

## 1. Core Networking Concept

- ① Network: Networks connect devices to share information, data, resources.
- ② Bandwidth: Bandwidth is data transmission speed.
- ③ Latency: Latency is delay in the data transfer.
- ④ Throughput: Throughput is actual data transfer speed.
- ⑤ Internet

	Intranet	Extranet
① Global network for everyone	① Private network for a company	① Private network for a company & trusted outsiders
② Anyone can access	② Only company stuff can access	② Only company stuff & trusted outsiders can access
③ less secure	③ More secure	③ Secure but given access to trusted outsiders
④ Share info with the world	④ Share info within the company	④ Share information within the company → trusted outsiders

⑥ Firewall: Firewall is a security system that blocks harmful data & allows only safe data in the network. It protects the computer & the network from hackers & viruses.

⑦ Data: Data is a raw facts

⑧ Information: Data that have been processed & organized

## 2. Cyber Attacks

1. Buffer overflow: Overloading a program with much data into buffer to crash it.
2. Brute force: Guessing password by trying every possible combinations.
3. Salamis: Attackers steal small amount of money from multiple account overtime making it difficult to detect.
4. SQL injection: Injecting malicious SQL to the website / web application to extract & manipulate sensitive data.
5. Ransomware: Ransomware is a malware that encrypts file until the user give money to attackers to unlock the file.
6. Phishing: Phishing is a type of social engineering attack where attackers impersonate as trusted entities.
7. Social Engineering: Trickling people into revealing sensitive credentials.

8. Man In Middle: Attackers ~~can~~ intercept & manipulate conversation between 2 parties.

9. Captcha: Attacker use automated tools to bypass captcha security.

10. Clickjacking: Clicking on an invisible UI to perform action like sending money.

11. Rootkit: Rootkit is a malware software that is hidden deep within the operating system that give access to the attackers.

12. XSS (Cross Site Scripting): Injecting malicious script to the website/webapplication to extract & manipulate sensitive information.

## Protocol & Standard

### Prevention of Attack:

① Validation

② 2FA - 2 factor authentication

③ Strong password

④ Account lockdown After trying too much.

⑤ PAN - Personal identification number : PAN is a unique

Ex: Robot, Blueprint

Workers in a LAN : LAN - Wide network

Ex: Computer

⑥ Mesh network each other

### 3. Network Topology

① LAN - Local Area Network: LAN is a network that connects devices within a limited geographical area. Ex: Home, office, building

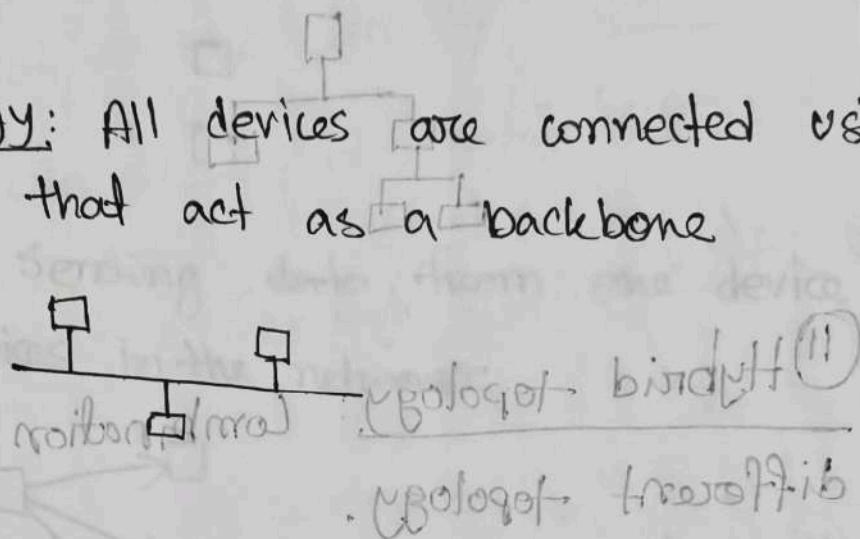
② MAN - Metropolitan Area Network: MAN is a network that connects devices within a larger geographical area. Ex: City

