Service Mesh in a Nutshell

Open Source 101

Venil Noronha

Open Source Technology Center, VMware

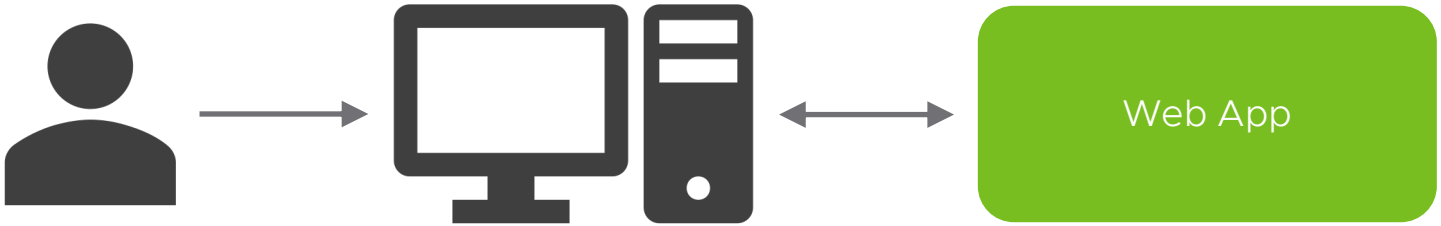
vmware

©2019 VMware, Inc.

Software as a Service

vmware®
©2019 VMware, Inc.

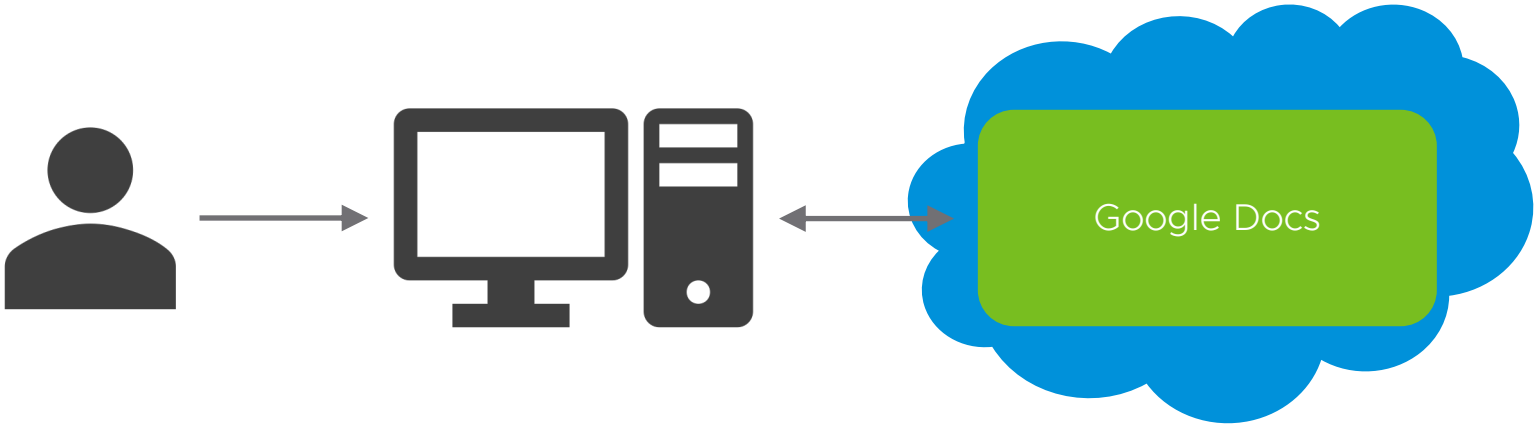
Software as a Service



Address: 192.168.0.10
Port: 9000

vmware
©2019 VMware, Inc.

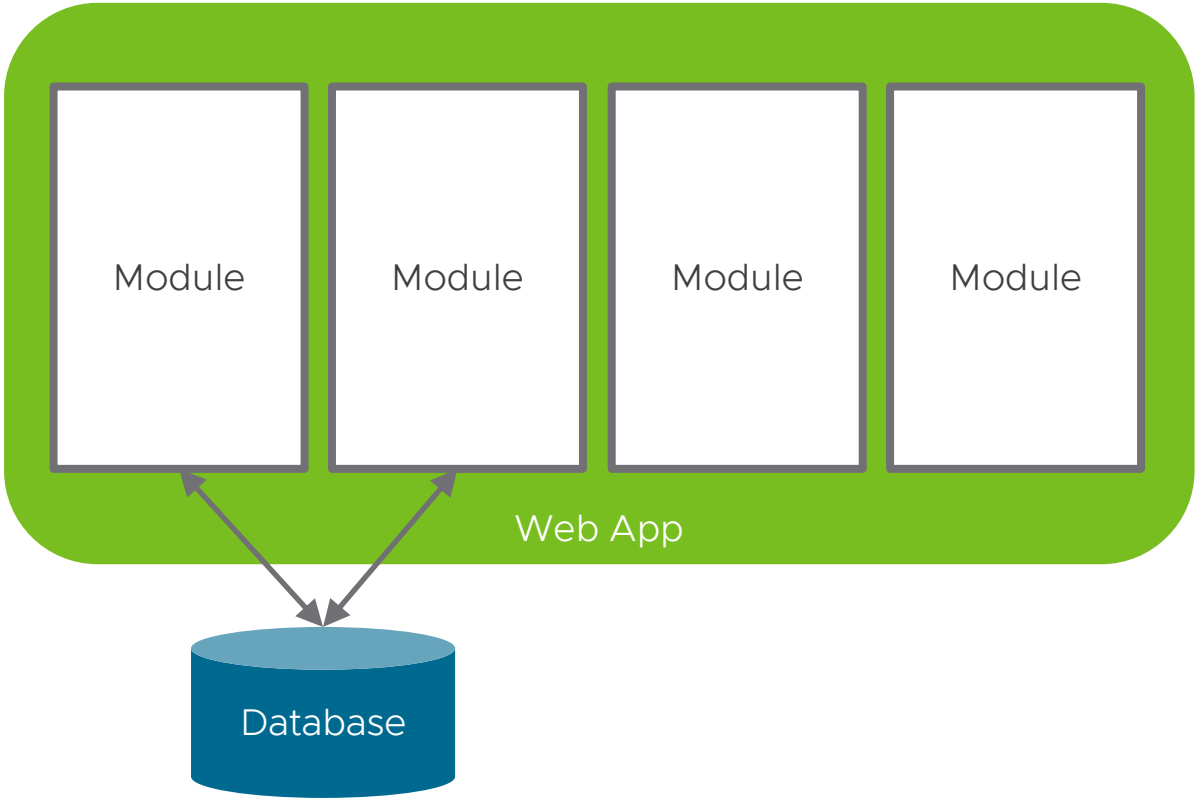
Software as a Service



Address: docs.google.com
Port: 80

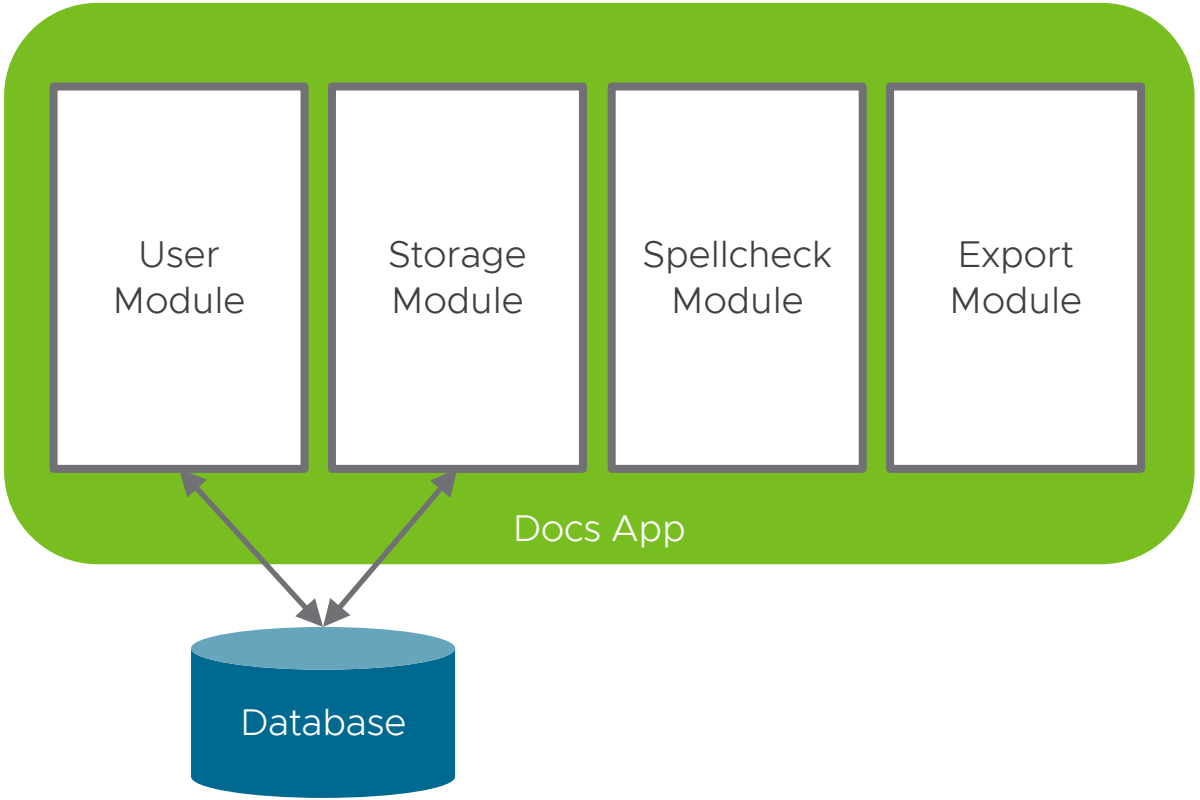
vmware
©2019 VMware, Inc.

A Monolithic Web App



vmware
©2019 VMware, Inc.

