Istio

1. install istioctl

```
$ curl -L https://git.io/getLatestIstio | sh -
$ cd istio-1.17.2/
```

2. install istio

```
$ istioctl install
```

3. Envoy 사이드카 Injection label 설정

```
$ kubectl label namespace default istio-injection=enabled
```

확인해본다.

```
$ kubectl get namespaces --show-labels
```

```
[ec2-user@ip-10-0-0-95 istio-1.17.2]$ kubectl get namespaces --show-labels
NAME              STATUS   AGE    LABELS
default           Active   63m    istio-injection=enabled,kubernetes.io/metadata.name=default
istio-system      Active   102s   kubernetes.io/metadata.name=istio-system
kube-node-lease   Active   63m    kubernetes.io/metadata.name=kube-node-lease
kube-public       Active   63m    kubernetes.io/metadata.name=kube-public
kube-system       Active   63m    kubernetes.io/metadata.name=kube-system
```

4. 서비스 배포

아래 yaml 파일을 가지고 서비스들을 배포해주도록 해준다.

```
#nginx-service
apiVersion: v1
kind: Service
metadata:
  name: nginx
  labels:
    app: nginx
    service: nginx
spec:
  ports:
  - port: 80
```

```
    name: http
  selector:
    app: nginx
---
apiVersion: v1
kind: ServiceAccount
metadata:
  name: service-nginx
  labels:
    account: nginx
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: nginx-v1
  labels:
    app: nginx
    version: v1
spec:
  replicas: 1
  selector:
    matchLabels:
      app: nginx
      version: v1
  template:
    metadata:
      labels:
        app: nginx
        version: v1
    spec:
      serviceAccountName: service-nginx
      containers:
      - name: nginx
        image: nginx:latest
        imagePullPolicy: IfNotPresent
        ports:
        - containerPort: 80
---
# httpdpage services
```

```
apiVersion: v1
kind: Service
metadata:
  name: httpdpage
  labels:
    app: httpdpage
    service: httpdpage
spec:
  ports:
  - port: 80
    name: http
  selector:
    app: httpdpage
---
apiVersion: v1
kind: ServiceAccount
metadata:
  name: service-httpdpage
  labels:
    account: httpdpage
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: httpdpage-v1
  labels:
    app: httpdpage
    version: v1
spec:
  replicas: 1
  selector:
    matchLabels:
      app: httpdpage
      version: v1
  template:
    metadata:
      labels:
        app: httpdpage
        version: v1
```

```
    spec:
      serviceAccountName: service-httpdpage
      containers:
      - name: httpd
        image: httpd:latest
        imagePullPolicy: IfNotPresent
        ports:
        - containerPort: 80
        volumeMounts:
        - name: tmp
          mountPath: /tmp
      volumes:
      - name: tmp
        emptyDir: {}
---
```

5. 게이트웨이 생성

```
apiVersion: networking.istio.io/v1alpha3
kind: Gateway
metadata:
  name: service-gateway
spec:
  selector:
    istio: ingressgateway
  servers:
  - port:
      number: 80
      name: http
      protocol: HTTP
    hosts:
    - "*"
---
apiVersion: networking.istio.io/v1alpha3
kind: VirtualService
metadata:
  name: httpdpage-nginx
spec:
  hosts:
```

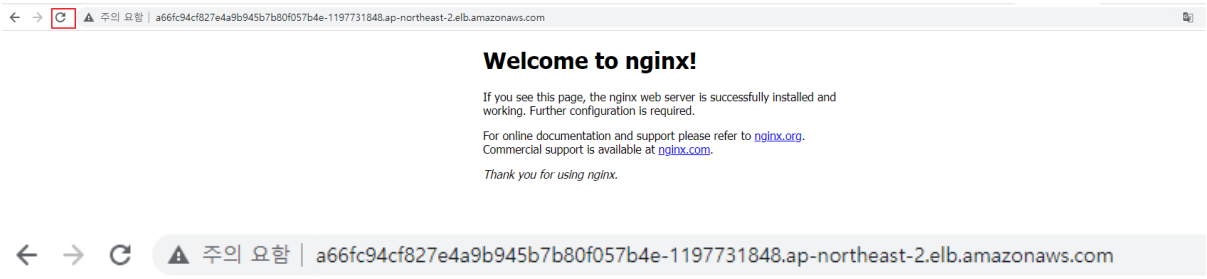
```
  - "*"
  gateways:
  - service-gateway
  http:
  - route:
    - destination:
        host: httpdpage
        port:
          number: 80
      weight: 50
    - destination:
        host: nginx
        port:
          number: 80
      weight: 50
```