③ PAN - Personal Area Network: PAN is a network that connects devices close to a single person. Ex: Hotspot, Bluetooth

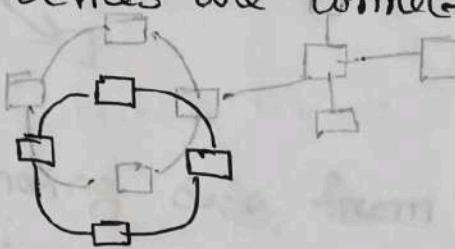
④ WAN - Wide Area Network: WAN is a network that connects devices in a huge geographical area. Ex: Country

⑥ Topology: Topology are structures that shows how devices are connected with each other using cables.

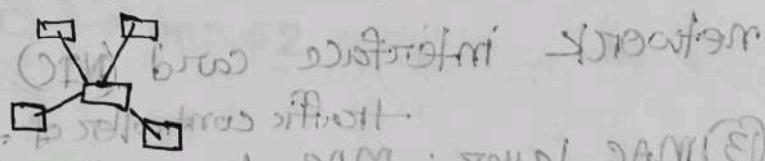
⑥ Bus topology: All devices are connected using single cable that act as a backbone



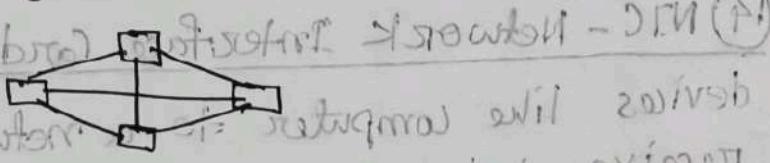
⑦ Ring topology: Devices are connected in a ring



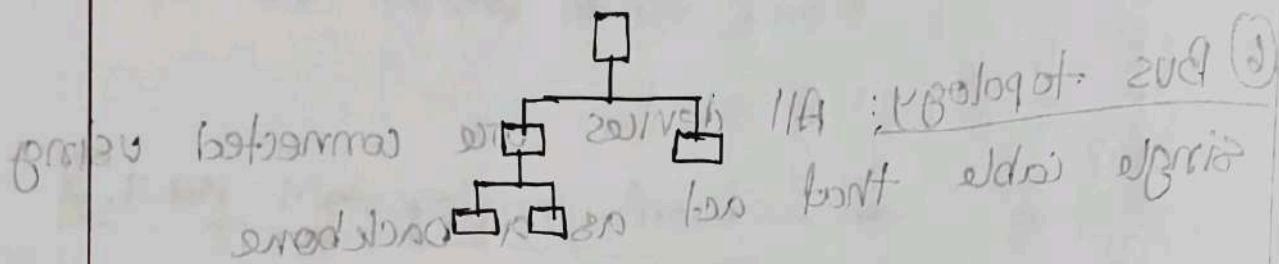
⑧ Star topology: All devices are connected with a central hub, route, switch



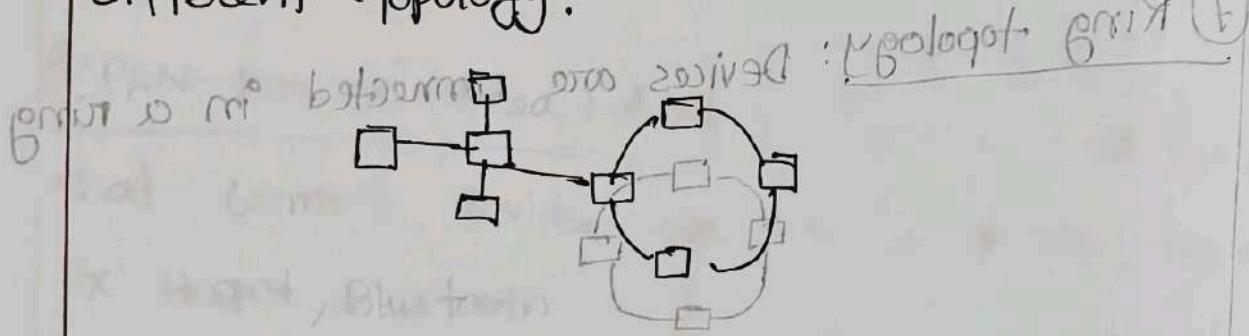
⑨ Mesh topology: All devices are connected with each other using cables



⑩ Tree topology: ~~Hier~~ Hierarchical structure, devices are connected like a branch of a tree



⑪ Hybrid topology: Combination of 2 or more different topology.

