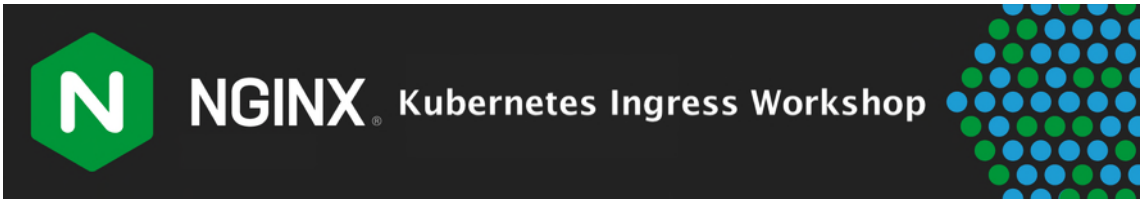


Nginx Plus Ingress Controller Workshop

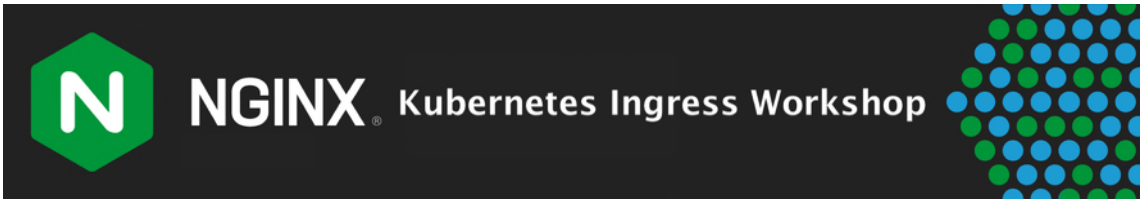
Welcome

Welcome to the Nginx Plus Workshop for Kubernetes Ingress Controller (KIC)! This Workshop will introduce Nginx Plus Ingress Controller with hands-on practice through self-paced lab exercises.

You will learn how to configure an `Nginx Plus Ingress Controller`, deploy it on a Kubernetes cluster, configure advanced Nginx Plus features, loadtest it, scale it up and down and monitor it in realtime. You will deploy new apps and services in your private cluster, terminate SSL, route HTTP traffic, configure redirects, set up healthchecks, and load balance traffic to running pods.

These Hands-On Lab Exercises are designed to build upon each other, adding additional services and features as you progress through them, completing the labs in sequential order is required.

By the end of this Workshop, you will have a working, operational Nginx Plus Ingress Controller, routing traffic to and from Kubernetes application pods and services, with the necessary skills to



Nginx Plus Ingress Controller Workshop

Overview

Welcome to the Nginx Plus Workshop for Kubernetes Ingress Controller (KIC)!

This Workshop will introduce Nginx Plus Ingress Controller with hands-on practice through self-paced lab exercises. You will learn how to deploy an Nginx Plus Ingress Controller on a Kubernetes cluster, configure basic and advanced Nginx Plus features; and then test it, and monitor it in realtime.

Nginx Plus Ingress	Hands-On Labs
	

The Hands-On Lab Exercises are designed to build upon each other, adding additional services and features as you progress through them. `It is important to complete the lab exercises in sequential order.`

By the end of this Workshop, you will have a working, operational Nginx Plus Ingress Controller, with the skills to deploy and operate one for your Digital Enterprise Kubernetes projects.

Prerequisites

- Students: UDF Account Registered with an Email Address

Client Machine

- Local Computer with Microsoft Remote Desktop application installed.

Lab Client Machine

- Ubuntu Jumphost
- Chrome Browser
- All labs are completed using RDP to an Ubuntu Jumphost.

Ubuntu	Chrome	Remote Desktop
		

** Prerequisite Knowledge **

It is `highly recommended` for Students attending this Workshop to be familiar with Nginx and have some experience with Kubernetes administration, networking tools, and Load Balancing concepts. Previous experience with VisualStudio Code is also helpful.

VisualStudio Code	Kubernetes	Nginx Plus
		

An excellent Prerequisite for taking this Workshop is the Nginx Basics Workshop, also available from F5 Networks, as it provides a fundamental basics of Nginx Plus, on which the Nginx Plus Ingress Controller is built. Please contact your Nginx Event Marketing team for information on additional Workshops.

Lab Outline

Lab 1: Lab Overview and Student access

- Lab 1: Workshop Lab Overview

Lab 2: Verify Nginx Plus Ingress Controller is running

- Lab 2: Verify Nginx Plus Ingress Controller is running

Lab 3: Configuring Nginx Ingress Controller

- Lab 3: Configure Nginx Ingress

Lab 4: Access Nginx Plus Dashboard

- Lab 4: Enable Nginx Plus Dashboard

Lab 5: Deploy Nginx Cafe Demo using manifests

- Lab 5: Deploy Nginx Cafe Demo

Lab 6: HTTP load testing the Cafe Application

- Lab 6: HTTP Load Testing

Lab 7: Scaling up/down the Cafe Application

- Lab 7: Scaling Cafe Ingress

Lab 8: Monitoring KIC with Prometheus and Grafana

- Lab 8: Prometheus and Grafana

Lab 9: Retail App using Virtual Server / VSRoute

- Lab9: VirtualServer/VSRroute

Lab 10: Advanced Nginx Plus features with VirtualServer/VSRoute

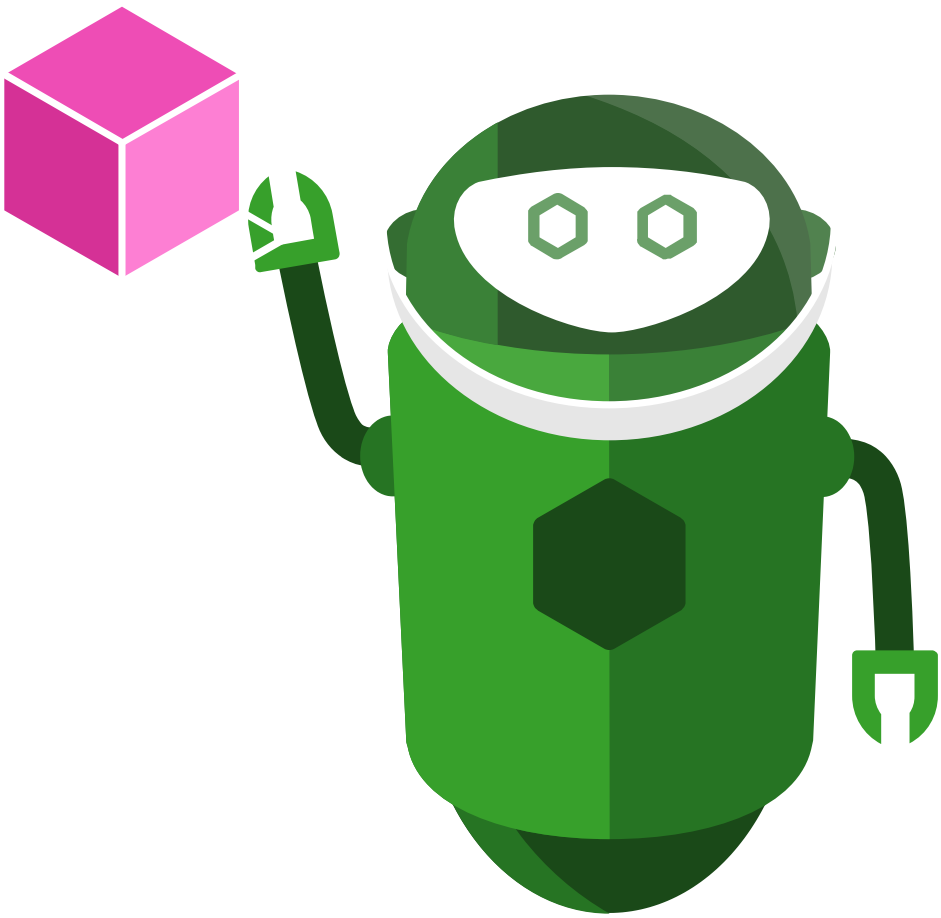
- Lab10: Advanced Nginx Plus

Authors

- Jason Williams - Product Management Engineer @ F5, Inc.
- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

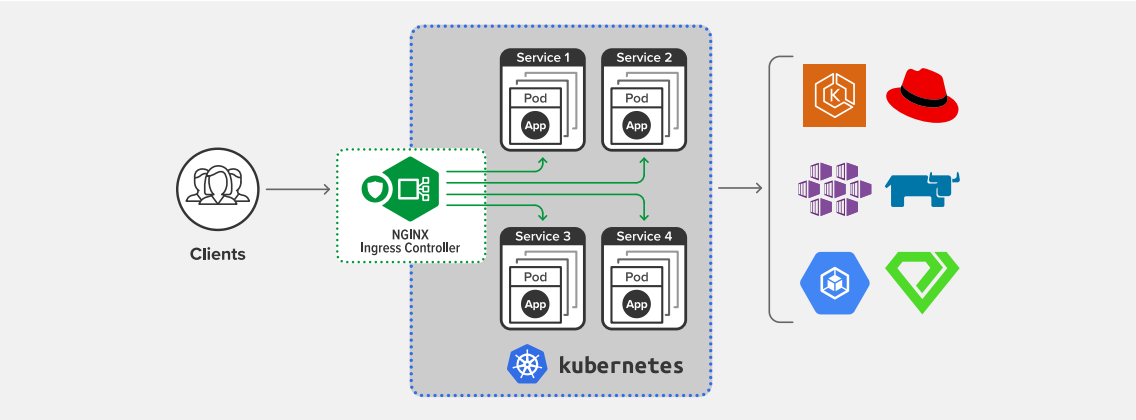
Click Lab1: Workshop Lab Overview to get started!

deploy and operate KIC for your own Digital Enterprise Applications running in Kubernetes. Thank You for taking the time to attend this Nginx Workshop!



About Nginx Plus Ingress Controller

Nginx Plus Ingress Controller is an Enterprise-Ready resource for directing traffic to/from a Kubernetes Cluster. Nginx runs all popular K8s frameworks, including Amazon EKS, Google GCP, Redhat Openshift, Azure AKS and others. It can also work with your on-premise Data Center based K8s clusters. Nginx Plus Ingress Controller is built from the same source code you know and trust from Nginx Plus. You can find the full Kubernetes support matrix and technical specifications for Nginx Ingress Controller on the http://www.nginx.com website.



Nginx Ingress Controller has the best-in-class traffic management solution for cloud-native apps in Kubernetes and containerized environments. In a recent CNCF survey, nearly two-thirds of respondents reported using the Nginx Ingress Controller, more than all other controllers combined – and Nginx Ingress Controller has been downloaded more than 10 million times on DockerHub.

Combining the speed and performance of Nginx with the trust and security behind F5 Networks, Nginx Plus Ingress Controller is synonymous with high-performing, scalable, and secure modern apps in production.

https://docs.nginx.com/nginx-ingress-controller/intro/nginx-plus/

https://docs.nginx.com/nginx-ingress-controller/technical-specifications/

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.
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This completes the Introduction.
Click on (LabGuide) to begin the workshop.

Lab 1: Lab Overview and Student Access

Introduction

In this lab you will setup the workshop environment and prepare the Jumphost where you will be doing the labs from. You will be using the Microsoft `RDP protocol` to connect to an Ubuntu Desktop Jumphost. It has `VisualStudio Code` editor with a built-in bash terminal with tools like `kubectl` and `curl` already loaded to be used by the student.

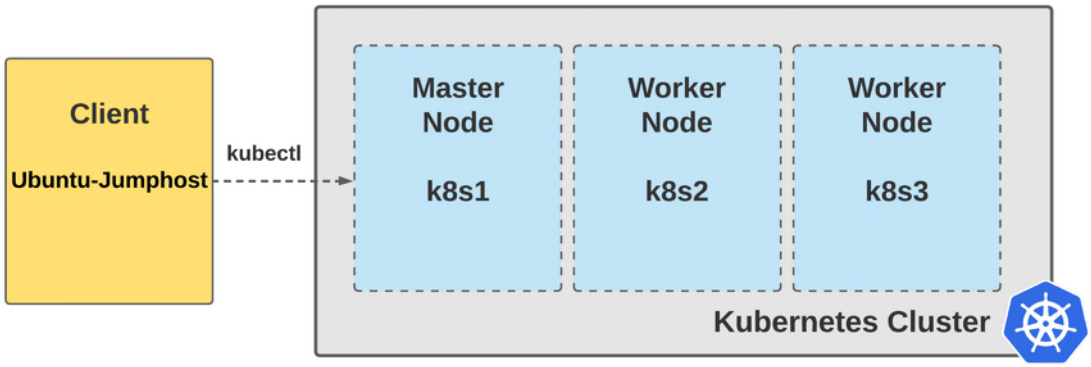
> ***Important:*** *All lab exercises must be run from the* `Ubuntu Desktop` *Jumphost in order to complete them successfully.*

Learning Objectives

By the end of the lab, you will be able to:

- Understand the components of the Workshop environment
- Connect to Jumphost with an RDP(Remote Desktop Protocol) client
- Ready to start the Workshop labs

The Basic Architecture of the lab is shown here for reference:



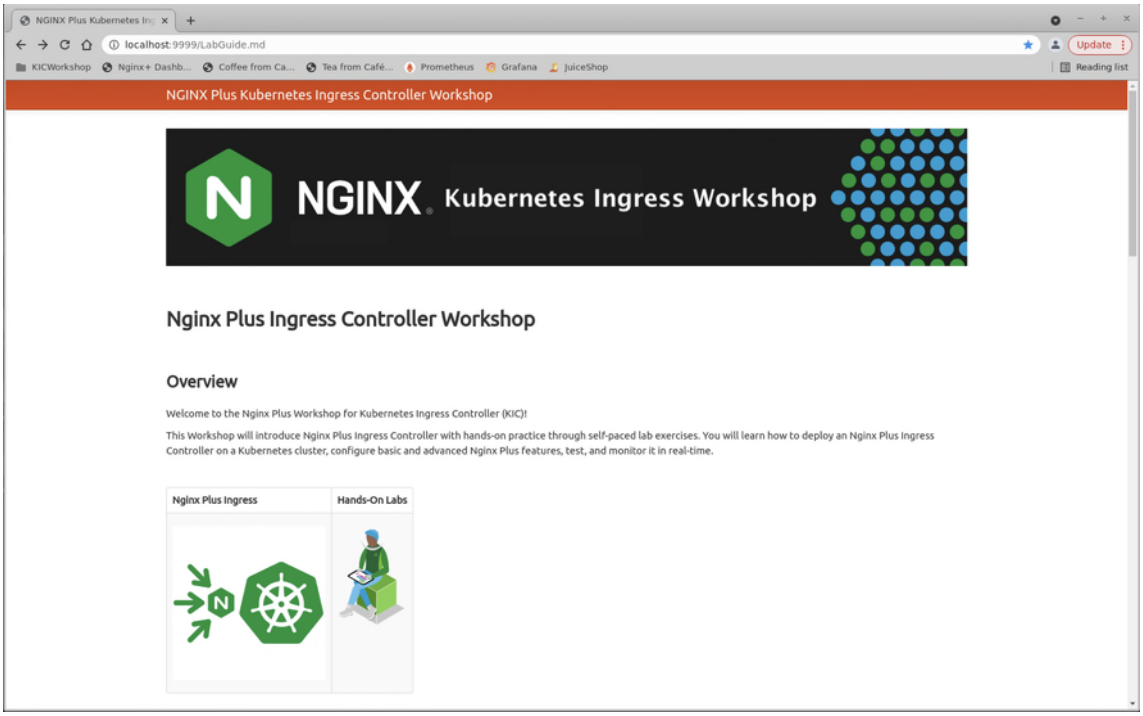
Access Jumphost

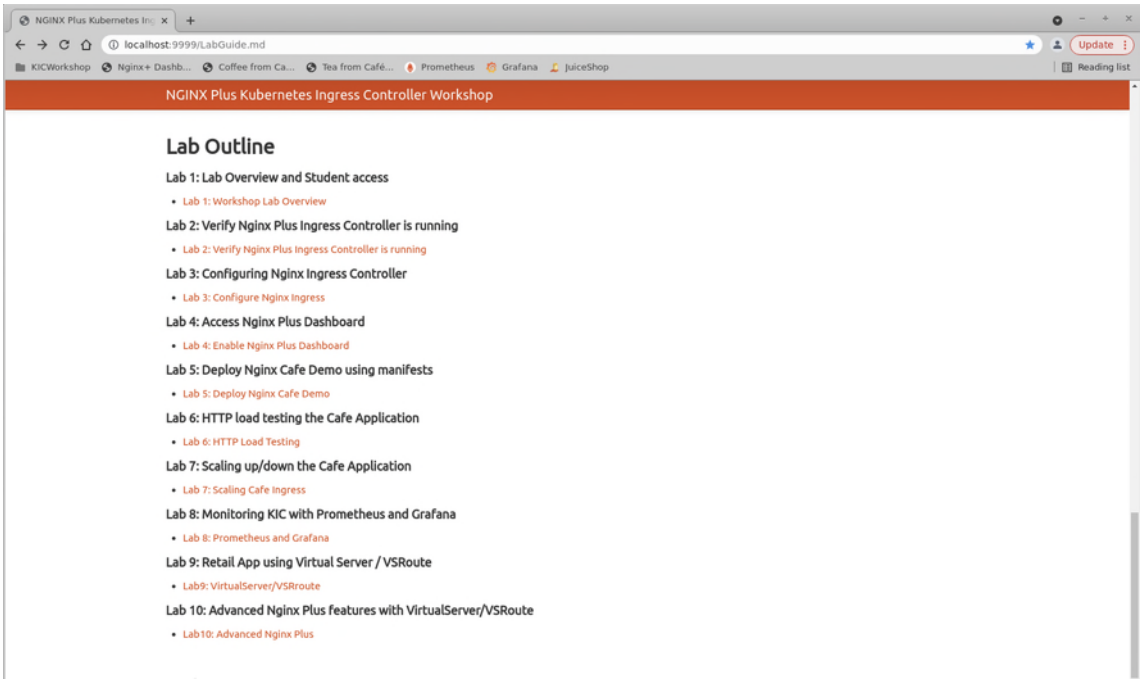
Prepare the your client machine for this lab by:

- Opening the LabGuide
- Opening `NginxPlus KIC Workshop vs-code workspace` shortcut, located on the desktop of the Jumphost:

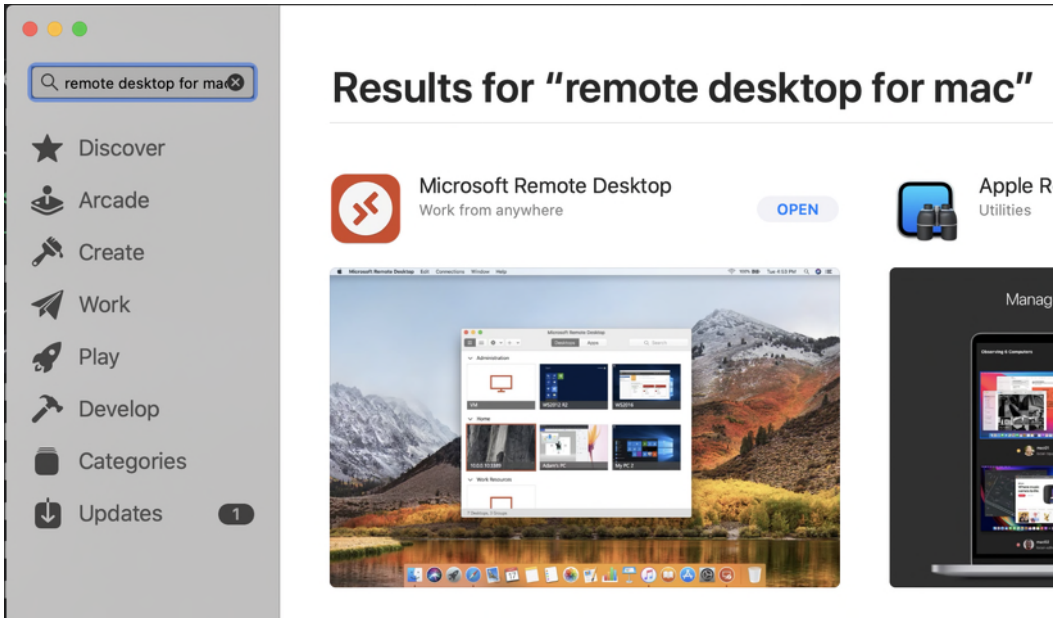
Locate the **`Ubuntu-Jumphost`** component and click on the **`ACCESS`** dropdown link.

Click `WORKSHOP LAB GUIDE`, which should open the Lab Guide in a seperate tab.

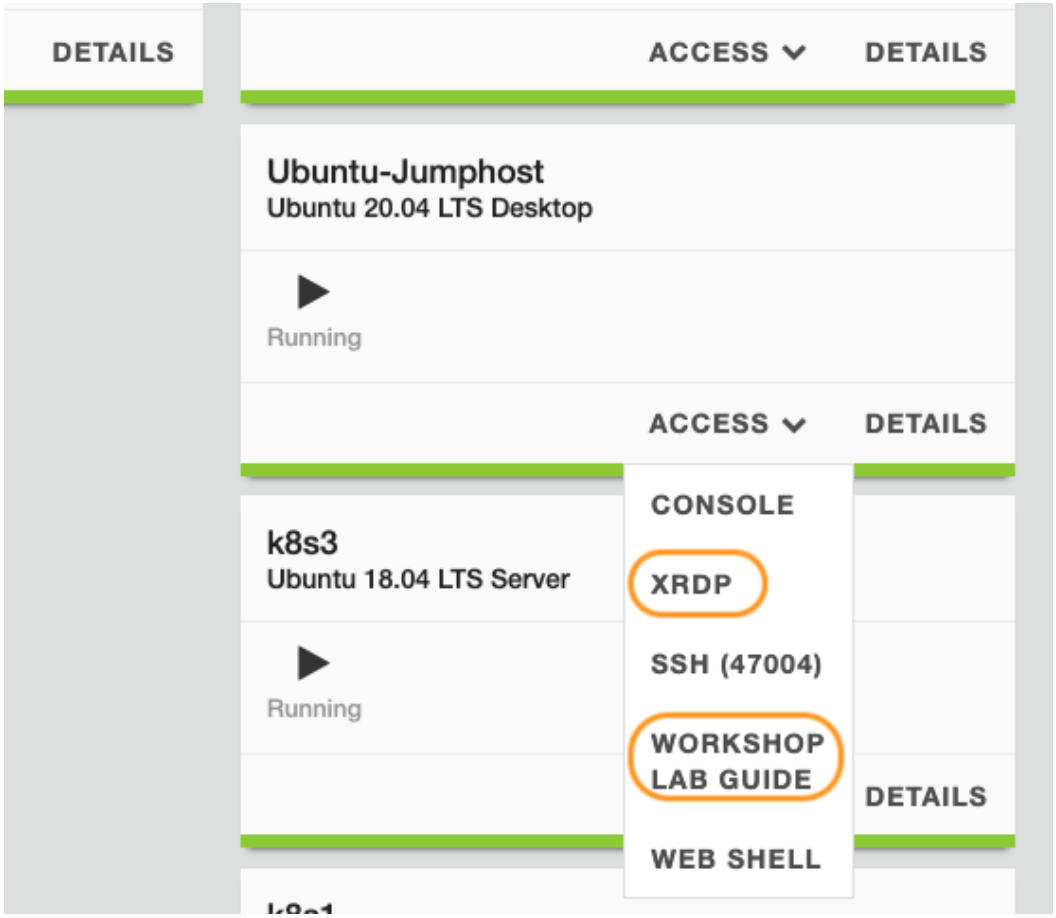




1. To access this Workshop, and complete the lab exercises, you will need a Remote Desktop client software installed on your system. Windows PCs should already have Microsoft's Remote Desktop Client software installed. Mac users may need to install `Microsoft RDP Client` from the Apple App Store (free). https://apps.apple.com/us/app/microsoft-remote-desktop/id1295203466?mt=12



2. Under `ACCESS` now click on `XRDP` to login to the Jumphost

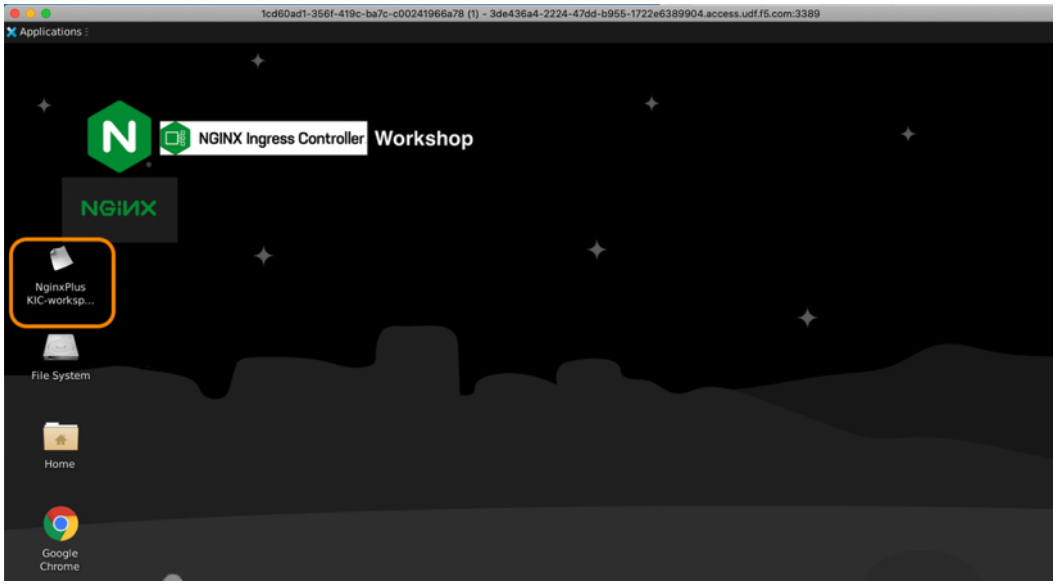


Note that you can re-open these components from the UDF Access page at any time.

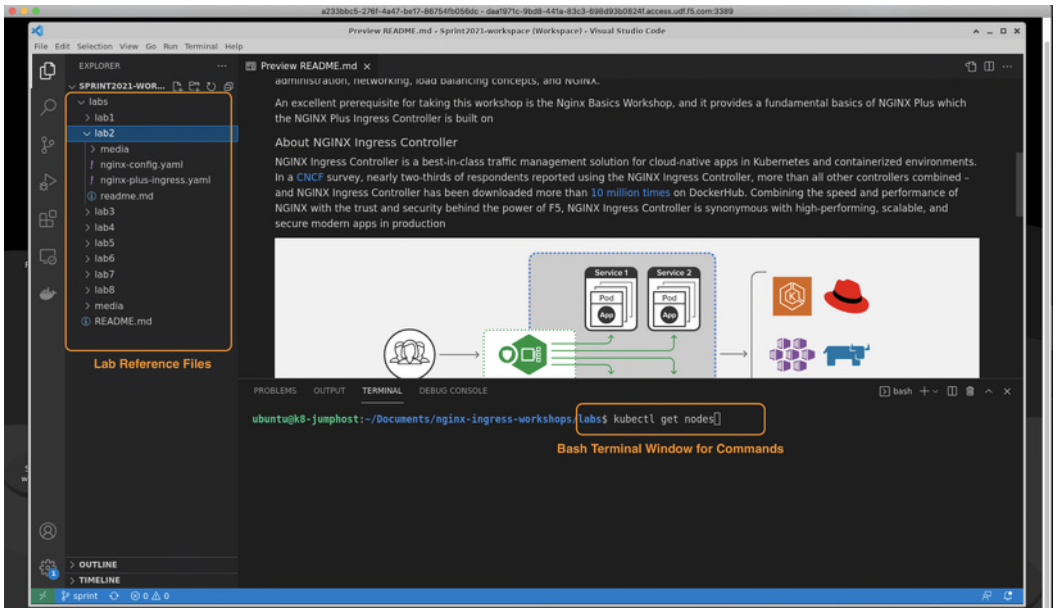
The `XRDP` session will use the below login credentials:

- username: **ubuntu**
- password: **Nginx123**

3. After you have logged into the Jumphost, open `NginxPlus KIC Workshop Workspace` to open VScode in the workshop project directory. You will be running all the lab exercises in VS Code and its built-in Terminal to run commands like `kubectl`, `curl`, `docker` and much more.



