Output of first step:

```
hafsa_027@Dell:~/k8s-master-app$ ./scripts/deploy.sh
================================================================
              KUBERNETES ZERO TO HERO - DEPLOYMENT
================================================================
[STEP 1] CHECKING PREREQUISITES
✓ minikube is installed
✓ kubectl is installed
✓ docker is installed
```

Step2:

```
# Step 2: Ensure Minikube is running
echo -e "${MAGENTA}[STEP 2] ENSURING MINIKUBE IS RUNNING${NC}"

if ! minikube status | grep -q "host: Running"; then
    echo -e "${YELLOW}Minikube is not running. Starting Minikube...${NC}"

    # Start Minikube with appropriate configuration
    minikube start --cpus=2 --memory=4096 --disk-size=20g

    if [ $? -ne 0 ]; then #$? → Stores the exit status of the most recent command
    #0 → The exit code 0 typically means success.
        echo -e "${RED}Failed to start Minikube. Trying with minimal configuration...${NC}"

        # Fallback to minimal configuration
        minikube start --driver=docker #Uses Docker as the virtualization driver , Runs Kubernetes inside a Docker container instead of a virtual machine.

        if [ $? -ne 0 ]; then
            echo -e "${RED}Failed to start Minikube. Exiting.${NC}"
            exit 1
        fi
    fi
else
    echo -e "${GREEN}✓ Minikube is already running${NC}"
fi
```

Output of Step 2:

```
✓ docker is installed
[STEP 2] ENSURING MINIKUBE IS RUNNING
✓ Minikube is already running
```

Step3:

```
# Step 3: Enable required Minikube addons
echo -e "${MAGENTA}[STEP 3] ENABLING MINIKUBE ADDONS${NC}"

# We'll handle addons more carefully, checking if they're already enabled
# and handling errors better

# Function to safely enable an addon
enable_addon() {
    local addon=$1
    local already_enabled=$(minikube addons list | grep $addon | grep -c "enabled")

    if [ $already_enabled -eq 1 ]; then
        echo -e "${GREEN}✓ $addon addon is already enabled${NC}"
        return 0
    fi

    echo -e "${CYAN}Enabling $addon addon...${NC}"
    minikube addons enable $addon

    if [ $? -ne 0 ]; then
        echo -e "${YELLOW}Warning: Failed to enable $addon addon. Continuing without it.${NC}"
        return 1
    else
        echo -e "${GREEN}✓ $addon addon enabled${NC}"
        return 0
    fi
}

# Try to enable addons but don't fail if they don't work
enable_addon "dashboard" || true

echo -e "${YELLOW}Note: Skipping Ingress and Metrics Server addons as they may not work in all environments${NC}"
echo -e "${YELLOW}The application will still work without these addons${NC}"
```

Output of Step 3:

```
[STEP 3] ENABLING MINIKUBE ADDONS
✓ dashboard addon is already enabled
Note: Skipping Ingress and Metrics Server addons as they may not work in all environments
The application will still work without these addons
```

Step4:

```
# Step 4: Configure Docker to use Minikube's Docker daemon
echo -e "${MAGENTA}[STEP 4] CONFIGURING DOCKER TO USE MINIKUBE${NC}"
echo -e "${CYAN}This allows us to build images directly into Minikube's registry${NC}"

#minikube docker-env prints environment variables needed to redirect Docker commands to Minikube's internal Docker daemon.
eval $(minikube docker-env)
if [ $? -ne 0 ]; then
    echo -e "${RED}Failed to configure Docker to use Minikube. Exiting.${NC}"
    exit 1
fi
echo -e "${GREEN}✓ Docker configured to use Minikube's registry${NC}"
```

Output of Step 4:

```
[STEP 4] CONFIGURING DOCKER TO USE MINIKUBE
This allows us to build images directly into Minikube's registry
```

Step5:

```
# Step 5: Build the Docker image
echo -e "${MAGENTA}[STEP 5] BUILDING DOCKER IMAGE${NC}"

echo -e "${CYAN}Building k8s-master-app:latest image...${NC}"
cd ~/k8s-master-app/app

# Added retry mechanism for Docker build with better network settings
MAX_ATTEMPTS=3
BUILD_SUCCESS=false

for ATTEMPT in $(seq 1 $MAX_ATTEMPTS); do
    echo -e "${YELLOW}Build attempt $ATTEMPT of $MAX_ATTEMPTS...${NC}"

    # Use host network for better connectivity in WSL
    docker build --network=host -t k8s-master-app:latest .
    # Builds an image named k8s-master-app:latest from the current directory (.).
    # --network=host to avoid network-related issues.

    if [ $? -eq 0 ]; then
        BUILD_SUCCESS=true
        break
    else
        echo -e "${YELLOW}Build attempt $ATTEMPT failed. Waiting before retry...${NC}"
        sleep 5
    fi
done

if [ "$BUILD_SUCCESS" != "true" ]; then
    echo -e "${RED}Failed to build Docker image after $MAX_ATTEMPTS attempts. Exiting.${NC}"
    exit 1
fi

echo -e "${GREEN}✓ Docker image built successfully${NC}"
docker images | grep k8s-master-app
```

