



Amazon Web Services



Sunbeam Infotech AWS Certification Training

www.sunbeaminfo.com

Agenda for today's session

- What are the different certifications available in AWS ?
- What will be covered in the training ?
- What is Cloud ?
- What is Data Center ?
- What is Virtualization ?
- What are the different Cloud service models ?
- What are the different Cloud deployment models ?
- What is AWS ?



Certification options in AWS

Available AWS Certifications

aws certified
Updated May 2019

Professional

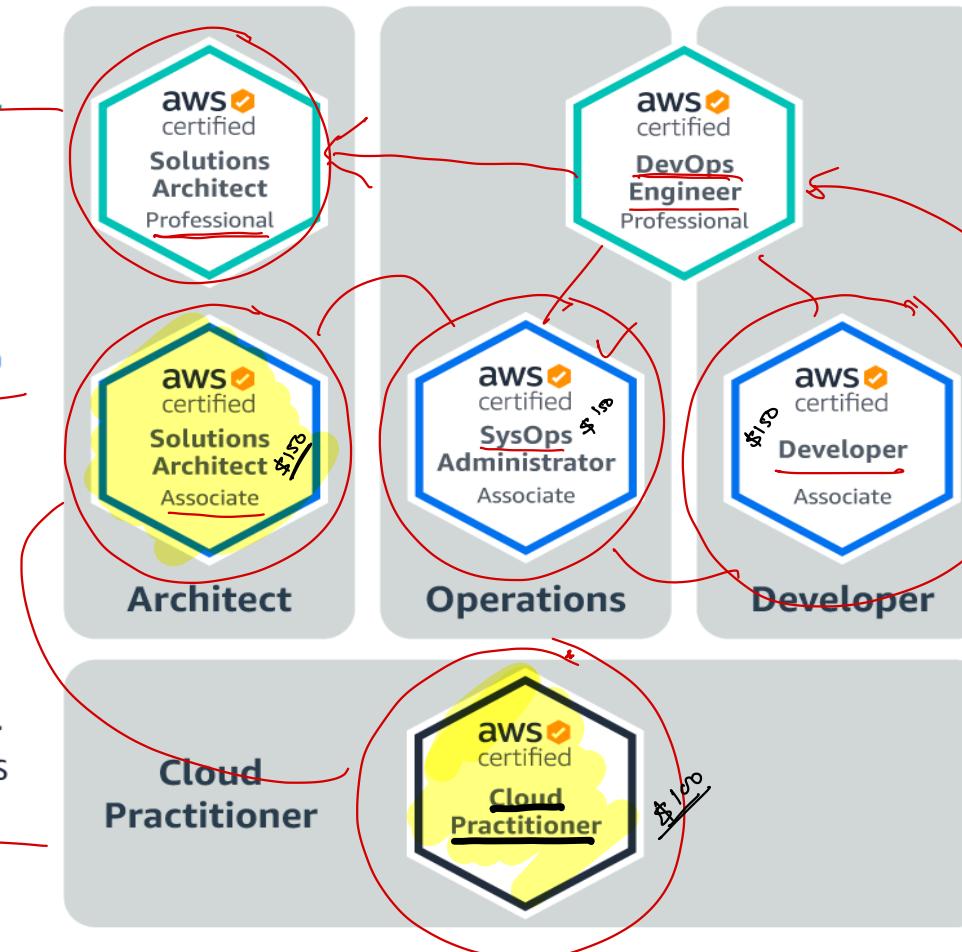
Two years of comprehensive experience designing, operating, and troubleshooting solutions using the AWS Cloud

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**



What will be covered in the training

- Training on certification path for becoming Certified AWS Cloud Practitioner

- ✓ Networking concepts
- ✓ Cloud concepts
- ✓ AWS technologies
- ✓ AWS billing and pricing



What will be covered in the training

- Training on certification path for becoming Certified AWS Solution Architect Associate
 - Computing Services EC2, Beanstalk etc.
 - Databases on AWS like RDS, DynamoDB etc.
 - Route 53 DNS
 - High Availability architecture using ELB, Auto Scaling Groups etc.
 - Serverless computing using Lambda
 - Application services like SNS, SQS, SWF, Kinesis, API Gateway etc.
 - Introduction to networking in AWS using VPC, CloudFront etc.
 - Storage services like S3, EFS, Storage Gateway etc.



What will be covered in the training

- Training will also cover many topics required for other certifications as well

- Container services like ECS and EKS
- Development services like CodeCommit, CodeDeploy, CodePipeline, CodeBuild etc.
- Management services like CloudWatch, CloudTrail, CloudFormation etc.
- Media services like Transcoder

DevOps

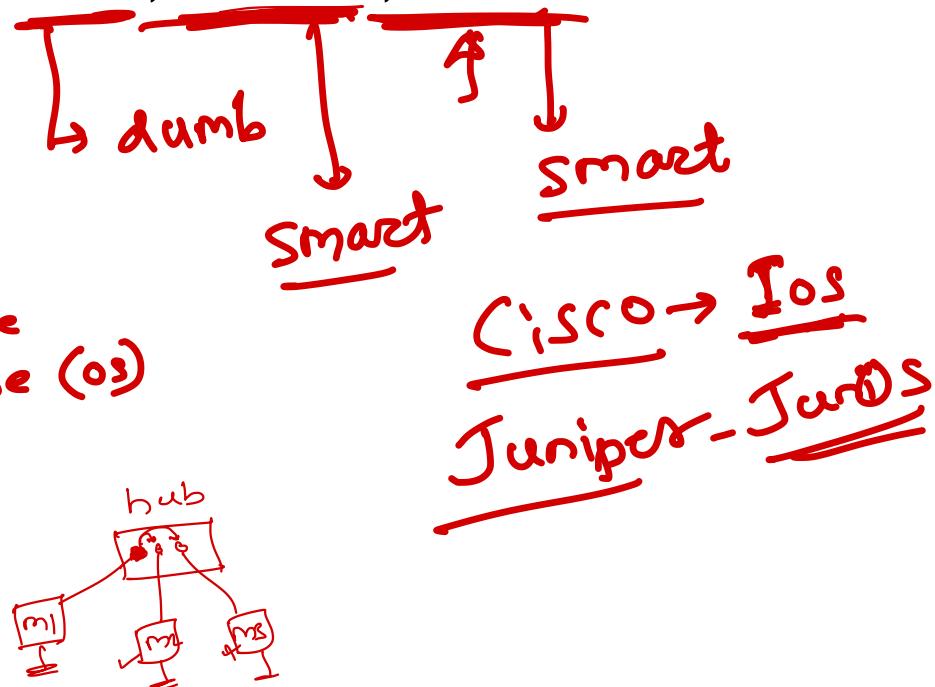
YAML - JSON



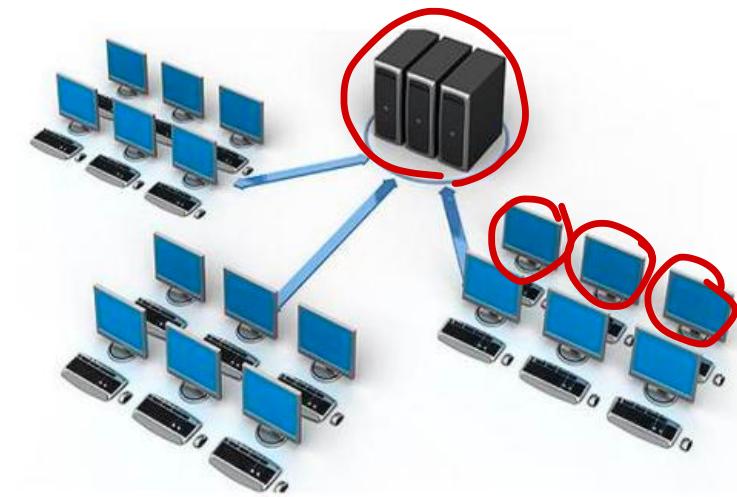
What is network ?

- It is the interconnection of multiple devices, generally termed as Hosts connected using multiple paths
 - The purpose of network is: sending/receiving data or media
 - It involves various devices like hubs, switches, routers etc.

