Software Development Life Cycle

# Lecture 2: Cloud Computing and AWS

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# Content

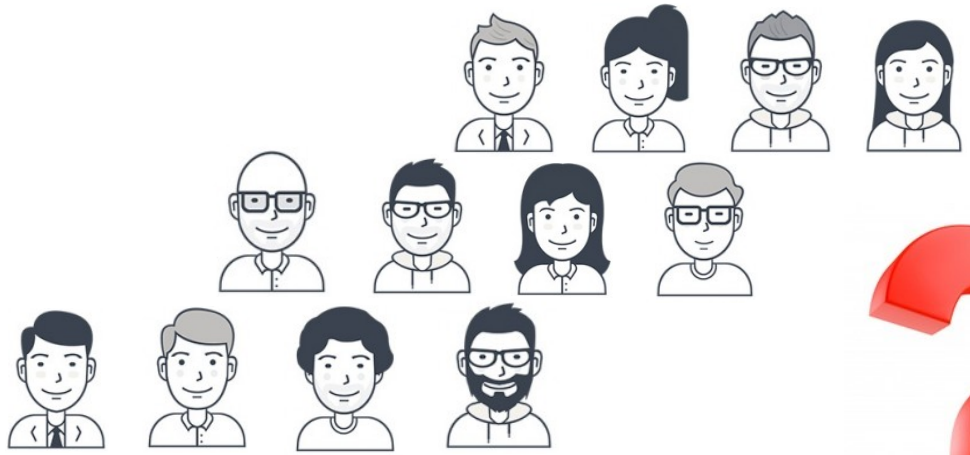
- Cloud Computing
- Characteristics of Cloud Computing
- Cloud Computring Service Model
- Virtualisaton
- Cloud Service Provider
- Amazon Web Services
- AWS – Free Tier

Cloud Computing and AWS

# Cloud Computing

# Before Cloud Computing

**Suppose you are operating a company and you want to host a website.**

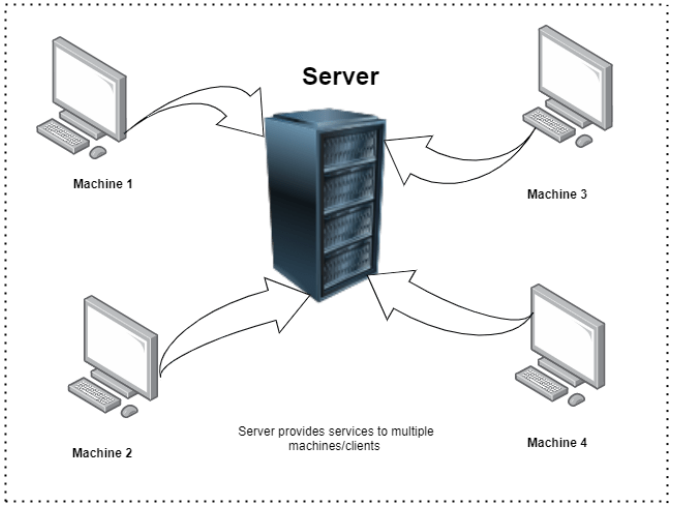
# Disadvantage of Traditional Systems

Expensive to keep up running.

Difficult to setup and maintain.

Need to keep monitoring resources.

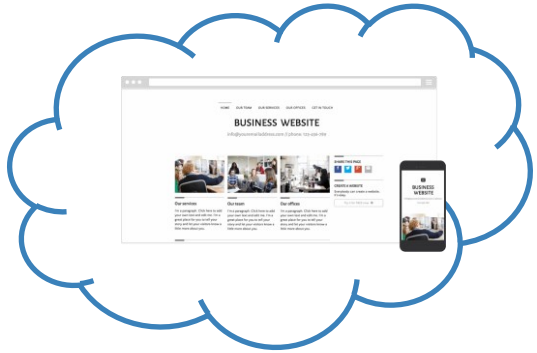
Hard to reconfigure resources.



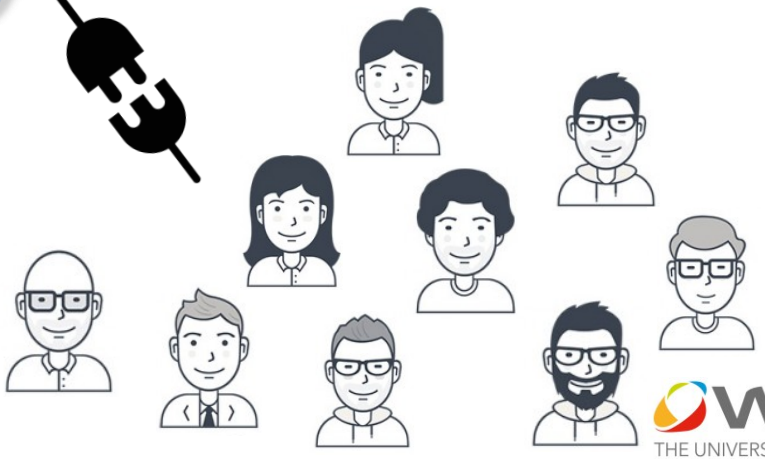

*Source: awscloudguide.com*

# Cloud Computing Concept

**Cloud computing is a better option to operate systems.**





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# Definition of Cloud Computing

*"**Cloud computing** is a model for enabling convenient, **on-demand network access** to a **shared pool** of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be **rapidly provisioned and released** with **minimal management effort** or service provider interaction."*

*- National Institute of Standards and Technology -*

*Source: Dreamstime.com*

*"**Cloud computing** is an information technology paradigm that enables **ubiquitous access** to **shared pools** of **configurable** system resources and higher-level services that can be **rapidly provisioned** with **minimal management effort**, often over the Internet."*

*- Wikipedia -*

# Advantages of Cloud Computing

## Cost efficiency

- It does not need any physical hardware investments and hardware maintanace.

## Almost unlimited resource

- At any time it is possible to quickly exntend stroage capacity with nominal monthly fees.

## Backup and restore data

- Once the data is stored in the cloud, it is easier to get back-up and restore that data.

## Improved collaboration

- Cloud applications improve collaboration by allowing groups of people to quickly and easily share information.

## Faster time to market

- It can make down the deployment of new servers through cloud migration.

## Mobility

- Anyone who is working at the remote locations can easily access all the cloud services.

## Automatic software integration

- There is no need to take additional efforts to customise and integrate application as software integration will be done automatically.

## Easy access

- Clouds allows to quickly and easily access store information anywhere, anytime using an internet connection.

# Disadvantages of Cloud Computing

## No internet no access

- Without Internet connection, there is no cloud service available.

## Poor service with low bandwidth

- Depening on the speed of bandwidth, cloud service will be vary.

## Possible downtime

- Downtime should be considered such as power loss, low internet connectivity, service maintenance, etc.

## Vendor lock-in

- When in need to migrate form one cloud platform to another, a company might face some serious challenges.

## Security in the cloud

- Although cloud provide powerfull security, hackers might access company's sensitive information.

## Lack of support

- Cloud may fail to provide proper support to the customers and FAQ or online help can be tedious job for non-technical persons.

## Limited control

- Because cloud infrastructure is owned and managed by the service provider, the cloud users have less control over the execution of services.

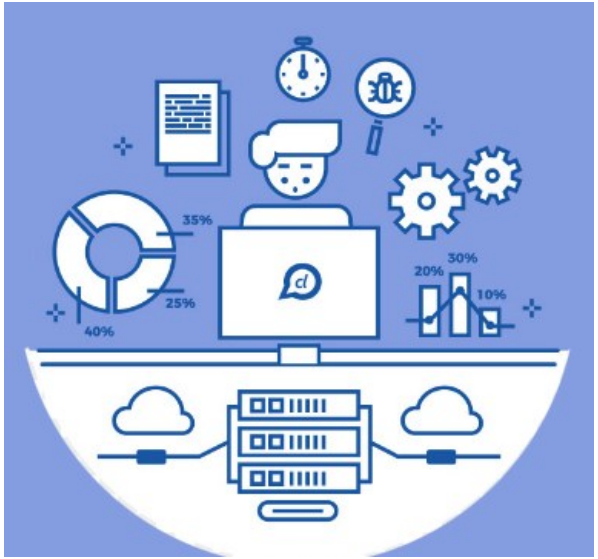
Cloud Computing and AWS

# Characteristics of Cloud Computing

# Characteristics of Cloud Computing

Cloud Computing has **several common chracteristics**:

- **Managed by cloud computing provider**
- **On demand self-service**
- **Broad network access**
- **Resource pooling**
- **Measured service**

