



Cloud Computing

(Source of text and images - Internet)

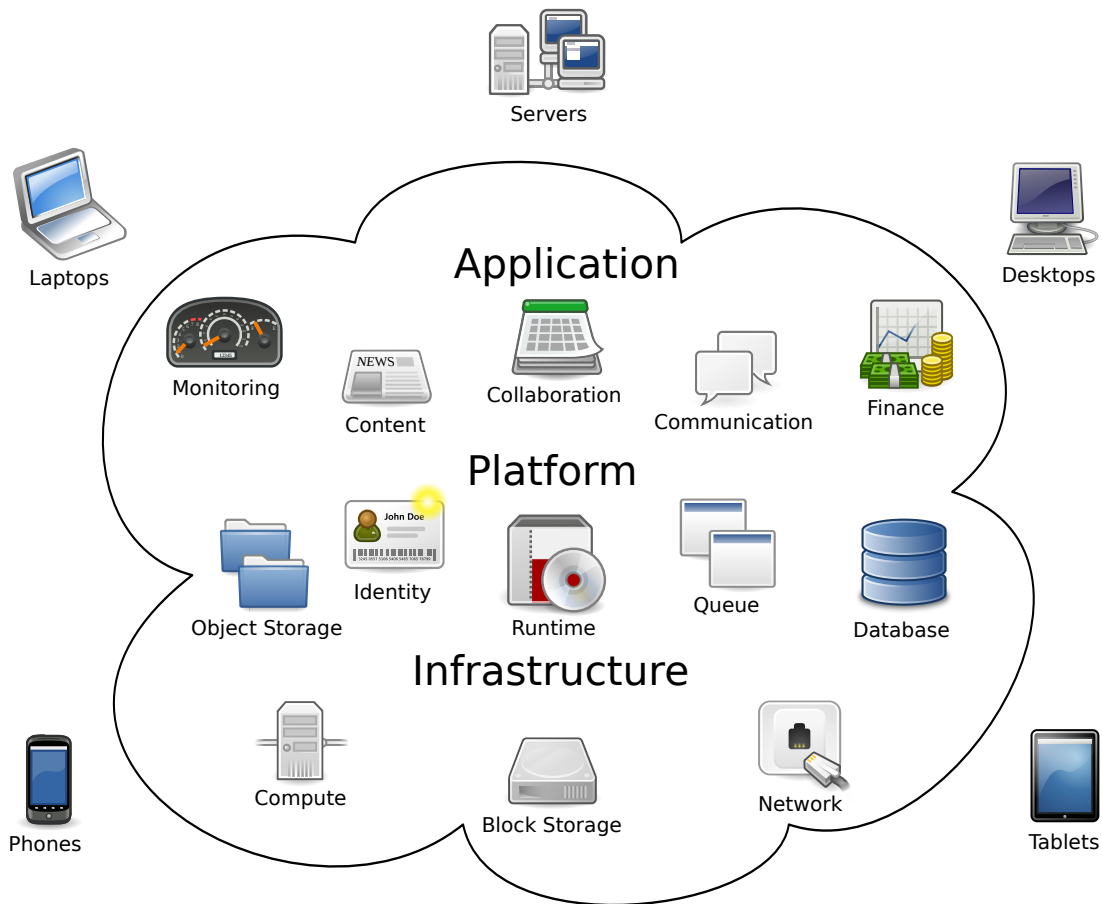
SESSION 1

Introduction to cloud

Cloud computing is

▼ Image

Source - Wikipedia



▼ Definition

Cloud computing is the on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user. Large clouds often have functions distributed over multiple locations, each of which is a data center. Cloud computing relies on sharing of resources to achieve coherence and typically uses a "pay as you go" model, which can help in reducing capital expenses but may also lead to unexpected operating expenses for users.

1. on-demand availability of computer resource
2. over the internet
3. pay as you go pricing

https://aws.amazon.com/about-aws/global-infrastructure/regions_az/?p=ngi&loc=2

▼ Characteristics

1. Cost Savings
2. Security
3. Disaster Recovery
4. Speed
5. Global
6. Productivity

What computing paradigms are there?