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graph TD; devices[devices] --> computers[computers]; devices --> personalDevices[personal devices]; devices --> IoTDevices[IoT devices]; devices --> homeAppliances[home appliances]; personalDevices --> phone[phone]; personalDevices --> basic[basic]; personalDevices --> smart[smart]; personalDevices --> tablets[tablets]; basic --- smart; phone --> basic; phone --> smart; tablets --> tablets; tablets --> PCs[PCs];
```



ios

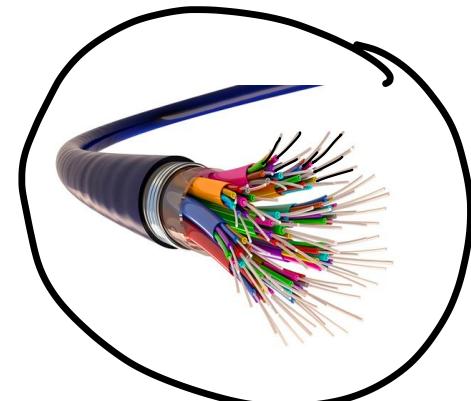
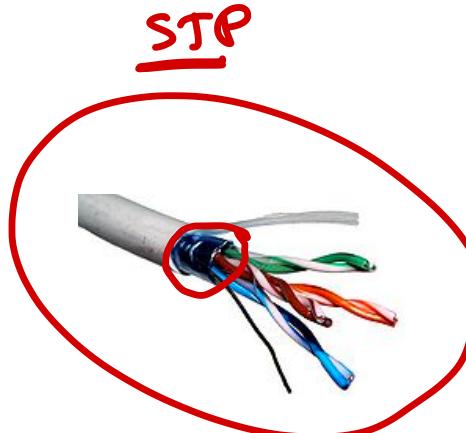
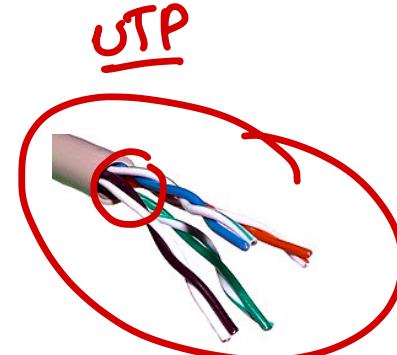
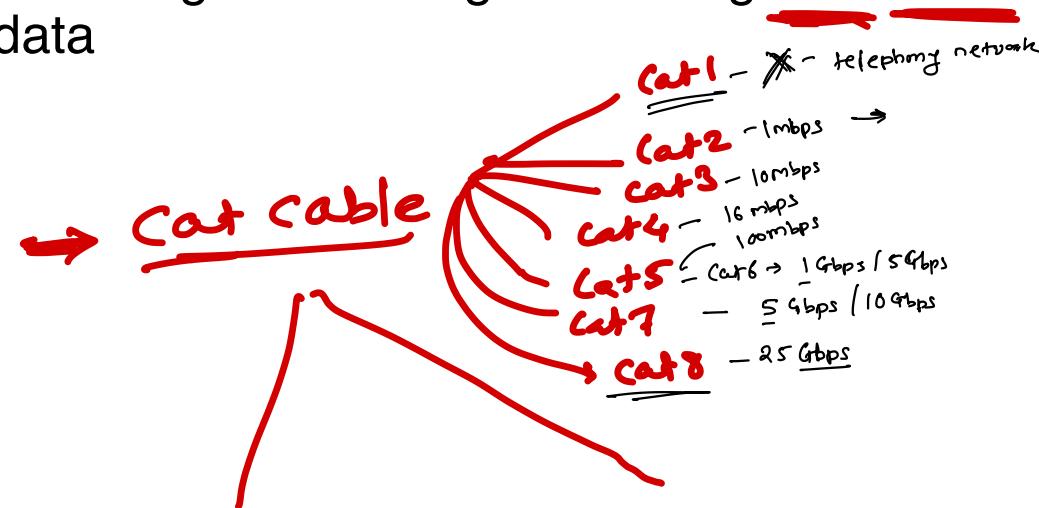


Wired network

- The network build by connecting devices together using wires/cables as a medium to transfer the data

- Cables

- Coaxial cable ~~X~~
- Twisted pairs cables
- Fiber optics



Wireless network

- The network build by connecting devices together using air as a medium to transfer the data
- EM Waves are used to transfer data from sender to receiver



Network Types

- Personal Area Network (PAN) - piconet - wireless
 - Smallest network which is very personal to the user
 - E.g. BlueTooth, ZigBee

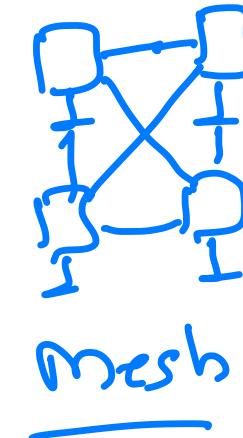
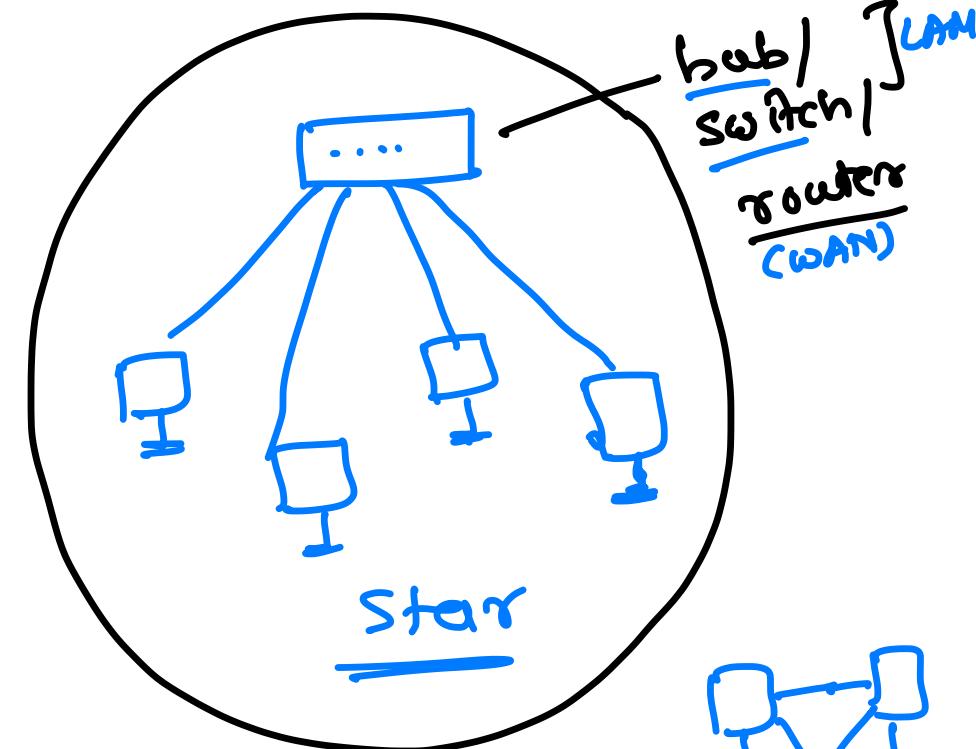
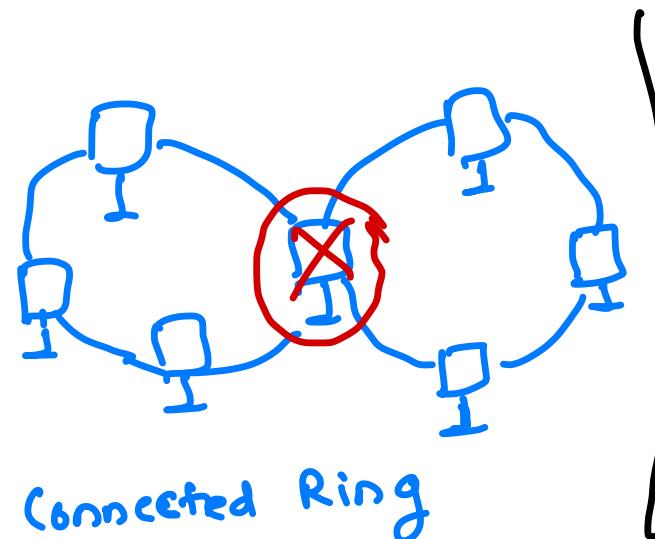
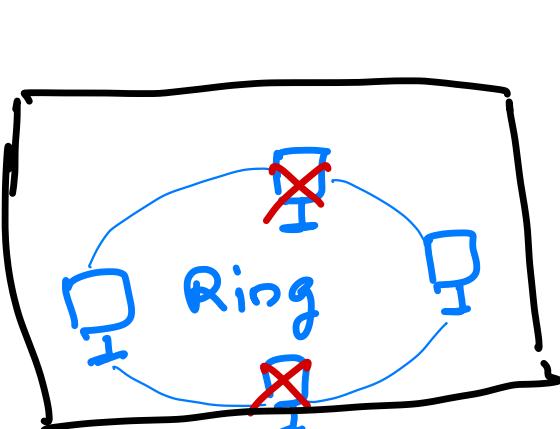
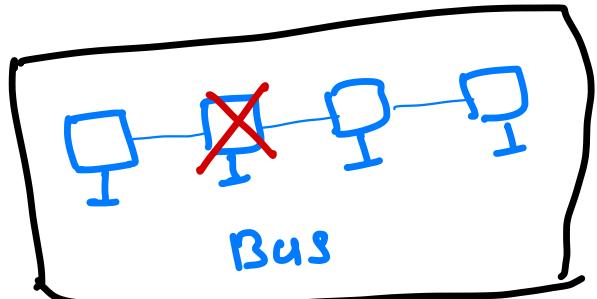
60 meters
8 devices [1 master | 7 slaves] 256
active
- Local Area Network (LAN) -
 - Spans across building(s) and operated under single administrative system
 - E.g. company, school network
 - Technologies: TokenRing or Ethernet
- Metropolitan Area Network (MAN) -
 - Spans across cities
 - E.g. cable network
 - Technologies: high speed fiber optics
- Wide Area Network (WAN) - VPC.
 - Spans across countries
 - Technologies: ATM, Frame Relay



What is a network topology ?

- Physical arrangement of computers is known as topology
- Famous topologies

- Bus
- Ring
- Token Ring
- Star
- Mesh



hub /
switch /
router
(WAN)

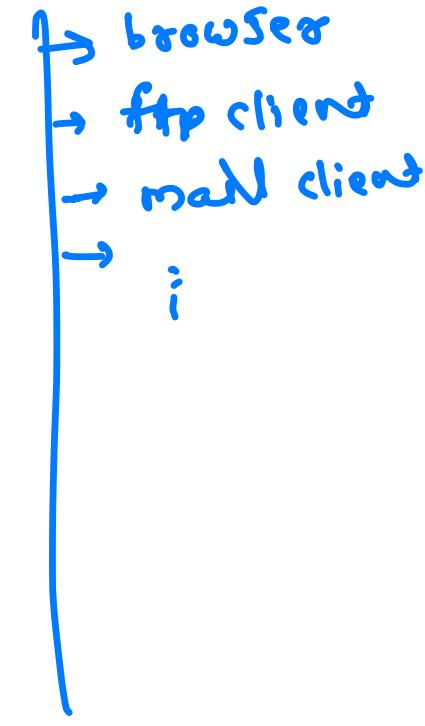
ISO OSI model

- Conceptual model that characterizes and standardizes the communication functions of a telecommunication or computing system without regard to its underlying internal structure and technology
- Goal is the interoperability of diverse communication systems with standard communication protocols
- Layered architecture having 7 layers
 - Application
 - Presentation
 - Session
 - Transport
 - Network
 - Data Link
 - Physical



Application Layer

- Specifies interface methods used by hosts in a communications network
- Contains communication protocols
 - **HTTP [80]**: Hyper Text Transfer Protocol
 - **HTTPs [443]**: Secure Hyper Text Transfer Protocol
 - **FTP [20, 21]**: File Transfer Protocol
 - **SFTP [115]**: Simple FTP
 - **DNS [53]**: Domain Name Service
 - **NFS [1023]**: Network File System
 - **POP3 [110]**: Post Office Protocol
 - **SMTP [25]**: Simple Mail Transfer Protocol
 - **SSH [22]**: Secure Shell
