

Cloud Computing Workshop

Session 1: Introduction



Dimitris Kargatzis



Stelios Sotiriadis

Welcome to Cloud Computing Workshop

- ✓ Explore the Cloud Computing technology and its tools
- ✓ Explore the Google Cloud Platform (GCP)
 - ▶ Virtualisation
 - ▶ Containerisation
 - ▶ Orchestration systems
 - ▶ Deployment methods and version control software

Tools to focus

- ✔ Virtual Machines (VMs) on GCP
- ✔ GitHub
- ✔ Docker containers
- ✔ Google Kubernetes Engine
- ✔ DevOps with Terraform and GCP and GitHub actions



Workshop administration

Plan for Session 1

- ✓ Short lecture (15 minutes): Cloud computing and Virtualisation
- ✓ Demo:
 - ▶ Redeem GCP coupons
 - ▶ Introduction to GCP, create VMs, connect from SSH, connect using pub key, open port, what is VPC, init script
 - ▶ GitHub: Push/Pull code from laptop to GitHub to VM
- ✓ Practical session:
 - ▶ Create VM, setup pub/key, connect from laptop
 - ▶ Install Python, run Hello World
- ✓ Tutorials:
 - ▶ Intro to Linux, Linux user management, GCP tutorial, Exercise on Python



Session 1: Cloud intro

Some facts!

- ✓ How much data is generated every minute?
 - ▶ YouTube users search 5M videos per day
 - ▶ Netflix users spent a combined **164 million** hours per day watching content
 - ▶ Amazon ships 306 items per second
 - ▶ In the fourth quarter of 2020, Uber's ridership worldwide reached 1.4 billion trip, it was 1.9 in 2019...
 - ▶ Instagram users post 49.380 photos
 - ▶ Google conducts 5.9M searches per day, it was 3.9 two years ago...
 - ▶ Everyday, we create roughly **2.5 quintillion bytes** of data.

640K ought to be enough for anybody!
(B. Gates – a rumor)



Essential questions?

- ✓ Where is such humongous data stored?
- ✓ How is data managed?
- ✓ Do we have enough resources to accommodate data, if data size is growing every day?
 - ▶ That is called data scaling
- ✓ How fast a software can analyze such data?
 - ▶ Computational intensive applications:
 - Need a lot of CPU and memory
 - ▶ Data intensive applications
 - Big data software solutions
 - Need CPU, memory and access to huge storage

Where data is stored?

✓ In a Cloud datacenter...

- ▶ A building, dedicated space within a building, or a group of buildings used to house computer systems and associated components, such as telecommunications and storage systems. [[Source](#)]

Apple (Maiden, N.C.)



NSA (Utah)



Switch SUPERNAP Campus (Las Vegas)
Size: 7 football fields...



SUPERNAP at a glance

- ✓ SUPERNAP

- ▶ A big building with a lot of electricity and air conditioning.
- ✓ It uses renewable power sources, the Nevada desert is an ideal place for solar panels
- ✓ From the street, though, all you see is a high concrete wall – to innocent bystanders, it could be a prison or military base back there
- ✓ SUPERNAP clients include eBay, AWS, Marvel, Cisco, PS4, MGM, Verizon, Salesforce, HP, Deutsche Bank...
 - ▶ [\[Source\]](#)

