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COMP 3104 - 15783

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## Lab 09 - Docker Containerization & Nginx Kubernetes Cluster

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### Container Setup

```
MINGW64:/d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker
jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$ touch Dockerfile

jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$
```

```
D:\Safe_Drive\comp_3104-developer_operations\lab_exercises\lab_09\lab11-Docker\Dockerfile - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
Dockerfile

1 # Use an official Python runtime as a parent image
2 FROM python:3.11-slim
3 # Set the working directory to /app
4 WORKDIR /app
5 # Copy the current directory contents into the container at /app
6 COPY . /app
7 # Install any needed packages specified in requirements.txt
8 RUN pip install --trusted-host pypi.python.org -r requirements.txt
9 # Make port 80 available to the world outside this container
10 EXPOSE 80
11 # Define environment variable
12 ENV NAME World
13 # Run app.py when the container launches
14 CMD ["python", "app.py"]
15
```

```
D:\Safe_Drive\comp_3104-developer_operations\lab_exercises\lab_09\lab11-Docker\requirements.txt - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
Dockerfile requirements.txt

1 Flask
2 Redis
3
```

```

D:\Safe_Drive\comp_3104-developer_operations\lab_exercises\lab_09\lab11-Docker\app.py - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
Dockerfile requirements.txt app.py
1  from flask import Flask
2  from redis import Redis, RedisError
3  import os
4  import socket
5
6  # Connect to Redis
7  redis = Redis(host="redis", db=0, socket_connect_timeout=2, socket_timeout=2)
8
9  app = Flask(__name__)
10
11 @app.route("/")
12 def hello():
13     try:
14         visits = redis.incr("counter")
15     except RedisError:
16         visits = "<i>cannot connect to Redis, counter disabled</i>"
17
18     html = "<h3>Hello {name}!</h3>\n" \
19           "<b>Hostname:</b> {hostname}<br/>" \
20           "<b>Visits:</b> {visits}"
21
22     return html.format(name=os.getenv("NAME", "world"), hostname=socket.gethostname(), visits=visits)
23
24 if __name__ == "__main__":
25     app.run(host='0.0.0.0', port=80)

```

```

MINGW64:/d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker
jayde@DESKTOP-90BKNF: MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$ ls
app.py Dockerfile ReadMe.md requirements.txt

jayde@DESKTOP-90BKNF: MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$ docker build --tag=helldocker .
[+] Building 8.8s (9/10)
=> [internal] load build definition from Dockerfile
[+] Building 9.6s (10/10) FINISHED
=> [internal] load build definition from Dockerfile
=> transferring dockerfile: 547B
=> [internal] load metadata for docker.io/library/python:3.11-slim
=> [auth] library/python:pull token for registry-1.docker.io
=> [internal] load .dockerrcignore
=> transferring context: 2B
=> [1/4] FROM docker.io/library/python:3.11-slim@sha256:e4676722fba839e2e5cdb844a52262b43e90e56dbd55b7ad953ee3615ad7534f 2.8s
=> => resolve docker.io/library/python:3.11-slim@sha256:e4676722fba839e2e5cdb844a52262b43e90e56dbd55b7ad953ee3615ad7534f 0.0s
=> sha256:6002d17b63fe84a7f8a66f20cfa63aec4f6cd2a44069f05b6296beabfcf2a8e1 14.36MB / 14.36MB 0.0s
=> => sha256:65868b001a40155a1d3f5aa7f5a10ba02a7d55697301839dc047c9d549b670bc 248B / 248B 0.0s
=> => sha256:1ee9c106547f05aa380c4cdec2837c546439943d73d965a3fc49f228dc8be993 1.29MB / 1.29MB 0.0s
=> => extracting sha256:1ee9c106547f05aa380c4cdec2837c546439943d73d965a3fc49f228dc8be993 0.0s
=> => extracting sha256:f002d17b63fe84a7f8a66f20cfa63aec4f6cd2a44069f05b6296b9abfcf2a8e1 0.0s
=> => extracting sha256:65868b001a40155a1d3f5aa7f5a10ba02a7d55697301839dc047c9d549b670bc 0.0s
=> [internal] load build context 0.0s
=> => transferring context: 1.53kB 0.0s
=> [2/4] WORKDIR /app 0.1s
=> [3/4] COPY . /app 0.0s
=> [4/4] RUN pip install --trusted-host pypi.python.org -r requirements.txt 4.0s
=> exporting to image 1.3s
=> => exporting layers 0.0s
=> => exporting manifest sha256:16c56cffa86dbc9f33d9a4048eb1ae7a12a95304257f5528b700e763c9014944 0.0s
=> => exporting config sha256:4010aa104f6b9fdclleeffd009abf974980bb4276555c5251f32a48654c423e0 0.0s
=> => exporting attestation manifest sha256:f376920dac61bdfb96e8fd3d319f0aa58e25b8fdd64a36bdef2a69132cd67fe5 0.0s
=> => exporting manifest list sha256:91cdf66dff1471146926146cd0b77b5431523077dfdf0f1b2603f8c321ec984f 0.0s
=> => naming to docker.io/library/helldocker:latest 0.0s
=> => unpacking to docker.io/library/helldocker:latest 0.4s

1 warning found (use docker --debug to expand):
- LegacyKeyValueFormat: "ENV key=value" should be used instead of legacy "ENV key value" format (line 12)

jayde@DESKTOP-90BKNF: MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$ |