A Monolithic Web App



Overall Failure

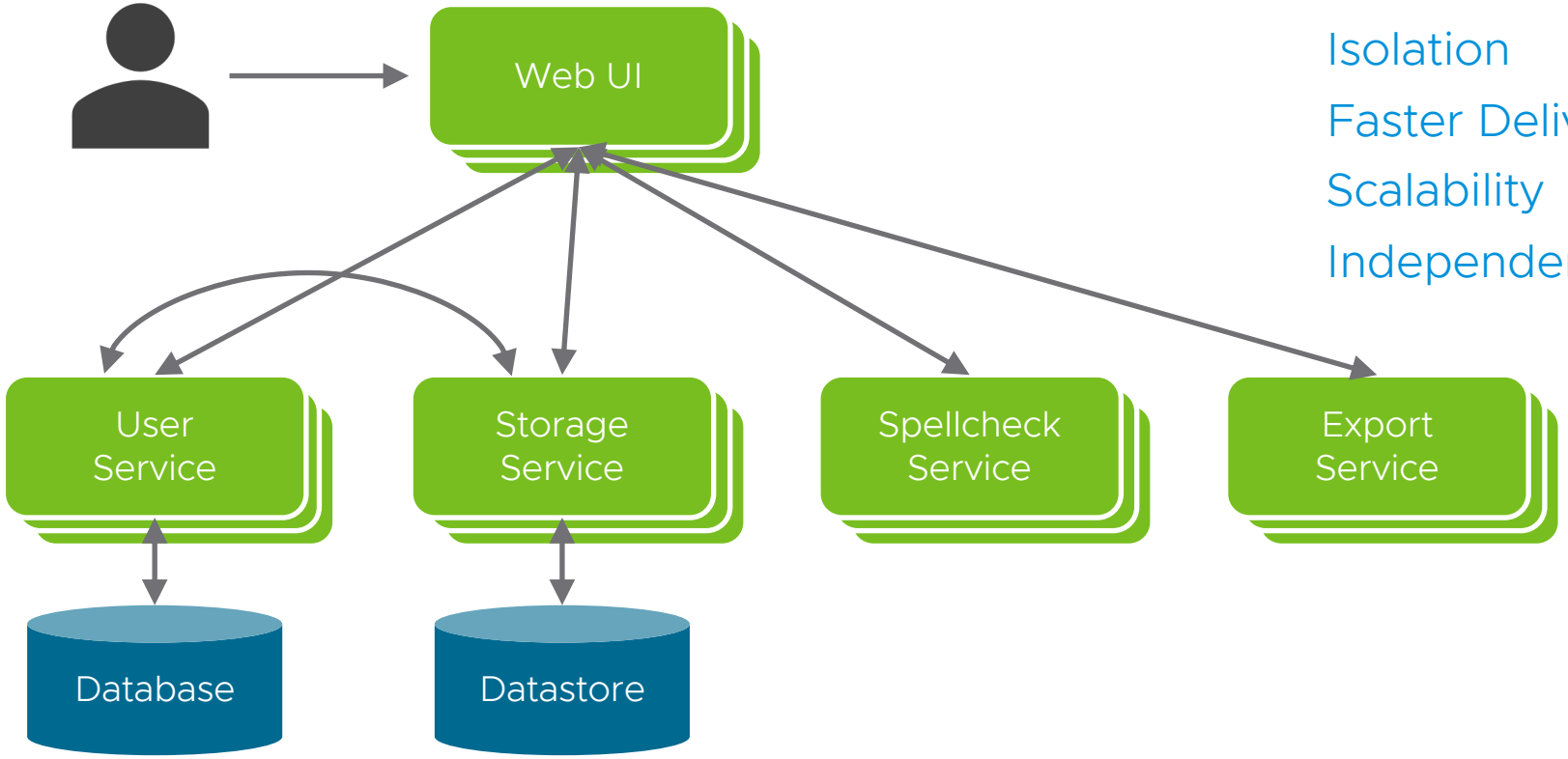
Slow Delivery

Bounded Scaling

Technology Lock-In

vmware
©2019 VMware, Inc.

The Microservices Architecture



Isolation

Faster Delivery

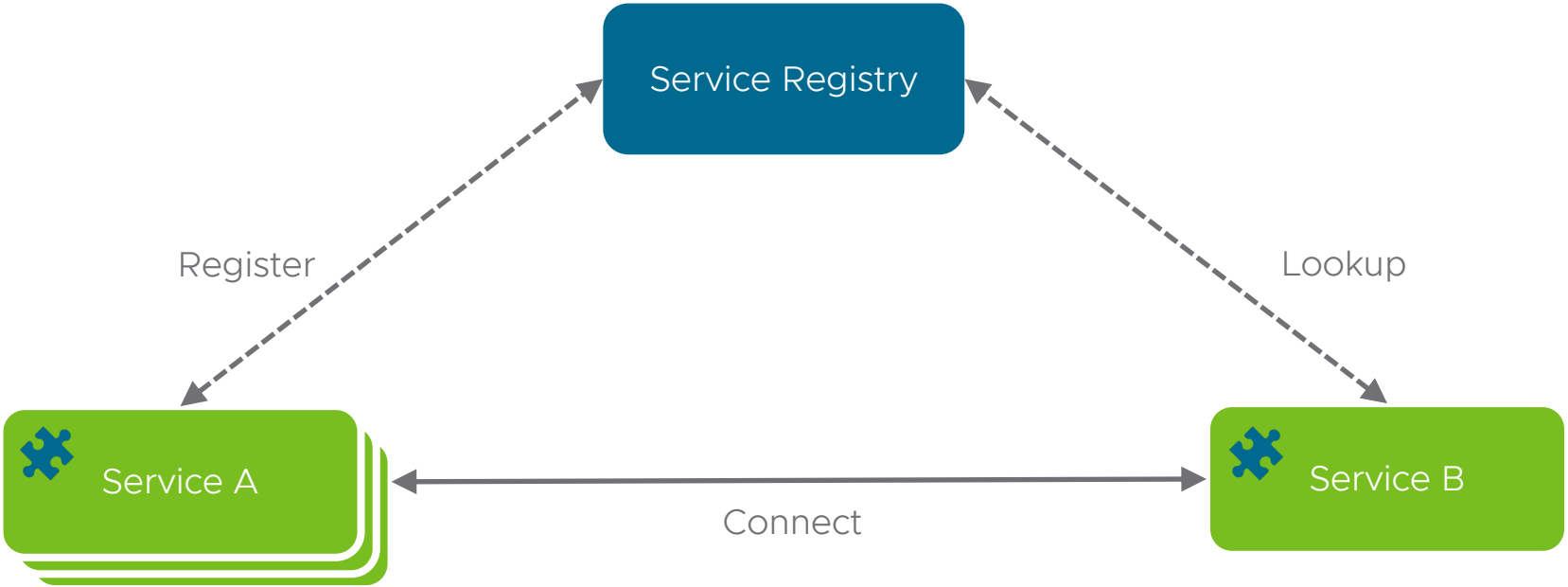
Scalability

Independence

vmware
©2019 VMware, Inc.

