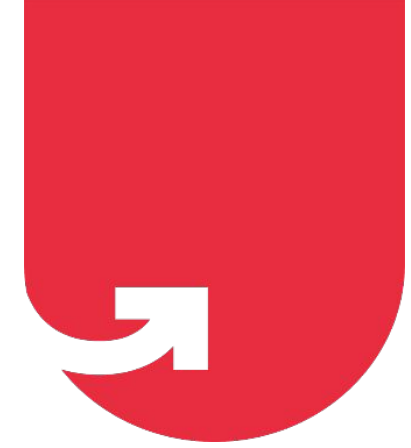


Introduction to Cloud

Session: Compute, Storage,
Database and Networking

Instructor: Siben Nayak



Compute, Storage, Database and Networking

SESSION INTRODUCTION

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Compute Engines

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Cloud Storage

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Cloud
Databases

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Networking

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Security

Compute Engines

Compute Engines

- ❑ **Virtual hardware** resources available to a Virtual Machine (VM) instance
- ❑ Consists of the following types of resources
 - **CPU**: The number and type of processors
 - **Memory**: The size and speed of memory (RAM)
 - **Storage**: The disk space
 - **Networking**: Dedicated network bandwidth (speed)
- ❑ **Different families** of compute engines grouped according to **different types of workload**
- ❑ Compute families are further broken down into **instance types**

Types of Compute Engines

General Purpose: These offer a balance of compute, memory and networking resources, and can be used for a variety of diverse workloads. Ideal for applications that use these resources in equal proportions such as web servers and code repositories.

Compute Optimised: These offer extremely high CPU performance for compute-intensive applications that benefit from high performance processors. Ideal for batch processing workloads, media transcoding, gaming servers, machine learning, etc.

Memory Optimised: These offer higher memory and have more memory per core than others. Ideal for memory intensive applications like in-memory databases.

Storage

LOCAL STORAGE

- ❑ Storing data on physical storage devices (hard drives, SSDs, pen drives, etc)
- ❑ Offline storage of data: Does not need internet to access data
- ❑ Inexpensive for lower volumes
- ❑ Complete control over data security
- ❑ Vulnerable to hardware failure, data loss and theft
- ❑ Limited availability: Data can only be accessed at the same physical location where it is stored



CLOUD STORAGE

- ❑ Storing data in an online space (Google Drive, Dropbox, Amazon S3 etc.)
- ❑ Ability to store and retrieve data from multiple places and devices
- ❑ Multiple people can work and collaborate on data simultaneously
- ❑ Security is partially controlled by the third-party provider
- ❑ Needs internet to access data
- ❑ Pay only for the storage used
- ❑ Vulnerable to data leaks and attacks



Types of Cloud Storage



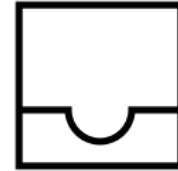
File storage

Data stored in a hierarchical system divided into directories and subdirectories (files and folders)



Block storage

Data broken into multiple blocks and stored across distributed systems. with each block representing a separate hard drive.



Object Storage

Data stored in metadata format identified only by a unique identifier; objects stored in the same format as they arrive.

COMPARISON

Feature	File Storage	Block Storage	Object Storage
Storage	Files and folders	Fixed-size blocks	Unstructured objects
Protocol	CIFS, NFS	Fibre channel, SATA	HTTP (SOAP/REST)
Use case	File sharing	OS, database	Anything (PDF, image, videos)
Access	Sequential	Sequential	Random
Cost	High	Very high	Low
Scalability	Low	Low	High
Example	Google Drive	Amazon EBS	Amazon S3

Databases

CLOUD DATABASES

- ❑ Database services available in the cloud
- ❑ **User Managed:** Users provision the compute from cloud providers and manage their own database installation
- ❑ **Cloud Managed:** Fully managed database service (DBaaS) provided by the cloud provider
- ❑ Support for both **relational** (MySQL, PostgreSQL, SQL Server and Oracle) and **non-relational** (MongoDB, CouchDB and DynamoDB) databases
- ❑ Pay only for the storage used and scale according to need

TYPES OF CLOUD DATABASES

Database Type	Use Case	Example
Relational	Traditional applications with relational data	E-commerce, CRM, banking
Non-relational	Low latency and high-scale applications	News feed, games
Key-value	High-traffic web applications	E-commerce, games, stock market
In-memory	Caching and session management	Database cache, Social media posts
Graph	Network graphs and relations	Social networks, recommendations
Time series	Applications with time interval based data	IOT devices, telemetry
Append only	Secure applications with immutable transactions	Banking, blockchain

