Lab 8 - Automated Analysis and Experiments with Prometheus and Grafana

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Setup Metrics Server

If you try to pull monitoring information using the following commands

```
kubectl top pod

kubectl top node
```

it does not show it, rather gives you a error message similar to

[output]

```
Error from server (NotFound): the server could not find the requested resource
(get services http:heapster:)
```

Even though the error mentions heapster, its replaced with metrics server by default now.

Deploy metric server with the following commands,

```
cd ~
git clone https://github.com/schoolofdevops/metrics-server.git
kubectl apply -k metrics-server/manifests/overlays/release
```

Validate

```
kubectl get deploy,pods -n kube-system --selector='k8s-app=metrics-server'
```

You could validate again with

```
kubectl top pod

kubectl top node
```

where expected output should be similar to,

```
kubectl top node

NAME                 CPU(cores)   CPU%   MEMORY(bytes)   MEMORY%
kind-control-plane   123m         6%     688Mi           17%
kind-worker          39m          1%     498Mi           12%
kind-worker2         31m          1%     422Mi           10%
```

If you see a similar output, monitoring is now been setup.

Deploy Prometheus and Grafana

Set up repository

```
helm repo add prometheus-community https://prometheus-community.github.io/helm-charts
helm repo update
```

Install Prometheus and Grafana as

```
helm upgrade --install prom -n monitoring \
  prometheus-community/kube-prometheus-stack \
  --create-namespace \
  --set grafana.service.type=NodePort \
  --set grafana.service.nodePort=30400 \
  --set prometheus.prometheusSpec.podMonitorSelectorNilUsesHelmValues=false \
  --set prometheus.prometheusSpec.serviceMonitorSelectorNilUsesHelmValues=false
```

Redeploy Nginx Ingress Controller

Re deploy nginx ingress controller with helm, this time enabling the exposing the metrics which can then be scraped/collected by prometheus.

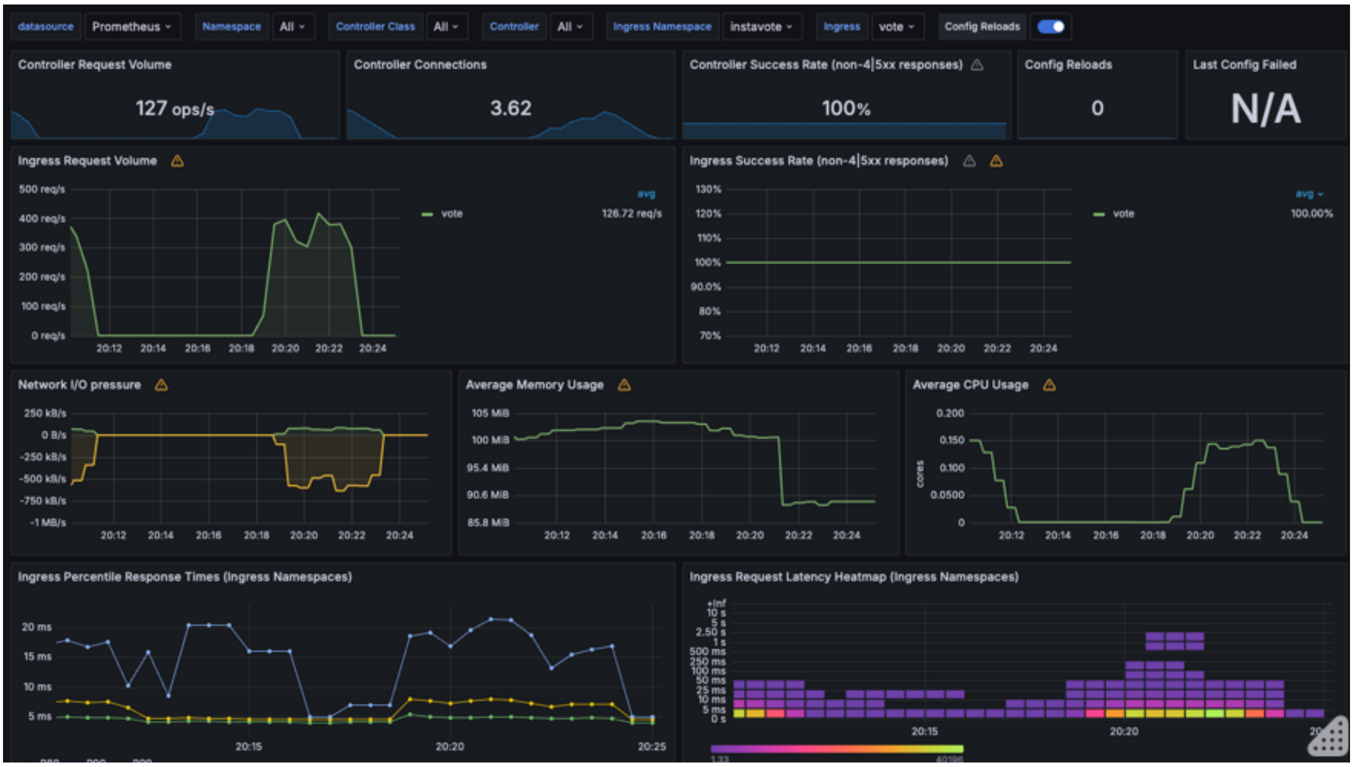
```
helm upgrade --install ingress-nginx ingress-nginx \
  --repo https://kubernetes.github.io/ingress-nginx \
  --namespace ingress-nginx --create-namespace \
  --set controller.metrics.enabled=true \
  --set controller.metrics.serviceMonitor.enabled=true --set \
controller.metrics.serviceMonitor.additionalLabels.release="prometheus" \
  --set controller.hostPort.enabled=true \
  --set controller.hostPort.ports.http=80 \
  --set controller.hostPort.ports.https=443 \
  --set controller.service.type=NodePort \
  --set-string controller.nodeSelector."kubernetes\.io/os"=linux \
  --set-string controller.nodeSelector.ingress-ready="true"
```

