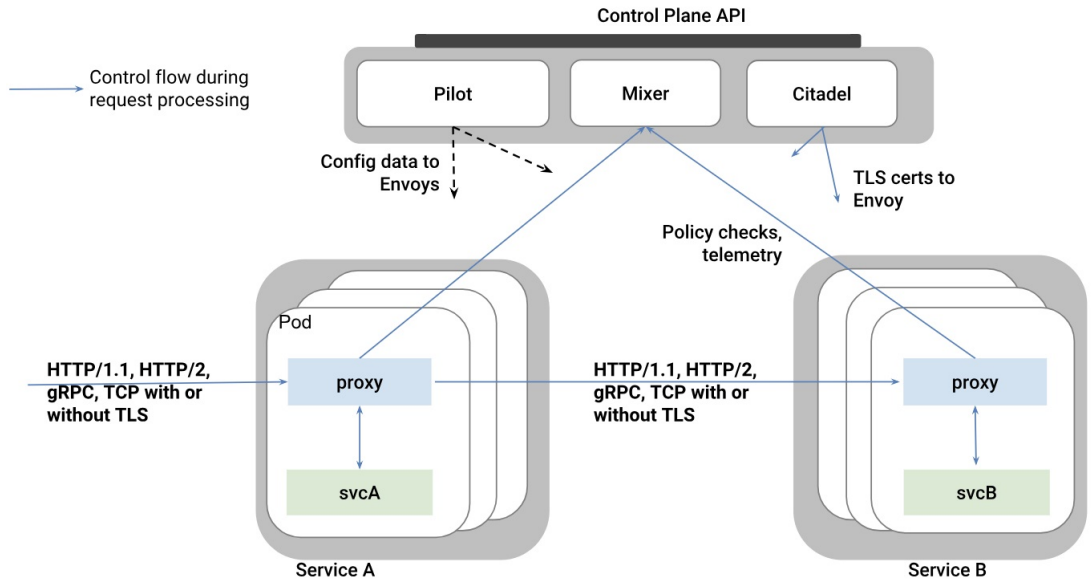
This chapter contains the following topics:

Introduction to Istio Service meshes

Cisco Container Platform includes support for Istio service meshes. An Istio service mesh is logically split into a Data Plane and a Control Plane. The Data Plane includes a set of intelligent proxies (Envoy) and the Control Plane provides a reliable Istio framework. The term Istio is sometimes also used as a synonym to refer to the entire service mesh stack that includes the Control Plane and the Data Plane components.

The service mesh technology allows you to construct North-South and East-West L4 and L7 application traffic meshes. It provides containerized applications a language-independent framework that removes several common tasks related to L4 and L7 application networking from the actual application code. The common tasks include L4 and L7 service routing and load balancing, support for polyglot environments in a language-independent manner and advanced telemetry. The service mesh technology enhances operational capabilities such as monitoring, security, load balancing and troubleshooting for the applications. You can deploy a service mesh in a multi-cloud topology allowing these functions to operate with applications that run across multiple independent cloud deployments.

The following figure shows the high-level architecture of an Istio service mesh.



Istio Architecture

In Cisco Container Platform, the components of Istio and Envoy are supported in the upstream Istio community. The Control and Data Plane components of the solution, such as Pilot, Mixer, Citadel and the Data Plane Envoy proxy for both North-South and East-West load balancing, are supported on Cisco Container Platform.

For more information on these technologies, refer to the upstream community documentation pages for Istio and Envoy.

Note Currently, the Istio service mesh feature is marked as a Tech Preview feature and uses the Istio community version v1.0. You need to contact your service representative for support on the version of Cisco Container Platform you have deployed.