```

```

MINGW64:/d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker
jayde@DESKTOP-90BKN4F MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$ docker image
Usage: docker image COMMAND

Manage images

Commands:
  build      Build an image from a Dockerfile
  history    Show the history of an image
  import     Import the contents from a tarball to create a filesystem image
  inspect   Display detailed information on one or more images
  load       Load an image from a tar archive or STDIN
  ls        List images
  prune     Remove unused images
  pull       Download an image from a registry
  push       Upload an image to a registry
  rm        Remove one or more images
  save      Save one or more images to a tar archive (streamed to STDOUT by default)
  tag       Create a tag TARGET_IMAGE that refers to SOURCE_IMAGE

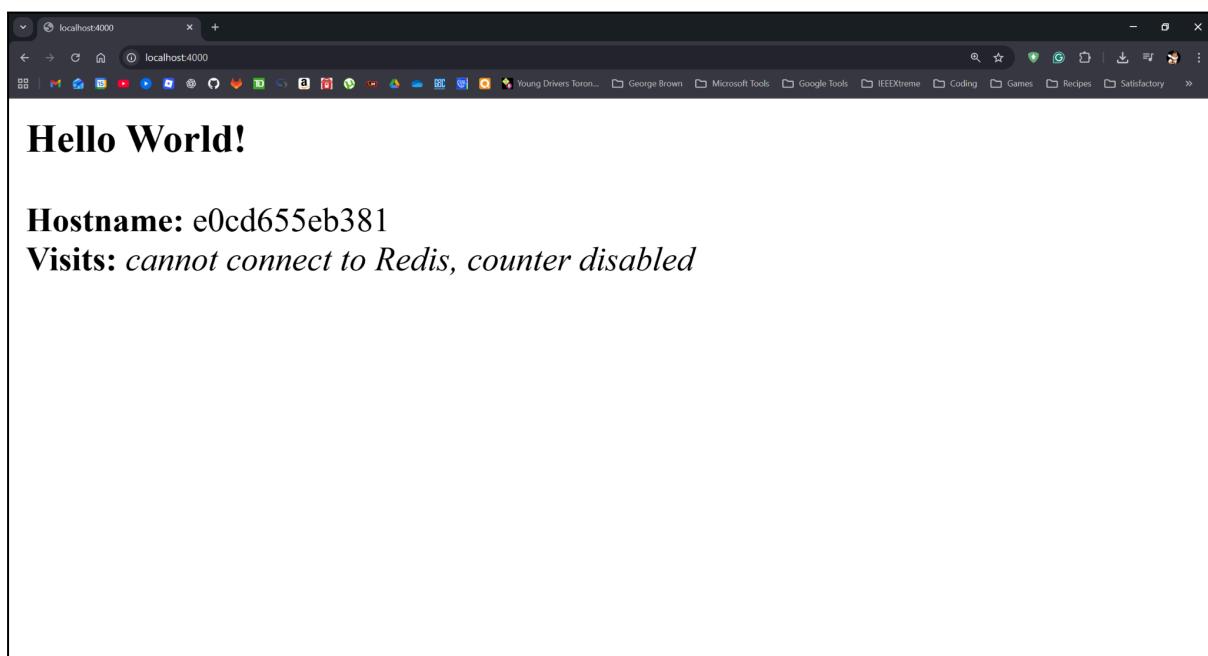
Run 'docker image COMMAND --help' for more information on a command.

jayde@DESKTOP-90BKN4F MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$
```