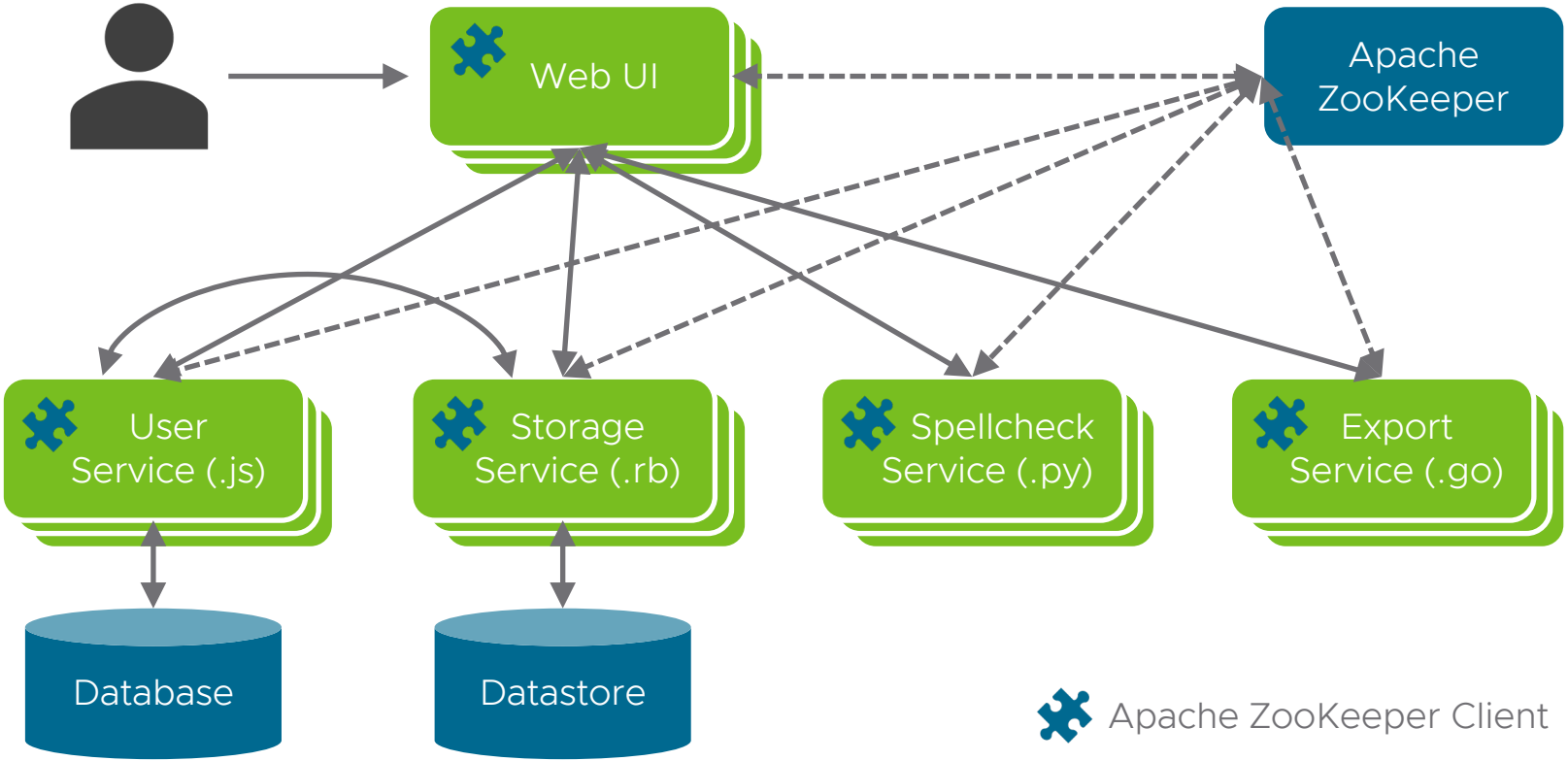
Service Discovery

Service Discovery &
Management Library



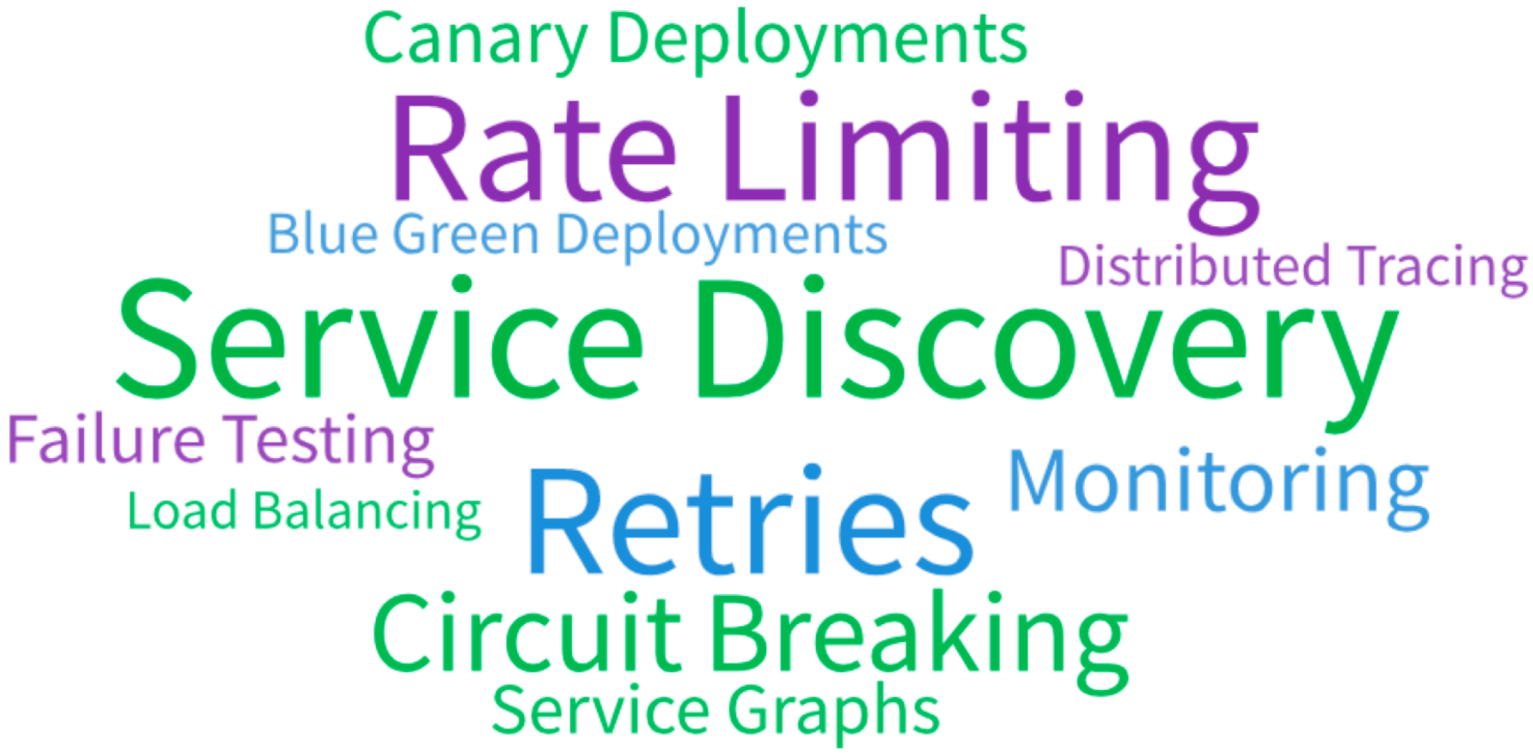
©2019 VMware, Inc.

The Microservices Architecture



vmware
©2019 VMware, Inc.

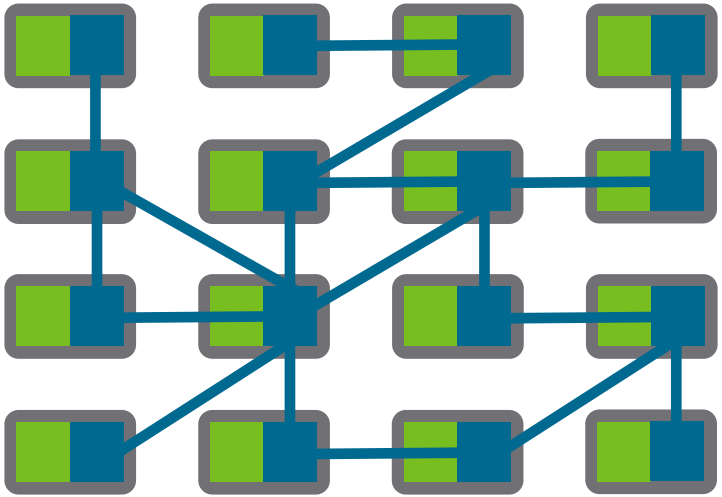
Challenges with Microservices



vmware ©2019 VMware, Inc.

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



vmware ©2019 VMware, Inc.

Service Mesh Implementations

Data Plane

CONDUIT

cilium

nginMesh

Control Plane

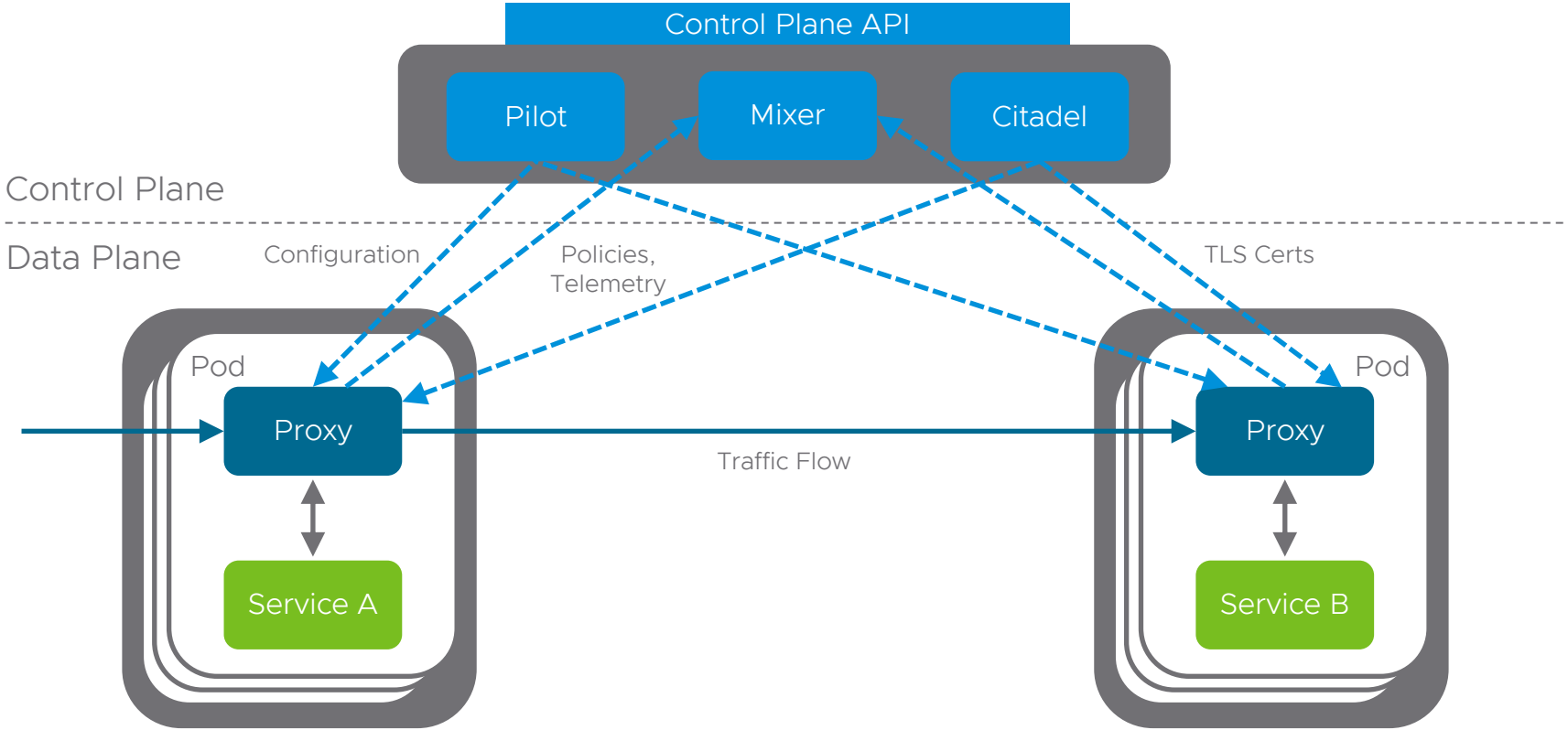
Istio

linkerd

Ambassador

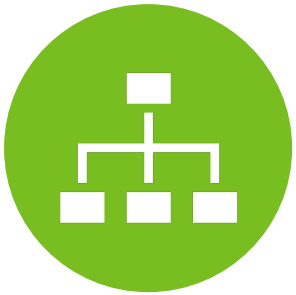
©2019 VMware, Inc.

Istio Architecture



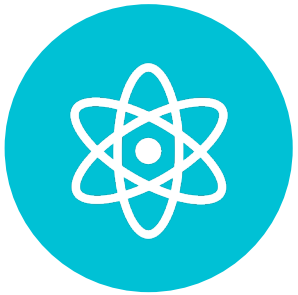
©2019 VMware, Inc.

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

vmware®
©2019 VMware, Inc.

