**Introduction to the Ultimate AWS Certified Cloud Practitioner – 2022**

**Introduction**

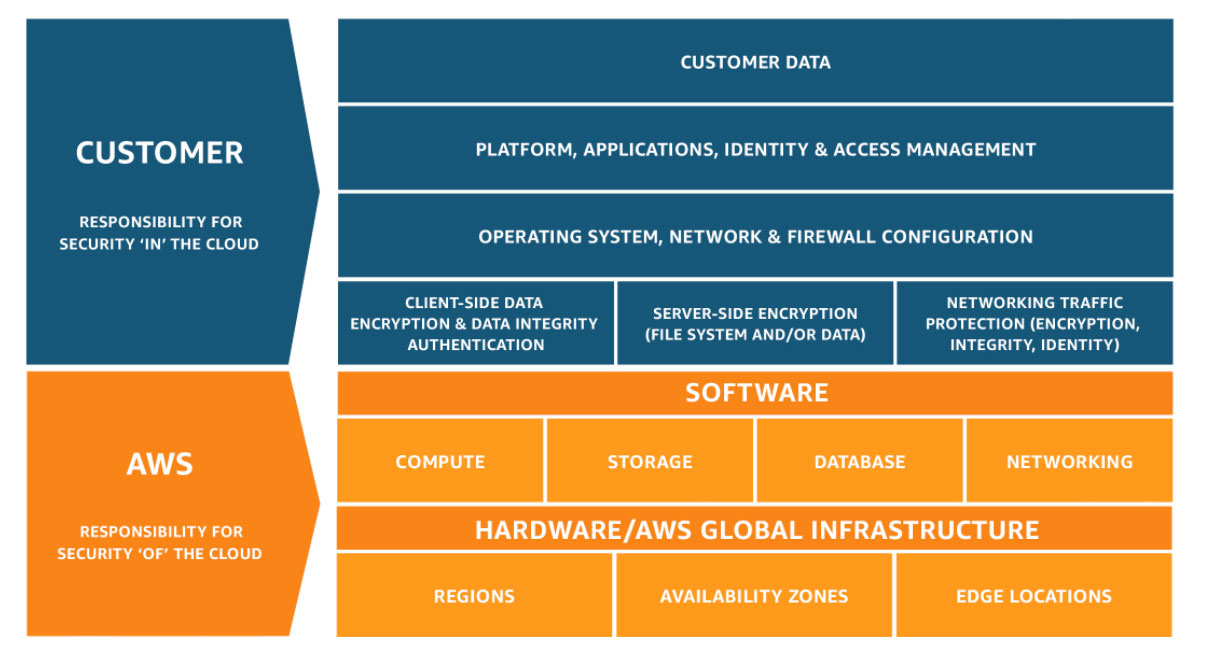
* The course will focus on the core services and will not cover ’‘distractor’ services (There are over 200 services in AWS)
* Create an account and password
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**Traditional IT Overview**

* ***How do websites work ?***
* A server is hosted in a location and contains the data we want. That server connected to a network. Therefore, to connect to the server and to view its data, we connect to the network whom connects to the server.
* The network is able to route your data request to the server and the server’s feedback to you
* For the server to find the client (I am the client) and vice versa. Both parties require IP addresses. The idea of an IP address is that you can send information to a specific server because you are sending it to its unique IP address. Then, once the server is done it can find you using your IP address
* An IP address, or Internet Protocol address, is a series of numbers that identifies any device on a network and send the results to your IP address’s location
* ***What does a server contain ?***
* A CPU (Central Processing Unit), which does the computations
* A RAM (Random Access Memory), which is the short-term memory where data is stored as the processor needs it. It is deleted once the computer is turned off
* Storage, which is the long term memory of a computer. This contains data that is not deleted once the server is turned off
* Database: A place where the data is stored in a structured way. Thus we can perform queries on the data
* Networks, this includes (Routers, Switches, DNS Server)
* Routers, at least the common home network device that is usually called a router, is the piece of network hardware that allows communication between your local home network—like your personal computers and other connected devices—and the internet.