## Running Docker Container & App

```

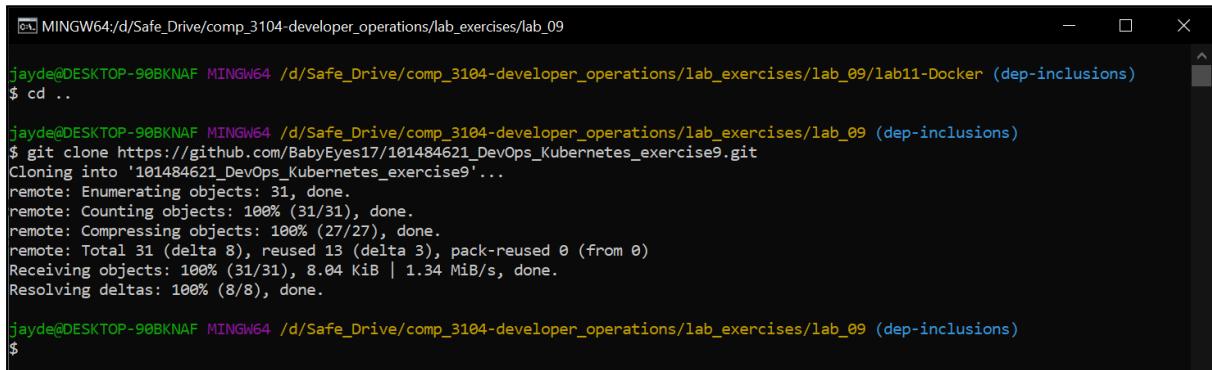
MINGW64:/d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker
jayde@DESKTOP-90BKN4F MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$ docker run -p 4000:80 hellodocker
 * Serving Flask app 'app'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on all addresses (0.0.0.0)
 * Running on http://127.0.0.1:80
 * Running on http://172.17.0.2:80
Press CTRL+C to quit
```



```

MINGW64:/d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker
jayde@DESKTOP-90BKN4F MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$ curl http://localhost:4000
<h3>Hello World!</h3><b>Hostname:</b> 1ba94dd67b52<br/><b>Visits:</b> <i>cannot connect to Redis, counter disabled</i>
jayde@DESKTOP-90BKN4F MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/lab11-Docker (dep-inclusions)
$
```

## Forking GitHub Repository



```
jayde@DESKTOP-90BKN4F MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09
$ cd ..

jayde@DESKTOP-90BKN4F MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09 (dep-inclusions)
$ git clone https://github.com/BabyEyes17/101484621_DevOps_Kubernetes_exercise9.git
Cloning into '101484621_DevOps_Kubernetes_exercise9'...
remote: Enumerating objects: 31, done.
remote: Counting objects: 100% (31/31), done.
remote: Compressing objects: 100% (27/27), done.
remote: Total 31 (delta 8), reused 13 (delta 3), pack-reused 0 (from 0)
Receiving objects: 100% (31/31), 8.04 KiB | 1.34 MiB/s, done.
Resolving deltas: 100% (8/8), done.

jayde@DESKTOP-90BKN4F MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09 (dep-inclusions)
$
```

