

Lab 5

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Request Routing

Apply virtual services that will route all traffic to v1 of each microservice:

```
C:\istioctl-1.25.0-win>kubectl apply -f samples/bookinfo/networking/virtual-service-all-v1.yaml
virtualservice.networking.istio.io/productpage created
virtualservice.networking.istio.io/reviews created
virtualservice.networking.istio.io/ratings created
virtualservice.networking.istio.io/details created
```

Display the defined routes:

```
C:\istioctl-1.25.0-win>kubectl get virtualservices -o yaml
apiVersion: v1
```

apiVersion: v1

items:

- apiVersion: networking.istio.io/v1

kind: VirtualService

metadata:

annotations:

kubectl.kubernetes.io/last-applied-configuration: |

```
{ "apiVersion": "networking.istio.io/v1", "kind": "VirtualService", "metadata": { "annotations": {}, "name": "details", "namespace": "default" }, "spec": { "hosts": [ "details" ], "http": [ { "route": [ { "destination": { "host": "details", "subset": "v1" } } ] } ] }
```

creationTimestamp: "2025-03-23T20:52:51Z"

generation: 1

name: details

namespace: default

resourceVersion: "5938"

uid: 30ebb8c9-50a9-4b61-92ba-f9fe0317e506

spec:

hosts:

- details

http:

- route:

- destination:

host: details

subset: v1

- apiVersion: networking.istio.io/v1

kind: VirtualService

metadata:

annotations:

kubectl.kubernetes.io/last-applied-configuration: |

```
{"apiVersion":"networking.istio.io/v1","kind":"VirtualService","metadata":{"annotations":{},"name":"productpage","namespace":"default"},"spec":{"hosts":["productpage"],"http":[{"route":[{"destination":{"host":"productpage","subset":"v1"}}]}]}
```

creationTimestamp: "2025-03-23T20:52:51Z"

generation: 1

name: productpage

namespace: default

resourceVersion: "5935"

uid: 14519326-6930-4fb1-b5be-d0a79d6e2f84

spec:

hosts:

- productpage

http:

- route:

- destination:

host: productpage

subset: v1

- apiVersion: networking.istio.io/v1

kind: VirtualService

metadata:

annotations:

kubectl.kubernetes.io/last-applied-configuration: |

```
{"apiVersion":"networking.istio.io/v1","kind":"VirtualService","metadata":{"annotations":{},"name":"ratings","namespace":"default"},"spec":{"hosts":["ratings"],"http":[{"route":[{"destination":{"host":"ratings","subset":"v1"}}]}]}
```

creationTimestamp: "2025-03-23T20:52:51Z"

generation: 1

name: ratings

namespace: default

resourceVersion: "5937"

uid: 7a2bd9ab-536d-49c5-aab4-6c0c2729accd

spec:

hosts:

```

- ratings

http:

- route:

  - destination:

    host: ratings

    subset: v1

- apiVersion: networking.istio.io/v1

kind: VirtualService

metadata:

  annotations:

    kubectl.kubernetes.io/last-applied-configuration: |

{"apiVersion":"networking.istio.io/v1","kind":"VirtualService","metadata":{"annotations":{},"name":"reviews","namespace":"default"},"spec":{"hosts":["reviews"],"
http":[{"route":[{"destination":{"host":"reviews","subset":"v1"}}]}]}}

  creationTimestamp: "2025-03-23T20:52:51Z"

  generation: 1

  name: reviews

  namespace: default

  resourceVersion: "5936"

  uid: b0c41ec6-f675-4caf-803a-74d170c5afe8

spec:

  hosts:

  - reviews

  http:

  - route:

    - destination:

      host: reviews

      subset: v1

kind: List

metadata:

  resourceVersion: ""

```

Test the new routing configuration:


```
C:\istioctl-1.25.0-win>kubectl apply -f samples/bookinfo/networking/virtual-service-ratings-test-delay.yaml
virtualservice.networking.istio.io/ratings configured
```

