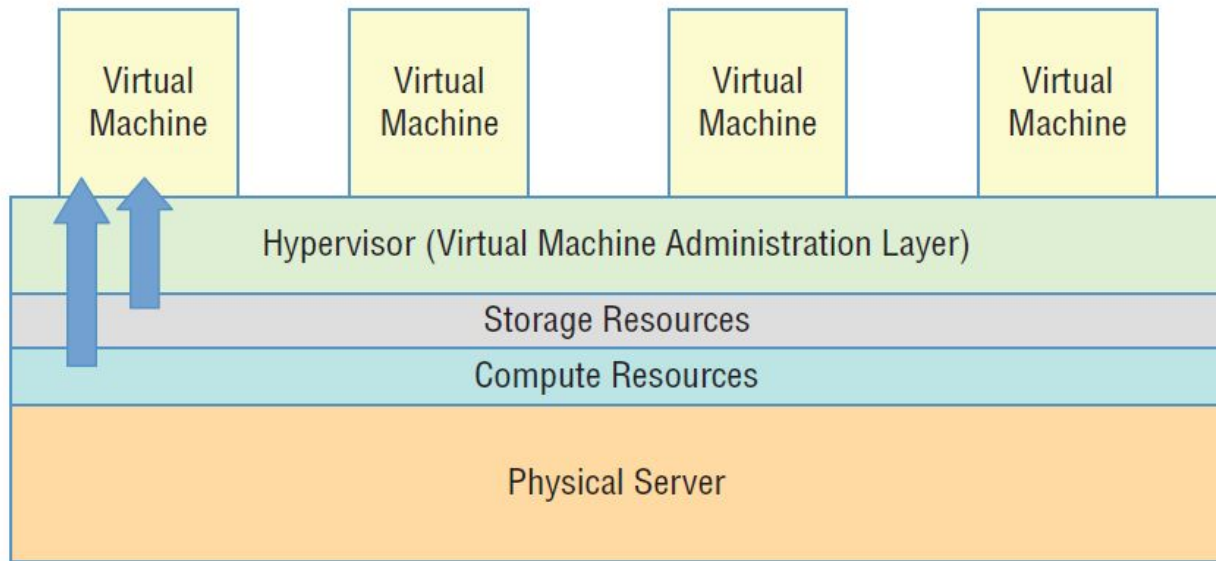# Cloud Computing?

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.

OR

Using someone else's computer to do your job.

Cloud Computing and Virtualization

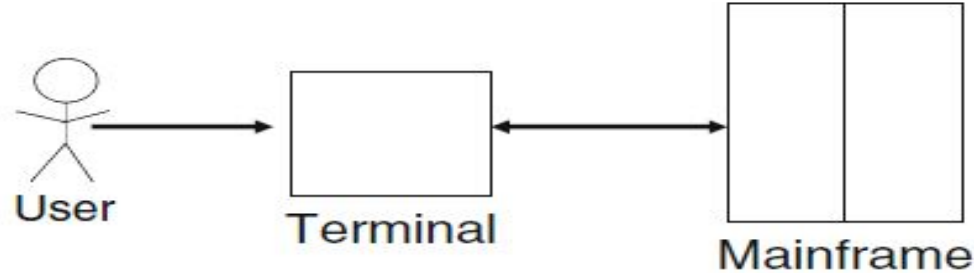- The technology that lies at the core of all cloud operations is virtualization.

Cloud Computing and Virtualization

- Major cloud providers have enormous server farms where hundreds of thousands of servers and data drives are maintained along with the network cabling necessary to connect them.
- A well-built virtualized environment could provide a virtual server using storage, memory, compute cycles, and network bandwidth collected from the most efficient mix of available sources it can find.