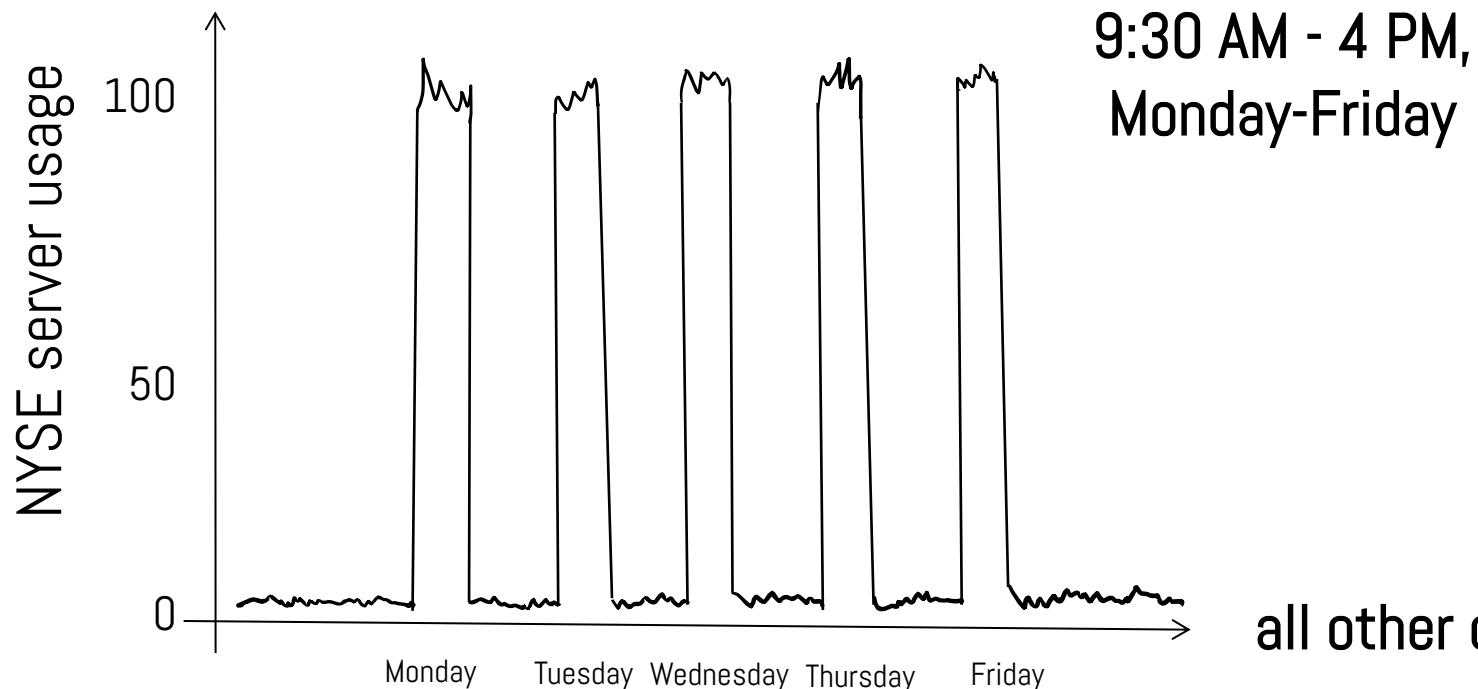


What is Cloud Computing?

- ✓ Example of New York stock exchange market
 - ▶ www.nyse.com
- ✓ NYSE is the largest equities-based exchange in the world, according to the total market capitalization of its listed securities
 - ▶ Data is generated on huge volumes
- ✓ Core Trading Session: 9:30 a.m. TO 4:00 p.m. ET
 - ▶ NYSE calendar

NYSE system

- ✓ On-line real time stock market data system resource utilization
 - ▶ Example of NYSE workload



- Why to pay for resources and capacity for evening-early morning and weekends?
- Why to run the servers if there aren't any workloads?

What is provision?

✓ Provision of resources:

- ▶ Create a virtualized environment with resources
 - Resources: CPU, memory, hard disk, virtual networks etc.
- ▶ Cloud environments are virtualized, this means it is easy to scale up in size
 - Scale up means:
 - From 2 cores, 4GB RAM, 100GB disk to move to
 - 4 cores, 64GB RAM, 250GB disk

What is deprovision?