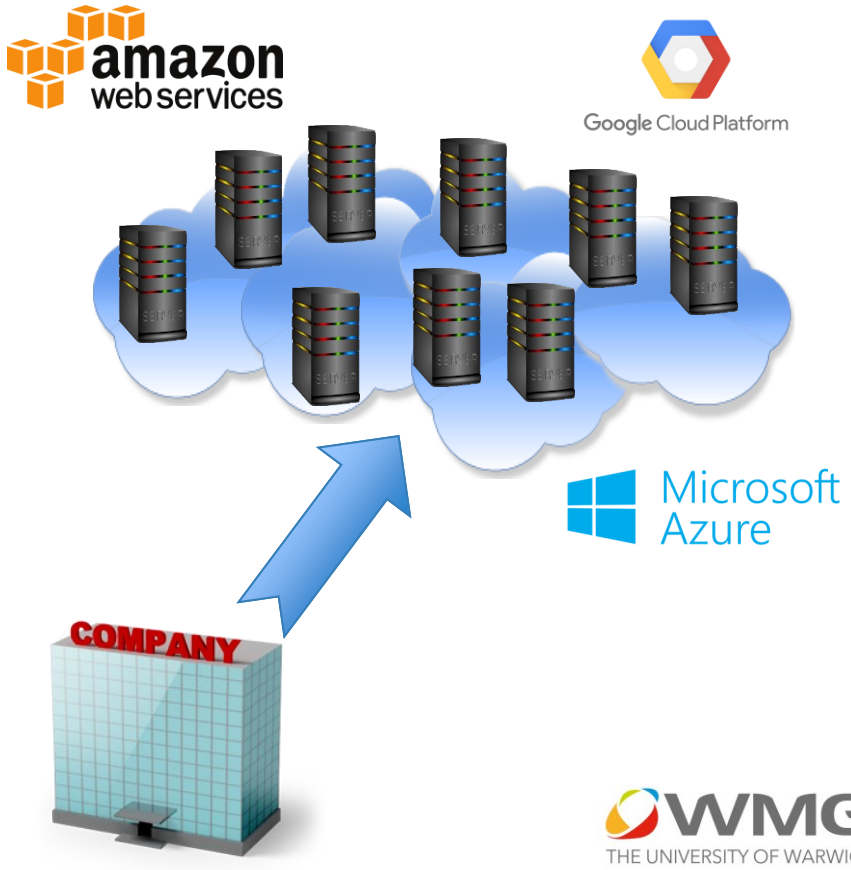



*Source: Dzone*

# Characteristics of Cloud Computing

## Managed by Cloud Computing Provider

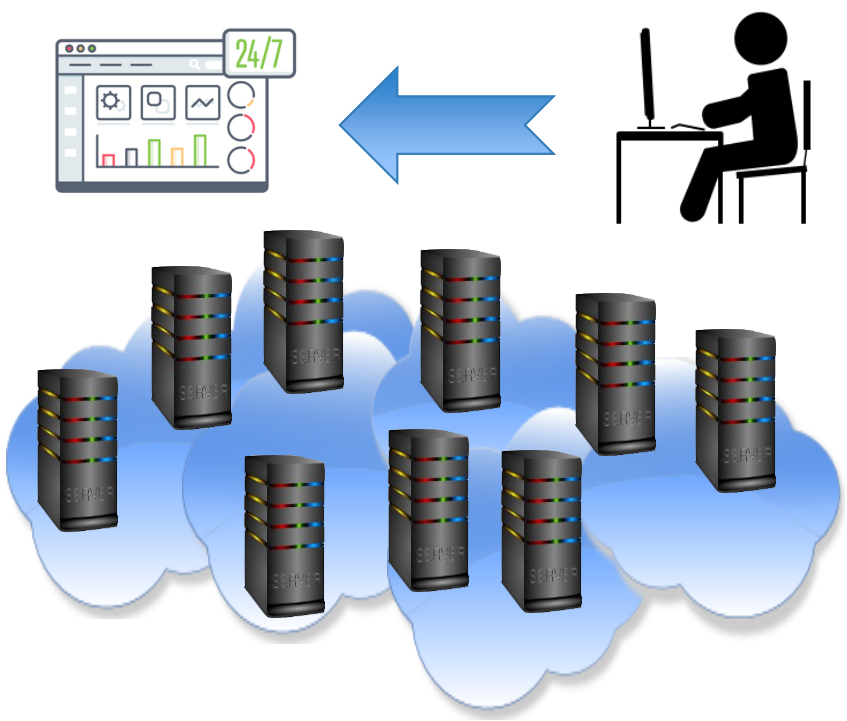
- There is no longer need to worry about **power**, **space**, **setup**, **maintanance**, etc.
- There is no longer need to understand **individual hardware** and **software configuration**.
- **Any software and hardware update** will be provided by **cloud computing providers**.



# Characteristics of Cloud Computing

## On Demand Self-service

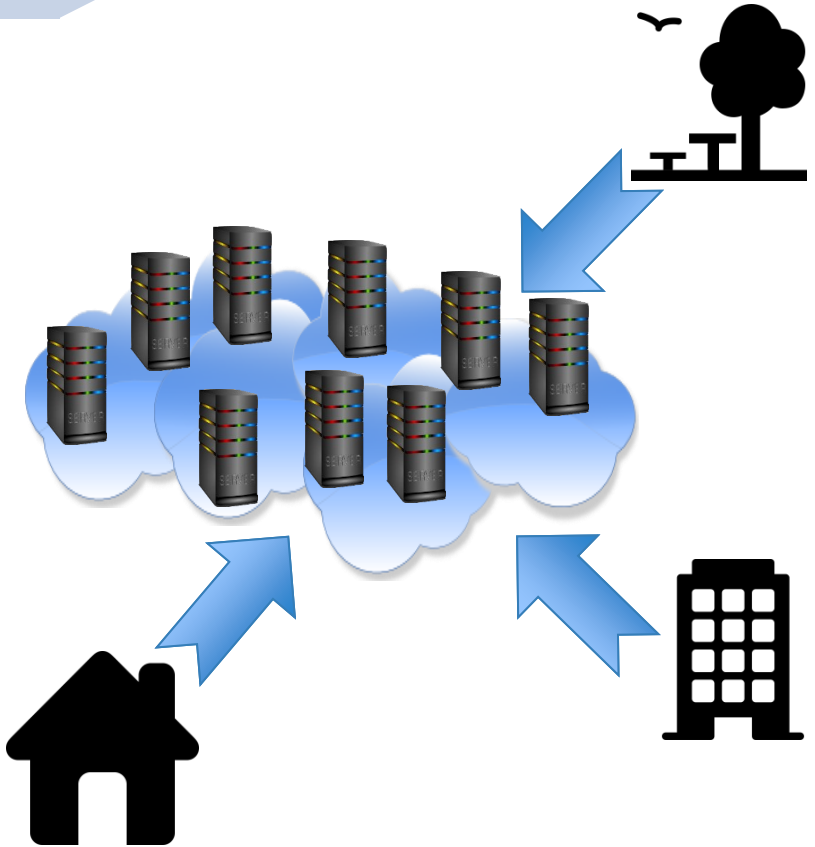
- Typically, cloud computing service providers **offer a self-service interface** to manage their resources.
- Customers allocate a new resource **by a number of clicks via the interface**.
- With minimal effort, new resource capacity is **automatically expanded or managed by customers**.
- It is managed automatically **without further technical assistance** needed from a cloud provider.



# Characteristics of Cloud Computing

## Broad Newtork Access

- Cloud computing service is **available via any networked devices and technologies**.
- It is oriented to "**anywhere, anytime**" service model.
- Cloud computing provides typically **24/7 service**.
- Cloud computing service is **accessible** even though there are **geopolitical turmoil or environmental threats** such as hurricane, earthquake, etc.



# Characteristics of Cloud Computing

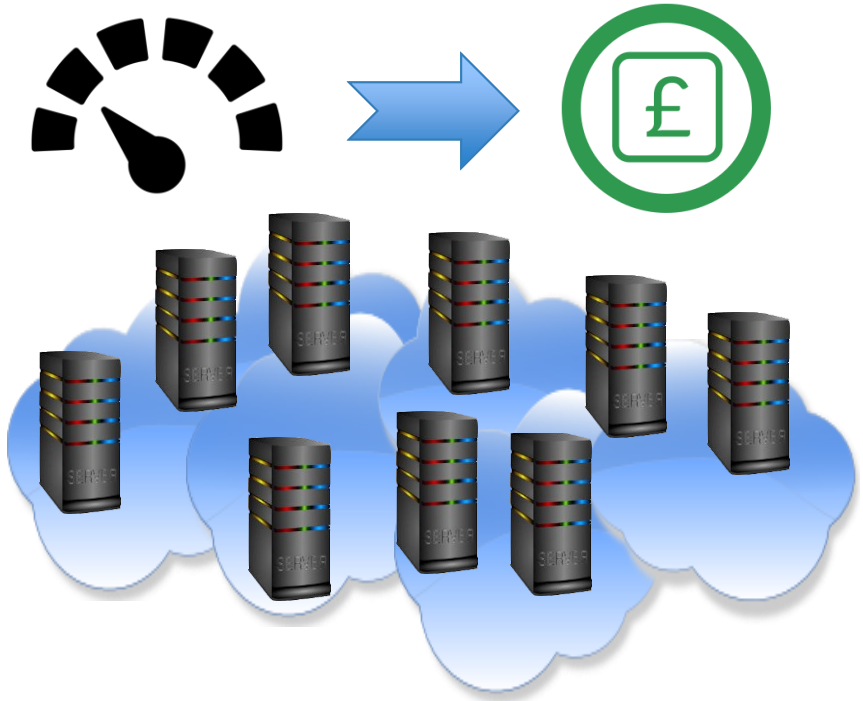
## Resource Pooling

- Cloud computing resources are based on a **pooling mechanism**.
- Cloud computing providers use **virtualisation technique to manage their resources**.
- Depending to customer demand, different physical and virtual resources are **dynamically assigned and reassigned**.
- There is no longer need to know **the exact location of the provided resource**.

# Characteristics of Cloud Computing

## Measured Service

- Cloud computing customers are able to **keep track of their resources usage**.
- Cloud computing service providers can **charge customers only based on the resources used**.
- It might be possible to **setup alert or warning** message based on your service usage
- It even add **automatically shutdown** your service after a certain amount of usage.



