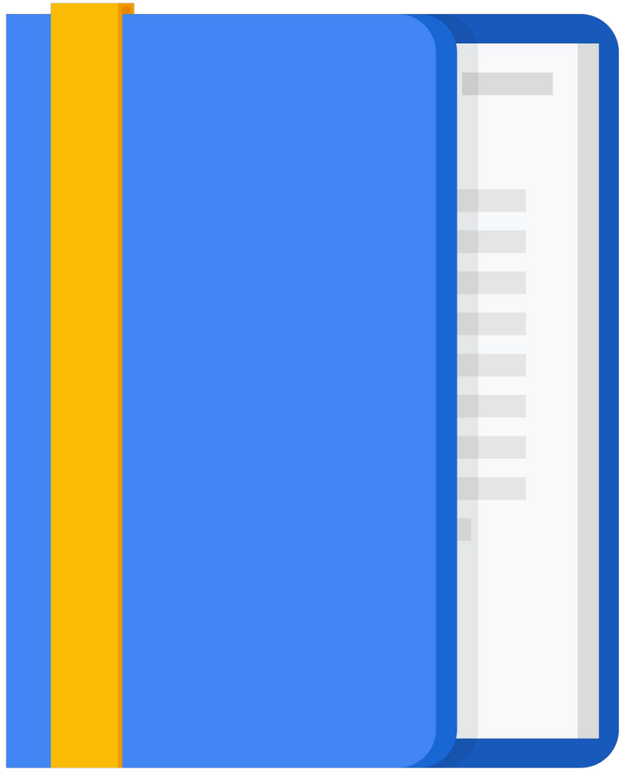
Introduction to Containers and Kubernetes

Objectives

- Understand containers
- Learn options for running containers
  - Kubernetes
  - App Engine
  - Cloud Run
- Create a basic Google Kubernetes Engine cluster



Agenda

Introduction to Containers

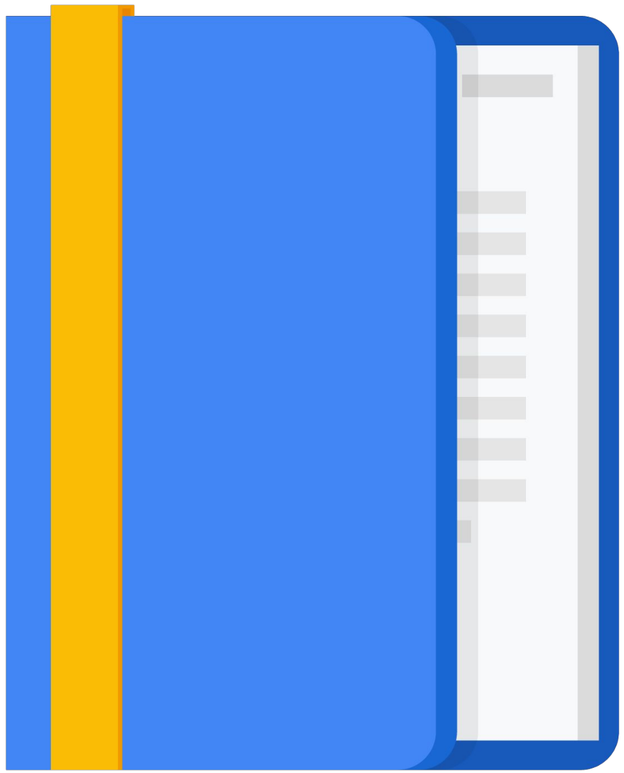
Lab

Computing Options

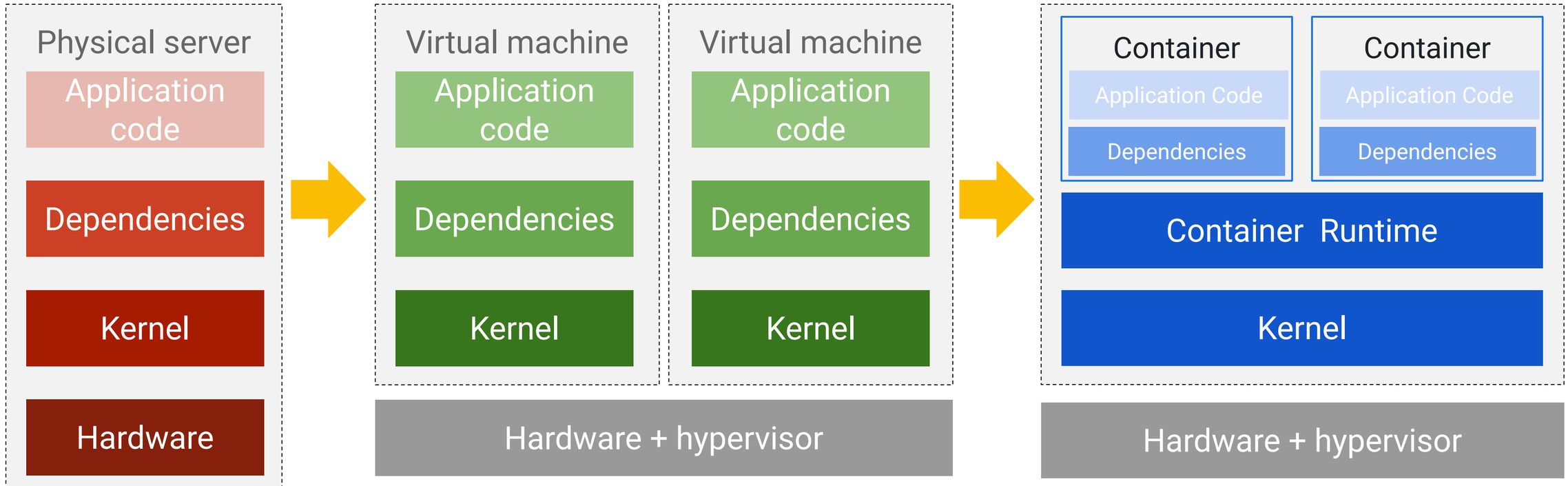
Introduction to Kubernetes

Lab

Quiz



Evolution towards containers



Deployment ~months
Not portable
Low utilization

Deployment ~minutes/days
Hypervisor-specific
Low isolation; workloads are tied to OS

Deployment ~seconds
High isolation
Workloads are independent of OS and hardware

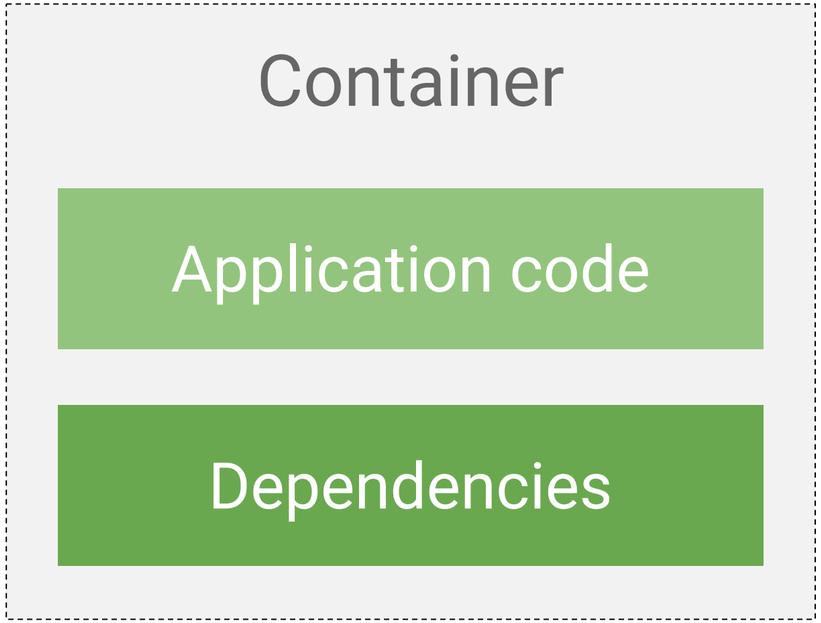
The importance of containers

Containers provide

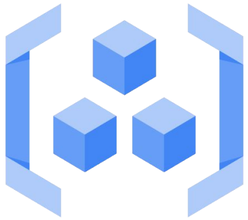
- Portability
- Isolation of workloads
- Reduced overhead
- Ease of automation
- Development support (agile, modular, etc.)

What is a container?

Containers are lightweight, standalone, resource-efficient, portable, executable packages



How can you get or create containers?



Download containerized software from a container registry such as gcr.io

docker

Build your own container using the open-source docker command

Build your own container using Cloud Build

Creating a container

Example

Let's build & run an app as a container

- Here is an example of some code.
  - It's a Python app that says 'hello world'.
  - Or if you reach the second endpoint, it gives you the version.
  - You don’t need to understand the code to create the container!
  - There is also a requirements.txt file that Python needs to run the app

app.py

```
from flask import Flask
app = Flask(__name__)

@app.route("/")
def hello():
  return "Hello World!\n"

@app.route("/version")
def version():
  return "Helloworld 1.0\n"

if __name__ == "__main__":
  app.run(host='0.0.0.0')
```

requirements.txt

```
Flask==0.12
uwsgi==2.0.15
```

Creating a container using Docker

Dockerfile

```
FROM ubuntu:18.10
RUN apt-get update -y && \
    apt-get install -y python3-pip python3-dev
COPY requirements.txt /app/requirements.txt
WORKDIR /app
RUN pip3 install -r requirements.txt
COPY . /app
ENTRYPOINT ["python3", "app.py"]
```

Create a Dockerfile to specify such things as:

- A requirements.txt file for dependencies.
- Your OS image and version of Python.
- How to install Python.
- How to run your app.

Then you build and run the container as an image

```
$> docker build -t py-server .
$> docker run -d py-server
```

- **`docker build`** builds a container and stores it locally as a runnable image.
- You can upload images to a registry service (like **Container Registry**) for sharing.
- **`docker run`** starts the container image.

Lab Intro

Container Registry: Qwik Start

Duration: 30 minutes

Introduction to QWIKLABS

Lab environment

For each lab, Qwiklabs offers:

- A free set of resources for a fixed amount of time
- A clean environment with permissions

You will have access to the labs for 72 hours.
Some labs are optional, and meant for you to do after class.

Logging into Qwiklabs

Google Cloud

Logging-into Qwiklabs

Demo: How to login and find our class

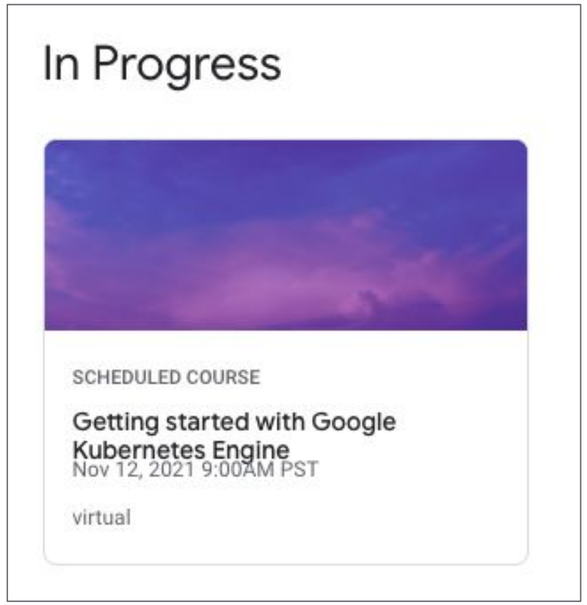
Videos are available as well:

- How to create a Qwiklabs account: https://bit.ly/createQLaccount
- How to login to Qwiklabs: https://bit.ly/loginQwiklabs
- How to start a Lab: https://bit.ly/startaql

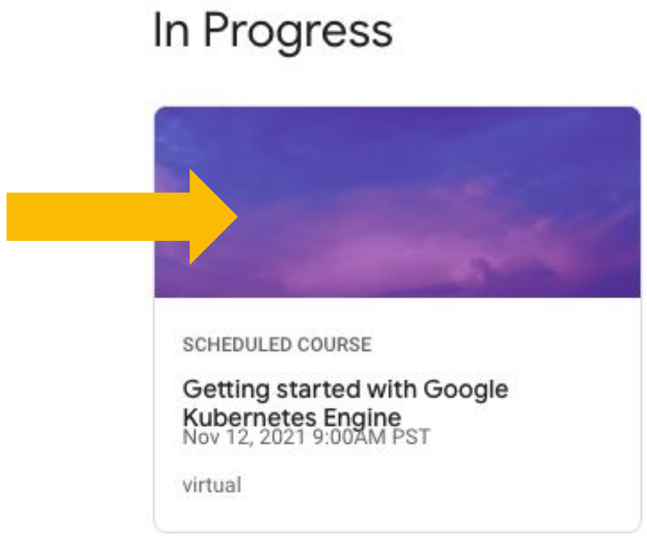
These can also be accessed from the help site:
https://traininghelp.cloudlearning.io

Open Qwiklabs

1. **Open an incognito window** (or private/anonymous window).
2. **Go** to **https://googlecloud.qwiklabs.com**
3. **Sign In** with existing account or **Join** with new account (with the corporate email you used to register for the course).
4. Launch the course from the In Progress section of your home page.