Output of Step 5:

```
[STEP 5] BUILDING DOCKER IMAGE
Building k8s-master-app:latest image...
Build attempt 1 of 3...
[+] Building 3.6s (15/15) FINISHED                                                                        docker:default
 => [internal] load build definition from Dockerfile                                                               0.0s
 => => transferring dockerfile: 1.62kB                                                                             0.0s
 => [internal] load metadata for docker.io/library/python:3.9                                                      1.8s
 => [auth] library/python:pull token for registry-1.docker.io                                                      0.0s
 => [internal] load .dockerignore                                                                                  0.1s
 => => transferring context: 2B                                                                                    0.0s
 => [1/9] FROM docker.io/library/python:3.9@sha256:5ea663a1c6ba266fdcac5949d1d2ea364ce30a2da92a3df95bb3c01437633ad9 0.0s
 => [internal] load build context                                                                                  0.0s
 => => transferring context: 25.22kB                                                                               0.0s
 => CACHED [2/9] WORKDIR /app                                                                                      0.0s
 => CACHED [3/9] RUN mkdir -p /data /config /logs &&     chmod 777 /data /config /logs                             0.0s
 => CACHED [4/9] COPY requirements.txt .                                                                           0.0s
 => CACHED [5/9] RUN pip install --no-cache-dir --upgrade pip &&     pip install --no-cache-dir -r requirements.txt 0.0s
 => [6/9] COPY app.py .                                                                                            0.1s
 => [7/9] RUN chmod +x app.py                                                                                      0.3s
 => [8/9] RUN echo '#!/bin/sh' > /healthcheck.sh &&     echo 'curl -s http://localhost:5000/api/health || exit 1' >> /healthcheck.sh &&  0.3s
 => [9/9] RUN useradd -m appuser &&     chown -R appuser:appuser /app /data /config /logs                          0.5s
 => exporting to image                                                                                             0.3s
 => => exporting layers                                                                                            0.2s
 => => writing image sha256:3fd49816bef32c436402dc39118316a21c2f6fd05acb5d433ba49580c8e5b40e                       0.0s
 => => naming to docker.io/library/k8s-master-app:latest                                                           0.0s
✓ Docker image built successfully
k8s-master-app                          latest    3fd49816bef3   Less than a second ago   1.02GB
```

Step6:

```
# Step 6: Apply Kubernetes manifests
echo -e "${MAGENTA}[STEP 6] DEPLOYING TO KUBERNETES${NC}"
cd ~/k8s-master-app

echo -e "${CYAN}Creating namespace...${NC}"
kubectl apply -f k8s/base/namespace.yaml

echo -e "${CYAN}Creating ConfigMap and sample files...${NC}"
kubectl apply -f k8s/volumes/volumes.yaml

echo -e "${CYAN}Creating ConfigMap for application settings...${NC}"
kubectl apply -f k8s/config/configmap.yaml

echo -e "${CYAN}Creating Secret...${NC}"
kubectl apply -f k8s/config/secret.yaml

echo -e "${CYAN}Creating Deployment...${NC}"
kubectl apply -f k8s/base/deployment.yaml
#Defines how the application pods should run, their container image, replicas, and resource limits.

echo -e "${CYAN}Creating Service...${NC}"
kubectl apply -f k8s/networking/service.yaml
#Creates a Service to expose the application for external access.

echo -e "${CYAN}Creating HorizontalPodAutoscaler...${NC}"
kubectl apply -f k8s/monitoring/hpa.yaml || true
if [ $? -ne 0 ]; then
    echo -e "${YELLOW}Warning: Failed to create HorizontalPodAutoscaler. This is expected if metrics-server is not enabled.${NC}"
    echo -e "${YELLOW}The application will still work without auto-scaling.${NC}"
fi

echo -e "${GREEN}✓ All Kubernetes resources applied${NC}"
```

Output of Step 6:

```
[STEP 6] DEPLOYING TO KUBERNETES
Creating namespace...
namespace/k8s-demo unchanged
Creating ConfigMap and sample files...
configmap/app-files unchanged
Creating ConfigMap for application settings...
configmap/app-config unchanged
Creating Secret...
secret/app-secrets unchanged
Creating Deployment...
deployment.apps/k8s-master-app configured
Creating Service...
service/k8s-master-app unchanged
Creating HorizontalPodAutoscaler...
horizontalpodautoscaler.autoscaling/k8s-master-hpa configured
✓ All Kubernetes resources applied
```

Step7:

```
# Step 7: Wait for deployment to be ready
echo -e "${MAGENTA}[STEP 7] WAITING FOR DEPLOYMENT TO BE READY${NC}"
echo -e "${CYAN}This may take a minute or two...${NC}"

echo "Waiting for deployment to be ready..."
kubectl -n k8s-demo rollout status deployment/k8s-master-app --timeout=180s

if [ $? -ne 0 ]; then
    echo -e "${RED}Deployment failed to become ready within the timeout period.${NC}"
    echo -e "${YELLOW}Checking pod status...${NC}"

    kubectl -n k8s-demo get pods

    echo -e "${YELLOW}Checking pod logs...${NC}"
    POD=$(kubectl -n k8s-demo get pods -l app=k8s-master -o name | head -1)
    #-l (or --selector): Filters pods based on labels.
    #-o (or --output): Controls the format of the output.
# name: Returns the pod names in the format pod/<pod-name> instead of a detailed table.
#head -1: Extracts only the first line

    if [ ! -z "$POD" ]; then
    #!: Negates the condition,-z "$POD": Checks if POD is empty (i.e., "" or not set).
        kubectl -n k8s-demo logs $POD
    fi
else
    echo -e "${GREEN}✓ Deployment is ready${NC}"
fi
```