 - **LDAP [389]**: Lightweight Directory Access Protocol
 - **ARP - Address resolution protocol**



→ browser
→ ftp client
→ mail client
: .



Presentation Layer

- Serves as the data translator for the network

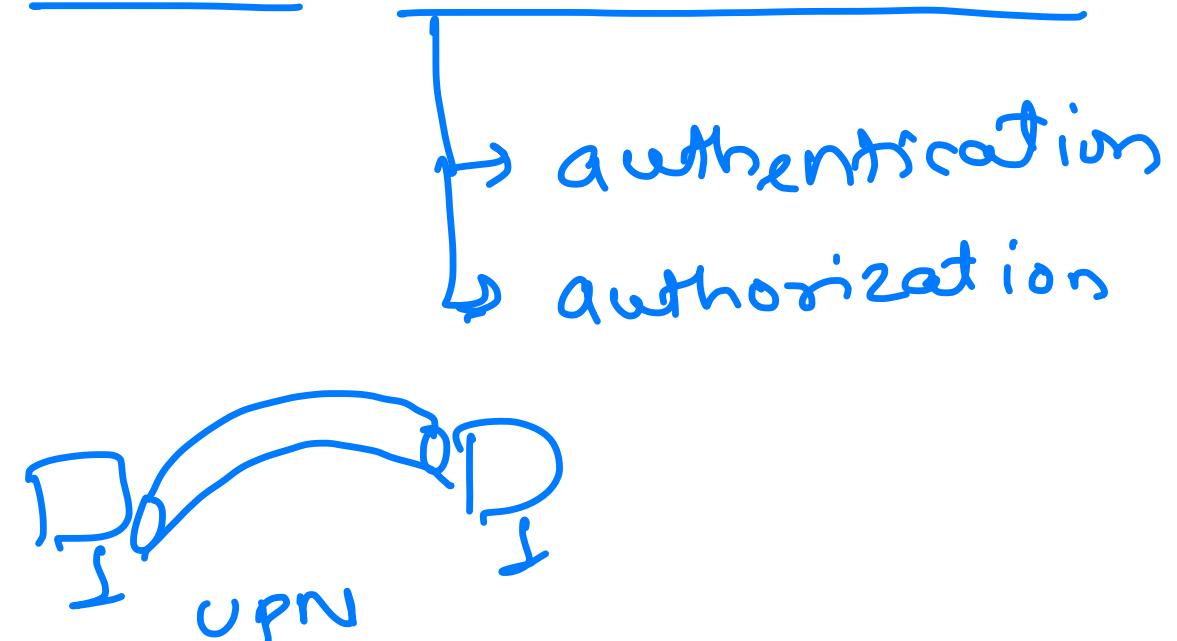
- Also known as syntax layer

- Responsible for binary → EBCDIC
 - Translation → 1010001111 →
 - Compression/Decompression → gzip
 - Encoding/Decoding
 - Encryption/Decryption



Session Layer

- Provides mechanism for opening, closing and managing session between processes
- Communication sessions consist of requests and responses that occur between applications
- Protocols
 - ASP: AppleTalk Session Protocol
 - ADSP: AppleTalk Data Stream Protocol
 - NetBIOS: Network BIOS
 - PAP: Password Authentication Protocol
 - PPTP: Point to Point Tunnelling Protocol
 - RPC: Remote Procedure Call
 - SCP: Session Control Protocol
 - SDP: Socket Direct Protocol



Transport Layer

- Provide host-to-host communication services for applications

- Creates Segment (data unit) containing

✓ Sequence number - used for assembling segments on receiver's side

✓ Checksum → used to check the error

✓ Port number

- Protocols

• TCP

- Connection oriented protocol

- Provides: Flow Control, Error checking

- Guarantees data delivery

- Slower than UDP

- E.g. WWW, HTTP, SSH

• UDP

- Connectionless protocol

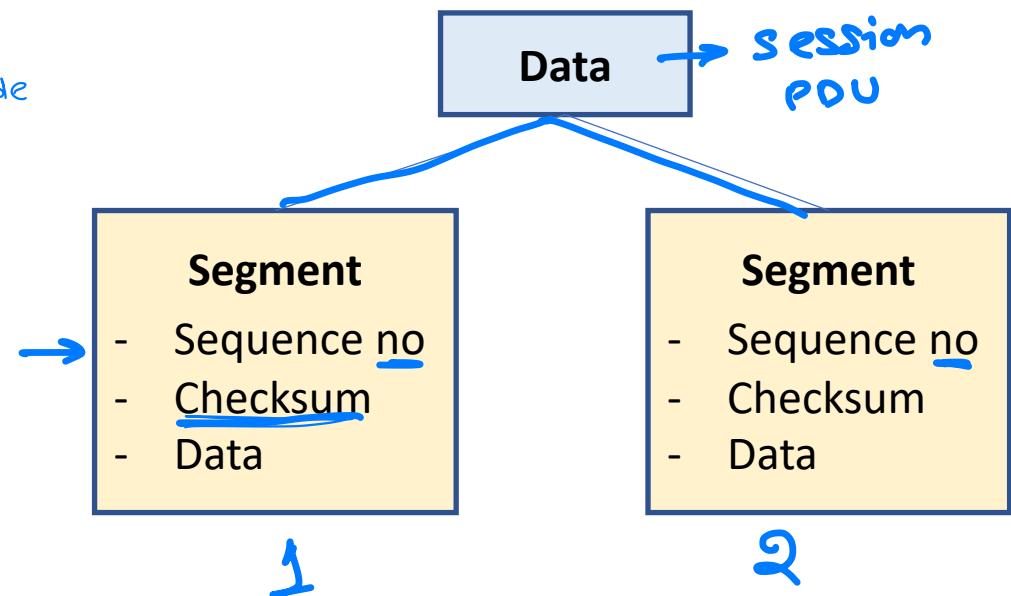
- Does not provide flow control

- Does not guarantee data delivery

- Faster than TCP

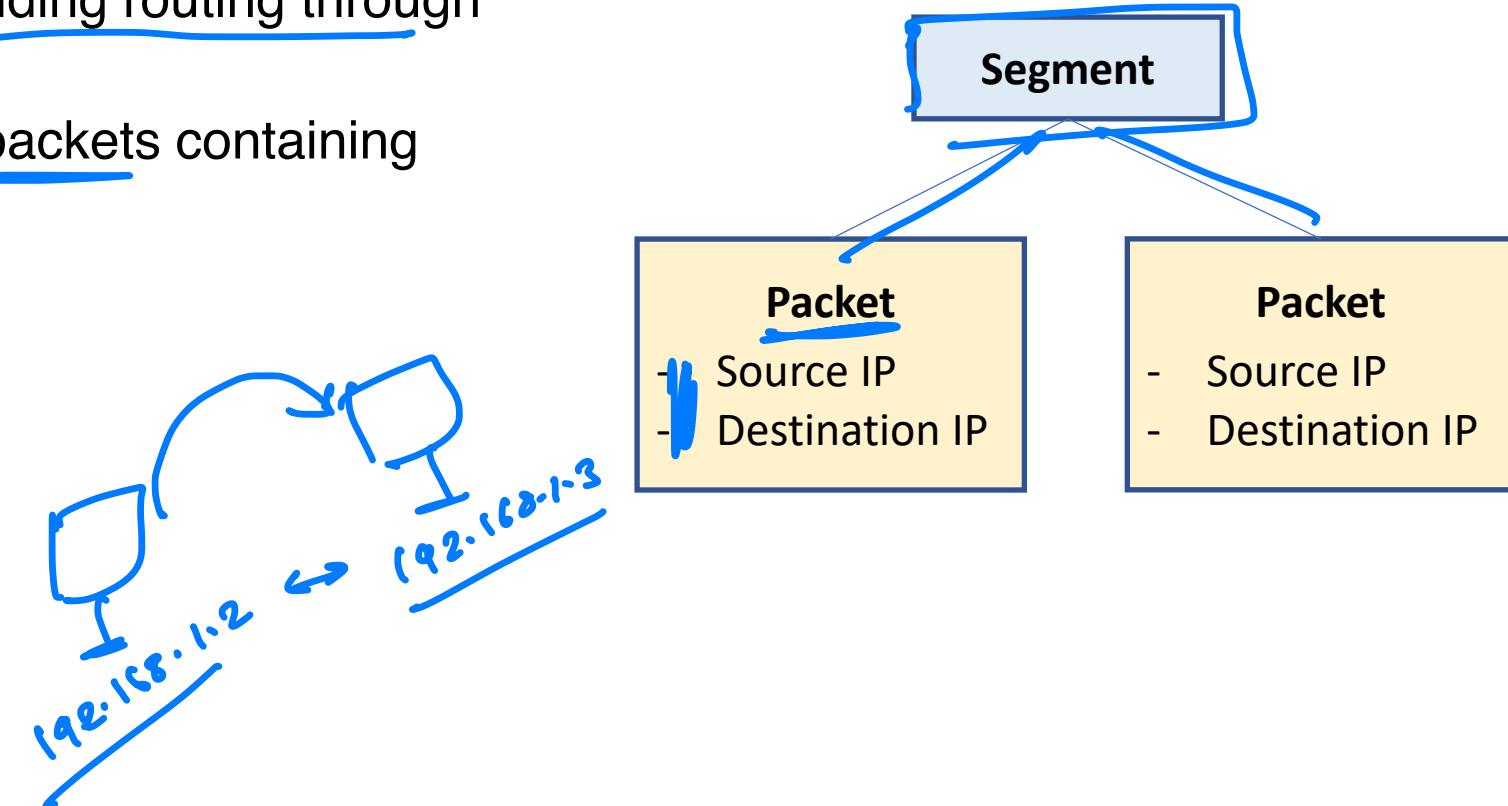
- E.g. streaming, online games

checksum



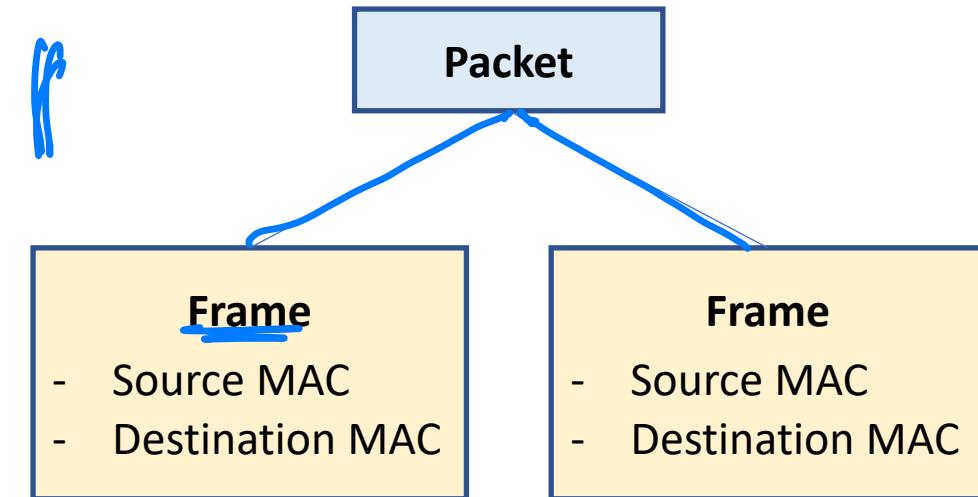
Network Layer

- Responsible for packet forwarding including routing through intermediate routers
- Responsible for splitting segment into packets containing
 - Source IP address
 - Destination IP address
- Protocols
 - IP: Internet Protocol
 - IPX: Internetwork Packet Exchange
 - IPSec: Internet Protocol Security
 - EGP: Exterior Gateway Protocol



Data Link Layer

- Transfers data between
 - adjacent network nodes in a wide area network (WAN) or
 - between nodes on the same local area network (LAN) segment
- Encapsulates packet into Frames containing
 - Source MAC Address
 - Destination MAC Address
- Sublayers
 - Logical Link Layer
 - Media Access Control Layer

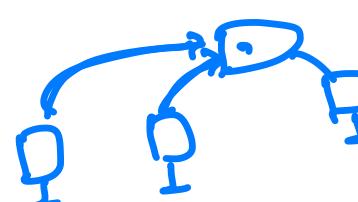


Data Link Layer: Logical Link Layer

- The uppermost sublayer multiplexes protocols running at the top of data link layer, and optionally provides flow control, acknowledgement, and error notification ↗ frame
- Provides addressing and control of the data link
- Services
 - Error control (automatic repeat request, ARQ)
 - Flow control [Data-link-layer flow control is not used in LAN protocols such as Ethernet, but in modems and wireless networks]



Data Link Layer: Media Access Control Layer

- Refers to the sublayer that determines who is allowed to access the media at any one time (CSMA/CD, CSMA/CA)
 - Determines where one frame of data ends and the next one starts (frame synchronization)