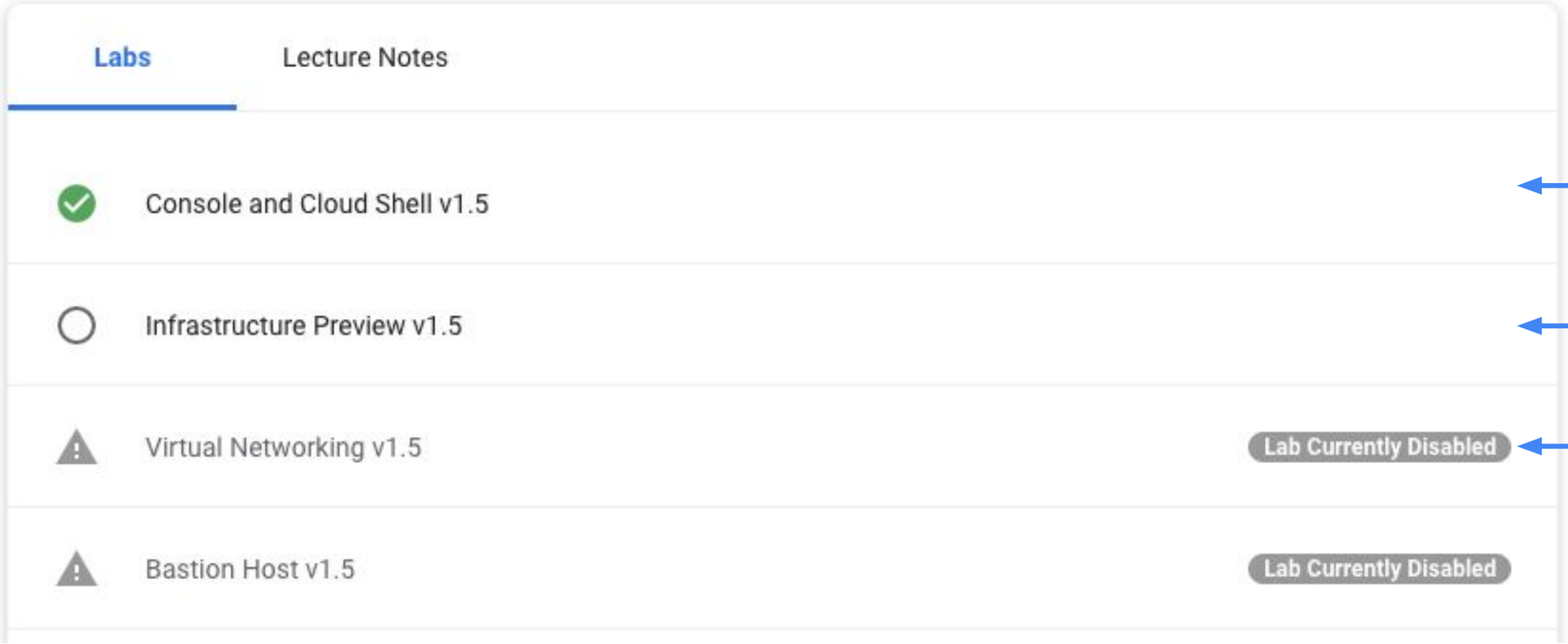
Click the “purple box” for this class...



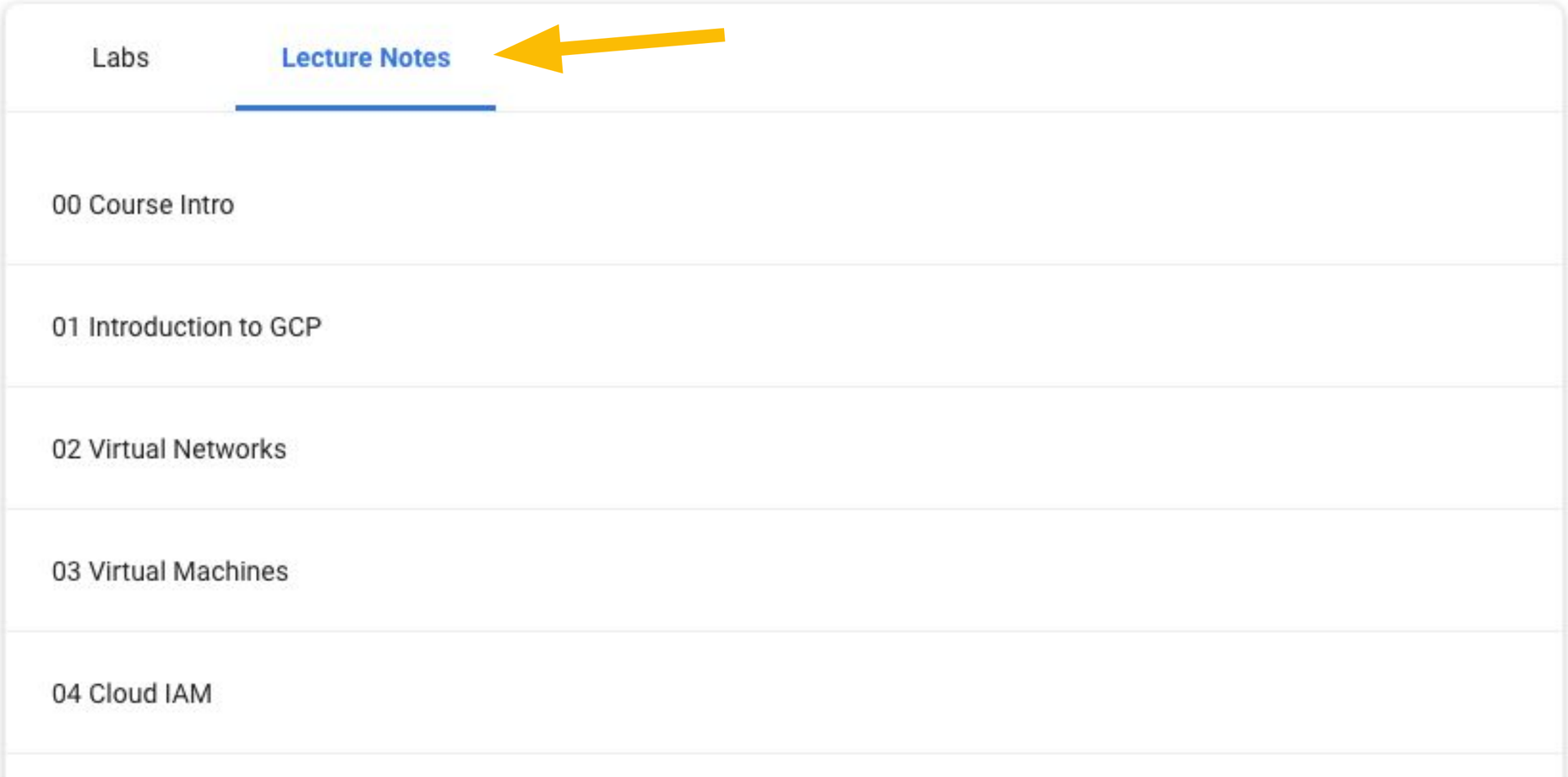
If you don’t see the “purple box”

1. Are you using the right URL? https://googlecloud.qwiklabs.com
2. Are you using the same business email that you used to register?
3. If you still don’t see the box, fill out the Troubleshooting Form listed in the chat.

View your labs



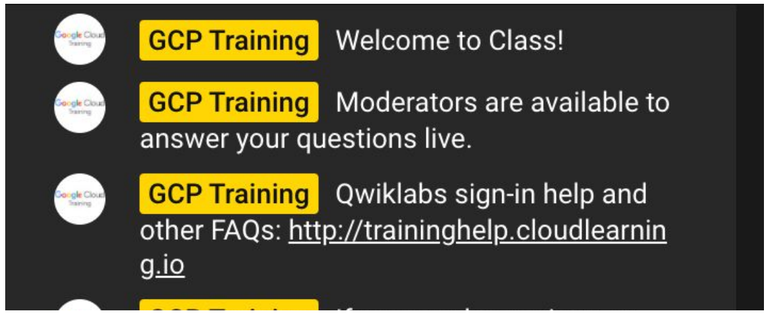
View lecture notes



Getting Help During Class

http://traininghelp.cloudlearning.io/

Includes how-tos for Qwiklabs, troubleshooting tips, where to find free training, and more...



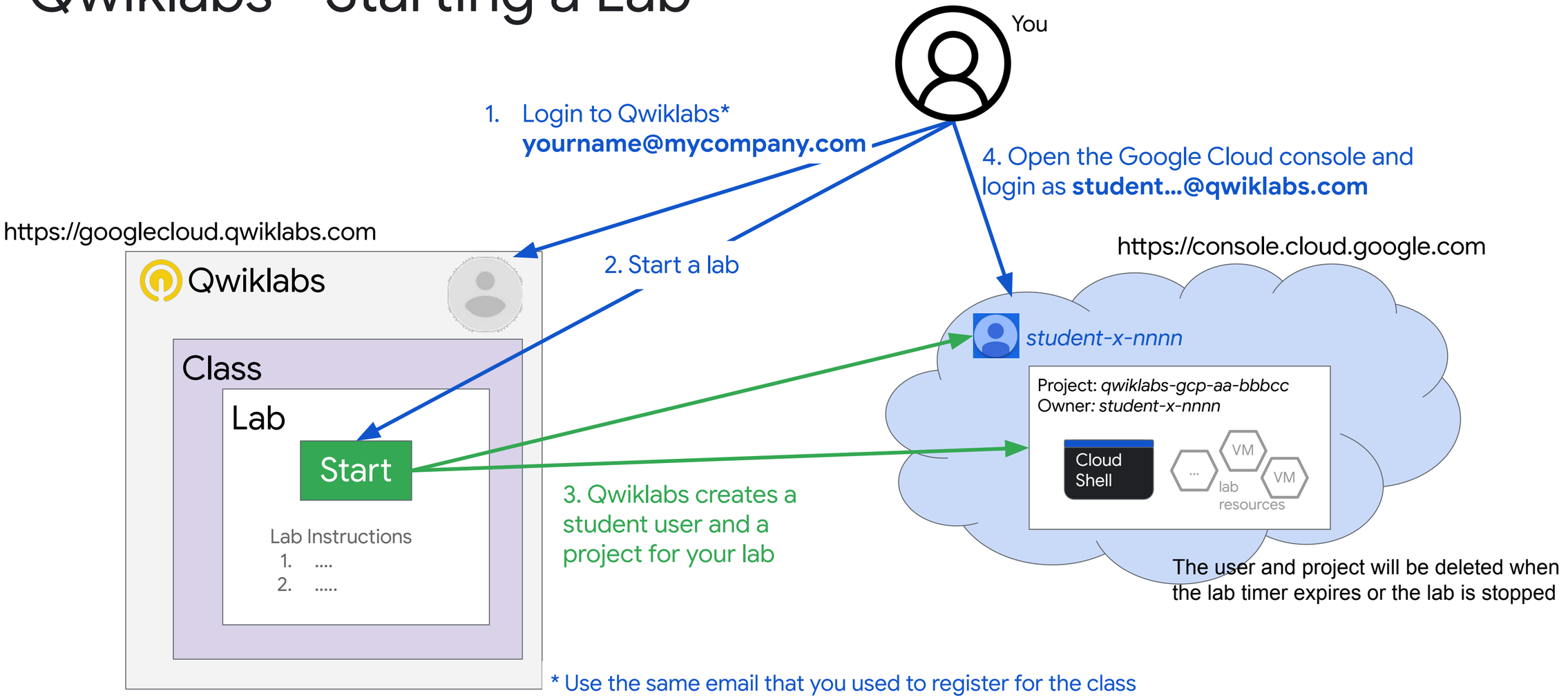
Live Chat

Moderators are live and available to answer questions. Look for the chat on the right side of your YouTube screen.

