Day 2 -Compute Engine — Creating and Attaching Persistent Disks

🔹 Overview

Google Compute Engine (GCE) is one of the core services of Google Cloud Platform (GCP) that allows you to create and run virtual machines (VMs) on Google's global infrastructure.
These VMs can run various operating systems such as:

- Linux distributions: *Debian, Ubuntu, SUSE, Red Hat, CoreOS*
- Microsoft Windows Server

It gives you Infrastructure-as-a-Service (IaaS) capability — meaning you can control the underlying hardware resources (CPU, RAM, storage, and networking) virtually without managing physical servers.

Compute Engine is widely used for:

- Hosting web applications
- Running backend services
- Performing large-scale data processing
- Deploying AI/ML models
- Building scalable enterprise systems

💾 Persistent Disks — The Core Storage Component

Every virtual machine needs storage to hold its data and operating system.
In GCP, this is provided by Persistent Disks (PDs).

Persistent disks are block storage devices that act like physical hard drives but with cloud advantages:

- They are network-attached, not physically tied to any one machine.
- Data is retained even if the VM is stopped or deleted.
- You can detach a disk from one VM and attach it to another when needed.

In essence, VMs are temporary compute environments, but persistent disks ensure data permanence and flexibility.

⚙️ Types of Persistent Disks

Google Cloud offers two major types of persistent disks based on performance and cost:

1. Standard Persistent Disk (HDD-based)

- Backed by Hard Disk Drives
- Designed for workloads with large, sequential I/O operations
- Cost-effective for backups, archives, or less frequently accessed data

2. SSD Persistent Disk

- Backed by Solid State Drives
- Much faster read/write performance
- Ideal for databases, transactional workloads, and I/O-intensive applications

📘 Important Note:
Both types of disks can be resized dynamically and support snapshot backups, meaning you can capture the disk state at any time and restore it later.

🧪 Hands-on Lab — What You Did

In today's lab, you learned how to create and attach a persistent disk to a VM, then format and mount it so it can be used for data storage.

Here's a breakdown of what happened step-by-step:

🪄 Step 1: Create a Virtual Machine (VM)

You first created a new instance using Compute Engine, choosing parameters like:

- Machine type (e.g., e2-medium)
- Operating System (e.g., Debian or Ubuntu)
- Region and zone (e.g., us-central1-a)

This step creates your virtual computer in the cloud.

💽 Step 2: Create a Persistent Disk

You then created a new persistent disk — an independent storage resource in GCP.
It can be done through the GCP Console or the gcloud command:

gcloud compute disks create my-disk --size=10GB --zone=us-central1-a

This creates a 10GB persistent disk in the specified zone.

🔗 Step 3: Attach the Disk to Your VM

After creation, the disk is attached to your running VM instance so it can use it for data storage:

gcloud compute instances attach-disk my-vm --disk=my-disk

This step is like connecting an external hard drive to a computer.

🧱 Step 4: Format the Disk

Before you can store files, the disk must be formatted (given a file system like ext4):

sudo mkfs.ext4 -m 0 -F -E lazy_itable_init=0,lazy_journal_init=0,discard /dev/sdb

Formatting prepares the disk to handle data properly.

📂 Step 5: Mount the Disk

Mounting connects the formatted disk to a specific directory path so the operating system can access it.

sudo mkdir -p /mnt/my-disk

sudo mount -o discard,defaults /dev/sdb /mnt/my-disk

Now the disk is available for use at /mnt/my-disk, just like a drive letter (e.g., D:) in Windows.

✅ Step 6: Verify Mounting

You can confirm that the disk is mounted and ready using:

df -h

This shows all attached and mounted drives with their available space.

🔍 Why This Matters in the Real World

Persistent disks are fundamental to cloud architecture and scalability.
They allow:

- Data durability: Your data is safe even if the VM is restarted or deleted.
- Scalability: You can dynamically add or resize disks based on usage.
- Flexibility: Move storage between VMs without losing data.
- Backups & Recovery: Use snapshots to create point-in-time backups.

For developers and data engineers, this is crucial when building systems like:

- Databases and analytics pipelines
- Web applications with persistent user data
- AI/ML workloads that process and store large datasets

🧠 Key Takeaways

1. Compute Engine = Virtual Machines on Google's Infrastructure
2. Persistent Disks = Independent, Durable Storage Volumes
3. VMs are temporary; persistent disks ensure data retention
4. Disks can be formatted, mounted, detached, and reused
5. Different disk types (HDD/SSD) fit different performance needs

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🏁 Conclusion

Today's lab introduced one of the most essential components of cloud infrastructure — virtual machines and persistent storage.

By learning how to create, attach, format, and mount a persistent disk, you've built the foundation for managing stateful cloud applications, where compute and storage are separate yet connected for maximum flexibility and reliability.