4. Using the VScode Terminal (the bottom pane), go ahead a try a `kubectl` command, such as `kubectl get nodes`.

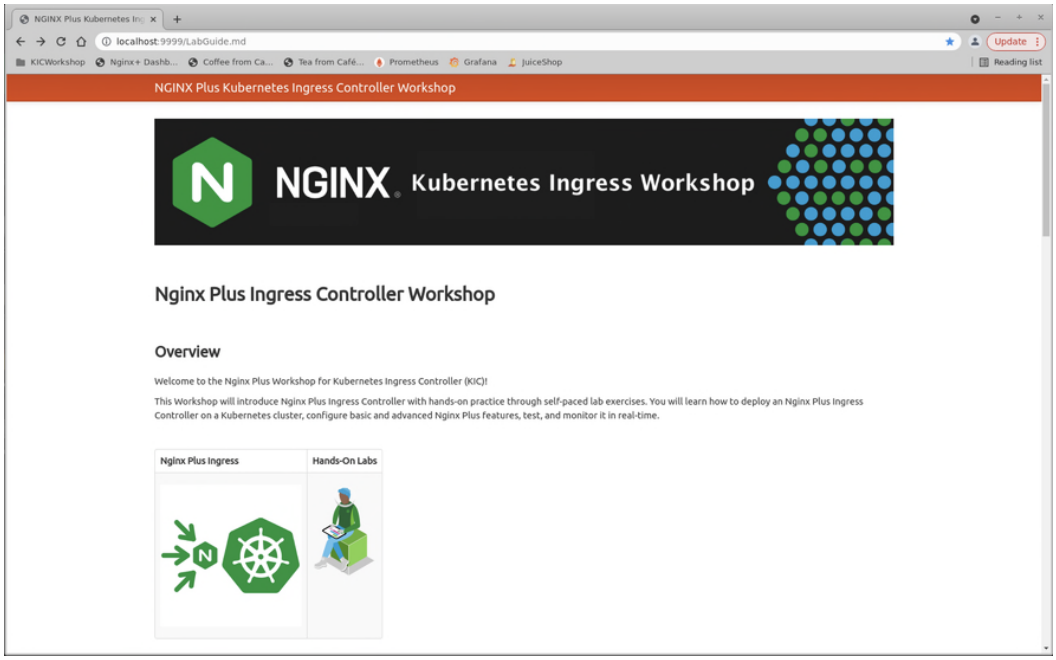


Verify your Kubernetes Cluster is up and all Nodes are in the "Ready" state using this command:

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl get nodes
NAME   STATUS   ROLES    AGE    VERSION
k8s1   Ready    master   340d   v1.21.2
k8s2   Ready    <none>   340d   v1.21.1
k8s3   Ready    <none>   340d   v1.21.1
```

NOTE: If your nodes are not showing in `Ready` status then please inform your instructor.

5. As part of the lab, you will be using `Chrome` browser which you can also find on the Jumphost desktop, which also has the Lab Guide and some other links bookmarked which will be used for subsequent labs.



This completes this Lab.

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

Navigate to (Lab2 | Main Menu)

Lab 2: Verify Nginx Plus Ingress Controller is running

Introduction

The Nginx Ingress Controller is already running in this workshop. You will be checking and verifying the Ingress Controller is running.

Learning Objectives

- Intro to Nginx Ingress Controller
- Intro to Kubernetes environment, interacting with `kubectl` command
- Access the NginxPlus Dashboard

Check your Ingress Controller

1. First, verify the Nginx Ingress controller is up and running correctly in the Kubernetes cluster:

   ```
   kubectl get pods -n nginx-ingress
   ```

   ```
   # Should look similar to this...
   NAME                            READY   STATUS    RESTARTS   AGE
   nginx-ingress-fd4b9f484-t5pb6   1/1     Running   1          12h
   ```

2. Instead of remembering the unique pod name, `nginx-ingress-xxxxxx-xxxx`, we can store the Ingress Controller pod name into the `$KIC_POD_NAME` variable to be used throughout the lab.

   Note: This variable is stored for the duration of the terminal session, and so if you close the terminal it will be lost. At any time you can refer back to this step to save the `$KIC_POD_NAME` variable once again

   Note: You must use the `kubectl` " `-n` ", namespace switch, followed by namespace name, to see pods that are not in the default namespace.

   ```
   export KIC_POD_NAME=$(kubectl get pods -n nginx-ingress -o
   jsonpath='{.items[0].metadata.name}')
   ```

   Verify the variable is set correctly.

   ```
   echo $KIC_POD_NAME
   ```

   Note: If this command doesn't show the name of the pod then run the previous command again.

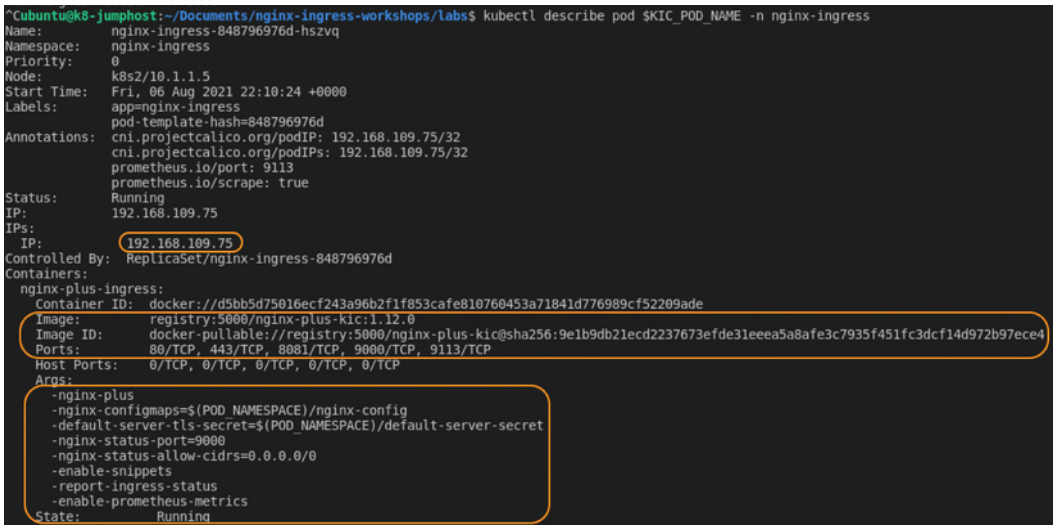
Inspect the details of your Ingress Controller:

1. Inspect the details of the NGINX Ingress Controller pod using the `kubectl describe` command

```
kubectl describe pod $KIC_POD_NAME -n nginx-ingress
```

Note: The IP address and TCP ports that are open on the Ingress (they should match the `lab2/nginx-plus-ingress.yaml` file, around lines `24-34`). We have the following Ports:

- Port `80 and 443` for web/ssl traffic,
- Port `8081` for Readiness,
- Port `9000` for the Dashboard, and
- Port `9113` for Prometheus (You will see this in a later Lab)



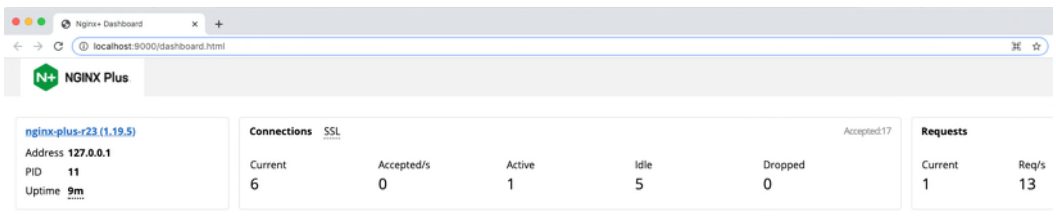
Check the KIC Nginx Plus Dashboard

1. Using Kubernetes port-forwarding, see if the dashboard is running on port `9000`. Using the VScode terminal pane, run the following `kubectl port-forward` command:

```
kubectl port-forward -n nginx-ingress $KIC_POD_NAME 9000:9000
```

2. Now open Chrome web browser to view the NGINX Plus Dashboard, at http://localhost:9000/dashboard.html.

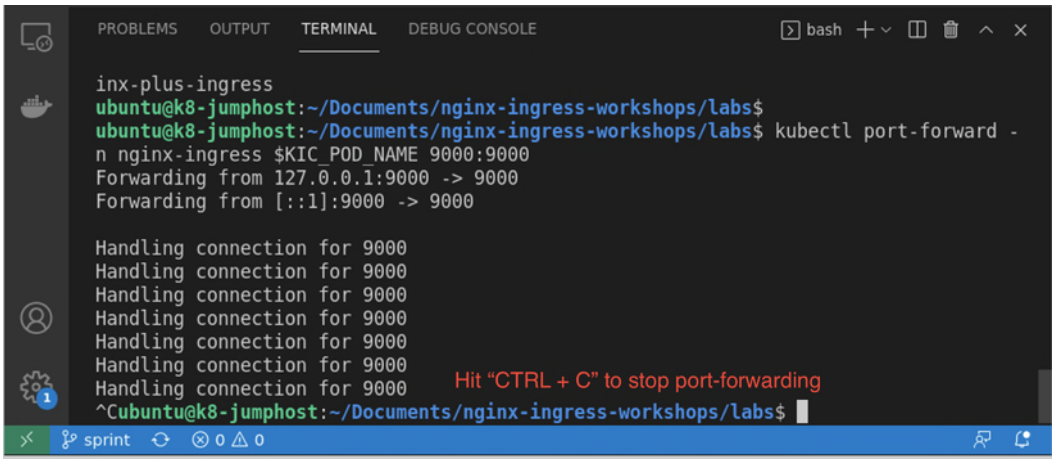
   Do you see the NGINX Plus Dashboard? If so, your Ingress Controller pod is up and running!



Question - Why is there almost nothing else to see?

▶ Click for Hints!

3. Close Chrome Web Browser, and hit `Ctrl-C` in the terminal to stop the Port Forward.



Take a look "under the hood" of Ingress Controller

The NGINX Ingress Controller is a pod running Nginx Plus under the hood, let's go check it out.

1. Use the VScode Terminal to enter a shell in the NGINX Ingress Controller pod by running the `kubectl exec` command

```
kubectl exec -it $KIC_POD_NAME -n nginx-ingress -- /bin/bash
```

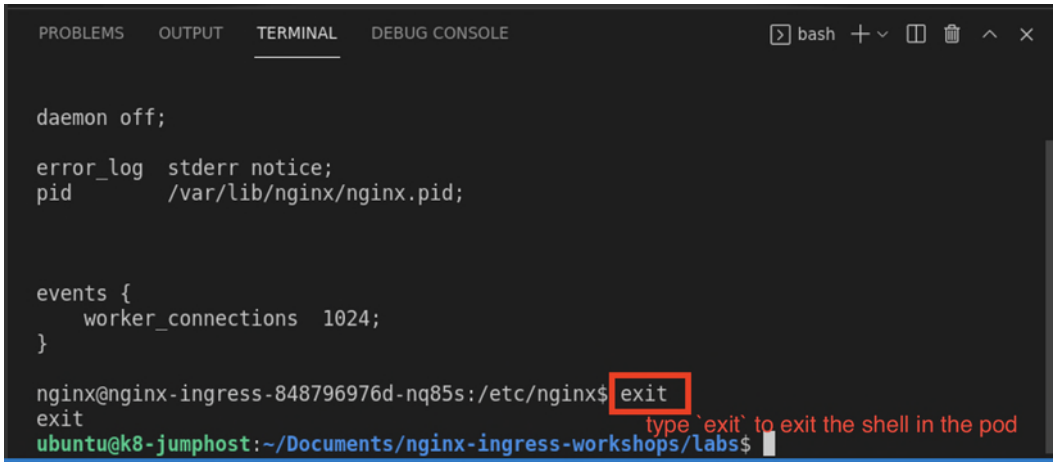
2. Once inside a shell in the NGINX Ingress Controller pod, run the following commands to inspect the root NGINX configuration

```
cd /etc/nginx
more nginx.conf
```

   If you have worked with Nginx config files, it should look very similar!

3. Type `q` to quit viewing the `nginx.conf`

4. Type `exit` to close the connection to the Ingress pod.



This completes this Lab.

References:

- https://docs.nginx.com/nginx-ingress-controller
- https://docs.nginx.com/nginx-ingress-controller/installation/installation-with-manifests/

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

Navigate to (Lab3 | Main Menu)

Lab 3: Configuring Nginx Ingress Controller

Introduction

The Nginx Ingress Controller is already running in this Workshop. You will be configuring Ingress Controller for external access outside of your cluster using a `LoadBalancer` Service. The Kubernetes `LoadBalancer` Service is what assigns IP addresses to the `Ingress`, so it can communicate with clients outside the cluster, and also with pods inside the Cluster.

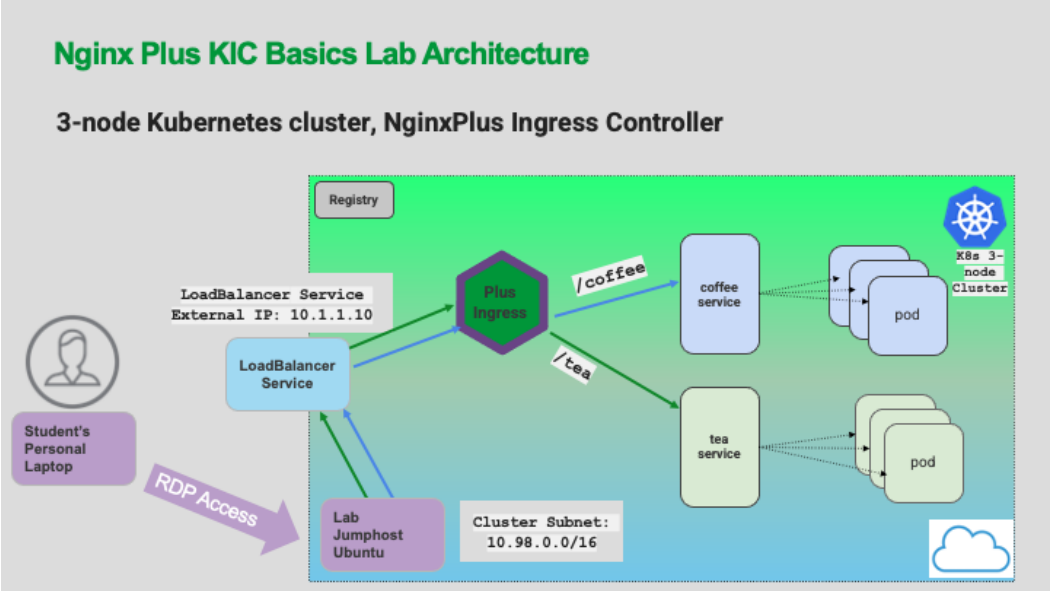
Note: Your Kubernetes cluster is running on a private lab network. We will be using a private IP for external access. In a public cloud environment, the `LoadBalancer` Service from a Cloud Provider would provide you with a routable public IP address.

Learning Objectives

- Test and verify the `LoadBalancer` Service
- Test and verify access to the Ingress Controller using the external IP address.

Inspect the LoadBalancer Service

1. Review this Workshop's network architecture diagram below. There are 3 important pieces of information needed for these exercises:
    - `LoadBalancer` Service
    - An External IP address
    - The Kubernetes Cluster IP subnet, used to assign IPs to Pods, including the Ingress Controller



2. Inspect the `lab3/loadbalancer.yaml` manifest. You can see that port `80` and `443` are being opened and we are requesting an external IP address. This will give the Ingress Controller a static private IP address from an IP address management system in the lab.

labs > lab3 > ! loadbalancer.yaml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: nginx-ingress
  namespace: nginx-ingress
spec:
  externalTrafficPolicy: Local
  type: LoadBalancer
  ports:
  - port: 80
    targetPort: 80
    protocol: TCP
    name: http
  - port: 443
    targetPort: 443
    protocol: TCP
    name: https
  selector:
    app: nginx-ingress
```

IMPORTANT SECURITY NOTE: In a real world deployment using a Cloud Provider, with a public IP address, this would expose your Ingress Controller to the open Internet with `NO PROTECTION` other than basic TCP port filters. Doing this in production would require Security/Firewall Protections, which are not part of this lab exercise.

3. Confirm there is an `nginx-ingress` service with `TYPE: LoadBalancer`. Run the following command to get networking details of our pod:

```
kubectl get deployments,services -n nginx-ingress
```

You will see the two IP addresses for the Ingress Controller. Both of these IPs must exist for the `LoadBalancer` service to work correctly:

- **`EXTERNAL-IP`** : This is your external IP address
- **`CLUSTER-IP`** : This is your Kubernetes internal IP address

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl get deployments,services -n nginx-ingress
NAME                                READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/nginx-ingress       1/1     1            1           4d

NAME                    TYPE           CLUSTER-IP     EXTERNAL-IP   PORT(S)                      AGE
service/nginx-ingress   LoadBalancer   10.98.133.36   10.1.1.10     80:31871/TCP,443:32470/TCP   25h
```

In the example above you see:

- `Cluster-IP` address of `10.98.133.36`
- `External-IP` address of `10.1.1.10`

- Both IPs are mapped from port `80` to a NodePort (`31871`); and from port `443` to NodePort (`32470`)

NOTE:

- Your `Cluster-IP` address may be different based on your cluster.
- Since this is a lab environment and not a public cloud environment, the `External-IP` address is contained within the lab and has no public access.

Verify access to the Ingress Controller using the External IP

1. Use the `LoadBalancer` External-IP address that we captured from the previous step to test your **nginx-ingress** service. Use `curl` command to test it.

   ```
   #Test Access to Ingress through LoadBalancer:
   curl -I http://10.1.1.10
   ```

   You should see the following output if the `LoadBalancer` Service is configured correctly for Ingress:

   ```
   ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ curl -I http://10.1.1.10
   HTTP/1.1 404 Not Found
   Server: nginx/1.19.10
   Date: Tue, 10 Aug 2021 22:56:53 GMT
   Content-Type: text/html
   Content-Length: 154
   Connection: keep-alive
   ```

   Question: Why did you get a 404?

   ▶ Click for Hints!

This completes this Lab.

References:

- Nginx KIC LoadBalancer for cloud providers
- Kubernetes LoadBalancer Service Type

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

This completes the Lab.
Navigate to (Lab4 | Main Menu)

Lab 4: Nginx Plus Dashboard access

Introduction

In this section, you are going to use the NGINX Plus Dashboard to monitor both NGINX Ingress Controller as well as our backend applications. This is a great feature to allow you to watch and triage any potential issues with NGINX Ingress controller as well as any issues with your backend applications, for example, HTTP response times, healthcheck failures, status codes, TCP connections, SSL sessions, etc.

Learning Objectives

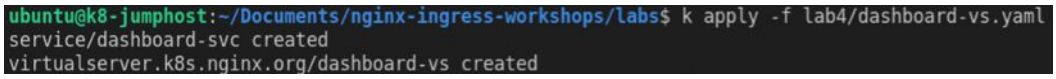
- Deploy the Nginx Dashboard Service
- Test access to the Dashboard

Deploy the Nginx Dashboard Service

We will deploy a `Service` and a `VirtualServer` resource to provide access to the NGINX Plus Dashboard for live monitoring. NGINX Ingress `VirtualServer` is a Custom Resource Definition (CRD)used by NGINX to configure NGINX Server and Location blocks for NGINX configurations.

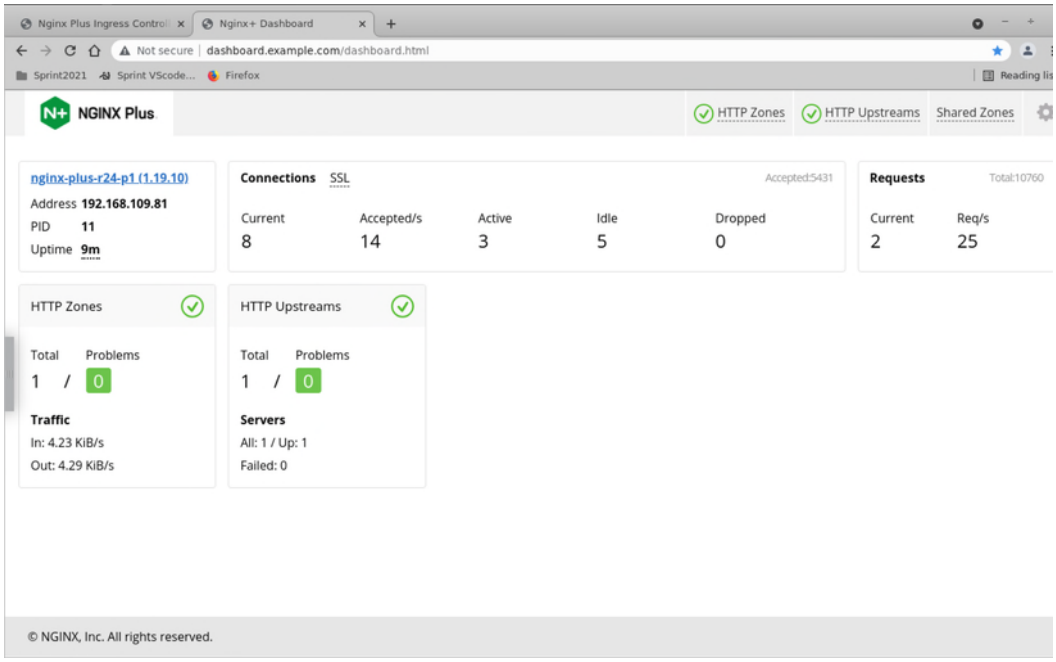
1. In the `lab4` folder, apply the `dashboard-vs.yaml` file to deploy a `Service` and a `VirtualServer` resource to provide access to the NGINX Plus Dashboard for live monitoring

```
kubectl apply -f lab4/dashboard-vs.yaml
```



Test access to the Dashboard

1. Open a new Chrome web browser tab, and click the Dashboard Bookmark, or directly open http://dashboard.example.com/dashboard.html



You should see the same Nginx Plus Dashboard as the `kubectl port-forward` test we did in a previously. Now your dashboard is exposed outside of your cluster at http://dashboard.example.com/dashboard.html.

> ***Recommended:*** *Leave this Dashboard Window open for the rest of the Workshop, you will refer to it often during later exercises.*

Congratulations! You have successfully configured your Ingress Controller for external access and the Nginx Plus Dashboard. Next we will deploy some application services and start routing some traffic through Nginx Ingress.

This completes this Lab.

References:

- NGINX Plus Live Activity Monitoring
- NGINX Plus Dashboard example

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

Navigate to (Lab5 | Main Menu)

Lab 5: Deploy the Nginx Cafe Ingress demo application, using manifests

Introduction

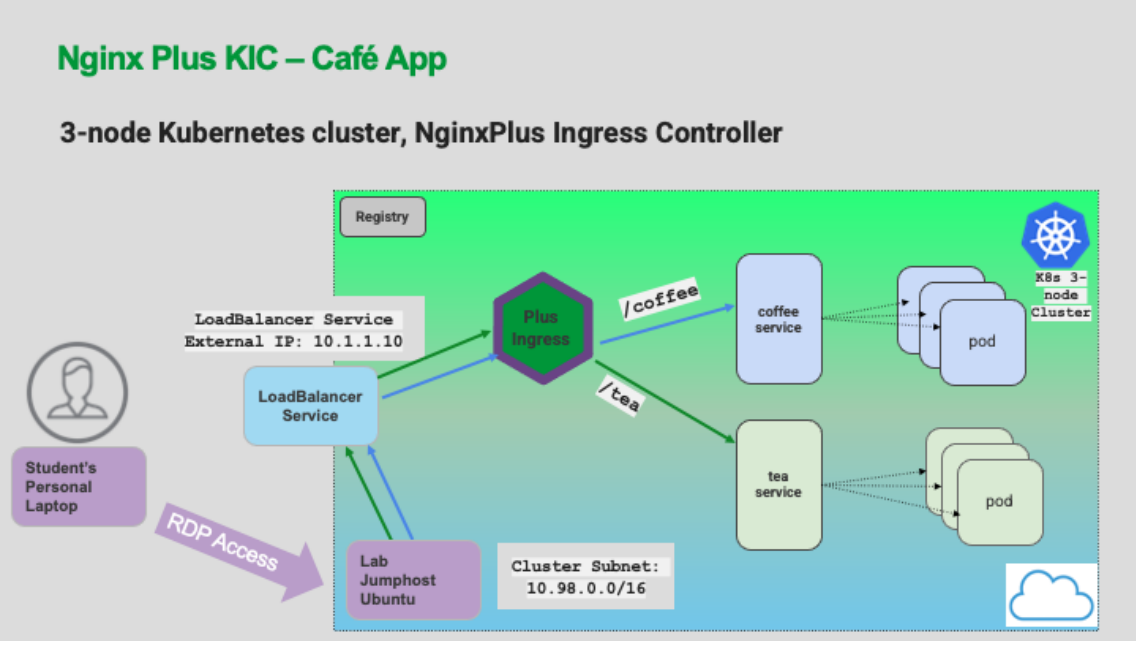
In this section, you will build the "Cafe" Ingress Demo, which represents a Coffee Shop website with Coffee and Tea applications. You will be adding the following components to your Kubernetes Cluster: **Coffee** and **Tea** `services`, `cafe-secret`, and `cafe` `virtualserver`.

Learning Objectives

- Deploy the Cafe Demo app
- Compare VirtualServer and Ingress manifests
- Verify the URL path access to `/coffee` and `/tea` work correctly
- Monitor the Nginx Plus Dashboard
- Verify the homepage redirect works correctly

Deploy the Cafe Demo app

The Cafe application that you will deploy looks like the following diagram below. Coffee and Tea pods and services, with Nginx Ingress routing the traffic for `/coffee` and `/tea` routes, using the `cafe.example.com` Hostname, and with TLS enabled. There is also a hidden third service - more on that later!



1. Deploy the Cafe application by applying the three manifests:

```
kubectl apply -f lab5/cafe-secret.yaml
kubectl apply -f lab5/cafe.yaml
kubectl apply -f lab5/cafe-virtualserver.yaml
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl apply -f lab5/cafe-secret.yaml
secret/cafe-secret created
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl apply -f lab5/cafe.yaml
deployment.apps/coffee created
service/coffee-svc created
deployment.apps/tea created
service/tea-svc created
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl apply -f lab5/cafe-virtualserver.yaml
virtualserver.k8s.nginx.org/cafe-vs created
```

2. Check that all pods are running, you should see **three** Coffee and **three** Tea pods:

```
kubectl get pods
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl get pods
NAME                              READY   STATUS    RESTARTS   AGE
coffee-5869b8cf4f-5kw25           1/1     Running   0          10m
coffee-5869b8cf4f-crd8w           1/1     Running   0          10m
coffee-5869b8cf4f-m85tk           1/1     Running   0          10m
tea-7dd9798597-jbgw4              1/1     Running   0          10m
tea-7dd9798597-pbs9g              1/1     Running   0          10m
tea-7dd9798597-pjd87              1/1     Running   0          10m
walkthrough-74546bf8f7-4x9p7      1/1     Running   4          5d20h
walkthrough-74546bf8f7-tpmnd      1/1     Running   30         301d
```

Note: Ignore the two walkthrough pods as they are part of the UDF lab environment.

3. Check that the Cafe `VirtualServer` , **`cafe-vs`** , is running:

```
kubectl get virtualserver cafe-vs
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl get virtualserver cafe-vs
NAME       STATE   HOST              IP    PORTS   AGE
cafe-vs    Valid   cafe.example.com                14m
```

Note: The `STATE` should be `Valid` . If it is not, then there is an issue with your yaml manifest file `(cafe-vs.yaml)` . You could also use `kubectl describe vs cafe-vs` to get more information about the `VirtualServer` we just created.

Compare VirtualServer and Ingress manifest

1. In the `lab5` folder, inspect the `cafe.yaml` manifest file. Find the following configuration details:

- **Question:** How many coffee and tea pods are we starting with?

▶ Click for Hints!

- **Question:** What are the two `Service` names ?

▶ Click for Hints!

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: coffee
spec:
  replicas: 3
  selector:
    matchLabels:
      app: coffee
  template:
    metadata:
      labels:
        app: coffee
    spec:
      containers:
      - name: coffee
        image: nginxinc/ingress-demo
        ports:
        - containerPort: 80
---
apiVersion: v1
kind: Service
metadata:
  name: coffee-svc
spec:
  type: ClusterIP
  clusterIP: None
  ports:
  - port: 80
    targetPort: 80
```

1. Now inspect the `cafe-virtualserver.yaml` file.

- **Question:** What is the hostname ?

  ▶ Click for Hints!

- **Question:** Are we using SSL ? If so, which certificate ?

  ▶ Click for Hints!

- **Question:** Are healthchecks enabled ?

  ▶ Click for Hints!

- **Question:** What URI paths are defined, routing to where ?

▶ Click for Hints!