Confirm the rule was created:

```
C:\istioctl-1.25.0-win>kubectl get virtualservice ratings -o yaml
apiVersion: networking.istio.io/v1
kind: VirtualService
metadata:
  annotations:
    kubernetes.io/last-applied-configuration: |
      {"apiVersion":"networking.istio.io/v1","kind":"VirtualService","metadata":{"annotations":{},"name":"ratings","namespace":"default"},"spec":{"hosts":["ratings"],"http":[{"fault":{"delay":{"fixedDelay":"7s","percentage":{"value":100}}},"match":[{"headers":{"end-user":{"exact":"jason"}}}],route":[{"destination":{"host":"ratings","subset":"v1"}}]}]}
  creationTimestamp: "2025-03-23T20:52:51Z"
  generation: 2
  name: ratings
  namespace: default
  resourceVersion: "7100"
  uid: 7a2bd9ab-536d-49c5-aab4-6c0c2729accd
spec:
  hosts:
  - ratings
  http:
  - fault:
      delay:
        fixedDelay: 7s
        percentage:
          value: 100
      match:
      - headers:
          end-user:
            exact: jason
        route:
        - destination:
            host: ratings
            subset: v1
    - route:
        - destination:
            host: ratings
            subset: v1
```

Injecting an HTTP abort fault

Creating a fault injection rule to send an HTTP abort for user Jason:

```
C:\istioctl-1.25.0-win>kubectl apply -f samples/bookinfo/networking/virtual-service-ratings-test-abort.yaml
virtualservice.networking.istio.io/ratings configured
```


Confirming the rule was created:

```
C:\istioctl-1.25.0-win>kubectl get virtualservice ratings -o yaml
apiVersion: networking.istio.io/v1
kind: VirtualService
metadata:
  annotations:
    kubernetes.io/last-applied-configuration: |
      {"apiVersion":"networking.istio.io/v1","kind":"VirtualService","metadata":{"annotations":{},"name":"ratings","namespace":"default"},"spec":{"hosts":["ratings"],"http":[{"abort":{"httpStatus":500,"percentage":{"value":100}}},"match":[{"headers":{"end-user":{"exact":"jason"}}}],route":[{"destination":{"host":"ratings","subset":"v1"}}]}]}
  creationTimestamp: "2025-03-23T20:52:51Z"
  generation: 3
  name: ratings
  namespace: default
  resourceVersion: "9359"
  uid: 7a2bd9ab-536d-49c5-aab4-6c0c2729accd
spec:
  hosts:
  - ratings
  http:
  - fault:
      abort:
        httpStatus: 500
        percentage:
          value: 100
      match:
      - headers:
          end-user:
            exact: jason
        route:
        - destination:
            host: ratings
            subset: v1
    - route:
        - destination:
            host: ratings
            subset: v1
```

Testing the page:

localhost:8080/productpage

BookInfo Sample

 jason
Sign out

The Comedy of Errors

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.

[Learn more about Istio --](#)


Book Details

ISBN-10	Publisher	Pages	Type	Language
1234567890	PublisherA	200	paperback	English

Book Reviews


★★★★★

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

 Reviewer1
Reviews served by: reviews-v2-5fdf9886c7-znm16

★★★★☆

"Absolutely fun and entertaining. The play lacks thematic depth when compared to other plays by Shakespeare."

 Reviewer2
Reviews served by: reviews-v2-5fdf9886c7-znm16


Traffic Shifting

Route all traffic to the v1 version:

```
C:\istioctl-1.25.0-win>kubectl apply -f samples/bookinfo/networking/virtual-service-all-v1.yaml
virtualservice.networking.istio.io/productpage unchanged
virtualservice.networking.istio.io/reviews configured
virtualservice.networking.istio.io/ratings configured
virtualservice.networking.istio.io/details unchanged
```

localhost:8080/productpage

BookInfo Sample

 jason
Sign out

The Comedy of Errors

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.