Istio Demo

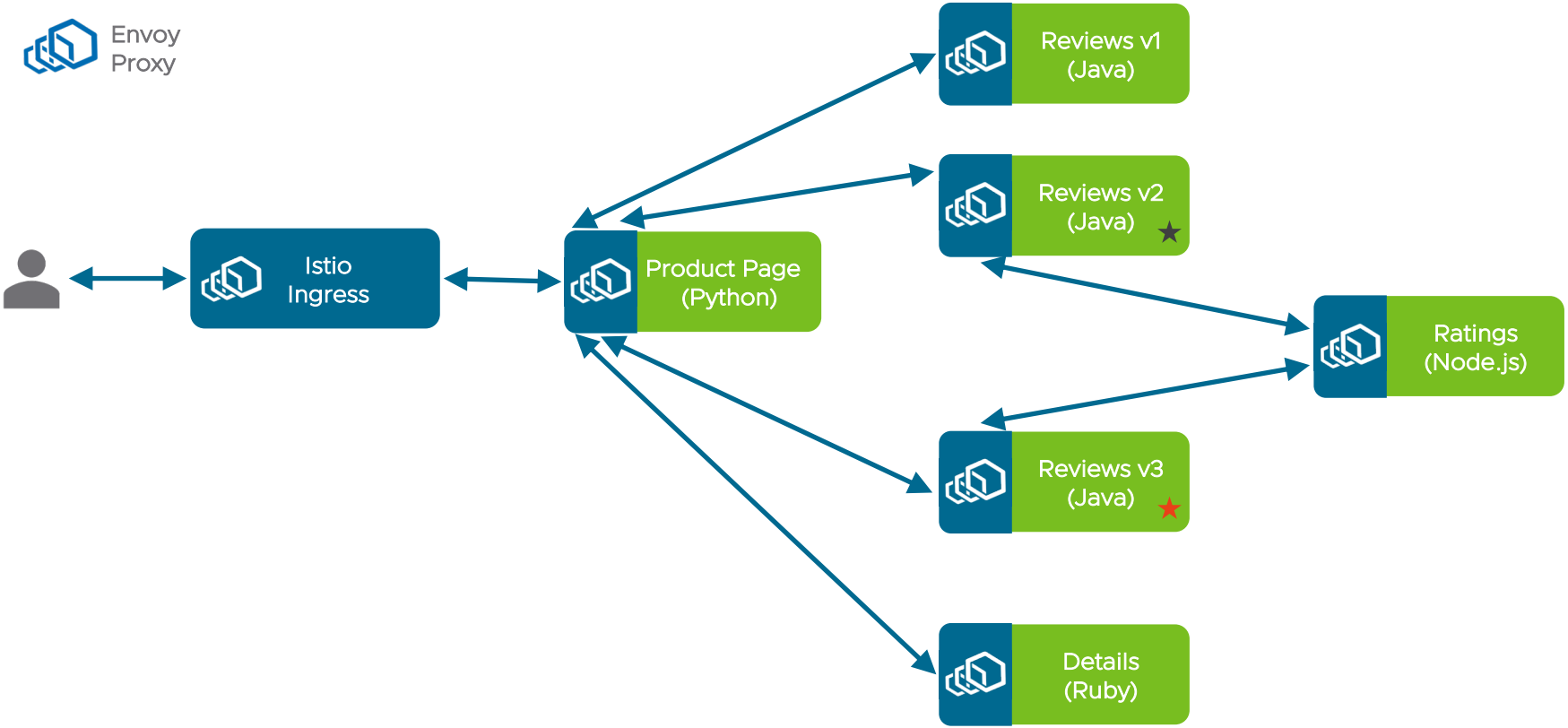
- Kubernetes Setup
- Istio Setup
- Bookinfo Sample
- Request Routing
- Metrics Dashboard
- Distributed Tracing
- Service Graph

vmware®
©2019 VMware, Inc.

```
$ 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
```

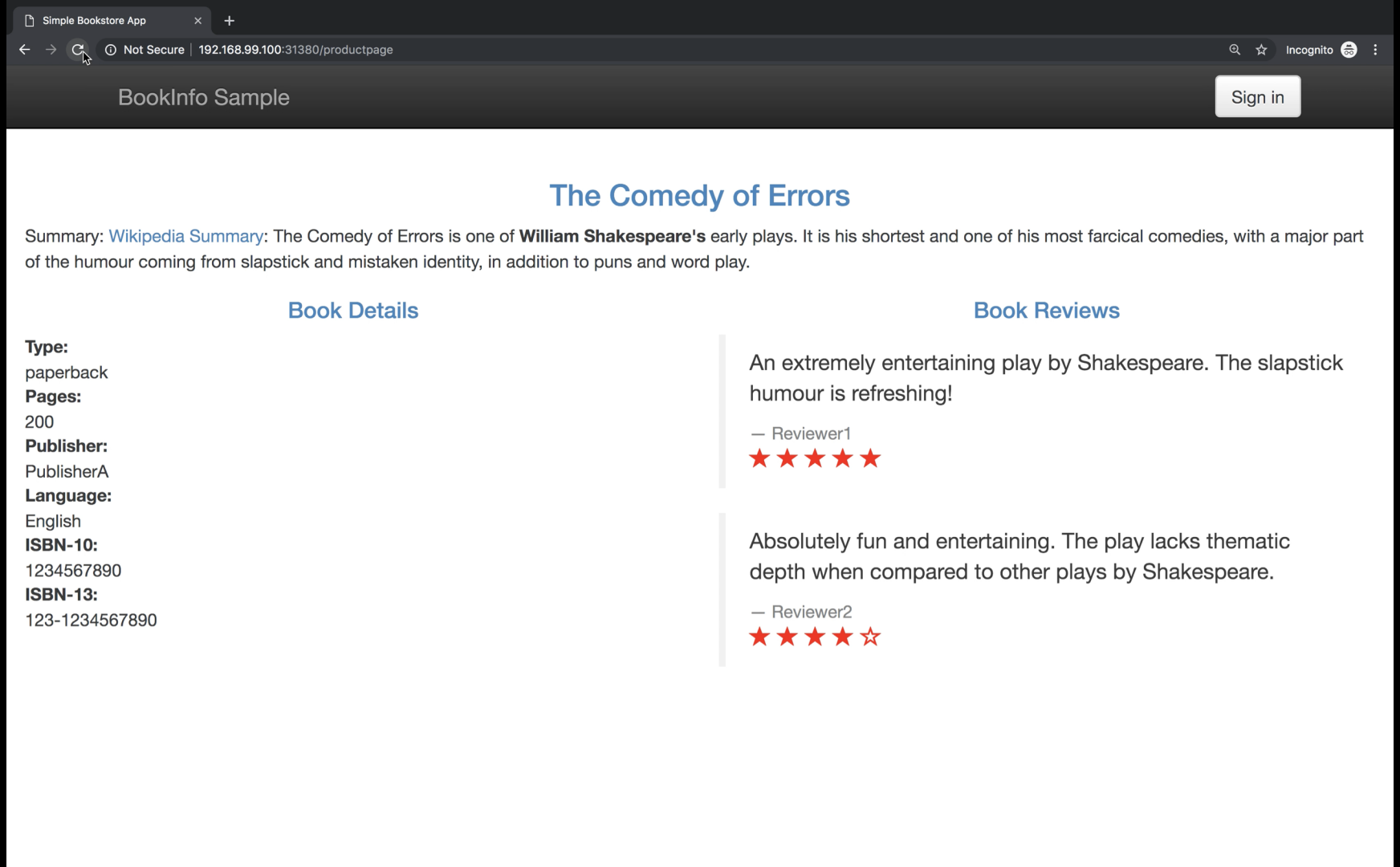
```
Every 2.0s: kubectl get pods -n istio-system      veniln-a01.vmware.com: Tue Apr 16 11:07:53 2019

NAME                                      READY     STATUS      RESTARTS   AGE
grafana-7f8d4cdd9-rppzq                   1/1       Running     0          7m
istio-citadel-f55646d75-8qnbn             1/1       Running     0          7m
istio-cleanup-secrets-1.1.3-9tcjj         0/1       Completed   0          7m
istio-egressgateway-7848bf4dfd-jbw4x      1/1       Running     0          7m
istio-galley-76c4fcb6d5-47f59             1/1       Running     0          7m
istio-grafana-post-install-1.1.3-75sml    0/1       Completed   0          7m
istio-ingressgateway-6b454db869-m4d26     1/1       Running     0          7m
istio-pilot-5bcdc6c4c5-vxxq6              2/2       Running     0          7m
istio-policy-6bb58b76bf-lcg4c             2/2       Running     6          7m
istio-security-post-install-1.1.3-x95w4   0/1       Completed   0          7m
istio-sidecar-injector-5cb4cfdbc8-mtpth   1/1       Running     0          7m
istio-telemetry-7d674f9847-kxgjm          2/2       Running     6          7m
istio-tracing-79c7955c98-8vkhm            1/1       Running     0          7m
kiali-7677969794-9jpr2                    1/1       Running     0          7m
prometheus-5b59764bb9-jlvlz               1/1       Running     0          7m
```

Bookinfo Architecture

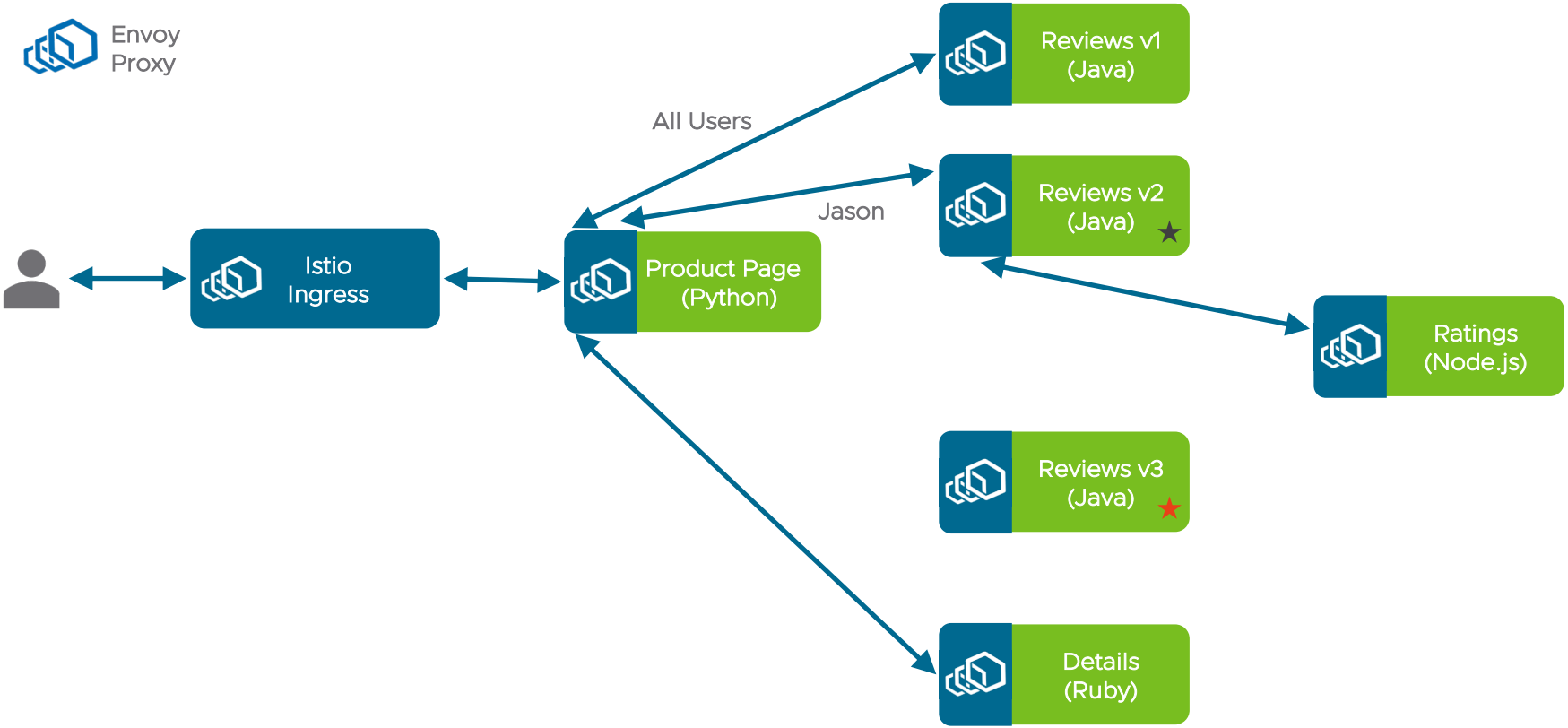


vmware
©2019 VMware, Inc.

