Start Lab 01:30:00

JAVAMS13 Working with Kubernetes Monitoring

1 hour 30 minutes Free ★★★★☆ Rate Lab

Overview

In this series of labs, you take a demo microservices Java application built with the Spring framework and modify it to use an external database server. You adopt some of the best practices for tracing, configuration management, and integration with other services using integration patterns.

In the previous lab, you containerized the application and deployed it to a Kubernetes Engine cluster with Cloud Kubernetes Monitoring support. That means you can monitor the health of the Kubernetes Engine cluster using Cloud Monitoring. A replica of that environment is preconfigured for you in this lab.

Traditionally, Java applications are monitored through JMX metrics, which provide metrics on such things as thread count and heap usage. In the cloud-native world where you monitor more than just the Java stack, you need to use more generic metrics formats, such as Prometheus.

Cloud Kubernetes Monitoring aggregates logs, events, and metrics from your Kubernetes Engine environment to help you understand your application's behavior in production. Prometheus is an optional monitoring tool often used with Kubernetes. If you configure Cloud Kubernetes Monitoring with Prometheus support, then services that expose metrics using the Prometheus data model also have their data exported from the cluster and made visible as external metrics in Cloud Monitoring.

In this lab, you enable Prometheus monitoring for Kubernetes and then modify the demo application to expose Prometheus metrics from within the application and its backend service. You can then use Cloud Monitoring to monitor internal performance metrics from your application while it is running on Kubernetes Engine.

Objectives

In this lab, you learn how to perform the following tasks:

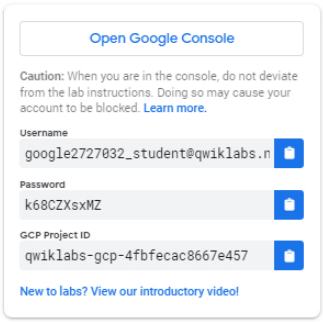
- Enable Cloud Monitoring for Kubernetes Engine
- Enable Prometheus monitoring in a Kubernetes Engine cluster
- Expose Prometheus metrics from inside a Spring Boot application
- Explore live application metrics using Cloud Monitoring

Task 0. Lab Preparation

Access Qwiklabs

How to start your lab and sign in to the Console

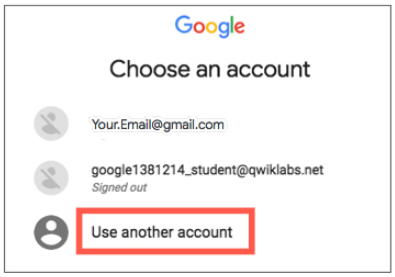
1. Click the **Start Lab** button. If you need to pay for the lab, a pop-up opens for you to select your payment method. On the left is a panel populated with the temporary credentials that you must use for this lab.



2. Copy the username, and then click **Open Google Console**. The lab spins up resources, and then opens another tab that shows the **Choose an account** page.

   Tip: Open the tabs in separate windows, side-by-side.

3. On the Choose an account page, click **Use Another Account**.



4. The Sign in page opens. Paste the username that you copied from the Connection Details panel. Then copy and paste the password.

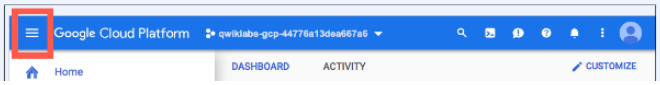
   Important: You must use the credentials from the Connection Details panel. Do not use your Qwiklabs credentials. If you have your own GCP account, do not use it for this lab (avoids incurring charges).

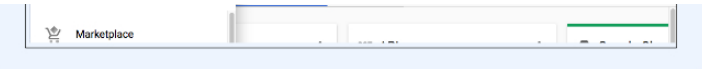
5. Click through the subsequent pages:

   - Accept the terms and conditions.
   - Do not add recovery options or two-factor authentication (because this is a temporary account).
   - Do not sign up for free trials.