1. Distributed Computing Distributed computing is a model in which a large number of computers work together to solve a common problem.
2. Parallel Computing Parallel computing is a type of computing in which multiple processors work together to solve a problem. In a parallel system, a single problem is divided into smaller tasks, which are then assigned to different processors to be solved simultaneously.
3. Cloud Computing

Types of cloud computing/Cloud Deployment Model

1. Public cloud

A public cloud is an IT model where public cloud service providers make computing services including compute and storage, develop-and-deploy environments, and applications—available on-demand to organizations and individuals over the public internet.

2. Private cloud

The private cloud provides computing services to a private internal network (within the organization) and selected users instead of the general public.

3. Hybrid cloud

A Hybrid cloud is an IT infrastructure that connects at least one public cloud and at least one private cloud

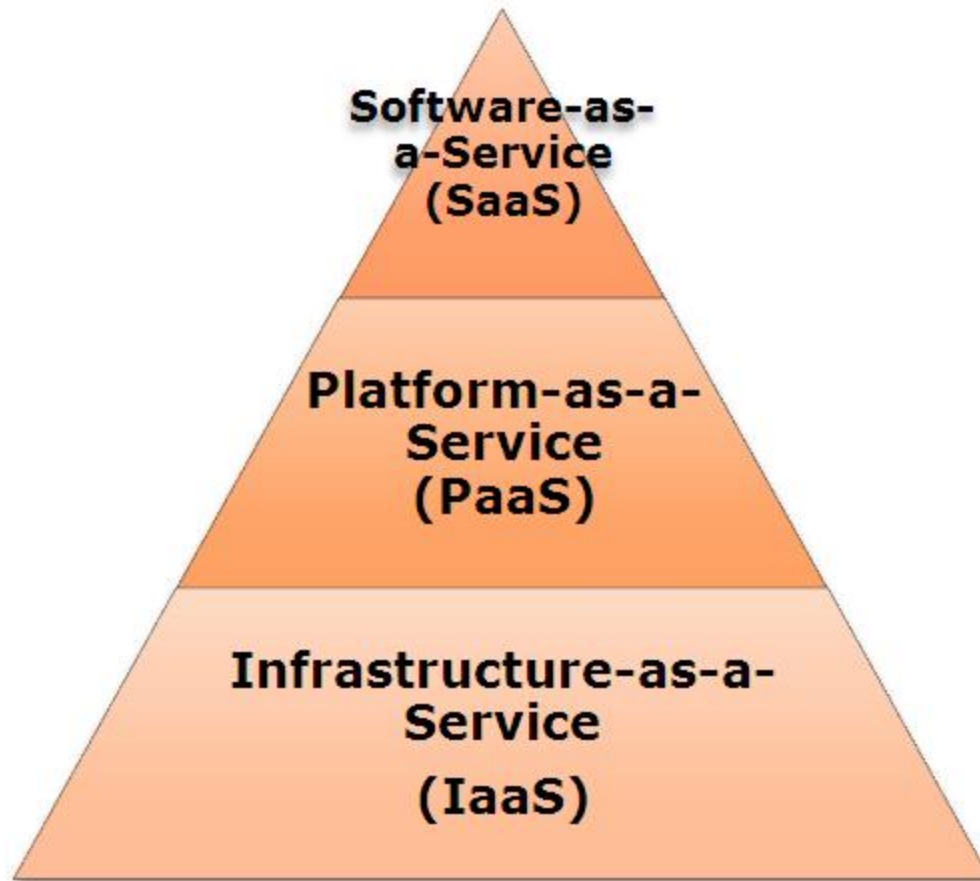
Understanding Cloud Vendors

1. AWS → AMAZON
2. AZURE → Microsoft
3. GCP → Google
4. HEROKU → Salesforce

Components

1. Client Infrastructure - User interface for interaction
2. Application/Service - Process user wants to access
3. Management/Security - Infrastructure to use the services.
4. Internet - Layer between client and Services

SESSION 2



Introduction to SaaS

Software as a service (or SaaS) is a way of delivering applications over the Internet—as a service. Instead of installing and maintaining software, you simply access it via the Internet, freeing yourself from complex software and hardware management.