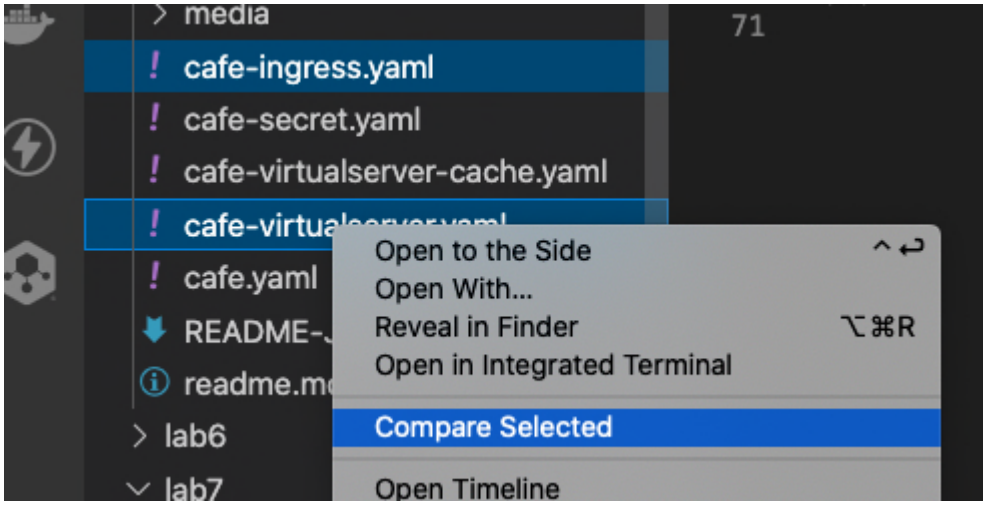
```yaml
apiVersion: k8s.nginx.org/v1
kind: VirtualServer
metadata:
  name: cafe-vs
spec:
  host: cafe.example.com
  tls:
    secret: cafe-secret
    redirect:
      enable: true  #Redirect from http > https
      code: 301
  upstreams:
  - name: tea
    service: tea-svc
    port: 80
    lb-method: round_robin
    slow-start: 20s
    healthCheck:
      enable: true
      path: /tea
      interval: 20s
      jitter: 3s
      fails: 5
      passes: 2
      connect-timeout: 30s
      read-timeout: 20s
  - name: coffee
    service: coffee-svc
    port: 80
    lb-method: round_robin
    healthCheck:
      enable: true
      path: /coffee
      interval: 10s
      jitter: 3s
      fails: 3
      passes: 2
      connect-timeout: 30s
      read-timeout: 20s
```

```yaml
  routes:
  - path: /
    action:
```

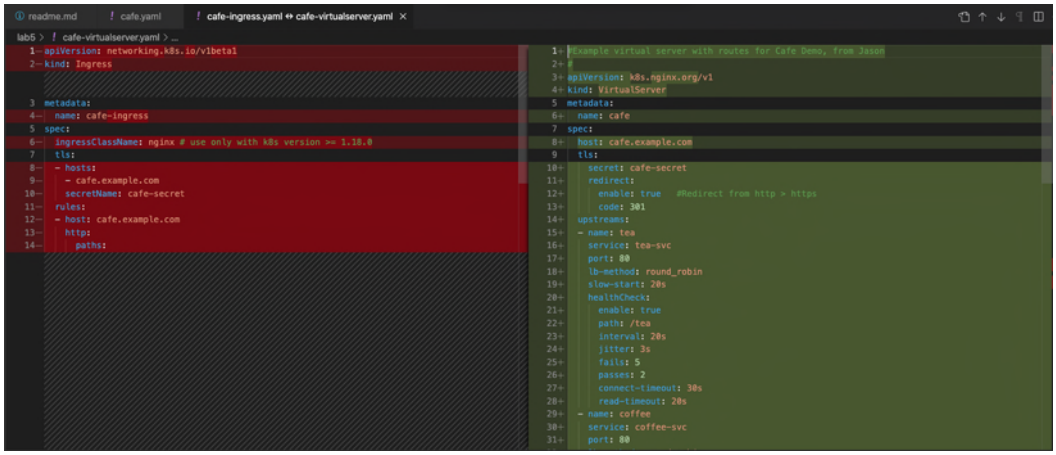
```
45          redirect:
46            url: https://cafe.example.com/coffee
47            code: 302
48        - path: /tea
49          action:
50            pass: tea
51        - path: /coffee
52          action:
53            pass: coffee
54        - path: /milk
55          action:
56            return:
57              code: 200
58              type: text/html
59              body: "Welcome to Nginx Plus KIC Workshop!!"
60
```

1. Compare the `cafe-ingress.yaml` and `cafe-virtualserver.yaml` files. How are they different? Do you see, that the `virtualServer` definition has quite a few more options for controlling how traffic is routed to your Ingress and to your pods:

   You can make use of VSCode built-in **compare** tool as seen below: `Select the two files and then right-click Compare Selected:



   Do you see how many more options there are in a `VirtualServer` type over a community `Ingress` type?



2. Now inspect the `cafe-secret.yaml` which is the TLS self-signed certificate we are using for this lab.

```yaml
apiVersion: v1
kind: Secret
metadata:
  name: cafe-secret
type: kubernetes.io/tls
data:
  tls.crt: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSURMa
  tls.key: LS0tLS1CRUdJTiBSU0EgUFJJVkFURSBLRVktLS0tLQpNS
```

Verify the URL path to `/coffee` and `/tea` work correctly

1. Access the application using `curl`. We'll use the `-k` option to turn off certificate verification of our self-signed certificate:

```
# To get coffee:
curl -k -I https://cafe.example.com/coffee
```

```
# If your prefer tea:
curl -k -I https://cafe.example.com/tea
```

Monitor the Nginx Plus Dashboard

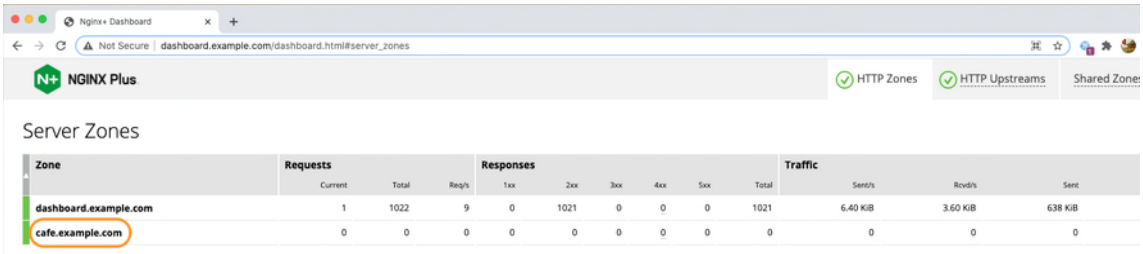
1. Open two new Chrome web browser windows for side by side viewing.

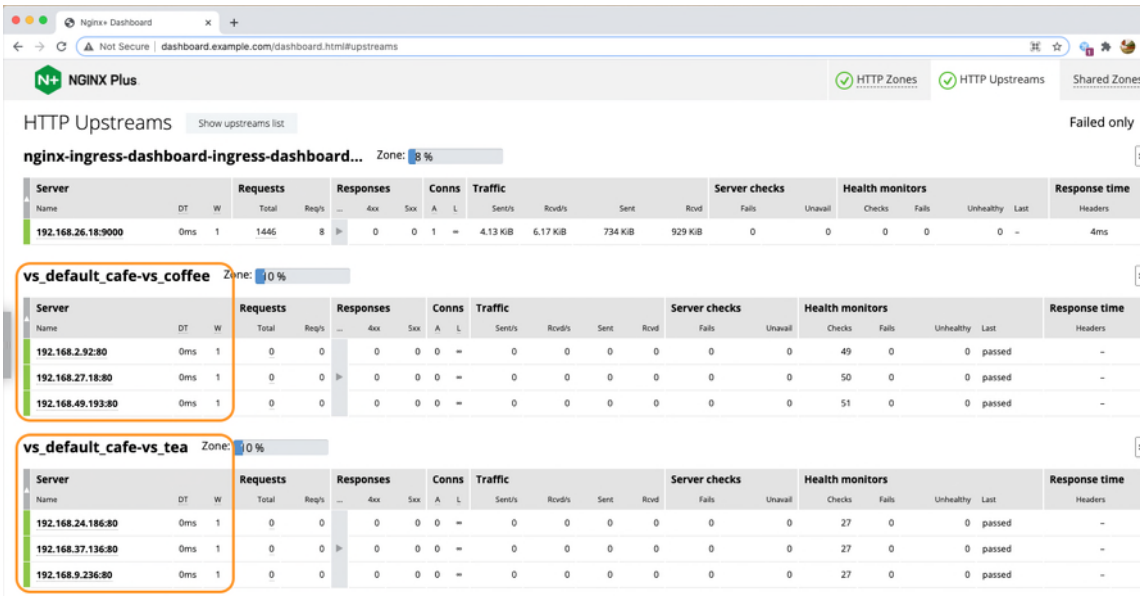
- Dashboard: http://dashboard.example.com/dashboard.html:
- And in two tabs, the Cafe Application components, Coffee (https://cafe.example.com/coffee) and Tea (https://cafe.example.com/tea)

Dashboard

Do you see any changes in the Plus Dashboard? Is `cafe.example.com` in the `HTTPZones` tab? In `HTTP Upstreams` tab do you see **three** coffee and **three** tea pod IP addresses?

The `Server Zones` table contains the Virtual Servers statistics of the Ingress, the HTTP Upstreams are the actual Pods running in Kubernetes which are being load balanced.



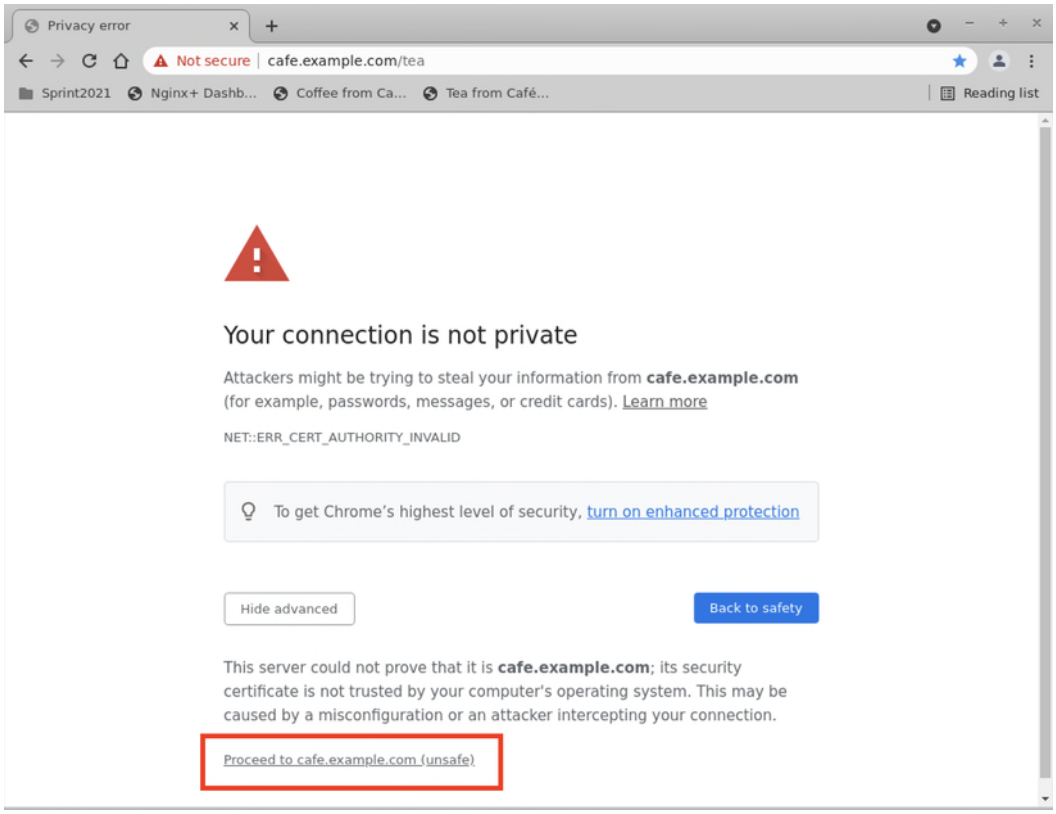


Cafe App

1. Using the second Chrome web browser window, open tabs for both:

   - Coffee - https://cafe.example.com/coffee
   - Tea - https://cafe.example.com/tea

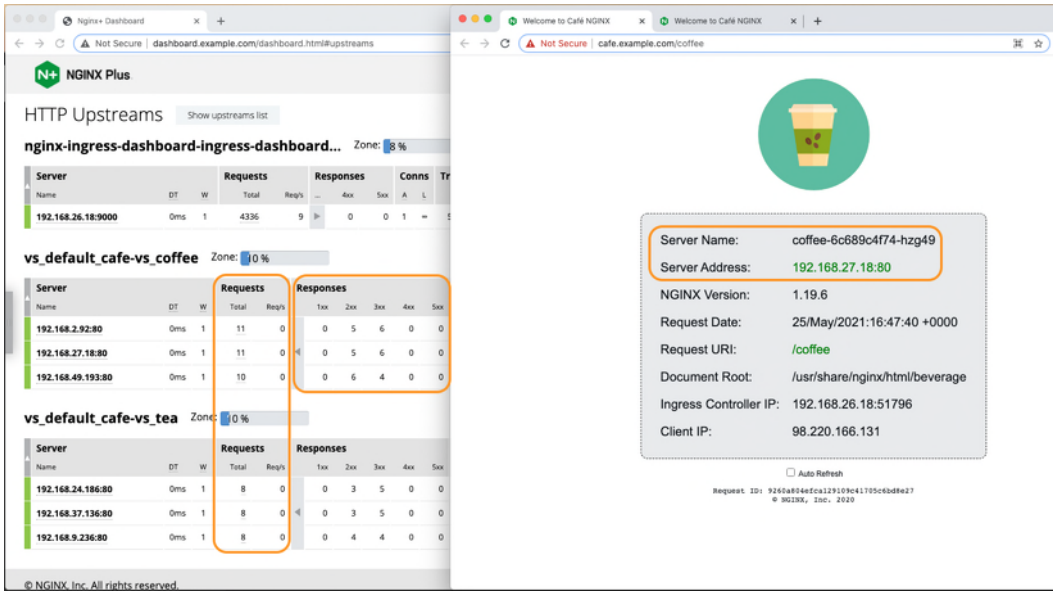
   Did you see an initial Chrome TLS Security warning ? No problem, we are using a self-signed TLS certificate for this Lab and you can safely Proceed.



2. While watching the Dashboard, try refreshing the pages for Coffee and Tea several times:

   What do you see in the HTTP Upstreams?

   The **Requests** column should increment each time you refresh, and request are distributed in in a "round-robin" Load Balancing method



3. Check the `Server Name` and `Server Address` in the gray box of the Coffee and Tea webpage, it should change as you refresh. The `Server Name` is the Kubernetes assigned pod name, and the `Server Address` you see is the Pod's internal IP address, assigned by the cluster network.

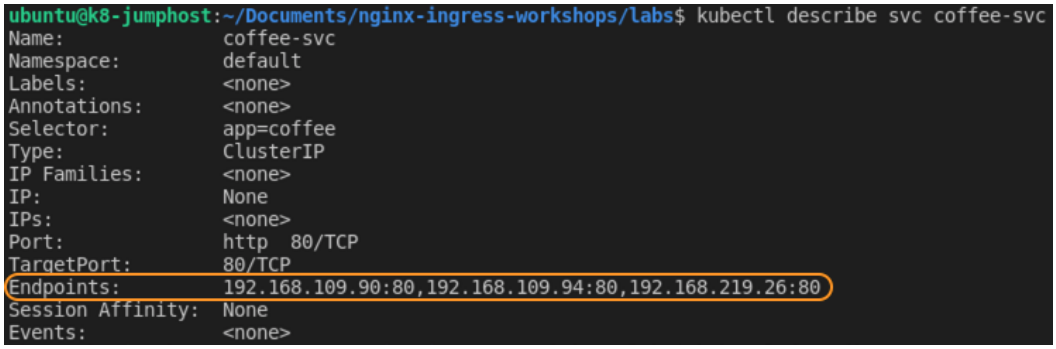
   Do they match up with the Server IPs in the Dashboard?

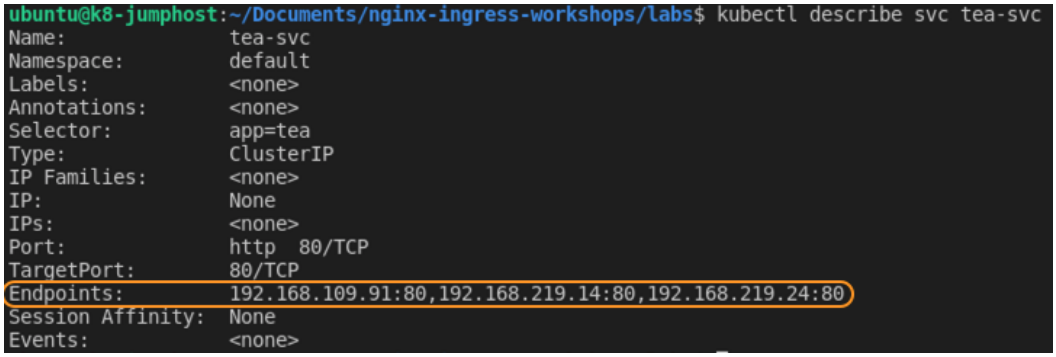
4. Verify the `Endpoint` addresses, with `kubectl` commands that shows you the details of Coffee and Tea `Service`:

   ```
   # Describe Coffee Service
   kubectl describe svc coffee-svc

   # Describe Tea Service
   kubectl describe svc tea-svc
   ```

   The Service `Endpoints` should match the Server IPs in the dashboard:

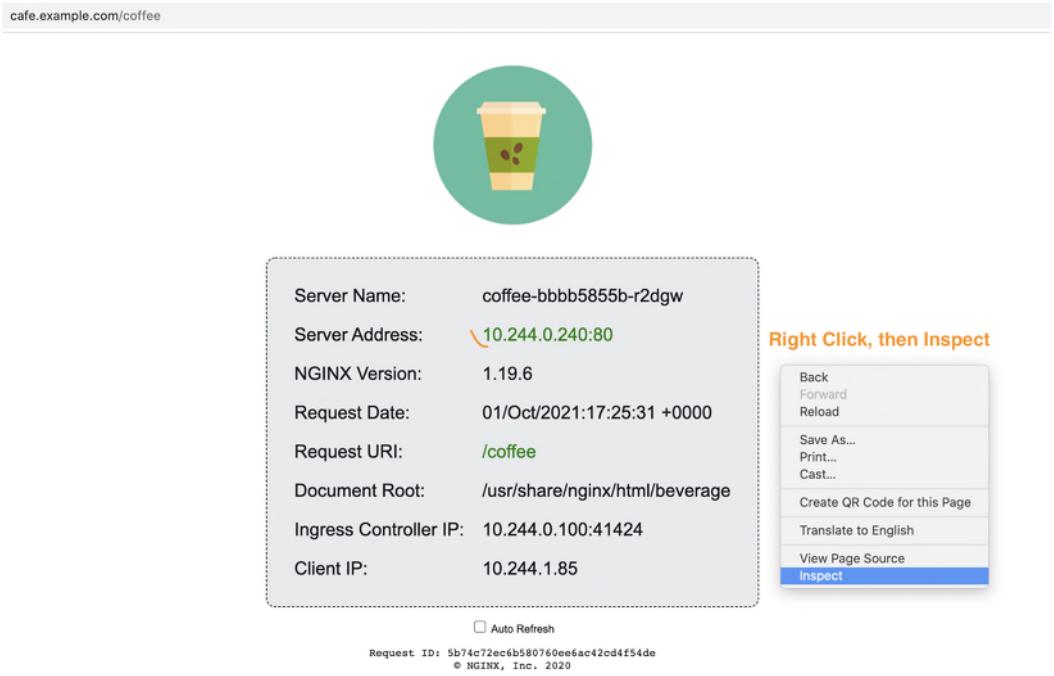




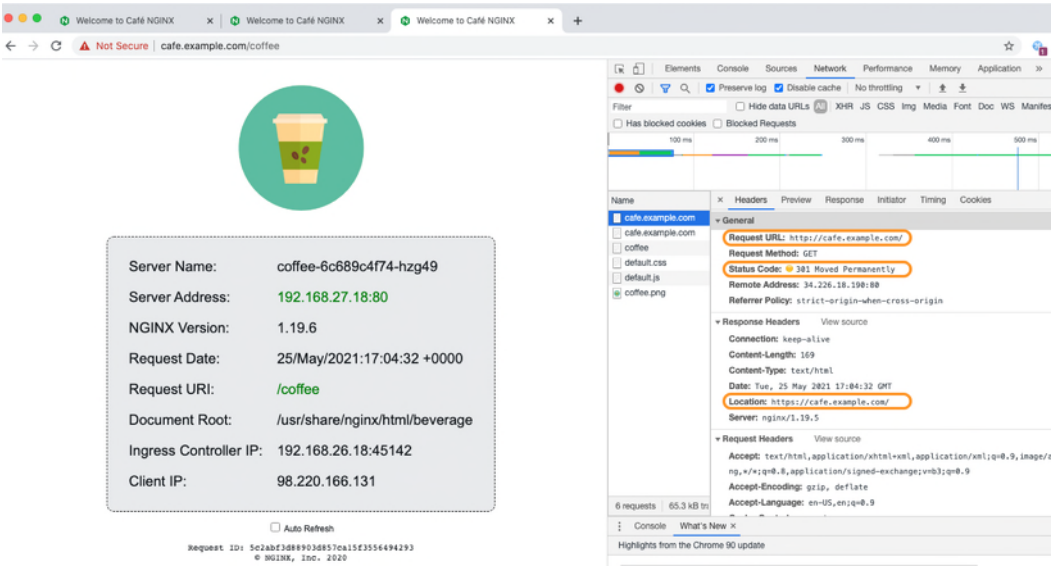
Verify the homepage redirect works correctly

What happens if you try just plain http://cafe.example.com? It should redirect you to TLS secured https://cafe.example.com/coffee.

1. Open Chrome Developer Tools: Right Click on the wepage and select `Inspect`.



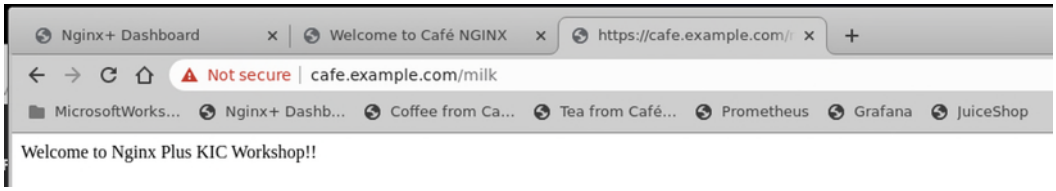
2. Inspect the HTTP Headers: Open the `Network` Tab > view `Headers`.



3. Try https://cafe.example.com/milk

   Question: What just happened and why?

   ▶ Click for Hints!



Now, let's throw some traffic at your Cafe Ingress!

This completes this Lab.

References:

- Nginx Ingress Controller Complete Example

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

Navigate to (Lab6 | Main Menu)

Lab 6: HTTP Load Testing and Cafe Scaling

Introduction

In this lab, you will send some HTTP traffic to your Ingress Controller and Cafe Application, and watch Nginx Ingress load balance the trafffic. You will scale the application pods and Ingress Controller up and down, and watch what happens in realtime, as Nginx responds dynamically to these cluster changes.

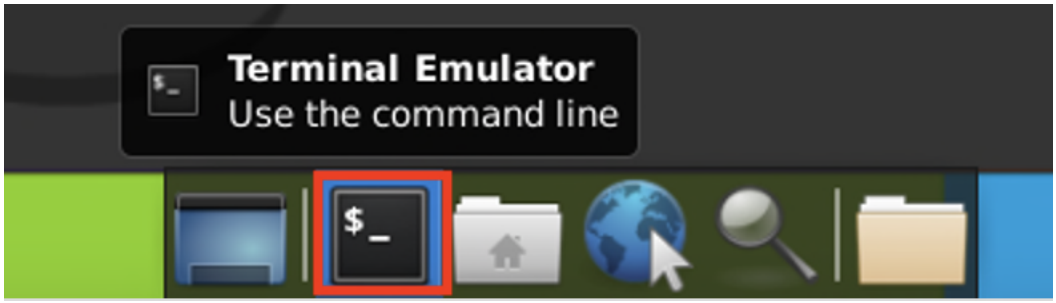
Learning Objectives

- HTTP Traffic Generation
- Scale Applications
- Optional Exercises
- Host-based Routing
- Observe Nginx Dashboard

HTTP Traffic Generation

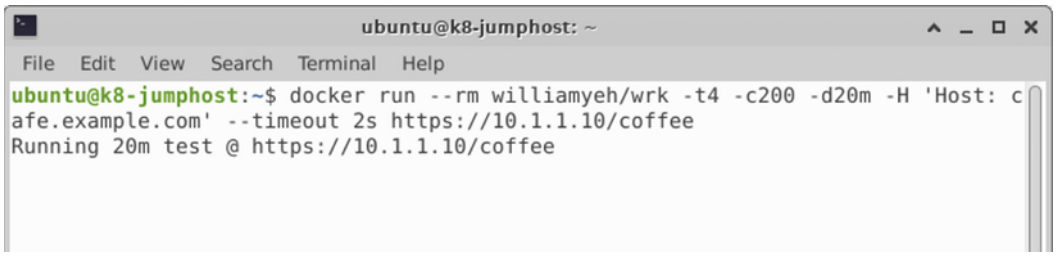
We will use a tool called `wrk` , runing in a docker container, to generate traffic to our Ingress.

1. Open a Terminal from the Ubuntu Desktop



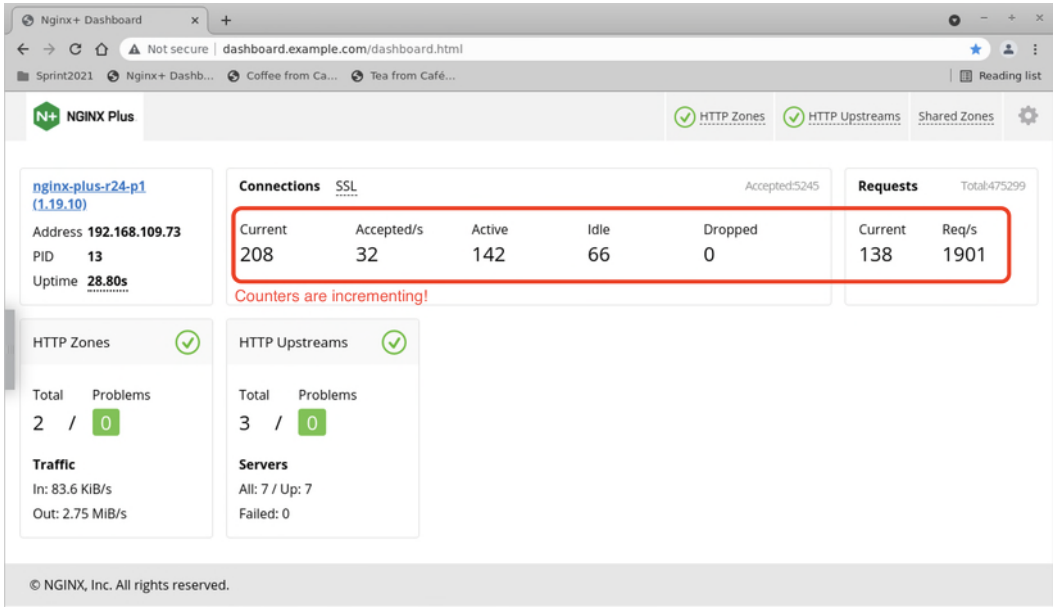
2. In the terminal window, run this command to start load generation using `wrk` inside a docker container:

```
docker run --rm williamyeh/wrk -t4 -c200 -d20m -H 'Host: cafe.example.com' --
timeout 2s https://10.1.1.10/coffee
```



This will run the `wrk` load tool for **20 minutes**, with **200 connections**. You can run this command again if you need additional time.

3. Observe your NGINX Plus Dashboard - http://dashboard.example.com/dashboard.html



Questions:

- Do you see the number of HTTP requests increasing?
- Do the coffee pods each take ~equal traffic?
- What does the HTTP Zones table show?

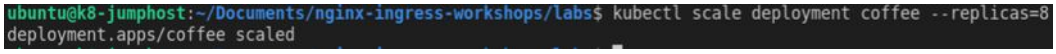
▶ Click for Hints!

Scale Applications

Coffee Break Time !! Let's scale the Coffee `Deployment`. In anticipation of a surge in coffee drinkers - The boss says we need more Keurig pods.

1. While watching the Dashboard, change the number (`replicas`) of Coffee pods from **three**, to a total of **eight**:

```
kubectl scale deployment coffee --replicas=8
```

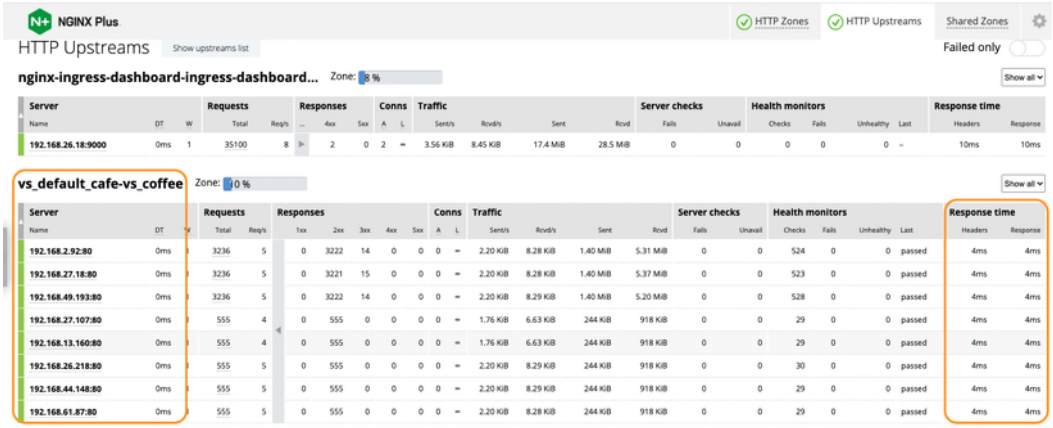


How long did it take Kubernetes to add the new pods?

Nginx Ingress will run Active healthchecks against the pods, and then begin routing traffic to the **five** new pods. Nginx Ingress Controller automatically discovers the new pods and immediately reconfigures it's upstream groups and route traffic to them once marked healthy (Pass the health checks).

Active healthchecks, DNS service Discovery and NGINX Plus reconfiguration API are Premium features of Nginx Plus, these features are used here, where the NGINX Ingress Controller uses the Nginx Plus API to automatically update the list Upstreams with newly discovered pods and begins to load balance them.

Caffiene crises averted...



2. Inspect the NGINX Plus Dashboard. Look at the far right column of the `HTTP Upstreams` view and you see `HTTP Header` and `Response times` values in milliseconds.

   Nginx Plus tracks the actual response time of the pods, when it receives the HTTP header, and when it receives the entire response body. Wouldn't it be nice if you could actually send more requests to the pods responding the fastest? With NGINX Plus, you can do just that.

3. Let's configure NGINX Ingress Controller to use a NGINX Plus Load Balancing algorithm called `Least-Time Last-Byte` so that the most responsive (faster) pods are prioritized for more HTTP Requests. Apply the following manifest:

   ```
   kubectl apply -f lab6/nginx-config-lastbyte.yaml
   ```

   - **Question:** Why are some pods faster or slower than others?
     ▶ Click for Hints!

4. After changing the algorithm, now look at the Dashboard `HTTP Upstream` metrics, you should see the **faster** pods taking more requests than the slower pods.

   Note: Faster means lower `Response Time` in milliseconds.