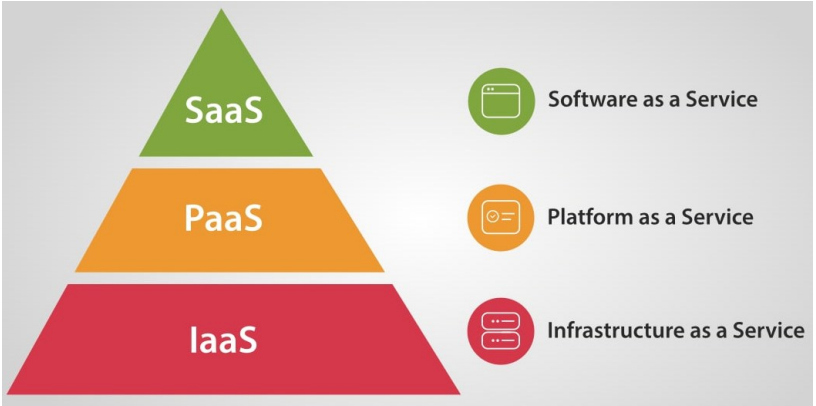
Cloud Computing and AWS

# Cloud Computing Service Model

# Cloud Computing Service Model

- There are typically **three primary service models** in cloud computing:
  - **Software as a Service**
  - **Platform as a Service**
  - **Infrastructure as a Service**
- Cloud computing service providers often describe their **particular products with other names**:
  - Storage as a Service
  - Database as a Service
  - Backup as a Service
  - Communication as a Service
  - Process as a Service

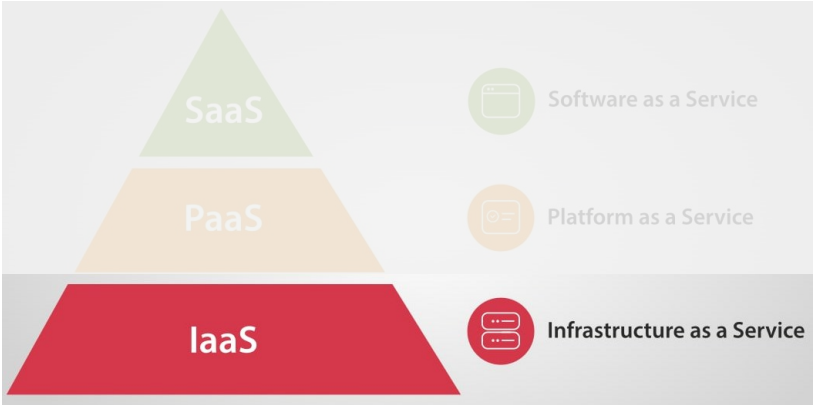
...




*Source: Litslink*

# Infrastructure as a Service (IaaS)

- **IaaS** allows a customer almost **complete IT resource control** including hardware, network, operating systems and other IT resources such as applications, programming languages, database, storage, etc.
- IaaS is sometimes referred to as **Hardware as a Service**.
- IaaS requires a customer to **configure and maintain IT resources for their own use**.
- IaaS level is typically **for system administrators** or **enterprise planners**.




*Source: Litslink*

DigitalOcean

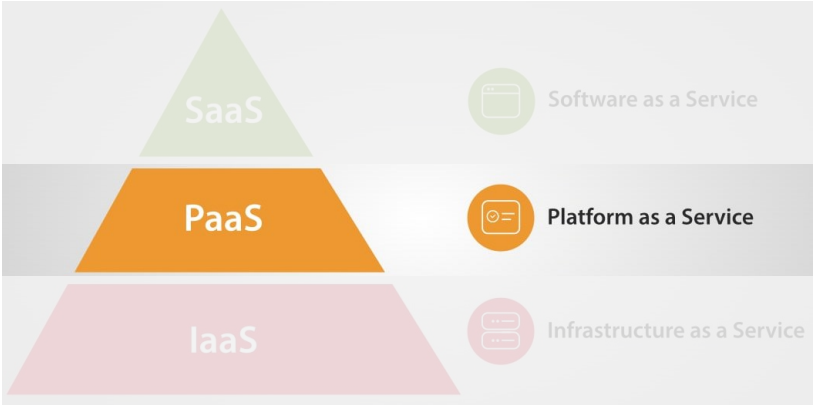
Microsoft Azure

Google Compute Engine

amazon web services™ EC2

# Platform as a Service (PaaS)

- **PaaS** provides a **pre-defined 'ready to use'** environment to a customer, which is already deployed and configured IT resource.
- PaaS **supports all the computing software** such as operating system, database, web server, programming environment.
- PaaS customers only log in to use the platform to **develop and deploy their applications through an interface**.
- PaaS level is typically for **application developers**.




*Source: Litslink*

Google App Engine

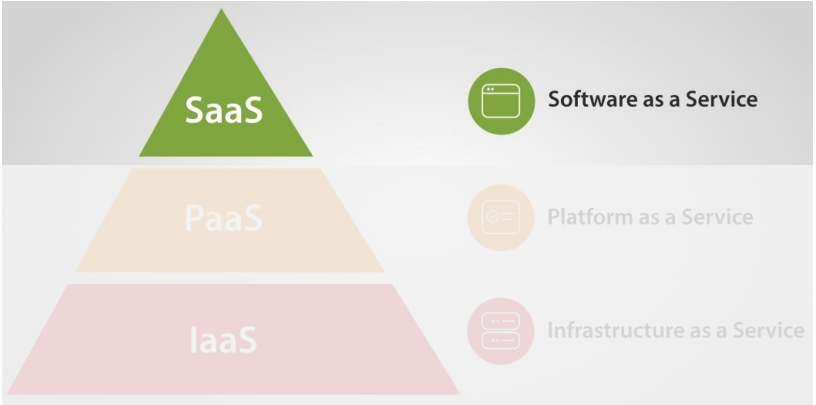
Microsoft Azure

AWS Elastic Beanstalk

force.com™ platform as a service

# Software as a Service (SaaS)

- **SaaS** provides **various software applications** including email, word, excel, calendar, etc.
- SaaS is **available through a web browser** or very **thin client**.
- SaaS products are generally **pre-built without significant customisation**.
- SaaS **provides all maintenance**, including patch and update.
- Sass is typically for **end users**.




*Source: Litslink*

CONCUR

Google Apps

Microsoft® Office 365

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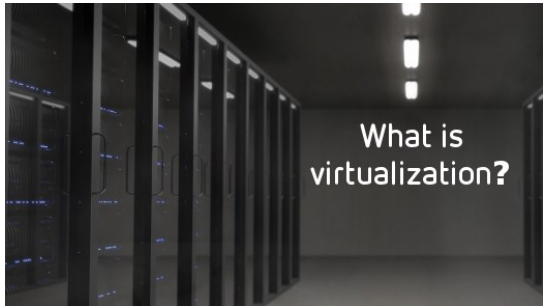
Cloud Computing and AWS

# Virtualisation

# Virtualisation

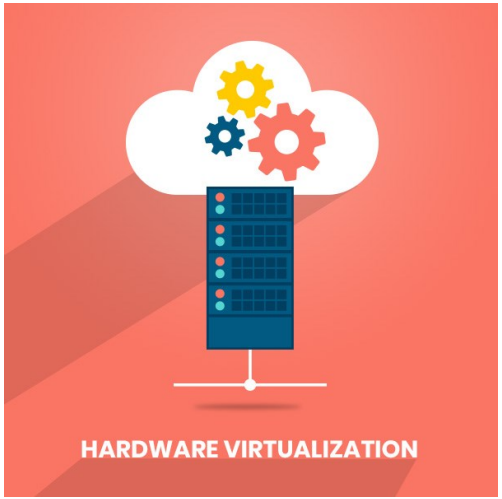
- **Virtualisation** plays a very important role in the cloud technology normally in the cloud computing such as users **share the data** in the clouds and also **share the infrastructure** with the help of virtualisation.
- Virtualisation is **the creation of a virtual version** of something which can be server, desktop, storage, operating system, network resource, etc.
- Virtualisation **allows to share a single physical instance of a resource** or an application among multiple customers and organisation.
- **A virtual machine** using virtualisation techniques provides **an environment that is logically separated** from hardware.
- The machine on which the virtual machine is going to create is known ad **Host Machine** and that virtual machine is referred as **Guest Machine**.




*Source: Opensource.com*

# Virtualisation – Hardware Virtualisation

- Hardware virtualisation is **the virtualisation of hardware computing platform** as complete hardware platforms, certain logical abstractions of hardware, or only the functionality required to run various operating systems.
- Hardware virtualisation **hides the physical characteristics** of a computing platform from the users, presenting instead an abstract computing platform.
- It is **mainly done for the server platforms** because controlling virtual machines is **much easier than controlling a physical server**.
- The **virtual machine software** or **virtual machine manager** or **hypervisor software** is installed on the hardware for hardware virtualisation to control hardware resources.
- After virtualisation of hardware system, we can install **different operating system** on it and run **different applications**.




*Source: Veritis Group Inc*

# Virtualisation – Hardware Virtualisation Advantages

## More efficient resource utilisation

- **Physical resources can be shared** among virtual machine. The unused resources can be allocated to a virtual machine and be used by other virtual machines if the need exists.

## Lower overall costs

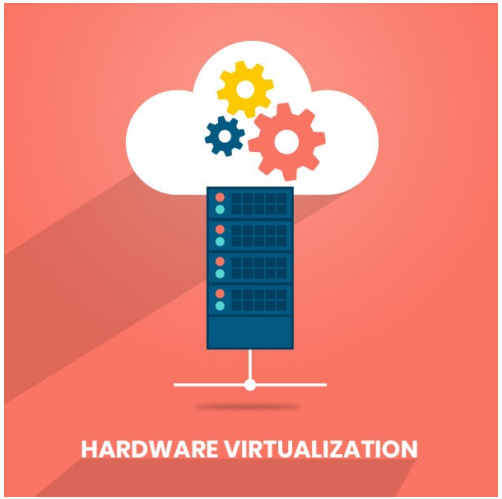
- Multiple operating systems can co-exist on a single hardware platform. **The servers, space, and power consumption drops significantly**.