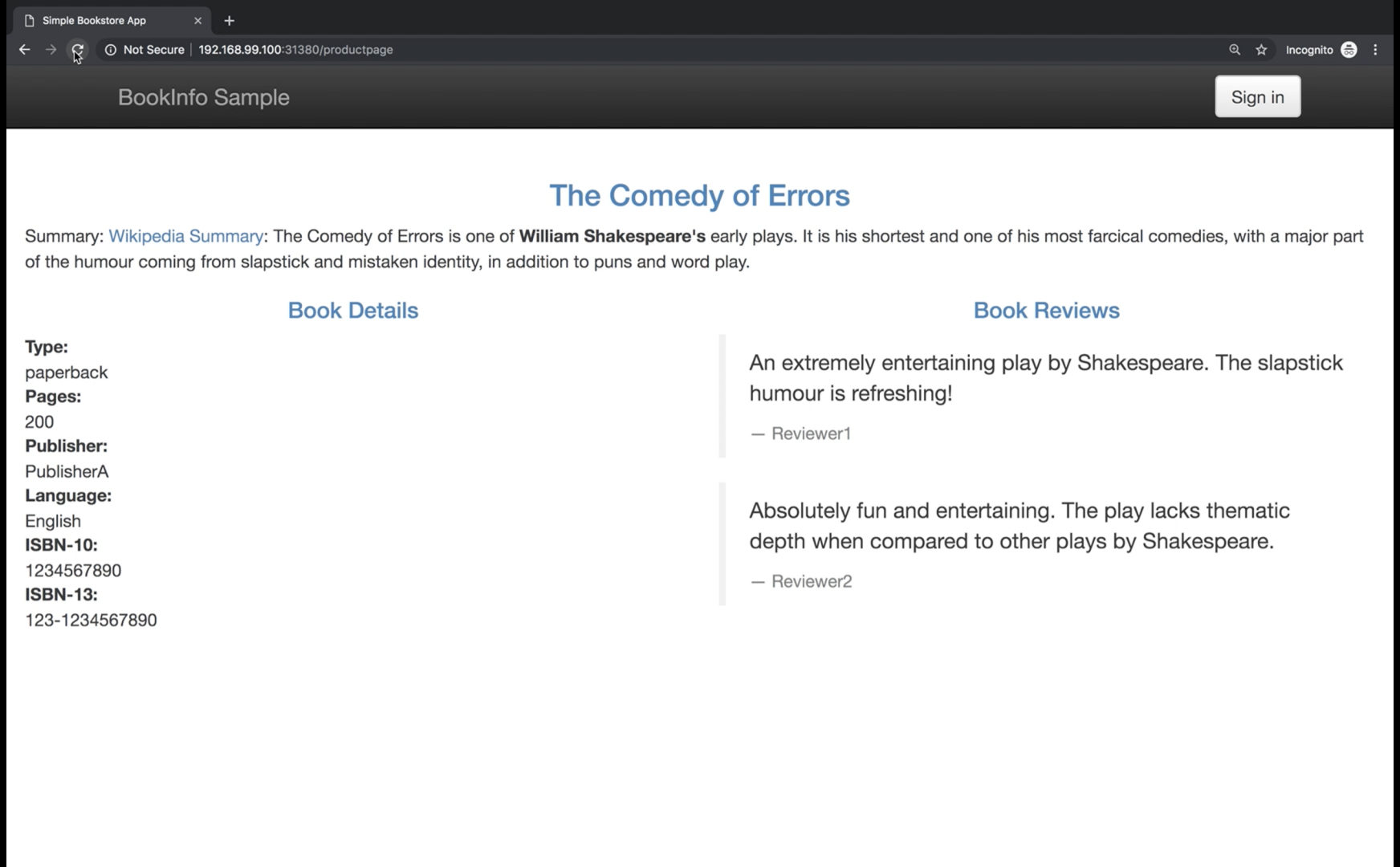
```
Every 2.0s: kubectl get pods        veniln-a01.vmware.com: Tue Apr 16 12:31:06 2019

NAME                                READY     STATUS    RESTARTS   AGE
details-v1-694cbbbb7b-sh6w8         2/2       Running   0          43s
productpage-v1-685d44989d-llcv2     2/2       Running   0          41s
ratings-v1-8fc58754d-wrt4j          2/2       Running   0          43s
reviews-v1-77f97bb977-9mgbn         2/2       Running   0          42s
reviews-v2-67d9587c4b-5f9s4         2/2       Running   0          42s
reviews-v3-df4799c7f-rmvrn          2/2       Running   0          42s
```


Simple Bookstore App
Not Secure | 192.168.99.100:31380/productpage
Incognito
BookInfo Sample
Sign in
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 Details
Type:
paperback
Pages:
200
Publisher:
PublisherA
Language:
English
ISBN-10:
1234567890
ISBN-13:
123-1234567890
Book Reviews
An extremely entertaining play by Shakespeare. The slapstick humour is refreshing!
— Reviewer1
Absolutely fun and entertaining. The play lacks thematic depth when compared to other plays by Shakespeare.
— Reviewer2