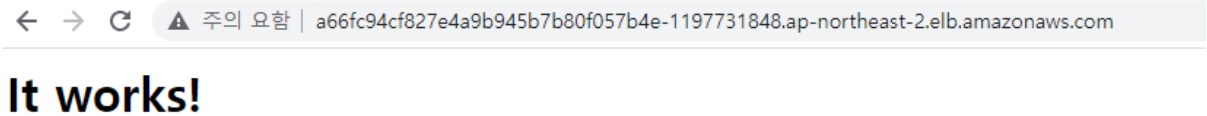
6. nlb 적용

```
apiVersion: install.istio.io/v1alpha1
kind: IstioOperator
spec:
  values:
    gateways:
      istio-ingressgateway:
        serviceAnnotations:
          service.beta.kubernetes.io/aws-load-balancer-type: "nlb"
```

```
$ istioctl upgrade -f nlb.yaml
```

nlb 주소로 접근하면 nginx 페이지 또는 httpd 페이지가 표시된 것을 확인할 수 있다.





It works!

7. 새로운 버전의 nginx page 생성

아래는 hello world가 표시되는 두번째 버전의 nginx이다.

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: nginx-v2
  labels:
    app: nginx
    version: v2
spec:
  replicas: 1
  selector:
    matchLabels:
      app: nginx
      version: v2
  template:
    metadata:
      labels:
        app: nginx
        version: v2
    spec:
      serviceAccountName: service-nginx
      containers:
      - name: nginx
        image: nginx:latest
        imagePullPolicy: IfNotPresent
        ports:
        - containerPort: 80
        volumeMounts:
        - name: html-volume
          mountPath: /usr/share/nginx/html
      volumes:
      - name: html-volume
        configMap:
          name: nginx-config
---
apiVersion: v1
kind: ConfigMap
```

```
metadata:
  name: nginx-config
data:
  index.html: |
    <html>
    <body>
    <h1>Hello, world!</h1>
    </body>
    </html>
```

8. DestinationRule 작성

버전 라우팅을 제어하기 위해 DestinationRule을 작성하여 사용가능한 버전을 정의해준다.

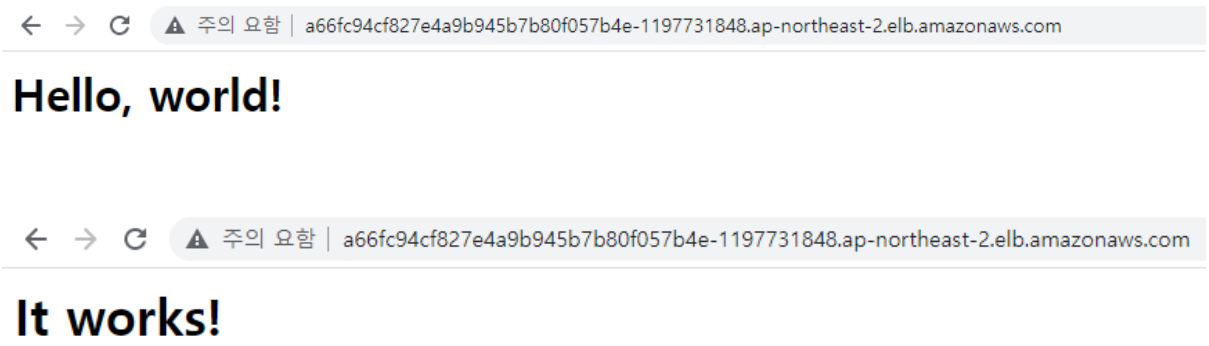
```
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: httpdpage
spec:
  host: httpdpage
  subsets:
  - name: v1
    labels:
      version: v1
---
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: nginx
spec:
  host: nginx
  subsets:
  - name: v1
    labels:
      version: v1
  - name: v2
    labels:
      version: v2
```

9. 특정 버전만 서비스 하기

VirtualService에서 subnet을 지정하면 특정 버전만 서비스 할 수 있게된다. 생성한 nginx는 총 2가지 버전이 있는데 v2만 서비스 할 수 있게끔 구성하였다.