## Increased uptime

- The modern hypervisors provide **highly orchestrated operations** that maximise the abstraction of the hardware and **help to ensure the maximum uptime**.

## Increased IT flexibility

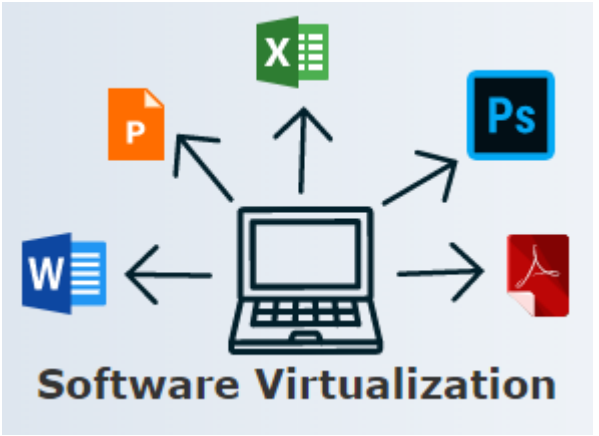
- Hardware virtualisation **helps for quick deployment of server resources** in a managed and consists ways. This **provides the business with resources needed in good time**.




*Source: Veritis Group Inc*

# Virtualisation – Software Virtualisation

- **Managing applications and distribution** becomes a typical task for IT department.
- **Installation mechanism differs** depending on applications
- For example, some applications **require certain frameworks** and these applications may have **conflict with existing applications**.
- Software virtualisation is just like a virtualisation but **able to abstract installation procedure** and **create virtual software installations**.
- **Virtualised software** is an application that will be **installed into its own self-contained unit**.
- Examples of software virtualisation tools is **VMWare**, **Virtual Box**, **Docker**, etc.




*Source: eduCBA*

# Virtualisation – Software Virtualisation Advantages

## Client deployments become easier

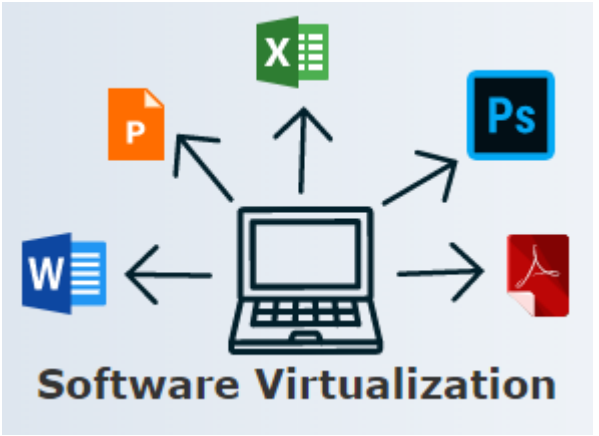
- It **is easy to install virtualised software** by copying a file to a workstation or linking a file in a network.

## Easy to manage

- Managing software updates becomes a simpler task. You may need to **update at one place** and **deploy the updated virtual application to the all clients**.

## Software migration

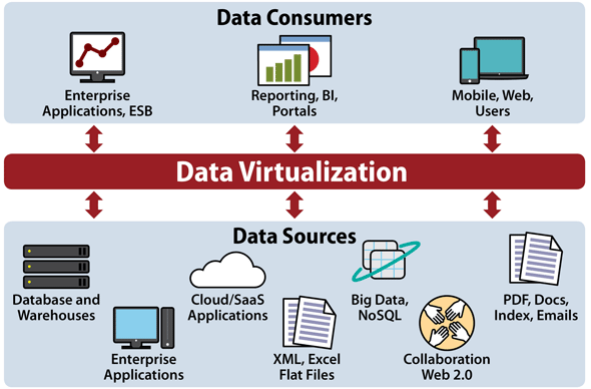
- Without software virtualisation, **moving from one software platform to another platform takes much time** for deploying and impact on end user systems.
- With the help of virtualised software environment, **the migration becomes easier**.




*Source: eduCBA*

# Virtualisation – Data Virtualisation

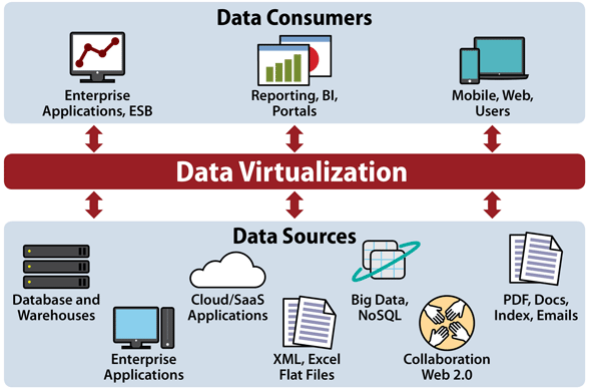
- Data virtualisation is an approach to data management that allows an application to **retrieve and manipulate data without technical details about the data**, such as how it is formatted at source, or where it is physically located.
- It **collects different types of data from different resources** and **allows users across the organisation to access the data** according to their work requirements.
- The data can be **accessed using any application** such as web portals, web services, E-commerce, Software as a Service, and mobile application.
- Data virtualisation can **reduce the risk of data errors**, **the risk of the workload moving data**.
- **Various abstraction and transformation techniques are used** to resolve differences in source, formats, and semantics.




*Source: Datamation*

# Virtualisation – Data Virtualisation Advantages

- The advantages of data virtualisation are:
  - Allows users to access the data **without worrying about where it resides** on the memory.
  - Provides **various security mechanism** that allows users to safely store their personal and professional information.
  - Reduces costs by **removing data replication**.
  - Provides **a user-friendly interfaces** to developer as customised views.
  - Provides **various simple and fast deployment resources**.
  - Increase business user efficiency by **providing data in real-time**.
  - Is **used in various fields**, including business intelligence, service-oriented architecture data services, enterprise search, and cloud computing.
  - Offers **better customer satisfaction**, **retention**, and **revenue growth**.




*Source: Datamation*

# Virtualisation – Data Virtualisation Usage

## Communication & Technology

- Data virtualisation is used, e.g., to increase revenue per customer, create a real-time operational data store for marketing, manage customers, improve customer insights, optimise customer care, etc.

## Finance

- Data virtualisation is used, e.g., to improve trade reconciliation, empowering data democracy, addressing data complexity, and managing fixed-risk income.

## Healthcare

- Data virtualisation helps, e.g., to improve patient care, drive new product innovation, and provide more efficient claims analysis.

## Manufacturing

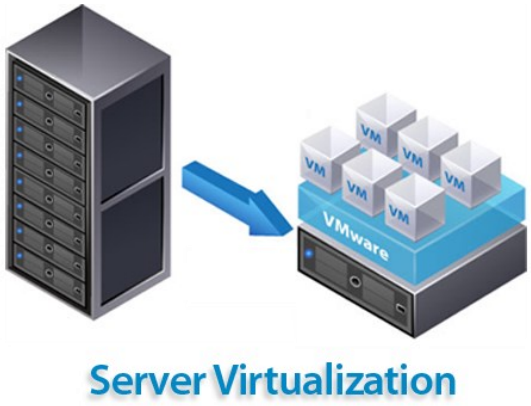
- Data virtualisation is used, e.g., to optimise a global supply chain, optimise factories and improve IT assets utilisation.

## Government

- Data virtualisation is used, e.g., to share data between organisation, protect data.

# Virtualisation – Server Virtualisation

- Server virtualisation is **the process of dividing a physical server into several virtual servers**, called virtual private server.
- Each virtual private server can be **run independently**.
- The concept of server virtualisation widely is used in the IT infrastructure **to minimise the costs by increasing the utilisation of existing resources**.
- It **reduces redundancy** without purchasing additional hardware component.
- Server virtualisation is common to use **in the testing and development environment**.
- However, when the main **physical server goes offline**, all the virtual servers hosted by **the server will also go down**. It must consider **fault tolerant mechanism** such secondary server.




*Source: Vents Magazine*

# Virtualisation – Server Virtualisation Advantages

## Independent Restart

- Each server can **restart independently** and does **not affect the working of other** virtual servers.

## Low Cost

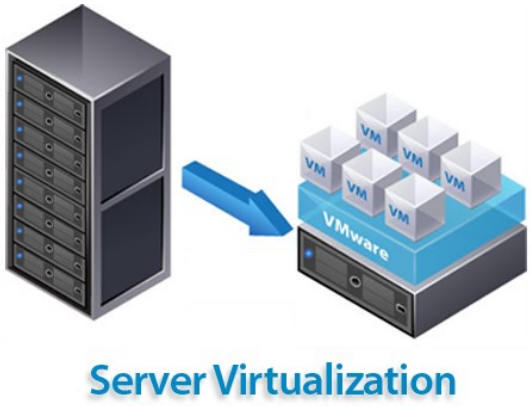
- Server virtualisation can **divide a single server into multiple** virtual private servers, so it reduces the cost of hardware component.

## Disaster Recovery

- In server virtualisation, data can easily and **quickly move from one server to another** and these data can be stored and retrieved from anywhere

## Faster Deployment of Resources

- Server virtualisation allows to **deploy resources in a simpler and faster** way.