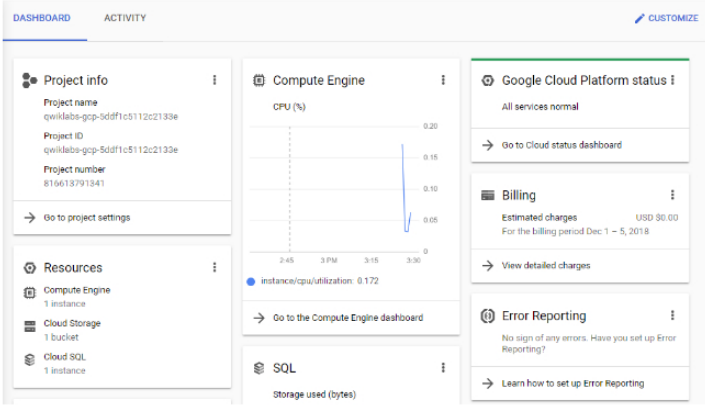
   After a few moments, the GCP console opens in this tab.

Note: You can view the menu with a list of GCP Products and Services by clicking the **Navigation menu** at the top-left, next to "Google Cloud Platform".





After you complete the initial sign-in steps, the project dashboard appears.



Fetch the application source files

To begin the lab, click the **Activate Cloud Shell** button at the top of the Google Cloud Console. To activate the code editor, click the `Open Editor` button on the toolbar of the Cloud Shell window. This sets up the editor in a new tab with continued access to Cloud Shell.

Note: the lab setup includes automated deployment of the services that you configured yourself in previous labs. When the setup is complete, copies of the demo application (configured so that they are ready for this lab session) are put into a Cloud Storage bucket named using the project ID for this lab.

1. In the Cloud Shell command line, enter the following command to create an environment variable that contains the project ID for this lab:

```
export PROJECT_ID=$(gcloud config list --format 'value(core.project)')
```

2. Verify that the demo application files were created.

```
gsutil ls gs://$PROJECT_ID
```

If you get a `BucketNotFound` error, this means that the lab's deployment script has not finished yet. You will need to wait for the DM template to complete before proceeding. This usually takes around 10 minutes upon starting the lab. Please wait a few minutes then retry.

3. Copy the application folders to Cloud Shell.

```
gsutil -m cp -r gs://$PROJECT_ID/* ~/
```

4. Make the Maven wrapper scripts executable.

```
chmod +x ~/guestbook-frontend/mvnw
chmod +x ~/guestbook-service/mvnw
```

Task 1. Enable Cloud Monitoring and view

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```

Task 1. Enable Cloud Monitoring and view the Cloud Kubernetes Monitoring dashboard

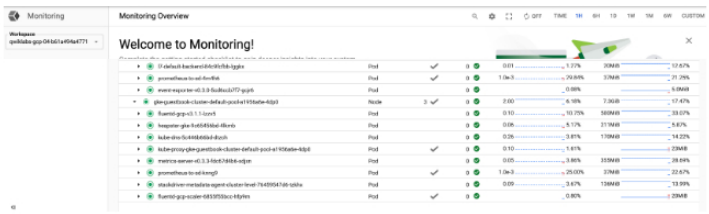
Create a Monitoring workspace

You will now setup a Monitoring workspace that's tied to your Qwiklabs GCP Project. The following steps create a new account that has a free trial of Monitoring.

1. In the Google Cloud Platform Console, click on **Navigation menu** > **Monitoring**.

2. Wait for your workspace to be provisioned.

   When the Monitoring dashboard opens, your workspace is ready.



Task 2. Expose Prometheus metrics from Spring Boot applications

Spring Boot can expose metrics information through Spring Boot Actuator. Micrometer is the metrics collection facility included in Spring Boot Actuator. Micrometer can expose all the metrics using the Prometheus format.

If you are not using Spring Boot, you can expose JMX metrics through Prometheus by using a Prometheus JMX Exporter agent.

