GCP Setup for gem5

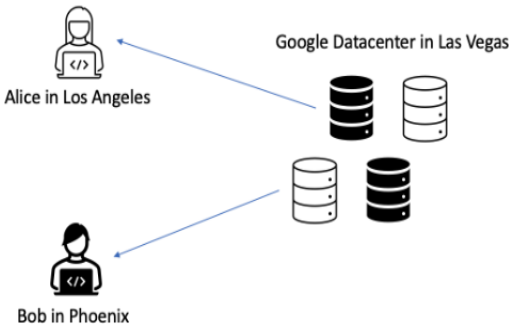
This is a step-by-step walkthrough detailing how to set up a GCP Ubuntu virtual machine instance from scratch, one of the VM options for the projects. This walkthrough assumes absolutely no knowledge of GCP or VMs. Please read the instructions carefully as you initialize the VM. If you have little to no experience on cloud computing or using cloud-based VMs, then please read the introductory sections to get a better understanding of using VMs on GCP.

Intro - What is GCP?

GCP stands for Google Cloud Platform, a cloud-based virtual machine (VM) hosting service, like Amazon's AWS and Microsoft's Azure. This means that Google has many servers all around the world with different hardware specifications that run different operating systems. Anyone can rent "*compute*", or essentially use the operating system like their own private computer online. This service is widely used because it prevents the need for people and companies to buy their own servers or computers to test or program their own projects on a temporary basis. You only pay for exactly what you use. Therefore, if you run a program on GCP for 1 hour, you are charged for 1 hour of compute. The cost is dependent on the equipment that you rent. If you want to rent a high-powered computer with many processors and lots of memory, 1 hour of compute could cost as much as a few dollars. However, if you want to run a simple python program or maybe host a static web page, then 1 hour of compute can be as cheap as a few cents if you use a simpler processor with lower memory.

How can people use this service?

This service is offered to regular customers by providing a website in which you can customize the specifications you want in your computer. From the number of processors, to the type of the operating system, to the amount of memory, to even the location in the world the physical computer is running, cloud providers grant a lot of freedom to users to choose exactly what they want in a cloud computer. This is the advantage of cloud computing; letting the provider worry about setting up the hardware and just dealing with the software. After making your selections, the cloud computer will be ready within a few seconds. Then it will allow you to connect through your browser.



Most cloud providers require you to provide billing information so that they can charge you as you are using their resources. Google requires billing information but also grants new customers $300 in free credits. Only when that is used up, they will charge you directly. However, you will have a dashboard indicating how much compute you have used. When you would like to take a substantial break from using the cloud computer, it is imperative to "turn off" the machine so that you won't be charged for the resources necessary to keep that operating system on and available. You can always turn it back on, or alternatively terminate the entire machine if you do not want to use cloud computing anymore.

How to access the cloud computer?

With any remote cloud service, you never need to worry about the physical infrastructure such as servers, hardware, or electricity, because that is being managed by the provider. Instead, you will be given remote access to the server through the operating system. For Linux-based operating systems on GCP, we can connect using the command line. This means we won't see a desktop with icons or use our mouse to click on things. (Although this is configurable, it takes a lot of setup and using the command line is often much easier and more than enough). However, good news is that you will be able to access your *instance* (your own created cloud computing environment) from anywhere you are by just using your web browser.

Whether you are at home, at work, in class, or are even using someone else's computer, as long as you can get to the Google Cloud website and log in, you will be able to access your instance and use the cloud computer. For this course, you can use GCP to create your own virtual machine running Ubuntu. On Ubuntu, you will then be able to download gem5, its dependencies, and complete the projects. The way you interact with the instance environment is by using the command line.

Please read the step-by-step instructions below to set up the necessary cloud computing environment for this course.

Step-by-step tutorial:

1) Create An Account

a. Visit cloud.google.com.
b. Click "Get started for free" in the upper right corner.
c. Sign into your Google Account. If you have previously used GCP or have run out of free credits, you may want to sign in with a different account or create a new Google account.