*Source: Vents Magazine*

Cloud Computing and AWS

# Cloud Service Providers

# Cloud Service Provider

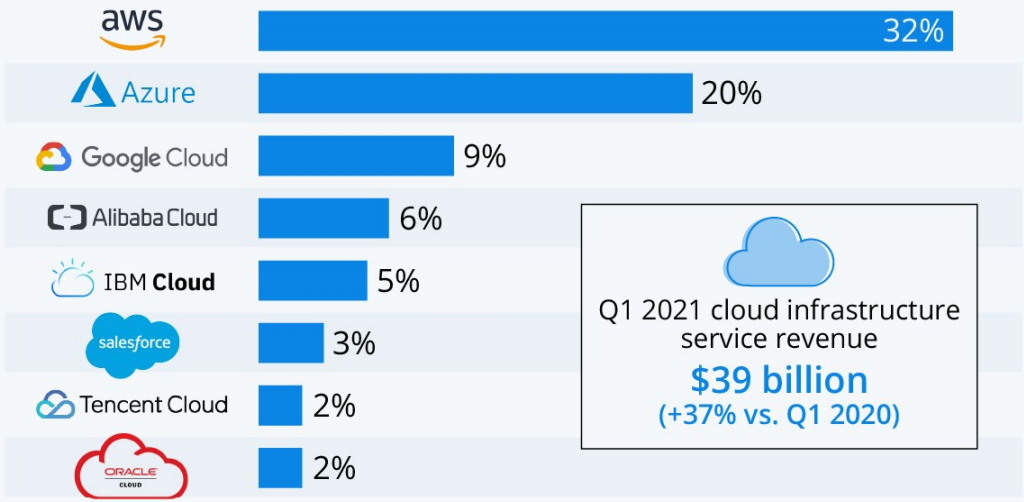
- Cloud service providers **offer various services** such as software as a service, platform as a service, infrastructure as a service, network services, business applications, mobile applications, and infrastructure in cloud.
- The cloud service providers **host these services** in a data centre, and users can **access these services** through cloud provider companies **using an Internet connection**.
- There are the following cloud service provider companies:
  - Amazon Web Services (AWS)
  - Microsoft Azure
  - Google Cloud Platform
  - Salesforce
  - Alibaba Cloud
  - IBM Cloud Services


*Source: eduCBA*

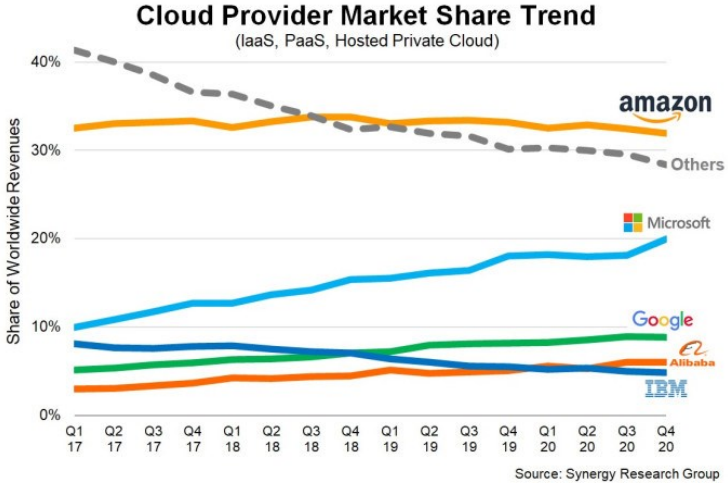
# Cloud Service Provider Market

## Amazon Leads $150-Billion Cloud Market

Worldwide market share of leading cloud infrastructure service providers in Q1 2021*




Source: Statista




Source: TechCrunch

# Cloud Service Provider – Amazon Web Services

- **Amazon Web Services (AWS)** is a comprehensive cloud platform by e-commerce giant **Amazon**.
- AWS provides cloud services **from multiple availability zones** (AZs) spread across **regions of the world**.
- Each AZ contains one or more data centres and customers can **setup virtual machines and replicate their data** in multiple AZs in order to **have a highly resilient system**.
- AWS is **scalable** because it has an ability to scale the computing resources up or down **according to the organisation's demand**.
- AWS is **cost effective** as it works on a **pay-as-you-go pricing model**.
- The major AWS product categories: **Compute**, **Storage**, **Data management**, **Networking**, **Monitoring**, **Migration to AWS, Machine Learning, Databases,** etc.

# Cloud Service Provider – Microsoft Azure

- **Microsoft Azure** is a cloud computing service created by **Microsoft** for building, testing, deploying, and managing applications and services.
- Azure uses large-scale virtualisation at Microsoft data centres worldwide and it **offers more than 600 services**.
- Azure is **scalable** because it has an ability to scale the computing resources up or down **according to the organisation's demand**.
- Azure is **cost effective** as it works on a **pay-as-you-go pricing model**.
- The major Azure product categories: **Compute**, **Networking**, **Storage**, **Mobile**, **Databases**, **Web**, **Internet of Things**, **Big Data**, **AI**, **DevOps**, etc.

# Amazon Web Services

### Compute
- **EC2** — Virtual Servers in the Cloud
- **EC2 Container Service** — Run and Manage Docker Containers
- **Elastic Beanstalk** — Run and Manage Web Apps
- **Lambda** — Run Code in Response to Events

### Storage & Content Delivery
- **S3** — Scalable Storage in the Cloud
- **CloudFront** — Global Content Delivery Network
- **Elastic File System** — Fully Managed File System for EC2
- **Glacier** — Archive Storage in the Cloud
- **Snowball** — Large Scale Data Transport
- **Storage Gateway** — Hybrid Storage Integration

### Database
- **RDS** — Managed Relational Database Service
- **DynamoDB** — Managed NoSQL Database
- **ElastiCache** — In-Memory Cache
- **Redshift** — Fast, Simple, Cost-Effective Data Warehousing
- **DMS** — Managed Database Migration Service

### Networking
- **VPC** — Isolated Cloud Resources
- **Direct Connect** — Dedicated Network Connection to AWS
- **Route 53** — Scalable DNS and Domain Name Registration

### Developer Tools
- **CodeCommit** — Store Code in Private Git Repositories
- **CodeDeploy** — Automate Code Deployments
- **CodePipeline** — Release Software using Continuous Delivery

### Management Tools
- **CloudWatch** — Monitor Resources and Applications
- **CloudFormation** — Create and Manage Resources with Templates
- **CloudTrail** — Track User Activity and API Usage
- **Config** — Track Resource Inventory and Changes
- **OpsWorks** — Automate Operations with Chef
- **Service Catalog** — Create and Use Standardized Products
- **Trusted Advisor** — Optimize Performance and Security

### Security & Identity
- **Identity & Access Management** — Manage User Access and Encryption Keys
- **Directory Service** — Host and Manage Active Directory
- **Inspector** — Analyze Application Security
- **WAF** — Filter Malicious Web Traffic
- **Certificate Manager** — Provision, Manage, and Deploy SSL/TLS Certificates

### Analytics
- **EMR** — Managed Hadoop Framework
- **Data Pipeline** — Orchestration for Data-Driven Workflows
- **Elasticsearch Service** — Run and Scale Elasticsearch Clusters
- **Kinesis** — Work with Real-Time Streaming Data
- **Machine Learning** — Build Smart Applications Quickly and Easily

### Internet of Things
- **AWS IoT** — Connect Devices to the Cloud

### Game Development
- **GameLift** — Deploy and Scale Session-based Multiplayer Games

### Mobile Services
- **Mobile Hub** — Build, Test, and Monitor Mobile Apps
- **Cognito** — User Identity and App Data Synchronization
- **Device Farm** — Test Android, iOS, and Web Apps on Real Devices in the Cloud
- **Mobile Analytics** — Collect, View and Export App Analytics
- **SNS** — Push Notification Service

### Application Services
- **API Gateway** — Build, Deploy and Manage APIs
- **AppStream** — Low Latency Application Streaming
- **CloudSearch** — Managed Search Service
- **Elastic Transcoder** — Easy-to-Use Scalable Media Transcoding
- **SES** — Email Sending and Receiving Service
- **SQS** — Message Queue Service
- **SWF** — Workflow Service for Coordinating Application Components

### Enterprise Applications
- **WorkSpaces** — Desktops in the Cloud
- **WorkDocs** — Secure Enterprise Storage and Sharing Service
- **WorkMail** — Secure Email and Calendaring Service

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## Over 200 Services

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# Amazon Web Services – Certification

## Professional

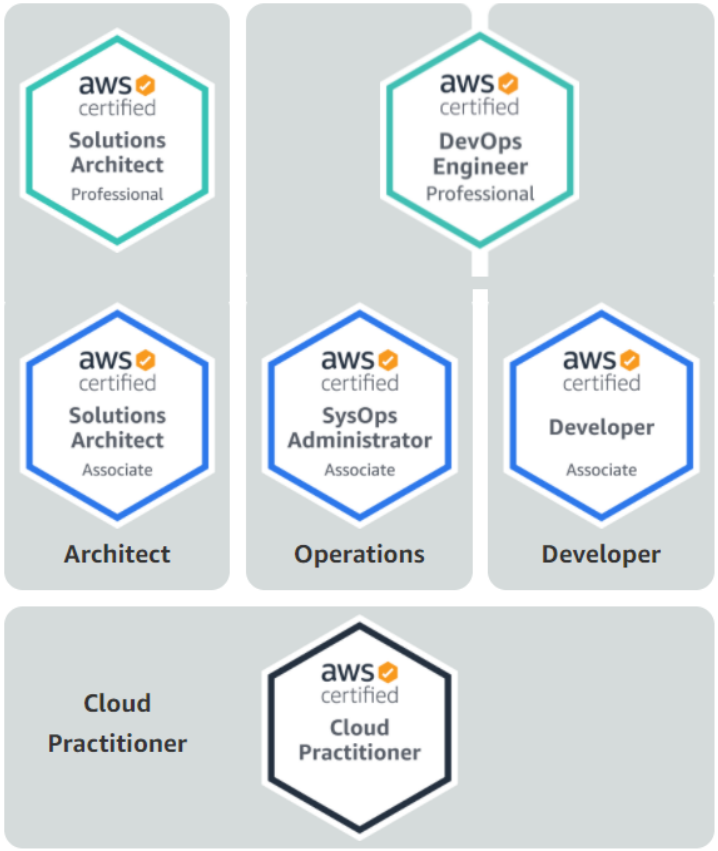
**Two years** of comprehensive experience designing, operating, and troubleshooting solutions using the AWS Cloud