In this task, you add the Spring Boot Actuator starter and Micrometer dependencies to the guestbook frontend application.

1. In the Cloud Shell code editor, open `~/guestbook-frontend/pom.xml`.

2. Insert the following new dependencies at the end of the `<dependencies>` section, just before the closing `</dependencies>` tag.

```
        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-starter-actuator</artifactId>
        </dependency>
        <dependency>
            <groupId>io.micrometer</groupId>
```

```
            <artifactId>micrometer-registry-prometheus</artifactId>
            <scope>runtime</scope>
        </dependency>
```

3. In the Cloud Shell code editor, open `~/guestbook-frontend/src/main/resources/application.properties`.

4. Add the following two properties to configure Spring Boot Actuator to expose metrics on port 9000.

```
management.server.port=9000
management.endpoints.web.exposure.include=*
```

5. To send log entries to Stackdriver Logging, via STDOUT and structured JSON logging, change `guestbook-frontend/src/main/resources/logback-spring.xml` to use the `CONSOLE_JSON` appender. Copy and replace the entire contents of the file with the following code:

```
<configuration>
    <include
resource="org/springframework/boot/logging/logback/defaults.xml" />
    <include resource="org/springframework/boot/logging/logback/console-
appender.xml" />

    <springProfile name="cloud">
        <include resource="org/springframework/cloud/gcp/logging/logback-
json-appender.xml"/>
        <root level="INFO">
            <appender-ref ref="CONSOLE_JSON"/>
        </root>
    </springProfile>
    <springProfile name="default">
        <root level="INFO">
            <appender-ref ref="CONSOLE"/>
        </root>
    </springProfile>
</configuration>
```

Task 3. Rebuild the containers

In this task you rebuild the containers and configure the frontend contaner deployment to expose the prometheus monitoring endpoint.

1. In the Cloud Shell change to the frontend application directory.

```
cd ~/guestbook-frontend
```

2. Build the frontend application container.

```
./mvnw clean compile jib:build
```

3. While this is compiling switch back to the Cloud Shell code editor and open

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```

2. Build the frontend application container.

```
./mvnw clean compile jib:build
```

3. While this is compiling switch back to the Cloud Shell code editor and open

```
    app: guestbook-frontend
  name: guestbook-frontend
spec:
  replicas: 2
  selector:
    matchLabels:
      app: guestbook-frontend
  template:
    metadata:
      labels:
        app: guestbook-frontend
    spec:
      volumes:
      - name: credentials
        secret:
          secretName: guestbook-service-account
      containers:
      - name: guestbook-frontend
        image: gcr.io/qwiklabs-gcp-02-d3683ac6304b/guestbook-frontend
        volumeMounts:
        - name: credentials
          mountPath: "/etc/credentials"
          readOnly: true
        env:
        - name: SPRING_CLOUD_CONFIG_ENABLED
          value: "false"
        - name: SPRING_CLOUD_GCP_CONFIG_ENABLED
          value: "false"
        - name: MESSAGES_ENDPOINT
          value: http://guestbook-service:8080/guestbookMessages
        - name: SPRING_PROFILES_ACTIVE
          value: cloud
        - name: GOOGLE_APPLICATION_CREDENTIALS
          value: /etc/credentials/service-account.json
        ports:
        - name: http
    app: guestbook-frontend
  name: guestbook-frontend
spec:
  replicas: 2
  selector:
    matchLabels:
      app: guestbook-frontend
  template:
    metadata:
      labels:
        app: guestbook-frontend
    spec:
      volumes:
      - name: credentials
        secret:
          secretName: guestbook-service-account
      containers:
      - name: guestbook-frontend
        image: gcr.io/qwiklabs-gcp-02-d3683ac6304b/guestbook-frontend
        volumeMounts:
        - name: credentials
          mountPath: "/etc/credentials"
          readOnly: true
        env:
        - name: SPRING_CLOUD_CONFIG_ENABLED
          value: "false"
        - name: SPRING_CLOUD_GCP_CONFIG_ENABLED
          value: "false"
        - name: MESSAGES_ENDPOINT
          value: http://guestbook-service:8080/guestbookMessages
        - name: SPRING_PROFILES_ACTIVE
          value: cloud
        - name: GOOGLE_APPLICATION_CREDENTIALS
          value: /etc/credentials/service-account.json
        ports:
        - name: http
```

Note: You haven't made any changes to the backend service application but you have to build the image so that it is available on the gcr.io container repository for the lab when you deploy the full application.