## Minikube Setup & Status Check

```
[jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)]$ minikube start --driver=docker --cpus=2 --memory=4096 --force
[minikube v1.37.0 on Microsoft Windows 10 Pro 10.0.19045.6456 Build 19045.6456]
[minikube skips various validations when --force is supplied; this may lead to unexpected behavior]
[Using the docker driver based on user configuration]
[Using Docker Desktop driver with root privileges]
[Starting "minikube" primary control-plane node in "minikube" cluster]
[Pulling base image v0.0.48 ...]
[Downloading Kubernetes v1.34.0 preload ...]
[> gcr.io/k8s-minikube/kicbase...: 488.52 MiB / 488.52 MiB 100.00% 10.67 M]
[> preloaded-images-k8s-v18-v1...: 337.07 MiB / 337.07 MiB 100.00% 6.72 Mi]
[Creating docker container (CPUs=2, Memory=4096MB) ...]
[Failing to connect to https://registry.k8s.io/ from inside the minikube container]
[To pull new external images, you may need to configure a proxy: https://minikube.sigs.k8s.io/docs/reference/networking/proxy/]
[Preparing Kubernetes v1.34.0 on Docker 28.4.0 ...]
[Configuring bridge CNI (Container Networking Interface) ...]
[Verifying Kubernetes components...]
[  Using image gcr.io/k8s-minikube/storage-provisioner:v5]
[Enabled addons: storage-provisioner, default-storageclass]
[Done! kubectl is now configured to use "minikube" cluster and "default" namespace by default]

[jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)]$
```

```
[jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)]$ minikube status
[minikube]
[type: Control Plane]
[host: Running]
[kubelet: Running]
[apiserver: Running]
[kubeconfig: Configured]

[jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)]$ kubectl config current-context
[minikube]

[jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)]$ docker info
[Client:
[Version: 28.5.1
[Context: desktop-linux
[Debug Mode: false
[Plugins:
[ai: Docker AI Agent - Ask Gordon (Docker Inc.)
[  Version: v1.9.11
[  Path: C:\Program Files\Docker\cli-plugins\docker-ai.exe
[buildx: Docker Buildx (Docker Inc.)
[  Version: v0.29.1-desktop.1
[  Path: C:\Program Files\Docker\cli-plugins\docker-buildx.exe
[compose: Docker Compose (Docker Inc.)
[  Version: v2.40.3-desktop.1
[  Path: C:\Users\jayde\.docker\cli-plugins\docker-compose.exe
[debug: Get a shell into any image or container (Docker Inc.)
[  Version: 0.0.45
[  Path: C:\Program Files\Docker\cli-plugins\docker-debug.exe
[desktop: Docker Desktop commands (Docker Inc.)
[  Version: v0.2.0
[  Path: C:\Program Files\Docker\cli-plugins\docker-desktop.exe
[extension: Manages Docker extensions (Docker Inc.)
[  Version: v0.2.31
[  Path: C:\Program Files\Docker\cli-plugins\docker-extension.exe
[init: Creates Docker-related starter files for your project (Docker Inc.)
[  Version: v1.4.0
[  Path: C:\Program Files\Docker\cli-plugins\docker-init.exe
[mcp: Docker MCP Plugin (Docker Inc.)
[  Version: v0.24.0
[  Path: C:\Program Files\Docker\cli-plugins\docker-mcp.exe
[model: Docker Model Runner (Docker Inc.)
[  Version: v0.1.46
[  Path: C:\Users\jayde\.docker\cli-plugins\docker-model.exe
[offload: Docker Offload (Docker Inc.)
[  Version: v0.5.1
[  Path: C:\Program Files\Docker\cli-plugins\docker-offload.exe
[sandbox: Docker Sandbox (Docker Inc.)
[  Version: v0.3.1
[  Path: C:\Program Files\Docker\cli-plugins\docker-sandbox.exe]
```

