

The background of the slide is a complex, abstract network of interconnected nodes and lines. The nodes are represented by small circles in various shades of blue, purple, and white, while the lines are thin, light blue or white. The overall effect is a dense, web-like structure that fills the entire frame, suggesting themes of connectivity, data, or technology.

GPU, Google Cloud

Attila Bagoly

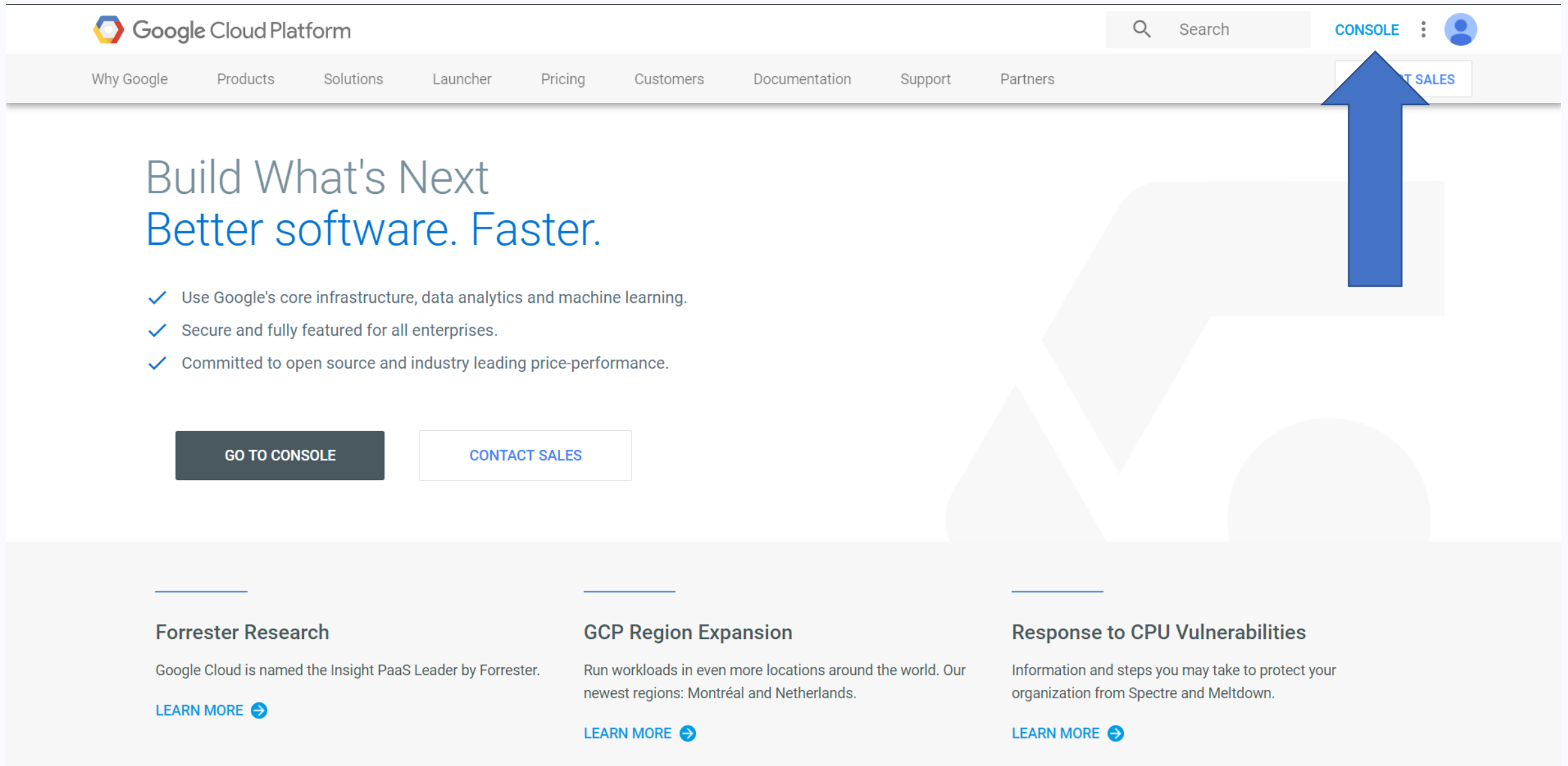
20 March 2018

Deep learning and machine learning in science

GPU support on local machine

- You need GPU with at least 3.5 compute capability: [GPU list](#)
- Install/upgrade your NVIDIA driver
- Install **GCC**: 6.3.0 (Ubuntu 17.04), 5.3.1 (Ubuntu 16.04); (version: `gcc -v`)
- Install **make**
- Install CUDA 9.0: [download](#) and install (details in [documentation](#))
- ADD CUDA to LD_LIBRARY_PATH (eg. export `LD_LIBRARY_PATH=/usr/local/cuda-9.0/lib64:${LD_LIBRARY_PATH}`)
- Download CUDNN 7.0.5 for CUDA 9.
(<https://developer.nvidia.com/rdp/cudnn-download>, you will have to sign up)
- Unzip the files and copy to CUDA directories (see [documentation](#))
- Install tensorflow: `pip3 install tensorflow-gpu`, [test your GPU](#)

- If you have GPU access use it
- If not, we provide GPU access in Google Cloud (thanks Google for support)
- You will get invitation, from szamodmsc 😊
- Won't have to give credit card for Google Cloud!!! (so don't start a free trial)
- Limit: 50\$/student
- Don't try to use for cryptocurrency mining! (your project will be removed!)
- We provide: prebuilt image and setup template
- VM: 4 core, 15GB RAM, 1x Nvidia Tesla K80 (0.26\$/hour, preemptible)



Google Cloud Platform

Why Google Products Solutions Launcher Pricing Customers Documentation Support Partners

**Build What's Next
Better software. Faster.**

- ✓ Use Google's core infrastructure, data analytics and machine learning.
- ✓ Secure and fully featured for all enterprises.
- ✓ Committed to open source and industry leading price-performance.

