Service Mesh in a Nutshell

Open Source Summit NA 2019

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Open Source Technology Center, VMware
Software as a Service
Software as a Service

Address: 192.168.0.10
Port: 9000
Software as a Service

Google Docs

Address: docs.google.com
Port: 80
A Monolithic Web App

Web App

Module

Module

Module

Module

Database
A Monolithic Web App

Overall Failure
Slow Delivery
Bounded Scaling
Technology Lock-In

Docs App

User Module
Storage Module
Spellcheck Module
Export Module

Database
The Microservices Architecture

- Isolation
- Faster Delivery
- Scalability
- Independence

User Service
Storage Service
Spellcheck Service
Export Service

Web UI

Database
Datastore
The Microservices Architecture

- Web UI
- Apache ZooKeeper
- User Service (.js)
- Storage Service (.rb)
- Spellcheck Service (.py)
- Export Service (.go)
- Database
- Datastore

Apache ZooKeeper Client
Challenges with Microservices

- Canary Deployments
- Rate Limiting
- Blue Green Deployments
- Distributed Tracing
- Service Discovery
- Failure Testing
- Load Balancing
- Monitoring
- Retries
- Circuit Breaking
- Service Graphs
What is a Service Mesh?

- Dedicated infrastructure layer
- Handles service-to-service communication
- Manages complex topology of services
- Array of lightweight network proxies
- Deployed alongside application code
- Doesn’t need the application to be aware
Service Mesh Implementations

**Data Plane**
- envoy
- Project Calico
- traefik
- CONDUIT
- Kong
- HashiCorp Consul
- cilium
- HAProxy
- nginx

**Control Plane**
- Istio
- linkererd
- Ambassador
- nginMesh
Istio Architecture

Control Plane API

- **Pilot**
- **Mixer**
- **Citadel**

Control Plane

Data Plane

Configuration

Policies, Telemetry

TLS Certs

Traffic Flow

Pod

Proxy

Service A

Pod

Proxy

Service B
Benefits of a Service Mesh

**Discoverable**
Services can find each other

**Resilient**
Built-in robustness frameworks, load balancing & test infrastructure

**Configurable**
Configure services dynamically at runtime

**Observable**
Standardized metrics, logging, monitoring & distributed tracing

**Secure**
Encrypt and protect service communication
Istio Demo

- Kubernetes Setup
- Istio Setup
- Bookinfo Sample
- Request Routing
- Metrics Dashboard
- Distributed Tracing
- Service Graph
$ make start-minikube
minikube start --bootstrapper=kubeadm \
   --memory=8192 \
   --cpus=4 \ 
   --kubernetes-version=v1.10.0 \ 
   --vm-driver=virtualbox

There is a newer version of minikube available (v1.0.0). Download it here:
https://github.com/kubernetes/minikube/releases/tag/v1.0.0

To disable this notification, run the following:
minikube config set WantUpdateNotification false
Starting local Kubernetes v1.10.0 cluster...
Starting VM...
Downloading Minikube ISO
120.92 MB / 153.08 MB [====================================>------] 78.99% 9s
<table>
<thead>
<tr>
<th>NAME</th>
<th>READY</th>
<th>STATUS</th>
<th>RESTARTS</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>grafana-7f8d4cdd9-rppzq</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-citadel-f55646d75-8qbn</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-cleanup-secrets-1.1.3-9tcjj</td>
<td>0/1</td>
<td>Completed</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-egressgateway-7848bf4dfd-jbw4x</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-galley-76c4fcb6d5-47f59</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-grafana-post-install-1.1.3-75sml</td>
<td>0/1</td>
<td>Completed</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-ingressgateway-6b454db869-m4d26</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-pilot-5bcdc6c4c5-vxxq6</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-policy-6bb58b76bf-lcg4c</td>
<td>2/2</td>
<td>Running</td>
<td>6</td>
<td>7m</td>
</tr>
<tr>
<td>istio-security-post-install-1.1.3-x95w4</td>
<td>0/1</td>
<td>Completed</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>istio-sidecar-injector-5cb4cfdbc8-mtpth</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
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<td>Running</td>
<td>6</td>
<td>7m</td>
</tr>
<tr>
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<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>kiali-7677969794-9jpr2</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
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<tr>
<td>prometheus-5b59764bb9-jlvlz</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
</tbody>
</table>
Bookinfo Architecture