Output of Step 7:

```
[STEP 7] WAITING FOR DEPLOYMENT TO BE READY
This may take a minute or two...
Waiting for deployment to be ready...
deployment "k8s-master-app" successfully rolled out
✓ Deployment is ready
```

Step8:

$ deploy.sh

```
203
204  # Step 8: Set up port forwarding for easier access
205  echo -e "${MAGENTA}[STEP 8] SETTING UP PORT FORWARDING${NC}"
206  echo -e "${CYAN}This will make the application accessible on localhost${NC}"
207
208  # To avoid conflicts from multiple port-forward processes running at the same time.
209  # Checks if a kubectl port-forward process is already running for k8s-demo.
210  # If found, pgrep returns the process ID(s).
211  # If a process is found (> /dev/null means we discard output):
212  # pkill -f "kubectl.*port-forward.*k8s-demo"
213  # Kills any existing port-forwarding processes related to k8s-demo.
214  if pgrep -f "kubectl.*port-forward.*k8s-demo" > /dev/null; then
215      echo -e "${YELLOW}Port forwarding is already running. Stopping it...${NC}"
216      pkill -f "kubectl.*port-forward.*k8s-demo"
217  fi
218
219  # Start port forwarding in the background
220  #Forwards port 80 on the service k8s-master-app
221  # To port 8080 on localhost., & Runs the process in the background.
222  kubectl -n k8s-demo port-forward svc/k8s-master-app 8080:80 &
223  PORT_FORWARD_PID=$! #$!: Captures the process ID (PID) of the last background command,Stores it in PORT_FORWARD_PID for later checks.
224
225  # Give it a moment to start,Pauses execution for 2 seconds to allow port forwarding to stabilize.
226  sleep 2
227
228  # Check if port forwarding started successfully
229  #/dev/null is a special file in Linux that discards any data written to it.("BLACK HOLE")
230  #ensures only the exit status is checked, not the output.
231  #The script only cares whether the process exists (exit code), not the output.
232  # If process exists: ps -p $PORT_FORWARD_PID returns exit code 0 (success).
233  # If process doesn't exist: It returns a non-zero exit code (failure).
234  #By redirecting output to /dev/null, the script can check the exit code silently
235  if ! ps -p $PORT_FORWARD_PID > /dev/null; then
236      echo -e "${RED}Failed to start port forwarding.${NC}"
237  else
238      echo -e "${GREEN}✓ Port forwarding started on port 8080${NC}"
239  fi
240
```

Output of Step 8:

If facing this error:

```
[STEP 8] SETTING UP PORT FORWARDING
This will make the application accessible on localhost
Unable to listen on port 8080: Listeners failed to create with the following errors: [unable to create listener: Error listen tcp4 127.0.0.1:808
0: bind: address already in use unable to create listener: Error listen tcp6 [::1]:8080: bind: address already in use]
error: unable to listen on any of the requested ports: [{8080 5000}]
Failed to start port forwarding.
```

netstat -tulnp | grep :8080 #to get process id command to check what is running on 8080 port if there was earlier

sudo pkill -9 <PID> # to actually kill the process

```
[STEP 8] SETTING UP PORT FORWARDING
This will make the application accessible on localhost
Forwarding from 127.0.0.1:8080 -> 5000
Forwarding from [::1]:8080 -> 5000
```

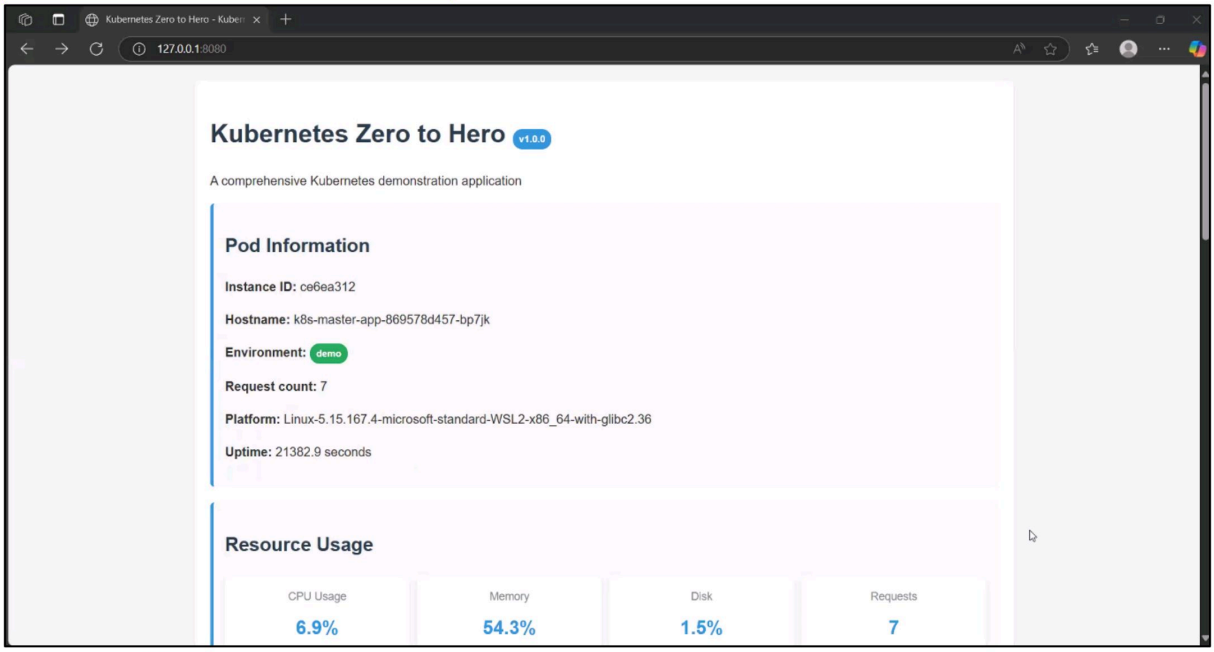
Step9:

```
# Step 9: Display access information
echo -e "${MAGENTA}[STEP 9] DEPLOYMENT COMPLETE${NC}"
echo -e "${BLUE}========================================================================${NC}"
echo -e "${GREEN}Kubernetes Zero to Hero application has been deployed!${NC}"
echo -e "${BLUE}========================================================================${NC}"

echo -e "${YELLOW}Your application is accessible via multiple methods:${NC}"
echo ""
echo -e "${CYAN}1. Port Forwarding:${NC}"
echo "   URL: http://localhost:8080"
echo "   (This is running in the background with PID $PORT_FORWARD_PID)"
echo ""

# Get Minikube IP
MINIKUBE_IP=$(minikube ip)
echo -e "${CYAN}2. NodePort:${NC}"
echo "   URL: http://$MINIKUBE_IP:30080"
echo ""

echo -e "${CYAN}3. Minikube Service URL:${NC}"
echo "   Run: minikube service k8s-master-app -n k8s-demo"
echo ""
```