Starting a Lab

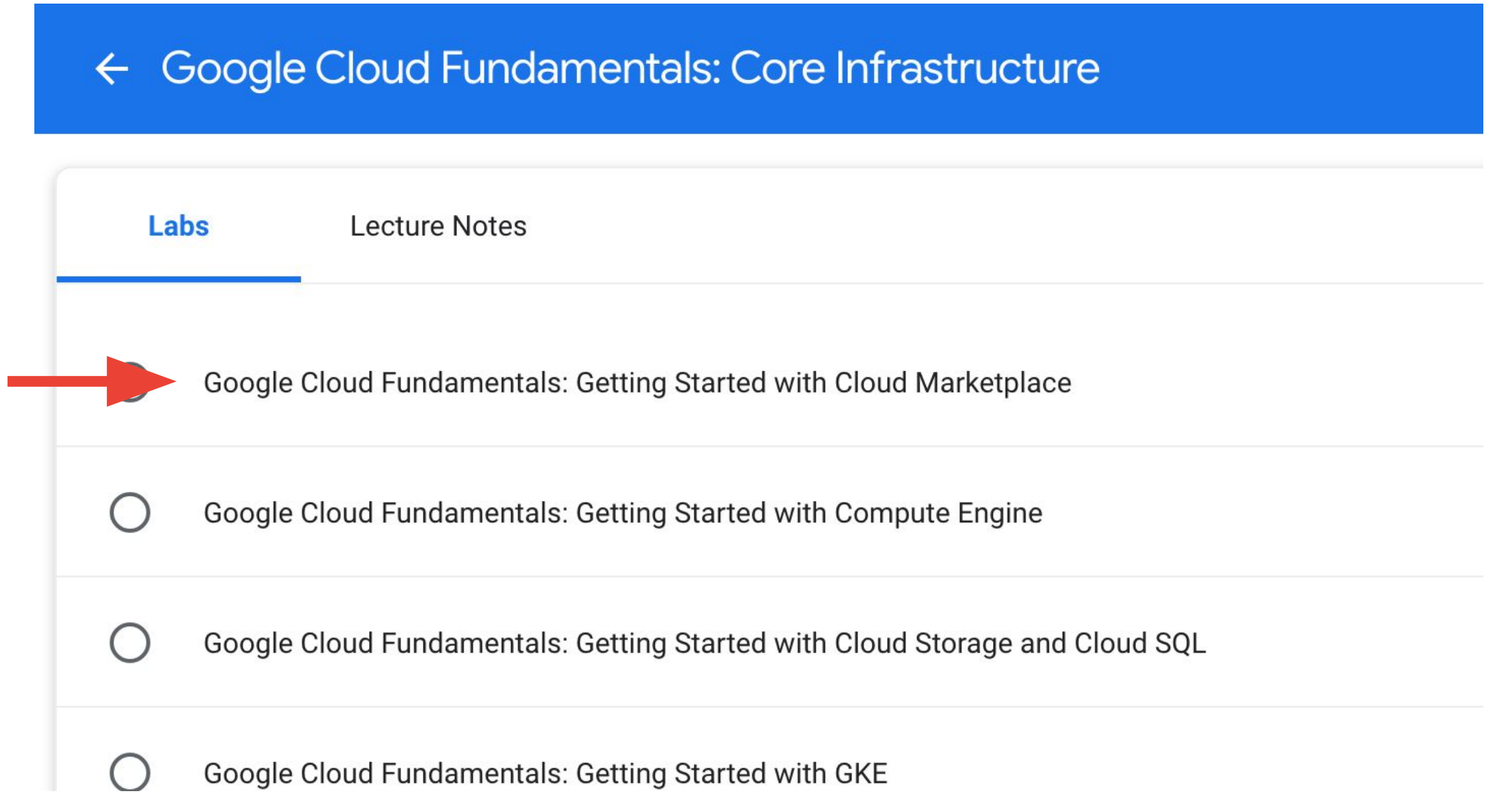
Google Cloud

Qwiklabs - Starting a Lab



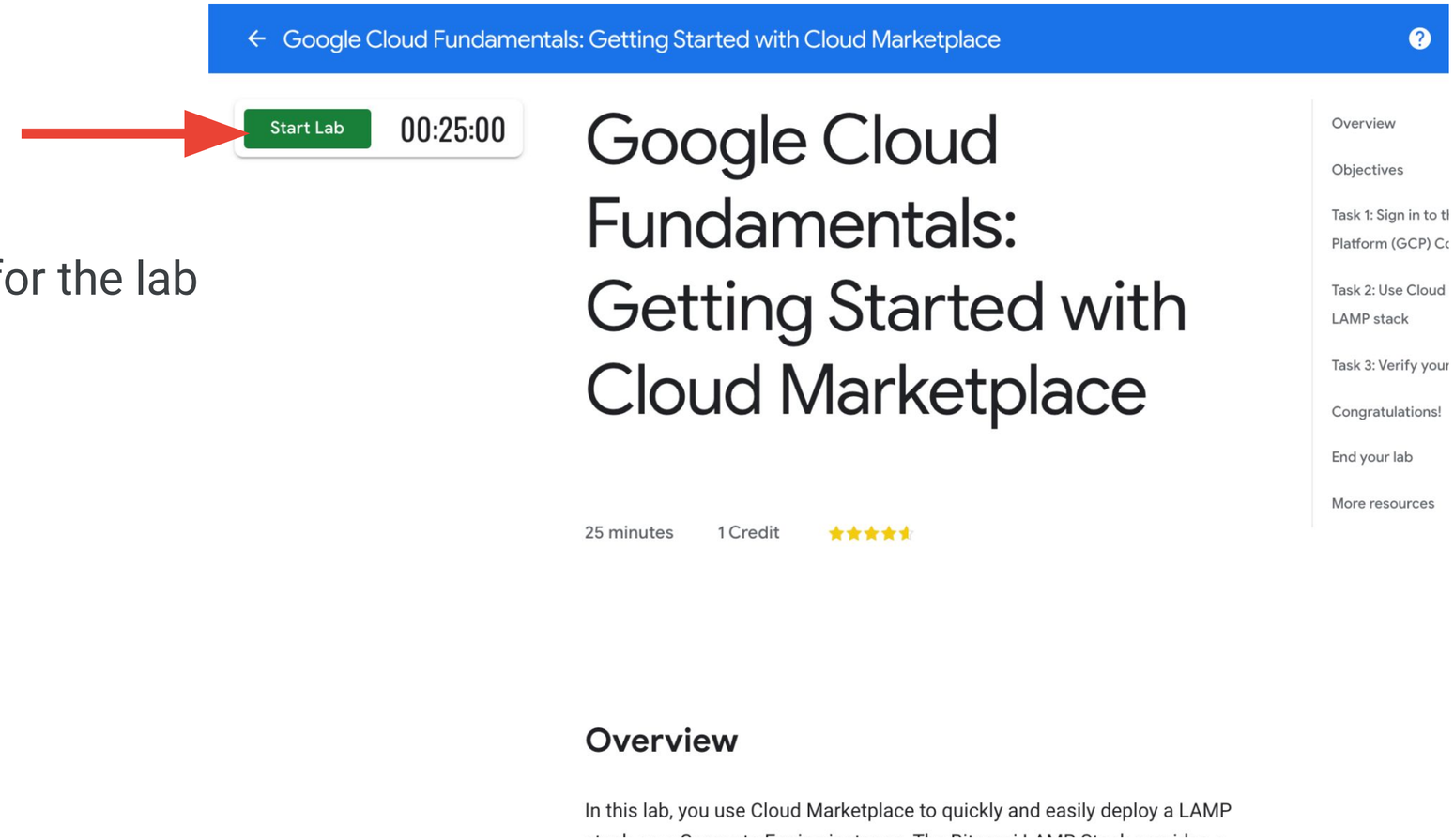
Find the lab and open it

To start a lab, click its name on the list.



Start the lab

Click **Start Lab**.



It may take a few minutes for the lab resources to be created.

Prepare to login to the console

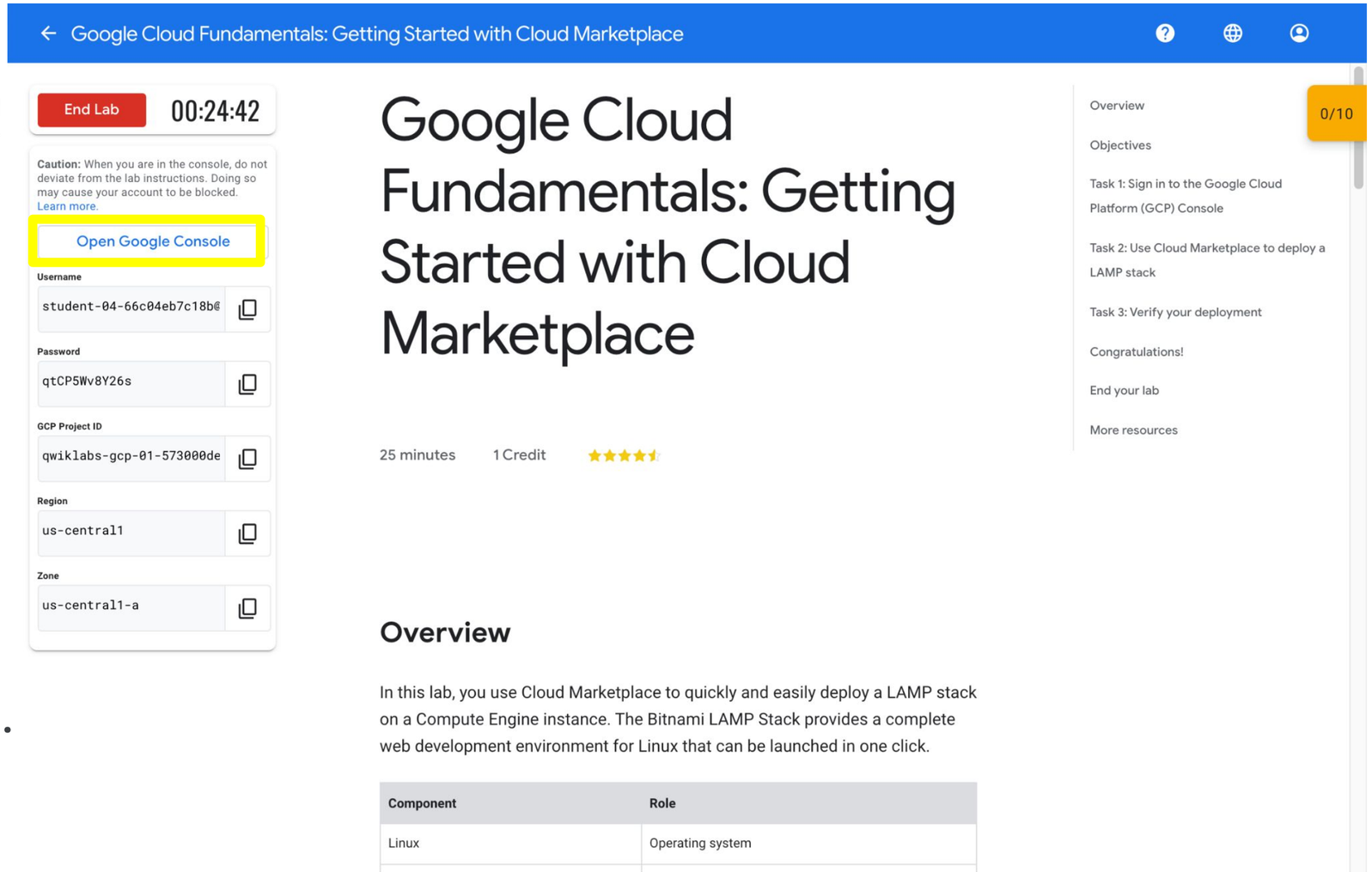
Keep this page open!

It contains

- Username
- Password
- Project id

and

- step-by-step instructions for completing the lab.