## Associate

**One year** of experience solving problems and implementing solutions using the AWS Cloud

## Foundational

**Six months** of fundamental AWS Cloud and industry knowledge




## Specialty

Technical AWS Cloud experience in the Specialty domain as specified in the **exam guide**

Cloud Computing and AWS

# Amazon Web Services

# Amazon Web Services – EC2

- **Amazon Elastic Compute Cloud (EC2)** is a web service that provides secure, resizable **compute capacity in the cloud**.
- **EC2's simple web service interface** allows to obtain and configure capacity with minimal friction.
- EC2 offers the broadest and deepest compute platform with choice of **processor**, **storage**, **networking**, **operating system**, and **purchase model**.
- EC2 provides **reliable, scalable, infrastructure on demand** by increasing and decreasing capacity within minutes not hours or days.
- EC2 provides **secure compute for application** by supporting 89 security standards and compliance certification including PCI-DCS, HIPAA/HITECH/ FedRAMP, GDPR, etch.
- EC2 provides **flexible options to optimise cost** by paying only the computer you need.

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Amazon EC2

# Amazon Web Services – Elastic Beanstalk

- **AWS Elastic Beanstalk** is an easy to use service for **deploying and scaling web applications and services**.
- It supports **various languages** such as Java, .NET. PHP, Node JS, Python, Ruby, Go, and **servers running on docker** such as Apache, Nginx, Passenger, and IIS.
- Elastic Beanstalk is **the fastest and simplest way to deploy** an application on AWS as customers (typically developers) can simply upload the application code. Then, Elastic Beanstalk **automatically handles the deployment**.
- Elastic Beanstalk operates the infrastructure and manages the application stack for customers. So, **there is no deed to spend the time or develop the expertise**.
- There is no additional charge for Elastic Beanstalk and so customers can **pay only for the AWS resources needed to store and run** the applications.


Amazon Beanstalk

# Amazon Web Services – S3

- **Amazon Simple Storage Service (S3)** is an object storage service that offers **scalability**, **data availability**, **security**, and **performance**.
- Customers of all sizes and industries can **use S3 to store and protect any amount of data** for a ranges of use cases.
- The cases includes data lakes, websites, mobile applications, backup and restore, archive, enterprise applications, IoT devices and big data analytics.
- It is **designed for 99.999999999% (11 9's) of durability** and stores data for millions of applications for companies all around the world.
- It **saves costs without sacrificing performance** by storing data across the S3 Storage Classes, which **support different data access levels at corresponding rates** such as S3 Standard, S3 Intelligent-IA, S3 Glacier, etc.
- S3 gives **robust capabilities to manage access, cost, replication and data protection** using S3 Access Points.


Amazon
S3

# Amazon Web Services – Lambda

- **AWS Lambda** is a **serverless computer service** that lets customers run code without provisioning or managing servers.
- With Lambda, customers can **run code for virtually any type of application** or **backend service** by uploading their code as a ZIP file or container image
- Lambda **automatically allocates computer execution power** and runs the code based on the incoming request or event for any scale of traffic.
- Customers can **write Lambda functions in any favourite language** (Node JS, Python, Go, Java, and more) and use both serverless and container tools such as Docker CLI.
- AWS Lambda **automatically scales customers' application** by running code in response to each event.
- With AWS Lambda, customers **only pay for the compute time**, so, customers are never paying for over-provisioned infrastructure.


Amazon Lambda

# Amazon Web Services – RDS

- **Amazon Relational Database Service (RDS)** makes it easy to set up, operate, and scale a relational database in the cloud.
- It **provides cost-effective and resizable capacity** while automating time-consuming administration takes such as hardware provisioning, database setup, patching and backups.
- RDS **frees customers to focus on their applications** so customers can give the fast performance, high availability, security and compatibility.
- RDA is **available on several database instance types** including Amazon Aurora, PostgreSQL, MySQL, MariaDB, Oracle Database, and SQL Server.
- Customers can **use the AWS Database Migration Service** to easily migrate or replicate the existing database to Amazon RDS.
- Customers **pay very low rates and only for the resources customers consume**.

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Amazon RDS

# Amazon Web Services – SNS

- **Amazon Simple Notification Service (Amazon SNS)** is a fully managed **messaging service** for both application-to-application (A2A) and application-to-person (A2P) communication.
- The A2A functionality **provides high-throughput, push-based, many-to-many messaging** between distributed systems, microservices, and event-driven serverless application.
- The A2P functionality enables to send messages or notifications to users at scale via **SMS**, **mobile push**, and **email**.
- Amazon SNS enables to **decouple applications into smaller, independent components** that are easier to develop, deploy and maintain.
- Amazon SNS is designed to **handle burst traffic patterns and enables customers to send millions of messages** per second.
- Amazon SNS has **no upfront costs**. Customers pay based on the number of messages, notifications and any additional API calls.

# Amazon Web Services – CloudFront

- **Amazon CloudFront** is a **fast content delivery network (CDN) service** that securely delivers data, videos, applications, and APIs to customers globally with low latency and high transfer speeds.
- Content delivery networks **provide a globally distributed network of proxy servers** that **cache content** to **improve access** for downloading the content.
- CloudFront **offers the most advanced security capabilities** including **field level encryption and HTTPS support** to protect against multiple types of attacks such as DDoS attacks.
- CloudFront is used by customers like Tinder and Slack **to secure and accelerate API calls** as well as **Websocket connections**.
- Amazon CloudFront is **integrated with AWS services** such as Amazon S3, Amazon EC2, Elastic Load Balancing, Amazon Route 53, and AWS Elemental Media Services for easy setup.


**Amazon CloudFront**

# Amazon Web Services – Auto Scaling

- **Amazon Auto Scaling** monitors customers' applications and **automatically adjusts capacity** to maintain steady, predictable performance at the lowest possible cost.
- Using Amazon Auto Scaling, it is **easy to setup application scaling for multiple resources across multiple service** in minutes.
- Amazon Auto Scaling **provides a simple, powerful user interface** that lets customers build scaling plans for resources.
- Amazon Auto Scaling is **available at no additional charge**. Customers pay only for the AWS resources needed to run applications and monitoring fee if it is used.
- For example, if your application uses Amazon EC2 and Amazon DynamoDB, you can **use AWS Auto Scaling to manage resource** provisioning for all of the EC2 Auto Scaling groups and database tables in your applications.

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**Amazon Auto Scaling**

# Amazon Web Services – VPC

- **Amazon Virtual Private Cloud (VPC)** is a service that lets customers **launch AWS resources in a locally isolated** virtual network defined.
- Then, customers have **complete control over the virtual networking environment**, including selection of own IP address range, creation of subnets, and configuration of route tables and network gateways.
- VPC lets customers to **use multiple layers of security**, including security groups and network access control lists to help control access to Amazon resources.
- With Amazon VPC's simple set-up, customers **spend less time setting up, managing, and validating**, so customers can concentrate on building the application that run in their VPCs.

# Amazon Web Services – IAM

- Amazon identify an Access Management (IAM) **enables customers to manage access** to AWS services and resource securely.
- Using IAM, you can **create and manage AWS users and groups, and use permissions** to allow and deny their access to AWS resources.
- IAM is a feature of your AWS account offered at **no additional charge**. It will be **charged only for use of other AWS services by your users**.
- IAM also enables to **add specific conditions** such as times of day to control how a user can use AWS, their originating IP address, whether they are using SSL, or whether they have authenticated with a multi-factor authentication device.




**Amazon IAM**

# Amazon Web Services – DynamoDB

- **Amazon DynamoDB** is a **key-value and document database** that delivers single-digit millisecond performance at any scale.
- DynamoDB can **handle more than 10 trillion requests** per day and can **support peaks of more than 20 million requests** per second.
- **Hundreds of thousands of AWS customers** such as Airbnb, Samsung, Toyota, and Capital One have chosen DynamoDB as their key-value and document database for mobile, web, gaming, ad tech, IoT and other applications.
- DynamoDB **automatically scales tables up and down** to adjust for capacity and maintain performance.
- DynamoDB **provides both provisioned and on-demand capacity modes** so that customers **can optimise costs** by specifying capacity per workload, or paying for only the resources they consume.
- DynamoDB **supports ACID transaction** to enable customers to **build business-critical applications** at scale.


Amazon DynamoDB

# Amazon Web Services – CloudWatch

- **Amazon CloudWatch** is a **monitoring and observability service** built for DevOps engineers, developers, site reliability engineers and IT managers.
- CloudWatch provides **customers with data and actionable insights** to **monitor** their applications, **respond** to system-wide performance changes, **optimise** resource utilisation.
- CloudWatch **collects monitoring and operational data** in the form of **logs**, **metrics**, and **events**, providing a unified view of AWS resource, applications, and services that run on AWS.
- Customers can use CloudWatch to:
  - **Detect anomalous behaviour** in their environments
  - **Set alarms** and take automated actions
  - **Visualise logs** and metrics side by side
  - **Discover insights** to keep their applications running on smoothly.