2) Account Information

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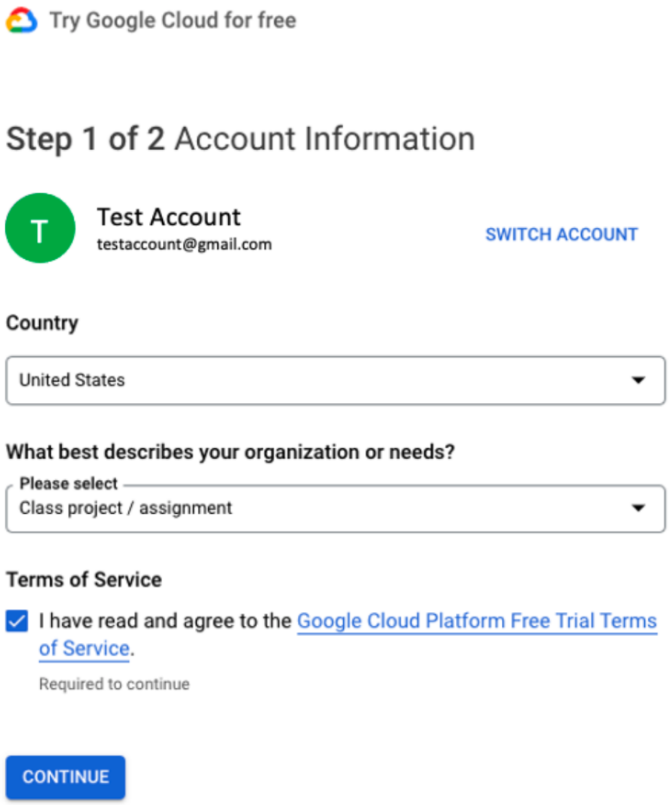
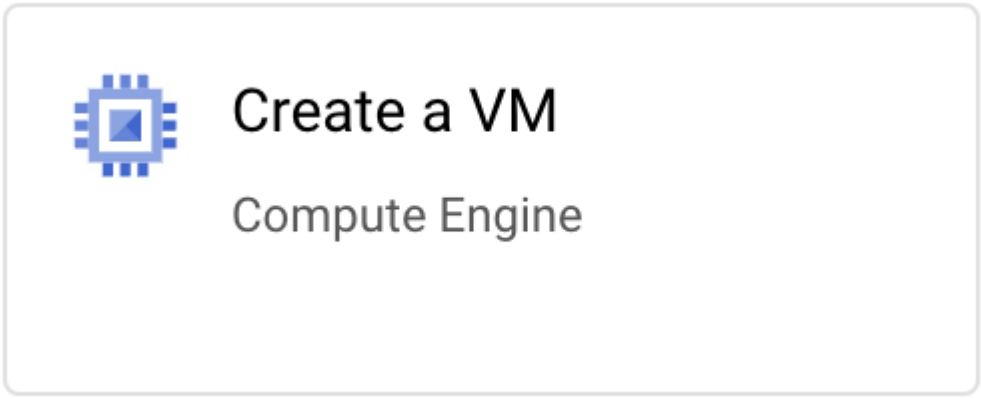


a. For "Country": select "**United States**".
b. For "What best describes your organization or needs?": select "**Other**".
c. Accept the Terms of Service and click "Continue".
d. Under "Profile Type", select "Individual".
e. Then select your preferred payment method and enter your information.

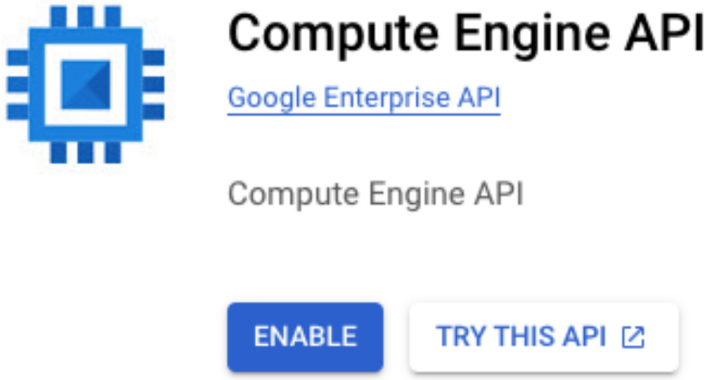
You can delete your payment information and your Google Cloud account at the end of the course.
NOTE: According to Google, new customers get $300 in free credits. If you have used GCP before, then you need to use a new Google account to qualify for the free credits. You still have to enter a payment method to use the VM for free. Make sure you see this notification before proceeding. This should be more than enough to complete all of the projects as long as you "STOP" the VM when you are not using it (explained in part 7). Even after your credits are over, you will not be automatically charged.