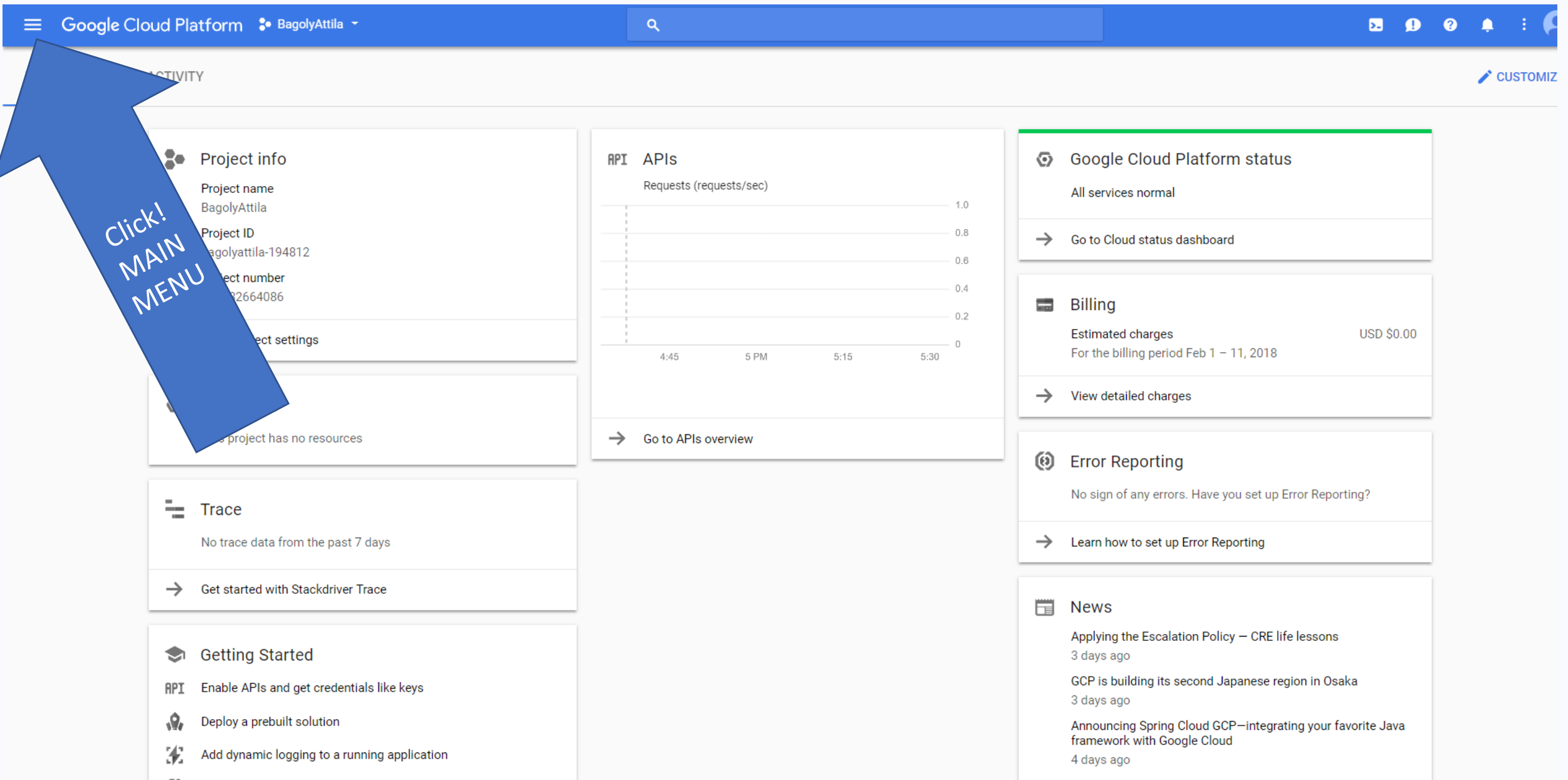
GO TO CONSOLE **CONTACT SALES**

Forrester Research
Google Cloud is named the Insight PaaS Leader by Forrester.
[LEARN MORE →](#)

GCP Region Expansion
Run workloads in even more locations around the world. Our newest regions: Montréal and Netherlands.
[LEARN MORE →](#)

Response to CPU Vulnerabilities
Information and steps you may take to protect your organization from Spectre and Meltdown.
[LEARN MORE →](#)

Introduction to Google Cloud: create VM



Google Cloud Platform BagolyAttila

ACTIVITY

Project info

- Project name: BagolyAttila
- Project ID: bagolyattila-194812
- Project number: 22664086
- Project settings

APIs

Requests (requests/sec)

4:45 5 PM 5:15 5:30

Go to APIs overview

Google Cloud Platform status

All services normal

Go to Cloud status dashboard

Billing

Estimated charges: USD \$0.00
For the billing period Feb 1 – 11, 2018

View detailed charges

Error Reporting

No sign of any errors. Have you set up Error Reporting?

Learn how to set up Error Reporting

News

- Applying the Escalation Policy – CRE life lessons (3 days ago)
- GCP is building its second Japanese region in Osaka (3 days ago)
- Announcing Spring Cloud GCP—integrating your favorite Java framework with Google Cloud (4 days ago)

Trace

No trace data from the past 7 days

Get started with Stackdriver Trace

Getting Started

- Enable APIs and get credentials like keys
- Deploy a prebuilt solution
- Add dynamic logging to a running application

Introduction to Google Cloud: create VM

The screenshot shows the Google Cloud Platform (GCP) console interface. The top navigation bar includes the GCP logo, the user name 'BagolyAttila', a search bar, and various utility icons. A left-hand sidebar lists navigation categories: Home, Cloud Launcher, Billing, APIs & Services, Support, IAM & admin, Getting started, COMPUTE (with sub-items: App Engine, Compute Engine, Kubernetes Engine, Cloud Functions), STORAGE (with sub-items: Bigtable, Datastore, Storage, SQL), and more. The main content area displays a 'Platform status' section with a graph, a 'Billing' section showing 'Estimated charges' of 'USD \$0.00' for the period 'Feb 1 - 11, 2018', an 'Error Reporting' section, and a 'News' section. Two blue arrows with text annotations are overlaid on the image. The first arrow points to the 'Project name' in the top navigation bar. The second arrow points to the 'Compute Engine' link in the left sidebar.

