16.2 IP Addressing Scheme

ROADMAP

* Protocol
* TCP/IP
* IPv4 Address
* IP Address Types
* NAT

PROTOCOL

Protocol: set of rules to follow to have proper communication.

Network protocols:

- TCP/IP - DOD
- IPx/SPx - Novell
- AppleTalk - Apple
- NetBIOS - Microsoft
- OSI – ISO

WHAT IS TCP/IP ?

TCP/IP is a standard protocol used between computers and network devices for communication.

TCP/IP addressing:

- IP Address is logical address given to each and every device in the network.
- It is a Network layer address (Layer 3)
- Two versions of IP:
  - ➢ IP Version 4
  - ➢ IP Version 6

IPV4 ADDRESS

Bit is represented by 0 or 1.

IP address in binary form (32 bit).

IP Address
00000000000000000000000000000000
11111111111111111111111111111111
10101010111000000001111111001100

32 bits divided into 4 octets

First Octet	Second Octet	Third Octet	Fourth Octet
10101010	11110000	00001111	01010101
8 Bits	8 Bits	8 Bits	8 Bits

BINARY TO DECIMAL

Taking example as all 0's

BINARY TO DECIMAL CONVERSION							
1	0	1	0	1	0	1	0
x	x	x	x	X	x	x	x
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
=	=	=	=	=	=	=	=
128	0	32	0	8	0	2	0
128+0+32+0+8+0+2+0=170							
170							

BINARY TO DECIMAL ON 4 OCTETS

Taking example as all 0's

Octet 1 — BINARY TO DECIMAL CONVERSION

1	0	1	0	1	0	1	0
x	x	x	x	x	x	x	x
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
=	=	=	=	=	=	=	=
128	0	32	0	8	0	2	0

128+0+32+0+8+0+2+0=170

170

Octet 2 — BINARY TO DECIMAL CONVERSION

1	1	1	1	0	0	0	0
x	x	x	x	x	x	x	x
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
=	=	=	=	=	=	=	=
128	64	32	16	0	0	0	0

128+64+32+16+0+0+0+0=240

240

Octet 3 — BINARY TO DECIMAL CONVERSION

0	0	0	0	1	1	1	1
x	x	x	x	x	x	x	x
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
=	=	=	=	=	=	=	=
0	0	0	0	8	4	2	1

0+0+0+0+8+4+2+1=15

15

Octet 4 — BINARY TO DECIMAL CONVERSION

0	1	0	1	0	1	0	1
x	x	x	x	x	x	x	x
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
=	=	=	=	=	=	=	=
0	64	0	16	0	4	0	1

0+64+0+16+0+4+0+1=85

85

IP ADDRESS: 170.240.15.85

IPV4 Address

Octets	First Octet	Second Octet	Third Octet	Fourth Octet
Binary	10101010	11110000	1111	1010101
Decimal	170	240	15	85
IPADDRESS	170.240.15.85			

IP Address in decimal form: 170.240.15.85

RANGE OF IPv4 ADDRESS

Taking example as all 0's

BINARY TO DECIMAL CONVERSION							
0	0	0	0	0	0	0	0
x	x	x	x	x	x	x	x
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
=	=	=	=	=	=	=	=
0	0	0	0	0	0	0	0
0+0+0+0+0+0+0+0=0							
0							

RANGE OF IPv4 ADDRESS

Taking example as all 1's

BINARY TO DECIMAL CONVERSION							
1	1	1	1	1	1	1	1
x	x	x	x	x	x	x	x
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
=	=	=	=	=	=	=	=
128	64	32	16	8	4	2	1
128+64+32+16+8+4+2+1=255							
255							

RANGE OF IPv4 ADDRESS

Taking example as all 1's in all four octets

BINARY TO DECIMAL CONVERSION								BINARY TO DECIMAL CONVERSION								BINARY TO DECIMAL CONVERSION								BINARY TO DECIMAL CONVERSION							
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
128+64+32+16+8+4+2+1=255								128+64+32+16+8+4+2+1=255								128+64+32+16+8+4+2+1=255								128+64+32+16+8+4+2+1=255							
255								255								255								255							
255								**255**								**255**								**255**							
255.255.255.255																															

RANGE OF IPv4 ADDRESS

MIN	0	0	0	0
MAX	255	255	255	255

Total IP Address Range: 0.0.0.0 to 255.255.255.255

IP ADDRESS CLASSIFICATION

IP ADDRESS are divided into 5 classes

CLASS NAME	STARTING IP	ENDING IP
CLASS A	0.0.0.0	127.255.255.255
CLASS B	128.0.0.0	191.255.255.255
CLASS C	192.0.0.0	223.255.255.255
CLASS D	224.0.0.0	239.255.255.255
CLASS E	240.0.0.0	255.255.255.255

CLASS A, B, C used in LAN & WAN

CLASS D reserved for multicasting

CLASS E reserved for research & development and for future use

TYPES OF COMMUNICATION

In an IPv4 network, the hosts can communicate one of three differentways:

- Unicast   - One to One
- Broadcast   - One to All
- Multicast   - One to Many

DIFFERENCE BETWEEN PUBLIC AND PRIVATE IP

PUBLIC IP	PRIVATE IP
Used on public network(INTERNET)	Used with the LAN or within the organization
Recognized on internet	Not recognized on internet
Given by the service provider(from IANA)	Given by the administrator
Globally unique	Unique within the network or organization
Pay to service provider	Free
Registered	Unregistered IP

PRIVATE IP ADDRESS

There are certain addresses in each class of IP address that are reserved for Private Networks.

These addresses are called private addresses.