   This is an important NGINX Plus feature. NGINX tracks each `pod` 's response time, and distributes more traffic to faster pods in the cluster.

   In today's Digital Experience production workloads, it is important to send customers' requests to the most reliable and performant `pod` (server). NGINX Plus's `LeastTime - LastByte` Load Balancing algorithm allows you to handle more total requests, and, it adjusts automatically as pod performance and conditions in the Kubernetes cluster change minute by minute.

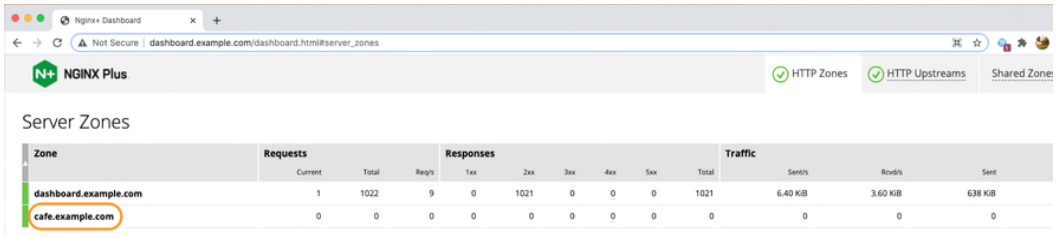
This yields a better customer experience, essential for today's modern digital experience workloads.

NOTE: the Response time differential must be `> 20ms` between the pods, for NGINX to consider some pods faster than others.

5. Boss says Coffee rush is now over, so scale back the number of coffee pods to **three**. Run the following `kubectl scale` command:

```
kubectl scale deployment coffee --replicas=3
```

Did you notice any errors in the NGINX Plus Dashboard while Kubernetes scaled up/down the pods?



When scaling down, NGINX will complete workloads before Kubernetes terminates a running `pod`, after all the responses in flight have finished processing on that `pod`, so there should not be any errors. When scaling up, NGINX also healthchecks new pods before sending any requests to them, to make sure they are ready to take requests.

Did you notice any errors when you asked NGINX to change its load balancing algorithm from round-robin to `Least-time Last-byte`? There should not have been any errors. The Dynamic Configuration Reload feature allows existing connections to finish their work, while allowing new connections to use the new configuration.

> *This results in **no dropped connections during configuration changes.***

Optional Lab Exercise1:

Try the same scale up, then scale down commands for the Cafe **Tea** `Deployment`. Does NGINX also send more traffic to the faster Tea pods? Set the tea pods back to **three** replicas when you are finished.

Note: You will have to target `/tea` with the `wrk` tool if you want to load test Tea:

1. Run the following command to apply load to the Tea Service:

```
docker run --rm williamyeh/wrk -t4 -c200 -d15m -H 'Host: cafe.example.com' --
timeout 2s https://10.1.1.10/tea
```

Optional Lab Exercise2:

1. You can change the load balancing algorithm back to round-robin if you like, and check out the differences. Apply the following manifest to make that change:

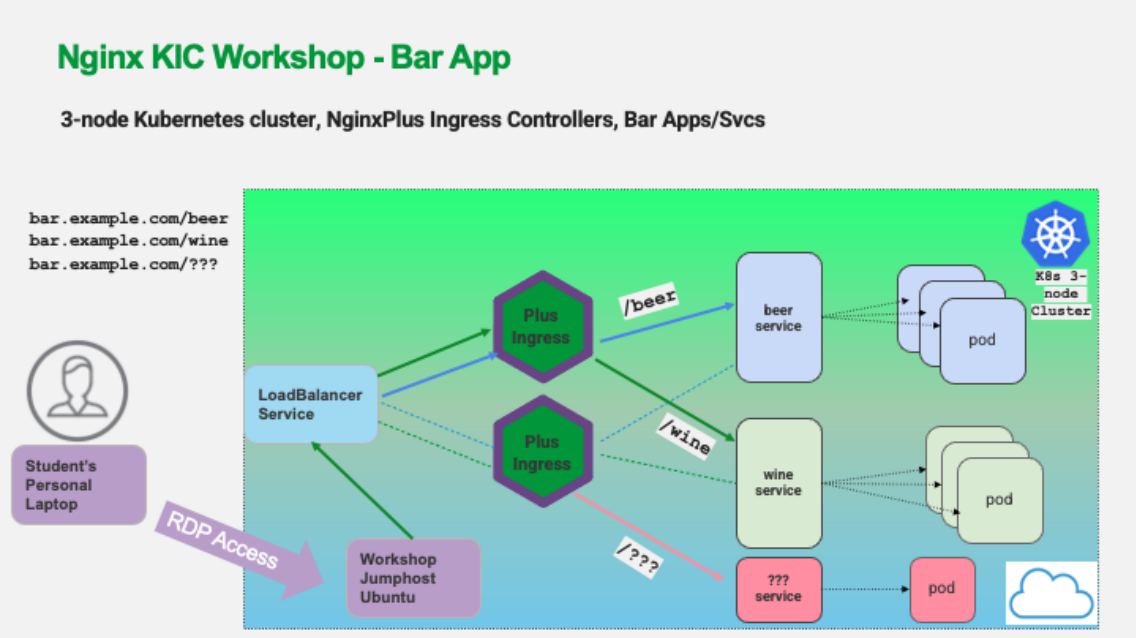
```
kubectl apply -f lab6/nginx-config-roundrobin.yaml
```

Host Based Routing

New business opportunity: The boss got a business loan to open the Cafe as a Bar in the evening for beer and wine tasting! So you need to add Beer and Wine applications, and expose these using the NGINX Ingress Controller.

Hurry up - it's almost Happy Hour!

See the topological view of the new **beer** and **wine** applications



1. In the `lab6` folder, inspect the `bar.yaml` and `bar-virtualserver.yaml` manifest files. You will see that we are adding the required `Deployment` and `Service`, and exposing them with `VirtualServer`, using a new hostname, `bar.example.com`.

```yaml
#Example virtual server with routes for Bar Demo
#
apiVersion: k8s.nginx.org/v1
kind: VirtualServer
metadata:
  name: bar-vs
spec:
  host: bar.example.com
  tls:
    secret: cafe-secret
    redirect:
      enable: true   #Redirect from http > https
      code: 301
  upstreams:
  - name: beer
    service: beer-svc
    port: 80
    slow-start: 20s
    healthCheck:
      enable: true
      path: /beer
      interval: 20s
      jitter: 3s
      fails: 5
      passes: 2
      connect-timeout: 30s
      read-timeout: 20s
  - name: wine
    service: wine-svc
    port: 80
    #lb-method: round_robin     You can set LB method here if you like
    healthCheck:
      enable: true
      path: /wine
      interval: 10s
      jitter: 3s
      fails: 3
      passes: 2
      connect-timeout: 30s
```

2. Create the **beer** and **wine** `Deployment` and `Service`, by applying the provided manifests.

```
kubectl apply -f lab6/bar.yaml
```

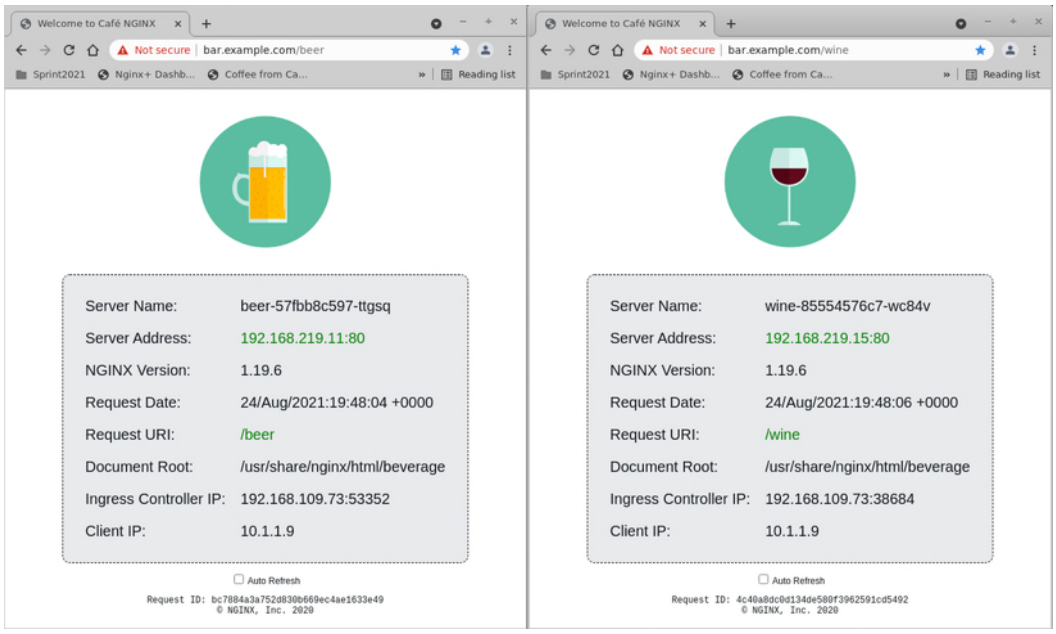
3. Create a new `VirtualServer` listening on the hostname, **`bar.example.com`**, with `/beer` and `/wine` URI paths to the new application deployments, by applying the `bar-virtualserver.yaml` file:

```
kubectl apply -f lab6/bar-virtualserver.yaml
```

4. Open two new Chrome web browser windows and browse to https://bar.example.com/beer and https://bar.example.com/wine.

   Note: You can once again safely proceed to this insecure site.

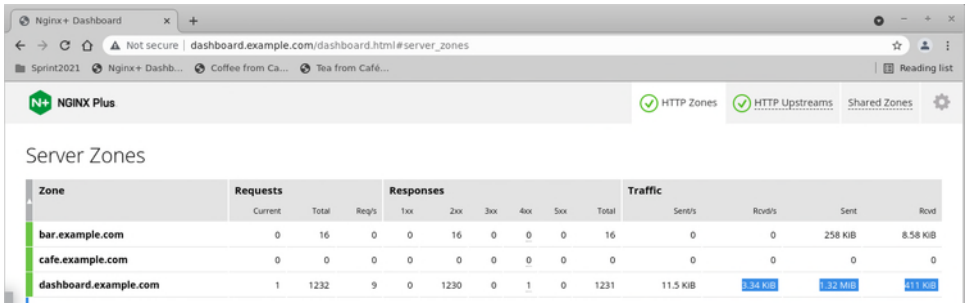
   Do the new `beer` and `wine` applications load as expected?

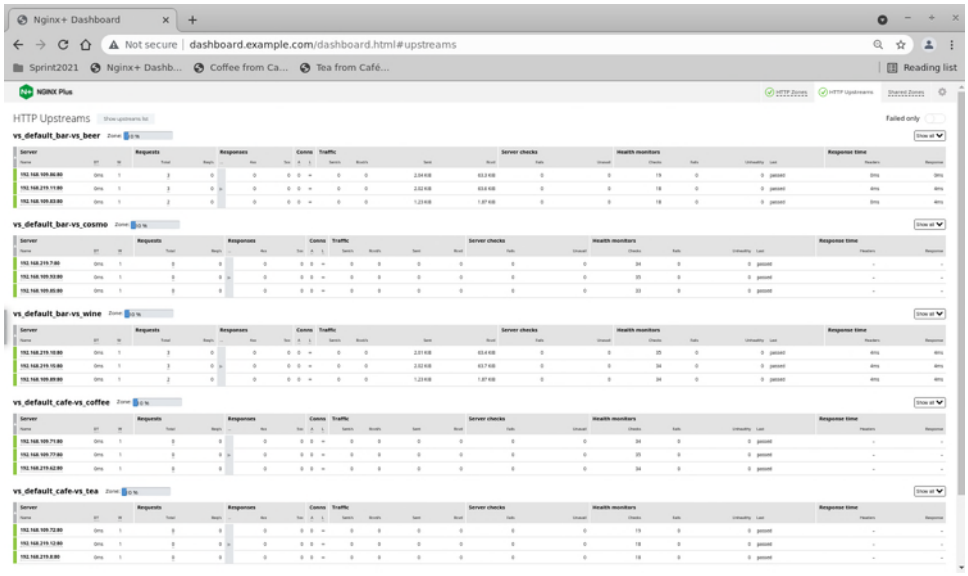


5. Observe your KIC Plus Dashboard again on http://dashboard.example.com/dashboard.html

   Questions:

   - What does the Dashboard show you when you refresh `/beer` and `/wine` multiple times?
   - Did you find your new `HTTP upstreams` for **beer** and **wine**?
   - What did you find in the `HTTP Zones` table?





You can see how easy it is to add new `Deployment` and `Service`, and then configure NGINX Plus Ingress Controller to create a new HTTP Host route, URI paths and route traffic to these new services and have access to these applications immediately. The NGINX Plus `VirtualServer` CRD's allow you to easily add new hosts and services.

This ability of self-service Host and Path based HTTP routing makes it easy to add and deploy new services, and NGINX Plus Ingress routes the traffic correctly **(and BTW - you didn't have to submit even one Ticket to IT and WAIT !!)**.

As you can see, this enables application/development teams to rapidly build, deploy, and expose new digital services for the business, without waiting for lengthy deployment/approval processes.

Bonus: `Sneaky Pete!` There was one additional `Happy Hour Drink Special` cocktail added by the boss's daughter. Did you find it?

▶ Click for Answer!

You should also notice that Cafe is still running as before, adding the Bar services and VirtualServer definitions had no impact.

This completes this Lab.

References:

- Least_time Algorithm
- Random Algorithm
- Dyanamic Reconfiguration with NGINX Plus
- Wrk Tool

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

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Lab 7: Nginx Ingress Controller High Availability and Enhanced Logging

Introduction

In Production Kubernetes clusters, it is important to have High Availability for the Ingress Controllers, just like any traditional load balancer, and the pods themselves. Nginx Ingress Controllers can be added and removed just like application pods.

It is considered a Best Practice to have **at least three Ingress Controllers** for Production workloads running in the cluster. This will provide a very solid High Availability foundation for managing production traffic.

It is also helpful to development and operations teams to see granular details about the traffic to and from the services and pods. NginxPlus has the capability to provide many details to gain insight into these traffic flows, using additional logging variables.

Learning Objectives

- Scaling Nginx Ingress Controller
- Seeing Ingress Under the Hood
- Configuring Enhanced Logging

Scaling Nginx Ingress

Next, let's scale the number of Ingress Controllers pods from one to **three**. This will provide High Availability, and also increase performance and capacity.

1. Run the following `kubectl scale` command:

   ```
   kubectl scale deployment nginx-ingress -n nginx-ingress --replicas=3
   ```

2. To see the newly created NGINX Plus Ingress Controller pods run the following command in the `nginx-ingress` namespace:

   ```
   kubectl get pods -n nginx-ingress
   ```

   You should see **three** NGINX Plus Ingress Controller pods running

   ```
   ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl get pods -n nginx-ingress
   NAME                             READY   STATUS    RESTARTS   AGE
   nginx-ingress-848796976d-jsvss   1/1     Running   0          102s
   nginx-ingress-848796976d-lq2vm   1/1     Running   0          102s
   nginx-ingress-848796976d-nq85s   1/1     Running   0          3h47m
   ```

   Questions:

   - What happened to your `WRK` loadtest traffic on the Dashboard ?
   - Did it drop by approximately 1/3rd. Why?

▶ Click for Hints!

3. Now scale the number of NGINX Plus Ingress Controllers up to **four**, in anticipation of a surge of traffic from an overnight Digital Marketing campaign for *free coffee=free caffeine*. Run the following `kubectl scale` command:

```
kubectl scale deployment nginx-ingress -n nginx-ingress --replicas=4
```

```
kubectl get pods -n nginx-ingress
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl scale deployment nginx-ingress -n nginx-ingress --re
plicas=4
deployment.apps/nginx-ingress scaled
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl get pods -n nginx-ingress
NAME                             READY   STATUS    RESTARTS   AGE
nginx-ingress-848796976d-7vzkw   1/1     Running   0          17s
nginx-ingress-848796976d-jsvss   1/1     Running   0          9m30s
nginx-ingress-848796976d-lq2vm   1/1     Running   0          9m30s
nginx-ingress-848796976d-nq85s   1/1     Running   0          3h55m
```

What do you observe?

Food for thought - With most Cloud providers, you could use AutoScaling to do this automatically!

4. The Marketing push is over, so scale the Ingress Controllers back down to **one**. Run the following `kubectl scale` command:

```
kubectl scale deployment -n nginx-ingress nginx-ingress --replicas=1
```

```
kubectl get pods -n nginx-ingress
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl scale deployment -n nginx-ingress nginx-ingress --re
plicas=1
deployment.apps/nginx-ingress scaled
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl get pods -n nginx-ingress
NAME                             READY   STATUS        RESTARTS   AGE
nginx-ingress-848796976d-7vzkw   0/1     Terminating   0          88s
nginx-ingress-848796976d-jsvss   0/1     Terminating   0          10m
nginx-ingress-848796976d-lq2vm   0/1     Terminating   0          10m
nginx-ingress-848796976d-nq85s   1/1     Running       0          3h56m
```

Ingress Under the Hood

1. Let's take peek under the hood – check out the NGINX Plus Ingress Controller Configurations. Run the following commands to view the NGINX Configuration:

```
# Store the KIC Pod name in a variable
export KIC_POD_NAME=$(kubectl get pods -n nginx-ingress -o
jsonpath='{.items[0].metadata.name}')

# Check the full Nginx config
kubectl exec -it $KIC_POD_NAME -n nginx-ingress -- nginx -T
```

Inspect the output: `nginx -T` prints out the entire Nginx configuration. Scroll up and down - do you see:

- `server` block
- the `listen` ports
- `café.example.com` Hostname
- `TLS` configurations
- `upstream blocks` with Pod IPs
- the `least_time` or `round-robin` load balancing method

This is all standard Nginx Plus under the hood, it should look very familiar.

Enhanced Logging with NGINX Plus Ingress

Let's add some additional fields to the Nginx Access Log, you need more data about the performance of the **coffee** and **tea** pods for Developers. They are asking you to help fix an **"application too slow"** escalation ticket from the Marketing team. The "free coffee" campaign was popular but customer feedback was the website was too slow.

For reference, this is the default Nginx Access Log format:

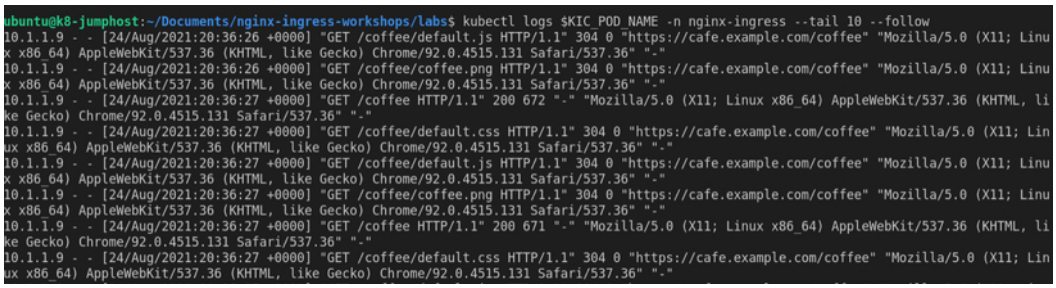
```
log_format main $remote_addr - $remote_user [$time_local] $request $status
$body_bytes_sent $http_refererm $http_user_agent $http_x_forwarded_for;
```

However, there are only **two** log variables with any useful data related to the actual pods:

- HTTP status code (`$status`)
- Bytes Sent (`$body_bytes_sent`)

1. Use the `kubectl log` command, to view the default Nginx Plus Ingress Controller Access log format:

   ```
   kubectl logs $KIC_POD_NAME -n nginx-ingress --tail 10 --follow
   ```

   How do you even know *which* `pod` sent the response? To properly troubleshoot and identify the poor performance of a pod, you need much more information.

2. Type `Ctrl-C` to stop the log `tail` when finished.

3. Lets implement an **Enhanced** Access Log format, to collect extra Nginx Plus Request and Response and pod statistics, we can do this by adding new log variables specifc to NGINX Plus Ingress such as the Kubernetes pods' resource and traffic details.

   NGINX Plus has many variables that can be used for logging. In the code snippet below (`lab7/nginx-config-enhanced-logging.yaml`), you can see the new **Enhanced** Access Log

format for the NGINX Plus Ingress Controller, as a `ConfigMap`:

```
kind: ConfigMap
apiVersion: v1
metadata:
  name: nginx-config
  namespace: nginx-ingress
data:
  lb-method: "least_time last_byte"
  log-format:  '$remote_addr - $remote_user [$time_local] "$request" $status
$body_bytes_sent "$http_referer" "$http_user_agent" "$http_x_forwarded_for"
rn="$resource_name" "$resource_type" "$resource_namespace" svc="$service"
"$request_id" rt="$request_time" ua="$upstream_addr"
uct="$upstream_connect_time" uht="$upstream_header_time"
urt="$upstream_response_time" uqt="$upstream_queue_time"
cs="$upstream_cache_status"'
```

Taking advantage of the additional logging variables from NGINX Plus will provide detailed insight into which upstream pods are working the best, and which are having issues. This should help the app dev team to identify the slow pods and further help in their troubleshooting steps.

4. Apply the **Enhanced** Access Log format (`lab7/nginx-config-enhanced-logging.yaml`) manifest using the `kubectl apply` command:

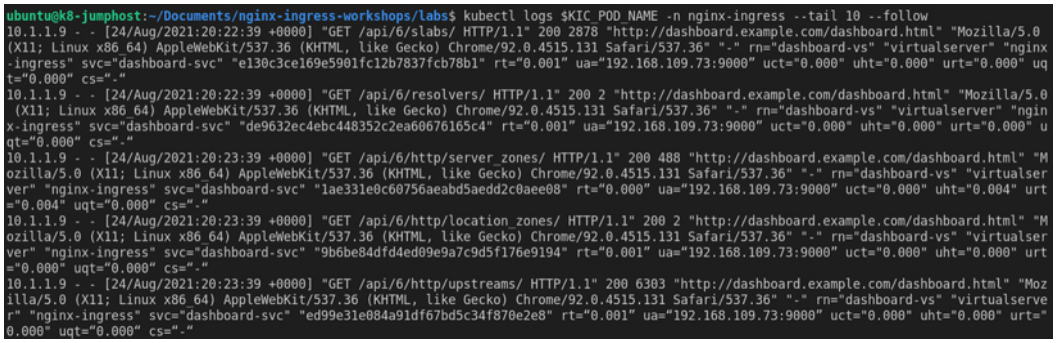
```
kubectl apply -f lab7/nginx-config-enhanced-logging.yaml -n nginx-ingress
```

5. Let's generate new traffic by refreshing the `cafe.example.com/coffee` webpage in the Chrome web browser several times, to send some requests, to see the new **Enhanced** Access Logging format.

   Now we are ready to inspect the the new logs: the Pod's HTTP Header and Response times have been added to the log format, in addition to the pod's actual Kubernetes name. The response time values in the log should be similar to what you observed in the Plus Dashboard.

6. Take a look at the **Enhanced** NGINX Access log format using the `kubectl log` command:

```
kubectl logs $KIC_POD_NAME -n nginx-ingress --tail 10 --follow
```



7. Type `Ctrl-C` to stop the log `tail` when finished.

This completes this Lab.

References:

- Summary of ConfigMap Keys - logging
- NGINX Variables

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

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Monitoring NGINX Plus Ingress with Prometheus and Grafana

Introduction

This lab exercise is going to walk you through how to install and use several tools to monitor your NGINXPlus Ingress Controller in your Kubernetes cluster.

Learning Objectives

By the end of the lab, you will be able to:

- Learn and Use Helm Charts
- Deploy Prometheus using Helm
- Deploy Grafana using Helm
- Access these apps thru NGINX Ingress Controller

Helm	Prometheus	Grafana
		

Here is a brief description of what these different tools and application provide, and how you will use them.

`Helm` will make it simple to install everything into your cluster. This keeps the setup easier to deploy and easier to manage. (Note, you can also install using the `manifests` method or `operator` method as well). It will come down to personal preference or specific requirements when installing software into Kubernetes. You will use the Helm Chart provided by NGINX for this lab exercise.

`Prometheus` is a software package that can watch and collect statistics from many different k8s pods and services. It then provides those statistics in a simple html/text format, often referred to as the "scraper page", meaning that it scrapes the statistics and presents them as a simple text-based web page.

`Grafana` is a data visualization tool, which contains a time series database and graphical web presentation tools. Grafana imports the Prometheus scraper page statistics into it's database, and allows you to create `Dashboards` of the statistics that are important to you. There are a large number of pre-built dashboards provided by both Grafana and the k8s community, so there are many available to use. And of course, you can customize them as needed or build your own.

Helm Installation

Note: Helm should already be installed on the Ubuntu Jumpbox for you.

1. Verify Helm is installed and you are running Version 3.x or higher:

   ```
   # check your helm version (Needs to be v3 or higher)
   helm version --short
   ```

   ```
   ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ helm version --short
   v3.7.0+geeac838
   ```

   If Helm is not installed, run this command to install it:

   ```
   # Install helm command
   curl -sSL https://raw.githubusercontent.com/helm/helm/master/scripts/get-
   helm-3 | bash
   ```

2. Create a new Kubernetes namespace called `monitoring`. You will use this namespace for Prometheus and Grafana components:

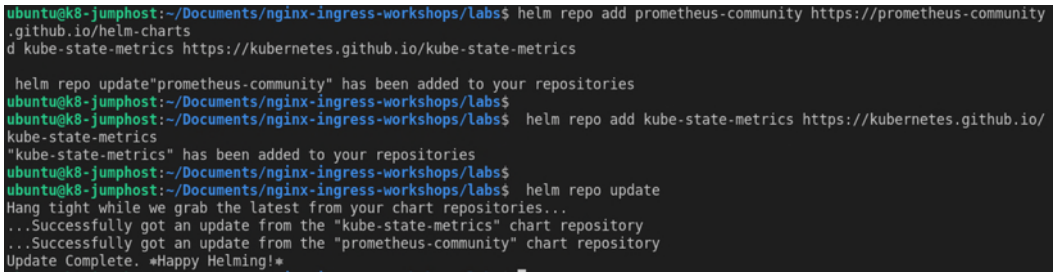
   ```
   kubectl create namespace monitoring
   ```

   ```
   ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl create namespace monitoring
   namespace/monitoring created
   ```

Prometheus Installation

1. The first step will be to deploy `Prometheus` into our cluster. Below are the steps to install it using Helm as follows:

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

helm repo add kube-state-metrics https://kubernetes.github.io/kube-state-metrics

helm repo update
```



2. Once the repos have been added to Helm, the next step is to deploy a `release`. For this lab, you will create a release called `nginx-prometheus`.

```
helm install nginx-prometheus prometheus-community/prometheus -n monitoring
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ helm install nginx-prometheus prometheus-community/prometheus -n monitoring
NAME: nginx-prometheus
LAST DEPLOYED: Thu Oct  7 20:42:47 2021
NAMESPACE: monitoring
STATUS: deployed
REVISION: 1
TEST SUITE: None
NOTES:
The Prometheus server can be accessed via port 80 on the following DNS name from within your cluster:
nginx-prometheus-server.monitoring.svc.cluster.local


Get the Prometheus server URL by running these commands in the same shell:
  export POD_NAME=$(kubectl get pods --namespace monitoring -l "app=prometheus,component=server" -o jsonpath="{.items[0].metadata.name}")
  kubectl --namespace monitoring port-forward $POD_NAME 9090


The Prometheus alertmanager can be accessed via port 80 on the following DNS name from within your cluster:
nginx-prometheus-alertmanager.monitoring.svc.cluster.local


Get the Alertmanager URL by running these commands in the same shell:
  export POD_NAME=$(kubectl get pods --namespace monitoring -l "app=prometheus,component=alertmanager" -o jsonpath="{.items[0].metadata.name}")
  kubectl --namespace monitoring port-forward $POD_NAME 9093
#################################################################################
######   WARNING: Pod Security Policy has been moved to a global property.  #####
######            use .Values.podSecurityPolicy.enabled with pod-based      #####
######            annotations                                               #####
######            (e.g. .Values.nodeExporter.podSecurityPolicy.annotations) #####
#################################################################################


The Prometheus PushGateway can be accessed via port 9091 on the following DNS name from within your cluster:
nginx-prometheus-pushgateway.monitoring.svc.cluster.local


Get the PushGateway URL by running these commands in the same shell:
  export POD_NAME=$(kubectl get pods --namespace monitoring -l "app=prometheus,component=pushgateway" -o jsonpath="{.items[0].metadata.name}")
  kubectl --namespace monitoring port-forward $POD_NAME 9091

For more information on running Prometheus, visit:
https://prometheus.io/
```

Grafana Installation

1. Next step will be to setup and deploy Grafana into your cluster:

```
helm repo add grafana https://grafana.github.io/helm-charts
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ helm repo add grafana https://grafana.github.io/helm-charts
"grafana" has been added to your repositories
```

2. The Grafana repo is added via Helm. Next you will install Grafana using the below command. For this lab, you will create a second release called `nginx-grafana`.