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Book Details


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Book Reviews

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

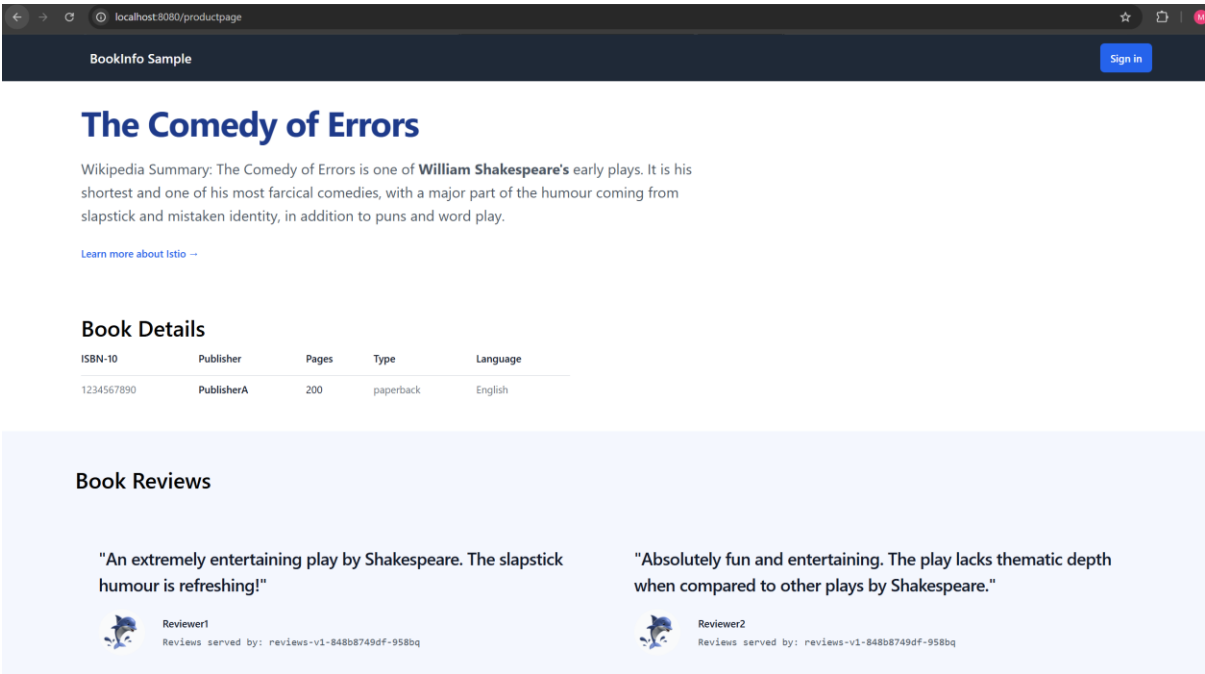
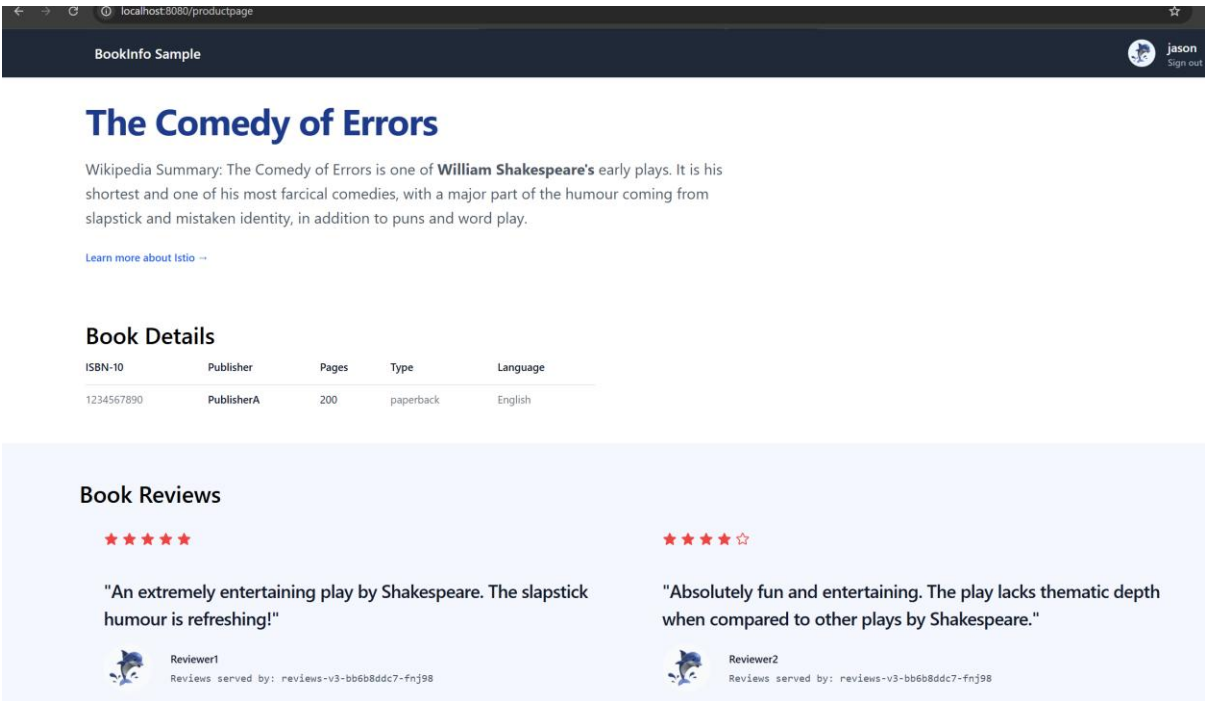
 Reviewer1
Reviews served by: reviews-v1-848b8749df-958bq