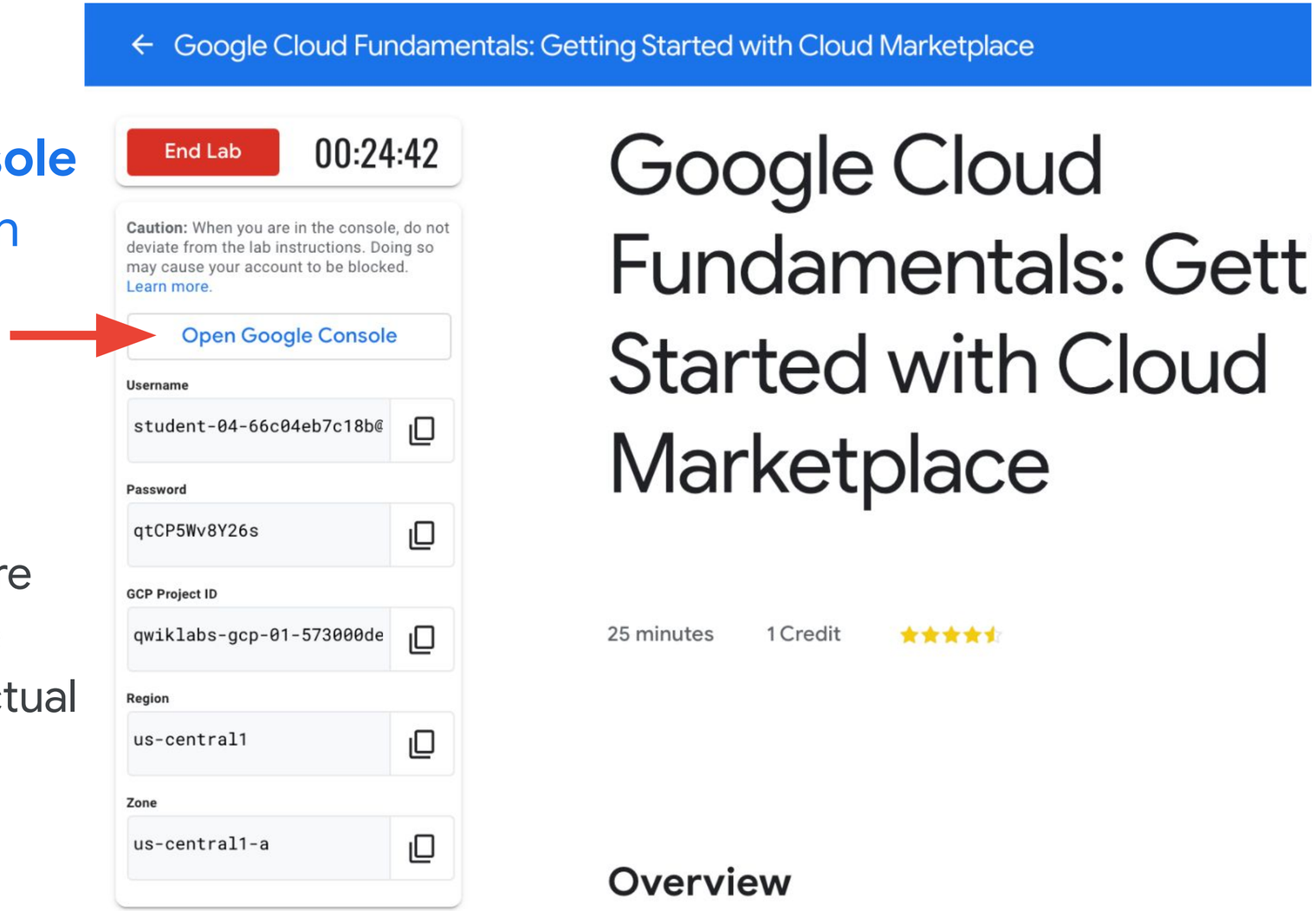
Google Cloud

Open the Google Cloud Console

Right-click Open Console and choose Open Link in Incognito Window.

(Incognito is also known as Private or Anonymous.)

Another tab will open, where you will login to the Google Cloud Console to do the actual lab work.



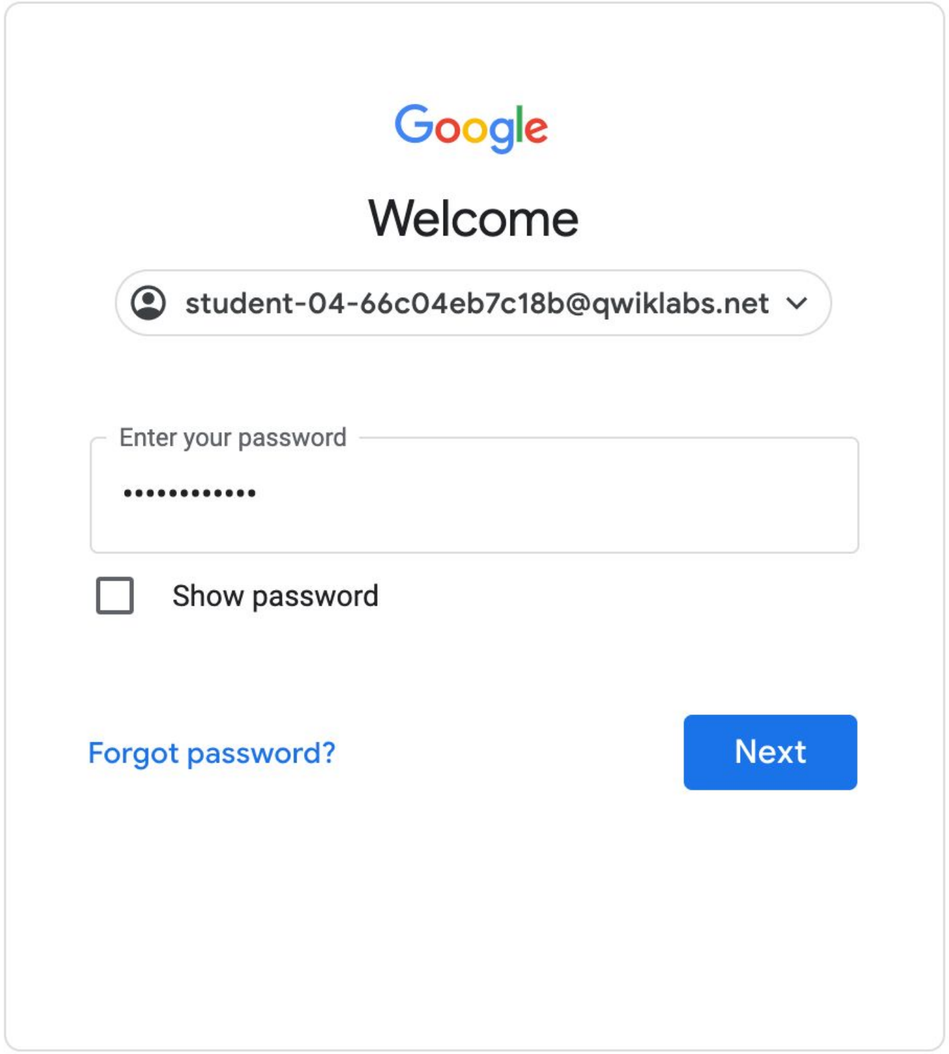
Google Cloud

Login to the Google Cloud Console

Copy/paste the user account and password information from the previous page into the login.

If you are asked, do not create any recovery information.

Do not use your corporate email!

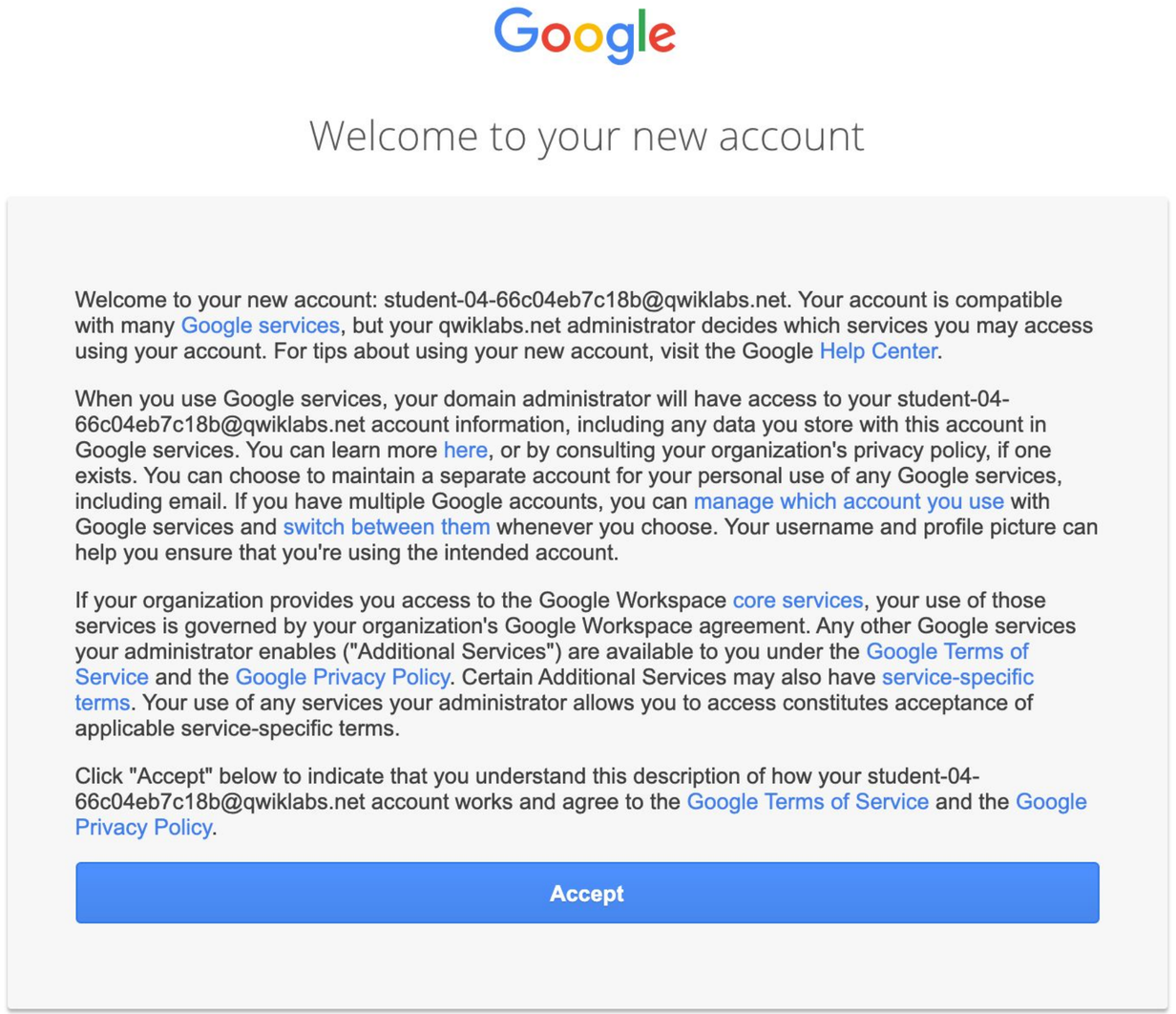


Google Cloud

Complete the login

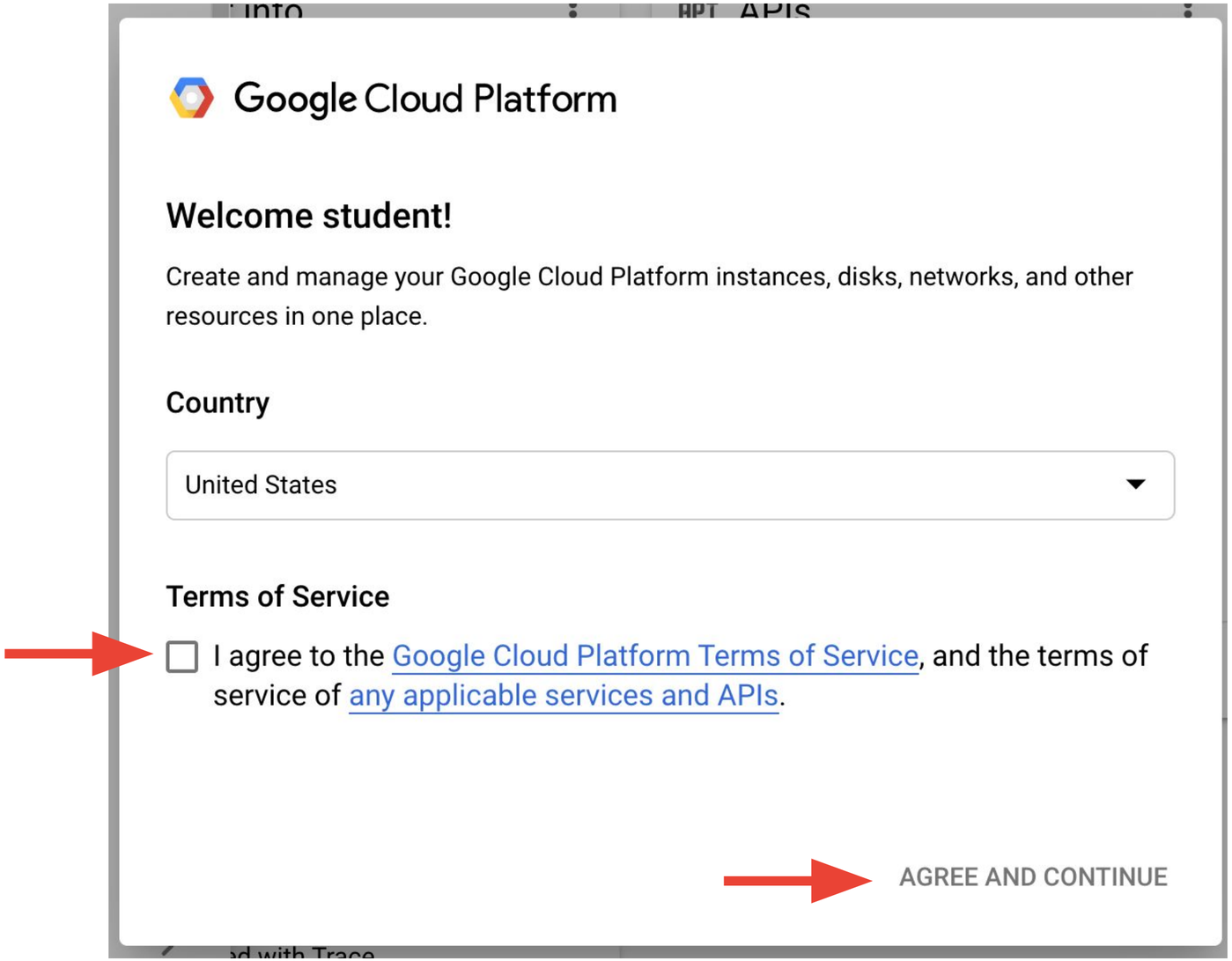
If prompted, accept the terms and conditions in order to continue.