Output of Step 9:

```
[STEP 9] DEPLOYMENT COMPLETE
========================================================================
Kubernetes Zero to Hero application has been deployed!
========================================================================
Your application is accessible via multiple methods:

1. Port Forwarding:
   URL: http://localhost:8080
   (This is running in the background with PID 58472)

2. NodePort:
   URL: http://192.168.49.2:30080

3. Minikube Service URL:
   Run: minikube service k8s-master-app -n k8s-demo

========================================================================
```

output after the main.py:




```
#Checks if it is readable (os.access(PATH, os.R_OK)).
# Stores this information in a dictionary under the volumes key.

            'config': {
                'path': CONFIG_PATH,
                'mounted': os.path.exists(CONFIG_PATH) and os.access(CONFIG_PATH, os.R_OK)
            },
            'logs': {
                'path': LOG_PATH,
                'mounted': os.path.exists(LOG_PATH) and os.access(LOG_PATH, os.R_OK)
            }
        },
        'timestamp': datetime.datetime.now().isoformat()
    })
```

Example Output

- If `LOG_PATH` is set to `/var/log/myapp`, then:

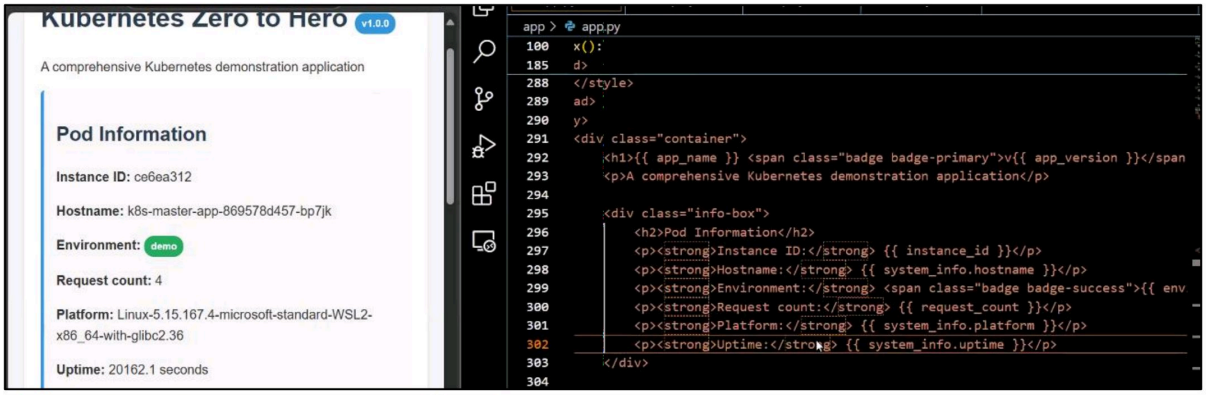
python Copy code

```
Clog_file = "/var/log/myapp/app.log"
```

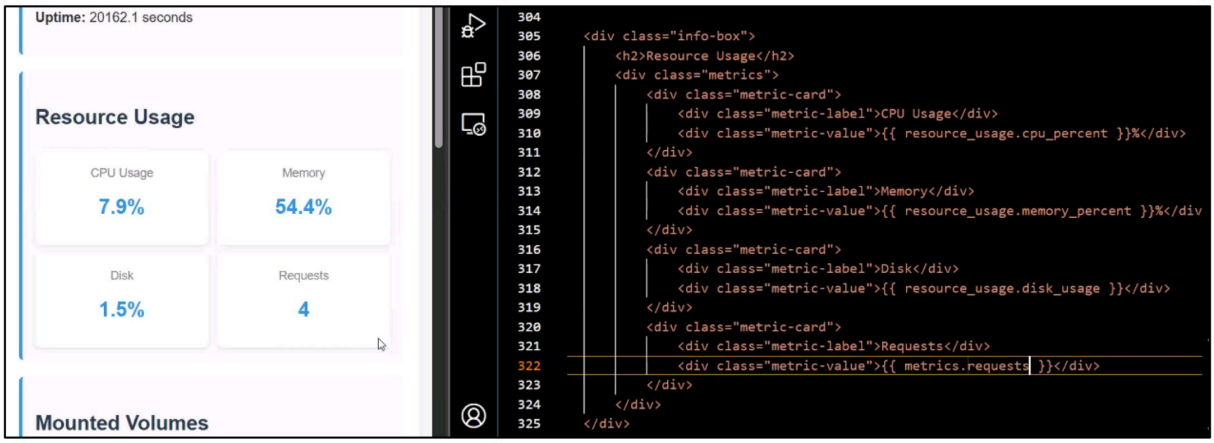
- If `LOG_PATH` is **not set**, then:

