Using Istio and Envoy for Edge Routing in Cloud Foundry

Shubha Anjur Tupil
Product Manager, Pivotal

Aaron Hurley
Engineer, Pivotal
Cloud Foundry is an Open Source Cloud Application Platform

- Integration friendly
- Any App
- Interoperable
- Services Marketplace
- IaaS Agnostic
- Proven at Scale
What users expect from a platform?

Security

- “mTLS everywhere”
- Application Isolation
- Policy configuration
- App security
- Secure app to app communication
What users expect from a platform?

Resiliency

- Backup and Disaster Recovery
- Resiliency of control plane components
What users expect from a platform?

High Availability

- Availability Zones
- Health Management for App Instances
- Process monitoring
- Resurrection for VMs
What users expect from a platform?

Telemetry
- Logging
- Metrics
Cloud Foundry and Kubernetes

- Productivity
- Application
- Unified

Optimization
- Abstraction Layer
- Project & Community

Customizability
- Container
- Expansive
Use cases (for Istio) in Cloud Foundry

Traffic Management
- Canary Releases
- A/B Testing
- Staged rollouts

Security
- mTLS everywhere
- Secure app to app communication

Cross Platform Workloads
- k8s + CF

Granular Control
- Per application controls
- Per route controls

Protocol Support
- HTTP/2
- UDP
- IPv6
- gRPC

Flexible L7 routing
- HTTP Header based routing
- Regex match

Fault Tolerance
- Circuit breaking
- Timeouts
- Retries
Motivations for using Istio in Cloud Foundry

- Community adoption
- Delivering value to our users faster
- Unified routing tier for K8s and non-K8s environments
- Simplify Cloud Foundry Routing architecture
CF Routing Data Plane

Load Balancer

*.apps.example.com

GoRouter

App

Cloud Foundry (Private Cloud)

Load Balancer

tcp.apps.example.com

TCP Router

App
CF Routing Control Plane

- Cloud Controller
  - Desired Workloads + routing metadata
- Diego BBS
  - Desired & Actual Workloads + routing metadata
- Route Emitter
- NATS
  - HTTP Route Mappings
- GoRouter
- TCP Router
  - TCP Route Mappings
- Routing API
- DB (non-durable)
- DB
- HTTP Route Mappings
- TCP Route Mappings

Desired Workloads
Desired & Actual Workloads
DB
Cleanup of Orchestration Layer

Unified Routing Tier

Removed NATS, Routing API (DB), Route Emitter

CF Routing Control Plane (In Progress)

- Cleanup of Orchestration Layer
- Unified Routing Tier
- Removed NATS, Routing API (DB), Route Emitter
Implementation Details

- Envoy
  - v1.7 (latest)
  - gRPC ADS via Pilot
  - Gateway

```yaml
apiVersion: networking.istio.io/v1alpha3
kind: Gateway
metadata:
  name: cloudfoundry-ingress
spec:
  servers:
    - port:
        name: http
        number: 80
        protocol: http
        hosts:
          - "*
```
Implementation Details

- Istio Pilot Discovery Service
  - In-Memory Config Store
  - CF Service Registry
    - Co-pilot Snapshotter
Implementation Details

- Co-pilot
  - Interfaces with CF components
    - gRPC - Cloud Controller (URLs)
    - HTTP stream - Diego BBS (IP:Port)
  - gRPC - Pilot (Route Mappings)
- Mesh Config Protocol (TBD)
Challenges

- Young project that moves quickly
- Istio built with Kubernetes in mind
- How should Istio functionality be exposed to Cloud Foundry users?
Weighted Routing Example (Istio)

```
reviews.yaml
apiVersion: networking.istio.io/v1alpha3
kind: VirtualService
metadata:
  creationTimestamp: null
  name: reviews
  namespace: default
  resourceVersion: "1999"
spec:
  hosts:
  - reviews
  http:
    - route:
      - destination:
        host: reviews
        subset: v1
        weight: 90
      - destination:
        host: reviews
        subset: v2
        weight: 10
```

$ istioctl create -f reviews.yaml
Weighted Routing Example (CF app manifest)

```
reviews.yaml
applications:
  - name: reviews-v1
    path: ./v1/
  - name: reviews-v2
    path: ./v2/
routes:
  - route: reviews.example.com
    destinations:
      - name: reviews-v1
        weight: 90
      - name: reviews-v2
        weight: 10
```

```
$ cf push -f reviews.yaml
```
Weighted Routing Example (CF CLI)

Envoy

reviews v1

90%

reviews v2

10%

$ cf update-route reviews-v1 example.com --hostname reviews --weight 90

$ cf update-route reviews-v2 example.com --hostname reviews --weight 10
We’re on our way...

**Wins:**

- Istio Gateway work
- Basic HTTP Routing through Envoy in CF
- CF e2e Test in Pilot

**Currently focused on:**

- Mesh Config Protocol
- Scaling of Control Plane
We love feedback!

- Try out [Cloud Foundry](http://github.com/cloudfoundry/istio-release)
- [github.com/cloudfoundry/istio-release](http://github.com/cloudfoundry/istio-release)
- How are you leveraging Istio?

#istio in [cloudfoundry.slack.com](http://cloudfoundry.slack.com)

sanjurtupil@pivotal.io (Shubha)

ahurley@pivotal.io (Aaron)
Resources

- Get Started with Cloud Foundry
- istio-release (BOSH release)
- CF Weighted Routing Proposal
- CF/Istio Proposal
- CF/Istio Technical Design Doc
- Mesh Config APIs / Protocol
- routing-release (BOSH release)
- CF Routing Team Backlog