3) Google Cloud Dashboard

a. Click on the "Create a VM/ Compute Engine" panel under the "Products" section as shown below. If you cannot find it as shown below, then in the left side menu panel, you can manually search for "Compute Engine".

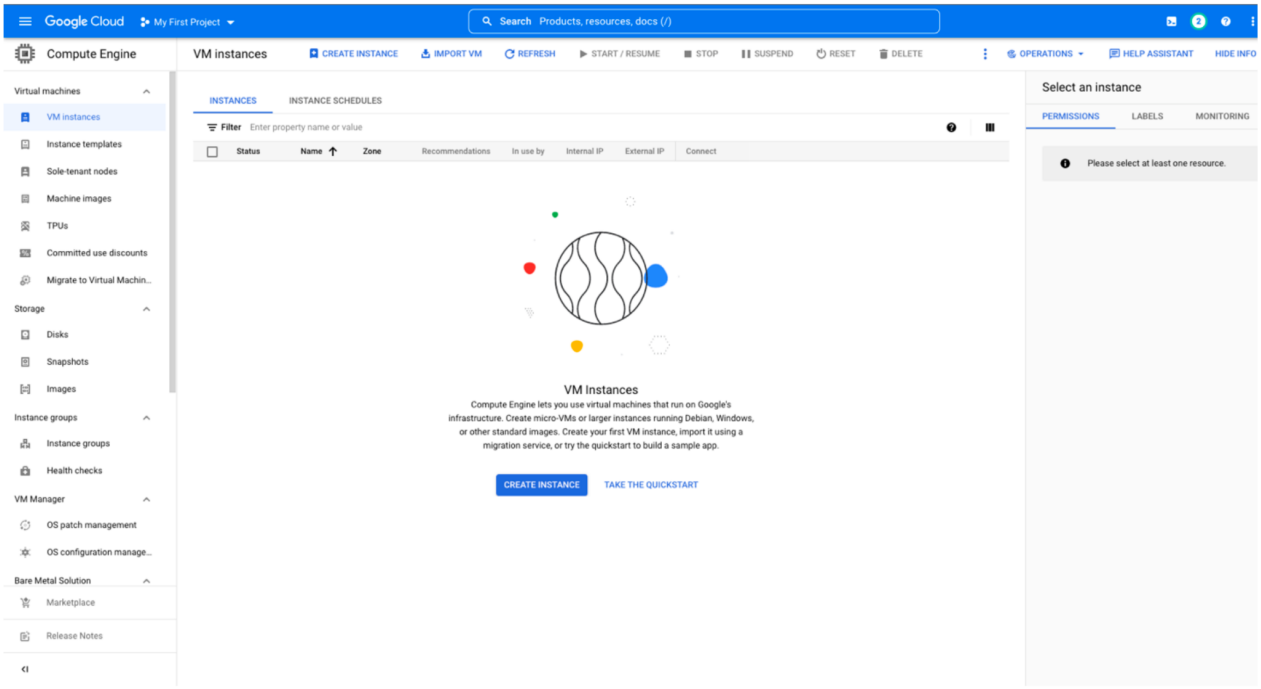


b. Click "Enable". This will take a few minutes to set up.