## Deploying nginx Image Using Kubernetes

```
[...]
jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9
$ kubectl apply -f nginx-deploy.yaml
deployment.apps/nginx configured

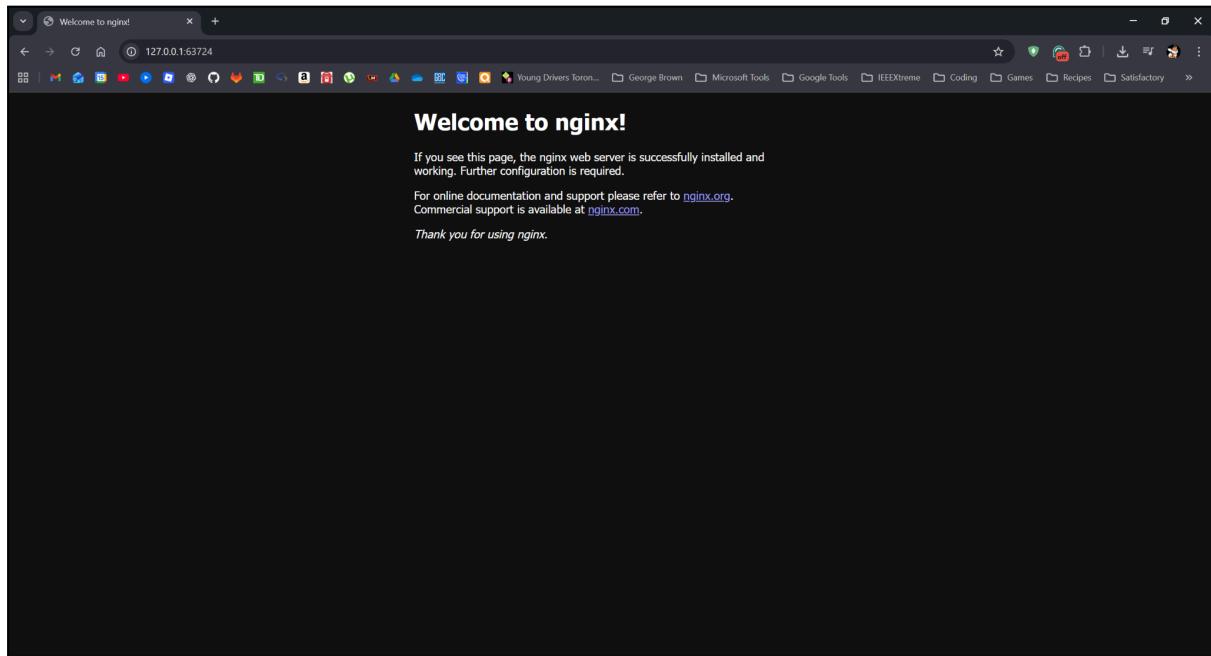
jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)
$ kubectl apply -f nginx-service.yaml
service/nginx-nodeport created

jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)
$ kubectl rollout status deployment/nginx
deployment "nginx" successfully rolled out

jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)
$ kubectl get pods -l app=nginx -o wide
NAME           READY   STATUS    RESTARTS   AGE     IP          NODE      NOMINATED NODE   READINESS GATES
nginx-6d5fdb986b-26817  1/1    Running   0          57s   10.244.0.5  minikube  <none>        <none>
nginx-6d5fdb986b-8s52f  1/1    Running   0          57s   10.244.0.3  minikube  <none>        <none>
nginx-6d5fdb986b-xzhv5  1/1    Running   0          57s   10.244.0.4  minikube  <none>        <none>

jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)
$ kubectl get svc nginx-nodeport
NAME            TYPE      CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
nginx-nodeport  NodePort  10.109.87.106 <none>       80:300080/TCP   16s

jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)
$
```



```
[...]
jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9
$ minikube service nginx-nodeport --url
http://127.0.0.1:63724
[!] Because you are using a Docker driver on windows, the terminal needs to be open to run it.

jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)
$
```

```
[...]
jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9
$ kubectl delete -f nginx-deploy.yaml
deployment.apps "nginx" deleted from default namespace

jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)
$ kubectl delete -f nginx-service.yaml
service "nginx-nodeport" deleted from default namespace

jayde@DESKTOP-90BKNAF MINGW64 /d/Safe_Drive/comp_3104-developer_operations/lab_exercises/lab_09/101484621_DevOps_Kubernetes_exercise9 (main)
$
```

The screenshot shows the Kubernetes Dashboard interface. The URL in the browser is `127.0.0.1:64549/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/service/default/kubernetes?namespace=default`. The main content area displays the details for the service named 'kubernetes' in the 'default' namespace.

**Metadata**

Name	Namespace	Created	Age	UID
kubernetes	default	Nov 16, 2025	13 minutes ago	1ab36ddc-b77e-419b-a047-7855c920dbce

Labels: component: apiserver, provider: kubernetes

**Resource information**

Type	Cluster IP	Session Affinity
ClusterIP	10.96.0.1	None

**Endpoints**

Host	Ports (Name, Port, Protocol)	Node	Ready
192.168.49.2	https:8443:TCP	-	true

**Pods**

There is nothing to display here.

**Sidebar Navigation**

- Workloads (Cron Jobs, Daemon Sets, Deployments, Jobs, Pods, Replica Sets)
- Replication Controllers, Stateful Sets
- Service (Ingresses, Ingress Classes, Services)
- Config and Storage (Config Maps, Persistent Volume Claims, Secrets, Storage Classes)
- Cluster