1. Gmail
2. Github

Pros and Cons of the SaaS Model

Pro

Cost

Maintenance --the best benefit of SaaS is the automatic access to patches and updates

Mobility --With no disc to be installed, SaaS-based applications can be used anywhere there's a network connection.

CONS

Security

Contractual --SaaS contracts can be difficult to understand and the penalties for overusing licenses are often steep.

Loss of control

Traditional Packaged software Vs SaaS

	On-premise enterprise software	Software as a service enterprise software
Price	High price	Low price
Ownership	License	Subscription
Database	Niche focus	Mass customization
Location	Onsite	Online
Operation	Manual	Automated
Customization	Flexible	Not so flexible
IT knowledge	Complex	Simple
Design	Unique solution	Uniform commodity

SaaS examples

Tableau
Skype

Introduction to PaaS

Platform as a Service (PaaS) provides the developers with a complete development and deployment environment in the cloud.

Example - Databases, Beanstalk

Pros and Cons of the PaaS Model

PROS

Simplified Development

Prebuilt functionality

Scalability -- The structure is flexible enough to allow business to expand without high investment

CONS

Vendor lock-in

Data Privacy

Integration --Two different PaaS solutions cannot be integrated with each other

Introduction to IaaS

known as Hardware as a Service. IaaS provides servers, hard drives, networking, and storage.