```
apiVersion: networking.istio.io/v1alpha3
kind: VirtualService
metadata:
  name: httpdpage-nginx
spec:
  hosts:
  - "*"
  gateways:
  - service-gateway
  http:
  - route:
    - destination:
        host: httpdpage
        subset: v1
        port:
          number: 80
      weight: 50
    - destination:
        host: nginx
        subset: v2
        port:
          number: 80
      weight: 50
```

nlb 접근시 hello, world 페이지와 httpd 페이지만 표시되는걸 확인할 수 있다.



10. Circuit breaking

Circuit breaking은 문제가 되는 기능자체를 동작하지 않도록 하여, 장애가 전파되지 않게 해준다.

Circuit break 대상이 되는 httpbin 앱을 설치해준다. httpbin은 echo 응답앱이다.

```
$ kubectl label namespace default istio-injection=enabled
$ kubectl apply -f ./samples/httpbin/httpbin.yaml
```

마이크로서비스 로드 테스트 툴인 fortio를 설치한다.

```
$ kubectl apply -f samples/httpbin/sample-client/fortio-deploy.yaml
```

fortio으로 httpbin 앱에 요청을 전송해준다.

```
$ export FORTIO_POD=$(kubectl get pods -lapp=fortio -o 'jsonpath={.items[0].metadata.name}')
$ kubectl exec "$FORTIO_POD" -c fortio -- /usr/bin/fortio curl -quiet http://httpbin:8000/get
```

응답은 다음과 같다.

```
  },
  "origin": "127.0.0.6",
  "url": "http://httpbin:8000/get"
}
HTTP/1.1 200 OK
server: envoy
date: Sun, 14 May 2023 05:41:16 GMT
content-type: application/json
content-length: 594
access-control-allow-origin: *
access-control-allow-credentials: true
x-envoy-upstream-service-time: 16
```

Prometheus를 설치한다.

```
$ kubectl apply -f https://raw.githubusercontent.com/istio/istio/master/samples/addons/prometheus.yaml
```

kiali를 설치하여 확인해준다.

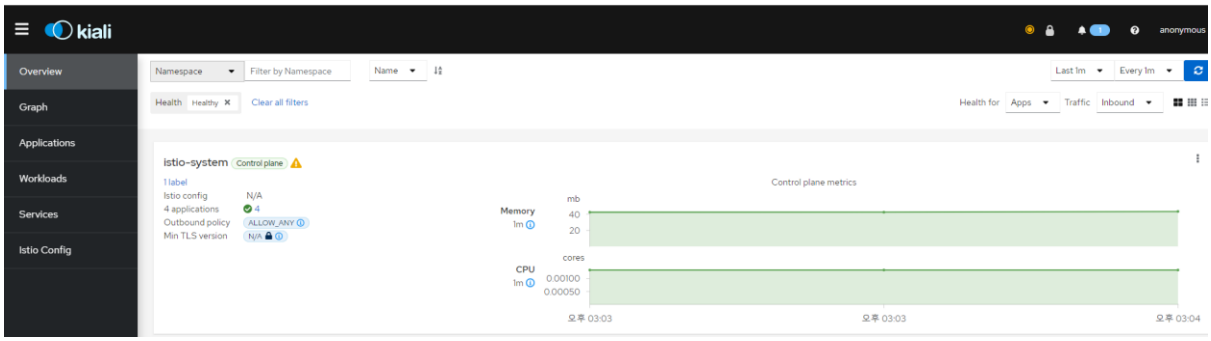
```
$ kubectl apply -f https://raw.githubusercontent.com/istio/istio/master/samples/addons/kiali.yaml
```