Project name

Go to linked billing account, and click on the project name (not in the header). The rows with credit applied label: you used from your 50\$

To start a machine!

Introduction to Google Cloud: create VM

The screenshot shows the Google Cloud Platform interface. The top navigation bar includes the Google Cloud Platform logo, the user name 'BagolyAttila', and a search bar. The left sidebar lists various services, with 'Compute Engine' selected. Under 'Compute Engine', 'VM instances' is highlighted. A large blue arrow points from the 'VM instances' link to the main content area, with the text 'To start a new VM: go to templates! We preconfigured machines for you!'. Another blue arrow points from the 'Disks' link in the sidebar to the 'Create disks' button in the main content area, with the text 'Here you can create disks!'. The main content area displays a 'VM instances' heading and a card with the text: 'Compute Engine lets you use virtual machines that run on Google's infrastructure. You can choose from micro-VMs to large instances running Debian, Windows, or other standard images. Create your first VM instance, import it by CloudEndure migration service or try the quickstart to build a sample app.' Below this text are three buttons: 'Create', 'Import', and 'Take the quickstart'. At the bottom of the page, there is a 'Cloud Launcher' section with a rocket icon and a '<|' button.

Google Cloud Platform BagolyAttila

Compute Engine

VM instances

VM instances

Instance groups

Instance templates

Disks

Snaps

Images

Health checks

Zones

Operations

Quotas

Settings

Here you can create disks!

To start a new VM: go to templates! We preconfigured machines for you!

Compute Engine lets you use virtual machines that run on Google's infrastructure. You can choose from micro-VMs to large instances running Debian, Windows, or other standard images. Create your first VM instance, import it by CloudEndure migration service or try the quickstart to build a sample app.

Create or Import or Take the quickstart

Cloud Launcher

<|

Introduction to Google Cloud

☰

Google Cloud Platform

BagolyAttila

Compute Engine

VM instances

Instance groups

Instance templates

Disks

Snapshots

Images

Committed use discounts

Metadata

Health checks

Zones

Operations

Quotas

Settings

Cloud Launcher

Instance templates

CREATE INSTANCE TEMPLATE

REFRESH

COPY

CREATE INSTANCE GROUP

DELETE

HIDE INFO PANEL

Filter instance templates

Columns

<input type="checkbox"/> Name ^	Machine type	Image	Disk type	In use by	Creation time
<input type="checkbox"/> preemptiblebase4core15gb1gpu	4 vCPUs, 15 GB, 1 GPU	deeplea17m-gpu-base	Standard persistent disk		Feb 10, 2018, 5:10:41 PM

Select an instance template

LABELS

Labels help organize your resources (e.g., cost_center:sales or env:prod).

No instance templates selected.

This is it!
Click!

Introduction to Google Cloud: create VM

Google Cloud Platform

BagolyAttila

Compute Engine

VM instances

Instance groups

Instance templates

Disks

Snapshots

Images

Committed use discounts

Metadata

Health checks

Zones

Operations

Quotas

Settings

← Instance templates

+ CREATE VM

COPY

CREATE INSTANCE GROUP

DELETE

preemptiblebase4core15gb1gpu

Machine type
n1-standard-4 (4 vCPUs, 15 GB memory)

GPUs
1 x NVIDIA Tesla K80

Labels
None

Creation time
Feb 10, 2018, 5:10:41 PM

Firewalls
☐ Allow HTTP traffic
☐ Allow HTTPS traffic

External IP
Ephemeral

IP forwarding
off

Network
default

Network tags
None

Boot disk

Image	deeplea17m-gpu-base
Disk type	Standard persistent disk
Size (GB)	16
Delete disk when instance is deleted?	Yes

Additional disks
None

Availability policies

Click!