Computing Phases

Phases

1. **Mainframe Computing**

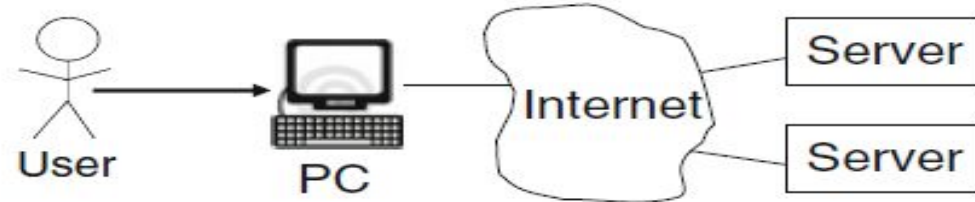   User → Terminal ↔ Mainframe

2. **PC Computing**

   User → PC

3. **Network Computing**

   User → PC — PC

   Server

   Server

Computing Phases

4. Internet Computing — User → PC → Internet → Server, Server
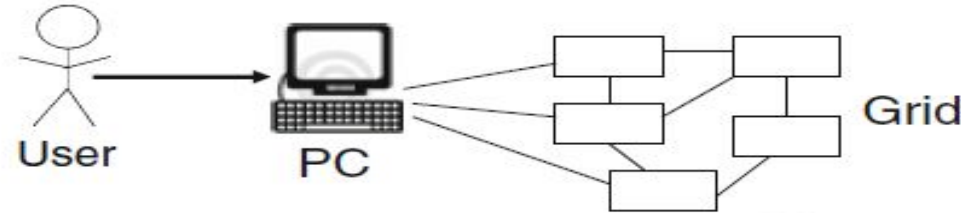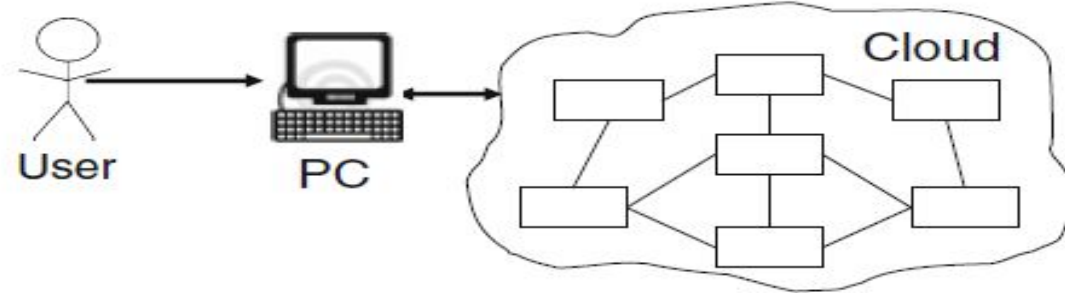
5. Grid Computing — User → PC → Grid