 - Frame synchronization uses: time based, character counting, byte stuffing and bit stuffing.
 - Services
 - Multiple access protocols for channel-access control,
 - CSMA/CD protocols for collision detection and re-transmission in Ethernet networks
 - CSMA/CA protocol for collision avoidance in wireless networks
 - Physical addressing (MAC addressing)
 - LAN switching (packet switching), including MAC filtering, Spanning Tree Protocol (STP) and Shortest Path Bridging (SPB)
 - Data packet queuing or scheduling
- store & forward
- 



Physical Layer

- Consists of the electronic circuit transmission technologies of a network
- Fundamental layer underlying the higher level functions in a network which provides means of transmitting raw bits rather than logical packets or segments
- The bitstream may be grouped into code words or symbols and converted to a physical signal that is transmitted over a transmission medium
- Translates logical communications requests from the data link layer into hardware-specific operations to cause transmission or reception of electronic signals
- Services
 - Modulation/Demodulation
 - Multiplexing
- Consists of
 - Cables/wires
 - Devices like hub, repeaters etc.



Addressing Modes: MAC Address

- Used to identify NIC uniquely
- Consists of 6 bytes [48 bits]
- First 3 bytes represents manufacturer
- Next 3 bytes represents NIC's unique address
- physical address
- windows → ipconfig /all
- macos/linux - ifconfig
- read only address
- * ethernet address
- * used in Data Link layer

78:4f:43:90:13:d0
manufacturer NIC
address address



Addressing Modes: IP Address

- Used to identify every device uniquely (OS) - used on network layer
 - Set by operating system running on the device
 - Can be written in
 - Decimal: 192.168.100.10
 - Binary: 11000000.10101000.01100100.00001010
 - Types
 - Private: used to communicate with other devices in local network
 - Public: used to communicate with other devices over internet
 - Versions
 - IPv4
 - 32 bit [4 bytes] address
 - Classful and Classless addressing
 - IPv6
 - 128 bit address
- ~~NAT~~ - share \rightarrow many ports \rightarrow 1 public IP
- \hookrightarrow public



IP Address: Classful addressing

Class A	Class B	Class C	Class D	Class E
0.x.x.x – 127.x.x.x	128.x.x.x to 191.x.x.x	192.x.x.x to 223.x.x.x	224.x.x.x to 239.x.x.x	240.x.x.x to 255.x.x.x
IP addresses start with: 0	IP addresses start with: 10	IP addresses start with: 110	IP addresses start with: 1110	IP addresses start with: 1111
Private: 10.x.x.x	Private: <u>172.16.x.x</u> to <u>172.31.x.x</u>	Private: 192.168.x.x	Reserved for multicast	Reserved for RnD
Net mask: 255.0.0.0	Net mask: <u>255/16M</u>	Net mask: <u>255.255.0.0</u>	Net mask: <u>255.255.255.0</u>	
1111111.00. ip: <u>192.168.5.6</u> ✓ NM: <u>255.255.255.0</u> network address <u>192.168.5.0</u>	1111111.00. ip: <u>172.35.0.5</u> NM: <u>255.255.0.0</u> <u>172.35.0.0</u>		1111111.00. ip: <u>17.5.6.7</u> NM: <u>255.0.0.0</u> <u>17.0.0.0</u>	1111111.00. ip: <u>17.5.6.100</u> NM: <u>255.0.0.0</u> <u>17.0.0.0</u>