```
helm install nginx-grafana grafana/grafana -n monitoring
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ helm install nginx-grafana grafana/grafana -n monitoring
NAME: nginx-grafana
LAST DEPLOYED: Thu Oct  7 20:47:30 2021
NAMESPACE: monitoring
STATUS: deployed
REVISION: 1
NOTES:
1. Get your 'admin' user password by running:

   kubectl get secret --namespace monitoring nginx-grafana -o jsonpath="{.data.admin-password}" | base64 --decode ; echo

2. The Grafana server can be accessed via port 80 on the following DNS name from within your cluster:

   nginx-grafana.monitoring.svc.cluster.local

   Get the Grafana URL to visit by running these commands in the same shell:

     export POD_NAME=$(kubectl get pods --namespace monitoring -l "app.kubernetes.io/name=grafana,app.kubernetes.io/instance=nginx-grafana" -o jsonpath="{.items[0].metadata.name}")
     kubectl --namespace monitoring port-forward $POD_NAME 3000

3. Login with the password from step 1 and the username: admin
#################################################################################
######   WARNING: Persistence is disabled!!! You will lose your data when   #####
######            the Grafana pod is terminated.                            #####
#################################################################################
```

If you want to check the status of your helm installations, you can run this command which will show all helm deployments across the cluster"

```
helm ls -A
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ helm ls -A
NAME            NAMESPACE       REVISION        UPDATED                                 STATUS          CHART                   APP VERSION
nginx-grafana   monitoring      1               2021-10-07 20:47:30.741107581 +0000 UTC deployed        grafana-6.16.12         8.1.6
nginx-prometheus        monitoring      1               2021-10-07 20:42:47.941163425 +0000 UTC deployed        prometheus-14.9.0       2.26.0
```

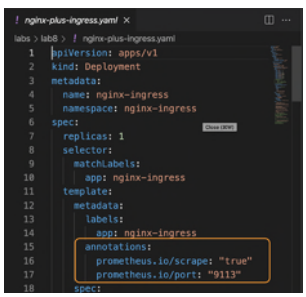
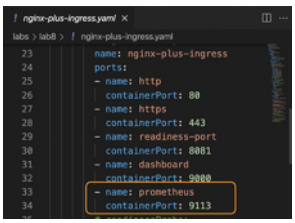
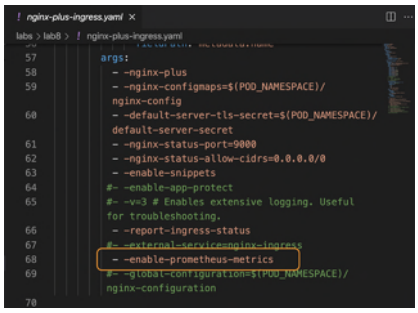
Testing the NginxPlus Prometheus "scraper" Port and Page

Verify that NginxPlus KIC is enabled for exporting Prometheus statistics. This requires 3 settings:

- Prometheus `Annotations` are enabled
- Port `9113` is open
- The Plus command-line argument `- -enable-prometheus-metrics` is enabled, to allow the collection of the KIC's statistics on that port.

!Bonus! - These settings have already been enabled for you in this lab, but they are `not` enabled by default.

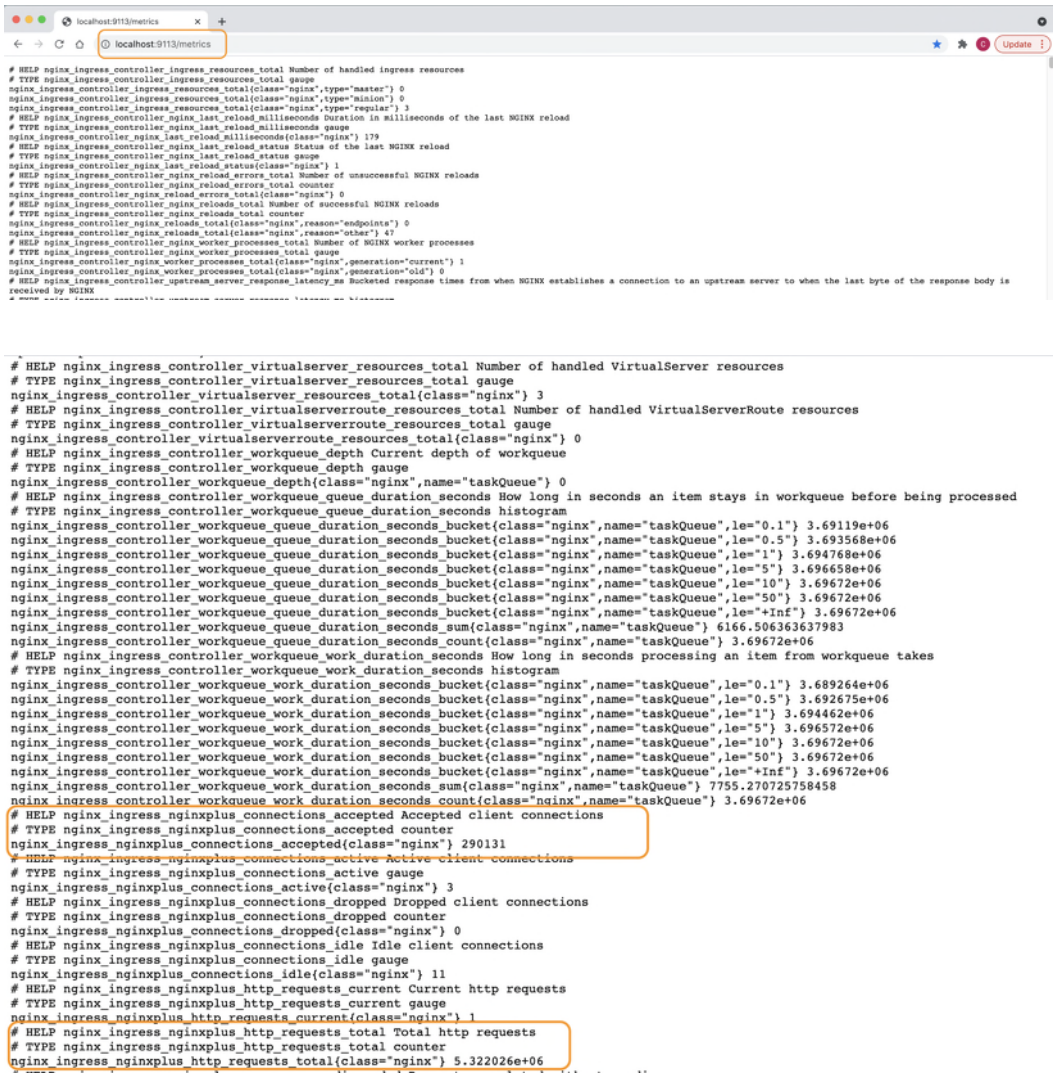
To see these settings, inspect the `lab2/nginx-plus-ingress.yaml` file, lines 15-17, 33-34, and 68.

Annotations	Port	Plus Args
		

1. Now verify this is enabled and working, using k8s port-forward:

```
kubectl port-forward -n nginx-ingress $KIC_POD_NAME 9113:9113
```

Open Chrome, and navigate to http://localhost:9113/metrics. You should see an HTML scraper page like this one:



If you see an HTML page from NGINX KIC similar to the one above, you are good to go. If you refresh this page several times, you will see that the stats are immediately updated. Notice that there is a `# TYPE` and `# HELP` in the scraper page entries, which describes the data type and definition of each metric.

> *It is important to point out, that the scraper page contains `all` of the NGINX Plus statistics that you see on the Dashboard, and a few extras.*

> ***This rich set of metrics will provide a great data source for the monitoring and graphing of NGINX Plus KIC.***

There are many tools that can collect, display, alert, and archive these metrics. You will use Prometheus and Grafana next to do just that.
Press `Control + C` to stop the port-forward when you are finished with the scraper page.

Prometheus Testing

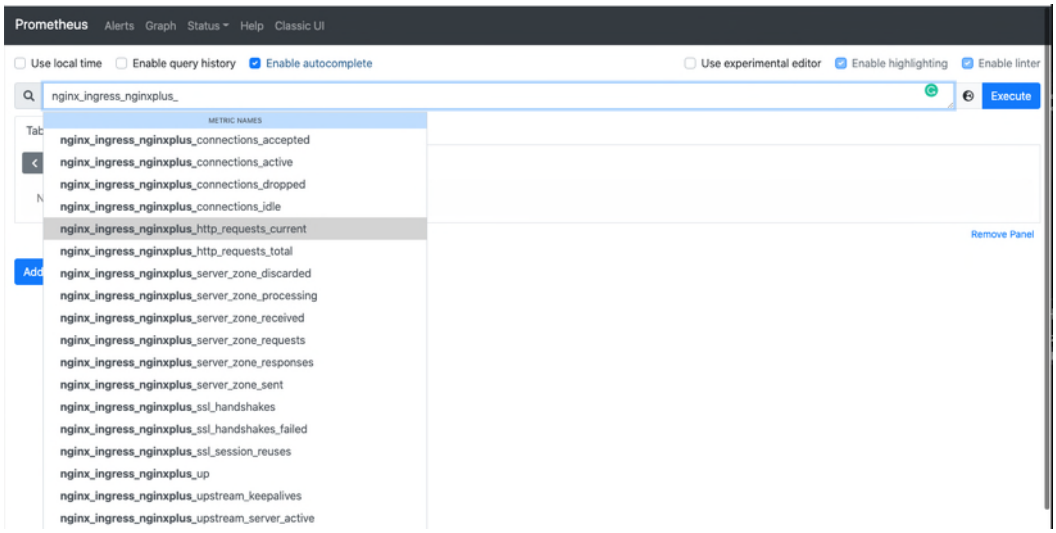
1. To test Prometheus you will run this command to create a shell variable for the Prometheus Server:

```
export PROMETHEUS_SERVER=$(kubectl get pods --namespace monitoring -l "app=prometheus,component=server" -o jsonpath="{.items[0].metadata.name}")
```

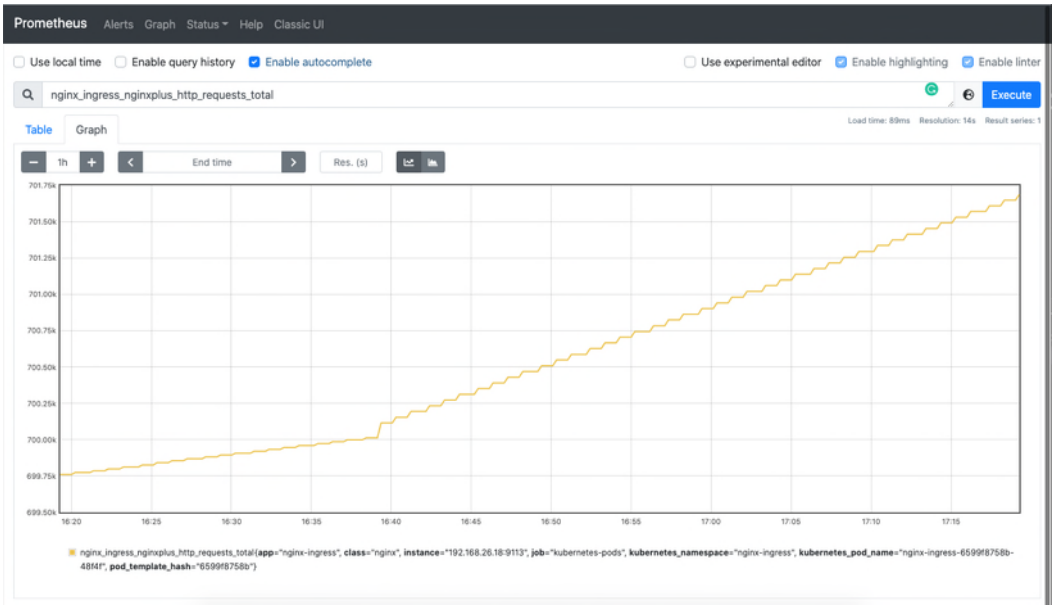
2. Use k8s port-forward to test access to the Prometheus Server:

```
kubectl port-forward $PROMETHEUS_SERVER 9090:9090 -n monitoring
```

Using Chrome, navigate to http://localhost:9090. You should see a webpage like this. Search for `nginx_ingress_` in the query box to see a list of all the statistics that Prometheus is collecting for you:



Select `nginx_ingress_nginxplus_http_requests_total` from the list, click on Graph, and then click the "Execute" Button. This will provide a graph similar to this one:



Take a few minutes to explore the many different statistics, time windows, etc.

Optional Prometheus Exercise

1. Create a Prometheus graph showing the `nginxplus HTTP upstream response time` from the pods. This should match the upstream response time values you see in the NGINX Plus Dashboard.

   Can you find where the pod `CPU stats` are recorded ? As you can see, there are hundreds of stats you can use to monitor NGINX KIC, k8s components, pods, and other resources.

   Press `Control + C` to stop port-forward when you are finished.

Grafana Testing

1. Retrieve the Grafana admin login password, which was dynamically created by Helm during the installation:

```
kubectl get secret --namespace monitoring nginx-grafana -o jsonpath="
{.data.admin-password}" | base64 --decode ; echo
```

2. To test Grafana, set a shell variable to the Grafana Server to the name of the Grafana pod:

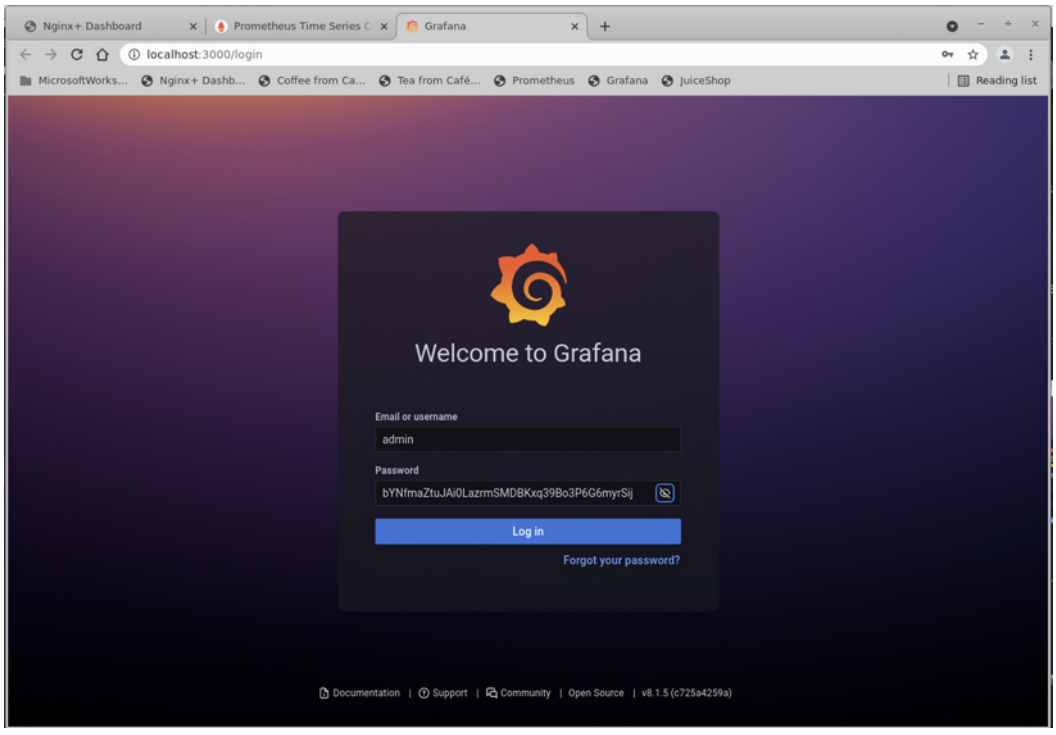
```
export GRAFANA_SERVER=$(kubectl get pods --namespace monitoring -l
"app.kubernetes.io/name=grafana,app.kubernetes.io/instance=nginx-grafana" -o
jsonpath="{.items[0].metadata.name}")
```

3. Use k8s port-forward:

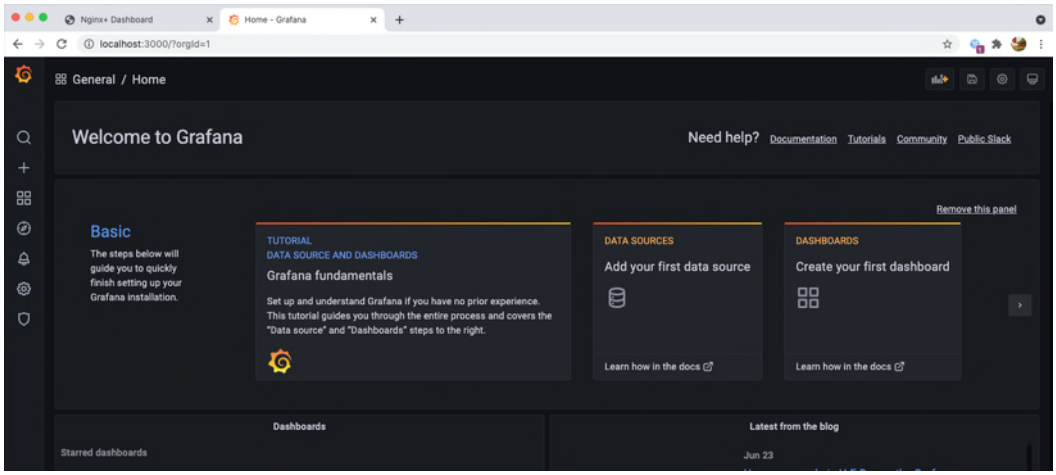
```
kubectl -n monitoring port-forward $GRAFANA_SERVER 3000:3000
```

4. Using Chrome, navigate to http://localhost:3000 on your browser.

   You can login into Grafana using `admin` and the `password` retrieved above.



   After logging in, you should see the main Grafana Welcome page:



You will be creating and using some custom Grafana Dashboards in the next sections.

Press `Control + C` to stop port-forward when you are finished.

NGINX Ingress for Prometheus and Grafana

For you and your team to access Prometheus and Grafana from outside the cluster, you will add these apps to your existing NGINX Ingress Controller. In your lab environment, you will use VirtualServer and VirtualServerRoute manifests, to take advantage of NGINX's ability to do cross-namespace routing. (Prometheus and Grafana are running in the "monitoring" namespace, remember?).

1. Inspect the `prometheus-vs.yaml`, `grafana-vs.yaml` and `grafana-vsr.yaml` files in the lab8 folder.

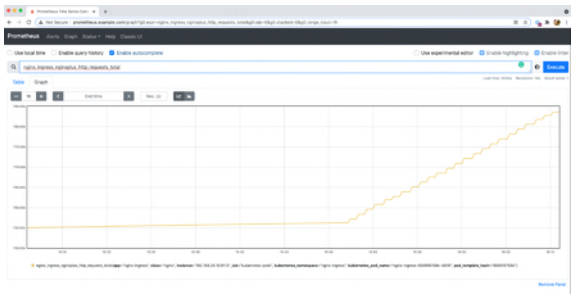
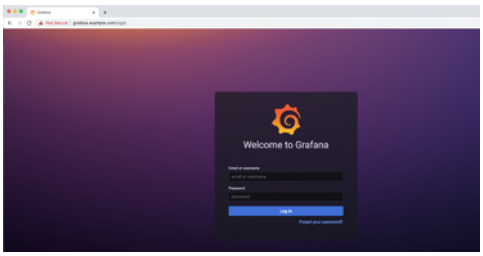
   Notice that you are routing requests to your Prometheus and Grafana applications that live in a different namespace (`monitoring` in this lab), which are specified in your `VirtualServer/VirtualServerRoute` configuration.

2. Apply the VS manifests:

```
kubectl apply -f lab8/prometheus-vs.yaml
kubectl apply -f lab8/grafana-secret.yaml
kubectl apply -f lab8/grafana-vs.yaml
kubectl apply -f lab8/grafana-vsr.yaml
```