6. Cloud Computing — User → PC ↔ Cloud
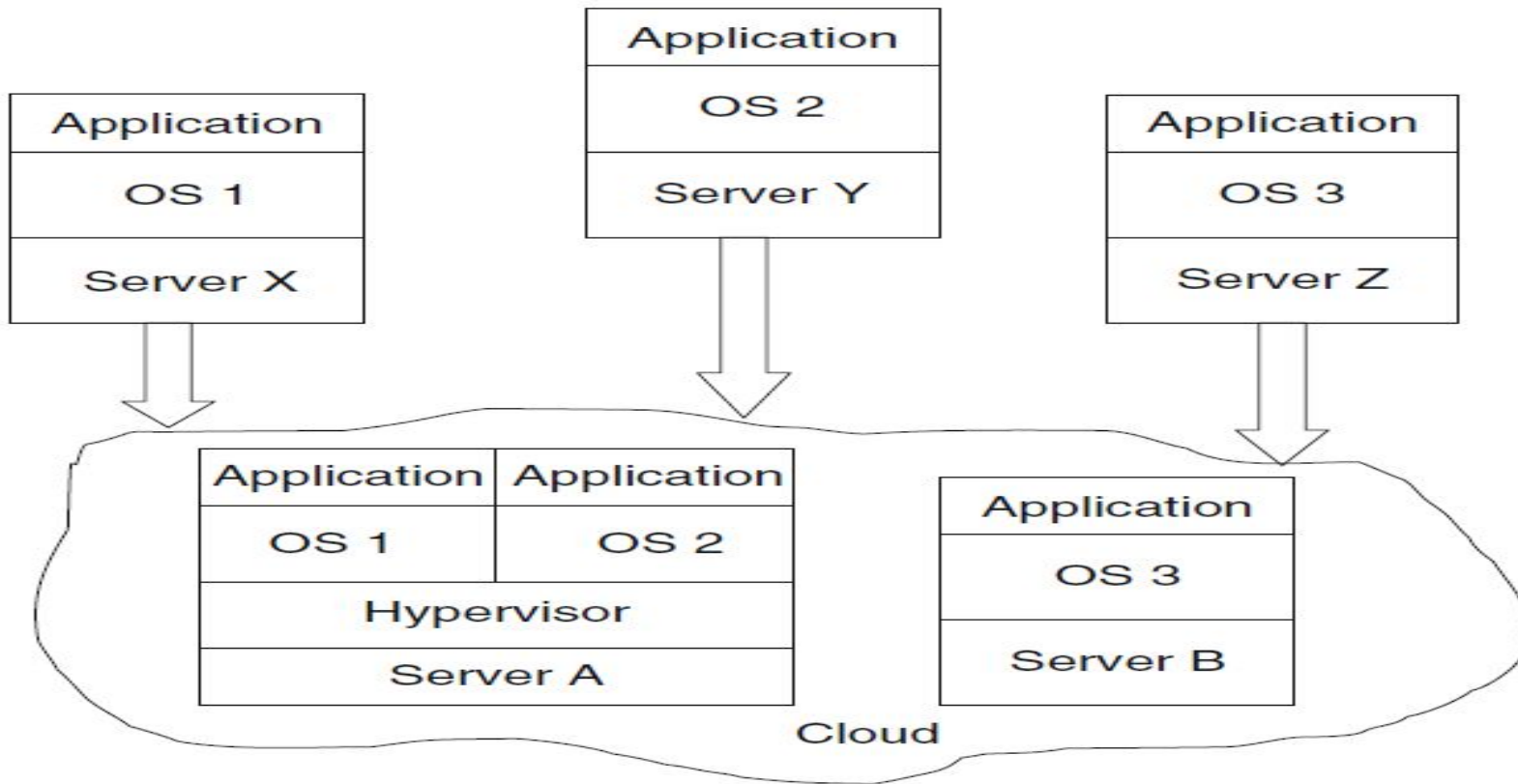
Virtualization

- The advantage of cloud computing is the ability to virtualize and share resources among different applications with the objective for better server utilization

- A well-built virtualized environment could provide a virtual server using storage, memory, compute cycles, and network bandwidth collected from the most efficient mix of available sources it can find.

- In non-cloud computing three independent platforms exist for three different applications running on its own server. In the cloud, servers can be shared, or virtualized, for operating systems and applications resulting in fewer servers

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Networking Basics – IP Address

❑ **IP Address:**

- An **IP address** is a number identifying of a computer or another device on the Internet.

- IP addresses uniquely identify the source and destination of data transmitted with the Internet Protocol.

IPv4 and IPv6

- IPv4 addresses are 32 bits long i.e 4 Bytes.

- An example of an IPv4 address is **216.58.216.164**.

- The maximum value of a 32-bit number is 2^{32}, or 4,294,967,296 i.e **4.3 Billion.**

- A major advantage of IPv6 is that it uses 128 bits of data to store an address, permitting 2^{128} unique addresses or 340,282,366,920,938,463,463,374,607,431,768,211,456

- The size of IPv6's address space — 340 duodecillion this is much, much larger than IPv4.

IP Address Classes

Class	Address range	Supports
Class A	1.0.0.1 to 126.255.255.254	Supports 16 million hosts on each of 127 networks.
Class B	128.1.0.1 to 191.255.255.254	Supports 65,000 hosts on each of 16,000 networks.
Class C	192.0.1.1 to 223.255.254.254	Supports 254 hosts on each of 2 million networks.
Class D	224.0.0.0 to 239.255.255.255	Reserved for multicast groups.
Class E	240.0.0.0 to 254.255.255.254	Reserved for future use, or research and development purposes.

Ranges 127.x.x.x are reserved for the loopback or localhost

Private IP

[Allowed Values]
- The Internet Assigned Numbers Authority (IANA) established certain blocks of IPV4 addresses for the use of private (LAN) and public (Internet) addresses.
- Private IP can only allow certain values

10.0.0.0 – 10.255.255.255 (10.0.0.0/8) <= **in big networks**

172.16.0.0 – 172.31.255.255 (172.16.0.0/12) <= **default AWS one**

192.168.0.0 – 192.168.255.255 (192.168.0.0/16) <= **example: home networks**

Public IP

- All the rest of the IP on the internet are public IP

CIDR(Classless Inter-Domain Routing)