* A router is responsible for organizing communication between computer networks. A router takes data packets from devices and directs them to the right place. Routers often use IP addresses to know where to look for information.
* A router is a networking device that routes data packets between computer networks. A router can connect networked computers to the Internet, so multiple users can share a connection. Routers help connect networks within an organization or connect the networks of multiple branch locations. And a router works as a dispatcher. It directs data traffic, choosing the best route for information to travel across the network, so that it's transmitted as efficiently as possible.
* Switch is a device that operates at the Data Link layer of the OSI model—Layer 2. It takes in packets being sent by devices that are connected to its **physical ports** and sends them out again, but only through the ports that lead to the devices the packets are intended to reach
* In networking, a packet is a small segment of a larger message. Data sent over computer networks\*, such as the Internet, is divided into packets. These packets are then recombined by the computer or device that receives them.
* While a network switch can connect multiple devices and networks to expand the LAN, a router will allow you to share a single IP address among multiple network devices. In simpler terms, the Ethernet switch creates networks and the router allows for connections between networks.
* DNS server (Domain Name System), DNS, or the Domain Name System, translates human readable domain names (for example, www.amazon.com) to machine readable IP addresses (for example, 192.0.2.44).
* ***IT Terminology***
* The Network: Cables, routers, and servers connected with each other
* The Router: A networking device that forwards the data packets between computer networks. They are able to send your data into the internet and know to exactly where to send it too
* The Switch: Takes a packet from the router and sends it to the correct server on your network
* The layout
* The client will send the data to a router. Then the router will send it to a switch. Then the switch will know to switch computers each set of data must go too
* Data Center: A room that is filled with servers
* ***What is cloud computing ?***
* Def: Cloud computing is an on-demand delivery of computing power, data storage, applications, and other IT resources. Through a cloud service platform, Cloud computing follows the “pay-as-you-go-pricing”. Therefore, it does not require users to purchase additional resources more than what they need. Also, cloud computing can dedicate the exact number of resources needed for the applications while providing real time access to all the resources.
* Cloud services examples:
* Gamil -> email cloud service
* Dropbox -> cloud storage service
* Netflix -> cloud storage service for videos on demand
* Types of cloud services
* A good link for the types of cloud computing: https://www.ibm.com/cloud/learn/introduction-to-private-cloud
* 1. Private Cloud
* Used by a single organization only and not by the public. The single organization has full control over this cloud service. However, other organizations still perform the maintenance on the system
* Private cloud (also known as an internal cloud or corporate cloud) is a cloud computing environment in which all hardware and software resources are dedicated exclusively to, and accessible only by, a single customer. Private cloud combines many of the benefits of cloud computing—including elasticity, scalability, and ease of service delivery—with the access control, security, and resource customization of on-premises infrastructure.
* Private clouds are typically hosted on-premises in the customer's data center. But, private clouds can also be hosted on an independent cloud provider’s infrastructure or built on rented infrastructure housed in an offsite data center. Management models also vary—the customer can manage everything itself or outsource partial or full management to a service provider.
* Has more security
* Meets specific business needs
* An example is : rock-space
* 2. Public Cloud
* This is a public service . It is owned and operated by a third part cloud service.
* This cloud service is delivered over the internet
* The most common public cloud services are: Azer, Google cloud, and AWS
* 3. Hybrid Cloud
* This service is a combination between public and private services. This service keeps certain services on premises (like the private cloud service). Some services will be extended over the internet (like the public cloud service)
* Hybrid Cloud should be used when a company would like to benefit from the advantages of the Public Cloud but would like to keep sensitive assets in its own infrastructure.
* Characteristics of Cloud computing
* 1. Able to provide an on-demand service and users have self service
* Users are able to access all the services. Also, users can have full control of the services without the interference of AWS engineers
* In the cloud, everything is self-service.