```
^Cubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl apply -f lab8/prometheus-vs.yaml
apply -f lab8/grafana-secret.yaml
 kubectl apply -f lab8/grafana-vs.yaml
 kubectl apply -f lab8/grafana-vsr.yamlvirtualserver.k8s.nginx.org/prometheus-vs created
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$  kubectl apply -f lab8/grafana-secret.yaml
secret/grafana-secret created
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$  kubectl apply -f lab8/grafana-vs.yaml
virtualserver.k8s.nginx.org/grafana-vs created
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$  kubectl apply -f lab8/grafana-vsr.yaml
virtualserverroute.k8s.nginx.org/grafana-dashboard created
```

3. To test access through NGINX Ingress, open Chrome and navigate to Prometheus (http://prometheus.example.com) and Grafana (https://grafana.example.com) bookmarks.

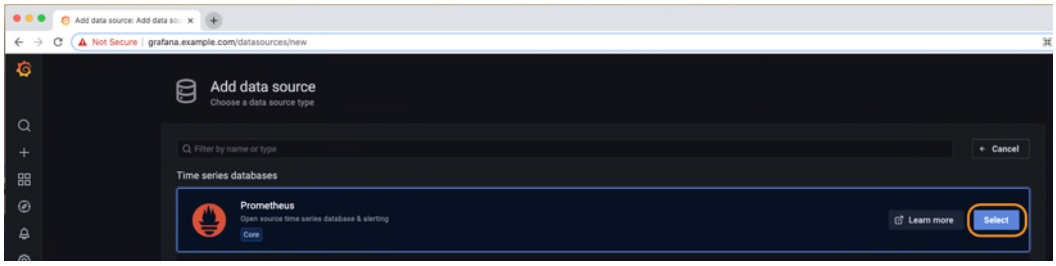
Prometheus	Grafana
	

Try another Prometheus query that interests you.

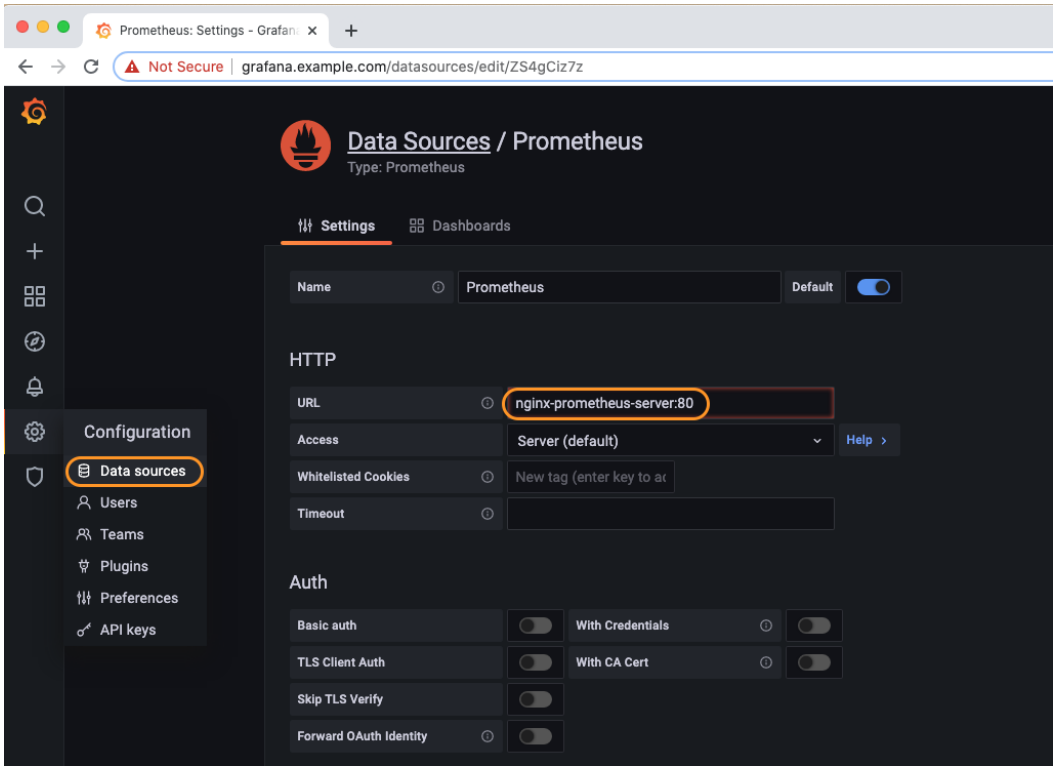
You can login to Grafana using the same admin/password credentials that you used earlier.

Configure Grafana Data Sources

1. Once logged in, from the left panel you need to click on `Configuration -> Data sources` and add `Prometheus` as a data source.



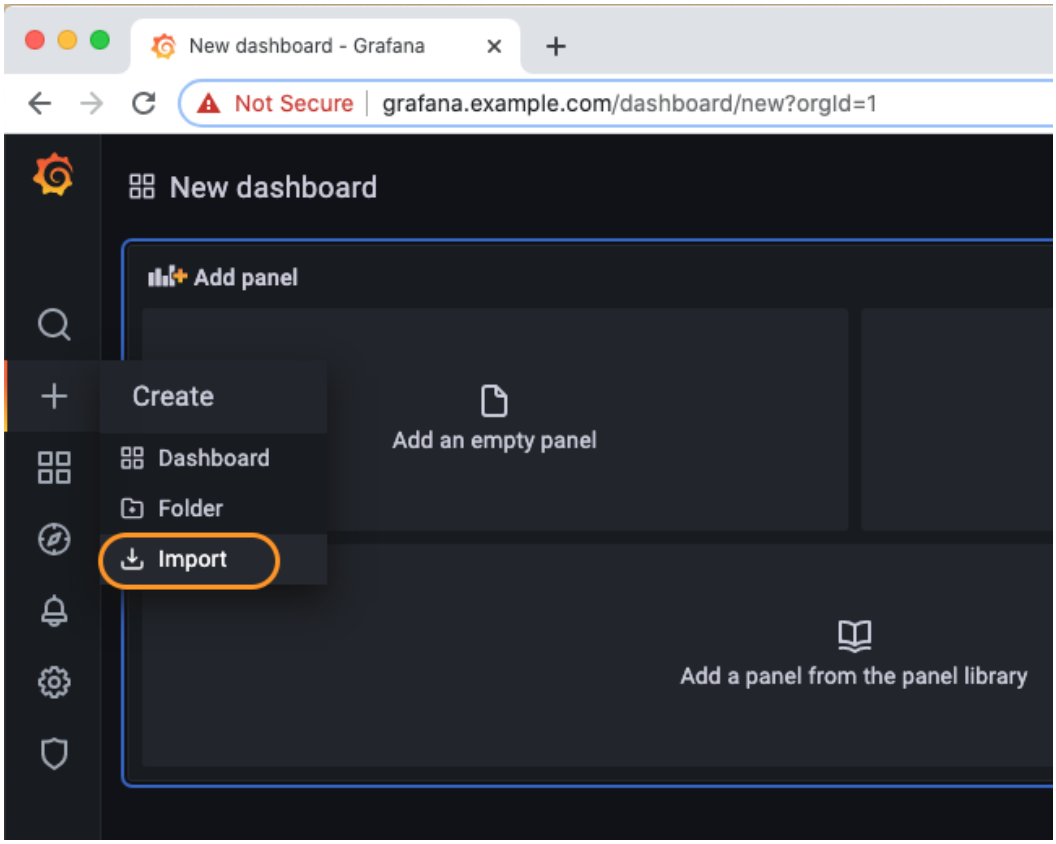
2. Once `Prometheus` is added as a data source, in the Prometheus `settings` tab, update HTTP URL to `nginx-prometheus-server:80` .



Scroll to the botton, and click "Save and Test", it should show a Green Checkmark status and then click the "Back" button.

Import Grafana Custom Dashboards

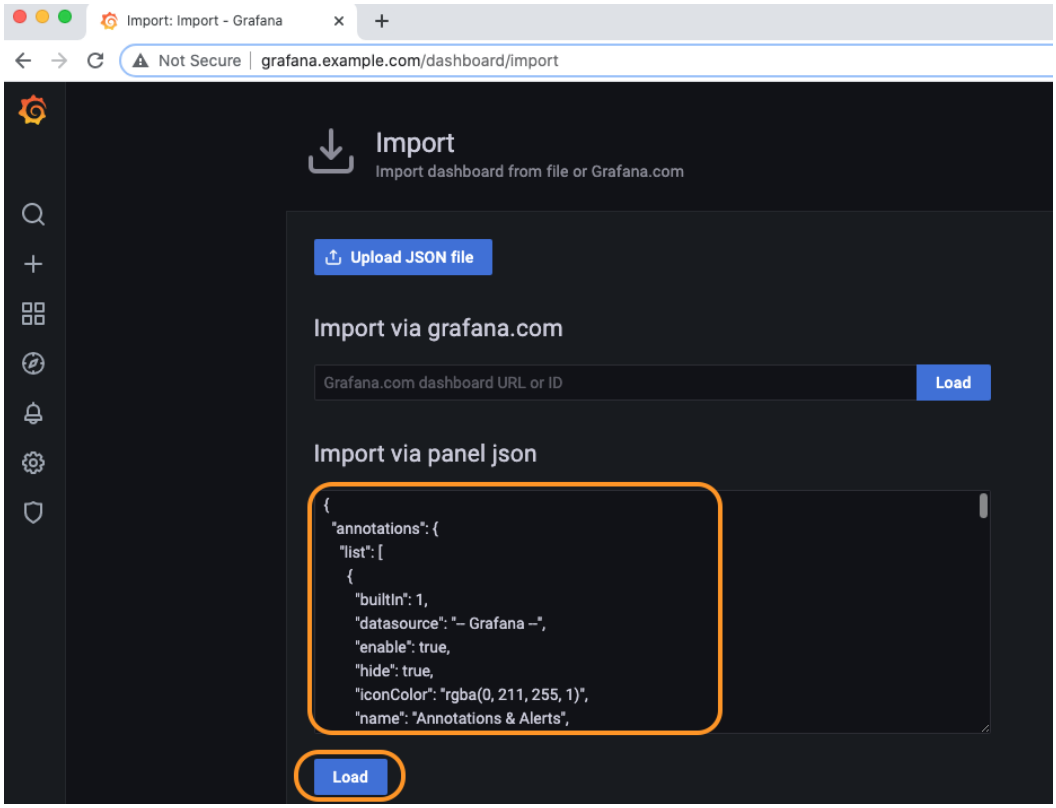
1. Now you should be ready to import the NGINX Dashboards for KIC from NGINX, Inc. From the left panel click on `Import` to add the dashboard:



2. Next you will import the two Grafana dashboard JSON definition files present in the `lab8` folder.

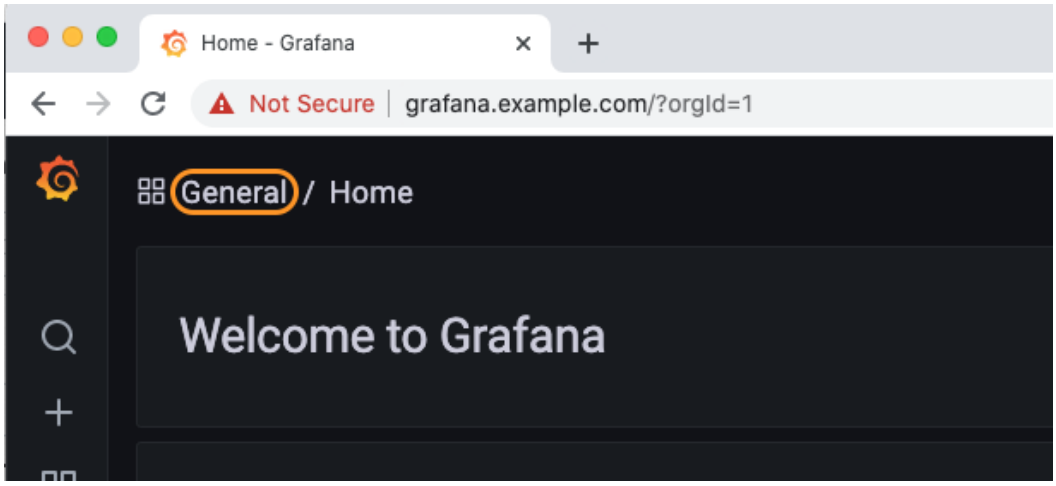
   - `NGINX-Basic.json` gives you basic metrics which come from NGINX Opensource.
   - `NGINXPlusICDashboard.json` is provided by NGINX, Inc, giving you advanced Layer 4 thru 7 TCP/HTTP/HTTPS metrics which are only available from NGINX Plus.

   Copy the entire json file and place it within the `Import via panel json` textbox and click on `Load` button.

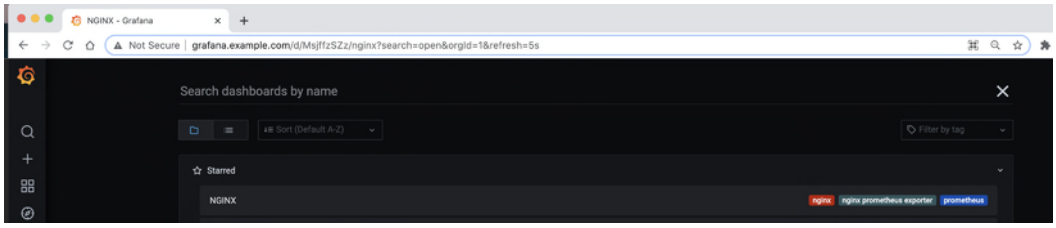


3. Once you have imported both Dashboards, it's time to check them out:

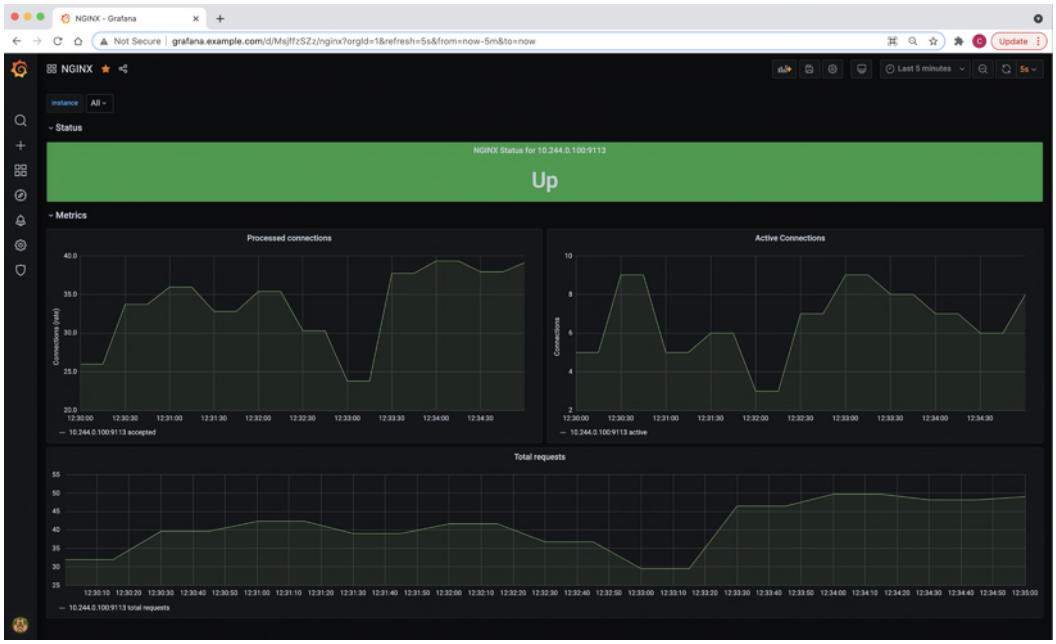
   From the Grafana homepage, navigate to the `General` section as shown:



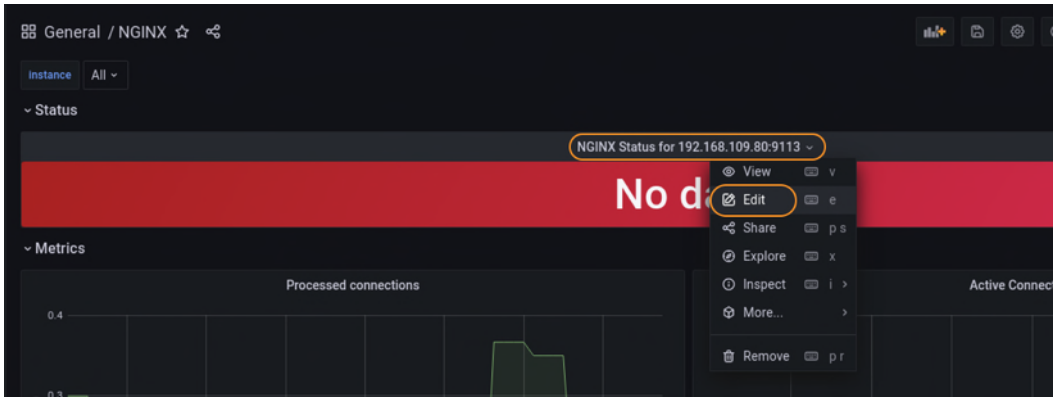
   In the `General` section, click on the `NGINX` dashboard.

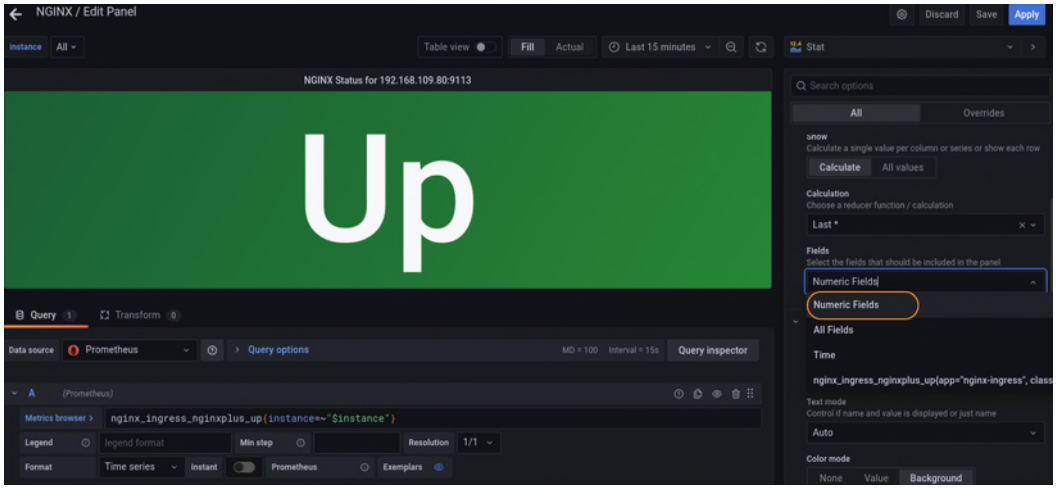


This should open up the NGINX Basic Grafana Dashboard. You can expand the sub-sections or adjust the `time range` and `refresh` interval in the upper right corner as needed. You can see this shows the up/down Status of the Ingress, and few Connections and Requests stats:

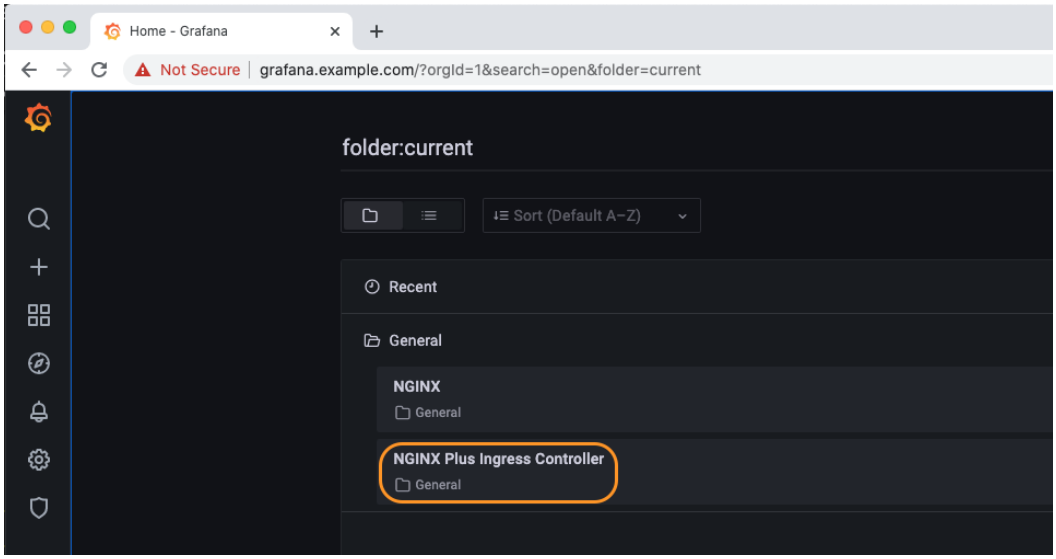


NOTE: If you see a red bar with the message "**No Data**" in the top most pane as seen in below screenshot then click on edit, and change Value options Fields to "Numeric Fields" and click Apply.

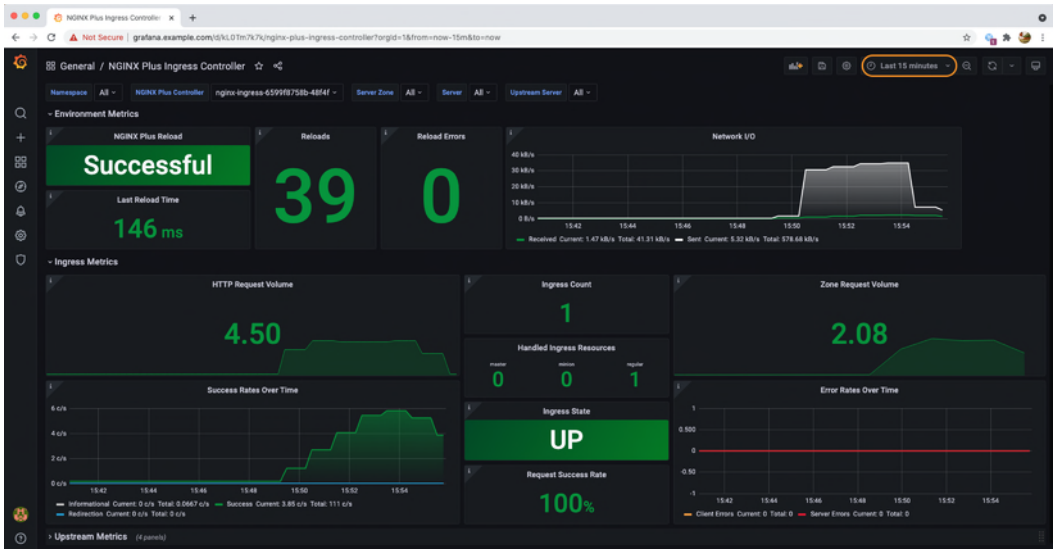




4. Next, from the `General` section, select the `NGINX Plus Ingress Controller` Dashboard.

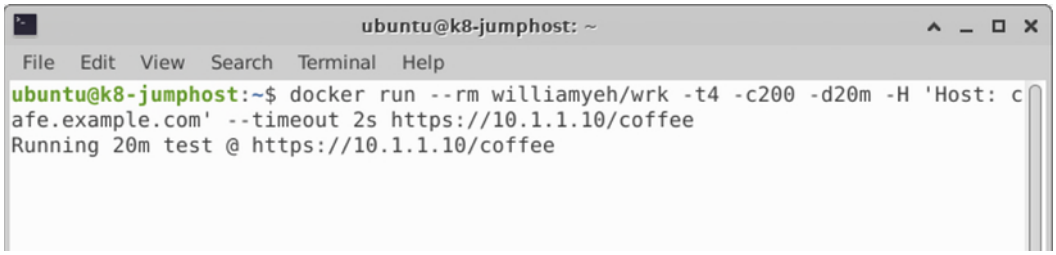


This should open up the NginxPlus Grafana Dashboard. You can expand the sub-sections or adjust the time range and refresh time as needed.



If the graphs are blank or do not show much data, try restarting the loadtest tool from the previous lab, you should see some statistics being collected and graphed after a few minutes:

```
docker run --rm williamyeh/wrk -t4 -c200 -d20m -H 'Host: cafe.example.com' --
timeout 2s https://10.1.1.10/coffee
```



This completes this Lab.

References:

- VirtualServer and VirtualServerRoute
- Grafana NGINX Plus IC Dashboard

Authors

- Jason Williams - Product Management Engineer @ F5, Inc.
- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

Navigate to (Lab9 | Main Menu)

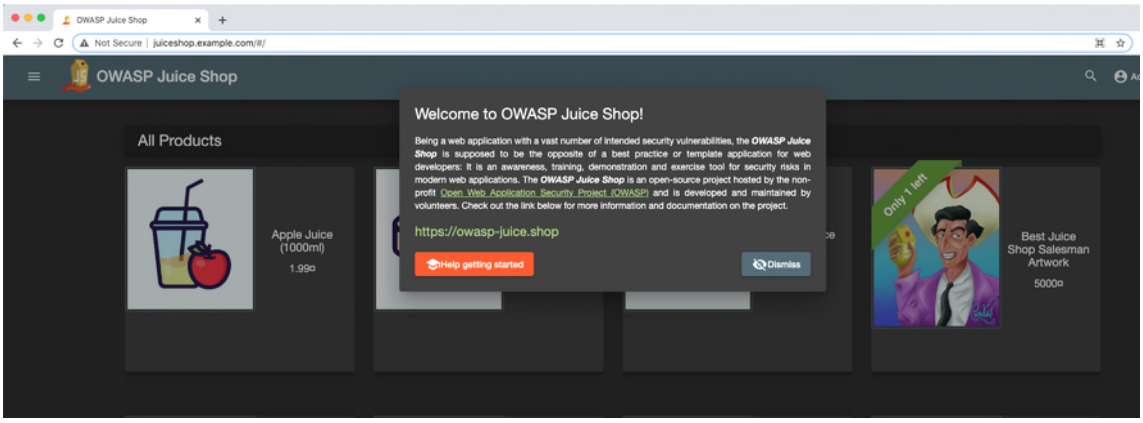
Lab 9: Deploy JuiceShop application, using VS/VSR manifests

In this lab, we deploy a new application, leaving the current Cafe and Bar apps up and running. This new app environment is deployed using NginxPlus VirtualServer/VSRroute manifests.

Learning Objectives

By the end of the lab, you will be able to:

- Create a new Kubernetes namespace
- Deploy and test a new application
- Access this new app thru Nginx Ingress Controller



You will launch a new application, called `Juice Shop`, representing a modern online retail sales app, a nice refeshing addition to Cafe and Bar. It will be deployed in a new Kubernetes namespace called "juice" in your cluster. The Juice Shop app is often used to test various HTTP and Website vulnerabilities. However, you will use it to test various NginxPlus features.

1. Inspect both of the Lab9 Juiceshop YAML files, `juiceshop.yaml`, and `juiceshop-vs.yaml`. Do you see the deployment, service, and virtual server and route definitions?

2. Next deploy the JuiceShop namespace, application using these manifests:

```
kubectl create namespace juice
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl create namespace juice
namespace/juice created
```

```
kubectl apply -f lab9/juiceshop.yaml
kubectl apply -f lab9/juiceshop-vs.yaml
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl apply -f lab9/juiceshop.yaml
deployment.apps/juiceshop created
service/juiceshop-svc created
secret/juice-secret created
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl apply -f lab9/juiceshop-vs.yaml
virtualserver.k8s.nginx.org/juiceshop-vs created
```

3. Show running Juice components:

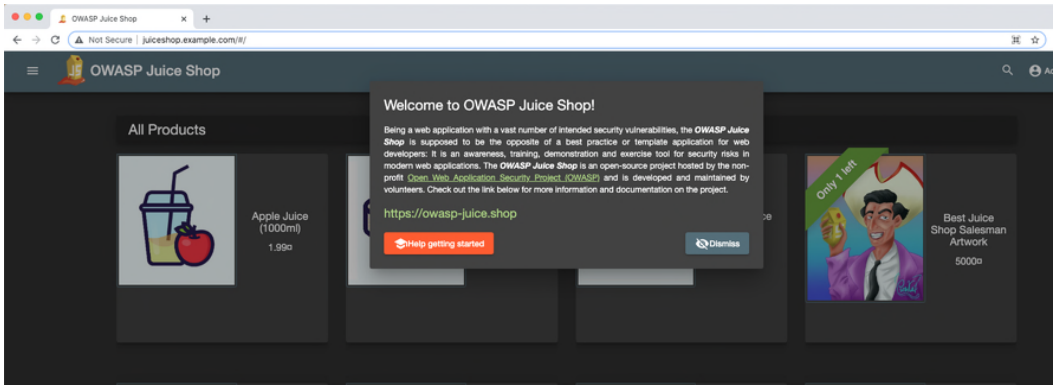
```
kubectl get pods,svc,vs -n juice -o wide
```

```
ubuntu@k8-jumphost:~/Documents/nginx-ingress-workshops/labs$ kubectl get pods,svc,vs -n juice -o wide
NAME                             READY   STATUS    RESTARTS   AGE   IP               NODE   NOMINATED NODE   READINESS GATES
pod/juiceshop-6cf9dddc7f-258w8   1/1     Running   0          95s   192.168.219.18   k8s3   <none>           <none>
pod/juiceshop-6cf9dddc7f-j5g5n   1/1     Running   0          95s   192.168.109.94   k8s2   <none>           <none>
pod/juiceshop-6cf9dddc7f-k65js   1/1     Running   0          95s   192.168.219.15   k8s3   <none>           <none>

NAME                    TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE   SELECTOR
service/juiceshop-svc   ClusterIP   None         <none>        80/TCP    95s   app=juiceshop

NAME                                        STATE   HOST                  IP    PORTS   AGE
virtualserver.k8s.nginx.org/juiceshop-vs    Valid   juiceshop.example.com                 82s
```

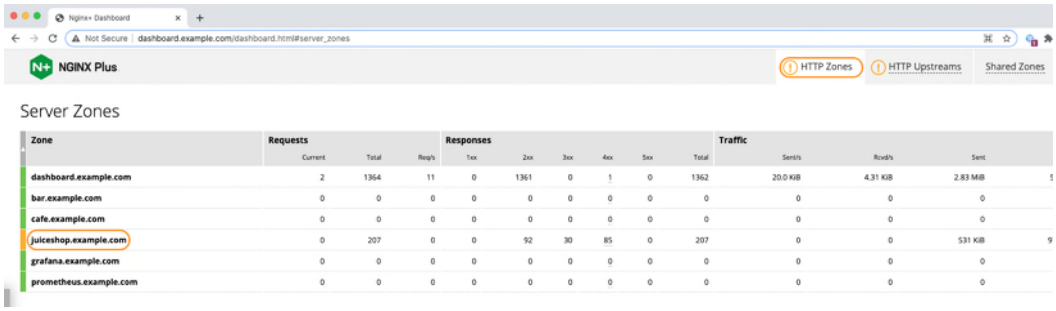
4. Test the new Juice Shop application and VS/VSR manifests.

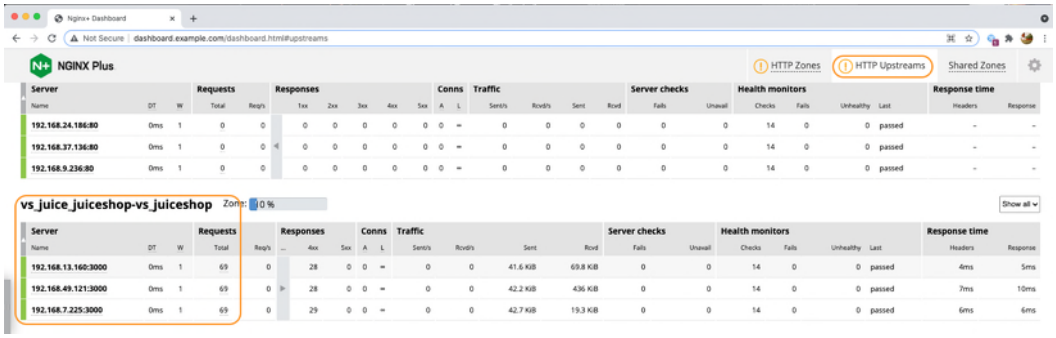
   Open Chrome, navigate to (http://juiceshop.example.com). Click around for a few minutes to explore the application.

   Did you notice, how easy it was with Plus KIC, to launch a completely new application in just a few seconds? With just 2 YAML manifest files - and `no IT tickets` required to do this? Nginx KIC can perform the Layer7 Hostname and path routing for many different applications running in your k8s cluster.



5. Check the KIC Plus Dashboard, you should see a new JuiceShop HTTP Zone and Upstreams:





This completes this Lab.

References:

- Nginx VirtualServer / Route
- JuiceShop Demo Source

Authors

- Chris Akker - Technical Solutions Architect @ F5, Inc.
- Shouvik Dutta - Technical Solutions Architect @ F5, Inc.

Navigate to (Lab10 | Main Menu)

Lab 10: Advanced Nginx Plus features with VirtualServer manifests

Learning Objectives

By the end of the lab, you will be able to:

- Enable and test some Nginx Plus features to control how Ingress Controller handles different situations and enables Enterprise features, like:
  - Active Healthchecks
  - Custom Error Pages
  - HTTP Caching
  - Mutual TLS
  - Blue/Green testing

Active Healthchecks

Nginx Plus provides many options for active health checking of pods and services. You will enable some checks for URI paths, and set the interval and counts that meet the needs of the application. A Community Ingress manifest has some limitations in defining a healthcheck. With an Nginx VirtualServer manifest, additional options can be configured for production workloads.

1. Inspect `lab10/juice-health-bad-vs.yaml` file, lines 17-25 for the healthchecks. You will notice we have commented out the correct TCP port for the healthcheck of the backend pods. What do you think will happen if you do not check the correct TCP port?

```
17      healthCheck:
18        enable: true
19        path: /
20        interval: 5s
21        jitter: 3s
22        fails: 3
23        passes: 2
24        #port: 3000
25        connect-timeout: 15s
26        read-timeout: 5s
27        statusMatch: "200"
```

2. Remove the running JuiceShop Virtual Server from the previous lab:

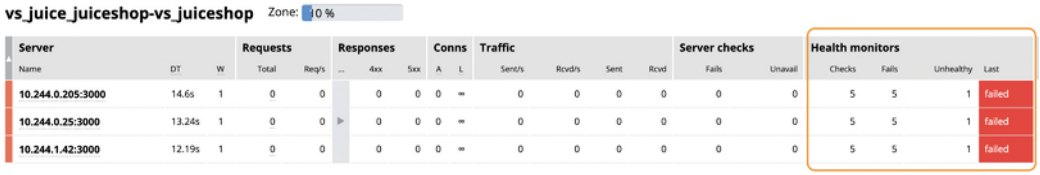
```
kubectl delete -f lab9/juiceshop-vs.yaml
```

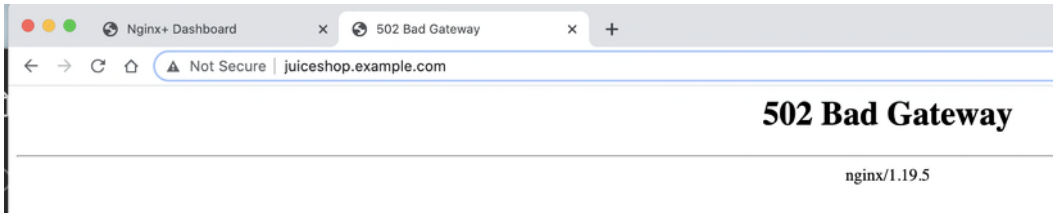
3. Try the new Virtual Server with incorrect healthchecks enabled:

```
kubectl apply -f lab10/juice-health-bad-vs.yaml
```

4. Check your Plus Dashboard, and then try refreshing your Juice Shop browser page. What did you see and what happened to your JuiceShop application ?

▶ Click for Hints!



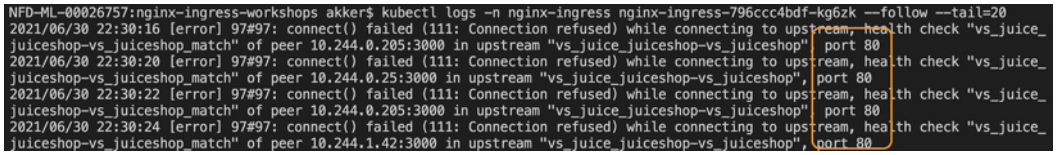


5. Quickly!! - checking further, look at the Ingress Controller logs, what do they show ?