- CIDR are used for Security Groups rules, or AWS networking in general.
- They help to define an IP address range
- We've seen WW.XX.YY.ZZ/32 == one IP
- We've seen 0.0.0.0/0 == all IPs
- But we can define for ex: 192.168.0.0/26: 192.168.0.0 – 192.168.0.63 (64 IP)

- https://www.ipaddressguide.com/cidr

Understanding CIDR

- A CIDR has two components:
- ❖ The base IP (XX.XX.XX.XX)
- ❖ The Subnet Mask (/26)

- The base IP represents an IP contained in the range.
- The subnet masks defines how many bits can change in the IP

- The subnet mask can take two forms. Examples:
  255.255.255.0 <u>this is less common</u>
  /24 this is more common

Understanding CIDRs Subnet Masks

The subnet masks basically allows part of the underlying IP to get additional next values from the base IP.

- ❏ */32 allows for 1 IP = 2^0*
- ❏ */31 allows for 2 IP = 2^1*
- ❏ */30 allows for 4 IP = 2^2*
- ❏ */29 allows for 8 IP = 2^3*
- ❏ */28 allows for 16 IP = 2^4*
- ❏ */27 allows for 32 IP = 2^5*
- ❏ */26 allows for 64 IP = 2^6*
- ❏ */25 allows for 128 IP = 2^7*
- ❏ */24 allows for 256 IP = 2^8*
- ❏ */16 allows for 65,536 IP = 2^16*
- ❏ */0 allows for all IPs = 2^32*

How to remember this

- /32 – no IP number can change
- /24 - last IP number can change
- /16 – last IP two numbers can change
- /8 – last IP three numbers can change
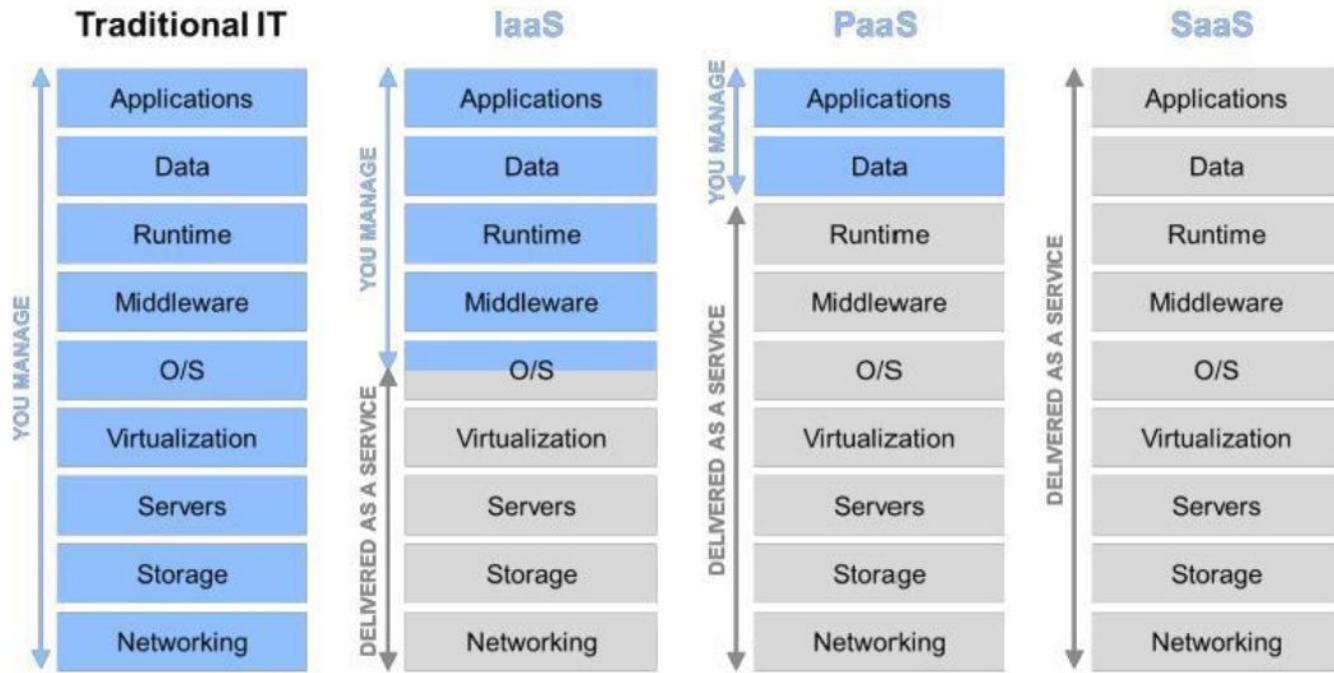- /0 – all IP numbers can change

Lets Do the Math…

 What will be the range and the total number of IP address available.
 192.168.0.0/24 = … ?