7. Redeploy the manifest:

```
mkdir -p ~/bin
cd ~/bin
curl -s "https://raw.githubusercontent.com/kubernetes-
sigs/kustomize/master/hack/install_kustomize.sh" | bash
export PATH=$PATH:$HOME/bin
cd ~/kustomize/base
cp ~/service-account.json ~/kustomize/base
kustomize build
gcloud container clusters get-credentials guestbook-cluster --zone=us-
central1-a
kustomize edit set namespace default
kustomize build | kubectl apply -f -
```

8. Wait for the pods to restart. Find the pod name for one of the instances.

```
kubectl get pods -l app=guestbook-frontend
```

You should see something like the following:

```
NAME                                 READY     STATUS    RESTARTS   AGE
guestbook-frontend-8567fdc8c8-c68vk   1/1       Running   0          5m
guestbook-frontend-8567fdc8c8-gvcf5   1/1       Running   0          5m
```

9. Establish a port forward to one of the Guestbook Frontend pod. Replacing `[podnumber]` with one of the ID's of the pods you received from the previous command:

```
kubectl port-forward guestbook-frontend-[podnumber] 9000:9000
```

Task 4. Install Prometheus and Stackdriver Sidecar

Stackdriver Kubernetes Monitoring can monitor Prometheus metrics from the Kubernetes cluster. Install Prometheus support to the cluster.

1. In a **new** Cloud Shell tab, install a quickstart Prometheus operator.

```
gcloud container clusters get-credentials guestbook-cluster --zone=us-central1-a
kubectl apply -f https://raw.githubusercontent.com/coreos/prometheus-operator/v0.38.1/bundle.yaml
```

2. Provision Prometheus using the Prometheus Operator.

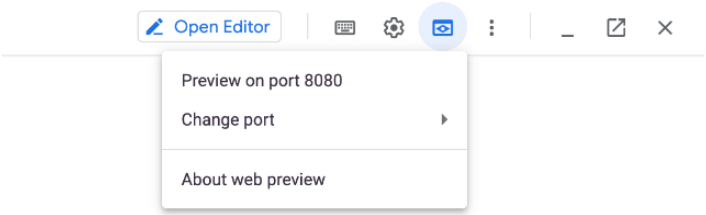
```
cd ~/prometheus
export PROJECT_ID=$(gcloud config list --format 'value(core.project)')

# Make sure the project ID is set
echo $PROJECT_ID
cat prometheus.yaml | envsubst | kubectl apply -f -
kubectl apply -f pod-monitors.yaml
```

> The prometheus.yaml file has an additional Stackdriver Sidecar that's designed to export the scraped Prometheus metrics to Stackdriver.

3. Validate Prometheus is running properly and scraping the data. Establish a port forward to Prometheus' port.

```
pkill java
kubectl port-forward svc/prometheus 9090:9090
```

4. Click `Web Preview` in the Cloud Shell, then click `Preview on port 8080`. It should open up a new page.

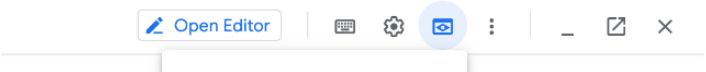


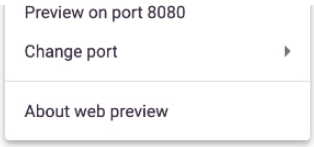
5. Now, in the URL, change the beginning of the line from `8080` to `9090` and refresh the page. Your URL should now look something like: `https://9090-dot-12909153-dot-devshell.appspot.com/graph`.