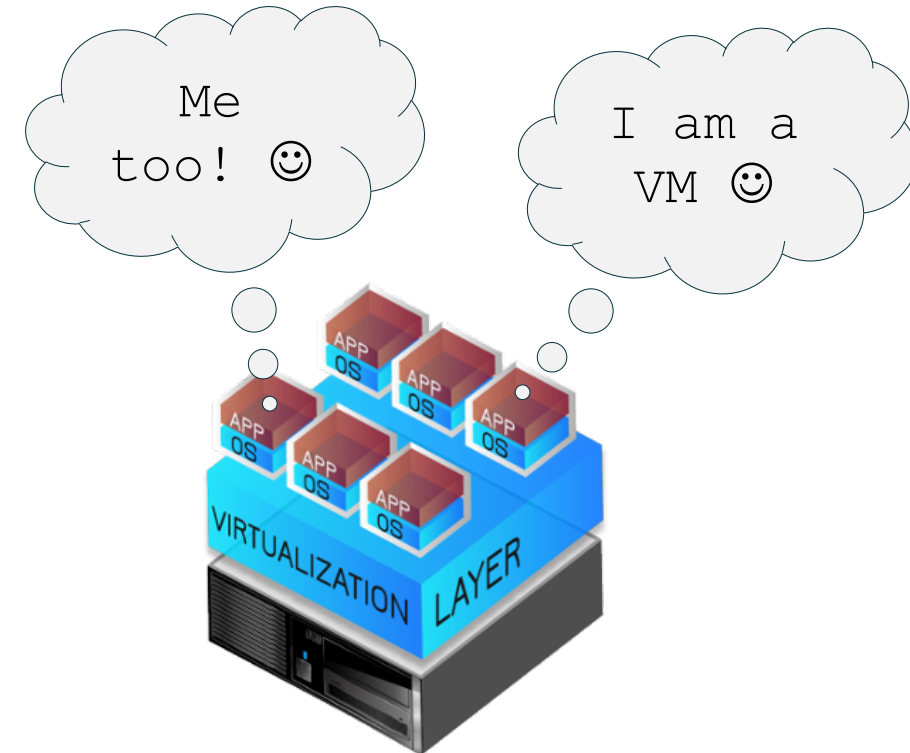
- ✔ Deprovision of resources:
 - ▶ Freeing up resources
 - ▶ In some case refer to changing the configuration of a virtualized environment
 - ▶ Deprovision also refers: turning off a virtual server
 - More cheap!

Virtualization

- ✓ Act of creating a virtual (rather than actual) version of something
 - ▶ Something: HW + SW
- ✓ It includes virtual computer hardware platforms, storage devices, and computer network resources. [Wikipedia]



Traditional Server Architecture



Virtualized Server Architecture

Virtual machine (VM)

- ✓ Preferred definition:

- ▶ A virtual machine is a computer file, typically called an image, that behaves like an actual computer

- ✓ Each virtual machine provides its own virtual hardware, including CPU, memory, hard drive, network interface, and other devices.

- ✓ Multiple virtual machines can run simultaneously on the same physical computer.