Cloud Launcher

Introduction to Google Cloud: create VM

The screenshot shows the Google Cloud Platform interface for creating a new VM instance. The left sidebar contains navigation links for Compute Engine, VM instances, Instance groups, Instance templates, Disks, Snapshots, Images, Committed use discounts, Metadata, Health checks, Zones, Operations, Quotas, and Settings. The main content area is titled 'Create an instance' and includes the following sections:

- Name:** A text input field containing 'whatever-you-want'.
- Zone:** A dropdown menu showing 'us-east1-b'.
- Machine type:** A section with a dropdown for '4 vCPUs' and '15 GB memory', with a 'Customize' link.
- Container:** A checkbox for 'Deploy a container image to this VM instance' with a 'Learn more' link.
- Boot disk:** A section showing a 'New 16 GB standard persistent disk' with image 'deeplea17m-gpu-base' and a 'Change' link.
- Identity and API access:** A section with a 'Service account' dropdown set to 'Compute Engine default service account' and 'Access scopes' radio buttons (selected: 'Allow default access').
- Firewall:** A section with checkboxes for 'Allow HTTP traffic' and 'Allow HTTPS traffic'.

At the bottom, there is a 'Cloud Launcher' button and a note: 'The following options have been customized: Management, disks, networking, SSH keys'.

Three blue arrows with white text provide instructions:

- Arrow 1: 'Give a name!' pointing to the Name field.
- Arrow 2: 'Find a zone (warehouse)! Prices can change! Suggestion: us-central' pointing to the Zone dropdown.
- Arrow 3: 'Click, then click on GPU!' pointing to the Machine type section.

- Two GPU type: K80 (cheaper), P100
- Always use K80!
- Not all zones have GPU (or just P100)!
- Find a zone which has K80!
- Make sure 1 Nvidia Tesla K80 is selected
- The effective hourly rate should be: \$0.261

Introduction to Google Cloud: create VM

Google Cloud Platform

BagolyAttila

1

Compute Engine

VM instances

Instance groups

Instance templates

Disks

Snapshots

Images

Committed use discounts

Metadata

Health checks

Zones

Operations

Quotas

Settings

Cloud Launcher

VM instances

CREATE INSTANCE

IMPORT VM

REFRESH

START

STOP

RESET

DELETE

HIDE INFO PANEL

Filter VM instances

Columns

<input type="checkbox"/>	Name ^	Zone	Recommendation	Internal IP	External IP	Connect
<input type="checkbox"/>	<input checked="" type="checkbox"/> whatever-you-want	us-east1-b		10.142.0.2	35.231.68.39	SSH

VM name!

IP

Select an instance

LABELS

MONITORING

Labels help organize your resources (e.g., cost_center:sales or env:prod).

No instances selected.

Congratulation! You just started your first machine in Google Cloud!

- You can access your VM via SSH
- For simplicity we use Google Cloud SDK
- Install: <https://cloud.google.com/sdk/>
- Log in with your GMAIL account, authorize the installed sdk to access your account!
- To SSH to VM:

```
gcloud compute ssh INSTANCE_NAME -- -L 8888:localhost:8888
```

- The template creates preemptible VM
- It's 50-80% cheaper than on demand VMs (\$0.261/60min)!
- Limitations:
 - maximum 24 hour runtime
 - Instance can terminate anytime if there is a high demand for the machines (Save your work!)
 - Instance termination before 24 hour is rare!
- You can create disks
- Attach these disks to the VM, and work on them

Introduction to Google Cloud: Stop/terminate VM

Google Cloud Platform | BagolyAttila

Products & services | Compute Engine

VM instances

Filter VM instances

Name	Zone	Recommendation	Internal IP	External IP	Console
preemptiblebase4core15gb1gpu-1	us-east1-b		10.142.0.2	35.231.68.39	SSH

Click here to stop!

Click here to delete!