python Copy code

```
Clog_file = "/logs/app.log"
```


Kubernetes Zero to Hero
v1.0.0
A comprehensive Kubernetes demonstration application
Pod Information
Instance ID: ce6ea312
Hostname: k8s-master-app-869578d457-bp7jk
Environment: demo
Request count: 4
Platform: Linux-5.15.167.4-microsoft-standard-WSL2-x86_64-with-glibc2.36
Uptime: 20162.1 seconds
app > app.py
<h1>{{ app_name }} v{{ app_version }}</span
A comprehensive Kubernetes demonstration application

<h2>Pod Information</h2>
Instance ID: {{ instance_id }}
Hostname: {{ system_info.hostname }}
Environment: {{ env
Request count: {{ request_count }}
Platform: {{ system_info.platform }}
Uptime: {{ system_info.uptime }}


Uptime: 20162.1 seconds
Resource Usage
CPU Usage
7.9%
Memory
54.4%
Disk
1.5%
Requests
4
Mounted Volumes

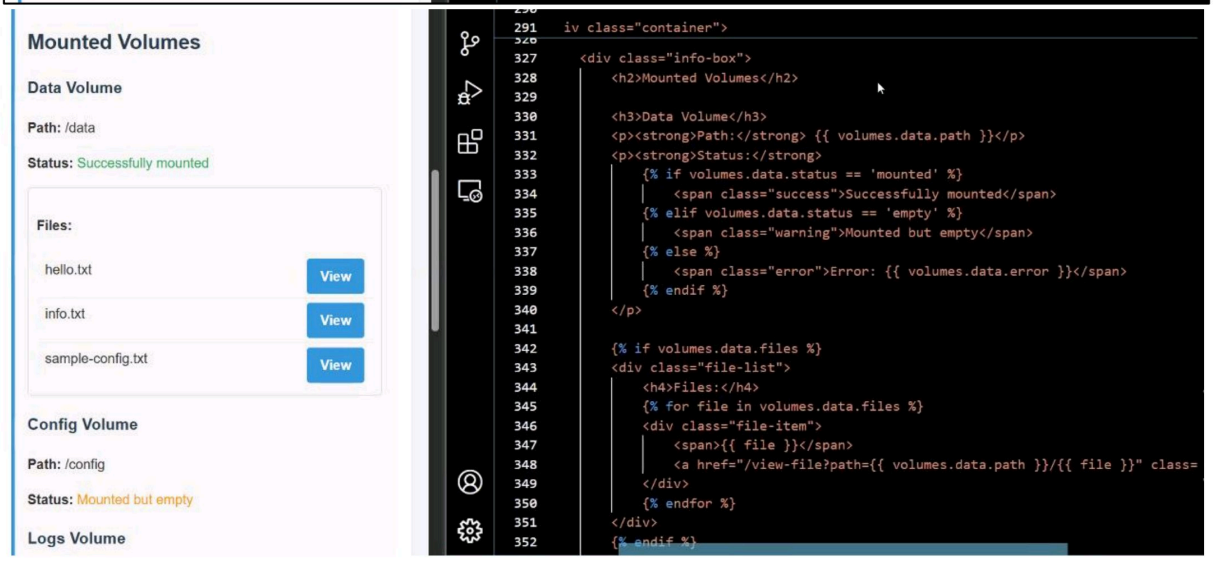
<h2>Resource Usage</h2>

CPU Usage
{{ resource_usage.cpu_percent }}%

Memory
{{ resource_usage.memory_percent }}%</div

Disk
{{ resource_usage.disk_usage }}

Requests
{{ metrics.requests }}


Mounted Volumes
Data Volume
Path: /data
Status: Successfully mounted
Files:
hello.txt
View
info.txt
View
sample-config.txt
View
Config Volume
Path: /config
Status: Mounted but empty
Logs Volume
<h2>Mounted Volumes</h2>
<h3>Data Volume</h3>
Path: {{ volumes.data.path }}
Status:
{% if volumes.data.status == 'mounted' %}
Successfully mounted
{% elif volumes.data.status == 'empty' %}
Mounted but empty
{% else %}
Error: {{ volumes.data.error }}
{% endif %}