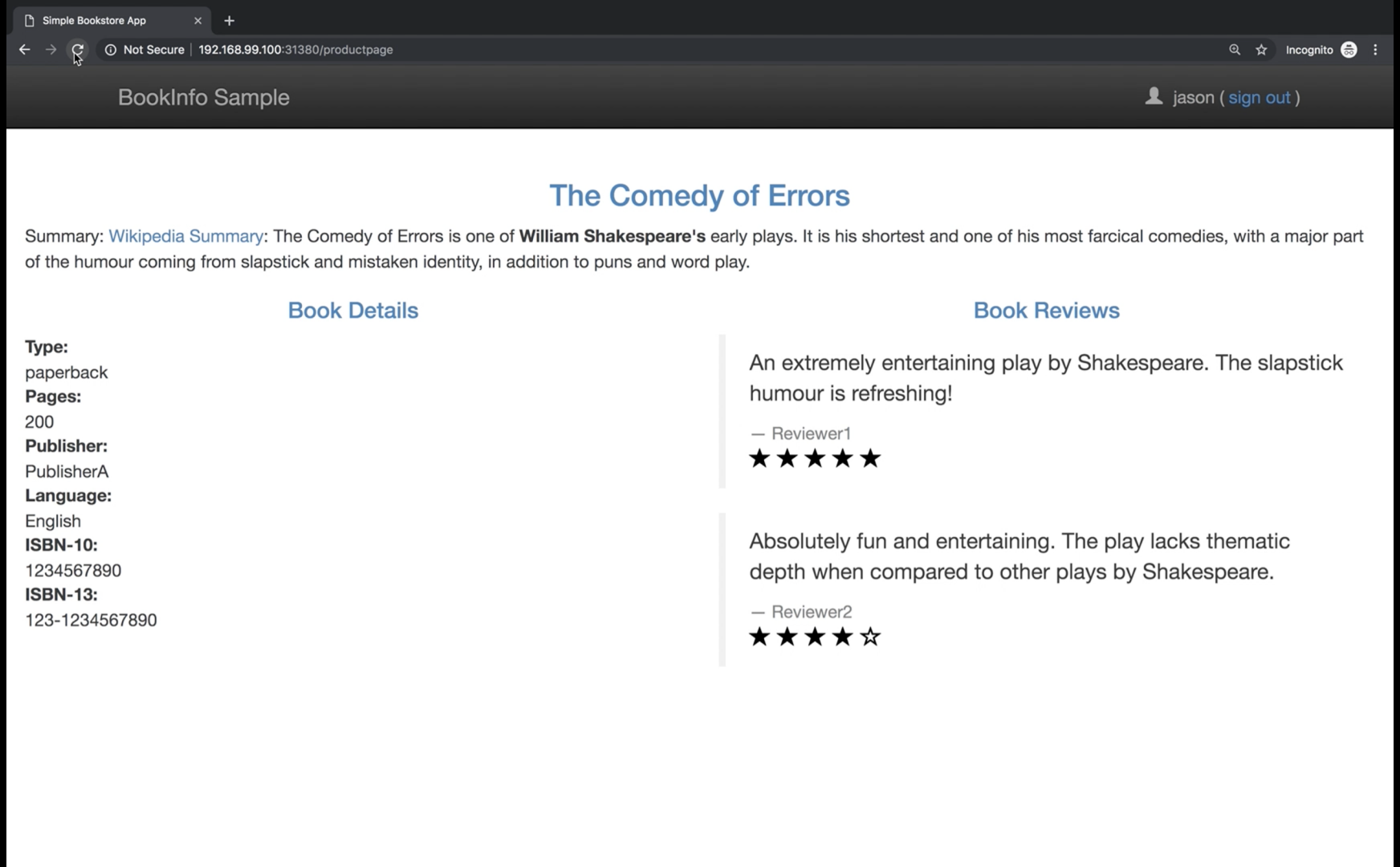
Request Routing

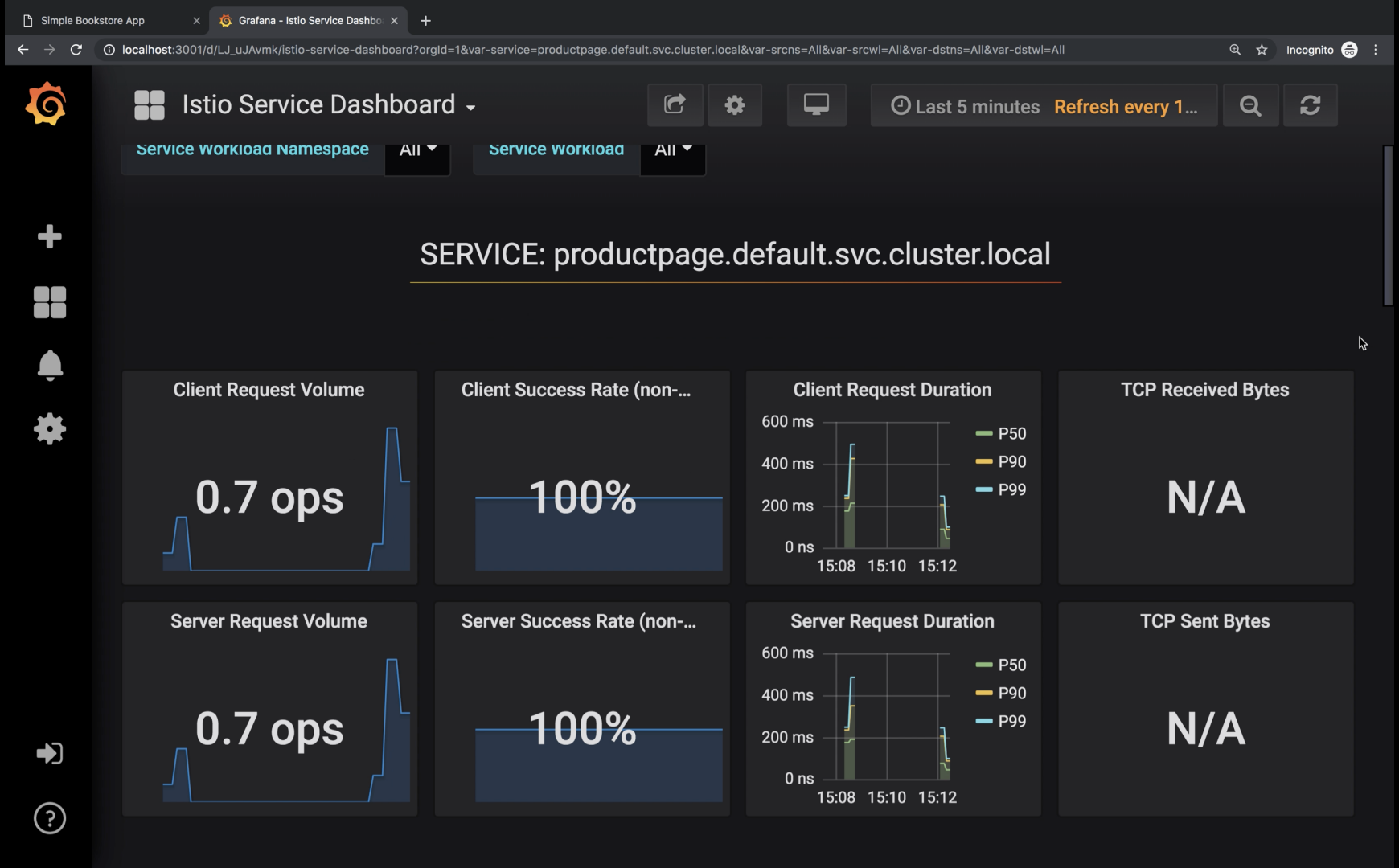


©2019 VMware, Inc.


Simple Bookstore App
Not Secure | 192.168.99.100:31380/productpage
Incognito
BookInfo Sample
Sign in
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 Details
Type:
paperback
Pages:
200
Publisher:
PublisherA
Language:
English
ISBN-10:
1234567890
ISBN-13:
123-1234567890
Book Reviews
An extremely entertaining play by Shakespeare. The slapstick humour is refreshing!
— Reviewer1
Absolutely fun and entertaining. The play lacks thematic depth when compared to other plays by Shakespeare.
— Reviewer2

```
$ kubectl apply -f samples/bookinfo/networking/virtual-service-reviews-test-v2.yaml
virtualservice.networking.istio.io/reviews configured
$
```


Simple Bookstore App
Not Secure | 192.168.99.100:31380/productpage
Incognito
BookInfo Sample
jason (sign out)
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 Details
Type:
paperback
Pages:
200
Publisher:
PublisherA
Language:
English
ISBN-10:
1234567890
ISBN-13:
123-1234567890
Book Reviews
An extremely entertaining play by Shakespeare. The slapstick humour is refreshing!
— Reviewer1
Absolutely fun and entertaining. The play lacks thematic depth when compared to other plays by Shakespeare.
— Reviewer2


Simple Bookstore App
Grafana - Istio Service Dashbo
localhost:3001/d/LJ_uJAvmk/istio-service-dashboard?orgId=1&var-service=productpage.default.svc.cluster.local&var-srcns=All&var-srcwl=All&var-dstns=All&var-dstwl=All
Incognito
Istio Service Dashboard
Last 5 minutes
Refresh every 1...
Service Workload Namespace
All
Service Workload
All
SERVICE: productpage.default.svc.cluster.local
Client Request Volume
0.7 ops
Client Success Rate (non-...
100%
Client Request Duration
600 ms
400 ms
200 ms
0 ns
15:08
15:10
15:12
P50
P90
P99
TCP Received Bytes
N/A
Server Request Volume
0.7 ops
Server Success Rate (non-...
100%
Server Request Duration
600 ms
400 ms
200 ms
0 ns
15:08
15:10
15:12
P50
P90
P99
TCP Sent Bytes
N/A

Simple Bookstore App | Grafana - Istio Service Dashbo

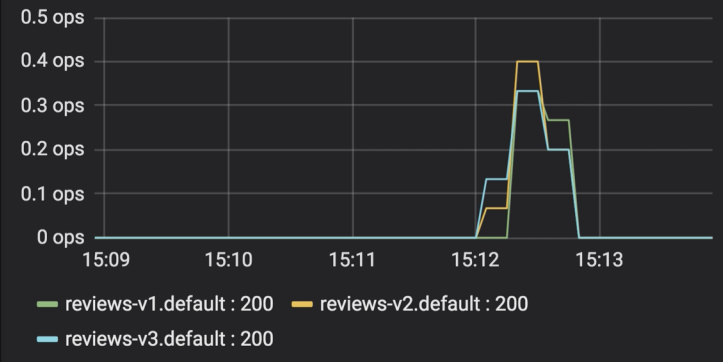
localhost:3001/d/LJ_uJAvmk/istio-service-dashboard?orgId=1&var-service=reviews.default.svc.cluster.local&var-srcns=All&var-srcwl=All&var-dstns=All&var-dstwl=All

Incognito

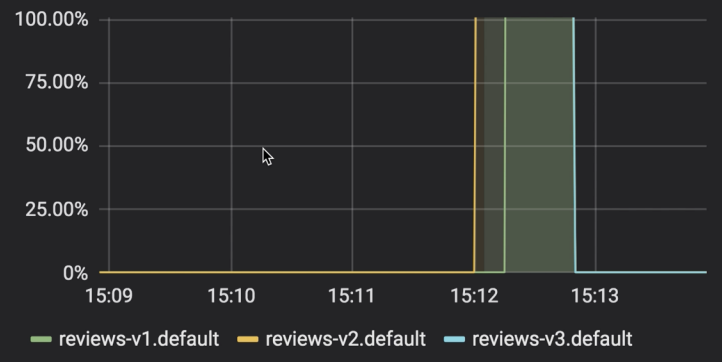
Istio Service Dashboard

Last 5 minutes | Refresh every 1...

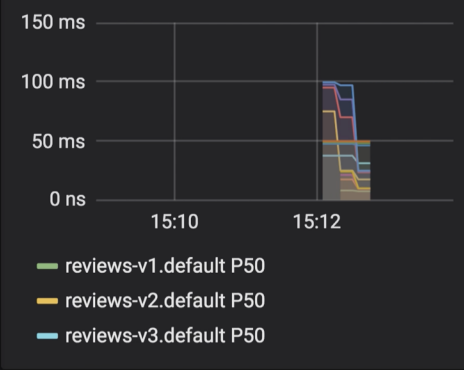
Incoming Requests by Destination And Response Code



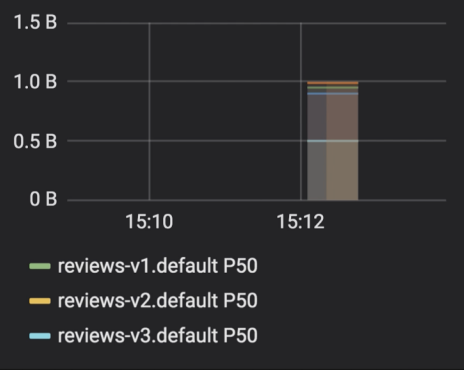
Incoming Success Rate (non-5xx responses) By Source