```
kubectl logs -n nginx-ingress $KIC_POD_NAME --follow --tail=20
```

Detailed Explanation: The Dashboard shows all your juiceshop upstreams as Down, due to `Failed` healthchecks. Your JuiceShop VirtualServer is running, but the website is now offline because the pods are in a `Failed` state. Nginx `502 Bad Gateway` errors are an important sign that Nginx has `no upstreams available` to service the request.

The Ingress Logs should show `[error] 97 ... 111: Connection refused` messages for the healthchecks on port 80 (but remember, the JuiceShop pods are running on port 3000!).

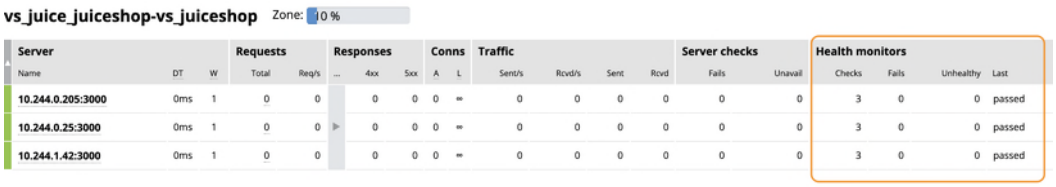


Type Ctrl+C to stop the log tail when you are finished.

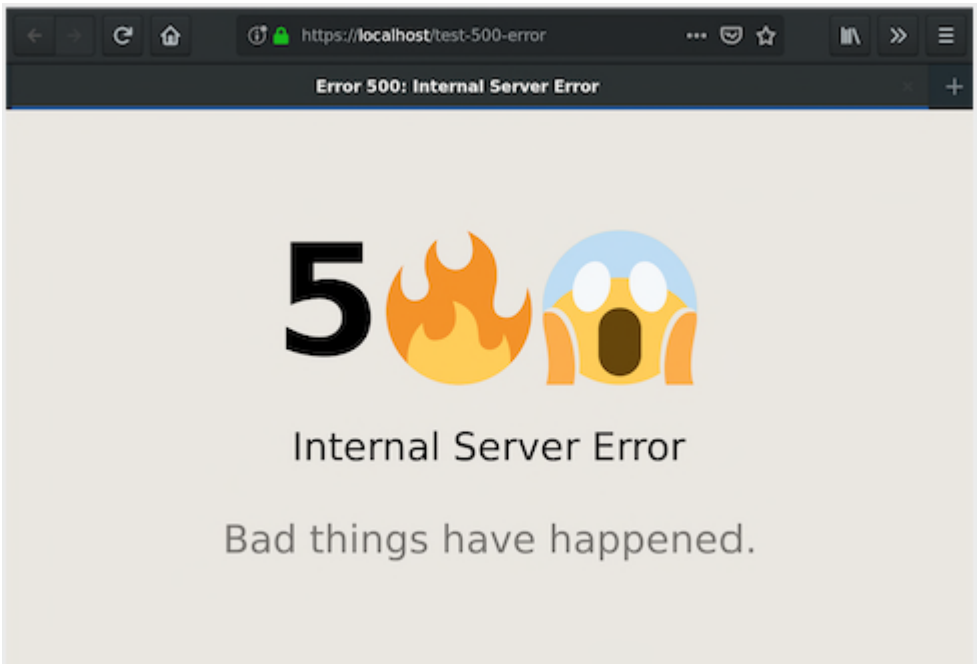
6. Inspect the fixed YAML manifest VS file, `juice-health-good-vs.yaml`, with the correct healthcheck port of 3000 on line #24. Now try that one:

```
kubectl apply -f lab10/juice-health-good-vs.yaml
```

7. Check your KIC Plus Dashboard again, with Health monitors now green, and your website is up and browser access is restored. The connection errors in the Ingress log should have stopped as well.



Custom Error Pages



The Director of Customer Support has asked if you can stop the ugly HTTP 502 error messages from going back to the customers, as the developers say they are too busy to fix it. While you can't actually stop them, you can hide the 502 errors and send the customers an alternative page.

So you will enable a `Sorry page` that gives customers a more friendly `Please try again later` message, with a Customer Support phone number to call if they need help.

Nginx Plus provides many options for intercepting HTTP response errors and providing user-friendly error pages from web applications. In this example, you will enable a simple error response page.

1. Inspect `lab10/juice-sorrypage.yaml` file, lines 30-40.

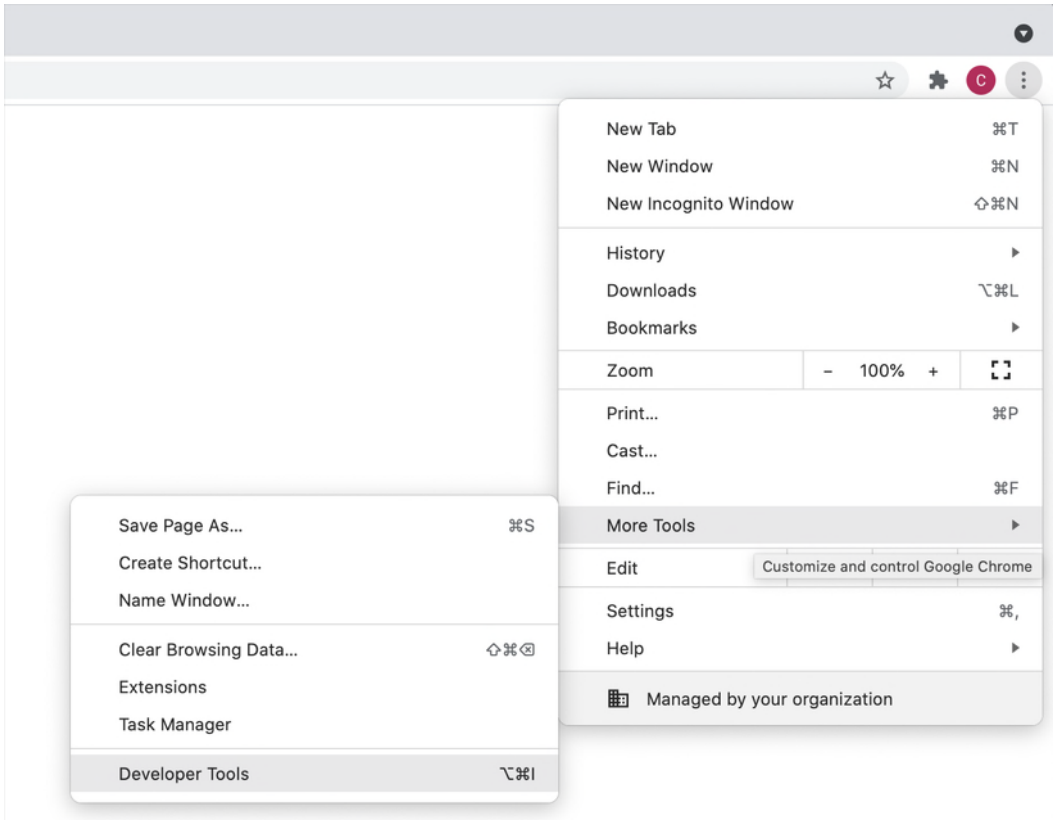
```
27  routes:
28  - path: /
29    action:
30      pass: juiceshop
31    errorPages:
32    - codes: [502]
33      return:
34        code: 200
35        type: application/json
36        body: |
37          {\"We apologize for the inconvenience.  Please try again in a few minutes, or call 1-888-JUICESHOP.\"}
38        headers:
39        - name: X-Debug-Original-Status
40          value: ${upstream_status}
41
```

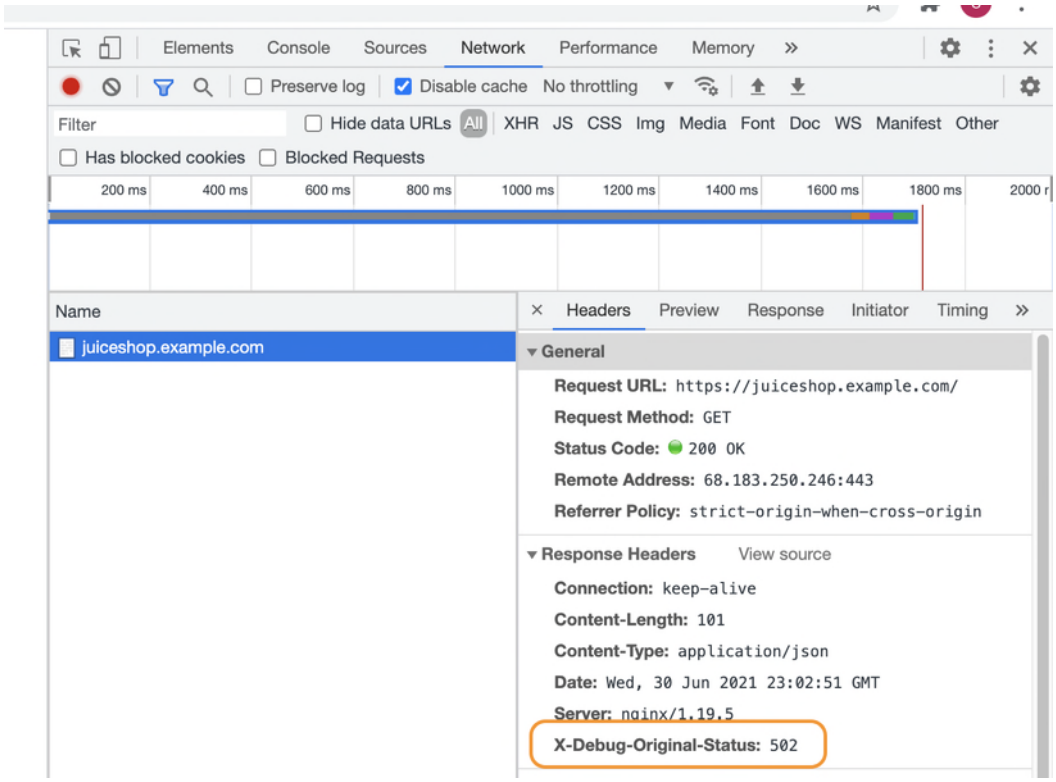
   Now apply the customer friendly error page manifest:

```
kubectl apply -f lab10/juice-sorrypage.yaml
```

2. And try a refresh on your Juice Shop Browser, what do you see now ?

   Notice we have modified this 502 Bad Gateway error page to be more customer friendly. For production, you could further customize this page if a user encountered an error page from a pod. If you check Chrome Developer Tools, you will see that we have also added a custom `Nginx Debug Header`, which shows what the original response error code was.





Leave the Chrome Developer Tools open, you will need it for the next section.

Nginx Caching

Next, you will use some of the extra RAM available in your Ingress Controller to provide caching of static images from the pods. This will `improve` the customer experience by delivering images from the KIC's RAM, instead of waiting for the pods to deliver them.

In the previous Enhanced Logging lab, you added the `cache status` variable - `$upstream_cache_status` - to the Nginx access log, so you can see the cache HITS, MISSES, and EXPIRED status in the access log. You will also insert a custom HTTP Header for X-Cache-Status, so we can see the Nginx cache Response Header values with Chrome Developer Tools.

Inspect `lab10/juice-cache-vs.yaml` file, lines 7-9. Notice you are using an `http-snippet` to customize Nginx to use 256MB of available RAM for the cache, and to add an Nginx `X-Cache-Status` HTTP response header. And, on lines 32-36, you are also using a `location-snippet` to further customize Nginx to cache 200 responses for 30 seconds (cache aging timer), and ignore any Cache-Control request headers.

HTTP Snippet	Location Snippet
	lab10 > ! juice-cache-vs.yaml 31 - path: ~*\\.css|js|jpg|png 32 location-snippets: | 33 proxy_cache juiceshop; 34 proxy_cache_valid 200 30s; 35 proxy_cache_methods GET; 36 proxy_ignore_headers Cache-Control; 37 action: 38 pass: juiceshop

lab10 > ! juice-cache-vs.yaml

```yaml
apiVersion: k8s.nginx.org/v1
kind: VirtualServer
metadata:
  name: juiceshop-vs
  namespace: juice
spec:
  http-snippets: |
    proxy_cache_path /tmp levels=1:2
    keys_zone=juiceshop:10m
    max_size=256m;
    add_header X-Cache-Status
    $upstream_cache_status;
```

Note: In production, you would like to set the cache aging timer higher than 30 seconds. We intentionaly set the timer low in this lab so you can see what happens when the cache timer expires.

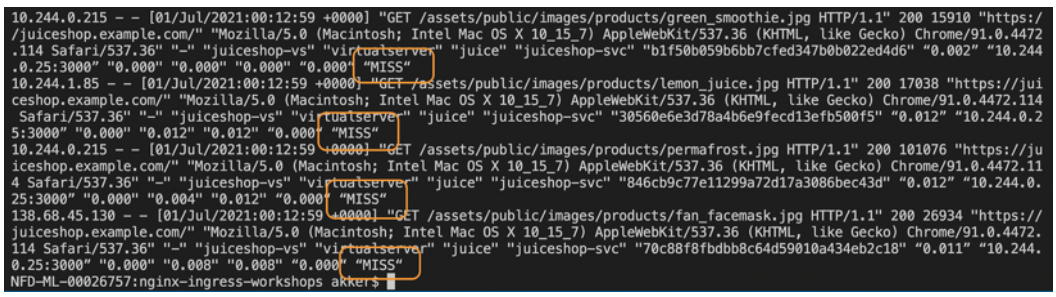
1. Now apply this Caching configuration, and test it:

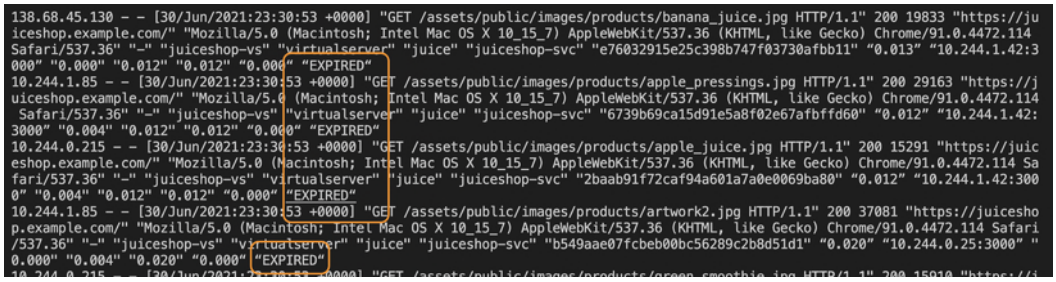
   ```
   kubectl apply -f lab10/juice-cache-vs.yaml
   ```

   Monitor the Ingress Controller access log, watch for "HIT", "MISS", and "EXPIRED" entries, while you refresh the Juice Shop pages:

   ```
   kubectl logs -n nginx-ingress $KIC_POD_NAME --follow --tail 50
   ```

   During refreshes, you should see some Cache "MISS" and "HIT" and "EXPIRED" log entries, it should be the last field of each log entry in the access log, as shown below. (This `Cache Status logging variable` was added when you enabled Enhanced Logging in a previous exercise).

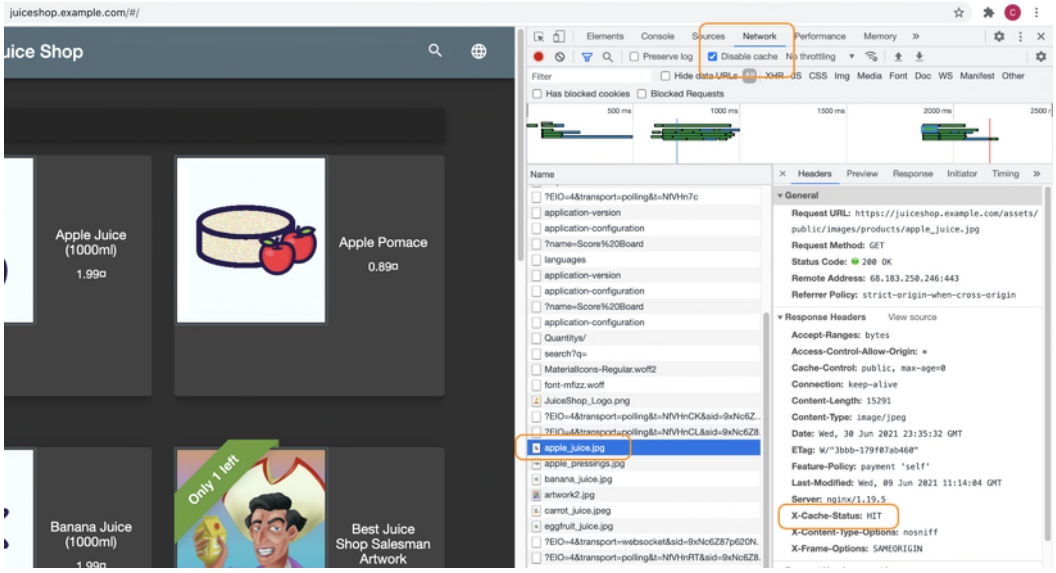




Type Ctrl+C to stop the log tail when you are finished.

2. Now, open a new Tab in Chrome, enable Developer Tools, and make sure you disable Chrome's internal browser cache, and select the `Network` tab at the top in Chrome Tools. Click the JuiceShop Favorite.

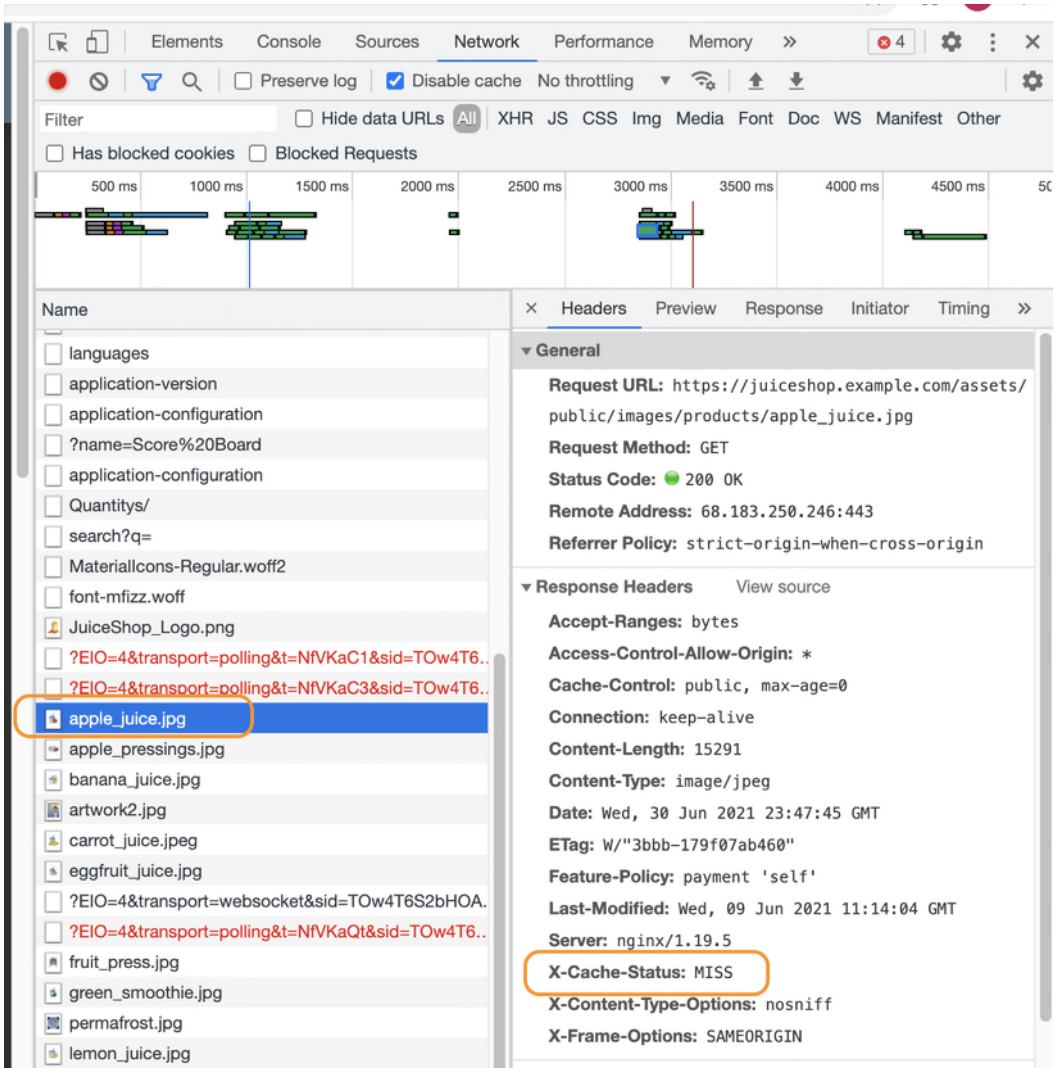
   Look for the `X-Cache-Status` Response Header and value (that Ingress is adding). It should look like this:

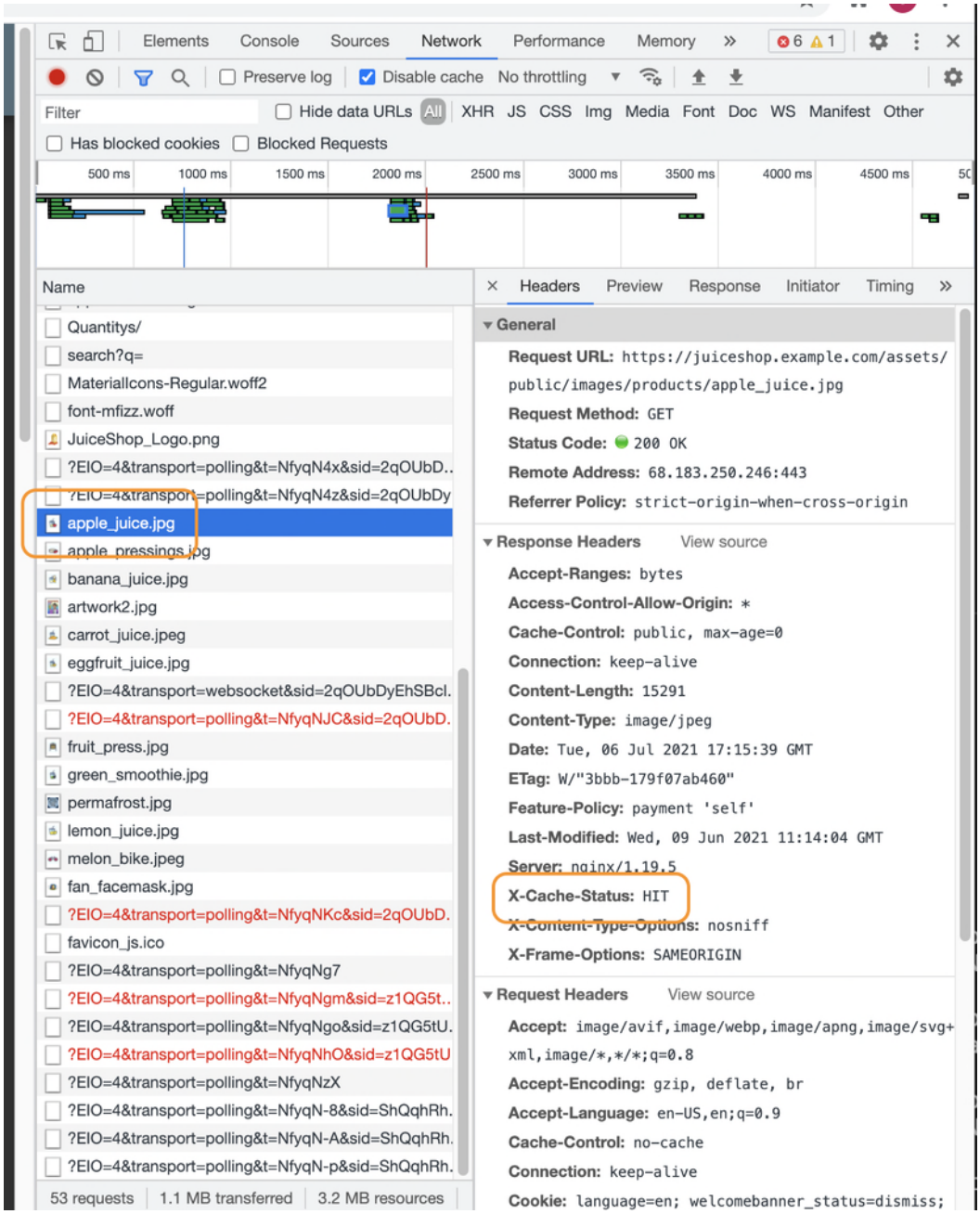


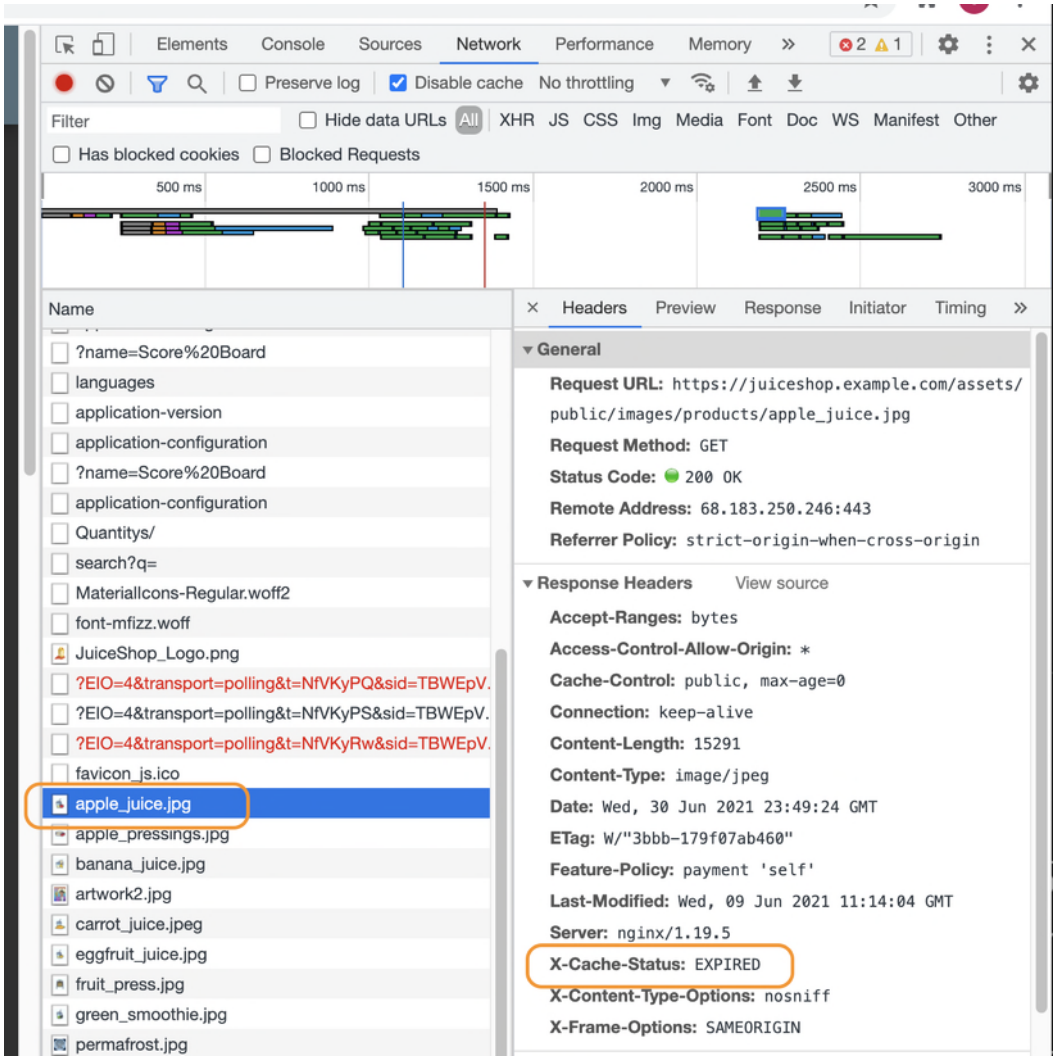
3. **Deep Dive** - As an example, if you click on the first image in the Name list, `apple_juice.jpg`, you should see an HTTP Response Header X-Cache-Status = MISS. If you refresh a couple times, and check again, it should now show X-Cache-Status = HIT. If you wait more than 30 seconds, and refresh again, it should show X-Cache-Status = EXPIRED.

   Explanation: the first request will be a cache MISS, because Nginx does not have a copy of this object in the Cache, and it must be served from the Upstream origin pod. After the first request, it will be a Cache HIT because Nginx is caching it and served it from its Cache. After the age timer expires, you will see EXPIRED.

   This is because the Nginx `proxy_cache_valid` directive is set to 30 seconds, on line #32 of the manifest YAML file.

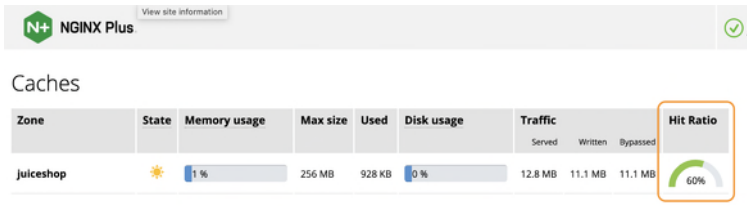

Elements
Console
Sources
Network
Performance
Memory
Preserve log
Disable cache
No throttling
Filter
Hide data URLs
All
XHR
JS
CSS
Img
Media
Font
Doc
WS
Manifest
Other
Has blocked cookies
Blocked Requests
500 ms
1000 ms
1500 ms
2000 ms
2500 ms
3000 ms
3500 ms
4000 ms
4500 ms
Name
languages
application-version
application-configuration
?name=Score%20Board
application-configuration
Quantitys/
search?q=
MaterialIcons-Regular.woff2
font-mfizz.woff
JuiceShop_Logo.png
?EIO=4&transport=polling&t=NfVKaC1&sid=TOw4T6..
?EIO=4&transport=polling&t=NfVKaC3&sid=TOw4T6..
apple_juice.jpg
apple_pressings.jpg
banana_juice.jpg
artwork2.jpg
carrot_juice.jpeg
eggfruit_juice.jpg
?EIO=4&transport=websocket&sid=TOw4T6S2bHOA.
?EIO=4&transport=polling&t=NfVKaQt&sid=TOw4T6..
fruit_press.jpg
green_smoothie.jpg
permafrost.jpg
lemon_juice.jpg
Headers
Preview
Response
Initiator
Timing
General
Request URL: https://juiceshop.example.com/assets/public/images/products/apple_juice.jpg
Request Method: GET
Status Code: 200 OK
Remote Address: 68.183.250.246:443
Referrer Policy: strict-origin-when-cross-origin
Response Headers
View source
Accept-Ranges: bytes
Access-Control-Allow-Origin: *
Cache-Control: public, max-age=0
Connection: keep-alive
Content-Length: 15291
Content-Type: image/jpeg
Date: Wed, 30 Jun 2021 23:47:45 GMT
ETag: W/"3bbb-179f07ab460"
Feature-Policy: payment 'self'
Last-Modified: Wed, 09 Jun 2021 11:14:04 GMT
Server: nginx/1.19.5
X-Cache-Status: MISS
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN


Elements
Console
Sources
Network
Performance
Memory
Preserve log
Disable cache
No throttling
Filter
Hide data URLs
All
XHR
JS
CSS
Img
Media
Font
Doc
WS
Manifest
Other
Has blocked cookies
Blocked Requests
500 ms
1000 ms
1500 ms
2000 ms
2500 ms
3000 ms
3500 ms
4000 ms
4500 ms
Name
Quantitys/
search?q=
MaterialIcons-Regular.woff2
font-mfizz.woff
JuiceShop_Logo.png
?EIO=4&transport=polling&t=NfyqN4x&sid=2qOUbD..
?EIO=4&transport=polling&t=NfyqN4z&sid=2qOUbDy
apple_juice.jpg
apple_pressings.jpg
banana_juice.jpg
artwork2.jpg
carrot_juice.jpeg
eggfruit_juice.jpg
?EIO=4&transport=websocket&sid=2qOUbDyEhSBcl.
?EIO=4&transport=polling&t=NfyqNJC&sid=2qOUbD.
fruit_press.jpg
green_smoothie.jpg
permafrost.jpg
lemon_juice.jpg
melon_bike.jpeg
fan_facemask.jpg
?EIO=4&transport=polling&t=NfyqNKc&sid=2qOUbD.
favicon_js.ico
?EIO=4&transport=polling&t=NfyqNg7
?EIO=4&transport=polling&t=NfyqNgm&sid=z1QG5t..
?EIO=4&transport=polling&t=NfyqNgo&sid=z1QG5tU.
?EIO=4&transport=polling&t=NfyqNhO&sid=z1QG5tU
?EIO=4&transport=polling&t=NfyqNzX
?EIO=4&transport=polling&t=NfyqN-8&sid=ShQqhRh.
?EIO=4&transport=polling&t=NfyqN-A&sid=ShQqhRh.
?EIO=4&transport=polling&t=NfyqN-p&sid=ShQqhRh.
53 requests
1.1 MB transferred
3.2 MB resources
Headers
Preview
Response
Initiator
Timing
General
Request URL: https://juiceshop.example.com/assets/public/images/products/apple_juice.jpg
Request Method: GET
Status Code: 200 OK
Remote Address: 68.183.250.246:443
Referrer Policy: strict-origin-when-cross-origin
Response Headers
View source
Accept-Ranges: bytes
Access-Control-Allow-Origin: *
Cache-Control: public, max-age=0
Connection: keep-alive
Content-Length: 15291
Content-Type: image/jpeg
Date: Tue, 06 Jul 2021 17:15:39 GMT
ETag: W/"3bbb-179f07ab460"
Feature-Policy: payment 'self'
Last-Modified: Wed, 09 Jun 2021 11:14:04 GMT
Server: nginx/1.19.5
X-Cache-Status: HIT
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN
Request Headers
View source
Accept: image/avif,image/webp,image/apng,image/svg+xml,image/*,*/*;q=0.8
Accept-Encoding: gzip, deflate, br
Accept-Language: en-US,en;q=0.9
Cache-Control: no-cache
Connection: keep-alive
Cookie: language=en; welcomebanner_status=dismiss;

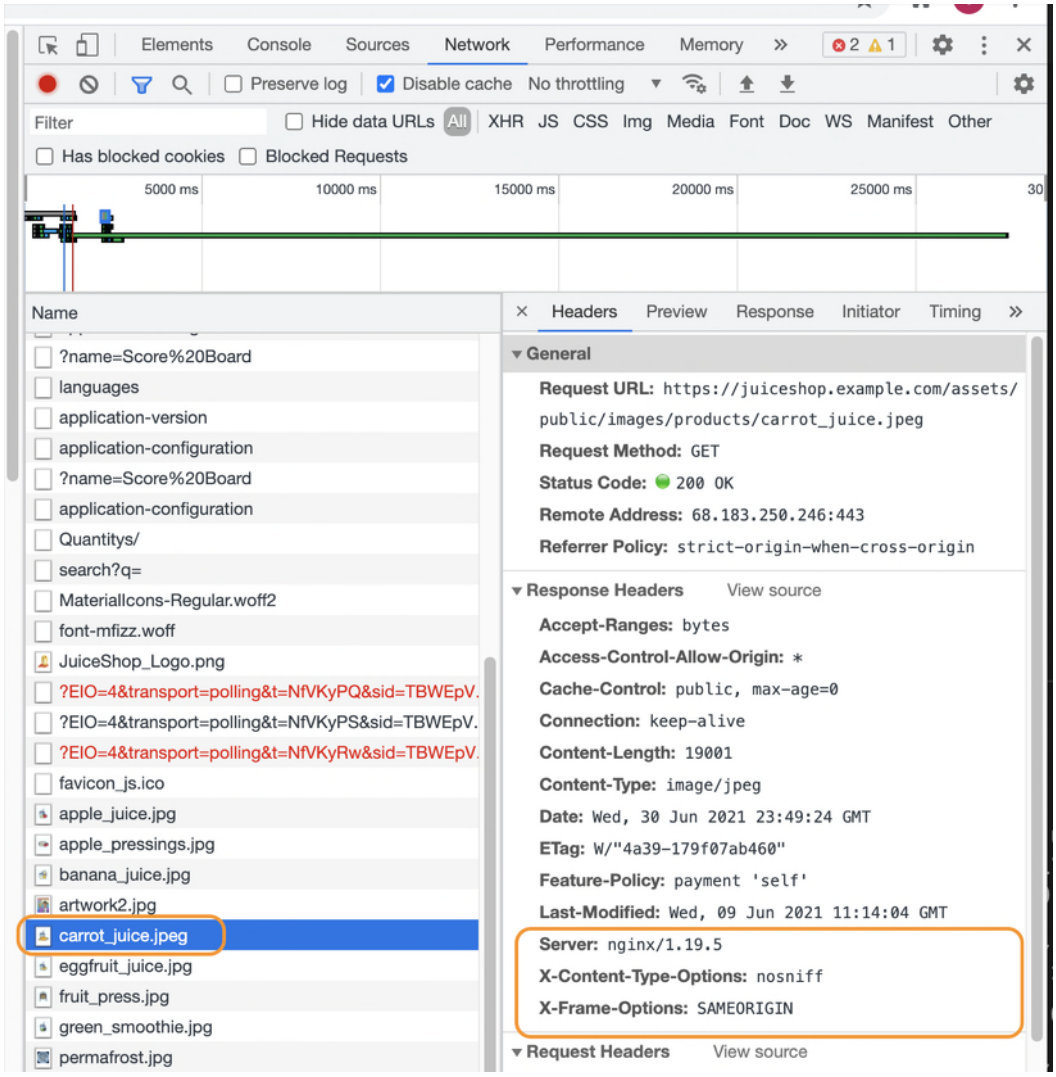


4. Check the Plus Dashboard, did you find the Cache statistics ? You see some basic stats about Nginx Caching, the memory and disk usage, Hit Ratio, and Bytes served, changing in real-time as you browse around the Juice Shop site.

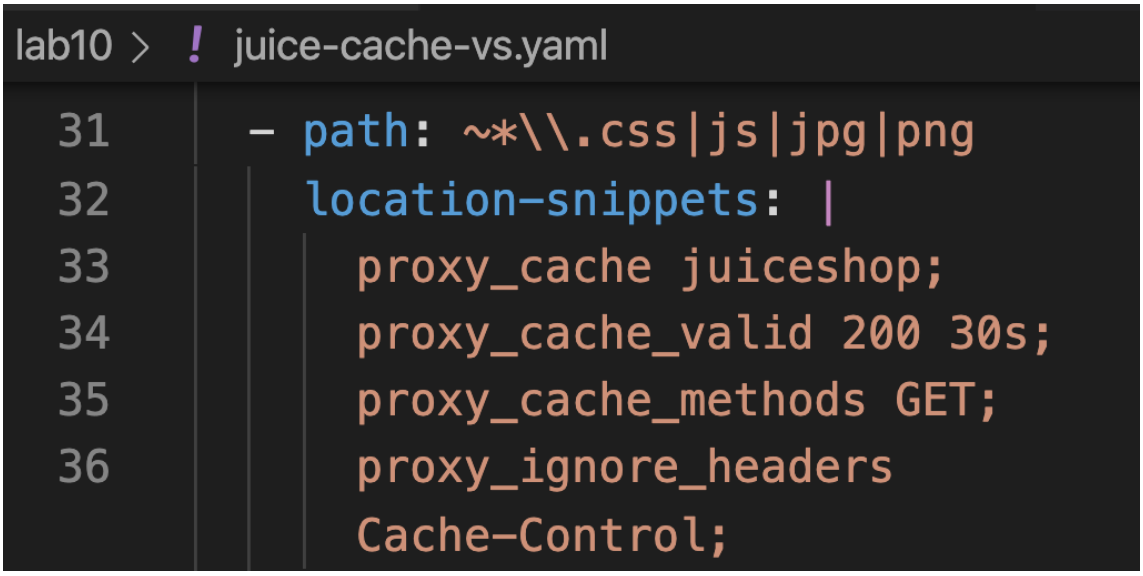
   How high can you get your hit ratio ?



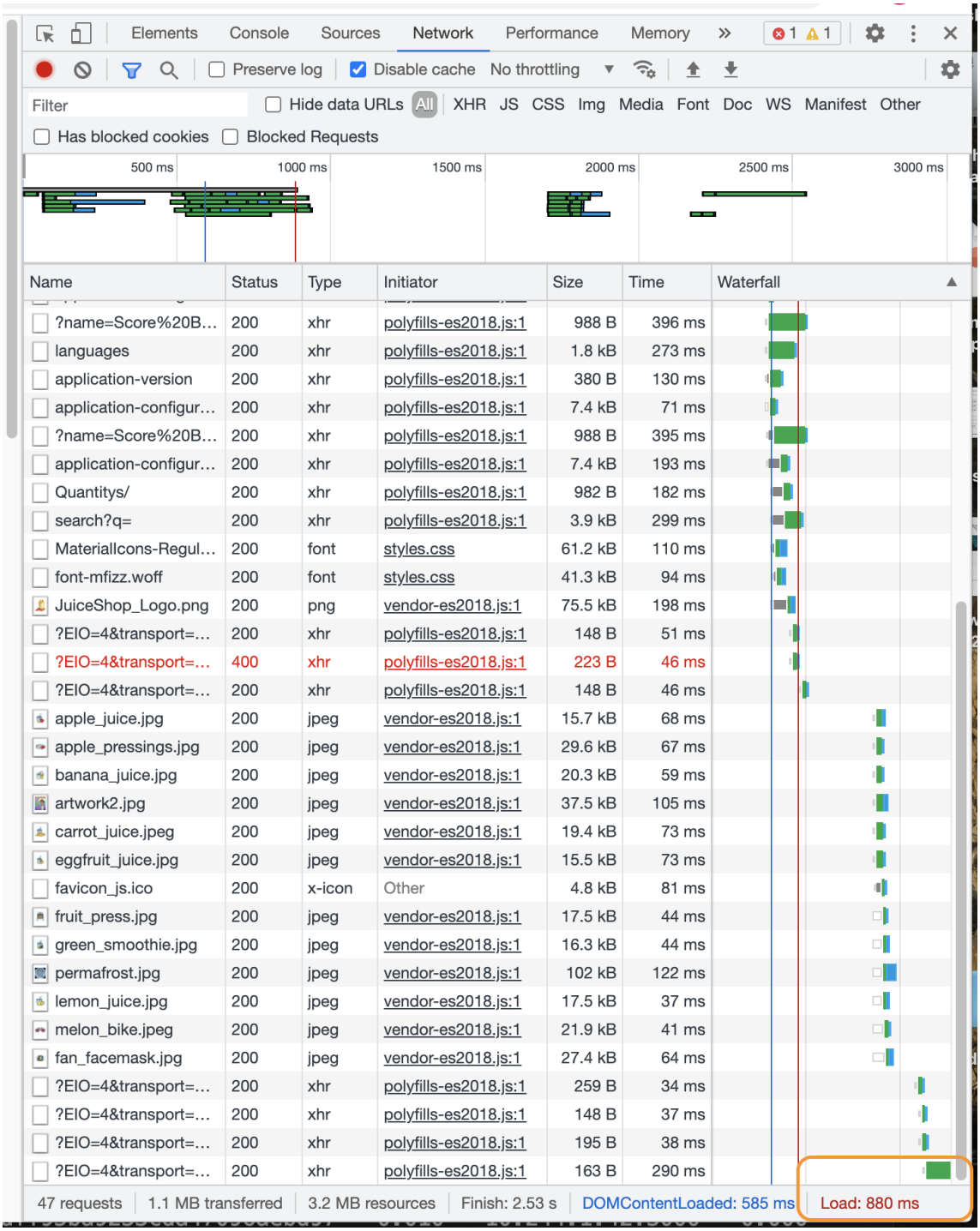
5. Again using Chrome Developer tools, look at the `carrot_juice.jpeg` object. What is different ? Why ?



▶ Click for Hints!



Inspect the very bottom right corner of Chrome Developer Tools...what is the difference in Page Load times, when there are Nginx Cache Hits, vs Cache Misses (refresh the page 5 or 6 times, then wait more than 30 seconds and refresh again)? You should see the Page Load time much faster with Cache Hits, of course. How fast could you get your page load time?



Final Check - did you notice just how much difference in response time there is, between the different JuiceShop pods ?

> *It's important to have Advanced features like `LeastTime LastByte` load balancing, and `Caching`, to help improve the user experience with imbalanced pods that may have poor performance.*

vs_juice_juiceshop-vs_juiceshop Zone: 0 %

Show all

Server			Requests		Responses			Conns		Traffic				Server checks		Health monitors				Response time	
Name	DT	W	Total	Req/s	...	4xx	5xx	A	L	Sent/s	Rcvd/s	Sent	Rcvd	Fails	Unavail	Checks	Fails	Unhealthy	Last	Headers	Response
10.244.0.205:3000	0ms	1	476	0		23	0	0	∞	0	0	388 KiB	5.89 MiB	0	0	167	0	0	passed	37ms	24308ms
10.244.0.25:3000	0ms	1	355	0		31	0	0	∞	0	0	293 KiB	4.41 MiB	0	0	168	0	0	passed	129ms	26716ms
10.244.1.42:3000	0ms	1	555	0		23	0	1	∞	0	0	457 KiB	8.75 MiB	0	0	167	0	0	passed	89ms	171ms

Mutual TLS

The Boss's business insurance auditor has informed him that his website must have SSL encryption for all his web traffic from end-to-end. Not just the traffic between his customers and the Ingress Controller, but also between the Ingress Controller and all of the application pods. This is called mutualTLS for the Ingress Controller. So now you have to configure/enable TLS between Ingress Controller and the Cafe coffee and tea pods, and verify that it works.

Inspect the `lab10/cafe-mtls.yaml`, lines 19, and 29-30. Notice the change from port 80 to port 443 for the container and the Service, to use for mutual TLS.

Container	Service
	lab10 > ! cafe-mtls.yaml 21 apiVersion: v1 22 kind: Service 23 metadata: 24 name: coffee-mtls-svc 25 spec: 26 type: ClusterIP 27 clusterIP: None 28 ports: 29 - port: 443 30 targetPort: 443 31 protocol: TCP 32 name: https

lab10 > ! cafe-mtls.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: coffee-mtls
spec:
  replicas: 3
  selector:
    matchLabels:
      app: coffee-mtls
  template:
    metadata:
      labels:
        app: coffee-mtls
    spec:
      containers:
      - name: coffee-mtls
        image: nginxinc/ingress-demo
        ports:
        - containerPort: 443
---
```