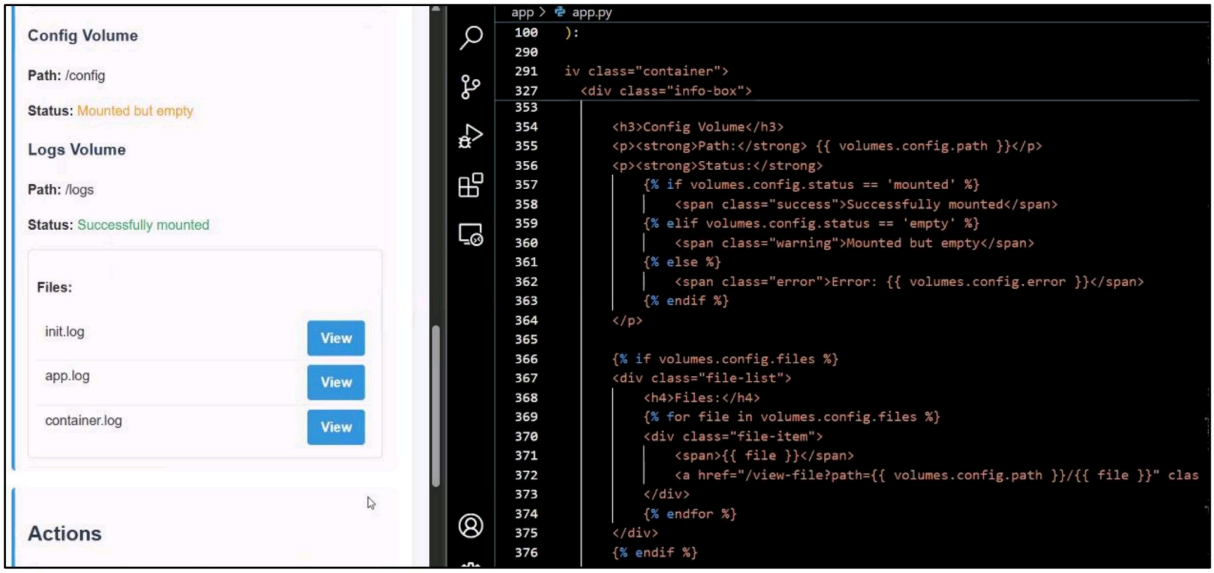
{% if volumes.data.files %}

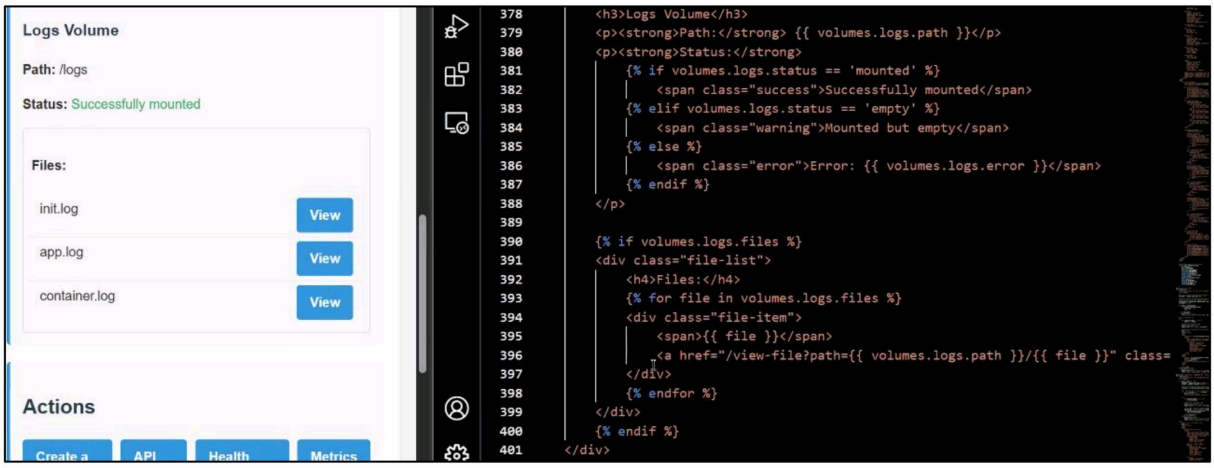
<h4>Files:</h4>
{% for file in volumes.data.files %}

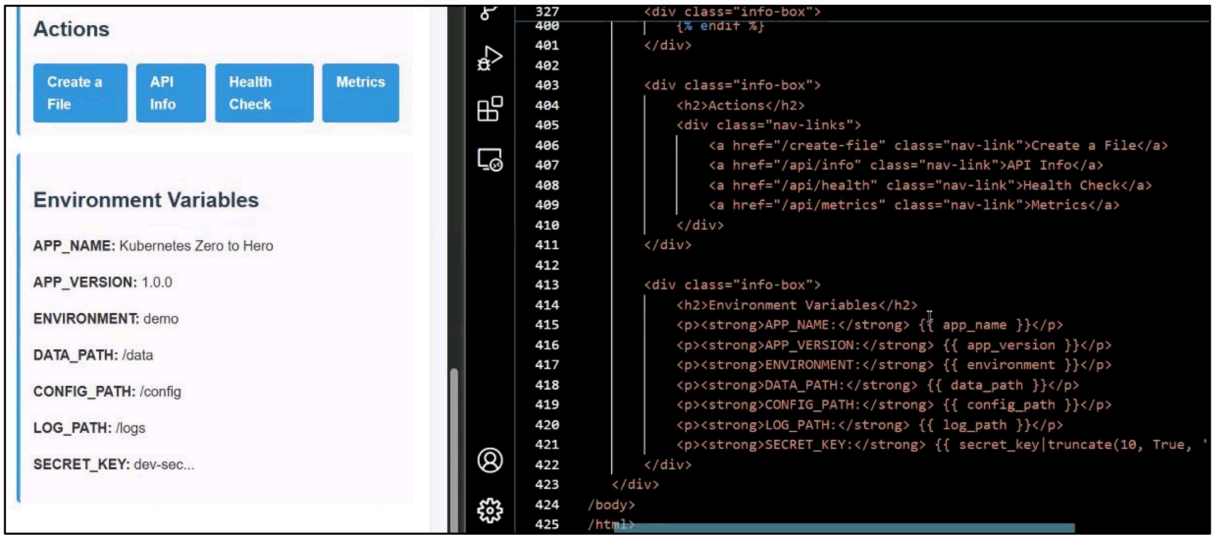
{{ file }}
<a href="/view-file?path={{ volumes.data.path }}/{{ file }}" class=