(Because this is a brand-new Google Account!)



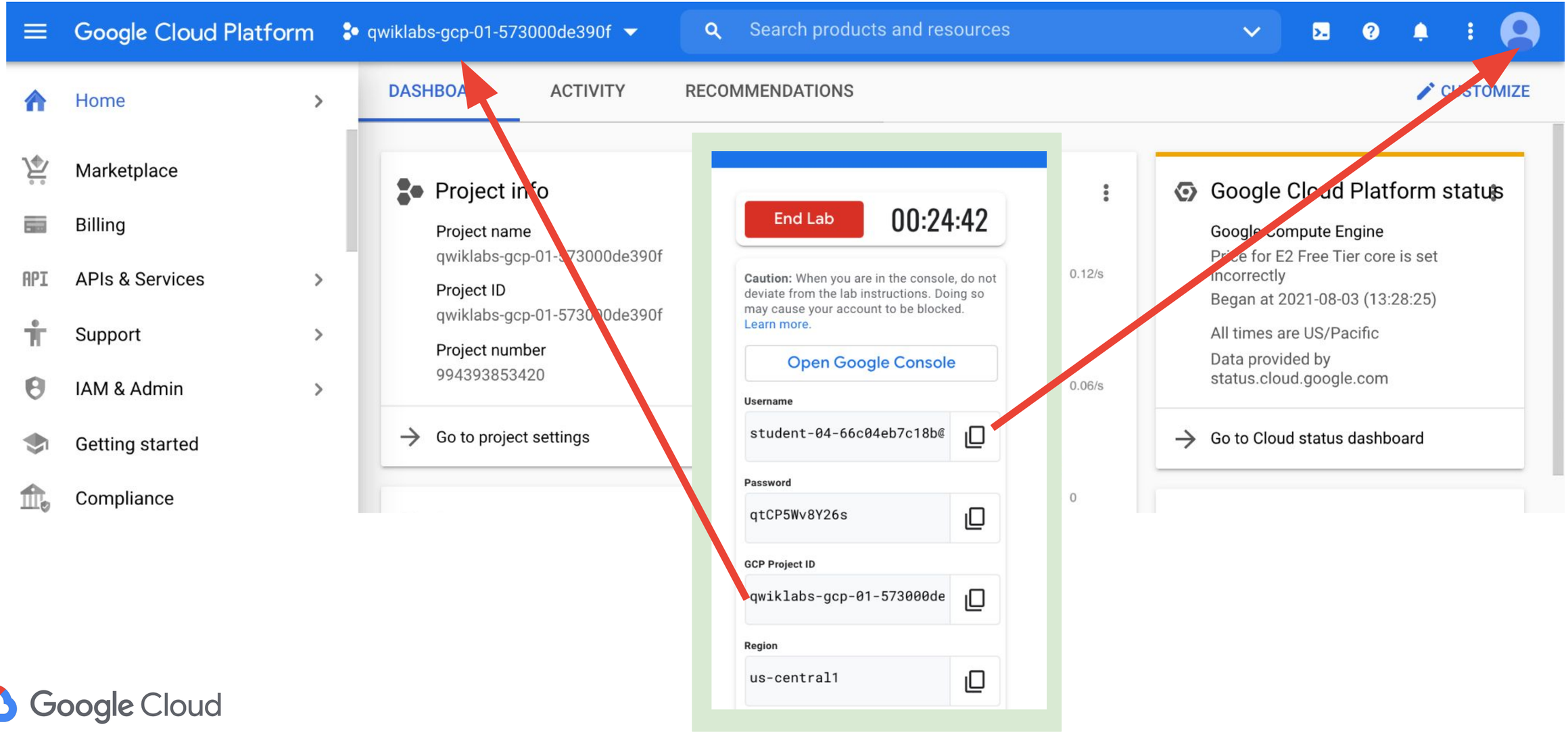
In the console, accept the Google Cloud Terms of Service

Accept the terms and conditions in order to continue.



Google Cloud

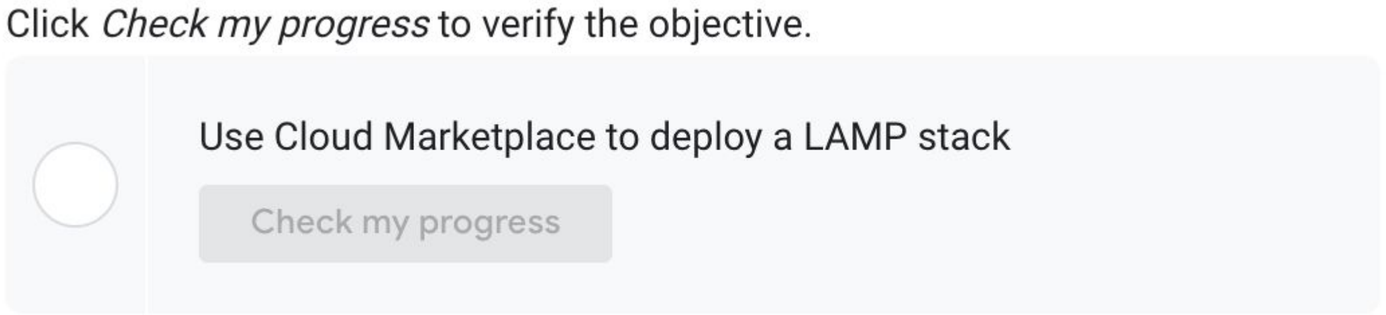
Verify your user account and project



Google Cloud

Enjoy the lab!

Some labs may provide the ability to self-check your progress as you complete them.



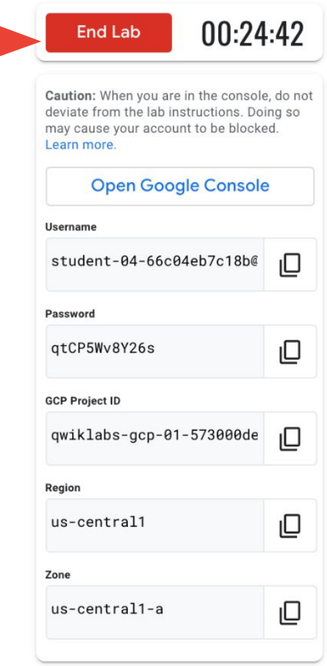
Google Cloud

Finish the lab

Click **End Lab**.

(The lab will automatically end when the timer expires.)

When the lab ends, the project and user are deleted. They are not reused.



Google Cloud

Agenda

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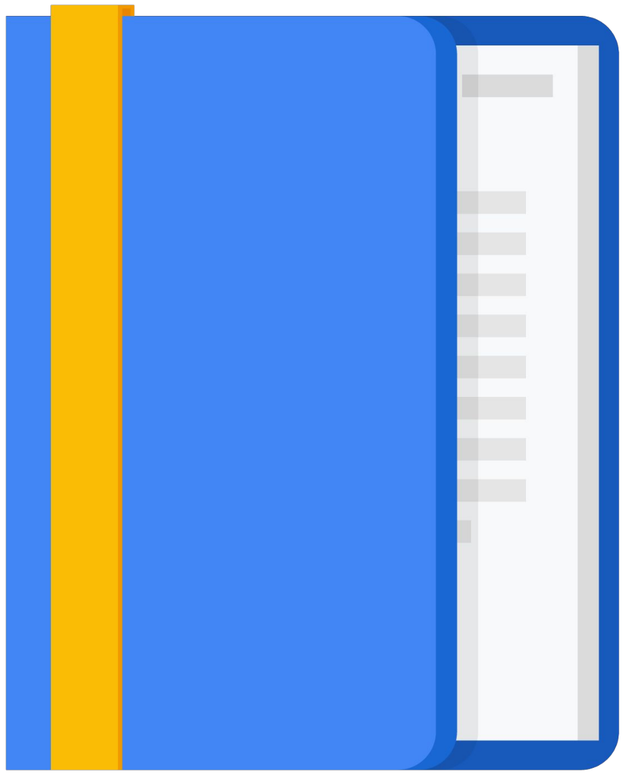
Lab

Computing Options

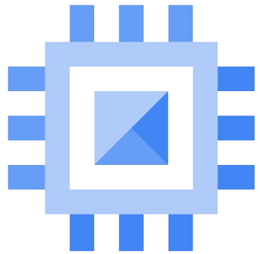
Introduction to Kubernetes

Lab

Quiz

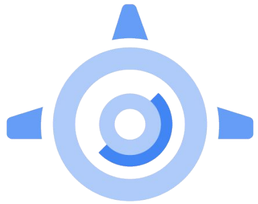


Where can I run containers?