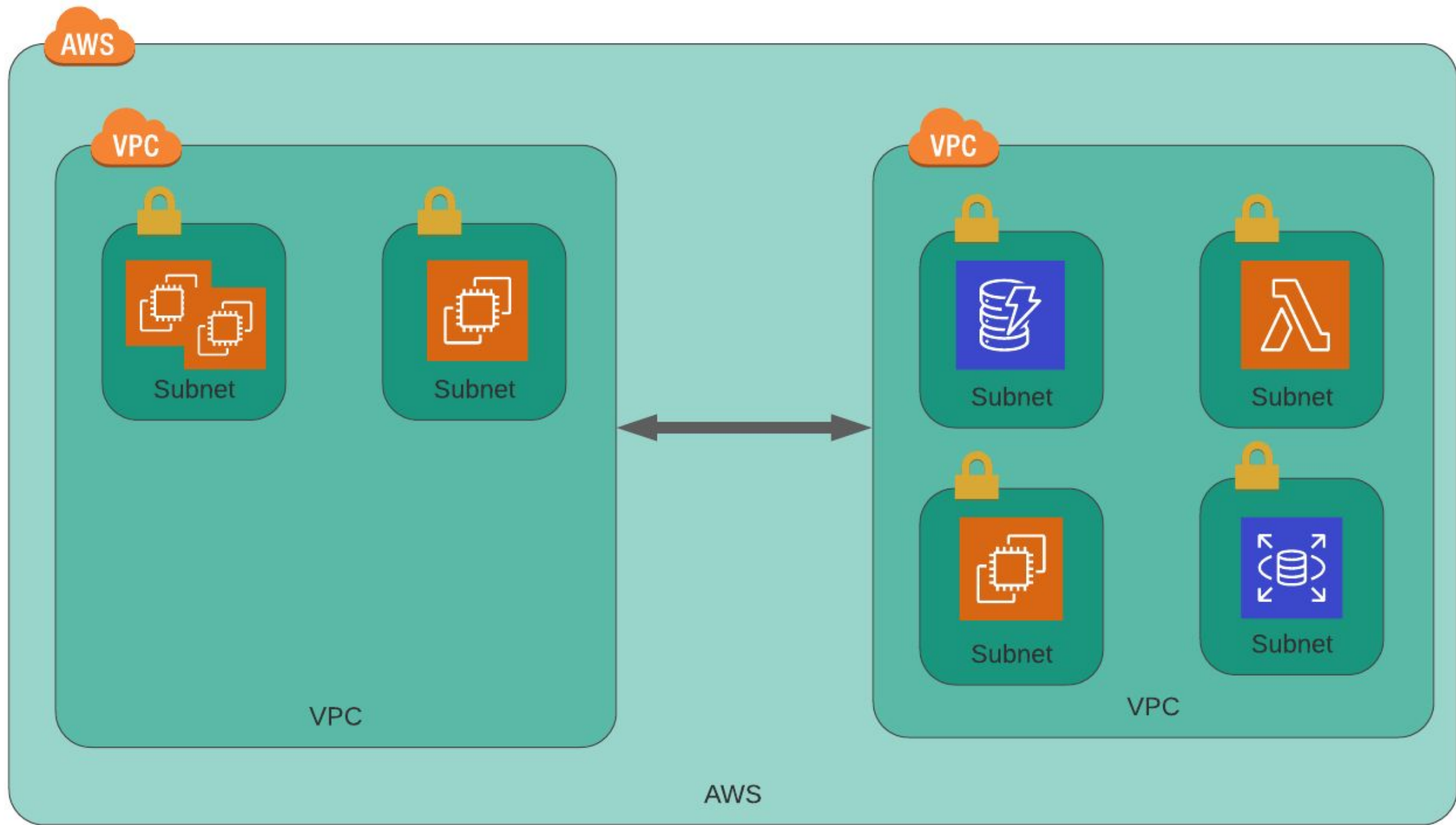
Networking

NETWORKING IN THE CLOUD

- ❑ Network capabilities and resources hosted in a public or private cloud platform
- ❑ Network resources can be virtual routers, bandwidth, virtual firewall, any network management software and more.
- ❑ **Cloud-enabled networking:** Combination of private and cloud networks (e.g. using a SaaS-based antivirus solution to manage and secure an in-house network).
- ❑ **Cloud-based networking:** Completely using networking resources from the cloud (e.g. applications that are fully deployed on a public cloud will also use the network nodes and equipment present in the same public cloud)