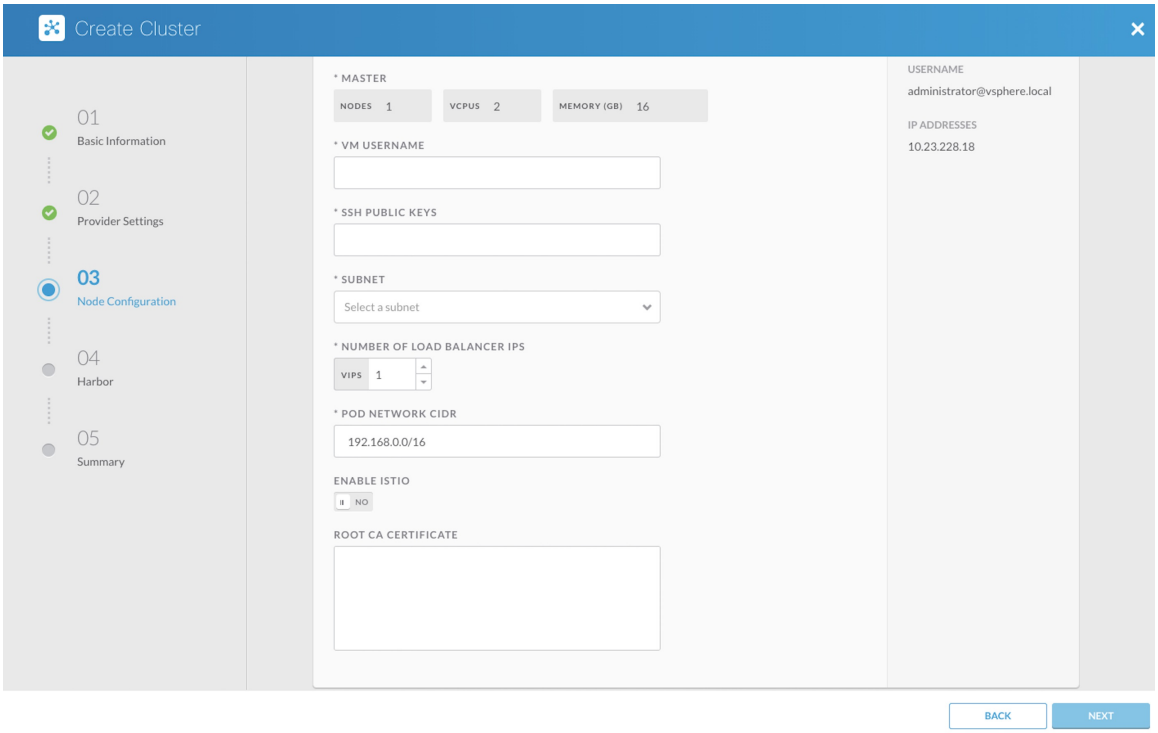
Configuring Istio Service meshes

An Istio service mesh is a configurable feature on Cisco Container Platform. You can configure a separate instance of the service mesh stack on each tenant cluster. Support for Istio must be configured at the time of creating a tenant Kubernetes cluster. You can perform this configuration using APIs or the Cisco Container Platform web interface.

Each instance of the Istio service mesh uses an IP address from the Virtual IP address pool that is associated with the tenant cluster. Consequently, you need to ensure that there is sufficient number of IP addresses free and available in the VIP pool before enabling Istio. Typically, at least three IP addresses are required, one each for the Kubernetes API, Kubernetes Ingress, and Istio Ingress gateway. This number may change in future when additional features require more virtual IP addresses.

For more information on the required number of virtual IP addresses for a given software version of Cisco Container Platform, refer to the Virtual IP address section.

The following figure shows the **Node Configuration** screen, using which you can enable the Istio service mesh on a tenant cluster of the Cisco Container Platform.



In the current version of Cisco Container Platform, you can use a boolean flag to enable an Istio service mesh in a tenant Kubernetes cluster of Cisco Container Platform. If you enable the flag, a predetermined configuration of an Istio-based service mesh with Envoy as the Data Plane is configured in the tenant Kubernetes cluster. An internal instance of a service load balancer is automatically configured and a virtual IP address is automatically allocated for the Ingress gateway function of Istio.

Monitoring Service meshes

On Cisco Container Platform, the Istio Control Plane is deployed in a special **istio-system** namespace of a tenant Kubernetes cluster. This is similar to how other add-on services such as Prometheus based monitoring or NGINX based Kubernetes ingress are provided. In a production deployment, a tenant Kubernetes cluster administrator grants read-write access to your development namespaces but not to the namespaces of system add-on services such as Istio, thereby protecting the Control Plane of such services from getting over-written accidentally or maliciously by your application containers.

The following is a checklist of monitoring and troubleshooting steps when using Istio on Cisco Container Platform:

1. If Istio fails to be enabled on your tenant Kubernetes cluster, in addition to the usual troubleshooting steps for Cisco Container Platform, also ensure that there is a sufficient number of virtual IP addresses available in the pool configured for this Kubernetes tenant cluster. In the current version of Cisco Container Platform,

at least three IP addresses need to be free and available for a tenant Kubernetes cluster that has Istio enabled.