Istio Ingress

Product Page (Python)

Reviews v1 (Java)

Reviews v2 (Java)

Reviews v3 (Java)

Details (Ruby)

Ratings (Node.js)
<table>
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</thead>
<tbody>
<tr>
<td>details-v1-694cbbbb7b-sh6w8</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>43s</td>
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<tr>
<td>productpage-v1-685d44989d-llcv2</td>
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<td>Running</td>
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<td>41s</td>
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<tr>
<td>ratings-v1-8fc58754d-wrt4j</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>43s</td>
</tr>
<tr>
<td>reviews-v1-77f97b977-9mgbn</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>42s</td>
</tr>
<tr>
<td>reviews-v2-67d9587c4b-5f9s4</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>42s</td>
</tr>
<tr>
<td>reviews-v3-df4799c7f-rmvrn</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>42s</td>
</tr>
</tbody>
</table>
The Comedy of Errors

Summary: Wikipedia Summary: The Comedy of Errors is one of William Shakespeare's early plays. It is his shortest and one of his most farcical comedies, with a major part of the humour coming from slapstick and mistaken identity, in addition to puns and word play.

Book Reviews

An extremely entertaining play by Shakespeare. The slapstick humour is refreshing!
— Reviewer1

Absolute fun and entertaining. The play lacks thematic depth when compared to other plays by Shakespeare.
— Reviewer2
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ISBN-10: 1234567890

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$ kubectl apply -f samples/bookinfo/networking/virtual-service-review
s-test-v2.yaml
virtualservice.networking.istio.io/reviews configured
$
The Comedy of Errors

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  — Reviewer1
  ★★★★★
- Absolutely fun and entertaining. The play lacks thematic depth when compared to other plays by Shakespeare.
  — Reviewer2
  ★★★★★☆
SERVICE: productpage.default.svc.cluster.local

Client Request Volume: 0.7 ops
Client Success Rate: 100%
Client Request Duration:
- P50: 0 ns
- P90: 400 ms
- P99: 600 ms
TCP Received Bytes: N/A

Server Request Volume: 0.7 ops
Server Success Rate: 100%
Server Request Duration:
- P50: 0 ns
- P90: 400 ms
- P99: 600 ms
TCP Sent Bytes: N/A
Find Traces

Service (6)
- productpage.default

Operation (6)
- all

Tags (7)
- http.status_code=200 err

Lookback
- Last Hour

Min Duration
- e.g. 1.2s, 100ms, 500us

20 Traces

Sort: Most Recent

Compare traces by selecting result items

istio-ingressgateway: productpage.default.svc.cluster.local:9080/productpage 30.47ms
da85fe7

6 Spans
metadata:
  name: details
  namespace: default
  selflink: ->
  uid: bde5ed35-6b8d-11e9-b795-88002744e69d
  resourceVersion: "13576"
  generation: 1
  creationTimestamp: "2019-04-16T19:27:58Z"
  annotations: kubectrl.kubernetes.io/last-applied-configuration: >
    "apiVersion": "networking.istio.io/v1alpha3","kind": "DestinationRule","metadata":{"annotations":{}},"name": "details","namespace": "default"

spec:
  host: details
  trafficPolicy: ~
  subsets:
    - labels:
        version: v1
        name: v1
  This subset's labels are not found from any matching host
The Envoy Proxy

- gRPC – JSON Transcoder
- Rate Limiting
- Prometheus
- Jaeger

Configuration

Requests & Responses

Envoy Proxy

xDS APIs

Stats

Tracing

Filter

Filter

Filter

Filter
Pros & Cons of Service Mesh

**Pros**

• Generic functionality is decoupled from Microservice code
• Freedom to choose the Microservice implementation language
• Standardized Tracing, Logging, Security, Access Control, etc.

**Cons**

• Service calls go through an extra hop i.e. the proxy sidecar
• Addresses only a subset of problems
• Not fully ready for large scale deployments
Thank You

istio.io
envoyproxy.io
venilnoronha.io
venilnoronha
venilnoronha