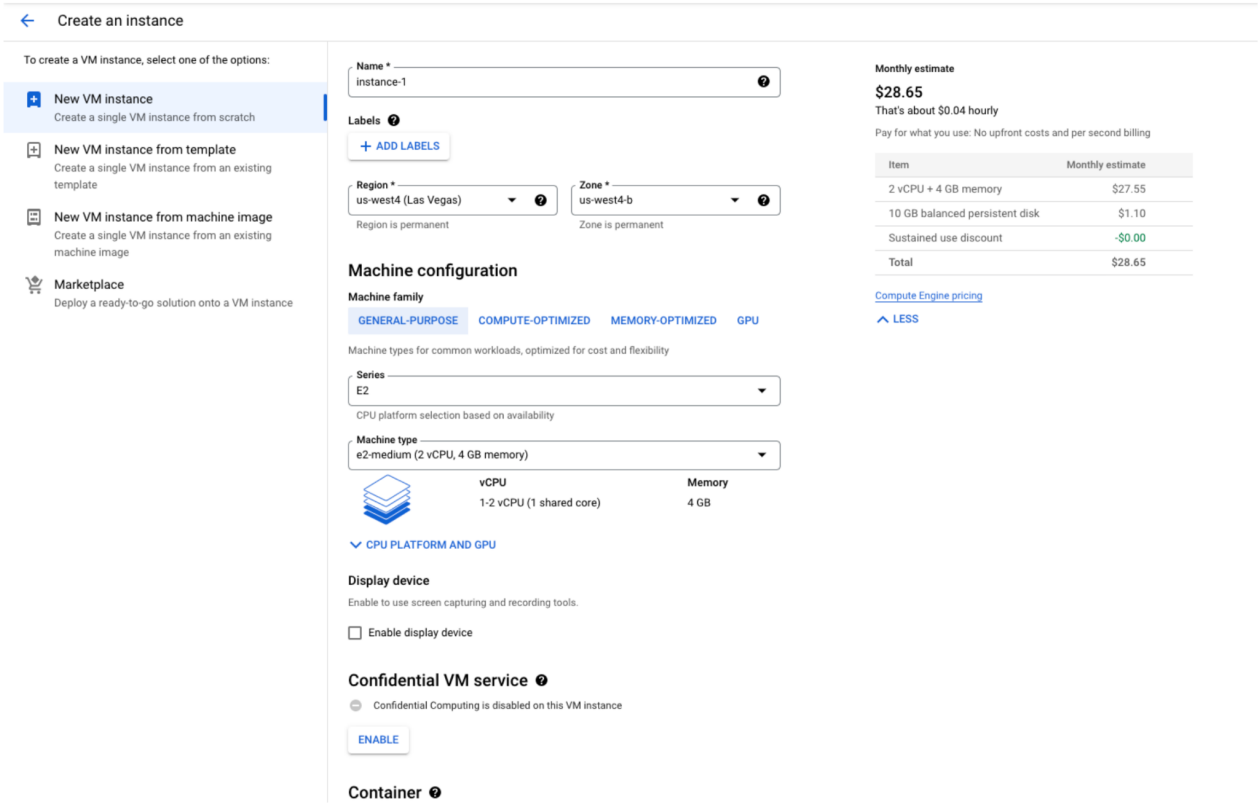
4) Create an Instance on Google Cloud VM

a. You should now see a dashboard like this:

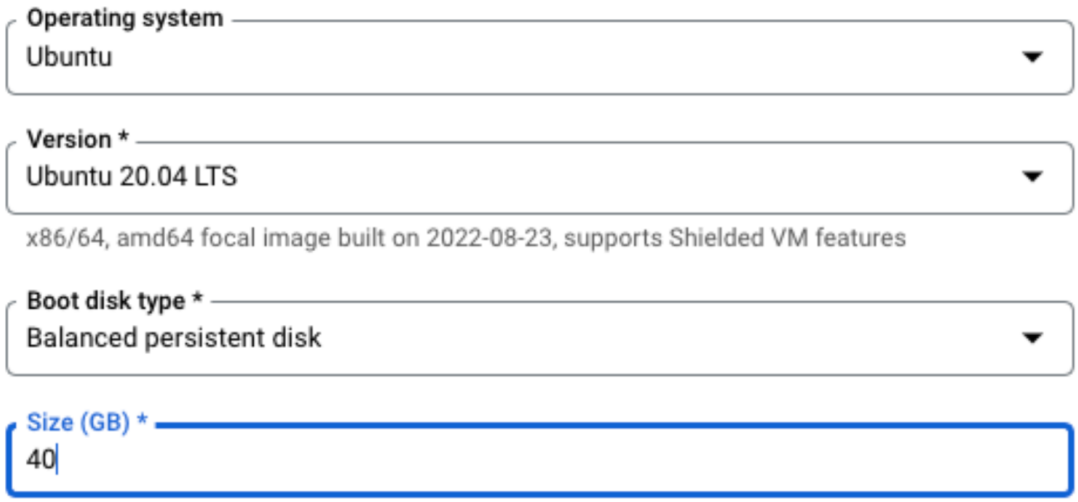


Usually, GCP will already set up an initial project, but if you are prompted to, then select any appropriate project name.