"Absolutely fun and entertaining. The play lacks thematic depth when compared to other plays by Shakespeare."

 Reviewer2
Reviews served by: reviews-v1-848b8749df-958bq

Transfer 50% of the traffic from reviews:v1(does not access the rating services) to reviews:v3 (accesses the rating services) with the following command:

```
C:\istioctl-1.25.0-win>kubectl apply -f samples/bookinfo/networking/virtual-service-reviews-50-v3.yaml
virtualservice.networking.istio.io/reviews configured
```



The Comedy of Errors

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.

[Learn more about Istio →](#)

Book Details

ISBN-10	Publisher	Pages	Type	Language
1234567890	PublisherA	200	paperback	English

Book Reviews

★★★★★

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



Reviewer1

Reviews served by: reviews-v2-5fdf9886c7-znm16

★★★★☆

"Absolutely fun and entertaining. The play lacks thematic depth when compared to other plays by Shakespeare."



Reviewer2

Reviews served by: reviews-v2-5fdf9886c7-znm16

Route 100% of the traffic to reviews:v3:

```
C:\istioctl-1.25.0-win>kubectl apply -f samples/bookinfo/networking/virtual-service-reviews-v3.yaml
virtualservice.networking.istio.io/reviews configured
```

Circuit Breaking

Deploy the httpbin service:

Creating a destination rule and verification that the destination rule was created correctly.

```
C:\istioctl-1.25.0-win>kubectl apply -f samples/httpbin/httpbin.yaml
serviceaccount/httpbin unchanged
service/httpbin unchanged
deployment.apps/httpbin unchanged

C:\istioctl-1.25.0-win>kubectl get destinationrule httpbin -o yaml
apiVersion: networking.istio.io/v1
kind: DestinationRule
metadata:
  annotations:
    kubectrl.kubernetes.io/last-applied-configuration: |
      {"apiVersion":"networking.istio.io/v1","kind":"DestinationRule","metadata":{"annotations":{},"name":"httpbin","namespace":"default"},"spec":{"host":"httpbin","trafficPolicy":{"connectionPool":{"http":{"http1MaxPendingRequests":1,"maxRequestsPerConnection":1},"tcp":{"maxConnections":1},"outlierDetection":{"baseEjectionTime":"3m","consecutive5xxErrors":1,"interval":"1s","maxEjectionPercent":100}}}}}
  creationTimestamp: "2025-03-23T21:54:37Z"
  generation: 1
  name: httpbin
  namespace: default
  resourceVersion: "11167"
  uid: e90c42c0-74b8-488b-8730-228a16c9907b
spec:
  host: httpbin
  trafficPolicy:
    connectionPool:
      http:
        http1MaxPendingRequests: 1
        maxRequestsPerConnection: 1
      tcp:
        maxConnections: 1
    outlierDetection:
      baseEjectionTime: 3m
      consecutive5xxErrors: 1
      interval: 1s
      maxEjectionPercent: 100
```

```
C:\istioctl-1.25.0-win>kubectl apply -f samples/httpbin/sample-client/fortio-deploy.yaml
service/fortio unchanged
deployment.apps/fortio-deploy unchanged
```


Create a destination rule to apply circuit breaking settings when calling the httpbin service:

```
1  apiVersion: networking.istio.io/v1
2  kind: DestinationRule
3  metadata:
4    name: httpbin
5  spec:
6    host: httpbin
7    trafficPolicy:
8      connectionPool:
9        tcp:
10         maxConnections: 1
11        http:
12         http1MaxPendingRequests: 1
13         maxRequestsPerConnection: 1
14      outlierDetection:
15        consecutive5xxErrors: 1
16        interval: 1s
17        baseEjectionTime: 3m
18        maxEjectionPercent: 100
```