Compute Engine

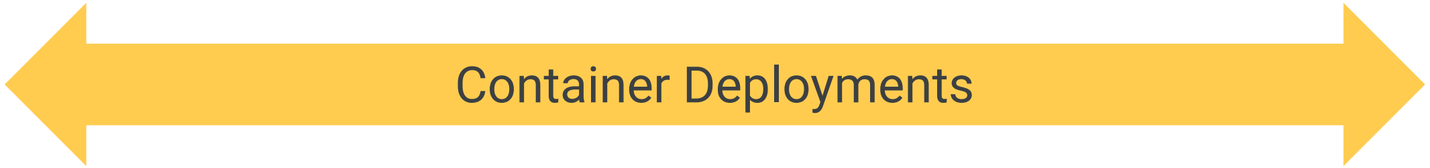
GKE



App Engine

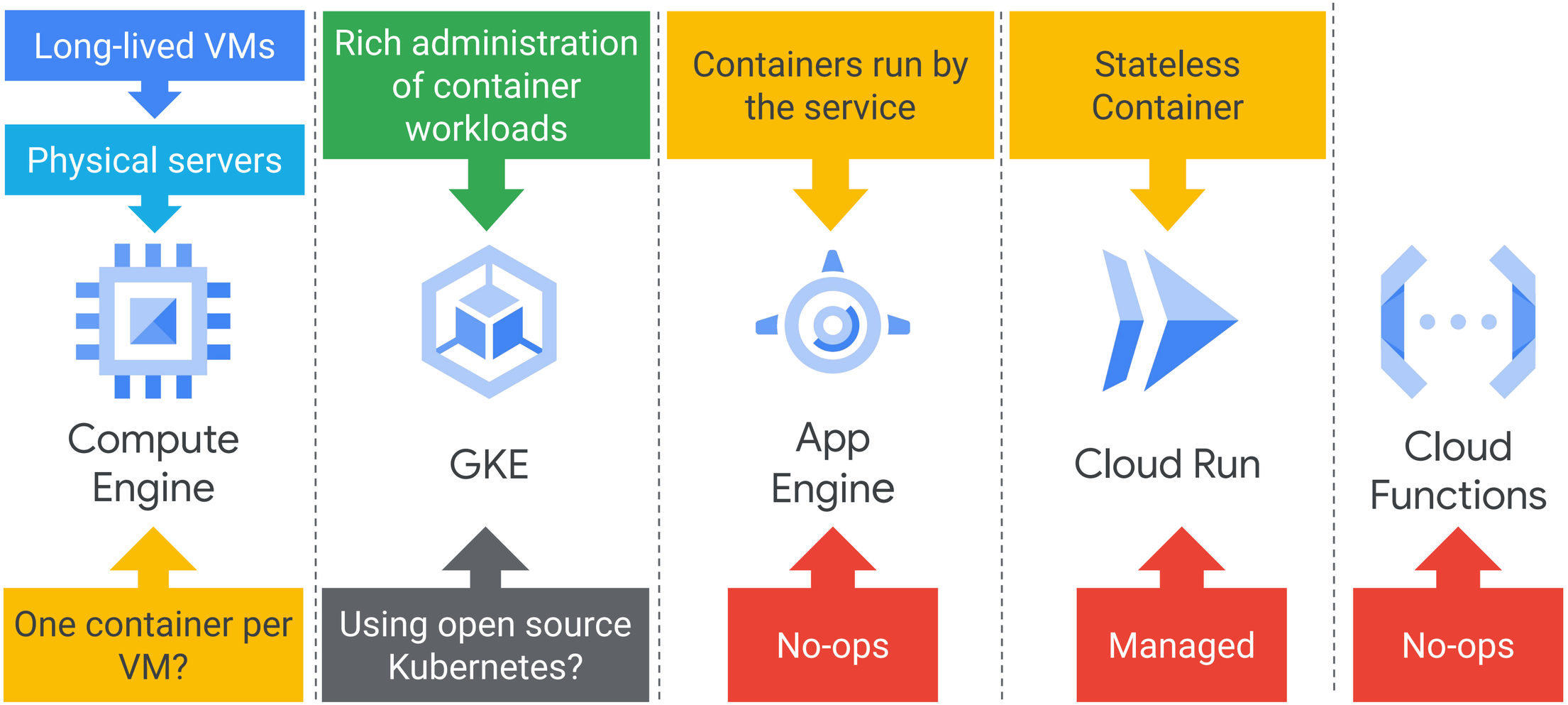
Cloud Run

Cloud Functions



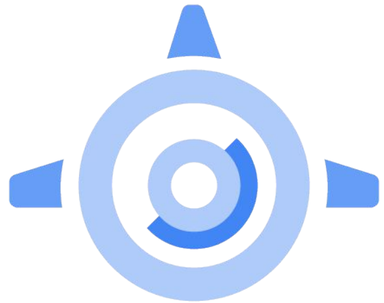
IaaS	Hybrid	PaaS	Stateless	Serverless logic

Which compute service should you adopt?



App Engine

- Provides a fully managed, code-first platform.
- Streamlines application deployment and scalability.
- Provides support for popular programming languages and application runtimes.
- Supports integrated monitoring, logging, and diagnostics.
- Simplifies version control, canary testing, and rollbacks.



Use Cases

- Websites
- Mobile app and gaming backends
- RESTful APIs

Cloud Run

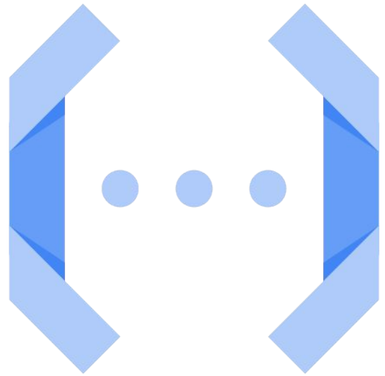
- Enables stateless containers.
- Abstracts away infrastructure management.
- Automatically scales up and down.
- Open API and runtime environment, built on Knative

Use Cases

- Deploy stateless containers that listen for requests or events.
- Build applications in any language using any frameworks and tools.

Cloud Functions

- Event-driven, serverless compute service.
- Automatic scaling with highly available and fault-tolerant design.
- Charges apply only when your code runs.
- Triggered based on events in Google Cloud services, HTTP endpoints, and Firebase.



Use Cases

- Supporting microservice architecture
- Serverless application backends
  - Mobile and IoT backends
  - Integrate with third-party services and APIs
- Intelligent applications
  - Virtual assistant and chat bots
  - Video and image analysis.

Agenda

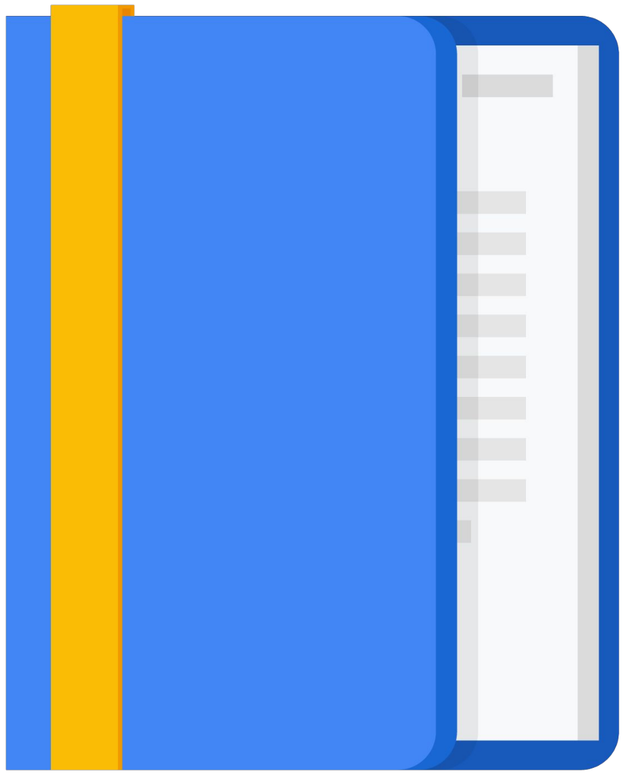
Introduction to Containers

Computing Options

Introduction to Kubernetes

Lab

Quiz



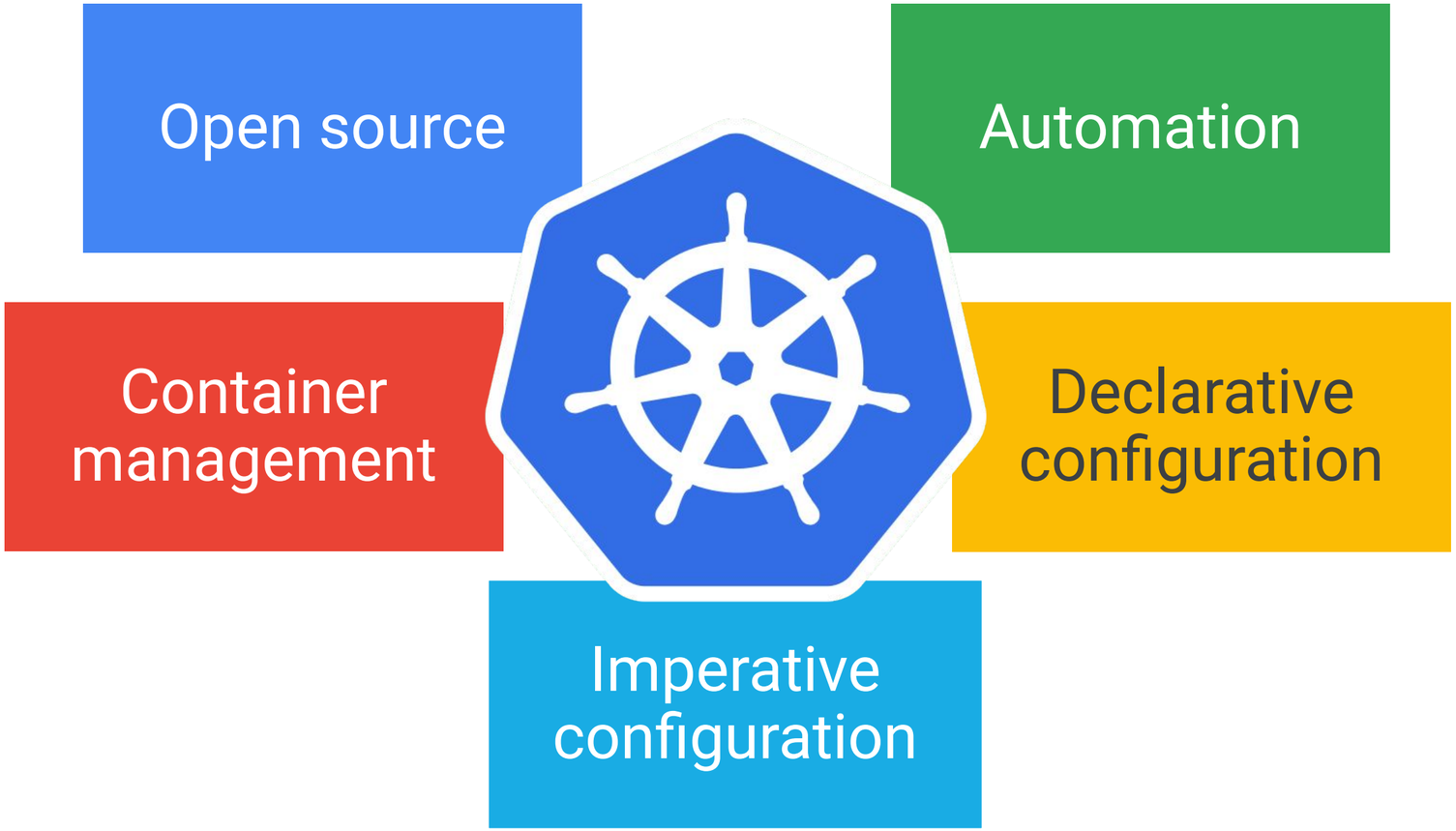
Managing your container infrastructure

You've embraced containers, but managing them at scale is a challenge

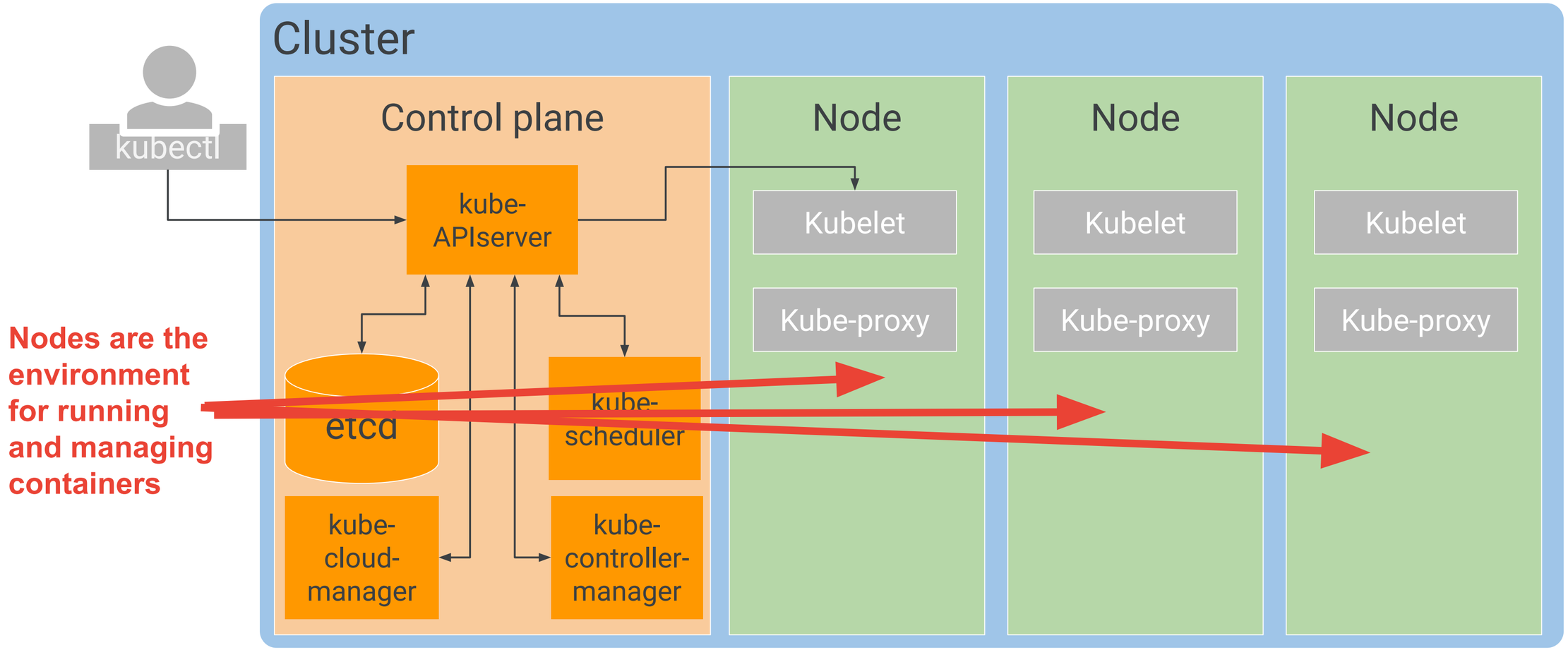
What can you do to better manage your container infrastructure?