* 2. Users have access to a broad network
* Resources available over the internet
* Resources can be accessed by many customers’ platforms
* 3. Multi-tenancy and have resources pooling
* Different customers can share the same services such has servers. Meaning that multiple companies can use the same exact server. While still maintaining their independent privacy and security
* 4. Rapid elasticity and scalability
* Automatically and quickly acquire additional resources when needed
* Elastic means ability to scale up when needed and down when needed
* 5. Measured service
* The customers usages are measured. Therefore, customers only pay for what they use
* Advantages of cloud computing against the other cloud services
* 1. Allows users to trade capital expense (CAPEX) for operational expense (OPEX)
* Customers do not own any of the hardware. They only rent the hardware when they need it. Therefore, customers do not need to purchase the hardware, reducing their Total Cost of Ownership (TCO) and they Operational Expenses (OPEX).
* 2. Users benefit from the scaling of massive economies
* The more customers use the public cloud computing service. The cheaper it gets, because if 2 customers rent a server and each use it for 2 hours. Then the server is free for 20 hours. But if 12 customers use the server. Then, the server is never free, and the charge of the server will be divided between 12 customers instead of 2
* 3. Customer’s do not need to premeasure the required number of resources or capacity
* Customers can scale their resources based on their usages without the need to pre plan how many resources required
* 4. Increased speed and agility
* Customers can buy extra resources, save money by using less resources all on demand. Therefore, the time spent thinking of how many resources you need is saved
* Agility means customers can rapidly develop, test and launch software applications
* 5. Maintenance cost saving
* Customers do not maintain cloud services. The cloud service provider maintains them
* 6. Flexibility in creating applications globally
* Customers of the same team in different parts of the world can create advanced applications in minutes. Due to AWS global infrastructure
* Disadvantages of cloud computing against the other cloud services
* 1. You must train your employees more so they can use the cloud effectively.
* ***AWS -Pricing***
* The AWS pricing model is based on three fundamentals
* 1. Computing time
* 2. Storage size
* 3. Data transfer
* Customers pay only for the data transfer out of the cloud. Any data transferred into the cloud is free
* ***In-Depth Look into the Types of Cloud Computing***
* 1. Infrastructure as a Service (IaaS)
* This cloud service provides the building blocks for the cloud Information technology (IT)
* IaaS, provides the networking, computers, data storage spaces
* IaaS, has high level of flexibility
* IaaS, is parallel with traditional on premises IT services. Therefore, customers can understand how to migrate from traditional on premises IT services to the cloud
* 2. Platform as a Service (PaaS)
* This cloud service removes the need for the customer to manage the infrastructure of the cloud service
* This service allows the customer to focus on the deployment and the management of their applications
* 3. Software as a Service (SaaS)
* This cloud computing service is fully run and managed by the cloud service provider

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| Services Comparison | | | | |
|  | On Premises | Iaas | PaaS | SaaS |
| Customer manages | Customer manages everything: application, data, runtime, middleware, OS, virtualization, servers, storage, and networking | Applications, Data, Runtime, Middleware, and O/S | Application & data, | Nothing is managed by the customer |
| Cloud Servies manages | N/A | virtualization, servers, storage, and networking | runtime, middleware, OS, virtualization, servers, storage, and networking | Cloud Computing service manages everything manages everything: application, data, runtime, middleware, OS, virtualization, servers, storage, and networking |
| Service Exp | N/A | AWS(EC2), GCP, Azure, Rackspace, Digital Ocean, Linode | AWS(Elastic Beanstalk), GCP, Azure, Heroku | AWS(many services). GCP, Azure |

* ***AWS Cloud History***
* Launched in 2002 and Now Netflix, Airbnb, NASA, DropBox and many other applications run on AWS Cloud
* AWS Global Infrastructure:
* AWS regions:
* Are regions of all around the world. For example, US-East.
* A region is a cluster of data centers
* Each region has its own resources
* How to choose an AWS region ?
* This depends on few factors, which are:
* Compliance: The compliance with data governance and legal requirements, some countries have laws that prevent the data launce of their country applications to be done from another country. Therefore, the data must be launched from their region
* Proximity: The proximity to launch an application in the location where most of the customers who will be using the applications are located. This will reduce the latency
* AWS services availability: The region you want to deploy your application from must have the AWS services you are using
* Pricing: The AWS pricing of services varies from one region to another. Therefore, try to select a cheaper pricing list
* Note: Capacity is unlimited in the cloud, you do not need to worry about it. The 4 points of considerations when choosing an AWS Region are: compliance with data governance and legal requirements, proximity to customers, available services and features within a Region, and pricing.