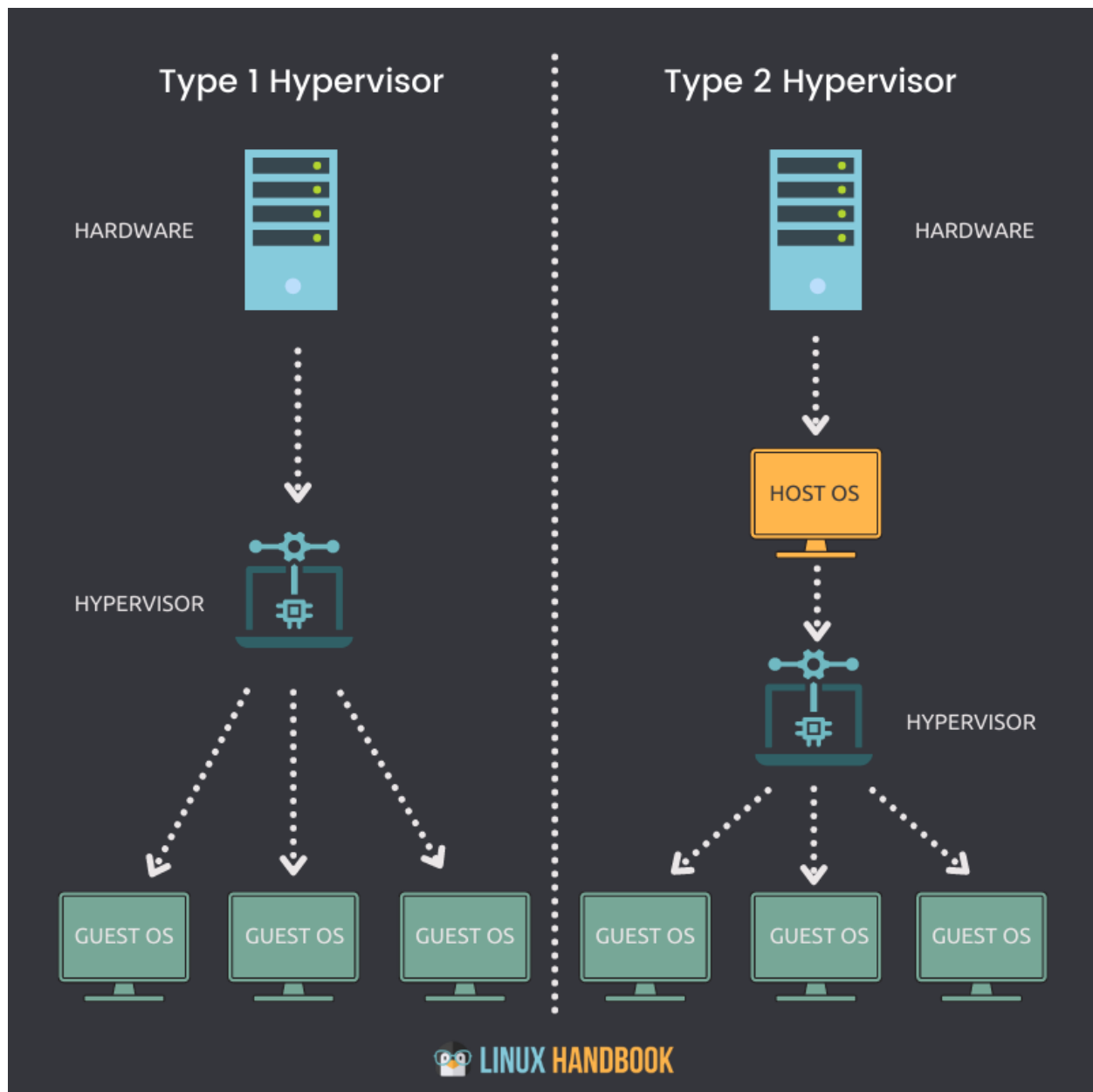
Example - EC2

Introduction to virtualization

Virtualization uses software to create an abstraction layer over computer hardware that allows the hardware elements of a single computer—processors, memory, storage and more—to be divided into multiple virtual computers, commonly called virtual machines (VMs). Each VM runs its own operating system (OS) and behaves like an independent computer, even though it is running on just a portion of the actual underlying computer hardware. This enables cloud users to purchase only the computing resources they need when they need it, and to scale those resources cost-effectively as their workloads grow.

A hypervisor is software that creates and runs virtual machines (VMs). A hypervisor, sometimes called a virtual machine monitor (VMM).

A hypervisor allows one host computer to support multiple guest VMs by virtually sharing its resources, such as memory and processing.



Types and Uses of Virtualization

Type 1 runs on bare metal
Type 2 runs on top of an operating system.

Use

Faster provisioning - On click
Minimal downtime - Maintained by provider
Resource efficiency - Pay for what you use