Setup Grafana Dashboard for Nginx Ingress Controller

Now, login to grafana and import custom dashboard for Nginx Ingress as

- Left menu (hover over +) ➔ Dashboard
- Click "Import"
- Enter the copy pasted json from https://raw.githubusercontent.com/kubernetes/ingress-nginx/main/deploy/grafana/dashboards/nginx.json
- Click Import JSON
- Select the Prometheus data source
- Click "Import"

It may look similar to this, with possibly less data initially



However, if you see some metric coming in, your setup with Nginx Ingress and Promethus Integration is working ! You may pat your back at this time :)

Updated Rollout Configuration with Experiment and Analysis

File: `/prod/rollout.yaml`

```
apiVersion: argoproj.io/v1alpha1
kind: Rollout
metadata:
  name: vote
spec:
  replicas: 5
  strategy:
    blueGreen: null
    canary:
      canaryService: vote-preview
      stableService: vote
      steps:
      - setCanaryScale:
          replicas: 2
      - experiment:
          duration: 3m
          templates:
          - name: canary
            specRef: canary
            service:
              name: experiment
          analyses:
            - name: fitness-test
              templateName: canary-fitness-test
      - setWeight: 20
      - pause:
          duration: 10s
      - setWeight: 40
      - pause:
          duration: 10s
      - setWeight: 60
      - analysis:
          templates:
          - templateName: loadtest
          - templateName: latency
      - setWeight: 80
      - pause:
          duration: 10s
      - setWeight: 100
      trafficRouting:
        nginx:
          stableIngress: vote
          additionalIngressAnnotations:
            canary-by-header: X-Canary
            canary-by-header-value: siege
```

Explanation

- **Rollout Configuration**:

- The rollout strategy includes canary steps with set weights and pauses.

- Each canary step includes an experiment with a specified duration (e.g., 3 minutes).
- The experiment step runs a experimental replicaset and launches a fitness test to validate if the new version looks okay.

- After 60% traffic is shifted to canary, a load test is lauched along with analysis from prometheus to check if the new version will perform okay with the load.

- **Analysis Templates**:

- Defines a templates for running various tests and analyses.

- The `loadtest` container runs the load testing script against the canary service (`vote-preview`).
- The `fitness-test` job runs a test to validate if the new version is fit for deployment.
- the `latency` analysis fetches latency metrics from Prometheus and checks if the application is responding in acceptable time frame even with load conditions.

How it Works

- At each setWeight step, traffic is gradually shifted to the canary version.
- The analysis step includes both the load test and the metric analysis.
- The experiment runs for 3 minutes, during which the fitness test is conducted.
- Simultaneously with load test , the analysis template checks Prometheus metrics to ensure the canary is performing correctly.
- If the analysis detects errors beyond the acceptable threshold, the rollout will trigger a rollback.
- If the canary passes the load test and analysis, the rollout proceeds to the next step.