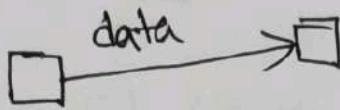


⑫ MAC - Media Access Control : MAC address is a uniquely identifier assigned to every network interface card (NIC)

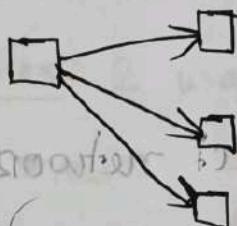
⑬ MAC layer : MAC layer is traffic controller of the local network ensuring data link layer data flow smoothly preventing error in OS model

⑭ NIC - Network Interface Card : NIC connect devices like computer to a network to send & receive data

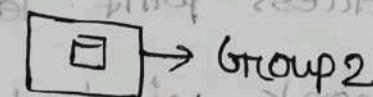
(15) Unicast: sending data from one device to another single specific device in a network.



(16) Broadcast: sending data from one device to all the devices in the network.



(17) Multicast: sending data from one device to a group of devices in a network.



18 Router: Router connect devices & send data to the right place like traffic

19 Switch: Link devices to a network & send data to the correct device

20 Hub: Join devices in a network

18 Router: Router connect network

19 Switch: switch manage traffic

20 Hub: Hub broadcast data to group

21 Gateway: Protocol translation

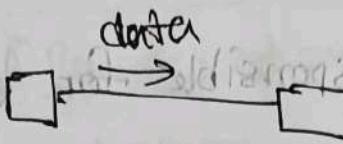
22 Access point: Access point let devices to connect to a network wirelessly

23 Bridge: Connect 2 parts of the network

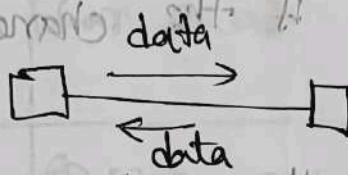
24 Repeater: Boosts the signal to extend the range

## Point-to-point

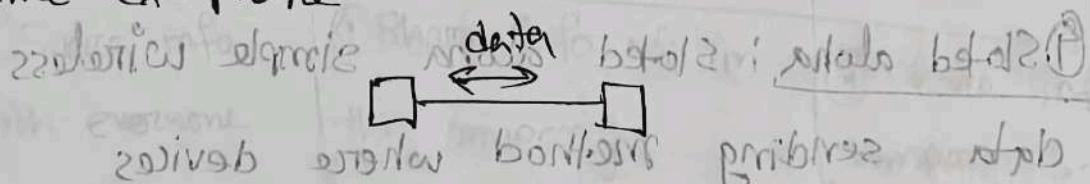
25) Simplex: One way communication. ex: radio



26) Half duplex: 2 way communication but not at the same time. Ex: walkie-talkie



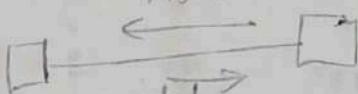
27) Full duplex: 2 way communication at the same time. ex: phone



## 4. Logical Link Control

① LLC: LLC is a sublayer of a data link layer in OSI model responsible for error detection.

② ALOHA: ALOHA is a simple ~~to~~ wireless data sending method where devices send data without checking if the channel is free.



③ Pure aloha: If collision happens it retransmits data after delay.

④ Slotted aloha: Slotted aloha simple wireless data sending method where devices transmit data in a fixed time slot.

⑤ IP address: A unique number assigned to a device in a network.

⑥ Subnet: A smaller network created by ~~to~~ dividing larger network.