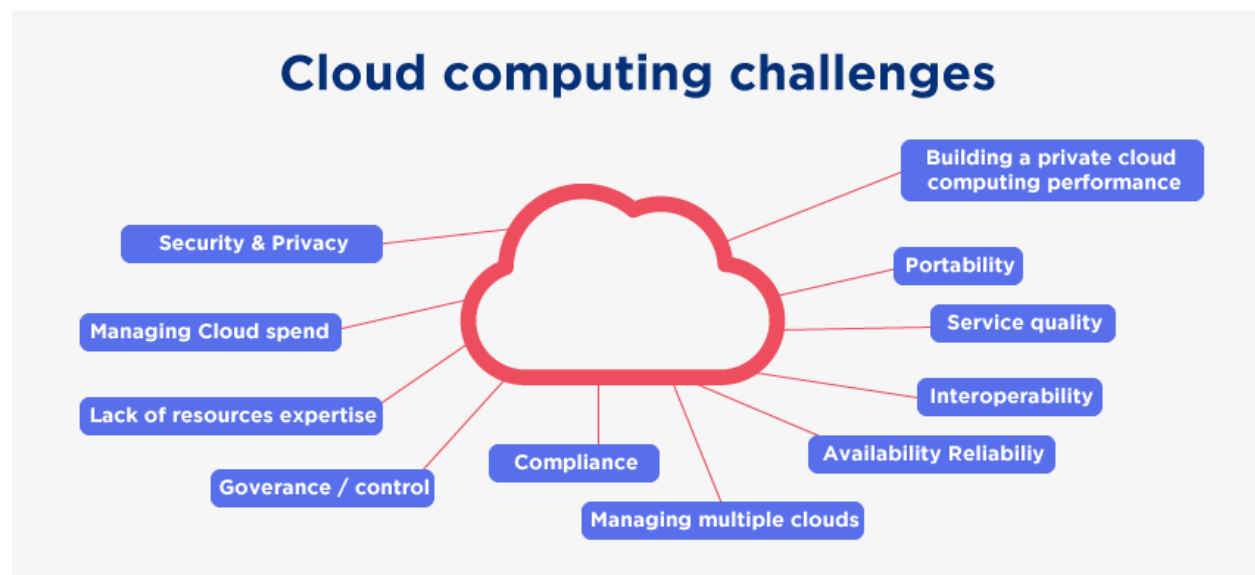
Virtual Machine Provisioning

The process of creating new VM is known as VM Provisioning. (More of a practical)

Virtual Machine Migration Services

The movement of VMs from one resource to another, such as from one physical host to another physical host, or data store to data store, is known as VM migration. There are two types of VM migration: cold and live. Cold migration occurs when the VM is shut down. Live migration occurs while the VM is actually running.

Challenges of the cloud environment



Lab

1. Resume Hosting
2. Data Viz Application

Session 3

S3 - Simple Storage Service

Amazon Simple Storage Service (Amazon S3) is an object storage service offering industry-leading scalability, data availability, security, and performance. Customers of all sizes and industries can store and protect any amount of data for virtually any use case, such as data lakes, cloud-native applications, and mobile apps.

Use Cases

Backup and storage
Disaster Recovery
Archive
Hybrid Cloud storage
Application hosting and Media hosting
Data lakes & big data analytics
Software delivery
Static website

Properties

Amazon S3 allows people to store objects (files) in “buckets” (directories). Buckets must have a globally unique name (across all regions all accounts). Buckets are defined at the region level.

The key is composed of prefix + object name (Key).

Max Object Size is 5TB (5000GB)

If uploading more than 5GB, must use “multi-part upload”

IAM Policies and Encryption is used for security.

Policies

Resources: buckets and objects

Actions: Set of API to Allow or Deny

Effect: Allow / Deny

Principal: The account or user to apply the policy to.

S3 Versioning

Static Website

Access Logs

S3 Replication - Cross Region and Same Region

Durability - Data loss (99.99999999999999%) 11 9's

Availability - Service is available -Depending on storage class

Storage Classes

<https://aws.amazon.com/s3/storage-classes/>

Amazon S3 Standard - General Purpose

--It is used for general purposes and offers high durability, availability, and performance object storage for frequently accessed data

Amazon S3 Standard-Infrequent Access (IA)

Amazon S3 Standard-Infrequent Access (IA)--

To access the less frequently used data, users use S3 Standard-IA. It requires rapid access when needed. We can achieve high strength, high output, and low bandwidth by using S3 Standard-IA. It is best in storing the backup, and recovery of data for a long time. It act as a data store for disaster recovery files.

Amazon S3 One Zone-Infrequent Access

Amazon S3 Intelligent Tiering

Amazon Glacier

Amazon S3 One Zone-Infrequent Access

--One Zone-IA stores data in a single Availability Zone. One Zone-IA stores data in a single Availability Zone

Amazon Glacier Deep Archive

Amazon S3 Intelligent-Tiering:

The first cloud storage automatically decreases the user's storage cost. It provides very cost-effective access based on frequency, without affecting other performances.

LifeCycle

Life Cycle--

An S3 Lifecycle Management in simple terms when in an S3 bucket some data is stored for a longer time in standard storage even when not needed. The need to shift this old data to cheaper storage or delete it after a span of time gives rise to life cycle management.