- If you stop a VM:
 - You will be charged for the disk ($16 \times 0.040\$/\text{month}$)
 - Stopped machines can be restarted (START button)
- If you terminate:
 - Your machine completely disappear
 - You will have to create a new one next time (as before)

- In [slide 9](#) go to Disks, and click on Create disk!

The screenshot shows the Google Cloud Platform interface for creating a disk. The left sidebar lists various services, with 'Disks' highlighted. The main content area is titled 'Create a disk' and contains several form fields:

- Name:** A text input field containing 'disk-1'. A blue arrow points to it with the text 'Give a name for the disk'.
- Description (Optional):** A text input field.
- Zone:** A dropdown menu showing 'us-east1-b'. A blue arrow points to it with the text 'Select zone. Must be the same as your VM zone!'.
- Disk Type:** A dropdown menu showing 'Standard persistent disk'.
- Source type:** A tabbed interface with 'Image', 'Snapshot', and 'None (blank disk)' options. A blue arrow points to the 'Image' tab with the text 'This has to be the source type!'.
- Source image:** A dropdown menu.
- Size (GB):** A text input field. A blue arrow points to it with the text 'Select disk size! Price: 0.04\$/GB/month (Disk Type: Standard persistent disk)'.
- Encryption:** A dropdown menu showing 'Automatic (recommended)'.

At the bottom right, a large blue arrow points towards the 'Create' button (not fully visible) with the text 'Finally: click on Create!'.

- Attach your disk to your VM (almost like you plug your external HDD/pendrive)
- Open Google Cloud SDK Shell on your computer and run:
`gcloud compute instances attach-disk [INSTANCE_NAME] --disk [DISK_NAME]`
- SSH into the machine: `gcloud compute ssh [INSTANCE_NAME]`
- Run: `sudo lsblk` (as result you should see new disk, if it's your first disk probably the ID will be sdb)

- Only first time run (it removes everything from the selected disk):

```
sudo mkfs.ext4 -m 0 -F -E lazy_itable_init=0,lazy_journal_init=0,discard  
/dev/[DEVICE_ID]
```

- To mount your disk:

- `sudo mkdir -p /mnt/disks/[MNT_DIR]` (you choose a directory name: [MNT_DIR])
- `sudo mount -o discard,defaults /dev/[DEVICE_ID] /mnt/disks/[MNT_DIR]`
- `sudo chmod a+w /mnt/disks/[MNT_DIR]`

- You should work on `/mnt/disks/[MNT_DIR]`

Introduction to Google Cloud: Stop/terminate VM

The screenshot shows the Google Cloud Platform interface for VM instances. The left sidebar contains navigation links: Products & services, Compute Engine, VM instances, Instance groups, Instance templates, Zones, Operations, Quotas, and Settings. The main panel displays a table of VM instances. A blue arrow points to the 'VM instances' link in the sidebar with the text 'Go back here!'. Another blue arrow points to the first instance in the table, 'preemptiblebase4core15gb1gpu-1', with the text 'Select your VM'. A third blue arrow points to the 'STOP' button in the top toolbar with the text 'Click here to stop!'. A fourth blue arrow points to the 'DELETE' button in the top toolbar with the text 'Click here to delete!'. The table has columns for Name, Zone, Recommendation, Internal IP, External IP, and Console. The instance 'preemptiblebase4core15gb1gpu-1' is highlighted.

Google Cloud Platform | BagolyAttila

VM instances | CREATE INSTANCE | IMPORT VM | REFRESH | START | STOP | RESET | DELETE | HIDE INFO PANEL

Filter VM instances

Name	Zone	Recommendation	Internal IP	External IP	Console
preemptiblebase4core15gb1gpu-1	us-east1-b		10.142.0.2	35.231.68.39	SSH

- If you stop a VM:
 - You will be charged for the disk ($16 \times 0.040\text{\$/month}$)
 - Stopped machines can be restarted (START button)
- If you terminate:
 - Your machine completely disappear
 - You will have to create a new one next time (as before)