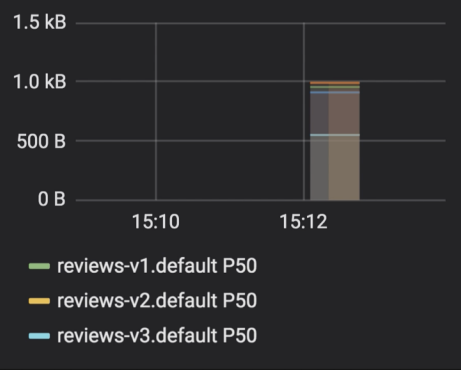
Incoming Request Duration by Source

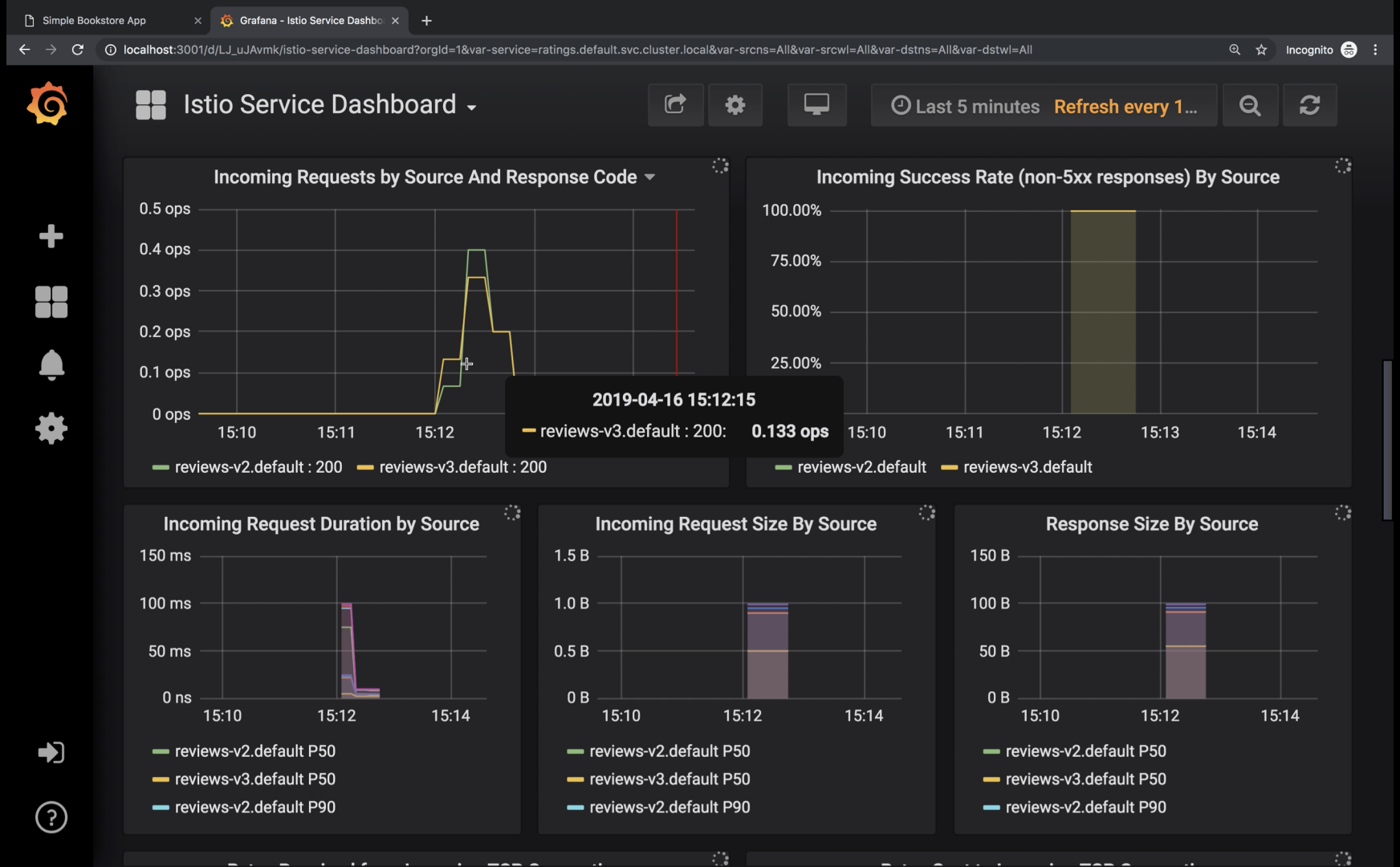


Incoming Request Size By Source



Response Size By Source




Simple Bookstore App
Grafana - Istio Service Dashbo
localhost:3001/d/LJ_uJAvmk/istio-service-dashboard?orgId=1&var-service=ratings.default.svc.cluster.local&var-srcns=All&var-srcwl=All&var-dstns=All&var-dstwl=All
Incognito
Istio Service Dashboard
Last 5 minutes
Refresh every 1...
Incoming Requests by Source And Response Code
0.5 ops
0.4 ops
0.3 ops
0.2 ops
0.1 ops
0 ops
15:10
15:11
15:12
2019-04-16 15:12:15
reviews-v3.default : 200: 0.133 ops
reviews-v2.default : 200
reviews-v3.default : 200
Incoming Success Rate (non-5xx responses) By Source
100.00%
75.00%
50.00%
25.00%
15:10
15:11
15:12
15:13
15:14
reviews-v2.default
reviews-v3.default
Incoming Request Duration by Source
150 ms
100 ms
50 ms
0 ns
15:10
15:12
15:14
reviews-v2.default P50
reviews-v3.default P50
reviews-v2.default P90
Incoming Request Size By Source
1.5 B
1.0 B
0.5 B
0 B
15:10
15:12
15:14
reviews-v2.default P50
reviews-v3.default P50
reviews-v2.default P90
Response Size By Source
150 B
100 B
50 B
0 B
15:10
15:12
15:14
reviews-v2.default P50
reviews-v3.default P50
reviews-v2.default P90

Simple Bookstore App | Grafana - Istio Workload Dashb | Jaeger UI

localhost:3002/jaeger/search?end=1555454221856000&limit=20&lookback=1h&maxDuration&minDuration&service=productpage.default&start=1555450621856000

Incognito

Jaeger UI | Lookup by Trace ID... | Search | Compare | Dependencies | About Jaeger

Find Traces

Service (6)

productpage.default

Operation (6)

all

Tags

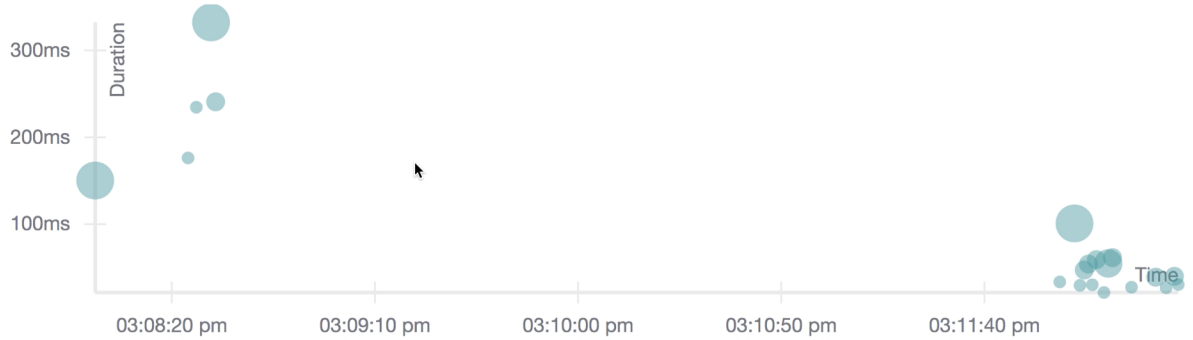
http.status_code=200 err

Lookback

Last Hour

Min Duration

e.g. 1.2s, 100ms, 500us



20 Traces

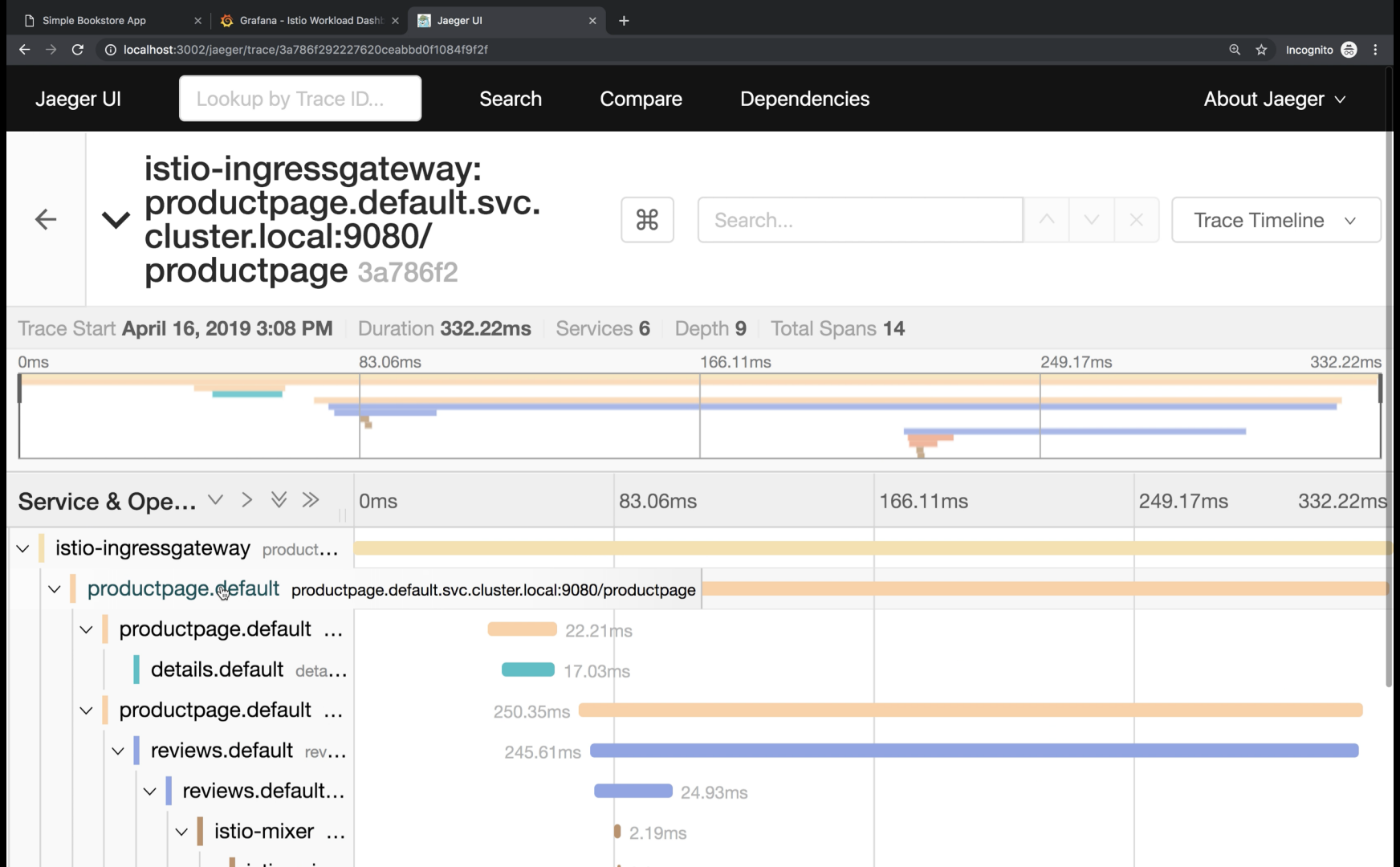
Sort: Most Recent

Compare traces by selecting result items

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

da85fe7

6 Spans | details.default (1) | istio-ingressgateway (1)


Simple Bookstore App
Grafana - Istio Workload Dashb
Jaeger UI
localhost:3002/jaeger/trace/3a786f292227620ceabbd0f1084f9f2f
Incognito
Jaeger UI
Lookup by Trace ID...
Search
Compare
Dependencies
About Jaeger
istio-ingressgateway: productpage.default.svc.cluster.local:9080/ productpage 3a786f2
Search...
Trace Timeline
Trace Start April 16, 2019 3:08 PM
Duration 332.22ms
Services 6
Depth 9
Total Spans 14
0ms
83.06ms
166.11ms
249.17ms
332.22ms
Service & Ope...
istio-ingressgateway product...
productpage.default productpage.default.svc.cluster.local:9080/productpage
productpage.default ...
22.21ms
details.default deta...
17.03ms
productpage.default ...
250.35ms
reviews.default rev...
245.61ms
reviews.default...
24.93ms
istio-mixer ...
2.19ms

Simple Bookstore App | Grafana - Istio Workload Dashb | Jaeger UI | Kiali Console

localhost:3003/kiali/console/graph/namespaces/?edges=hide&graphType=versionedApp&namespaces=default&injectServiceNodes=true&duration=60&pi=15000&layout=dagre