CLASS	START IP	END IP
CLASS A	10.0.0.0	10.255.255.255
CLASS B	172.16.0.0	172.31.255.255
CLASS C	192.168.0.0	192.168.255.255

ELASTIC IP ADDRESS

- To use an Elastic IP address, you first allocate one to your account, and then associate it with your instance or a network interface.

- When you associate an Elastic IP address with an instance or its primary network interface, the instance's public IP address (if it had one) is released back into Amazon's pool of public IP addresses.

- You can disassociate an Elastic IP address from a resource, and reassociate it with a different resource.

- A disassociated Elastic IP address remains allocated to your account until you explicitly release it.

- An Elastic IP address is for use in a specific region only.

NETWORK AND HOST PORTIONS

IP Address is divided into Network & HostPortion.

CLASS	NETWORK/HOST PORTION
CLASS A	N.H.H.H
CLASS B	N.N.H.H
CLASS C	N.N.N.H

Host: specific a device in the network.

Network: set of devices

SUBNET MASK

CLASS A	DEFAULT SUBNET MASK		255.0.0.0
N	H	H	H
255	0	0	0
11111111	00000000	00000000	00000000

CLASS B	DEFAULT SUBNET MASK		255.255.0.0
N	N	H	H
255	255	0	0
11111111	11111111	0	0

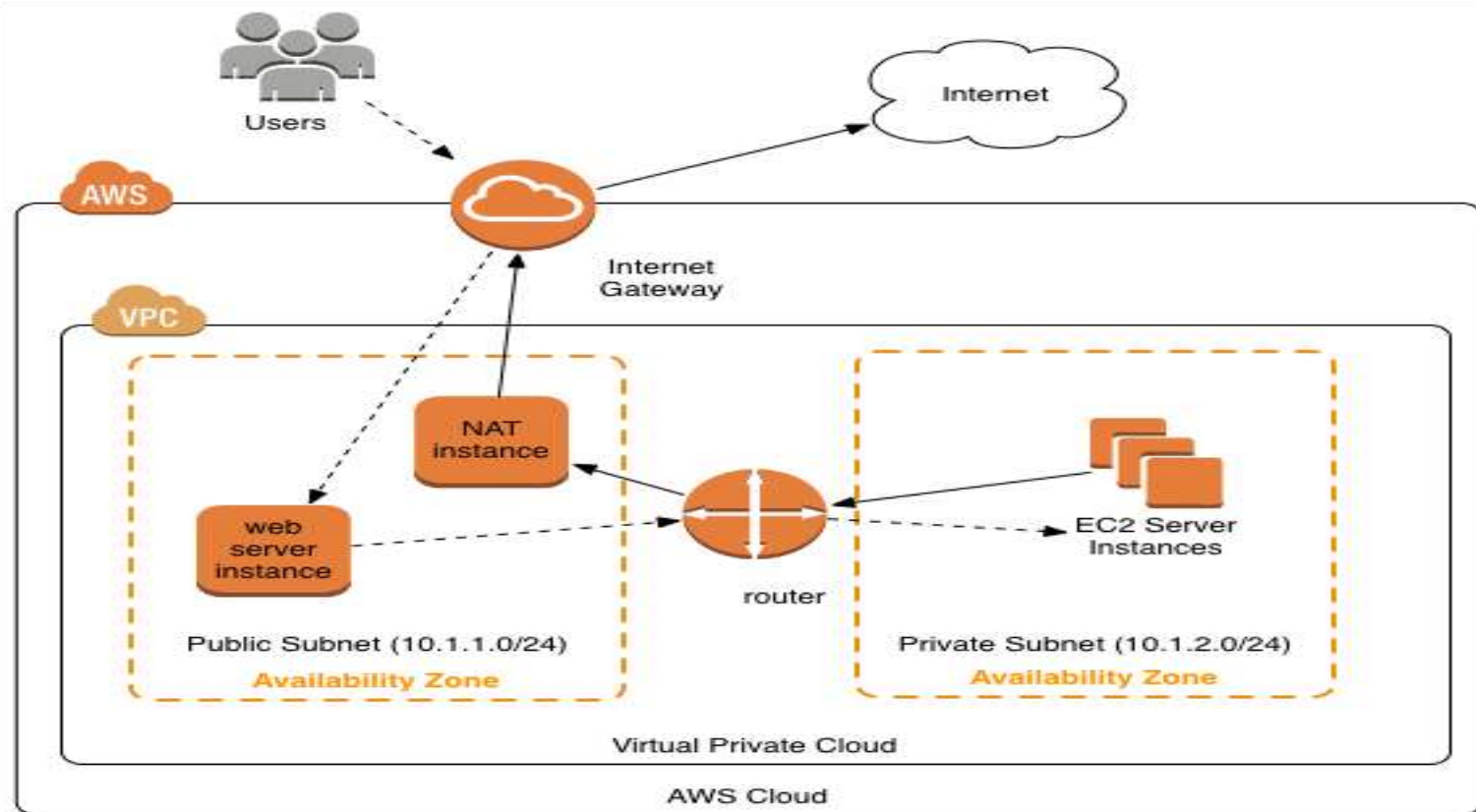| CLASS C	DEFAULT SUBNET MASK		255.255.255.0
N	N	N	H
255	255	255	0
11111111	11111111	11111111	0

/8

/16

/24

NETWORK ADDRESS TRANSLATION (NAT)

NAT (Network Address Translation) Maps Private IPs to Public IPs

It is required because of shortage of IPv4 Address

You can use a network address translation (NAT) instance in a public subnet in your VPC to enable instances in the private subnet to initiate outbound IPv4 traffic to the Internet or other AWS services, but prevent the instances from receiving inbound traffic initiated by someone on the Internet.

NETWORK ADDRESS TRANSLATION (NAT)

THANK YOU