**Amazon CloudWatch**

# Amazon Web Services – Lambda

- **Amazon FreeRTOS** is open source, real-time operating system for microcontrollers.
- It makes small, low-power edge devices easy to **program, deploy, secure, connect, and mange**.
- Distributed freely under the MIT open source license, FreeRTOS **include a kernel and a growing set of software libraries** suitable for use across industry sectors and applications.
- The FreeRTOS kernel is **trusted by world-leading companies** as the de facto standard for microcontrollers and small microprocessors with proven robustness, tiny footprint, and wide device support.
- With FreeRTOS, small, low-power devices **are easily allowed to connect AWS Cloud service** such as AWS IoT Core, AWS IoT Greengrass, etc.
- The FreeRTOS offers feature stability with **long term support release**.



**Amazon freeRTOS**

Cloud Computing and AWS

# AWS – Free Tier

# AWS Free Tier

- **The AWS Free Tier** provides customers the ability to explore and try out **AWS services free of charge up** to **specified limits** for each service.
- The Free Tier is comprised of three different types of offerings, a **12-month Free Tier**, an **Always Free offer**, and **short term trials**.
- Services with a 12-month Free Tier allow customers to **use the product for free up to specified limits for one year** from the date the account was created.
- Services with a Always Free offer allow customers to use the product for **free up to specified limits as long as they are an AWS customer**.
- Services with a short term trials are fee to use for **a specified period of time or up a one-time limit** depending on the service selected.

# AWS Free Tier

- The AWS Free Tier is **available to all types of customers** such as students, entrepreneurs, small businesses, etc.
- When your free usage expires, you simply pay **standard, pay-as-you-go service rates**.
- To avoid charges while on the AWS Free Tier, you must **keep your usage below the AWS Free Tier limits**.
- You can track AWS Free Trier usage and **set a billing alarm** to notify you **if you start incurring charges**.
- If you don’t use the full benefits provided by the AWS Free Tier in a given month, the benefits **don’t roll over to the next month**.

# AWS Free Tier – Services ( 1 )

## COMPUTE

Free Tier — 12 MONTHS FREE

### Amazon EC2

**750 Hours**

per month

Resizable compute capacity in the Cloud.

**750 hours** per month of Linux, RHEL, or SLES t2.micro or t3.micro instance dependent on region

**750 hours** per month of Windows t2.micro or t3.micro instance dependent on region

## DATABASE

Free Tier — 12 MONTHS FREE

### Amazon RDS

**750 Hours**

per month of db.t2.micro database usage (applicable DB engines)

Managed Relational Database Service for MySQL, PostgreSQL, MariaDB, Oracle BYOL, or SQL Server.

**750 Hours** per month of db.t2.micro database usage (applicable DB engines)

**20 GB** of General Purpose (SSD) database storage

**20 GB** of storage for database backups and DB Snapshots

## STORAGE

Free Tier — 12 MONTHS FREE

### Amazon S3

**5 GB**

of standard storage

Secure, durable, and scalable object storage infrastructure.

**5 GB** of Standard Storage

**20,000 Get Requests**

**2,000 Put Requests**

# AWS Free Tier – Services ( 2 )

**DATABASE**

Free Tier — ALWAYS FREE

## Amazon DynamoDB

**25 GB**

of storage

Fast and flexible NoSQL database with seamless scalability.

- **25 GB** of Storage
- **25** provisioned Write Capacity Units (WCU)
- **25** provisioned Read Capacity Units (RCU)

Enough to handle up to 200M requests per month.

**MOBILE**

Free Tier — ALWAYS FREE

## Amazon SNS

**1 Million**

publishes

Fast, flexible, fully managed push messaging service.

- **1,000,000 Publishes**
- **100,000 HTTP/S Deliveries**
- **1,000 Email Deliveries**

**SECURITY, IDENTITY, & COMPLIANCE**

Free Tier — FREE TRIAL

## Amazon GuardDuty

**30 Days**

Free Trial

Intelligent threat detection and continuous monitoring to protect your AWS accounts and workloads.

30-day Free Trial

# AWS Free Tier – Services ( 3 )

## DEVELOPER TOOLS

Free Tier — ALWAYS FREE

### Amazon CloudWatch

**10**

custom metrics and alarms

Monitoring for AWS cloud resources and applications.

**10 Custom Metrics and 10 Alarms**

**1,000,000 API Requests**

**5GB of Log Data Ingestion and 5GB of Log Data Archive**

**3 Dashboards with up to 50 Metrics Each per Month**

## MOBILE

Free Tier — 12 MONTHS FREE

### Amazon API Gateway

**1 Million**

API Calls Received per month

Publish, maintain, monitor, and secure APIs at any scale.

**1 Million API Calls Received** per month

## DESKTOP & APP STREAMING

Free Tier — FREE TRIAL

### Amazon AppStream 2.0

**40 Hours**

per month use of the stream.standard.large instance type when using Image Builder

Stream desktop applications securely to a browser.

**40 hours** per month use of the stream.standard.large instance type when using Image Builder

# AWS Free Tier – Services ( 4 )

## STORAGE

Free Tier — 12 MONTHS FREE

### Amazon CloudFront

**50 GB**

of data transfer out

Web service to distribute content to end users with low latency and high data transfer speeds.

**50 GB** of Data Transfer Out

**2,000,000** HTTP or HTTPS Requests

## MACHINE LEARNING

Free Tier — 12 MONTHS FREE

### Amazon Comprehend

**50 K**

units of text (5M characters) for each API per month

Continuously trained and fully managed natural language processing (NLP).

**50K** units of text (5M characters) for each API per month

**5 Topic Modeling Jobs** up to 1MB each per month for the first 12 months

## MEDIA SERVICES

Free Tier — 12 MONTHS FREE

### Amazon Elastic Transcoder

**20 Minutes**

of audio transcoding

Fully managed media transcoding service.

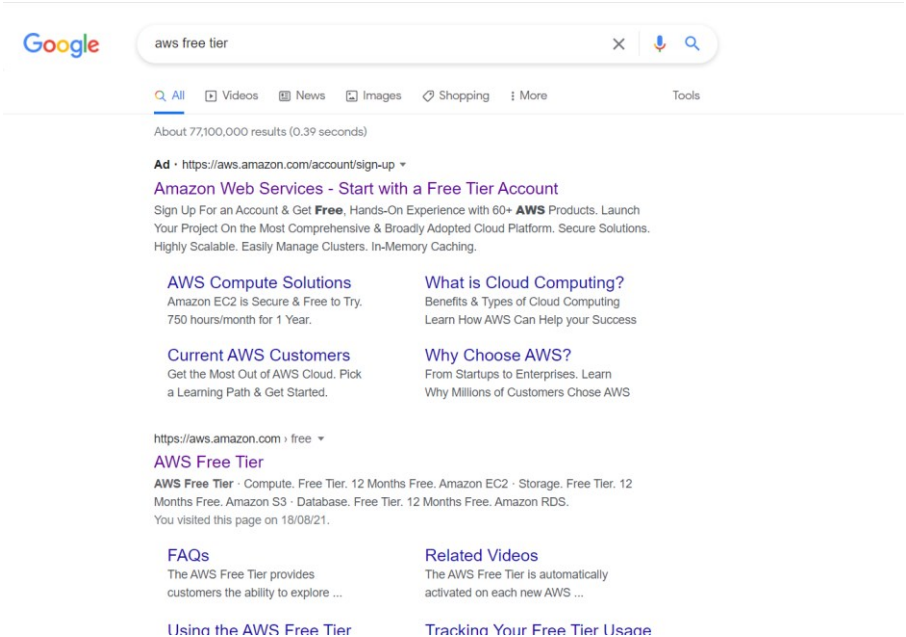
**20 Minutes** of Audio Transcoding

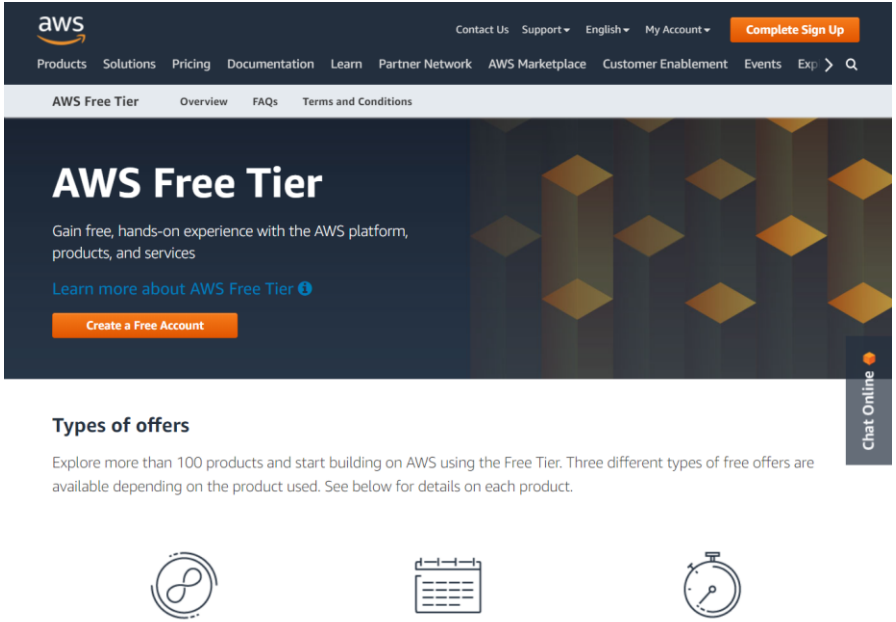
**20 Minutes** of SD Transcoding

**10 Minutes** of HD Transcoding

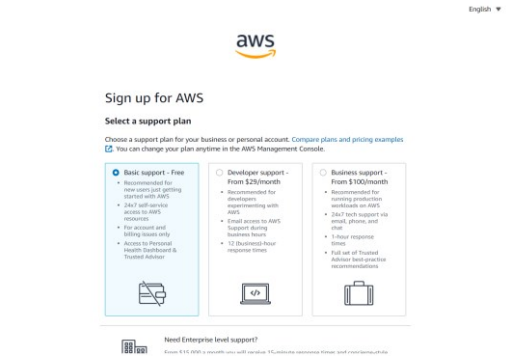
# AWS Free Tier – Demo

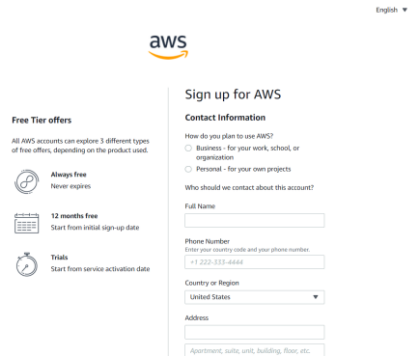
- Search '**aws free tier**' and Click **AWS Free Tier** link