```
apiVersion: v1
kind: Service
metadata:
```

```
  name: kiali
  namespace: istio-system
spec:
  selector:
    app: kiali
  type: LoadBalancer
  ports:
    - protocol: TCP
      port: 80
      targetPort: 20001
```

kiali에 들어가준다.

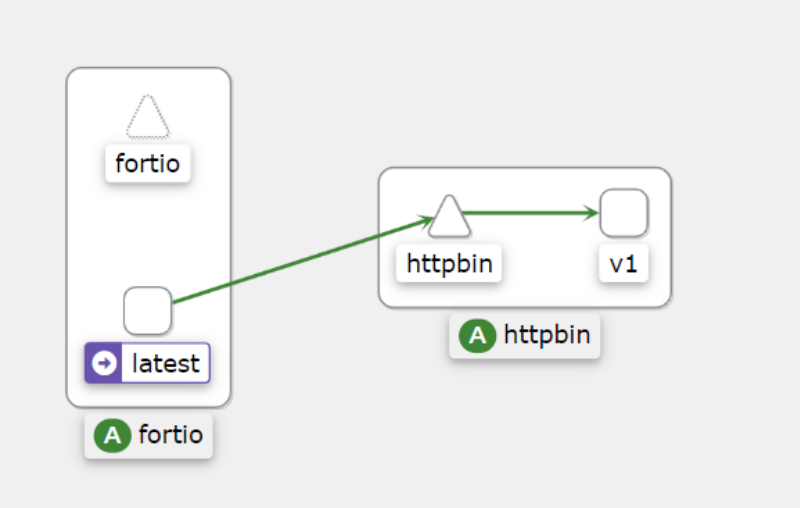
다음 페이지가 표시된다.



그래프에 들어가준다.

테스트를 진행한다.

```
$ kubectl exec "$FORTIO_POD" -c fortio -- /usr/bin/fortio load -c 2 -qps 0 -n 20 -loglevel Warning
http://httpbin:8000/get
```



그래프의 흐름을 관찰할 수 있다.

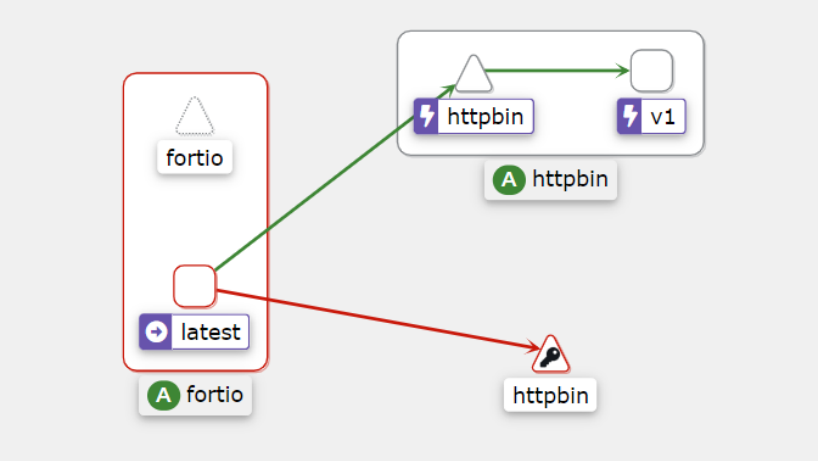
11. 최소한의 커넥션만 허용하도록 설정

```
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: httpbin
spec:
  host: httpbin
  trafficPolicy:
    connectionPool:
      tcp:
        maxConnections: 1
      http:
        http1MaxPendingRequests: 1
        maxRequestsPerConnection: 1
    outlierDetection:
      consecutiveErrors: 1
      interval: 1s
      baseEjectionTime: 3m
      maxEjectionPercent: 100
```

테스트 -> 동시 연결수를 최대 3개로 늘리고 30개의 요청을 보낸다.

```
$ kubectl exec "$FORTIO_POD" -c fortio -- /usr/bin/fortio load -c 3 -qps 0 -n 30 -loglevel Warning
http://httpbin:8000/get
```

Circuit break가 작동되었을 때 다음과 같이 표시된다.



12. Grafana 설치

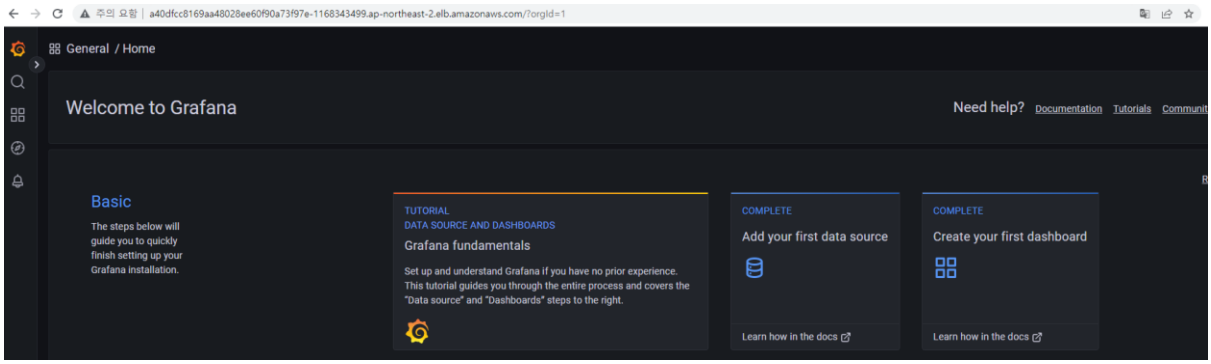
```
$ kubectl apply -f https://raw.githubusercontent.com/istio/istio/master/samples/addons/grafana.yaml
```

로드벨런서 서비스 생성