Comparison		
Internet	Intranet	Extranet
① Global network for everyone	① Private network for a company	① Private network for a company & trusted outsiders
② Access by everyone	② Only company staff can access	② Only company staff & trusted outsiders can access
③ less secure	③ more secure	③ secure but access by trusted outsider
④ Share info with everyone	④ Share info within the company	⑤ Share info within company & trusted outsiders

Dos	DDoS
① Denial of service	① Distributed Denial of service
② Attack from one place to stop service	② Attack from multiple place to crash the service
③ Easy to detect	③ Harder to detect
④ Attack size small	④ Attack size big
⑤ Not costly	⑤ Costly

Hub	Switch
① Broadcast data	① Manage traffic
② Easy to setup	② Complicated to set up
③ Not costly	③ Expensive
④ Best for small network	④ Best for big network
⑤ Send data to every connected device	⑤ Send data to only the right device
⑥ Speed slow	⑥ Speed fast

## Router

① Router connect network

② Expensive

③ Not easy to set up

④ Speed slow

## Switch

① switch manage traffic

② Not expensive

③ Easy to setup

④ Speed fast

Router	MAC	WAN	Access point	WAN
① Router connect network	① Access point let devices connect to the network wireless			
② Not easy to setup	② Easy to setup			
③ Connect to the internet	③ To connect to the internet need router			
④ Give IP address to the device	④ Doesn't give IP address to the device			

LAN	MAN	PAN	WAN
① Local Area Network	① Metropolitan Area Network	① Personal Area Network	① Wide area Network
② Connect device within a limited geographical area	② Connected within a large geographical area	② Connect device within / close to a person	② Connected device within the largest geographical area.
③ cheap	④ Expensive	③ Very cheap	③ Most expensive
④ Ex: Home, office	④ Ex: City	④ Ex: Bluetooth	④ Ex: <del>International</del> Country

Star	Ring	Bus	Mesh	Tree	Hybrid
① Every device is connected to a hub	① Devices are connected in a circle or ring format	① All devices are connected in a backbone line	② All devices are connected with each other	② Hierarchical structure, more all devices are connected	② 2 or more connected to topology are connected
③ Easy to set up	③ Easy to setup	③ Hard to setup	③ Hard to setup	④ Hard to setup	④ Hard to setup
④ If switch goes down whole system goes down	⑤ If one device goes down whole system goes down	⑥ If one device goes down whole system goes down	⑦ If one device goes down it doesn't affect the whole system	⑧ If one device goes down whole system goes down	⑨ If one device goes down it doesn't affect the topology
⑤ finding problem is easy	⑤ finding problem is easy	⑥ not costing	⑥ not costing	⑦ costing	⑦ costing
⑥ not costing	⑥ not costing	⑦ costing	⑦ costing	⑧ moderate	⑧ costly
⑦ finding problem is hard	⑦ finding problem is hard	⑧ finding problem is hard	⑨ finding problem is hard	⑩ finding problem is hard	⑪ finding problem is hard
⑧ finding problem is hard	⑨ finding problem is hard	⑩ finding problem is hard	⑪ finding problem is hard	⑫ finding problem is hard	⑬ finding problem is hard

## Pure ALOHA

① No fixed time slot  
device can send data  
anytime

② Higher chance of  
collision

③ Simple

④ Easy to setup

⑤ Not costly

## SLOTTED ALOHA

① Time is divided into  
fixed time slot

② Lower chance of  
collision

③ Complex

④ Harder to setup

⑤ Costly



### Stop & Wait ARQ

- ① Sender wait for the acknowledgement (ACK) after each frame before sending the next.

② Low efficiency

③ Low cost

④ Simple

### Go Back N ARQ

- ① Sender send multiple frame if there is an error. It resend from bad frame onward.

② Better efficiency

③ Moderate cost

④ Moderate

### Selective Repeat ARQ

- ① Sender resends only the bad frame.