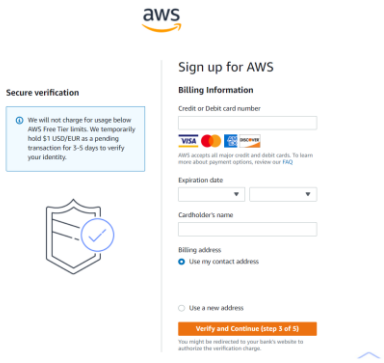


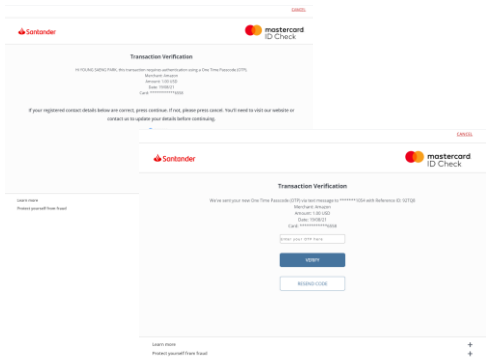



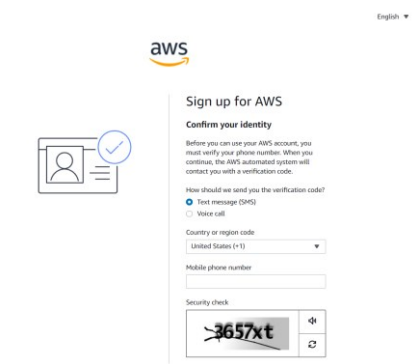
# AWS Free Tier – Create Account ( 1 )



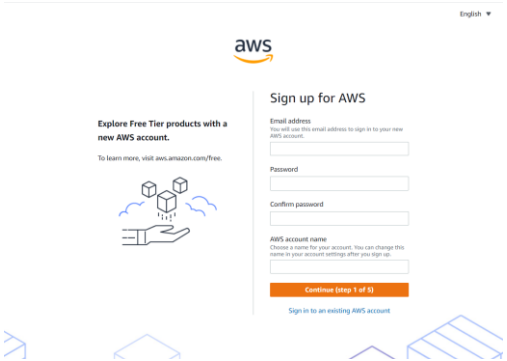



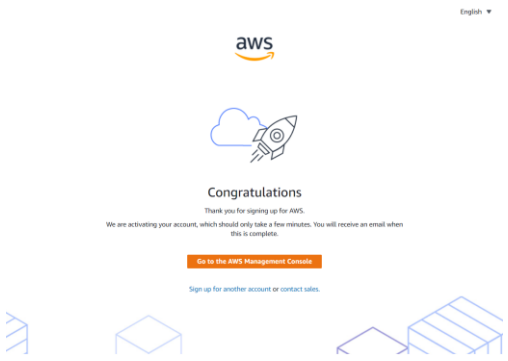



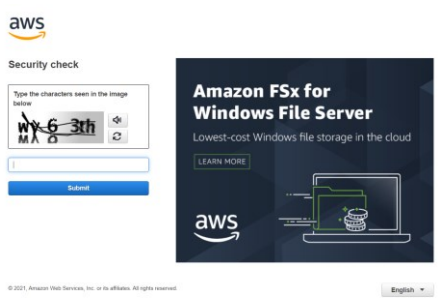



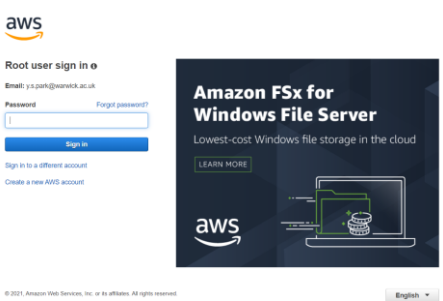

# AWS Free Tier – Create Account ( 2 )

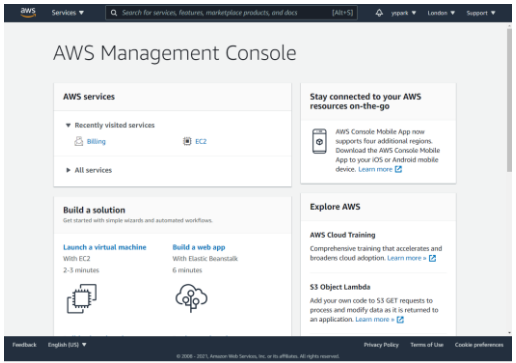




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# AWS Free Tier – AWS Live Demo


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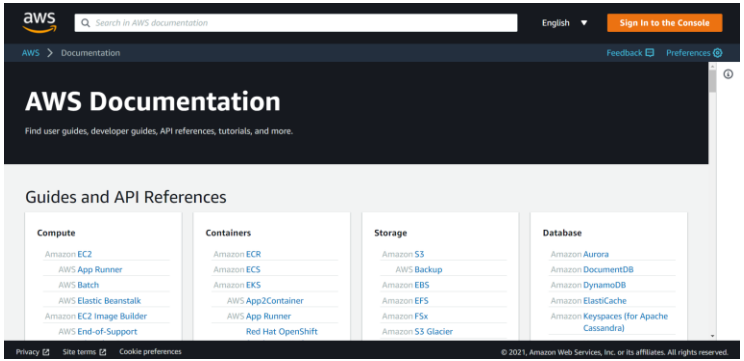
# Summary

- **Cloud computing** enables convenient, **on-demand network access** to a **shared pool** of configurable computing resources that can be **rapidly provisioned and released** with **minimal management effort**.
- The advantages of cloud computing include **cost efficiency**, **unlimited resource**, **easy to backup and restore data**, **improved collaboration**, **faster to market**, **mobility**, **automatic software integration**, **easy to access**, etc.
- The disadvantages of cloud computing might be **no internet no access**, **poor service with low bandwidth**, **vendor lock-in**, **limited control**, etc,
- Cloud computing has several common characteristics including **managed by cloud computing provider**, **on demand self-service**, **broad network access**, **resource polling**, **measured service**, etc.

# Summary

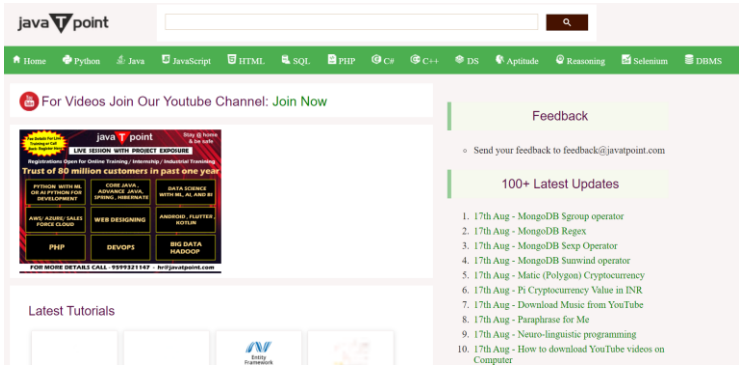
- **Virtualisation** is a technique, which **allows to share** a single physical instance of a resource or an application among multiple customers and organisation.
- There are a number ways of virtualisation including **hardware virtualisation**, **software virtualisation**, **data virtualisation**, **server virtualisation**, etc.
- Cloud service providers offer three primary services **software as a service**, **platform as a service**, **infrastructure as a service**, etc.
- Among cloud service providers, **Amazon Web Service (AWS)** is the world's most comprehensive and broadly adapted cloud platform, **offering over 200 services**.
- **The AWS Free Tier** provides customers the ability to explore and try out **AWS services free of charge up** to **specified limits** for each service.

# MAIN REFERENCE




**AWS Documentation**
AWS

**Computer, Storage, Database, etc**




**javaTpoint**

**Virtualisation**

# 📌 OTHER REFERENCE


- Wikipedia:
  - https://en.wikipedia.org/wiki/Software_engineering
  - https://en.wikipedia.org/wiki/Mobile_app_development
  - https://en.wikipedia.org/wiki/Embedded_software
  - https://en.wikipedia.org/wiki/Data_collection_system
  - https://en.wikipedia.org/wiki/Programming_language_generations
  - https://en.wikipedia.org/wiki/DevOps
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# THANKS!

**Any questions?**

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