1. First, for proper testing, you need to remove the previous Cafe virtual server, as we will still be using the cafe.example.com hostname:

   ```
   kubectl delete vs cafe-vs
   ```

2. Check the Plus Dashboard, the Cafe HTTP Zone should now be gone.

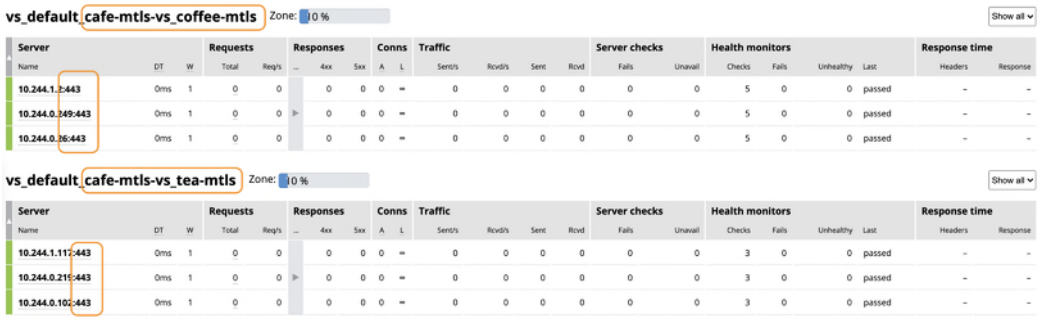
3. Start a fresh Cafe Demo, deploy the mTLS enabled pods and services and Virtual Server manifests:

   ```
   kubectl apply -f lab10/cafe-mtls.yaml
   kubectl apply -f lab10/cafe-mtls-vs.yaml
   ```

   Question - Will changing the pods from port 80 to port 443 break the previously defined Healthchecks?

   ▶ Click for Hints!

4. Check the Plus Dashboard, and your new mTLS Cafe Application - ensure all 6 "mtls" coffee and tea pods are now in Up/Green status.



5. Using Chrome, check the access to coffee and tea as before:

   https://cafe.example.com/coffee

   https://cafe.example.com/tea

   Do you see the pod Server Name now shows coffee-mtls-pod-name and tea-mtls-pod-name ?

   Do you see the pod Server Address now shows port 443, and not 80 ?

Server Name:	coffee-mtls-678c888d87-cdkbm
Server Address:	10.244.1.2:443
NGINX Version:	1.19.6
Request Date:	06/Jul/2021:18:09:09 +0000
Request URI:	/coffee
Document Root:	/usr/share/nginx/html/beverage
Ingress Controller IP:	10.244.0.100:56092
Client IP:	10.244.1.85

☐ Auto Refresh

Request ID: 53ea41f2282ecba2f712b52e292cd3d4

Blue/Green | A/B Testing

During the development cycle of modern applications for Kubernetes, developers will often want to test new versions of their software, using various test tools, and ideally, a final check with live customer traffic. There are several names for this dev/test concept - `Blue/Green deployments, A/B testing, Canary testing,` etc.

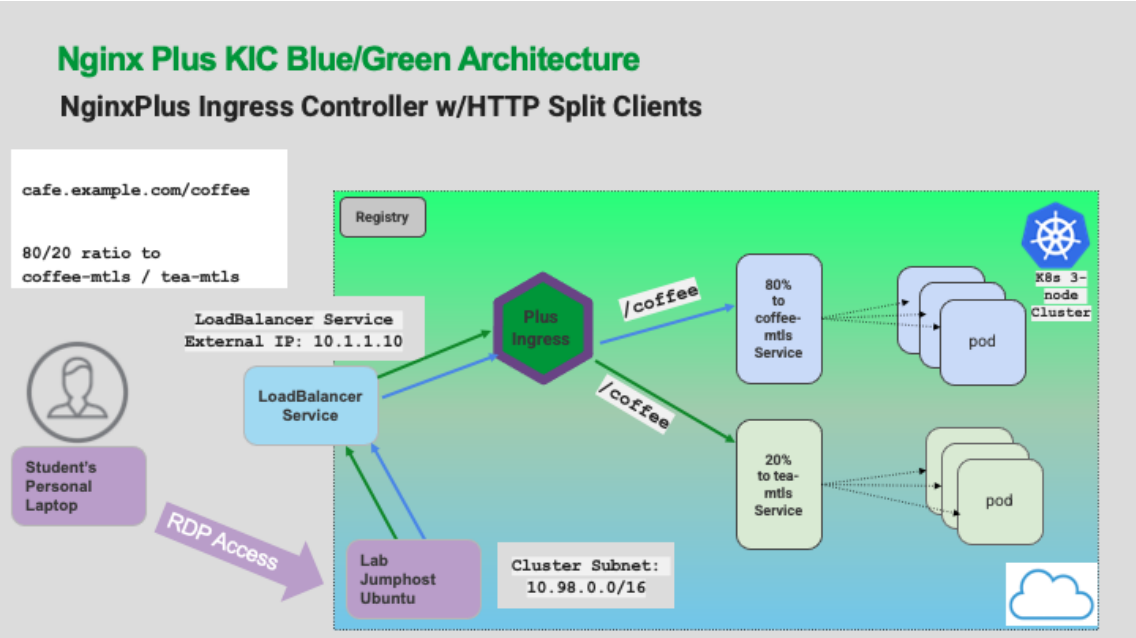
However, switching ALL customers to new versions that might still have a few bugs in the code is quite risky.

> *Wouldn't it be nice if your Ingress Controller could split off just a small fraction of your live traffic, and route it to your new application pod for final testing?*

Nginx Plus Ingress Controller can do this, using a feature called `HTTP Split Clients.` This feature allows you to define a percentage of traffic to be split between different k8s Services, representing different versions of your application.

You will use the currently running Cafe-mTLS coffee and tea pods, and split the traffic at an 80:20 ratio between coffee and tea Services.

Refer to the following diagram for testing Blue/Green traffic splitting with Nginx Plus Ingress Controller:



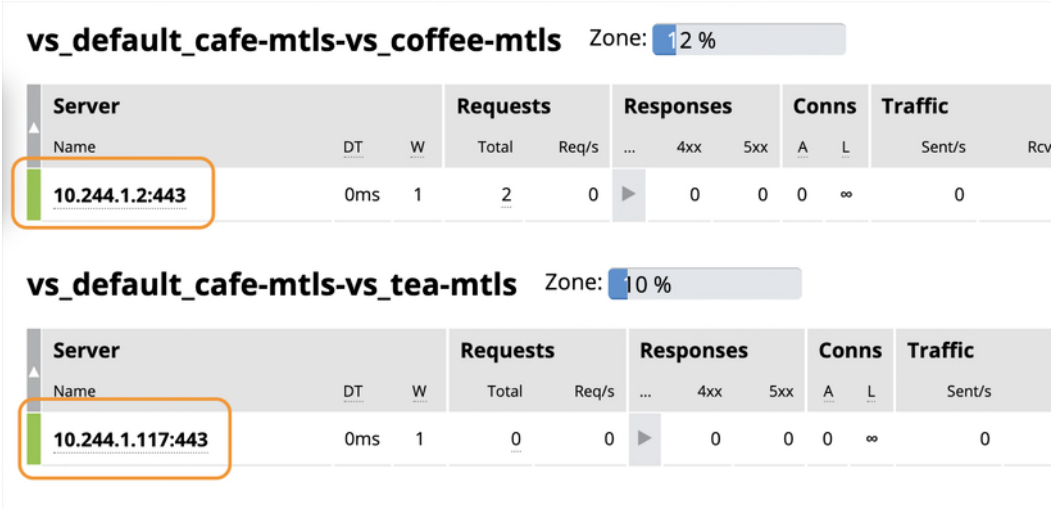
Assume that coffee is your existing application, and tea is your new test build of the application.

Having read the tea leaves you are highly confident in your new code. So you decide to route 20% of your live traffic to tea. (crossing your fingers)

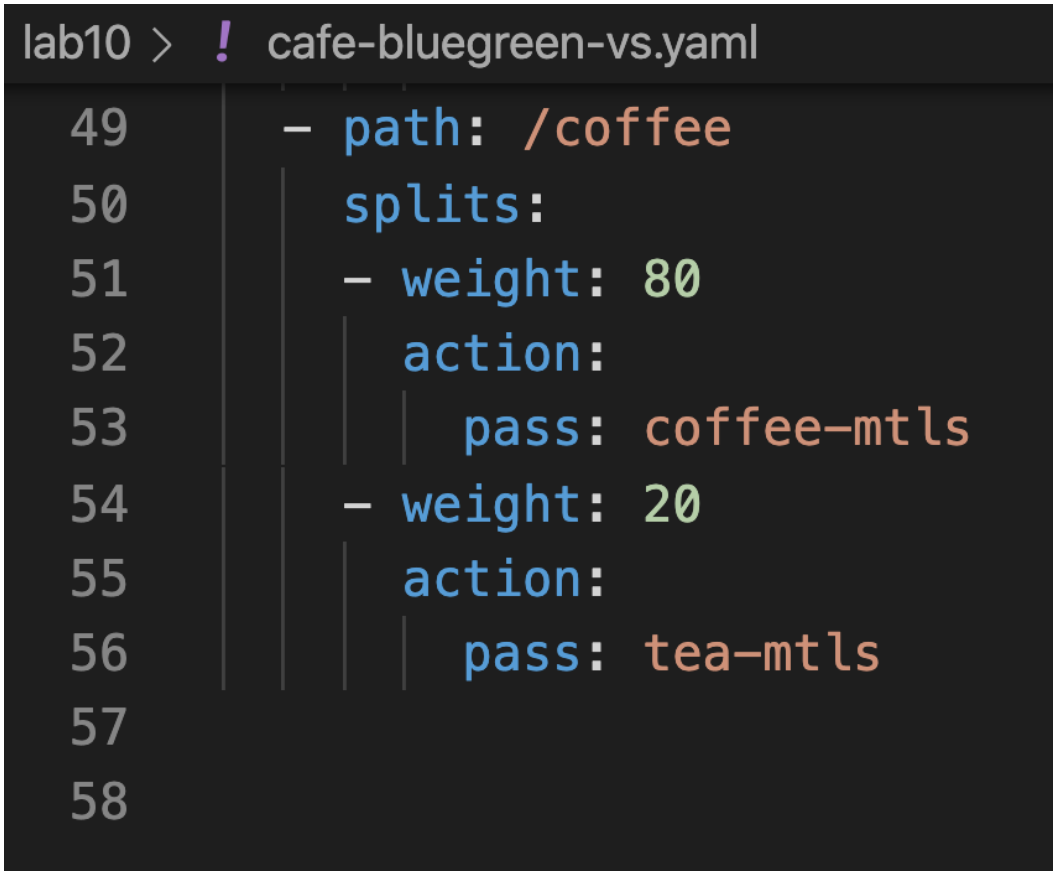
1. First, to see the split ratio more clearly, scale down the number of coffee and tea pods to just one each:

```
kubectl scale deployment coffee-mtls --replicas=1
kubectl scale deployment tea-mtls --replicas=1
```

2. Check the Plus Dashboard, there should only be one coffee and one tea upstream now.



Inspect the `lab10/cafe-bluegreen-vs.yaml` file, and note the `split and weight` directives on lines 49-56.



3. Next, remove the existing VirtualServer for mTLS from the previous exercise:

```
kubectl delete -f lab10/cafe-mtls-vs.yaml
```

4. Now configure the Cafe Virtual Server to send 80% traffic to coffee-mtls, and 20% traffic to tea-mtls:

```
kubectl apply -f lab10/cafe-bluegreen-vs.yaml
```

5. Open a Chrome tab for https://cafe.example.com/coffee, and check the Auto Refresh box at the bottom of the page.

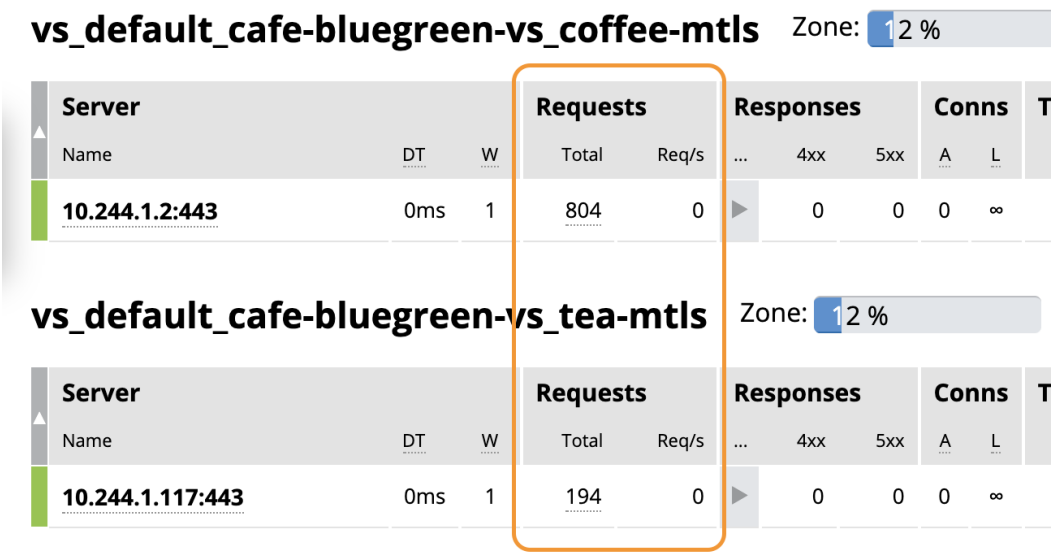
Server Name:	coffee-mtls-678c888d87-cdkbm
Server Address:	10.244.1.2:443
NGINX Version:	1.19.6
Request Date:	06/Jul/2021:18:41:47 +0000
Request URI:	/coffee
Document Root:	/usr/share/nginx/html/beverage
Ingress Controller IP:	10.244.0.100:41080
Client IP:	10.244.1.85

Auto Refresh

Request ID: d794c70563224073e81edceceb50e729

Check the statistics on the Plus Dashboard cafe-bluegreen upstreams.... Do you see approximately an 80/20 Requests ratio between coffee and tea? You can configure the ratio in 1% increments, from 1-99%.

Note: Nginx will not load the Split configuration, if the ratio does not add up to 100%.



> ***Important!*** *You are still using the https://cafe.example.com/coffee URL - you did not have to change the PATH of the url, but Nginx Ingress Controller is routing the requests to 2 different services, 80% to coffee-mtls AND 20% to tea-mtls! This allows for easy testing of new application versions, without requiring DNS changes, new URLs or URIs, or other system changes.*

References

- Active Healthchecks: https://docs.nginx.com/nginx-ingress-controller/configuration/virtualserver-and-virtualserverroute-resources/#upstream-healthcheck
- Error Pages: https://docs.nginx.com/nginx-ingress-controller/configuration/virtualserver-and-virtualserverroute-resources/#errorpage
- Caching:

  https://docs.nginx.com/nginx-ingress-controller/configuration/global-configuration/configmap-resource/

  https://www.nginx.com/blog/nginx-caching-guide/
- Blue/Green A/B Testing:

  https://github.com/nginxinc/kubernetes-ingress/tree/master/examples-of-custom-resources/traffic-splitting

  https://www.nginx.com/blog/performing-a-b-testing-nginx-plus/

  https://www.nginx.com/blog/dynamic-a-b-testing-with-nginx-plus/

Workshop Wrap-Up

You have completed all the lab exercises in the workshop. Do a final visual check on your Plus Dashboard, and check your Grafana dashboards, what do you see? These tools should show where you finished with statistics and graphs that match your last few lab exercises.

During the Workshop, you learned the following Nginx, Ingress, and Kubernetes topics and completed the following lab exercises:

1. Verify Nginx Ingress Controller is up and running.
2. Configure access to the NginxPlus Dashboard for monitoring real-time statistics.
3. Deploy the Café demo application for coffee/tea services.
4. Add the Bar application and Virtual Server.
5. Run a load test on your Ingress Controller and the Cafe application.
6. Scale your Cafe application, and Nginx Ingress up and down, under load without errors.
7. Change Nginx logging to help troubleshoot pod performance issues.
8. Set up and run Prometheus and Grafana with Helm, to monitor your cluster, apps and Ingress Controller.
9. Launch a new application, JuiceShop, and test it.
10. Enable some of the Advanced features of Nginx Plus, like Active Healthchecks, Caching, Sorry pages, mTLS, and Blue-Green split client testing.

Thank You for your time and attention. Please provide feedback to your Workshop hosts when asked, it is important for us to hear your feedback so we can continually improve this workshop.

This completes this Lab.

> *Click on Preview below for a Overview on additional workshops from NGINX !!*

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Navigate to (Preview | Main Menu)