6. In the Prometheus console, select Status > Targets

```
kubectl port-forward svc/prometheus 9090:9090
```

4. Click `Web Preview` in the Cloud Shell, then click `Preview on port 8080`. It should open up a new page.





5. Now, in the URL, change the beginning of the line from `8080` to `9090` and refresh the page. Your URL should now look something like: `https://9090-dot-12909153-dot-devshell.appspot.com/graph`.

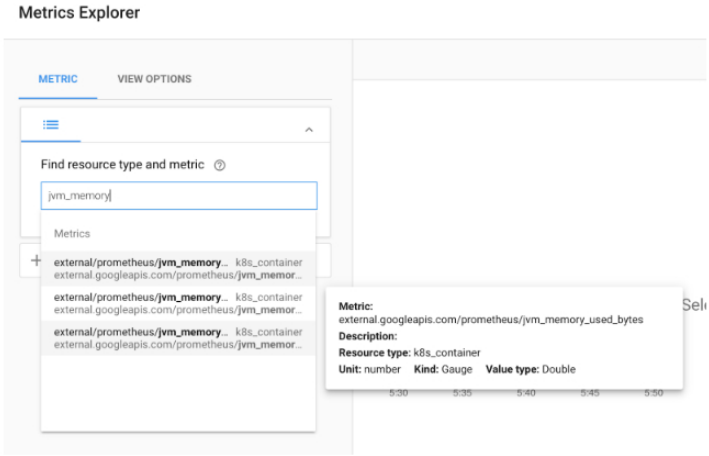
6. In the Prometheus console, select **Status** > **Targets**.

Task 5. Explore the metrics

1. In the Google Cloud Console, navigate to the **Operations** > **Monitoring**.

2. Click **Metrics Explorer**.

3. In the Metrics Explorer, search for `jvm_memory` to find metrics collected by the Prometheus agent from the Spring Boot application.



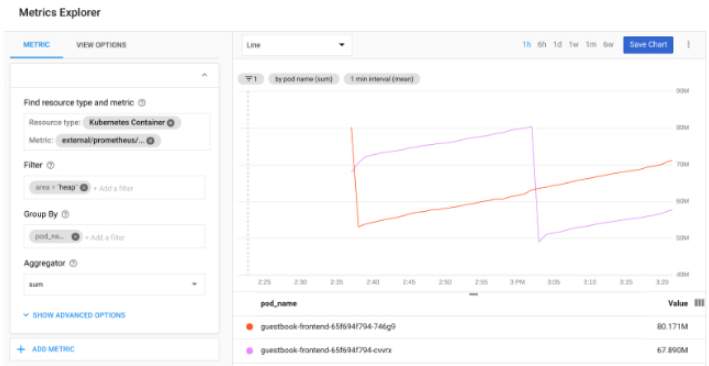
> It may take a few minutes for the Prometheus metrics to show up in the Metrics Explorer.

4. Select `jvm_memory_used_bytes` to plot the metrics. For **Resource Type**, select `Kubernetes Container`.

   The JVM memory has multiple dimensions (for example, Heap versus Non-Heap and Eden Space versus Metaspace).

5. In **Filter**, filter by **area**, setting the value to **heap**, and in **Group By**, select **pod_name**, and in **Aggregator**, select **sum**.

   These options build a graph of current heap usage of the frontend application.



End your lab

When you have completed your lab, click **End Lab**. Qwiklabs removes the resources you've used and cleans the account for you.

You will be given an opportunity to rate the lab experience. Select the applicable number of stars, type a comment, and then click **Submit**.

The number of stars indicates the following:

- 1 star = Very dissatisfied
- 2 stars = Dissatisfied
- 3 stars = Neutral
- 4 stars = Satisfied
- 5 stars = Very satisfied

You can close the dialog box if you don't want to provide feedback.

For feedback, suggestions, or corrections, please use the **Support** tab.