* AWS availability zones
* The availability zone is what goes into the region. Each availability zone (AZ) is one or more discrete data centers with redundant power, networking, and connectivity
* AZ is a Global Infrastructure identity that is composed of one or more discrete data centers with redundant power, networking, and connectivity, and are used to deploy infrastructure
* Each region tends to have 3 availability zones. Minimum is 2 and max is 6
* Each AZ is separate from the other AZ in the same region. This separation is a safety measure for potential disasters
* All AZ of the same region are connected with high bandwidth, ultra-late latency networking. Therefore this connections between the AZ forms a region
* AWS data centers
* A combination of servers and computers
* AWS edge locations/points of presence (edge locations)
* Amazon has 216 Points of Presence (205 Edge Locations & 11 Regional Caches) in 84 cities across 42 countries
* This point is important when content is delivered to end users with lower latency
* Global AWS do not require regions selection, AWS has many global services:
* Identity and access management (IAM)
* Route 53 \*DNS service)
* CloudFront(Content Delivery Network)
* WAF(Web Application Firewall)
* Note: The AWS’s main user aka the Root user has access to all the different services. Therefore, The root user can create users that have access to a specific AWS services and specific features of those services. And the root user makes users that have access to all the services and as much privileges as the Root User, expect the ability to delete the root user. If a user has no access to a specific service. Then, they will not be able to go to that service.
* For example if user43 has no access to IAM then that user will not be able to go to access anything on the IAM (Identity Access Management) service
* Most used AWS are regional such as:
* Amazon EC2(IaaS)
* Elastic Beanstalk (PaaS)
* Rekognition (SaaS)
* Lambda (faas) (function as a service)
* ***AWS -Shared Responsibility Model***
* It defines the distribution of responsibilities for security in the AWS Cloud



* Whatever the customer uses in the cloud its security is the responsibility of the customer (OS, firewall, etc) & AWS will be responsible for the security of the cloud
* This diagram is important. & responsibilities distinguishments will be asking in the exam
* ***AWS Acceptable USE Policy History***
* When using AWS you must agree to amazon’s policy agreement, which include:
* No legal, harmful, offensive use or content
* No security violations
* No network abuses
* No email or other messaging abuses
* ***Networking Definitions***
* SHH is: SSH: SSH means “Secure Shell”. It has a built-in username/password authentication system to establish a connection. It uses Port 22 to perform the negotiation or authentication process for connection. Authentication of the remote system is done by the use of public-key cryptography and if necessary, it allows the remote computer to authenticate users. It is a secure way to transfer data between servers.
* The World Wide Web (WWW), commonly known as the Web, is an information system where documents and other web resources are identified by Uniform Resources.
* HTTPS: is a secure version of the HTTP protocol that uses the SSL/TLS protocol for encryption and authentication. HTTPS is specified by RFC 2818 (May 2000) and uses port 443 by default instead of HTTP's port 80
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* A port in networking is a software-defined number associated to a network protocol that receives or transmits communication for a specific service. In a specific cloud server, a specific port tells the server that we are requesting a specific service. Port numbers identify specific applications or services on a computer system, just like an IP address identifies a machine in an IP network and ascertains the destination of a data packet. A port is always associated with a protocol.
* TCP: Transmission Control Protocol (TCP) is a standard that defines how to establish and maintain a network conversation by which applications can exchange data. TCP works with the Internet Protocol (IP), which defines how computers send packets of data to each other.
* Key Pairs are what the SSH used to access the EC2 instance. A key pair consists of a public key that AWS stores, and a private key file that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance. Amazon EC2 supports ED25519 and RSA key pair types.
* RSA: RSA (Rivest–Shamir–Adleman) is a public-key cryptosystem that is widely used for secure data transmission. It is a signature algorithm for key pairs that SSH supports
* Network bandwidth is a measurement indicating the maximum capacity of a wired or wireless communications link to transmit data over a network connection in a given amount of time. Typically, bandwidth is represented in the number of bits, kilobits, megabits or gigabits that can be transmitted in 1 second.