		1111111.00. ip: <u>192.168.10.7</u> NM: <u>255.255.255.0</u> <u>192.168.10.0</u>		



00000000 : 0
10000000 : 128
11000000 : 192
11100000 : 224
11110000 : 240
11111000 : 248
11111100 : 252
11111110 : 254
11111111 : 255

2 bits

$$\begin{array}{r} 100 \\ 101 \\ \hline 10 \\ | \\ 11 \end{array}$$

3 bits

$$\begin{array}{r} 000 \\ 001 \\ \hline 010 \\ 011 \\ \hline 100 \\ 101 \\ \hline 110 \\ 111 \\ \hline 111 \end{array}$$

network mask

→ used to find the network

$$\begin{array}{r} 192 \cdot 168 \cdot 10 \cdot 25 / 24 \\ 255 \cdot 255 \cdot 255 \cdot 0 \\ \hline 8 \cdot 8 \cdot 8 \cdot 8 \\ 172 \cdot 16 \cdot 5 \cdot 6 / 16 \text{ - CIDR} \end{array}$$

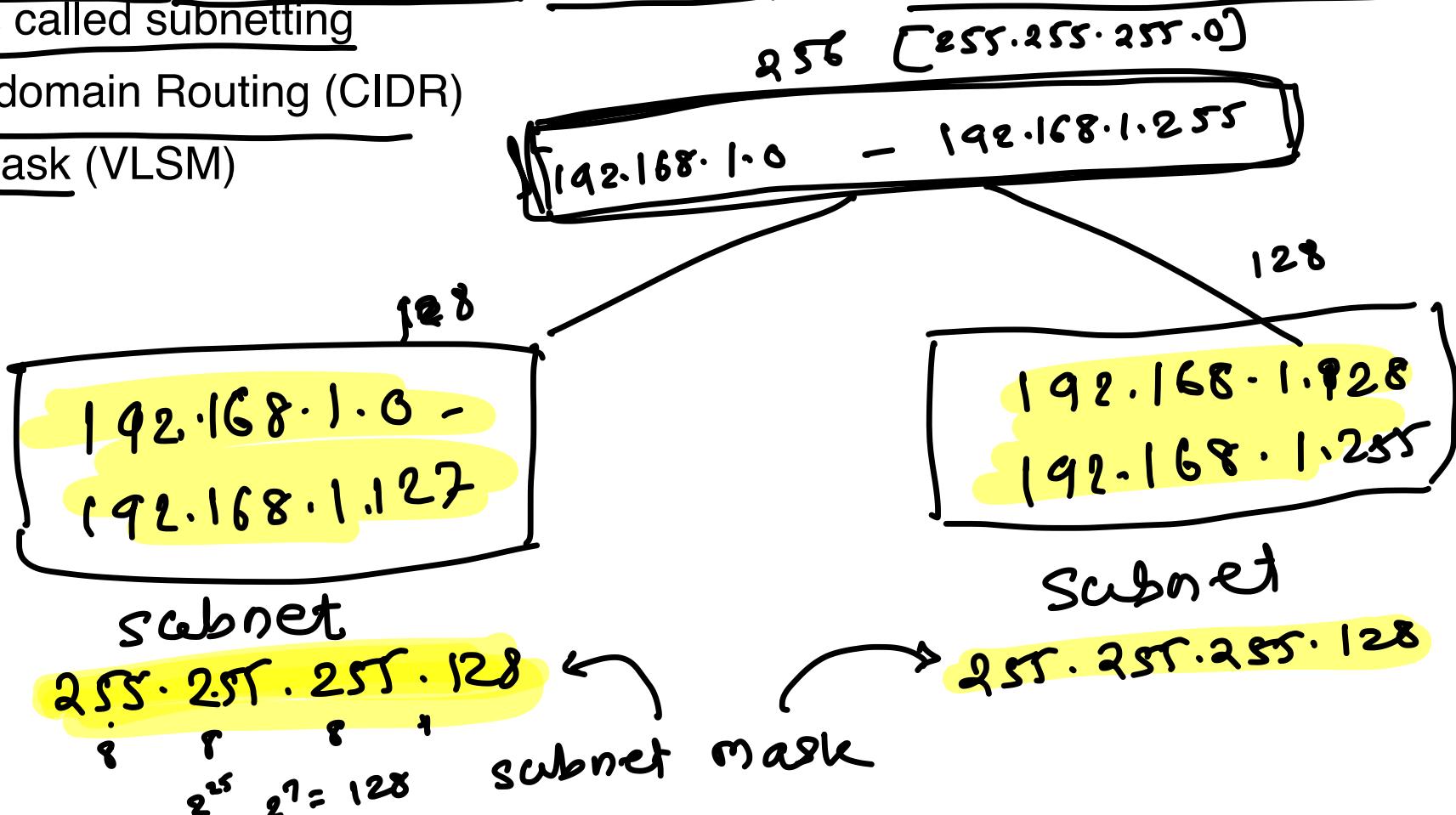
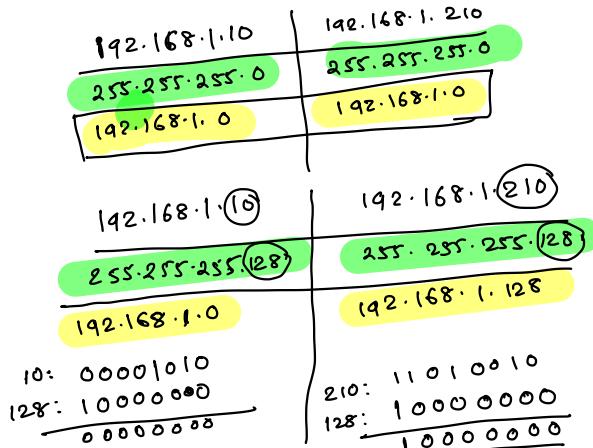
$$\begin{array}{r} 1111111 \cdot 1111111 \cdot 0_0_0_0_0_0 \\ 255 \cdot 255 \cdot 0 \cdot 0 \\ \hline 128 \end{array}$$

1s ← 11110000
255 255 255 240



IP Address: Classless addressing

- To reduce the wastage of IP addresses in a block, we use sub-netting
- Dividing a large block of addresses into several contiguous sub-blocks and assigning these sub-blocks to different smaller networks is called subnetting
- Also known as Classless Interdomain Routing (CIDR)
- Uses variable length subnet mask (VLSM)
- E.g. 172.168.100.12/28



class C

$$/24 : \underline{255.255.255.0} \rightarrow 24 = \text{networks}, 8 = \text{hosts}$$

$$125: 25 \cdot - \cdot \cdot 128$$

$$126: \cancel{\quad} \cdot \cdot 192$$

$$127: \cancel{\quad} \cdot \cdot 224$$

$$128: \cancel{\quad} \cdot \cdot 240$$

$$129: \cancel{\quad} \cdot \cdot 248$$

$$130: \cancel{\quad} \cdot \cdot 252$$

$$131: \cancel{\quad} \cdot \cdot 254$$

$$132: \cancel{\quad} \cdot \cdot 255$$

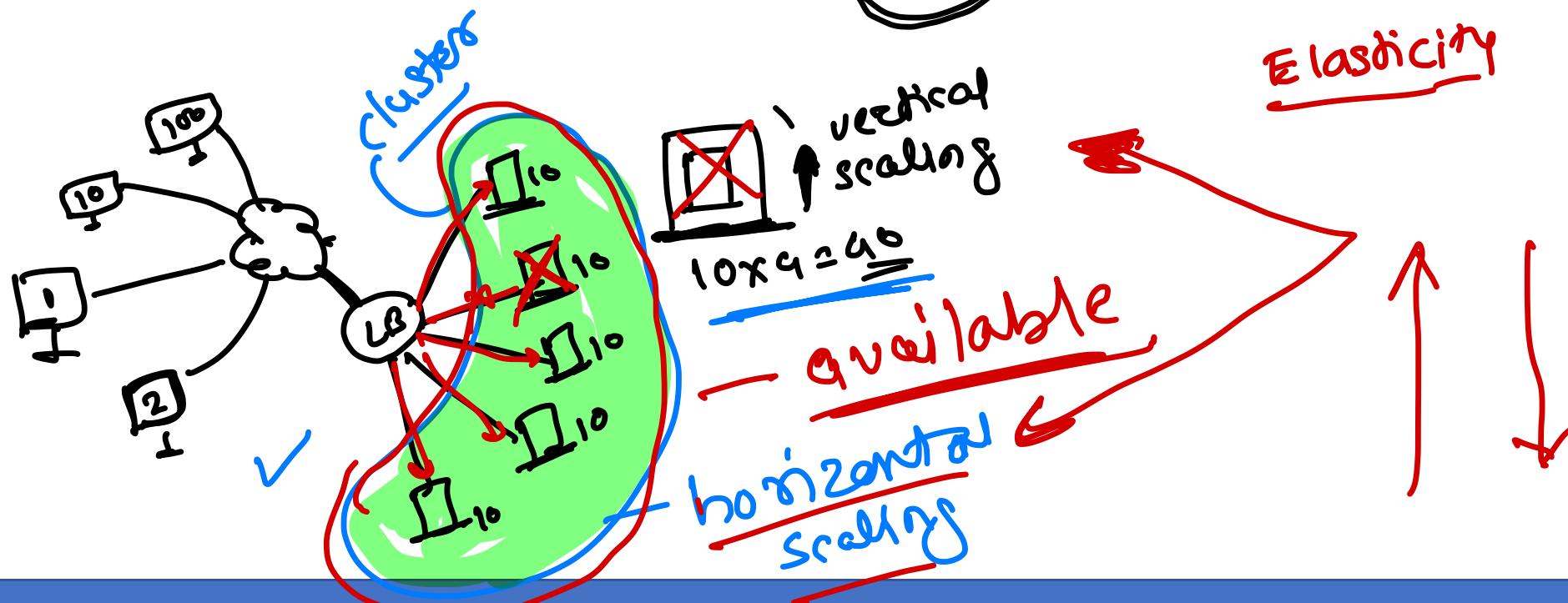
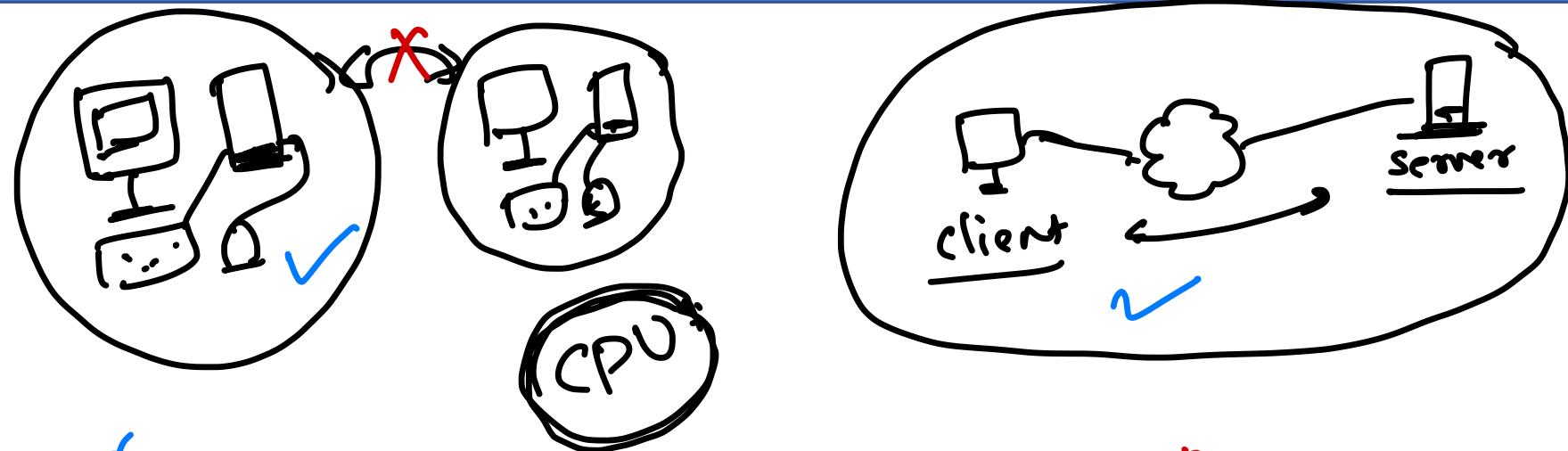
$$2^2 = 4 \quad 2^1 = 2 \quad 2^0 = 1$$

$$2^2 = 4 \quad 2^1 = 2 \quad 2^0 = 1$$



Computing Model

- Desktop computing ✓
- Client-Server computing ✓
- Cluster computing ✓
- Grid computing ✓
- Cloud Computing



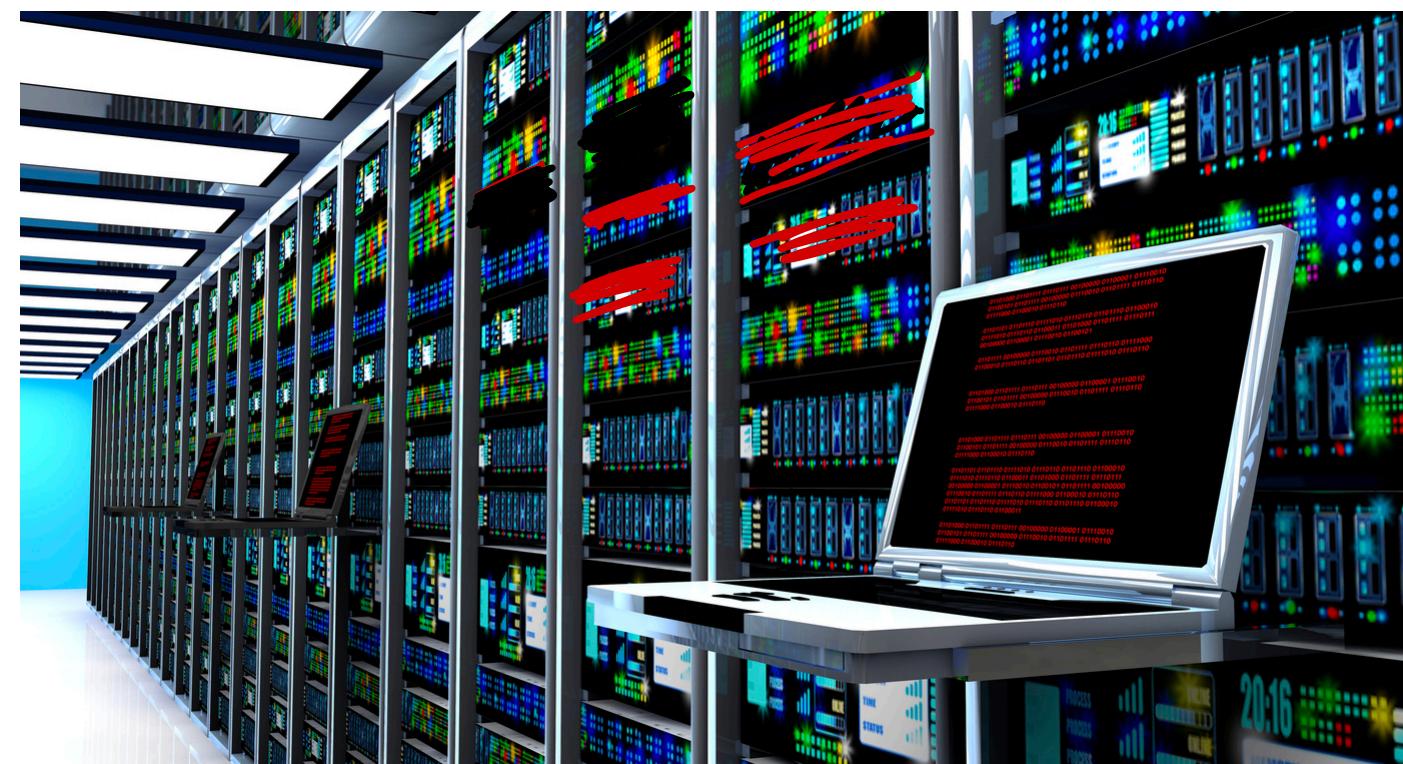
What is cloud computing ?

- The practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer.
- Is the delivery of on-demand computing resources – everything from data centers over the internet on a pay for use basis
- Cloud computing is an umbrella term used to refer to Internet based development and services



What is Data Center ?

- Where your IT devices and applications are located
- For a non-technical person it is the cloud where the user's files/data is stored
- Components
 - Servers
 - Security
 - WAN
 - Storage
 - File Sharing



What is Virtualization ?

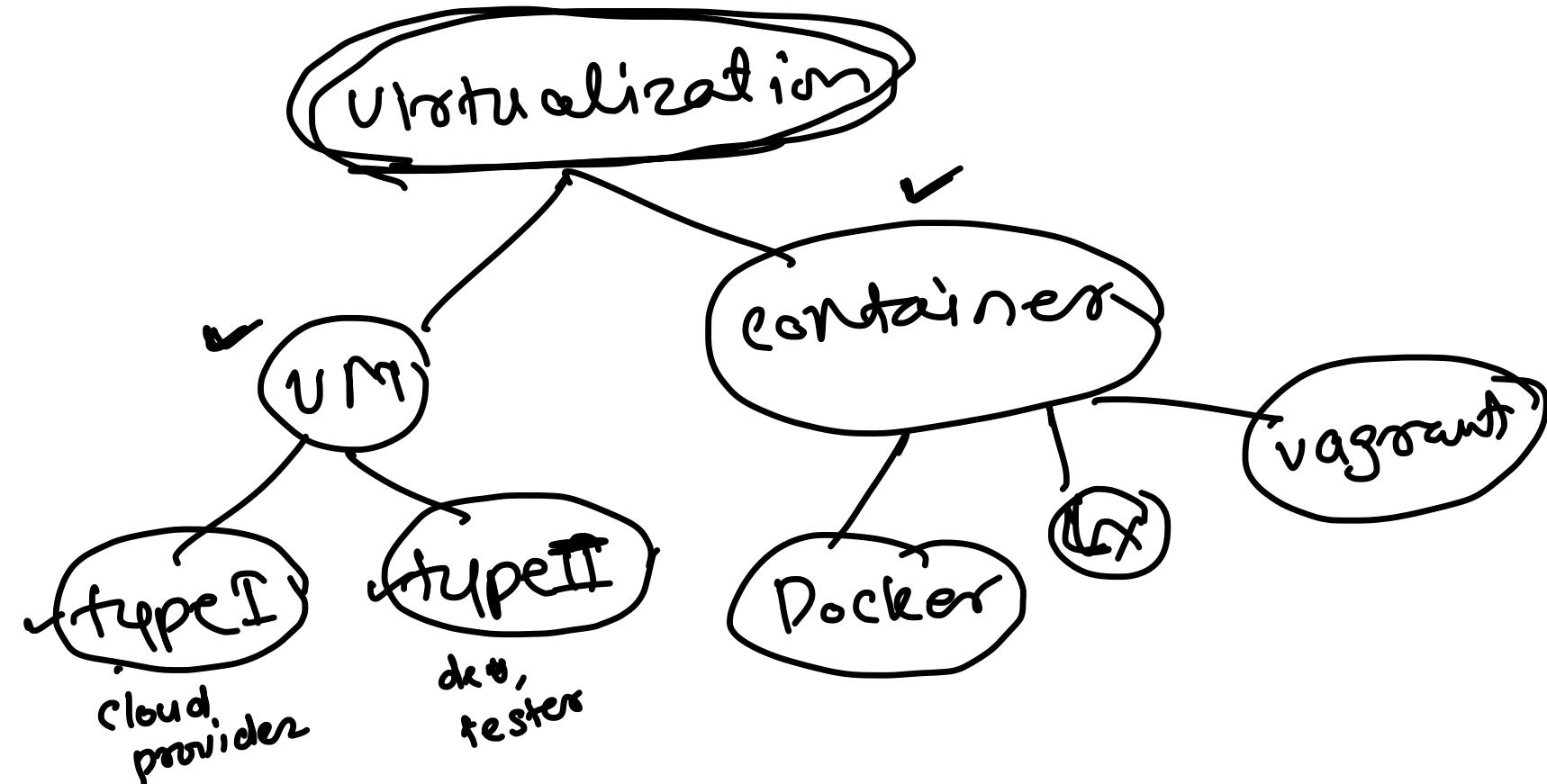
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- Refers to the act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, storage devices, and computer network resources

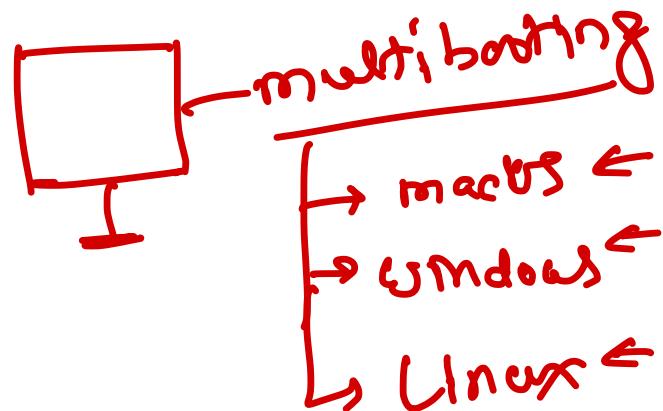