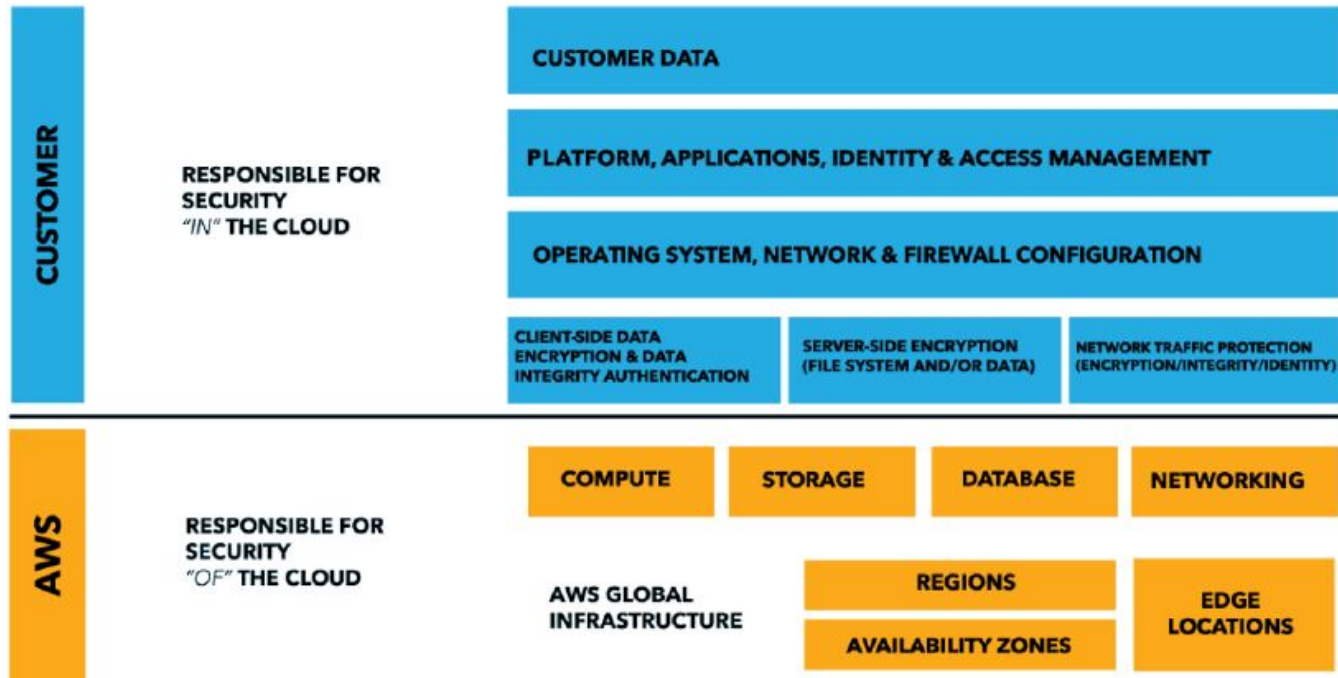 *192.168.0.0/16 = … ?*

 134.56.78.123/32 = … ?

 0.0.0.0/0

Lets Do the Math…

- What will be the range and the total number of IP address available.
- *192.168.0.0/24 = … ?*
  - ***192.168.0.0 – 192.168.0.255 (256 IP)***
- *192.168.0.0/16 = … ?*
  - ***192.168.0.0 – 192.168.255.255 (65,536 IP)***
- *134.56.78.123/32 = … ?*
  - ***Only 134.56.78.123***
- *0.0.0.0/0*
  - ***All IP!***

- For above calculation : https://www.ipaddressguide.com/cidr

Service Models or Cloud Stack

Source: Microsoft.