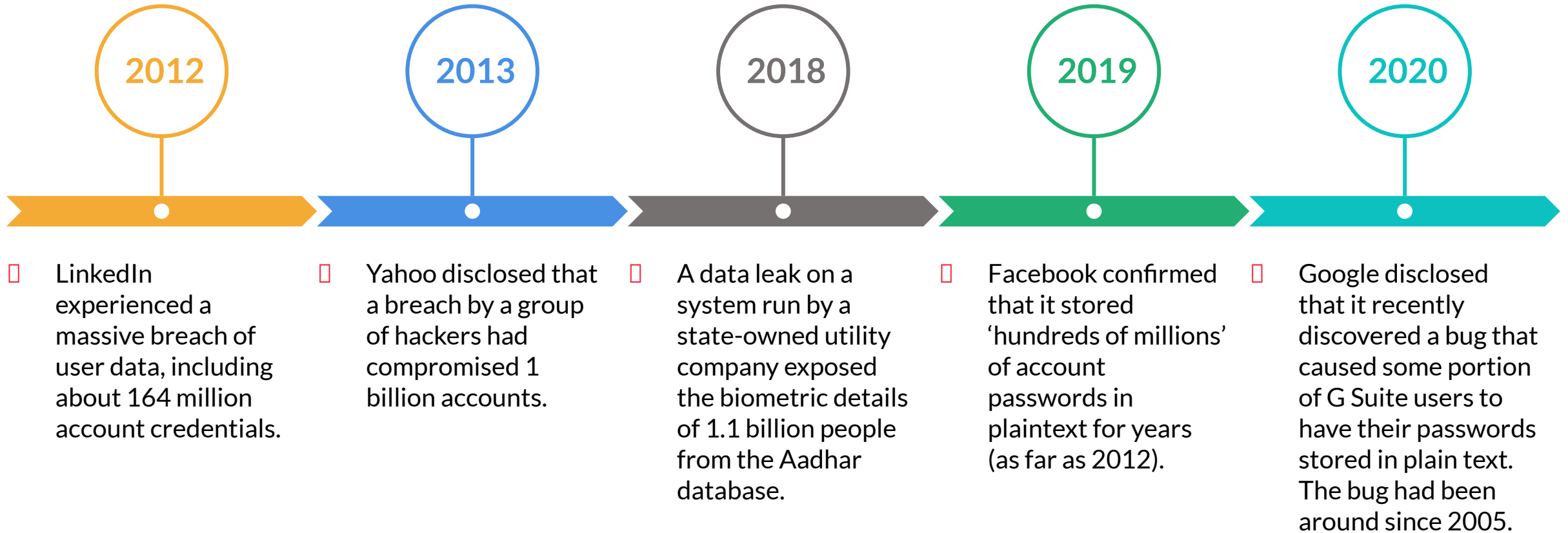
VIRTUAL PRIVATE CLOUD

- ❑ **Private cloud** environment within a public cloud provider's infrastructure
- ❑ **Logically isolated** virtual network to create a **secured private space** isolated from other tenants and users of the cloud provider
- ❑ Provides **granular control** over IP addresses and applications that can **access** particular resources
- ❑ Allows to **dynamically** increase/decrease **size** of virtual network
- ❑ **Reduced risks** due to isolation from other customers and applications
- ❑ Consist of multiple smaller portions or subdivisions called **Subnet**



Security

TRIVIA



SECURITY IN THE CLOUD

□ **Practices, procedures, technologies, controls and applications** used to protect data, services, applications and the related infrastructure in the cloud from both internal and external threats



□ **Preventive:** Minimise threats by enforcing strong security controls like user authentication and authorisation



□ **Detective:** Identify and handle ongoing threats like detecting malicious activities through intrusion detection



□ **Corrective:** Post attack damage control and remediation

SECURITY VULNERABILITIES

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Data Loss

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Data Breach and
Leak

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Weak Access
Management

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Insecure APIs

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Misconfiguration

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Denial of Service

SECURITY GROUPS

- ❑ **Virtual firewall** controlling traffic to individual instances
- ❑ Defined based on following attributes:
 - **Port**: The port being accessed (for e.g. 80, 8080, 22)
 - **Protocol**: The communication protocol being used (for e.g. HTTP/HTTPS)
 - **Source/Destination**: A range of IP addresses or another security group
- ❑ Applicable at the **instance level**, so all resources can have **different rules**
- ❑ **Evaluate all the rules** before allowing traffic



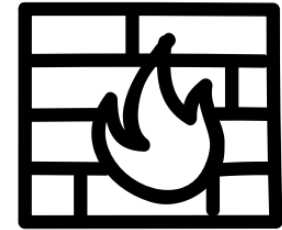
ACCESS CONTROL LISTS

- ❑ A **list** of **who** has **what** access to the cloud resources
- ❑ Applicable to both **users** and **user groups**
- ❑ Collection of entries that define two items:
 - **Permission**: Defines what actions can be performed on a resource
 - **Scope**: Defines who can perform these actions
- ❑ Applicable at the **subnet level**, so all resources in a subnet inherit the **same rules**
- ❑ **Evaluates rules in the same order** as specified and applies the **first matched rule**



WEB APPLICATION FIREWALL

- ❑ A firewall that protects web applications by filtering and monitoring HTTP traffic from the internet
- ❑ Uses a set of rules or policies that protect against vulnerabilities in the application by filtering out malicious traffic
- ❑ Protects web applications from attacks such as cross-site forgery, cross-site-scripting (XSS), file inclusion and SQL injection, etc
- ❑ Three types of WAF: **Network** (hardware based), **Host** (integrated into the application) and **Cloud** (third-party SaaS firewall)



Summary

SUMMARY

- ❑ **Different** types of compute engine families
- ❑ **Cloud Storage** - Storing data in an online space
- ❑ **Cloud databases** - Databases services available in cloud
- ❑ **Network capabilities and resources** hosted in a public or private cloud platform
- ❑ Important to **secure** the cloud environment