- Types

- Type I
- Type II
- Containerization

Docker
vagrant



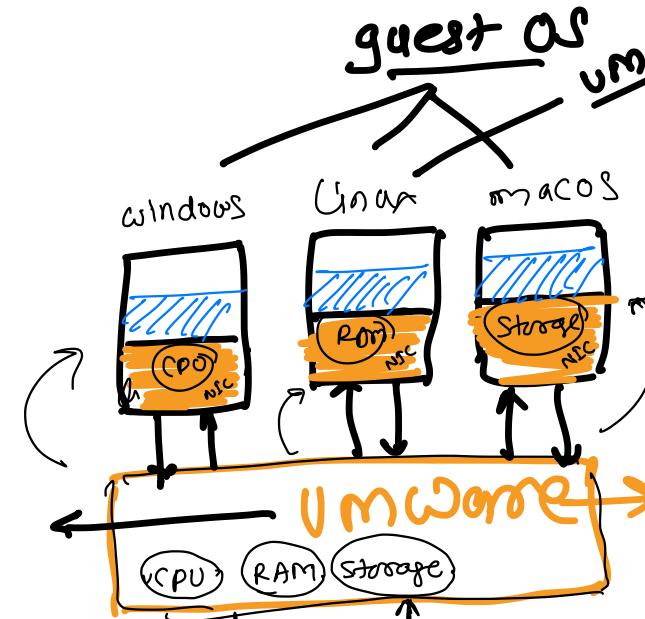
Type II



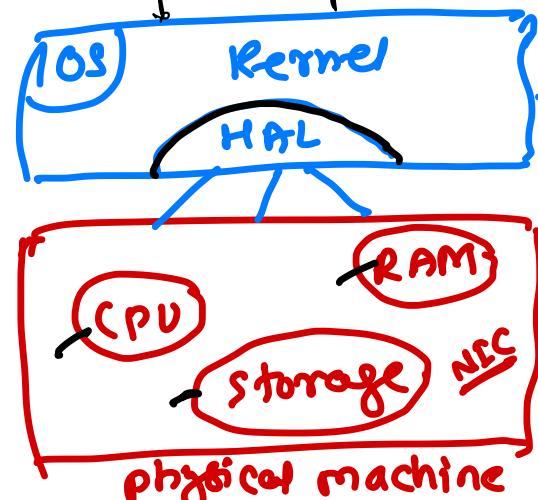
parallels

↳ developer/
tester

→ VMware Fusion,
VirtualBox, parallels



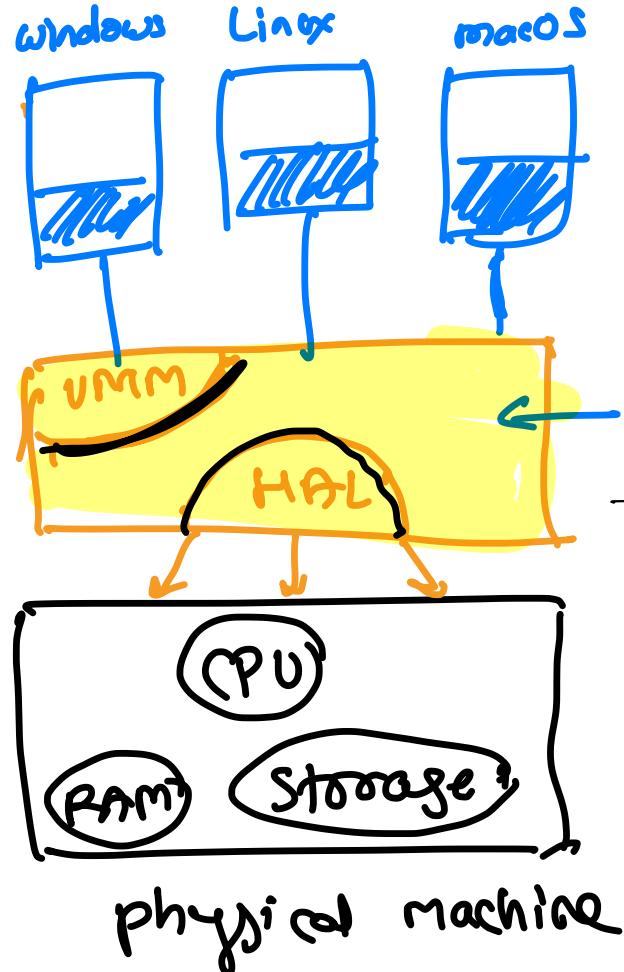
Simulated H



Host OS
 $(\underline{4 \text{ GB}} / \underline{10 \text{ GB}})$
 $(\underline{16 \text{ GB}} / \underline{512 \text{ GB}})$

network
→ host only
→ shared
bridged

Type I



↳ VMware ESXi / ESXi
↳ Xen

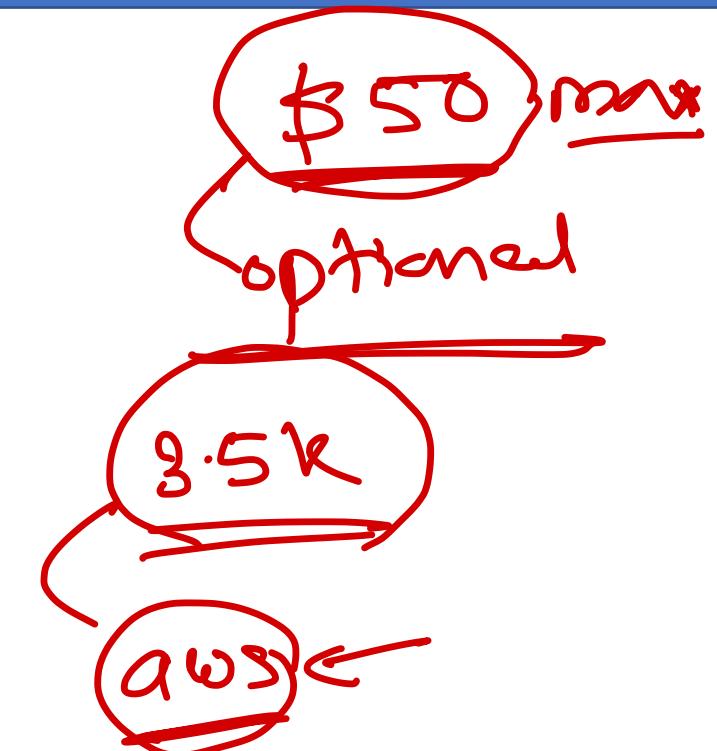
[16GB / 512GB]
[15.5GB / 511GB]

https://aws.amazon.com

↳ free / free Tiers

↳ credit/ debit Card

↳ 2 RS

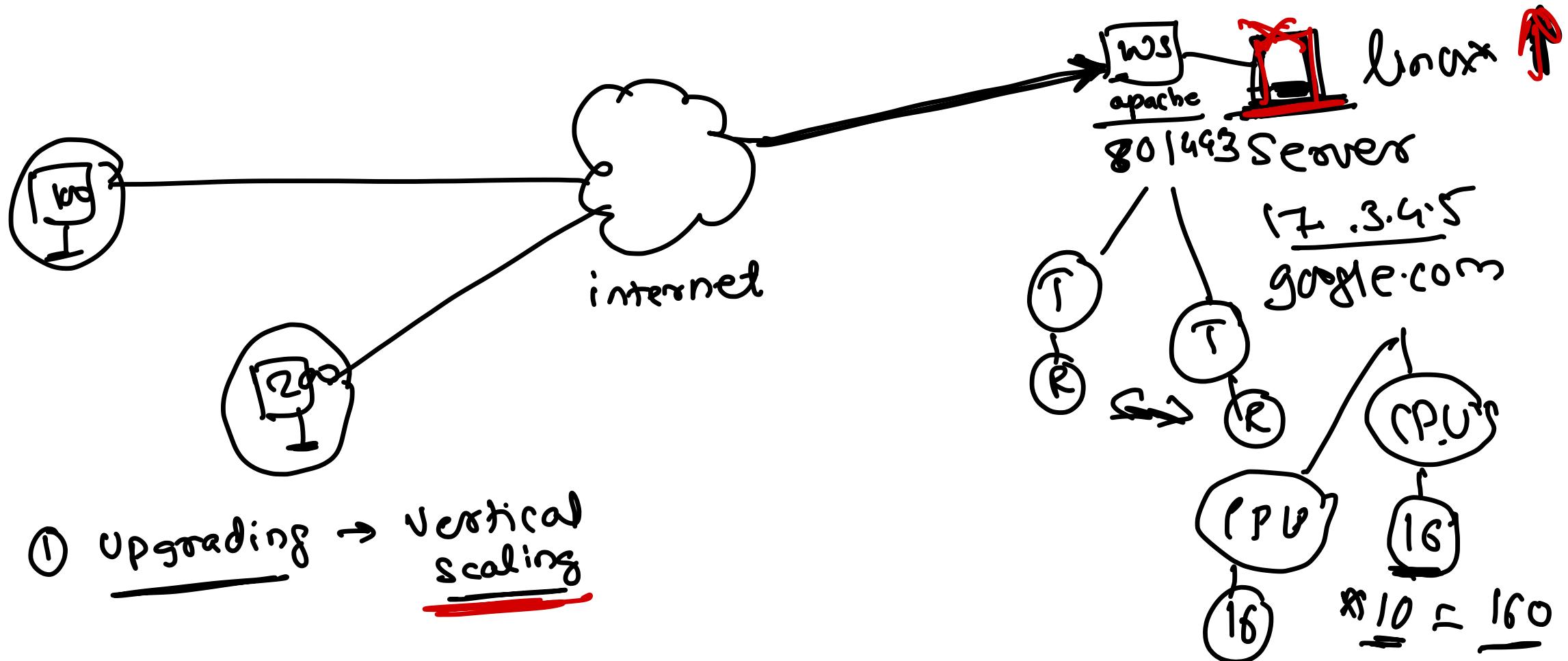


Terminologies

- Scalability
 - refers to the idea of a system in which every application or piece of infrastructure can be expanded to handle increased load
- Elasticity
 - the degree to which a system is able to adapt to workload changes by provisioning and de-provisioning resources in an autonomic manner, such that at each point in time the available resources match the current demand as closely as possible
- Availability
 - refers to the ability of a user to access information or resources in a specified location and in the correct format
- Information Assurance
 - availability, integrity, authentication, confidentiality and nonrepudiation
- On-demand service
 - A model by which a customer can purchase cloud services as needed

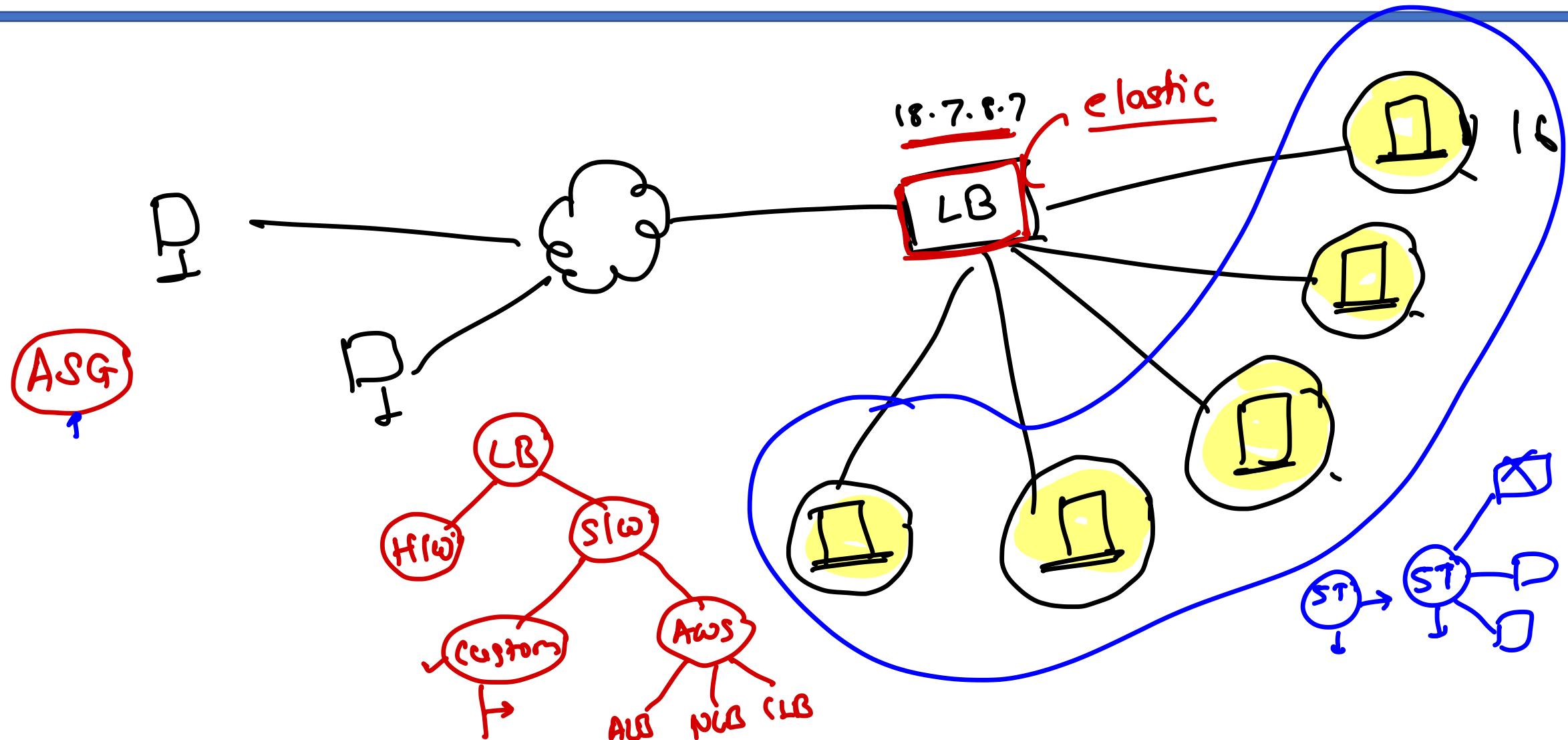


Scalability

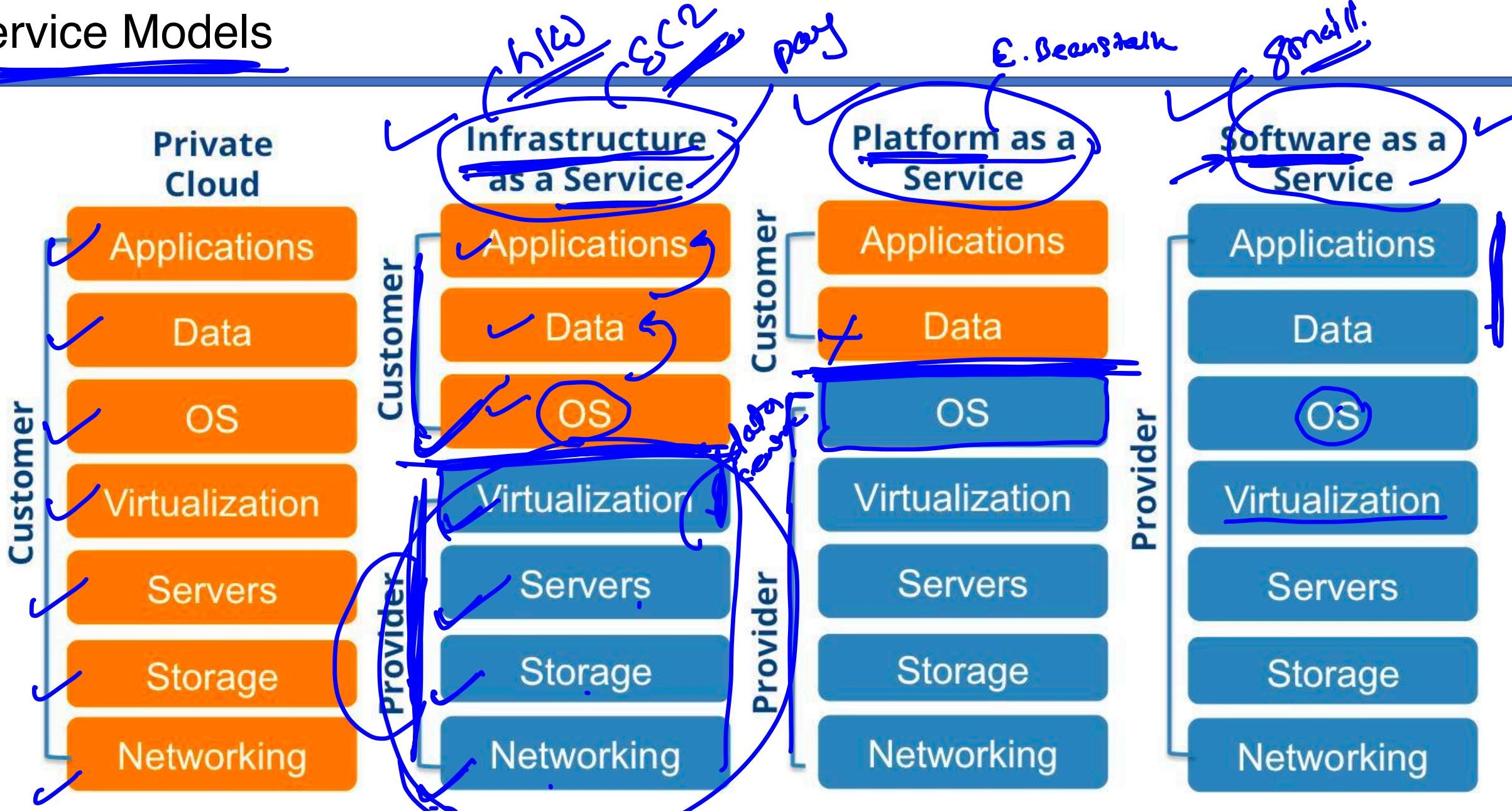


Horizontal scaling

10000 → 1000



Service Models



Service Models

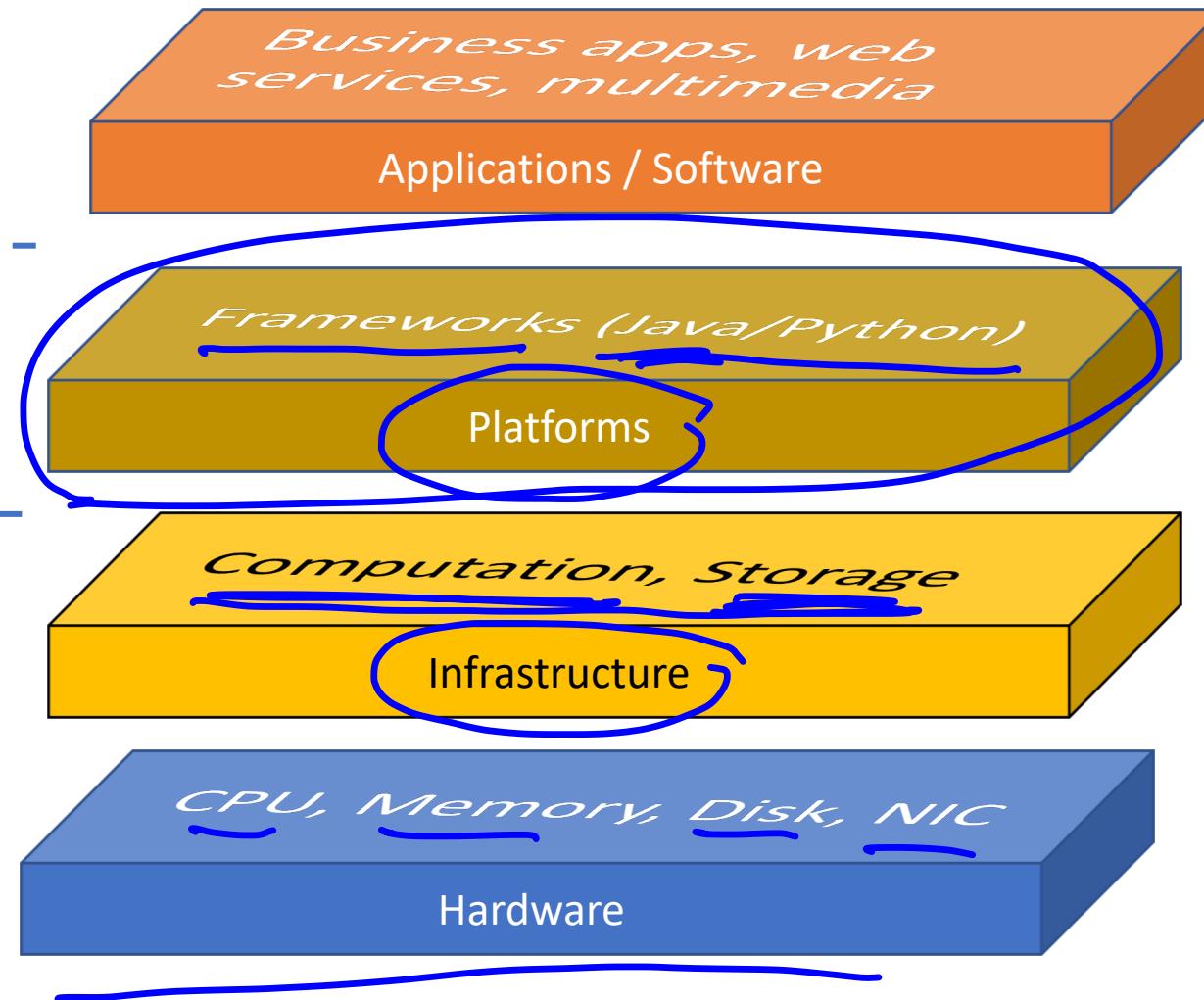
2.7 → 3.0
2.5 - 2.6.2.7

end users

Software
as a Service (SaaS)

developers
Platform
as a Service (PaaS)

operations
Infrastructure
as a Service (IaaS)



Google Apps,
Facebook, YouTube,
Dropbox, Google Photos

Google App Engine,
Amazon Simple DB, S3,
Microsoft Azure

Amazon EC2,
Google Compute VM,
Azure VM

Data Center



Service Models: IaaS

- Infrastructure as a Service
- Allocates virtualized computing resources to the user through the internet
- IaaS is completely provisioned and managed over the internet *by the provider*
- helps the users to avoid the cost and complexity of purchasing and managing their own physical servers
- Every resource of IaaS is offered as an individual service component and the users only have to use the particular one they need
- The cloud service provider manages the IaaS infrastructure while the users can concentrate on installing, configuring and managing their software
- Generally meant for operations team to setup the required infrastructure
- Benefits
 - Time and cost savings: more installation and maintenance of IT hardware in-house,
 - Better flexibility: On-demand hardware resources that can be tailored to your needs,
 - Remote access and resource management.



Service Models: PaaS

- Provides a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the infrastructure typically associated with developing and launching an app