By configuring the experiment and analysis to run in parallel, you can ensure comprehensive testing and validation of the canary version, enabling automatic rollback if any issues are detected.

Template for Load Testing

File `prod/loadtest-analysistemplate.yaml`

```
apiVersion: argoproj.io/v1alpha1
kind: AnalysisTemplate
metadata:
  name: loadtest
```

```
spec:
  metrics:
  - name: loadtest-vote
    provider:
      job:
        spec:
          template:
            spec:
              containers:
              - name: siege
                image: schoolofdevops/loadtest:v1
                command:
                  - siege
                  - "--concurrent=2"
                  - "--benchmark"
                  - "--time=5m"
                  - "--header='X-Canary: siege'"
                  - "http://vote.example.com"
              restartPolicy: Never
              hostAliases:
              - ip: "xx.xx.xx.xx"
                hostnames:
                - "vote.example.com"
          backoffLimit: 4
```

where, * replace `xx.xx.xx.xx` with internal IP Address of `worker` node. Find out by using

```
kubectl get nodes -o wide
```

[sample output]

```
NAME                 STATUS   ROLES           AGE     VERSION   INTERNAL-IP
EXTERNAL-IP   OS-IMAGE                         KERNEL-VERSION     CONTAINER-
RUNTIME
kind-control-plane   Ready    control-plane   2d23h   v1.30.0   172.18.0.2
<none>        Debian GNU/Linux 12 (bookworm)   6.8.0-31-generic   containerd://
1.7.15
kind-worker          Ready    <none>          2d23h   v1.30.0   172.18.0.4
<none>        Debian GNU/Linux 12 (bookworm)   6.8.0-31-generic   containerd://
1.7.15
kind-worker2         Ready    <none>          2d23h   v1.30.0   172.18.0.3
<none>        Debian GNU/Linux 12 (bookworm)   6.8.0-31-generic   containerd://
```

```
1.7.15
```

From this output, you are going to use `172.18.0.4` in the configuration above.

AnalysisTemplate for Prometheus Metrics

File : `prod/latency-analysistemplate.yaml`

```
apiVersion: argoproj.io/v1alpha1
kind: AnalysisTemplate
metadata:
  name: latency
spec:
  metrics:
  - name: nginx-latency-ms
    initialDelay: 1m
    interval: 1m
    failureLimit: 2
    count: 4
    successCondition: result < 50.0
    failureCondition: result >= 50.0
    provider:
      prometheus:
        address: http://prom-kube-prometheus-stack-
prometheus.monitoring.svc.cluster.local:9090
        query: |
          scalar(
            1000 * histogram_quantile(0.99,
              sum(
                rate(

nginx_ingress_controller_request_duration_seconds_bucket{ingress="vote",
exported_namespace="prod"}[1m]
                )
              ) by (le)
            )
          )
```

Fitness Test for Canary

File: `prod/fitness-analysistemplate.yaml`

```
apiVersion: argoproj.io/v1alpha1
kind: AnalysisTemplate
metadata:
  name: canary-fitness-test
spec:
  metrics:
  - name: canary-fitness
    interval: 30s
    count: 3
    successCondition: result == "true"
    failureLimit: 1
    provider:
      job:
        spec:
          template:
            spec:
              containers:
              - name: fitness-test
                image: curlimages/curl
                command: ["/bin/sh", "-c"]
                args:
                - |
                  FITNESS_RESULT="false"
                  CANARY_SERVICE_URL="http://vote-preview"

                  # Perform the fitness test
                  RESPONSE=$(curl -s $CANARY_SERVICE_URL)

                  # Check if the response contains the expected string
                  if [[ "$RESPONSE" == *"Processed by container ID"* ]]; then
                    FITNESS_RESULT="true"
                  fi

                  # Return the fitness test result
                  echo $FITNESS_RESULT
              restartPolicy: Never
          backoffLimit: 1
```

Update Kustomization for Prod

File : `prod/kustomization.yaml`

```
apiVersion: kustomize.config.k8s.io/v1beta1
kind: Kustomization
resources:
- ../base
- ingress.yaml
- fitness-analysistemplate.yaml
- latency-analysistemplate.yaml
- loadtest-analysistemplate.yaml
```

apply

```
kustomize build prod
kubectl apply -k prod
```

watch the rollout using

```
kubectl argo rollouts get rollout  vote
```

#courses/argo/labs/v1