b. Select “Create Instance”. You should then see a panel as such:



c. Under “Name” select anything you want. Maybe something relevant like “gem5projects”.
d. Don’t add any labels.
e. You can keep the “region” and the “zone” the default. If you are getting errors for the default region, then select any other region and zone.
f. Under “Machine configuration” select “General purpose”.
g. Under “Series” select E2. Under “Machine type” select “e2-standard-2 (2 vCPU, 8 GB memory)”.
h. Don’t change any other setting until you scroll down to Boot Disk. Then click “change”.
i. Select the following configurations in the right-side panel:



j. Under “Firewall”, select both options: “Allow HTTP traffic” and “Allow HTTPS traffic”.
k. NOTE: You may see the pricing change as you go through the configuration:

Monthly estimate

$59.49

That's about $0.08 hourly

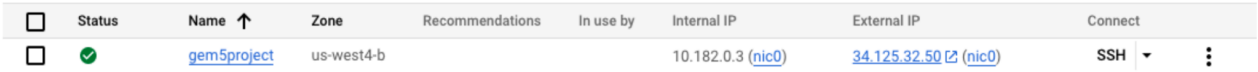
Pay for what you use: No upfront costs and per second billing

Item	Monthly estimate
2 vCPU + 8 GB memory	$55.09
40 GB balanced persistent disk	$4.40
Sustained use discount	-$0.00
Total	$59.49

Compute Engine pricing

Don't be alarmed. Remember that you get $300 in free credits, so you won't be charged until your credits expire.

l. After clicking "create", you should see this in your console (with different IP addresses than shown here):



5) Starting up the VM.

a. Click the "SSH" button on the right hand side of the VM instance listing (under the "Connect" label). There is no need to click the dropdown arrow to the right of the SSH. There should be a screen that says "Transferring SSH keys to the VM".

b. You should then be inside an in-browser terminal window connected to the VM.

6) Uploading all necessary files to the GCP VM.

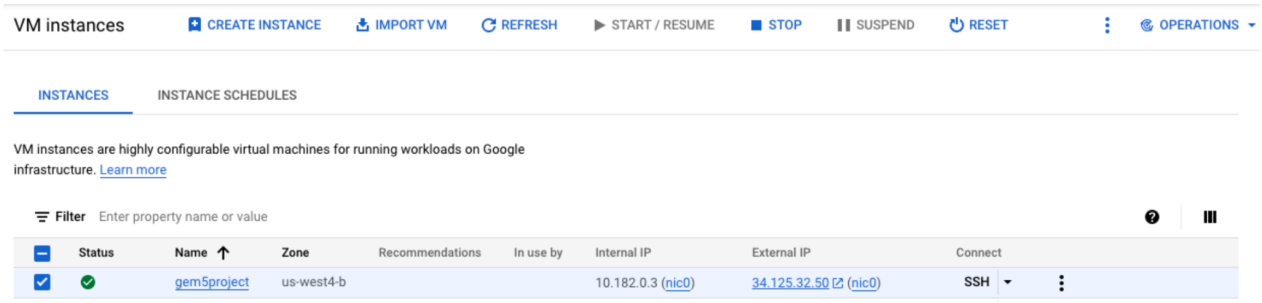
a. On your local machine desktop (not the GCP VM) download gem5.zip and benchmarks.zip from Canvas.

b. Then go back to the GCP terminal. At the top right corner of the in-browser terminal, click the "up" arrow to upload *benchmarks.zip* and *gem5.zip*. This process should take a few minutes.

c. Type the command "`sudo apt install zip unzip`".
d. Then run "`unzip gem5.zip`".
e. Then run "`unzip benchmarks.zip`".
f. You should see the folder gem5-21.0.0.0 and benchmarks in your home directory. After you return to the "gem5 Setup Instructions" document, you will receive further instructions on how to appropriately name your folders.

7) Important GCP VM Tools:

a. In order to disconnect from your VM, type "exit" in the terminal, and your window should close and take you back to the dashboard. Note that this does not shut down the VM. The VM is still on and operating, but you are just not connected to it.
b. When you're done working on the project for the day, or plan to take a break for more than a few hours, in order to minimize the use of free credits, you must shut down the VM.
c. In the dashboard with your VM listings, click the checkbox for the VM from the dashboard and then press the "STOP" button at the top of the dashboard.



d. When restarting the VM, click the checkbox for the VM and press "START/RESUME". Then click the SSH button on the right side to connect.

Now the setup of the VM on GCP is complete. In order to set up and install gem5, you can return to the "**gem5 Setup Instructions**" document and proceed to "Part 2: Setting up gem5".