 - Generally meant for developers
 - Benefits
 - Mastering the installation and development of software applications
 - Time saving and flexibility for development projects: no need to manage the implementation of the platform, instant production
 - Data security: You control the distribution, protection, and backup of your business data
- *infra + OS + env = platform*



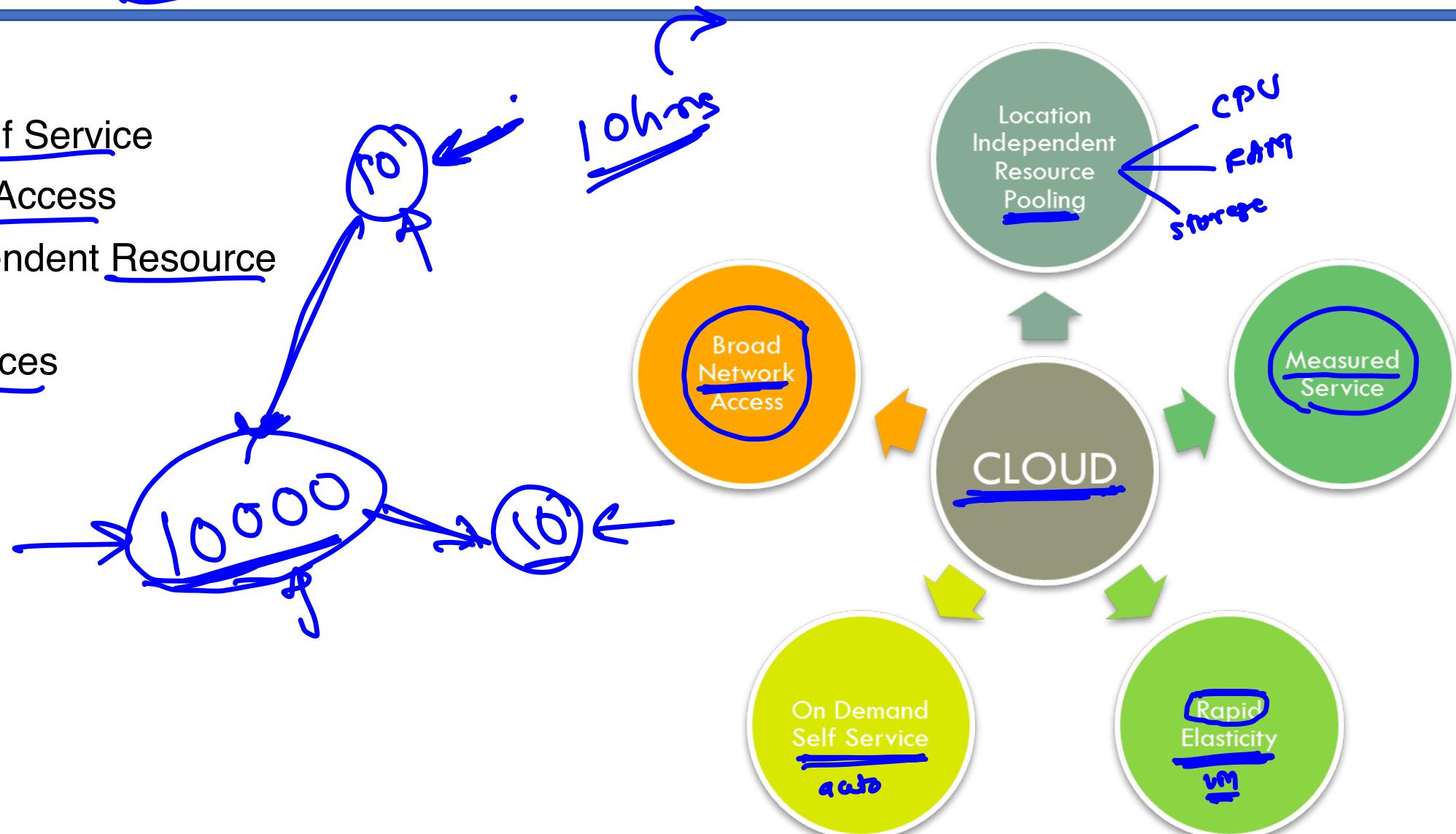
Service Models: SaaS

- Software as a Service
 - Software distribution model in which a third-party provider hosts applications and makes them available to customers over the Internet
 - User wont know which computer or operating system or infrastructure is used to host the software
 - Generally meant for end user
 - Benefits
 - You are entirely free from the infrastructure management and aligning software environment: no installation or software maintenance
 - You benefit from automatic updates with the guarantee that all users have the same software version
 - It enables easy and quicker testing of new software solutions.
- ↳ dropbox, youtube*



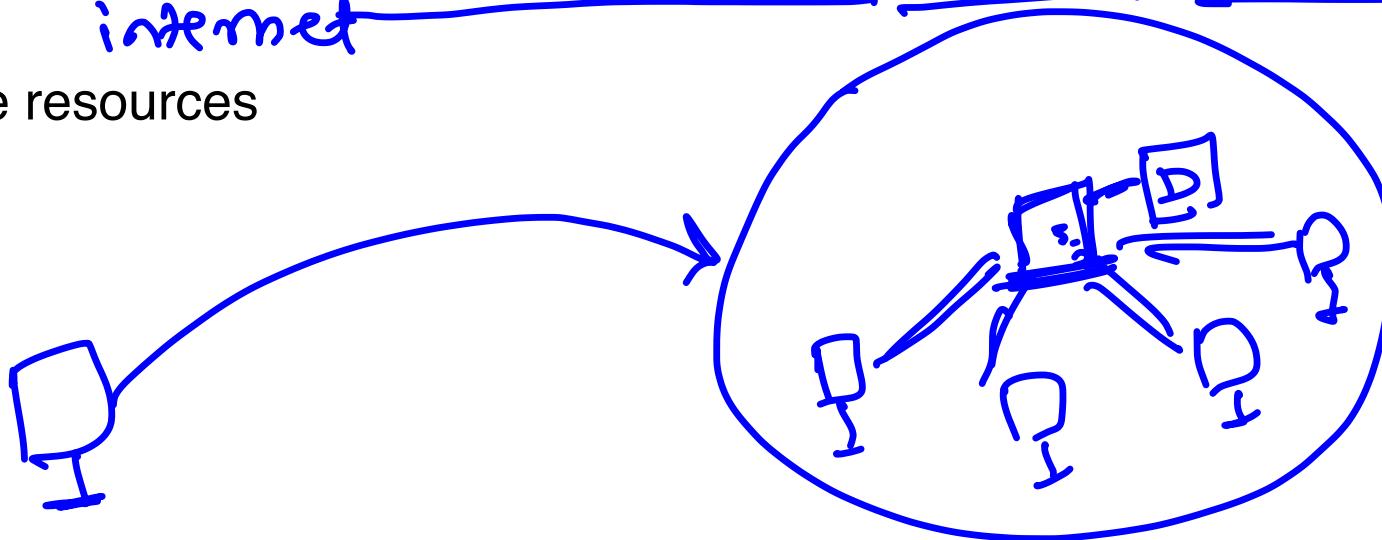
Cloud Computing Characteristics

- Rapid Elasticity
- On Demand Self Service
- Broad Network Access
- Location Independent Resource Sharing
- Measured Services



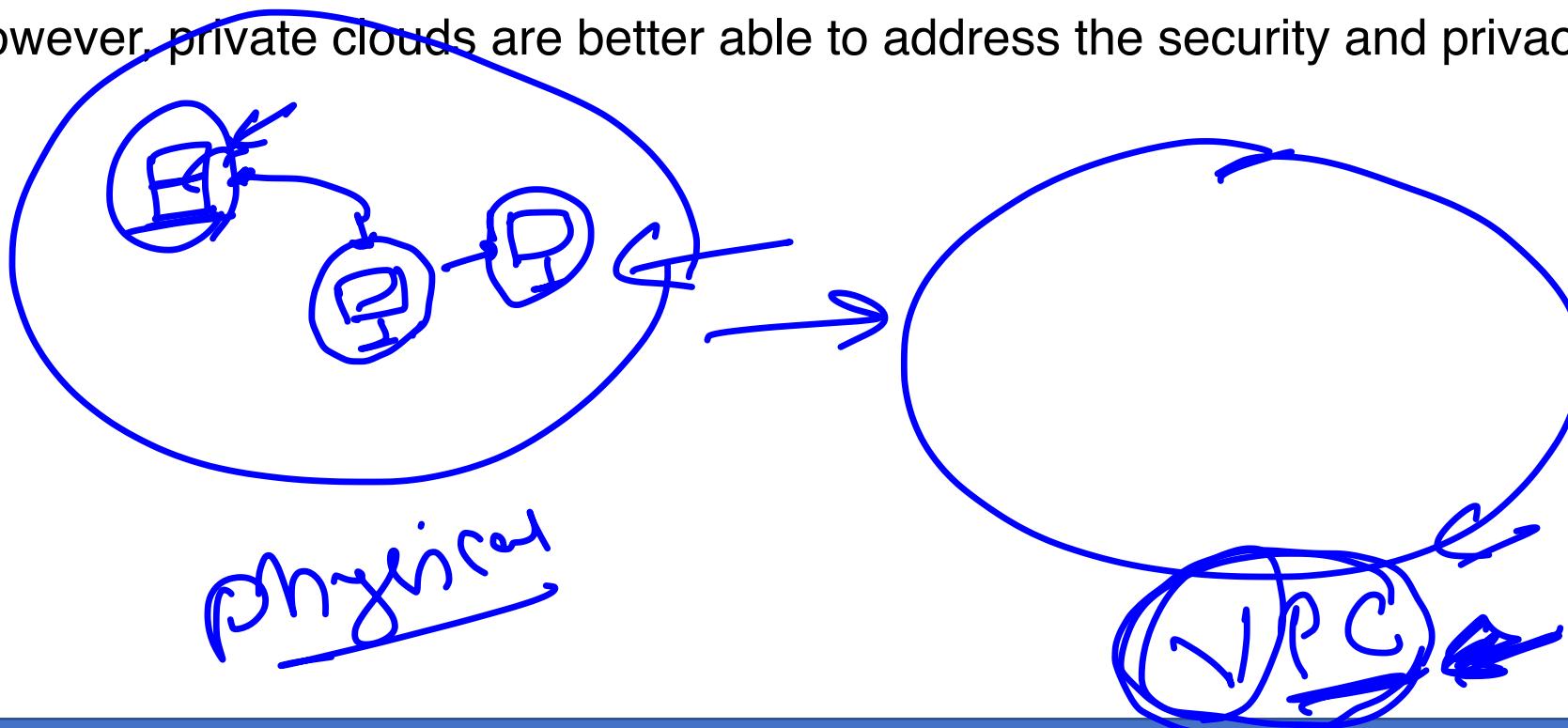
Cloud Deployment Models: Public → internet

- Supports all users who want to make use of a computing resource, such as hardware (OS, CPU, memory, storage) or software (application server, database) on a subscription basis
- Most common uses of public clouds are for application development and testing, tasks such as file-sharing, and e-mail service internet
- Requires internet to access the resources



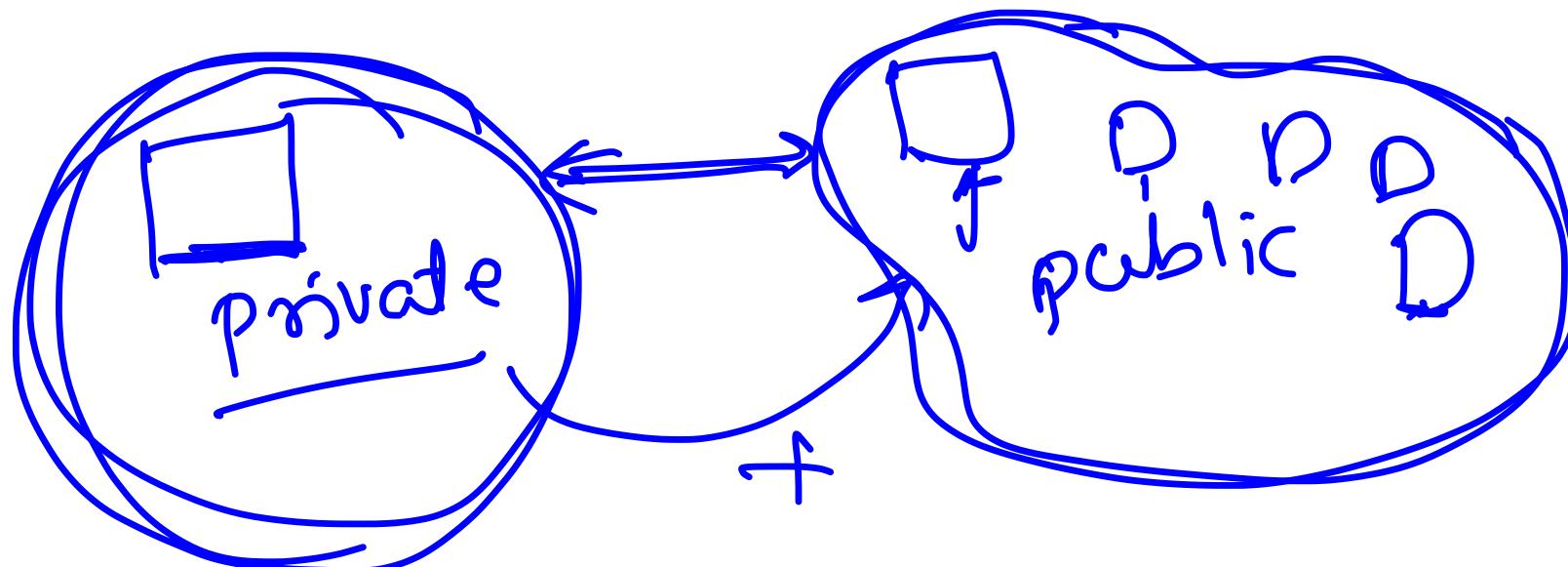
Cloud Deployment Models: Private

- Typically infrastructure used by a single organization
- Such infrastructure may be managed by the organization itself to support various user groups, or it could be managed by a service provider that takes care of it either on-site or off-site
- Private clouds are more expensive than public clouds due to the capital expenditure involved in acquiring and maintaining them
- However, private clouds are better able to address the security and privacy concerns of organizations



Cloud Deployment Models: Hybrid

- Organization makes use of interconnected private and public cloud infrastructure
- Many organizations make use of this model when they need to scale up their IT infrastructure rapidly, such as when leveraging public clouds to supplement the capacity available within a private cloud
- For example, if an online retailer needs more computing resources to run its Web applications during the holiday season it may attain those resources via public clouds.

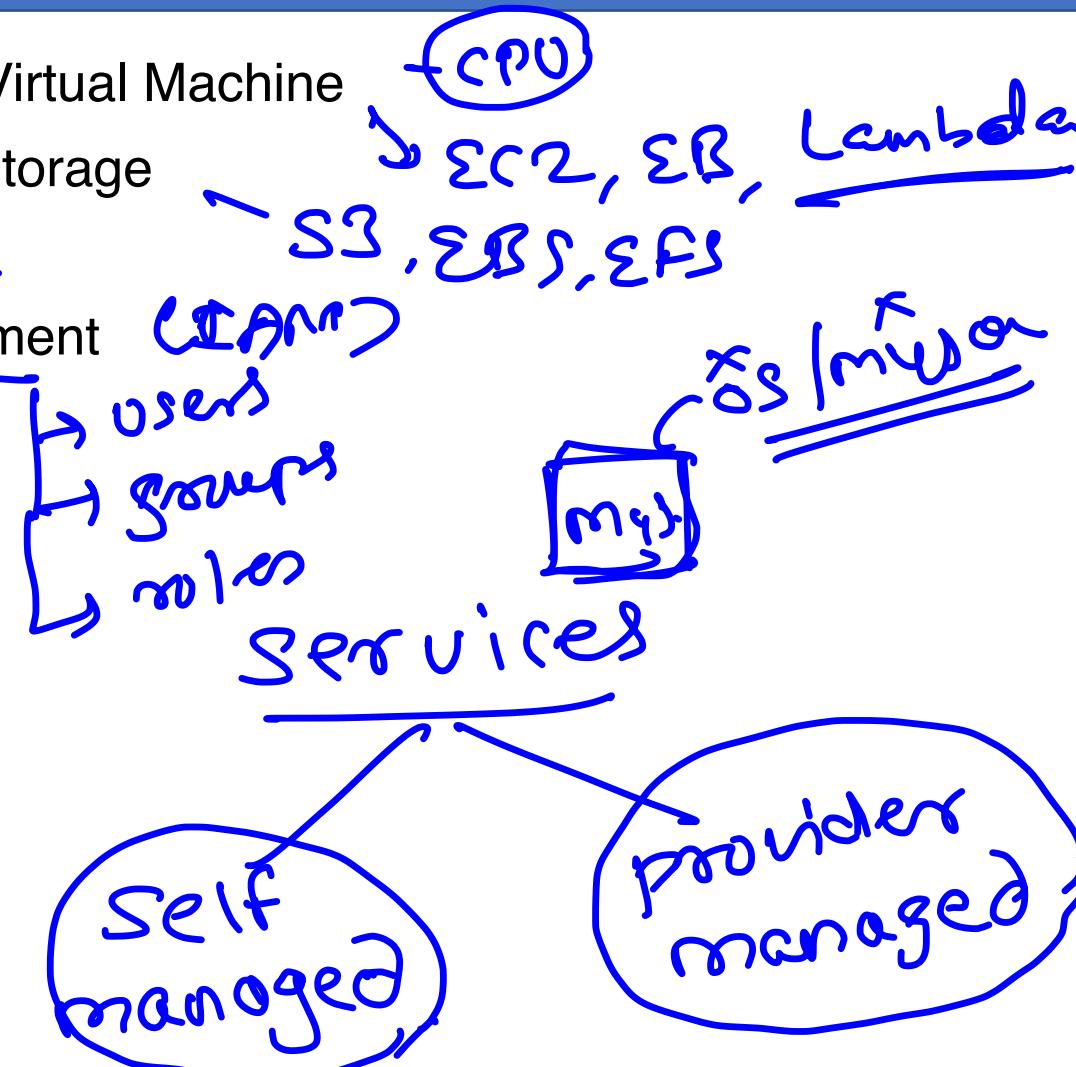


Cloud Services

- Compute: used to create the Virtual Machine
- Storage: used to provide the storage
- Database: RDBMS + No SQL