Kubernetes!

What is Kubernetes?



Kubernetes provides an infrastructure...



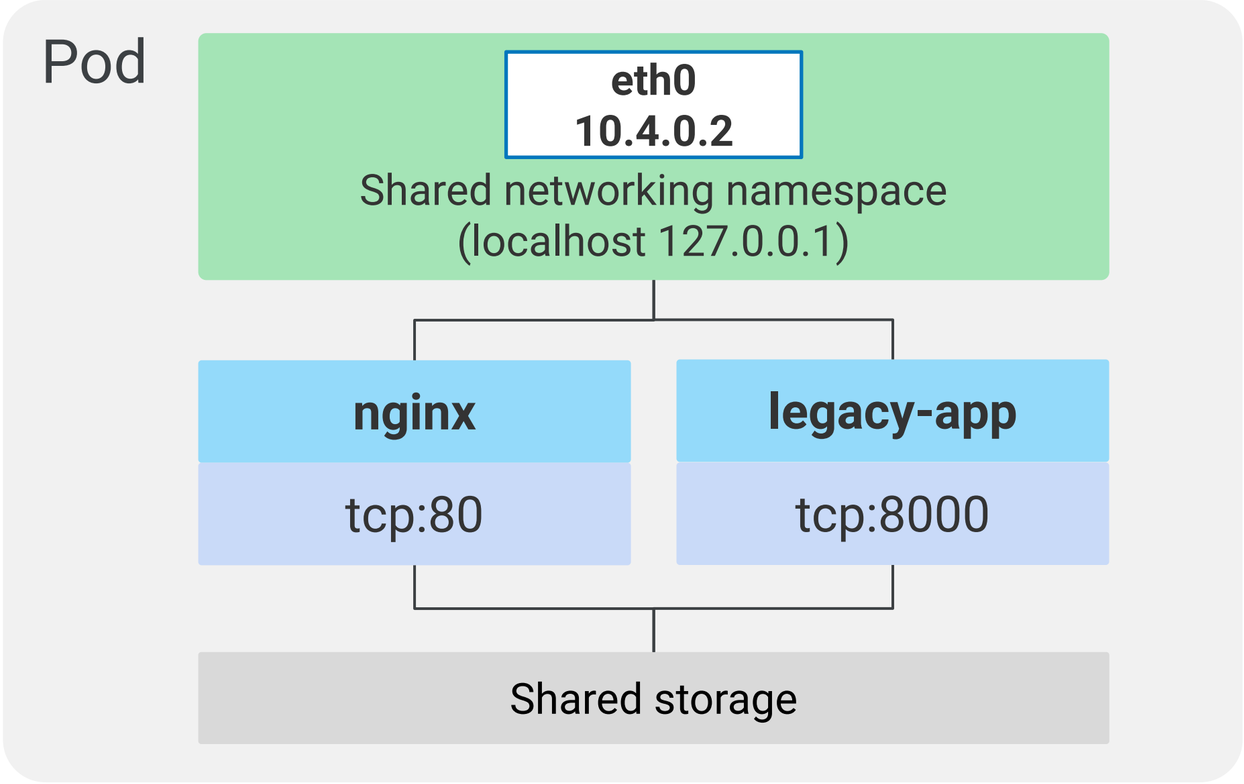
When you deploy containers on nodes you use a wrapper called a Pod

The pod provides

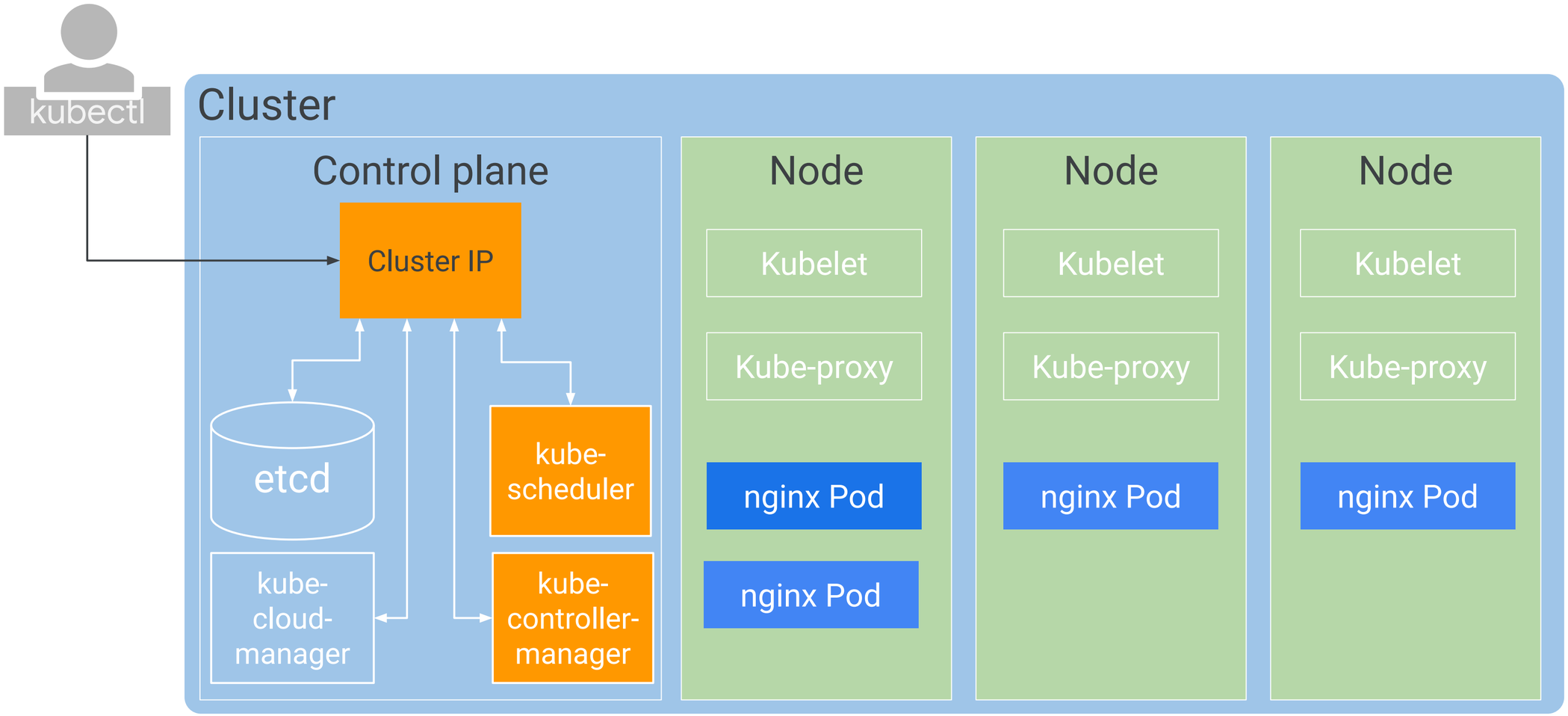
- isolation from other pods
- networking and other services

in a consistent way, regardless of the physical environment

Pods are the basic unit of deployment in Kubernetes



Pods run on nodes



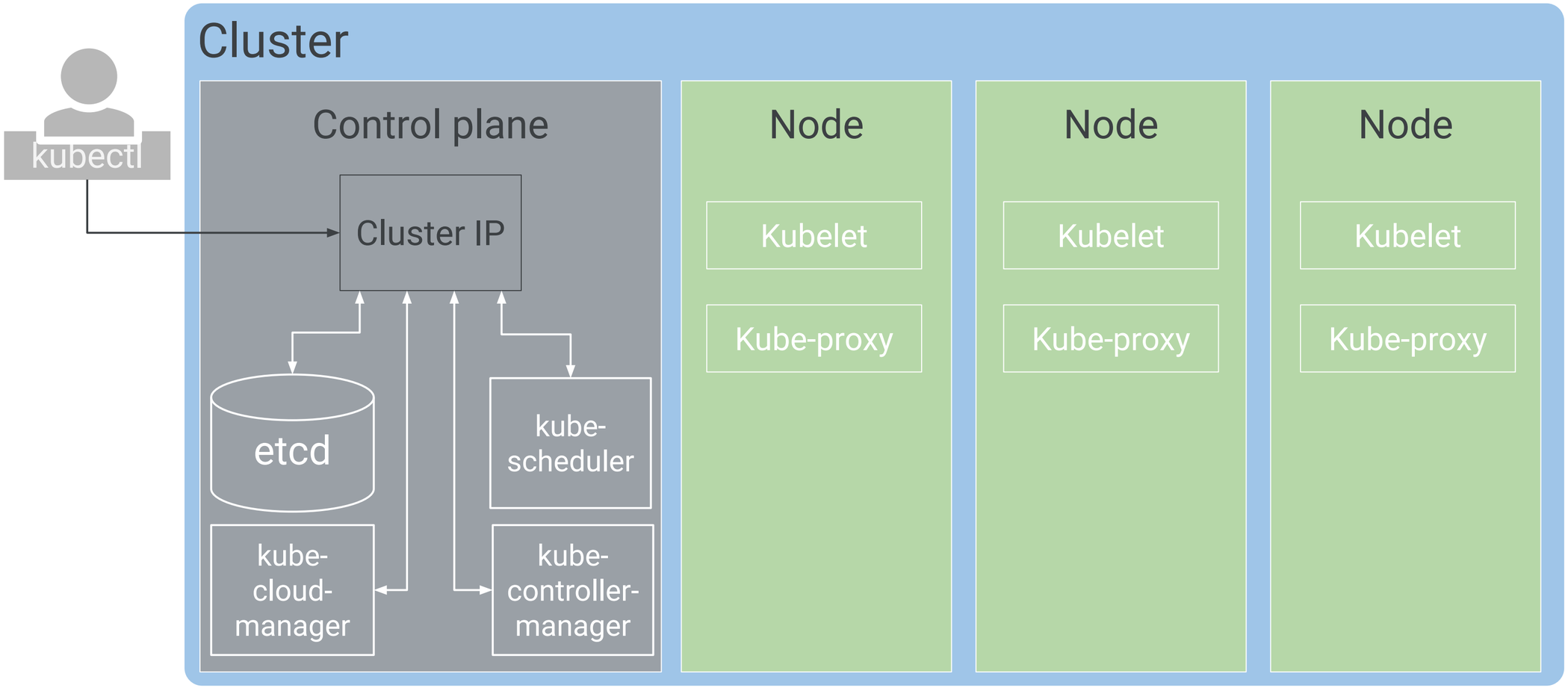
Managing Kubernetes within Google Cloud

Kubernetes is powerful, but managing the infrastructure is a full-time job

Is there a managed service for Kubernetes within Google Cloud?