* Memory of a computer is broken down into volatile, virtual, and secondary. Volatile memory is the closest to the CPU, then virtual, then secondary. The closer the memory to the CPU the faster its processing time but is has smaller storage area to CPU the faster your run time is.
* Volatile memory is the closest to the CPU and it include (registers, cache, and RAM). The closest to the CPU is registers, then cache, then RAM. Voltitle memory is called volatile, because once the server is turned off all of the data will be lost, because volatile memory requires constant electricity
* Virtual memory: this memory swaps data between the volatile memory and the secondary memory. It allows for the creation of more space in the volatile memory. However, the swapping actions generation more computational power
* Secondary memory: this memory includes everything from hard desks, USB, and even cloud memory. This is the memory that is external and the furthest from the CPU. The secondary memory is the largest in terms storage, but it is the slowest
* Internet Protocols IP. IPv4 and IPv6
* IPv4 stands for Internet Protocol version 4. It is the underlying technology that makes it possible for us to connect our devices to the web. Whenever a device accesses the Internet, it is assigned a unique, numerical IP address such as 99.48. 227.227.
* IPv6 is the next generation Internet Protocol (IP) address standard intended to supplement and eventually replace IPv4, the protocol many Internet services still use today. Every computer, mobile phone, home automation component, IoT sensor and any other device connected to the Internet needs a numerical IP address to communicate between other devices. The original IP address scheme, called IPv4, is running out of addresses due to its widespread usage from the proliferation of so many connected devices.
* DNS: DNS translates domain names to IP addresses so browsers can load Internet resources
* Private DNS (IPv4) : The internal DNS hostname.
* Primary private IPv4 IP: The primary private IPv4 address.
* Secondary private IPv4 IPs : Any secondary private IPv4 addresses.
* Public DN : The external DNS hostname.
* IPv4 Public IP: The public IPv4 address. If you associated an Elastic IP address with the instance or the primary network interface, this is the Elastic IP address.
* Elastic Ips: Any associated Elastic IP addresses
* SSD: A solid-state drive (SSD) is a new generation of storage device used in computers. SSDs use flash-based memory, which is much faster than a traditional mechanical hard disk.
* Apache HTTP Server (httpd): The Apache HTTP Server ("httpd") was launched in 1995 and it has been the most popular web server on the Internet since April 1996.
* HTTPd -> Hypertext Transfer Protocol daemon: It is a piece of software that listens for network requests (which are expressed using the Hypertext Transfer Protocol) and responds to them
* #!/bin/bash
* This line is a shell scripting line
* It's called a shebang. In unix-speak, # is called sharp (like in music) or hash (like hashtags on twitter), and ! is called bang. (You can actually reference your previous shell command with !!, called bang-bang). So when put together, you get haSH-BANG, or shebang.
* The part after the #! tells Unix what program to use to run it. If it isn't specified, it will try with bash (or sh, or zsh, or whatever your $SHELL variable is) but if it's there it will use that program. Plus, # is a comment in most languages, so the line gets ignored in the subsequent execution.
* the main function of a shell is to interpret the UNIX commands given by the user. Unix consists of numerous shells out of that bash is one of them that is widely used. It is the default shell assigned by Linux-based operating systems.
* A shell provides an interface to connect with the system. When we use an operating system, we indirectly interact with the shell. While using a terminal every time on any Linux distribution system, we interact with the shell. The main function of the shell is to interpret or analyze Unix commands. A shell takes commands from the user and translates them into the kernel’s understandable form. In other words, it acts as a medium between the user and the kernel of the operating system. The kernel is a computer program that is considered as the main part of a computer’s operating system.
* IOPS (input/output operations per second). IOPS tells us how quickly each drive can process IO requests
* ‘Sequential Read/Write Speed’ simply means that how fast that drive can write or read the data from a series of blocks.
* Random means the files are scattered all over the drive, not in neat rows or groups, so take more work to find. Random IO is the most difficult and time-consuming type a storage device must deal with.
* when we turn on our computer, it starts to process numbers of files from multiple locations, which simply means that the drive needs to access the data from random blocks, again and again.