Verification of the destination rule:

```
c:\istioctl-1.25.0-win>kubectl get destinationrule httpbin -o yaml
apiVersion: networking.istio.io/v1
kind: DestinationRule
metadata:
  annotations:
    kubectl.kubernetes.io/last-applied-configuration: |
      {"apiVersion": "networking.istio.io/v1", "kind": "DestinationRule", "metadata": {"annotations": {}, "name": "httpbin", "namespace": "default", "spec": {"host": "httpbin", "trafficPolicy": {"connectionPool": {"http": {"http1MaxPendingRequests": 1, "maxRequestsPerConnection": 1}, "tcp": {"maxConnections": 1}}, "outlierDetection": {"baseEjectionTime": "3m", "consecutiveSxxErrors": "1", "interval": "1s", "maxEjectionPercent": 100}}}}}
  creationTimestamp: "2025-03-23T21:54:37Z"
  generation: 1
  name: httpbin
  namespace: default
  resourceVersion: "11167"
  uid: e90c42c0-74b8-488b-8730-228a16c9907b
spec:
  host: httpbin
  trafficPolicy:
    connectionPool:
      http:
        http1MaxPendingRequests: 1
        maxRequestsPerConnection: 1
      tcp:
        maxConnections: 1
    outlierDetection:
      baseEjectionTime: 3m
      consecutiveSxxErrors: 1
      interval: 1s
      maxEjectionPercent: 100
```

Inject the client with the Istio sidecar proxy:

```
maxEjectionPercent: 100
C:\istioctl-1.25.0-win>kubectl apply -f samples/httpbin/sample-client/fortio-deploy.yaml
service/fortio created
deployment.apps/fortio-deploy created
```

The command starts the fortio tool in the pod we just set in the FORTIO_POD variable (in this case fortio-deploy-74ffb9b4d6-lfxmn), and makes an HTTP request to the httpbin service in the Kubernetes cluster:

```
C:\istioctl-1.25.0-win>kubectl get pods --selector=app=fortio --no-headers
fortio-deploy-74ffb9b4d6-lfxmn 1/1 Running 1 (45h ago) 45h

C:\istioctl-1.25.0-win>set FORTIO_POD=fortio-deploy-74ffb9b4d6-lfxmn

C:\istioctl-1.25.0-win>kubectl exec %FORTIO_POD% -c fortio -- /usr/bin/fortio curl -quiet http://httpbin:8000/get
HTTP/1.1 200 OK
Access-Control-Allow-Credentials: true
Access-Control-Allow-Origin: *
Content-Type: application/json; charset=utf-8
Date: Tue, 25 Mar 2025 19:51:09 GMT
Content-Length: 226

{
  "args": {},
  "headers": {
    "Host": [
      "httpbin:8000"
    ],
    "User-Agent": [
      "fortio.org/fortio-1.66.5"
    ]
  },
  "method": "GET",
  "origin": "10.244.0.25:55026",
  "url": "http://httpbin:8000/get"
}
```

Call the service with two concurrent connections (-c 2) and send 20 requests (-n 20):

```
C:\istioctl-1.25.0-win>kubectl exec %FORTIO_POD% -c fortio -- /usr/bin/fortio load -c 2 -qps 0 -n 20 -loglevel Warning http://httpbin:8000/get
{"ts":"1742932637.764774","level":"info","r":1,"file":"logger.go","line":290,"msg":"Log level is now 3 Warning (was 2 Info)"}
Fortio 1.66.5 running at 0 queries per second, 16->16 procs, for 20 calls: http://httpbin:8000/get
Starting at max qps with 2 thread(s) [gomax 16] for exactly 20 calls (10 per thread + 0)
Ended after 20.647488ms : 20 calls. qps=968.64
Aggregated Function Time : count 20 avg 0.0019682602 +/- 0.003666 min 0.000310555 max 0.012853701 sum 0.039365204
# range, mid point, percentile, count
>= 0.000310555 <= 0.001 , 0.000655278 , 70.00, 14
> 0.001 <= 0.002 , 0.0015 , 85.00, 3
> 0.002 <= 0.003 , 0.0025 , 90.00, 1
> 0.012 <= 0.0128537 , 0.0124269 , 100.00, 2
# target 50% 0.000787863
# target 75% 0.00133333
# target 90% 0.003
# target 99% 0.0127683
# target 99.9% 0.0128452
Error cases : no data
# Socket and IP used for each connection:
[0] 1 socket used, resolved to 10.111.201.33:8000, connection timing : count 1 avg 0.00089938 +/- 0 min 0.00089938 max 0.00089938 sum 0.00089938
[1] 1 socket used, resolved to 10.111.201.33:8000, connection timing : count 1 avg 0.000851776 +/- 0 min 0.000851776 max 0.000851776 sum 0.000851776
Connection time (s) : count 2 avg 0.000875578 +/- 2.38e-05 min 0.000851776 max 0.00089938 sum 0.001751156
Sockets used: 2 (for perfect keepalive, would be 2)
Uniform: false, Jitter: false, Catchup allowed: true
IP addresses distribution:
10.111.201.33:8000: 2
Code 200 : 20 (100.0 %)
Response Header Sizes : count 20 avg 196 +/- 0 min 196 max 196 sum 3920
Response Body/Total Sizes : count 20 avg 422 +/- 0 min 422 max 422 sum 8440
All done 20 calls (plus 0 warmup) 1.968 ms avg, 968.6 qps
```