2. Confirm that all pods are running in the istio-system namespace of the tenant Kubernetes cluster. The following figure shows a sample CLI output indicating that all Istio control pods are running correctly in a tenant Kubernetes cluster. If one or more pods continuously fails to run, use **kubectl describe pod <name_of_pod>** to troubleshoot the issue.

```
ccpuser@vhosakot-istio14-master5ebb31962c:~$ kubectl get pods -n istio-system
NAME                                      READY     STATUS      RESTARTS   AGE
grafana-5b977b576f-2r5gs                  1/1       Running     0          20h
istio-citadel-5ff4f56f56-lk6wz            1/1       Running     0          20h
istio-egressgateway-6567bc7ffb-84tj8      1/1       Running     0          20h
istio-ingressgateway-5dfb78f45b-c6jxc     1/1       Running     0          20h
istio-mixer-post-install-w56cx            0/1       Completed   0          20h
istio-pilot-6ddc9b5b49-hl5nd              2/2       Running     0          20h
istio-policy-f67cb98b5-n2q2m              2/2       Running     0          20h
istio-sidecar-injector-5545db64bf-tttc9   1/1       Running     0          20h
istio-statsd-prom-bridge-949999c4c-82spd   1/1       Running     0          20h
istio-telemetry-667d4c6765-2s9hj          2/2       Running     0          20h
istio-tracing-754cdfd695-2wd45            1/1       Running     0          20h
prometheus-86cb6dd77c-4cj77               1/1       Running     0          20h
servicegraph-ccd4d4859-sgcwc              1/1       Running     0          20h
```

3. Confirm that all Istio services are running in the **istio-system** namespace of the tenant Kubernetes cluster.

   The following figure shows a CLI output with the Istio services up and running.

```
ccpuser@vhosakot-istio14-master5ebb31962c:~$ kubectl get svc -n istio-system
NAME                       TYPE           CLUSTER-IP       EXTERNAL-IP    PORT(S)
grafana                    ClusterIP      10.98.223.200    <none>         3000/TCP
istio-citadel              ClusterIP      10.97.93.126     <none>         8060/TCP,9093/TCP
istio-egressgateway        ClusterIP      10.108.19.80     <none>         80/TCP,443/TCP
istio-ingressgateway       LoadBalancer   10.111.228.87    10.10.99.148   80:31380/TCP,443:31390/TCP,31400:31400/TCP
istio-pilot                ClusterIP      10.104.249.174   <none>         15003/TCP,15005/TCP,15007/TCP,15010/TCP,15011/TCP,8080/TCP,909
istio-policy               ClusterIP      10.108.75.85     <none>         9091/TCP,15004/TCP,9093/TCP
istio-sidecar-injector     ClusterIP      10.109.55.202    <none>         443/TCP
istio-statsd-prom-bridge   ClusterIP      10.107.183.156   <none>         9102/TCP,9125/UDP
istio-telemetry            ClusterIP      10.110.209.16    <none>         9091/TCP,15004/TCP,9093/TCP,42422/TCP
prometheus                 ClusterIP      10.101.6.183     <none>         9090/TCP
servicegraph               ClusterIP      10.105.53.151    <none>         8088/TCP
tracing                    LoadBalancer   10.101.62.116    <pending>      80:31960/TCP
zipkin                     ClusterIP      10.99.116.160    <none>         9411/TCP
ccpuser@vhosakot-istio14-master5ebb31962c:~$
```

4. Confirm that the Ingress gateway service has an external IP address allocated and that this IP address is one of the previously available IP addresses in the virtual IP address pool associated with this tenant Kubernetes cluster. An example of this CLI output is shown in the preceding figure.

5. Deploy the bookinfo example application provided in the Istio upstream community web site.

6. The **istioctl** CLI utility is not deployed in the current version of the Cisco Container Platform. Most of the Istio functionality is now available through the **kubectl** CLI, but if you want to use **istioctl**, run these steps to deploy **istioctl** on a tenant Kubernetes cluster of the Cisco Container Platform:

```
export ISTIO_VERSION=1.0
    curl -L https://git.io/getLatestIstio | sh -
    chmod +x istio-${ISTIO_VERSION}/bin/istioctl
    sudo mv istio-${ISTIO_VERSION}/bin/istioctl /usr/local/bin/
    istioctl version
```

For more information and operational guidelines, refer to the Istio upstream documentation.