What is a Virtual Machine?

A **virtual machine (VM)** is software that emulates a physical computer.

AWS EC2 provides VMs that share physical servers but give you the illusion of a dedicated machine.

Running locally: program runs directly on your own hardware.

Running on a VM: program runs on abstracted, virtualized hardware that can be provisioned on demand in the cloud.

SSH and changing IPs

SSH works only if the security group allows traffic from your current public IP.

If your IP changes (e.g., switching Wi-Fi, moving locations), you must **update the inbound rule** in your EC2 security group to match the new IP.

Alternative: open `0.0.0.0/0` (all IPs), but that's insecure.

Public IPs and Elastic IP

By default, an EC2 instance gets a **new public IP** every time it's stopped or restarted.

This makes connecting harder (since your DNS/clients must be updated each time).

An **Elastic IP** gives you a static, permanent IP.

Trade-off: easier to connect, but incurs cost if unused.

Instance types and specs

Example: `t2.micro` = 1 vCPU, 1 GiB RAM.

Instance type defines the **resources** you "pay" for: CPU, memory, storage, network bandwidth.

Why it matters: heavier workloads need bigger instances; lightweight apps can use free-tier. Specs determine performance, throughput, and scalability.

AWS vs. GCP setup

AWS Learner Lab: manual — you manage keys, security groups, IP addresses, binaries.

GCP (Cloud Shell/Run): more automated — no keys or inbound rules needed, faster setup.

AWS gives flexibility and realism. GCP feels simpler for quick prototypes.

Testing performed

Used **curl** inside EC2 (`curl localhost:8080/albums`) to confirm the server works.

Used **curl externally** from laptop and Cloud Shell to verify inbound traffic worked.

Found **latency was much lower from Cloud Shell** than laptop, showing how network distance dominates performance.

```
Statistics:
Total requests: 1060
Average response time: 28.27ms
Median response time: 28.09ms
95th percentile: 31.40ms
99th percentile: 33.41ms
Max response time: 57.05ms
```

```
Statistics:
Total requests: 588
Average response time: 50.98ms
Median response time: 49.52ms
95th percentile: 64.22ms
99th percentile: 74.06ms
Max response time: 75.74ms
```