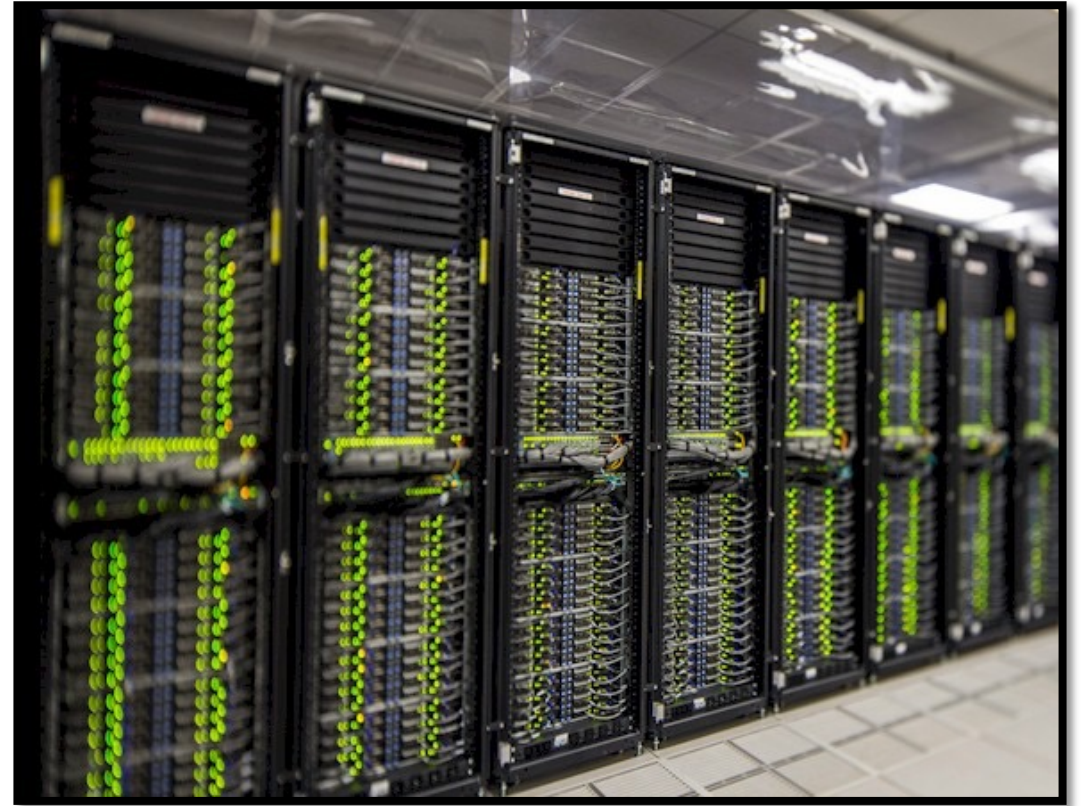
- ✓ The virtual machine is sandboxed from the rest of the system.

- ▶ A VM provides isolation from the rest of the environment

[Source: [MS Azure](#)]

Characteristics of virtualization

- ✓ Multi tenancy in one bare metal server
 - ▶ Bare metal?
 - A 'Single-tenant physical server'
 - Cloud administrators creates several virtual machines (multi-tenancy).
 - ▶ Run multiple VMs of same or different operating systems in same hardware
- ✓ Isolation:
 - ▶ Each VMs is isolated from each other
 - This means that users have access to only their own data and applications



Let us summarize what we just learned

✔ Cloud Computing:

- ▶ A fancy name for a very cool technology
- ▶ Pay as you go for online services (HW and SW)
- ▶ On demand hardware resources over the network

✔ Virtualization

- ▶ Process of creating a virtual version of a computer
- ▶ Virtual machines (VMs) are “seating” on top of a bare metal
 - Easy to manage!
 - Hard to alter (e.g. scale up and down)

What is Cloud deployment?

- ✔ **Cloud deployment** refers to the enablement of:
 - ▶ SaaS (software as a service)
 - ▶ PaaS (platform as a service)
 - ▶ IaaS (infrastructure as a service)
- ✔ Models are delivered to end users over the Internet
- ✔ **A key technical skill** for a modern computer engineer, application developer and data engineer
 - ▶ Understanding the complexity of a deployment will give you intuitions to develop a better software



Demo: Welcome to GCP

Connecting to GCP



- ✓ Intro to GCP and interface
- ✓ Create a VM
- ✓ Connecting (ssh) and running commands
- ✓ Optional: Connecting (ssh) from your laptop
- ✓ Installing software
- ✓ GitHub (push/pull code)



Practical Session

Connecting to GCP



✓ Run the tutorials:

- ▶ Introduction to Linux (ready)
- ▶ User Linux management (ready)
- ▶ GCP Tutorial (video)

✓ Exercises:

- ▶ Create VM (todo)
- ▶ GitHub push-pull code from laptop (todo)