```
apiVersion: v1
kind: Service
metadata:
  name: grafana
  namespace: istio-system
spec:
  selector:
    app: grafana
  type: LoadBalancer
  ports:
    - protocol: TCP
      port: 80
      targetPort: 3000
```

```
$ kubectl get svc -A
```

```
[ec2-user@ip-10-0-0-95 istio-1.17.2]$ kubectl get svc -A
NAMESPACE      NAME                  TYPE           CLUSTER-IP       EXTERNAL-IP                                                                    PORT(S)                  AGE
default        fortio                ClusterIP      172.20.70.249    <none>                                                                         8080/TCP                 37m
default        httpbin               ClusterIP      172.20.254.68    <none>                                                                         8000/TCP                 39m
default        httpdpage             ClusterIP      172.20.176.169   <none>                                                                         80/TCP                   76m
default        kubernetes            ClusterIP      172.20.0.1       <none>                                                                         443/TCP                  3h17m
default        nginx                 ClusterIP      172.20.65.248    <none>                                                                         80/TCP                   77m
istio-system   grafana               LoadBalancer   172.20.11.56     a40dfcc8169aa48028ee60f90a73f97e-1168343499.ap-northeast-2.elb.amazonaws.com   80:31634/TCP             92s
```



13. jaeger install

Jaeger는 end to end 분산 추적 시스템으로 사용자는 복잡한 분산 시스템에서 트랜잭션을 모니터링하고 문제를 해결할 수 있다.

```
$ kubectl apply -f https://raw.githubusercontent.com/istio/istio/master/samples/addons/jaeger.yaml
```

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: jaeger
  namespace: istio-system
  labels:
    app: jaeger
spec:
  selector:
    matchLabels:
      app: jaeger
  template:
    metadata:
      labels:
        app: jaeger
      annotations:
        sidecar.istio.io/inject: "false"
        prometheus.io/scrape: "true"
        prometheus.io/port: "14269"
    spec:
      containers:
        - name: jaeger
```

```
            image: "docker.io/jaegertracing/all-in-one:1.18"
            env:
              - name: BADGER_EPHEMERAL
                value: "false"
              - name: SPAN_STORAGE_TYPE
                value: "badger"
              - name: BADGER_DIRECTORY_VALUE
                value: "/badger/data"
              - name: BADGER_DIRECTORY_KEY
                value: "/badger/key"
              - name: COLLECTOR_ZIPKIN_HTTP_PORT
                value: "9411"
              - name: MEMORY_MAX_TRACES
                value: "50000"
              - name: QUERY_BASE_PATH
                value: /jaeger
            livenessProbe:
              httpGet:
                path: /
                port: 14269
            readinessProbe:
              httpGet:
                path: /
                port: 14269
            volumeMounts:
              - name: data
                mountPath: /badger
            resources:
              requests:
                cpu: 10m
        volumes:
          - name: data
            emptyDir: {}
---
apiVersion: v1
kind: Service
metadata:
  name: tracing
  namespace: istio-system
```

```
  labels:
    app: jaeger
spec:
  type: LoadBalancer
  ports:
    - name: http-query
      port: 80
      protocol: TCP
      targetPort: 16686
  selector:
    app: jaeger
---
# Jaeger implements the Zipkin API. To support swapping out the tracing backend, we use a Service named Zipkin.
apiVersion: v1
kind: Service
metadata:
  labels:
    name: zipkin
  name: zipkin
  namespace: istio-system
spec:
  ports:
    - port: 9411
      targetPort: 9411
      name: http-query
  selector:
    app: jaeger
```

서비스를 조회하면 다음과 같은 주소가 표시된다.

```
$ kubectl get svc -A
```

```
istio-system   tracing                  LoadBalancer   172.20.140.96    a41f16d033bc2414ba20f827af90961b-214673756.ap-northeast-2.elb.amazonaws.com   80:31895/TCP   24m
                3m50s
```

접속하면 다음과 같은 페이지가 표시된다.