Yes! Google Kubernetes Engine

GKE manages all the control plane components



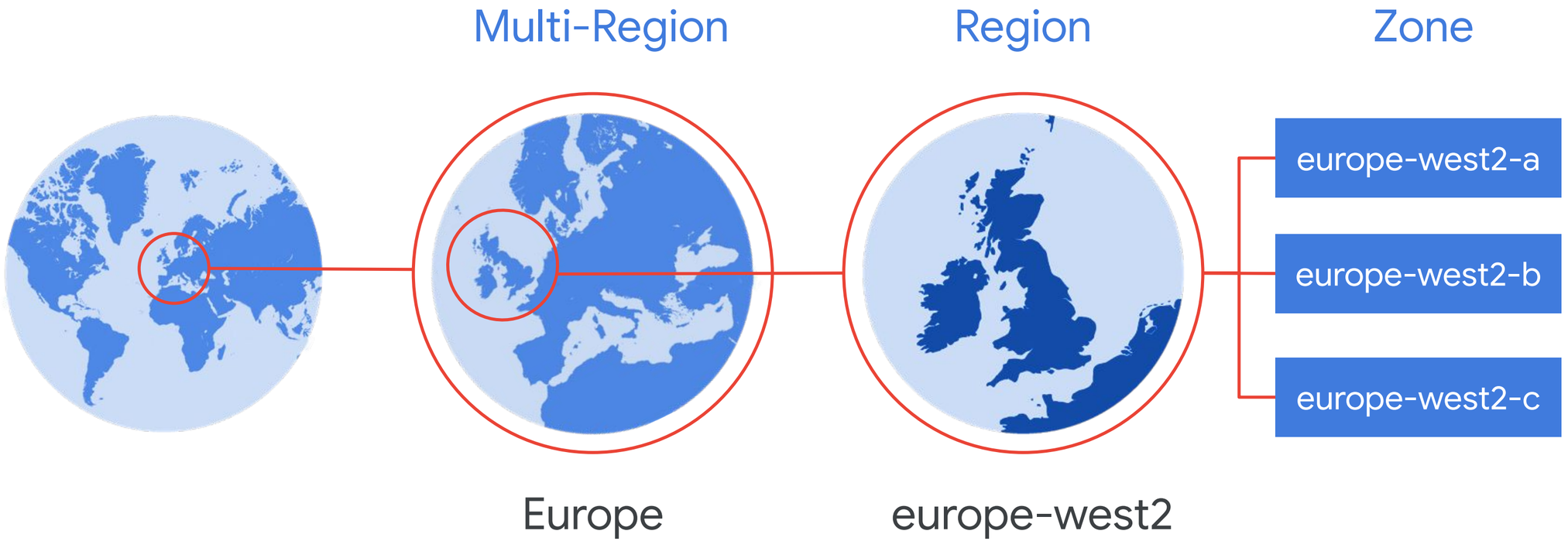
GKE has many features

- Fully managed
- Container-optimized OS
- Auto upgrade
- Auto repair
- Cluster scaling
- Seamless integration
- Identity and access management
- Integrated logging and monitoring
- Integrated networking
- Cloud Console

GKE Cluster Options

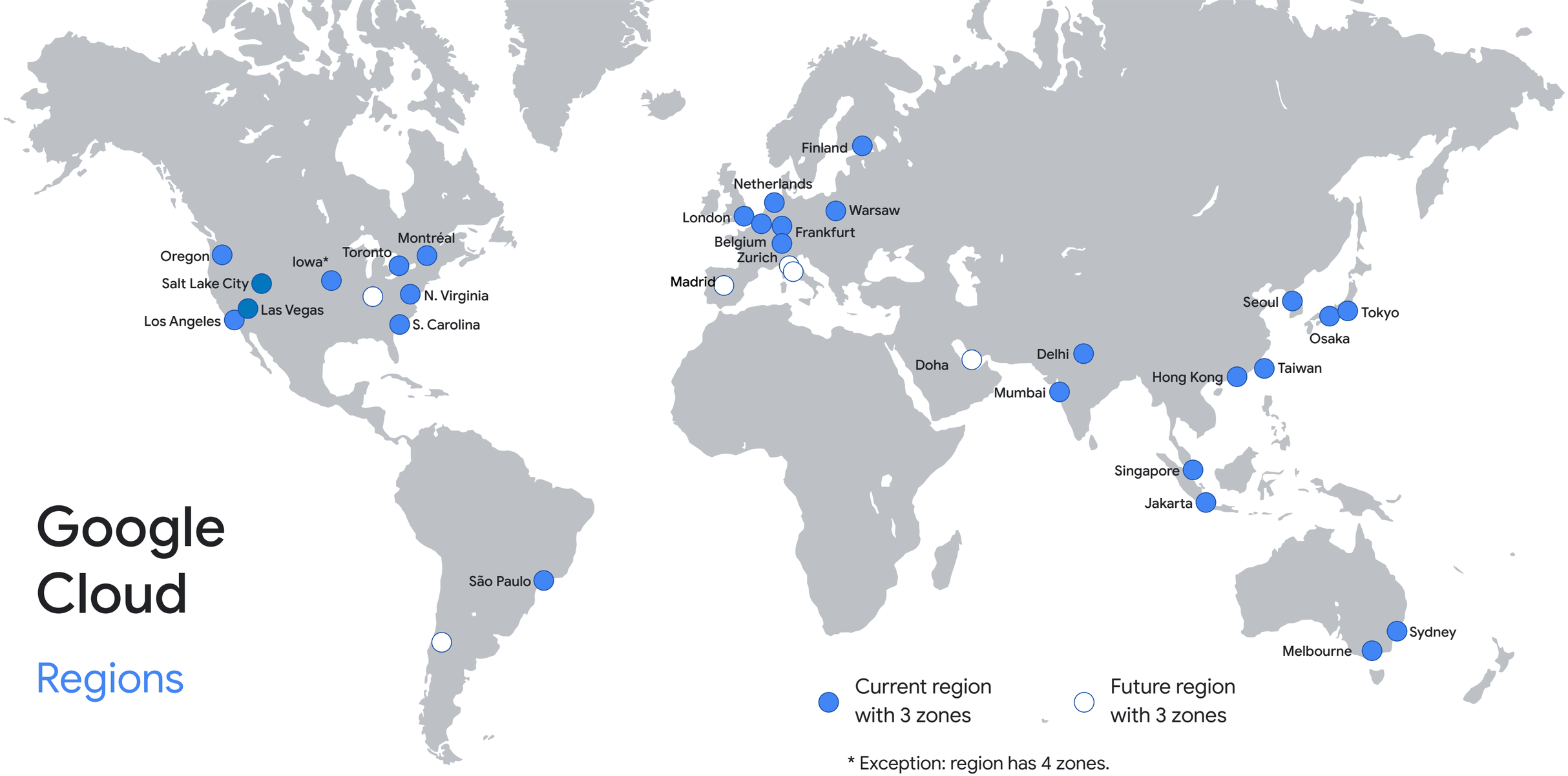
- **Autopilot**
  - GKE manages the entire cluster and node infrastructure
  - You pay by the pod
- **Standard**
  - You manage the node infrastructure
  - You pay for the nodes regardless of utilization
  - Additional standard options
    - Availability: *regional or zonal cluster*
    - Networking routing and isolation
    - Automatically scale nodes
    - Automatically apply updates to nodes

Google Cloud is organized into regions and zones



Google Cloud

Regions



* Exception: region has 4 zones.

https://cloud.google.com/about/locations/

Lab Intro

Deploying Kubernetes Engine

Duration: 30 minutes

Agenda

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Lab

Computing Options

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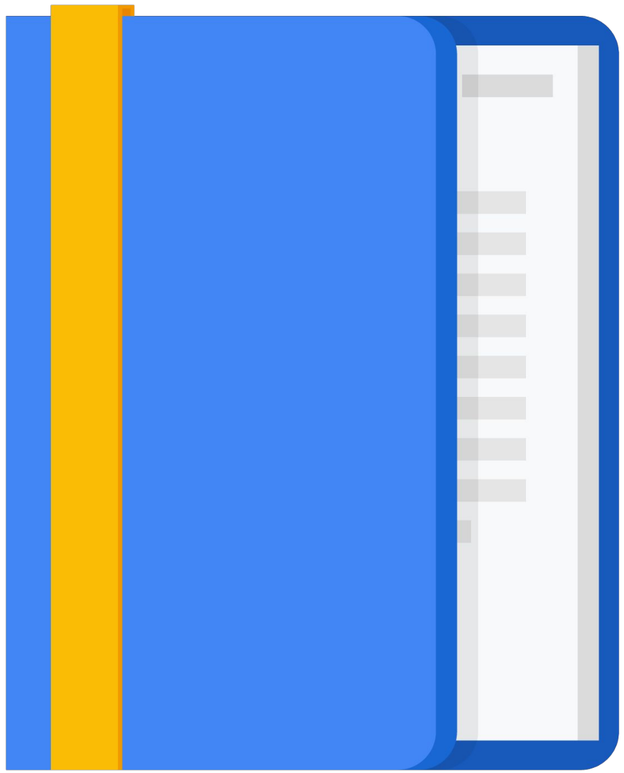
Lab

Quiz



Question #1

Question

Which of these problems are containers intended to solve? Mark all that are correct (3 correct answers).

A. Applications need a way to isolate their dependencies from one another.

B. It's difficult to troubleshoot applications when they work on a developer's laptop but fail in production.

C. Packaging applications in virtual machines can be wasteful.

D. Some developers need parts of their applications to be Linux-based while other parts are Windows-based.

Question #1

Answer

Which of these problems are containers intended to solve? Mark all that are correct (3 correct answers).

A. **Applications need a way to isolate their dependencies from one another.** 

B. **It's difficult to troubleshoot applications when they work on a developer's laptop but fail in production.** 

C. **Packaging applications in virtual machines can be wasteful.** 

D. Some developers need parts of their applications to be Linux-based while other parts are Windows-based.

Question #2

Question

You are choosing a technology for deploying applications, and you want to deliver them in lightweight, standalone, resource-efficient, portable packages. Which choice best meets those goals?

A. Containers

B. Executable files

C. Hypervisors

D. Virtual Machines

Question #2

Answer

You are choosing a technology for deploying applications, and you want to deliver them in lightweight, standalone, resource-efficient, portable packages. Which choice best meets those goals?

A. **Containers** 

B. Executable files

C. Hypervisors

D. Virtual Machines

Question #3

Question

When you use Kubernetes, you describe the desired state you want, and Kubernetes's job is to make the deployed system conform to your desired state and to keep it there in spite of failures. What is the name for this management approach?

A. Containerization

B. Declarative configuration

C. Imperative configuration

D. Virtualization

Question #3

Answer

When you use Kubernetes, you describe the desired state you want, and Kubernetes's job is to make the deployed system conform to your desired state and to keep it there in spite of failures. What is the name for this management approach?

A. Containerization

B. Declarative configuration 

C. Imperative configuration

D. Virtualization

Question #4

Question

What is a stateful application?

A. An application that is not containerized.

B. An application that requires data to be stored persistently.

C. A web front end.

Question #4

Answer

What is a stateful application?

A. An application that is not containerized.

B. An application that requires data to be stored persistently. 

C. A web front end.

Question #5

Question

You are classifying a number of your applications into workload types. Select the stateful applications in this list of applications. Choose all responses that are correct (2 correct responses).

A. A gaming application that keeps track of user state persistently.

B. A shopping application that saves user shopping cart data between sessions.

C. Image recognition application that identifies product defects from images.

D. Web server front end for your inventory system.

Question #5

Answer

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B. A shopping application that saves user shopping cart data between sessions. 

C. Image recognition application that identifies product defects from images.

D. Web server front end for your inventory system.

Question #6

Question

What is the relationship between Kubernetes and Google Kubernetes Engine?

A. Google Kubernetes Engine is a closed-source variant of Kubernetes.

B. Google Kubernetes Engine is Kubernetes as a managed service.

C. Kubernetes and Google Kubernetes Engine are two names for the same thing.

Question #6

Answer

What is the relationship between Kubernetes and Google Kubernetes Engine?

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B. Google Kubernetes Engine is Kubernetes as a managed service. 

C. Kubernetes and Google Kubernetes Engine are two names for the same thing.

Question #7

Question

What is the name for the computers in a Kubernetes cluster that can run your workloads?

A. Containers

B. Container images

C. Control Planes

D. Nodes

Question #7

Answer

What is the name for the computers in a Kubernetes cluster that can run your workloads?

A. Containers

B. Container images

C. Control Planes

D. **Nodes** 

Question #8

Question

You are developing a new solution and want to explore serverless application solutions. Which Google Cloud compute services provide serverless compute resources that you can use with containers?

A. App Engine

B. Cloud Functions

C. Compute Engine

D. Google Kubernetes Engine

Question #8

Answer

You are developing a new solution and want to explore serverless application solutions. Which Google Cloud compute services provide serverless compute resources that you can use with containers?

A. **App Engine** 

B. Cloud Functions

C. Compute Engine

D. Google Kubernetes Engine

Question #9

Question

You are deploying a containerized application, and you want maximum control over how containers are configured and deployed. You want to avoid the operational management overhead of managing a full container cluster environment yourself. Which Google Cloud compute solution should you choose?

A. App Engine

B. Cloud Functions

C. Compute Engine

D. Google Kubernetes Engine

Question #9

Answer

You are deploying a containerized application, and you want maximum control over how containers are configured and deployed. You want to avoid the operational management overhead of managing a full container cluster environment yourself. Which Google Cloud compute solution should you choose?

A. App Engine

B. Cloud Functions

C. Compute Engine

D. Google Kubernetes Engine 


Google Cloud