{% endfor %}

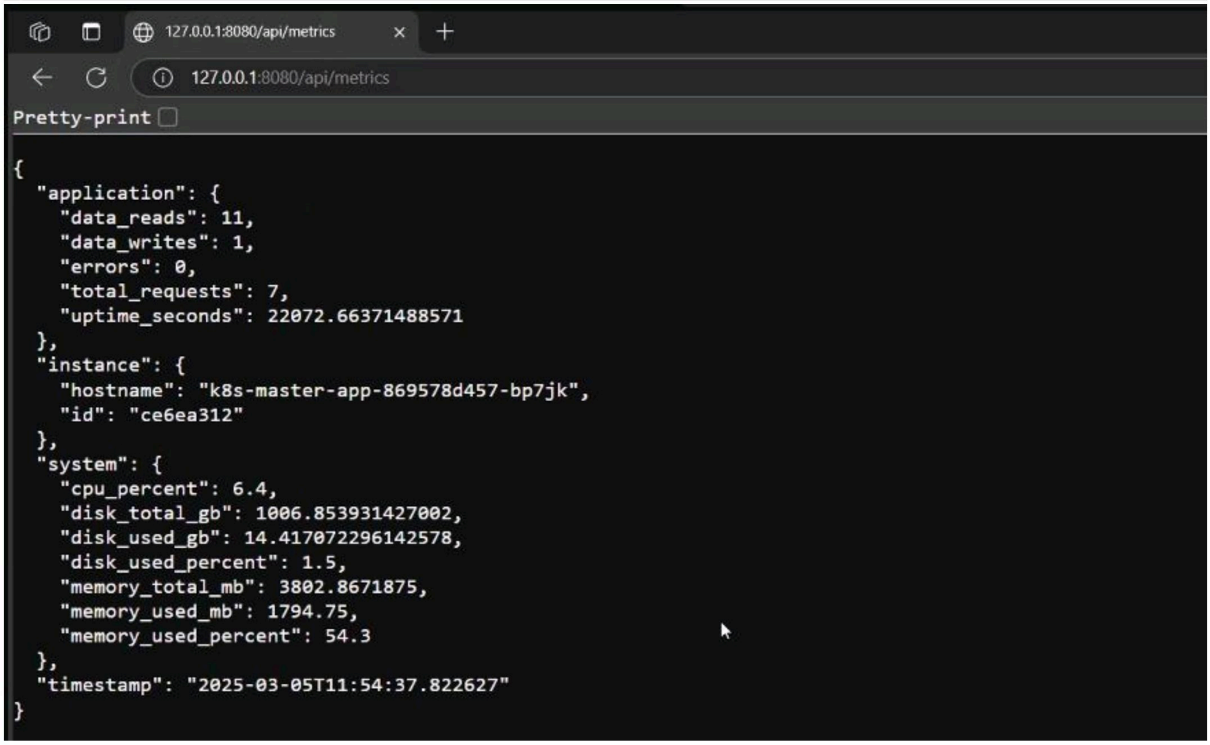
{% endif %}


Config Volume
Path: /config
Status: Mounted but empty
Logs Volume
Path: /logs
Status: Successfully mounted
Files:
init.log
View
app.log
View
container.log
View
Actions
app > app.py
100):
290
291 iv class="container">
327
353
354 <h3>Config Volume</h3>
355 Path: {{ volumes.config.path }}
356 Status:
357 {% if volumes.config.status == 'mounted' %}
358 Successfully mounted
359 {% elif volumes.config.status == 'empty' %}
360 Mounted but empty
361 {% else %}
362 Error: {{ volumes.config.error }}
363 {% endif %}
364
365
366 {% if volumes.config.files %}
367
368 <h4>Files:</h4>
369 {% for file in volumes.config.files %}
370
371 {{ file }}
372 <a href="/view-file?path={{ volumes.config.path }}/{{ file }}" clas
373
374 {% endfor %}
375
376 {% endif %}


Logs Volume
Path: /logs
Status: Successfully mounted
Files:
init.log
View
app.log
View
container.log
View
Actions
Create a
API
Health
Metrics
378 <h3>Logs Volume</h3>
379 Path: {{ volumes.logs.path }}
380 Status:
381 {% if volumes.logs.status == 'mounted' %}
382 Successfully mounted
383 {% elif volumes.logs.status == 'empty' %}
384 Mounted but empty
385 {% else %}
386 Error: {{ volumes.logs.error }}
387 {% endif %}
388
389
390 {% if volumes.logs.files %}
391
392 <h4>Files:</h4>
393 {% for file in volumes.logs.files %}
394
395 {{ file }}
396 <a href="/view-file?path={{ volumes.logs.path }}/{{ file }}" class=
397
398 {% endfor %}
399
400 {% endif %}
401