Incognito

kiali

admin

Overview

Graph

Applications

Workloads

Services

Istio Config

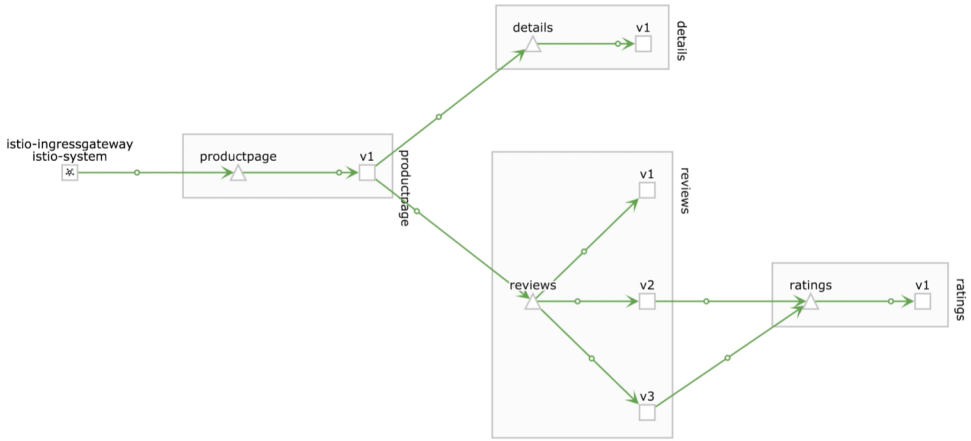
Namespace: **default**

Graph

Apr 16, 15:49:16 ... Apr 16, 15:50:16

Display | Edge Labels | Graph Type: Versioned app | Find... | Hide...

Fetching: Last min | Every 15 sec



Legend

Namespace: default

applications, services, workloads

Current Graph:

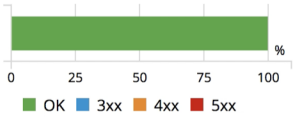
7 apps

4 services

11 edges

HTTP Traffic (requests per second):

Total	%Success	%Error
3.08	100.00	0.00

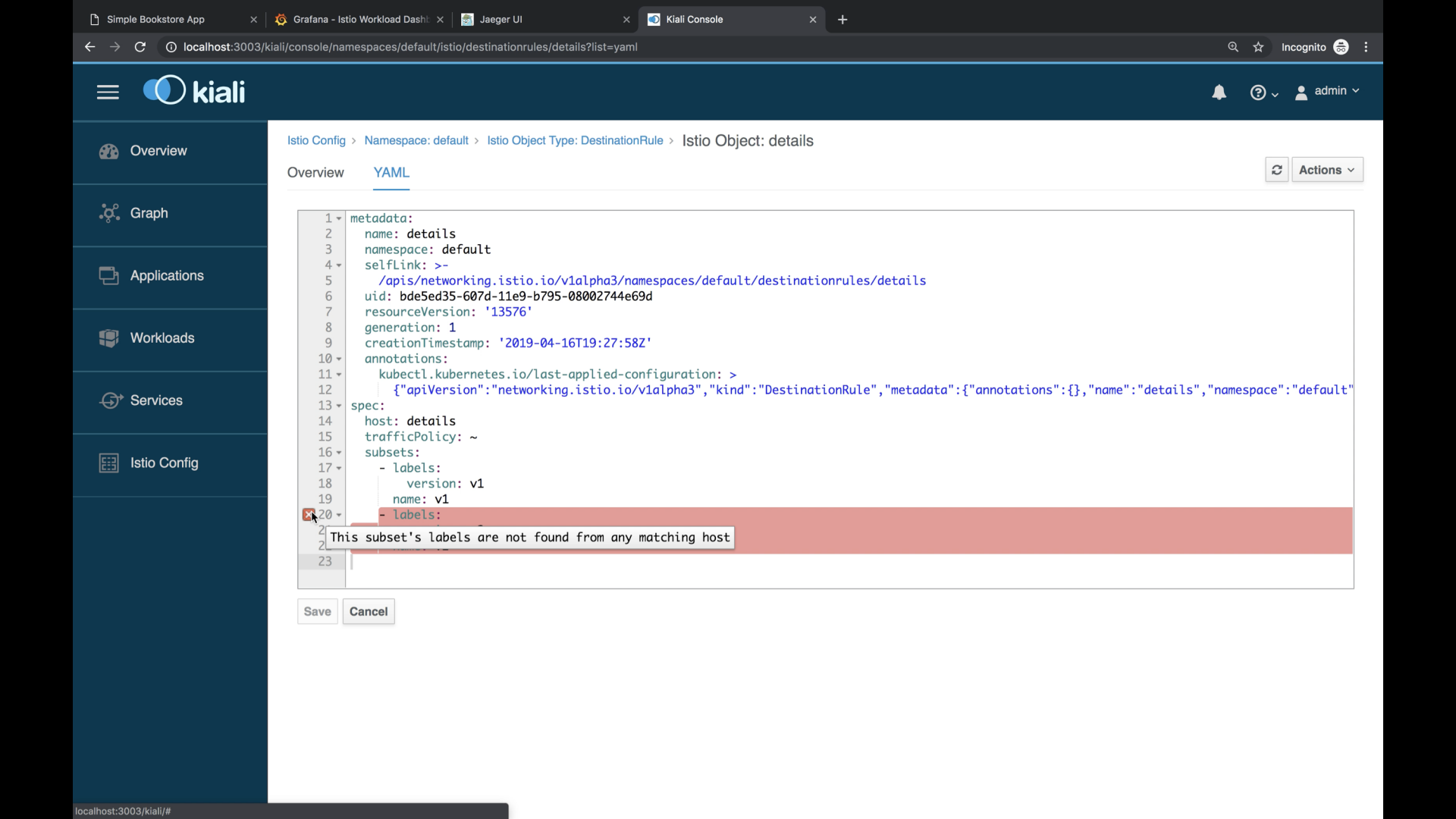


HTTP - Total Request Traffic min / max:

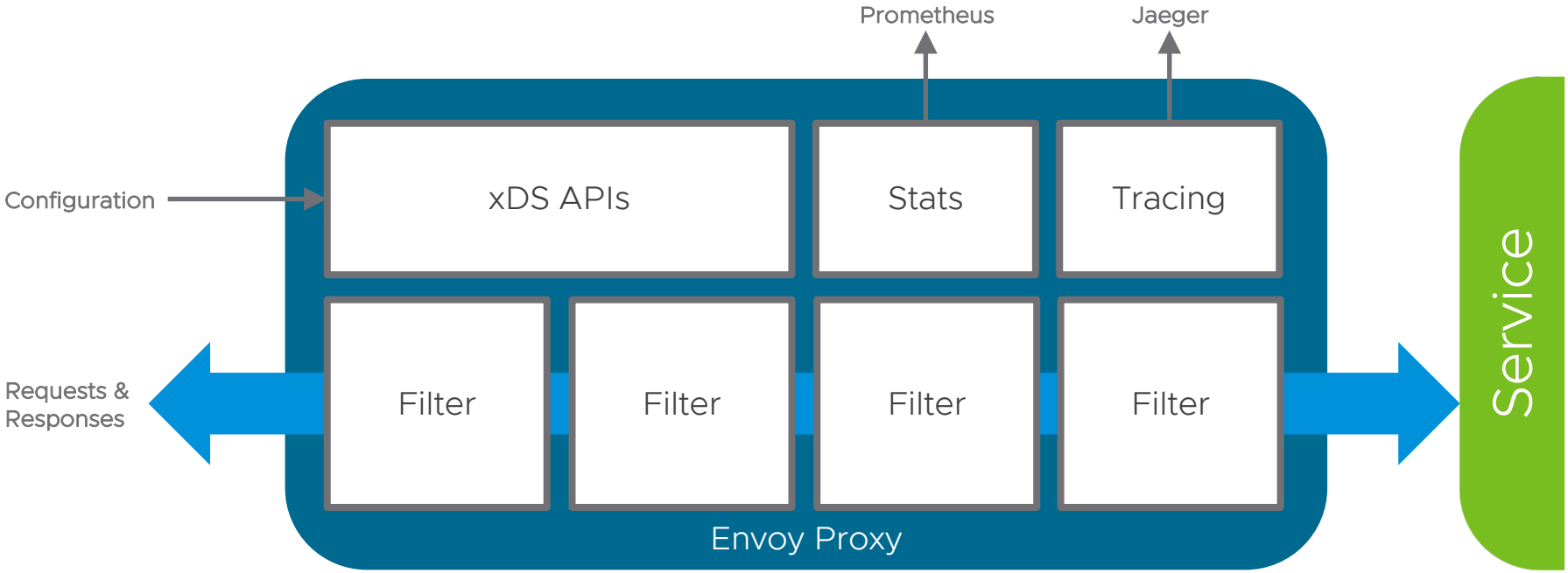
Not enough traffic to generate chart.

TCP - Total Traffic - min / max:

Not enough traffic to generate chart.


Simple Bookstore App
Grafana - Istio Workload Dashb
Jaeger UI
Kiali Console
localhost:3003/kiali/console/namespaces/default/istio/destinationrules/details?list=yaml
Incognito
kiali
admin
Overview
Graph
Applications
Workloads
Services
Istio Config
Istio Config > Namespace: default > Istio Object Type: DestinationRule > Istio Object: details
Overview
YAML
Actions
1 metadata:
2 name: details
3 namespace: default
4 selfLink: >-
5 /apis/networking.istio.io/v1alpha3/namespaces/default/destinationrules/details
6 uid: bde5ed35-607d-11e9-b795-08002744e69d
7 resourceVersion: '13576'
8 generation: 1
9 creationTimestamp: '2019-04-16T19:27:58Z'
10 annotations:
11 kubectl.kubernetes.io/last-applied-configuration: >
12 {"apiVersion":"networking.istio.io/v1alpha3","kind":"DestinationRule","metadata":{"annotations":{},"name":"details","namespace":"default"
13 spec:
14 host: details
15 trafficPolicy: ~
16 subsets:
17 - labels:
18 version: v1
19 name: v1
20 - labels:
This subset's labels are not found from any matching host
23
Save
Cancel
localhost:3003/kiali/#

The Envoy Proxy



gRPC – JSON Transcoder

Rate Limiting

vmware
©2019 VMware, Inc.

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

vmware ©2019 VMware, Inc.

Thank You

istio.io

envoyproxy.io

venilnoronha.io

venilnoronha

venilnoronha

vmware®

©2019 VMware, Inc.