Administering & Monitoring cloud services

Administration - to control or manage something (IAM)

Monitor - to test regularly for a period of time (Cloudwatch)

AWS Identity and Access Management (IAM) enables you to securely control access to AWS services and resources for your users. Using IAM, you can create and manage AWS users and groups, and use permissions to allow and deny their access to AWS resources. IAM allows you to do the following:

- **Manage IAM users and their access:** You can create users in IAM, assign them individual security credentials (access keys, passwords, and

multi-factor authentication devices), or request temporary security credentials to provide users access to AWS services and resources. You can manage permissions in order to control which operations a user can perform.

- **Manage IAM roles and their permissions:** You can create roles in IAM and manage permissions to control which operations can be performed by the entity, or AWS service, that assumes the role. You can also define which entity is allowed to assume the role.
- **Manage federated users and their permissions:** You can enable identity federation to allow existing identities (users, groups, and roles) in your enterprise to access the AWS Management Console, call AWS APIs, and access resources, without the need to create an IAM user for each identity

Amazon CloudWatch is a monitoring and management service built for developers, system operators, site reliability engineers (SRE), and IT managers. **CloudWatch provides you with data and actionable insights to monitor your applications, understand and respond to system-wide performance changes, optimize resource utilization, and get a unified view of operational health.** CloudWatch collects monitoring and operational data in the form of logs, metrics, and events, providing you with a unified view of AWS resources, applications and services that run on AWS, and on-premises servers. You can use CloudWatch to set high resolution alarms, visualize logs and metrics side by side, take automated actions, troubleshoot issues, and discover insights to optimize your applications, and ensure they are running smoothly.

Deploy application over cloud

AWS CodeCommit is a fully-managed source control service that makes it easy for companies to host secure and highly scalable private Git repositories.

AWS CodeArtifact is a fully managed artifact repository service that makes it easy for organizations of any size to securely store, publish, and share software packages used in their software development process.

AWS CodeBuild is a fully managed continuous integration service that compiles source code, runs tests, and produces software packages that are ready to deploy.

AWS CodeDeploy is a fully managed deployment service that automates software deployments to compute services such as Amazon EC2, AWS Lambda, and your on-premises servers. AWS CodeDeploy makes it easier for you to rapidly release new features, helps you avoid downtime during application deployment, and handles the complexity of updating your applications.

CodePipeline builds, tests, and deploys your code every time there is a code change, based on the release process models you define.

Comparison among SAAS, PAAS, IAAS

Basis Of	IAAS	PAAS	SAAS
Stands for	Infrastructure as a service.	Platform as a service.	Software as a service.
Uses	IAAS is used by network architects.	PAAS is used by developers.	SAAS is used by the end user.
Access	IAAS gives access to the resources like virtual machines and virtual storage.	PAAS gives access to run time environment to deployment and development tools for application.	SAAS gives access to the end user.
Model	It is a service model that provides virtualized computing resources over the internet.	It is a cloud computing model that delivers tools that are used for the development of applications.	It is a service model in cloud computing that hosts software to make it available to clients.
Technical understanding.	It requires technical knowledge.	Some knowledge is required for the basic setup.	There is no requirement about technicalities company handles everything.
Popularity.	It is popular among developers and researchers.	It is popular among developers who focus on the development of apps and scripts.	It is popular among consumers and companies, such as file sharing, email, and networking.
Cloud services.	Amazon Web Services, sun, vCloud Express.	Facebook, and Google search engine.	MS Office web, Facebook and Google Apps.
Enterprise services.	AWS virtual private cloud.	Microsoft Azure.	IBM cloud analysis.
Outsourced cloud services.	Salesforce	Force.com, Gigaspaces.	AWS, Terremark
User Controls	Operating System, Runtime, Middleware, and Application data	Data of the application	Nothing

Cloud Pricing → <https://aws.amazon.com/pricing>

Compute Products and Services

EC2

Lambda

Elastic Beanstalk

benefits and limitations