Shared Responsibility in AWS

Private vs Public IP (IPv4)

Web Server (public):
79.216.59.75

Server (public):
211.139.37.43

WWW

Internet Gateway (public):
149.140.72.10

Internet Gateway (public):
253.144.139.205

Company A
Private Network
192.168.0.1/22

Company B
Private Network
192.168.0.1/22
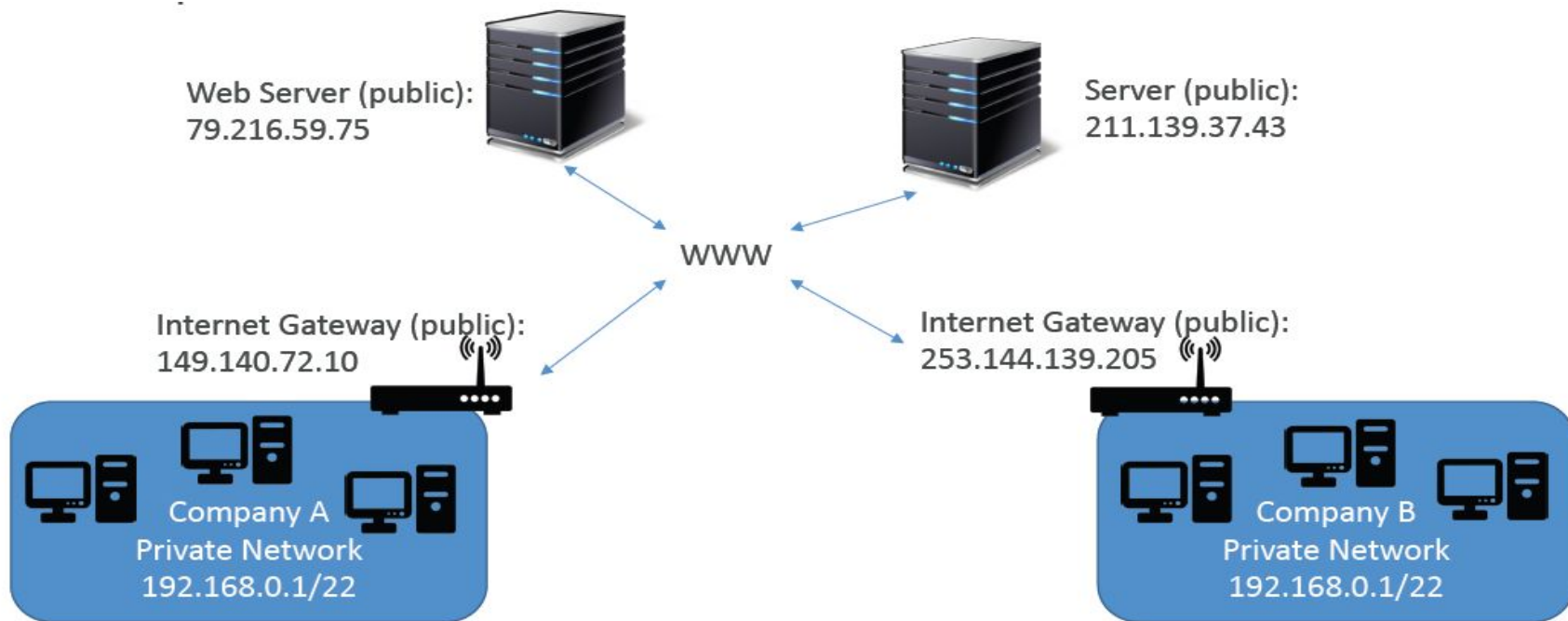
Cloud Terminology

 Scalability & High Availability

Scalability means that an application / system can handle greater loads by adapting.

• There are two kinds of scalability:

    Vertical Scalability
    Horizontal Scalability (= elasticity)

Cloud Terminology

- Vertical Scalability
- Vertically scalability means increasing the size
of the instance
- For example, your application runs on a t2.micro
- Scaling that application vertically means running it on a t2.large
- Vertical scalability is very common for non distributed systems, such as a database.

Cloud Terminology

- Horizontal Scalability
- Horizontal Scalability means increasing the number of instances / systems for your Application.
- Horizontal scaling implies distributed systems.
- common for web applications / modern applications

Cloud Terminology

- High Available
- High Availability usually goes hand in hand with horizontal scaling
- High availability means running your application / system in at least 2 data centers (== Availability Zones)
- The goal of high availability is to survive a data center loss
- The high availability can be passive (for RDS Multi AZ for example)

AWS Free Tier :

https://aws.amazon.com/free/

AWS Global Infrastructure

https://www.infrastructure.aws/