- Security and Identity Management
- Media Services
- Machine Learning
- Cost Management
- Application Integration

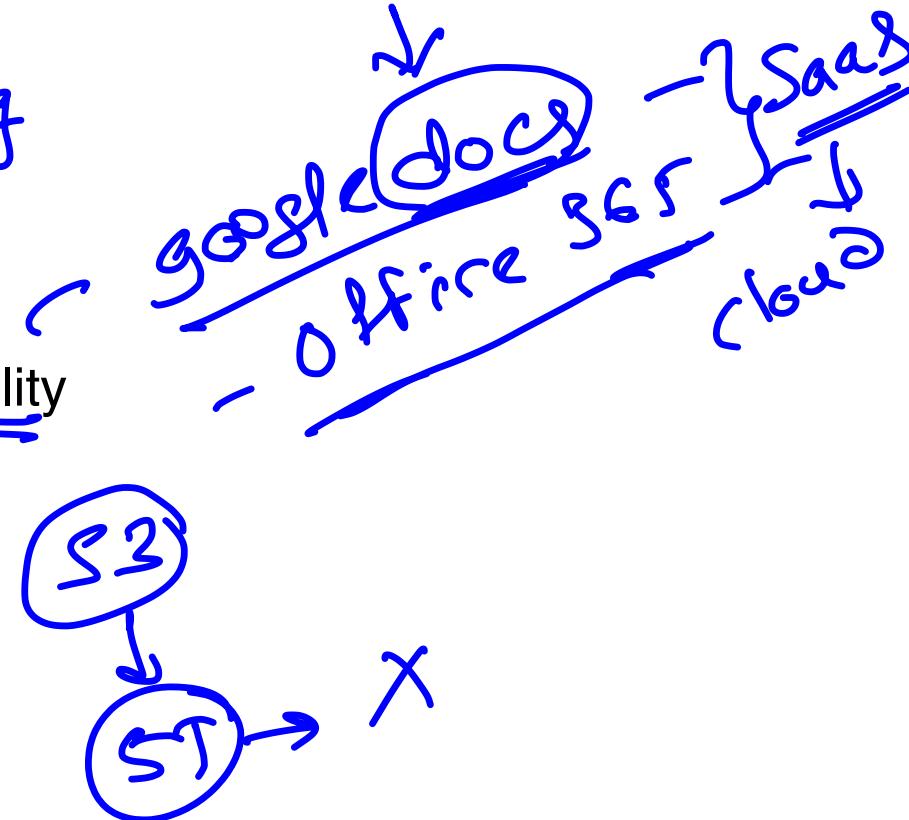
* Application Services

- ↳ SNS
- ↳ SES



Advantages

- Lower computer costs
- Improved performance ← scaling
- Reduced software costs ←
- Instant software updates
- Improved document format compatibility
- Unlimited storage capacity
- Increased data reliability
- Universal document access
- Latest version availability



Disadvantages

Serverless

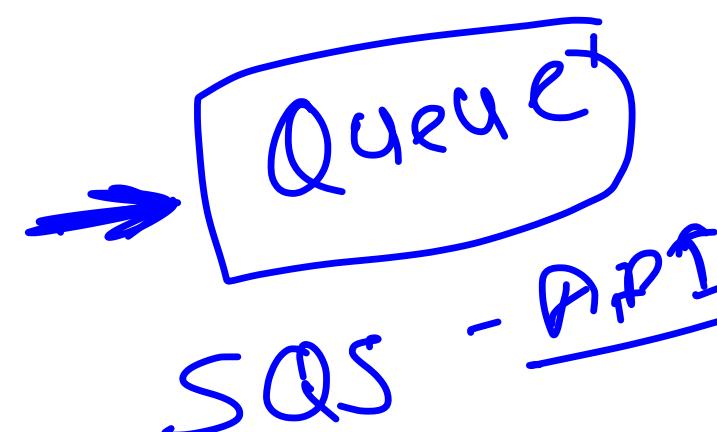
- Requires a constant Internet connection
- Does not work well with low-speed connections
- Features might be limited → provider dependent
- Stored data might not be secure
- Stored data can be lost
- Each cloud system uses different protocols and different APIs

→ " "

→ " "

→ " "

→ developer)



99.99999999%

Stack /
Queue

X Google



Cloud Providers

- Amazon Web Services
- Google Cloud Platform
- Microsoft Azure - 28%
- Rackspace -
- DigitalOcean -
- Alibaba Cloud -
- Oracle Cloud -
- IBM Cloud -
- salesforce

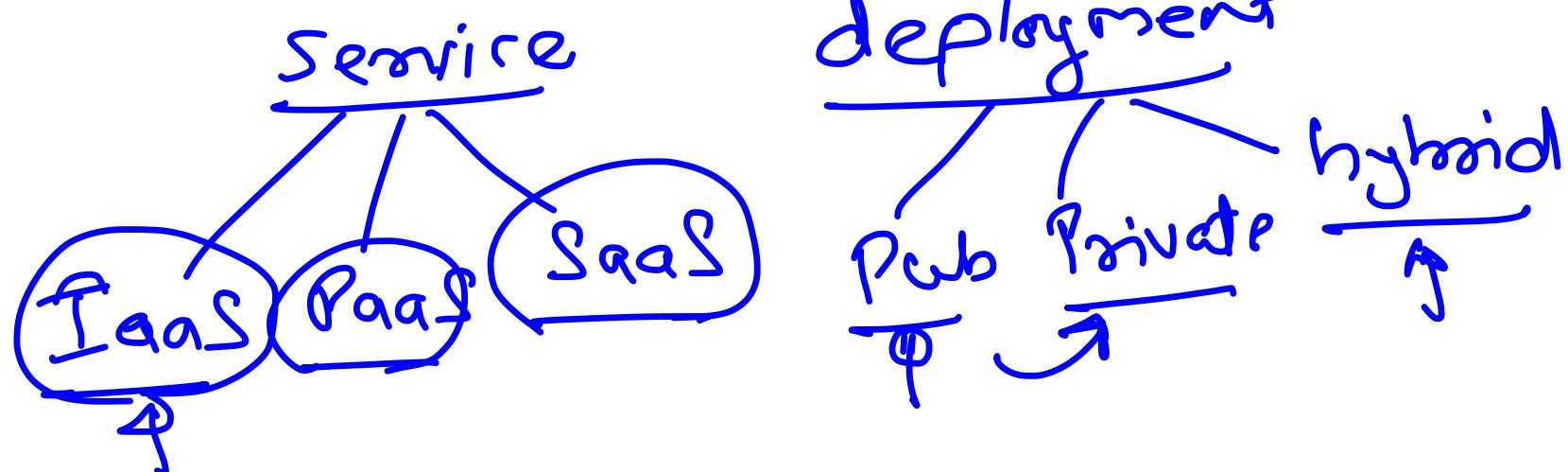
52%
- 96%

- ① cheaper
- ② security
- ③ simple
- ④ programmatically
- ⑤ services

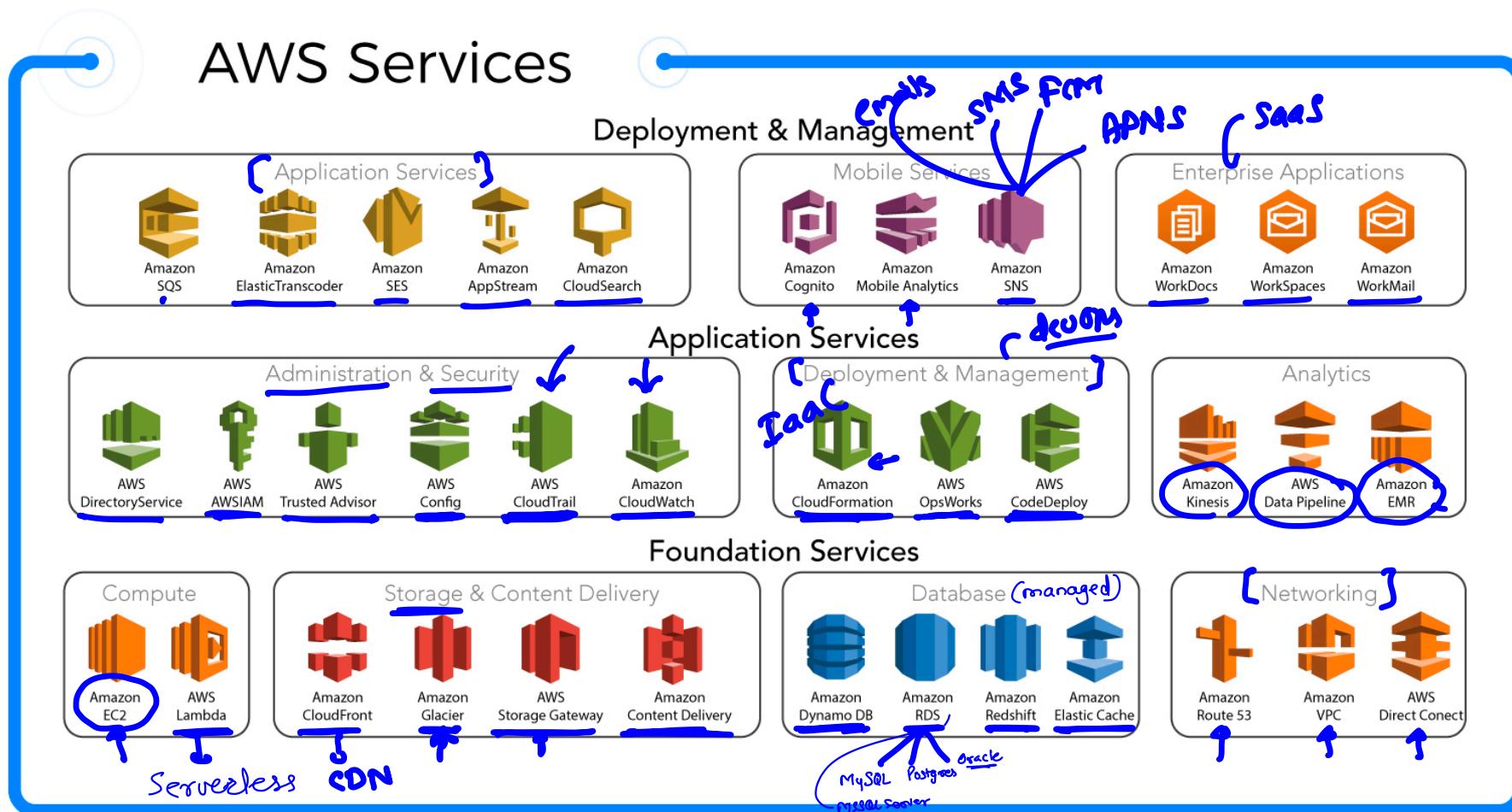
On-demand - \$15
(\$30) free
\$ 360
75
\$ 500
56%

What is AWS ?

- AWS stands for Amazon Web Services
- Platform that offers flexible, reliable, scalable, easy-to-use and cost-effective cloud computing solutions
- Amazon's cloud implementation
- It's a combination of IaaS, PaaS and SaaS offerings



AWS Services



Global Infrastructure: Region

- Geographic area having availability zone(s)
- Collection of availability zones that are geographically located close to one other
- Every Region will act independently of the others, and each will contain at least two Availability Zones
- E.g.
 - US East: N. Virginia, Ohio
 - US West: N. California, Oregon
 - Asia Pacific: Mumbai, Seoul, Singapore, Sydney, Tokyo



Global Infrastructure: Availability Zone

- Essentially the physical data centers of AWS
- This is where the actual compute, storage, network, and database resources are hosted that we as consumers provision within our Virtual Private Clouds (VPCs)
- Availability Zones are always referenced by their Code Name, which is defined by the AZs Region Code Name that the AZ belongs to, followed by a letter
- E.g.

- the AZs within the eu-west-1 region (EU Ireland), are

- eu-west-1a
- eu-west-1b
- eu-west-1c



Global Infrastructure: Edge Locations

- Edge Locations are AWS sites deployed in major cities and highly populated areas across the globe
- Generally used to cache data and reduce latency for end-user access by using the Edge Locations as a global Content Delivery Network (CDN)
- Edge Locations are primarily used by end users who are accessing and using your services
- E.g.
 - Route 53: DNS Lookup
 - CloudFront
 - Content Delivery Network (CDN)
 - Cached contents, streaming distribution, acceleration