Bring the number of concurrent connections up to 3:

```
C:\istioctl-1.25.0-win>kubectl exec %FORTIO_POD% -c fortio -- /usr/bin/fortio load -c 3 -qps 0 -n 30 -loglevel Warning http://httpbin:8000/get
{"ts":"1742932729.101864","level":"info","r":1,"file":"logger.go","line":290,"msg":"Log level is now 3 Warning (was 2 Info)"}
Fortio 1.66.5 running at 0 queries per second, 16->16 procs, for 30 calls: http://httpbin:8000/get
Starting at max qps with 3 thread(s) [gomax 16] for exactly 30 calls (10 per thread + 0)
Ended after 7.116027ms : 30 calls. qps=4215.8
Aggregated Function Time : count 30 avg 0.00068097597 +/- 0.0007796 min 0.000219983 max 0.003234977 sum 0.020429279
# range, mid point, percentile, count
>= 0.000219983 <= 0.001 , 0.000609992 , 90.00, 27
> 0.002 <= 0.003 , 0.0025 , 96.67, 2
> 0.003 <= 0.00323498 , 0.00311749 , 100.00, 1
# target 50% 0.000639992
# target 75% 0.000864997
# target 90% 0.001
# target 99% 0.00316448
# target 99.9% 0.00322793
Error cases : no data
# Socket and IP used for each connection:
[0] 1 socket used, resolved to 10.111.201.33:8000, connection timing : count 1 avg 0.000428752 +/- 0 min 0.000428752 max 0.000428752 sum 0.000428752
[1] 1 socket used, resolved to 10.111.201.33:8000, connection timing : count 1 avg 0.000428966 +/- 0 min 0.000428966 max 0.000428966 sum 0.000428966
[2] 1 socket used, resolved to 10.111.201.33:8000, connection timing : count 1 avg 0.000460269 +/- 0 min 0.000460269 max 0.000460269 sum 0.000460269
Connection time (s) : count 3 avg 0.000439329 +/- 1.481e-05 min 0.000428752 max 0.000460269 sum 0.001317987
Sockets used: 3 (for perfect keepalive, would be 3)
Uniform: false, Jitter: false, Catchup allowed: true
IP addresses distribution:
10.111.201.33:8000: 3
Code 200 : 30 (100.0 %)
Response Header Sizes : count 30 avg 196 +/- 0 min 196 max 196 sum 5880
Response Body/Total Sizes : count 30 avg 422 +/- 0 min 422 max 422 sum 12660
All done 30 calls (plus 0 warmup) 0.681 ms avg, 4215.8 qps
```

Query the Istio proxy (pilot-agent) to get statistics about network traffic and load on the httpbin service:

```
C:\istioctl-1.25.0-win>kubectl exec %FORTIO_POD% -c istio-proxy -- pilot-agent request GET stats | findstr httpbin | findstr pending
cluster.outbound|8000||httpbin.default.svc.cluster.local;.circuit_breakers.default.remaining_pending: 1
cluster.outbound|8000||httpbin.default.svc.cluster.local;.circuit_breakers.default.rq_pending_open: 0
cluster.outbound|8000||httpbin.default.svc.cluster.local;.circuit_breakers.high.rq_pending_open: 0
```