Actions
Create a File
API Info
Health Check
Metrics
Environment Variables
APP_NAME: Kubernetes Zero to Hero
APP_VERSION: 1.0.0
ENVIRONMENT: demo
DATA_PATH: /data
CONFIG_PATH: /config
LOG_PATH: /logs
SECRET_KEY: dev-sec...
327
400 {% endif %}
401
402
403
404 <h2>Actions</h2>
405
406 Create a File
407 API Info
408 Health Check
409 Metrics
410
411
412
413
414 <h2>Environment Variables</h2>
415 APP_NAME: {{ app_name }}
416 APP_VERSION: {{ app_version }}
417 ENVIRONMENT: {{ environment }}
418 DATA_PATH: {{ data_path }}
419 CONFIG_PATH: {{ config_path }}
420 LOG_PATH: {{ log_path }}
421 SECRET_KEY: {{ secret_key|truncate(10, True, '
422
423
424 /body>
425 /html>

```python
@app.route('/api/metrics')
def get_metrics():
    """API endpoint for application metrics - useful for monitoring systems"""
    # Get basic resource usage stats
    cpu_percent = psutil.cpu_percent()
    memory_info = psutil.virtual_memory()
    disk_info = psutil.disk_usage('/')

    # Collect all metrics
    all_metrics = {
        'system': {
            'cpu_percent': cpu_percent,
            'memory_used_percent': memory_info.percent,
            'memory_used_mb': memory_info.used / (1024 * 1024),
            'memory_total_mb': memory_info.total / (1024 * 1024),
            'disk_used_percent': disk_info.percent,
            'disk_used_gb': disk_info.used / (1024**3),
            'disk_total_gb': disk_info.total / (1024**3)
        },
        'application': {
            'uptime_seconds': time.time() - start_time,
            'total_requests': metrics['requests'],
            'data_reads': metrics['data_reads'],
            'data_writes': metrics['data_writes'],
            'errors': metrics['errors']
        },
        'instance': {
            'id': INSTANCE_ID,
            'hostname': socket.gethostname()
        },
        'timestamp': datetime.datetime.now().isoformat()
    }
```



```python
@app.route('/api/info')
def api_info():
    """API endpoint returning application information"""
    return jsonify({
        'app_name': APP_NAME,
        'version': APP_VERSION,
        'environment': ENVIRONMENT,
        'instance_id': INSTANCE_ID,
        'hostname': socket.gethostname(),
        'request_count': request_count,
        'uptime_seconds': time.time() - start_time,
    # Kubernetes volumes allow persistent storage across container restarts.
    # Volumes are mounted inside a container as directories.
    # This lets the application store logs, config files, and data that persist beyond container restarts.
    #Volumes are defined in your Kubernetes YAML files (deployment.yaml or volumes.yaml):
        'volumes': {
            'data': {
                'path': DATA_PATH,
                'mounted': os.path.exists(DATA_PATH) and os.access(DATA_PATH, os.R_OK)
            },
    #Checks if it is readable (os.access(PATH, os.R_OK)).
    # Stores this information in a dictionary under the volumes key.

            'config': {
                'path': CONFIG_PATH,
                'mounted': os.path.exists(CONFIG_PATH) and os.access(CONFIG_PATH, os.R_OK)
            },
            'logs': {
                'path': LOG_PATH,
                'mounted': os.path.exists(LOG_PATH) and os.access(LOG_PATH, os.R_OK)
            }
        },
        'timestamp': datetime.datetime.now().isoformat()
    })
```

127.0.0.1:8080/api/info

127.0.0.1:8080/api/info

Pretty-print


```
{
  "app_name": "Kubernetes Zero to Hero",
  "environment": "demo",
  "hostname": "k8s-master-app-869578d457-bp7jk",
  "instance_id": "ce6ea312",
  "request_count": 7,
  "timestamp": "2025-03-05T11:54:18.452301",
  "uptime_seconds": 22053.293340444565,
  "version": "1.0.0",
  "volumes": {
    "config": {
      "mounted": true,
      "path": "/config"
    },
    "data": {
      "mounted": true,
      "path": "/data"
    },
    "logs": {
      "mounted": true,
      "path": "/logs"
    }
  }
}
```

```python
@app.route('/api/health')
def health_check():
    """Health check endpoint for Kubernetes liveness and readiness probes"""
    # Check if we can access our mounted volumes
    data_ok = os.path.exists(DATA_PATH) and os.access(DATA_PATH, os.R_OK)
    config_ok = os.path.exists(CONFIG_PATH) and os.access(CONFIG_PATH, os.R_OK)
    logs_ok = os.path.exists(LOG_PATH) and os.access(LOG_PATH, os.W_OK)

    # For a real application, you might check database connections,
    # cache availability, etc.

    # Overall health status
    is_healthy = data_ok and config_ok and logs_ok

    # Log health check results
    logger.info(f"Health check: {'PASS' if is_healthy else 'FAIL'}")

    response = {
        'status': 'healthy' if is_healthy else 'unhealthy',
        'checks': {
            'data_volume': 'accessible' if data_ok else 'inaccessible',
            'config_volume': 'accessible' if config_ok else 'inaccessible',
            'logs_volume': 'writable' if logs_ok else 'not writable'
        },
        'timestamp': datetime.datetime.now().isoformat(),
        'hostname': socket.gethostname()
    }

    # Set the HTTP status code based on health
    status_code = 200 if is_healthy else 503

    return jsonify(response), status_code
```