② Best efficiency

③ High cost

④ Complex

### IPV4

① 32 bit address

② Low cost

③ Simple

④ Used in older device

### IPV6

① 128 bit address

② High cost

③ Complex

④ Used in new device

## Static IP address

① Fixed IP address

② Set by admin

③ More maintenance

④ Costly

⑤ Complex

## Dynamic IP address

① Not fixed IP address

② Set automatic by DHCP

③ less maintenance

④ Not costly

⑤ Simple

PV9E

2207bb0 fid 28①

+202 NBTT②

xelqrrr③

2207bb0 fid 28④

PV9E

2207bb0 fid 28①

+202 wsl②

xelqrrr③

2207bb0 fid 28④

## Long Ques

Q) 7 layer of OSI model with function,

① Physical layer: Physical layer is responsible for sending bits (0 & 1) across the physical connection.

② Data link layer: Data link layer is responsible for moving data from one device to another.

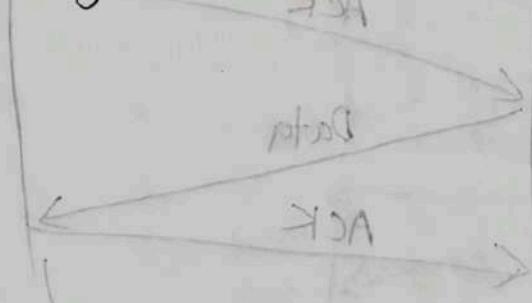
③ Network layer: Network layer is responsible for connecting source & destination.

④ Transport layer: Transport layer is responsible for delivering message to the correct destination.

⑤ Session layer: Establish, maintain, terminate communication

⑥ Presentation layer: Data encryption, compression

⑦ Application layer: User let user interact with the network using application.



## ② List of factors while choosing topology:

- ① Cost
- ② Reliability
- ③ Performance
- ④ Scalability
- ⑤ Ease of management

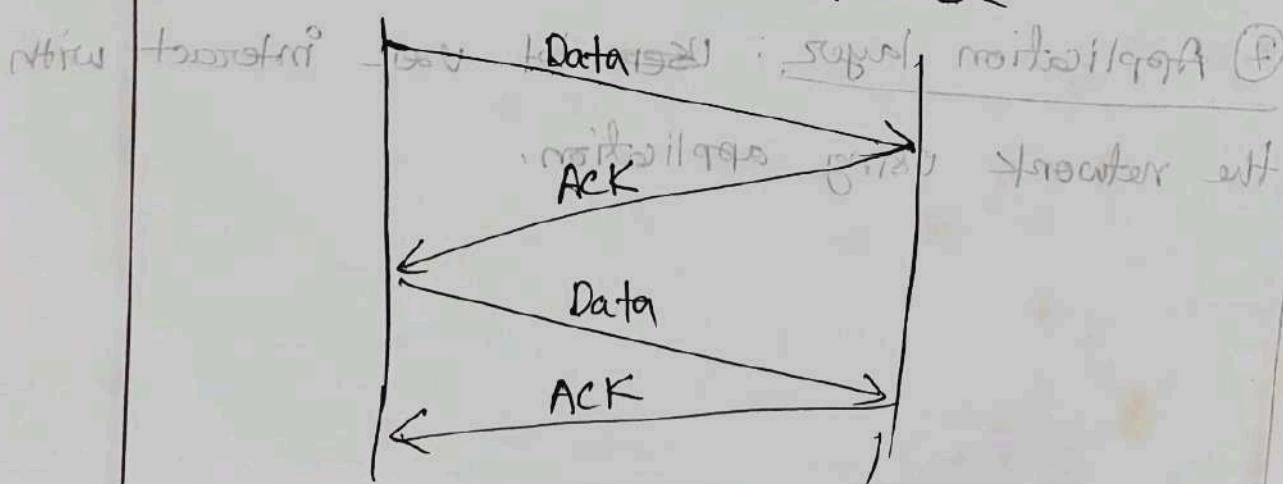
## ③ Explain each ARQ with necessary diagram:

### ① Stop & wait ARQ:

- ① Sender wait for the acknowledgement (ACK) after sending each frame & after receiving ACK it send the next.
- ② Low efficiency
- ③ Low cost
- ④ Simple

Sender

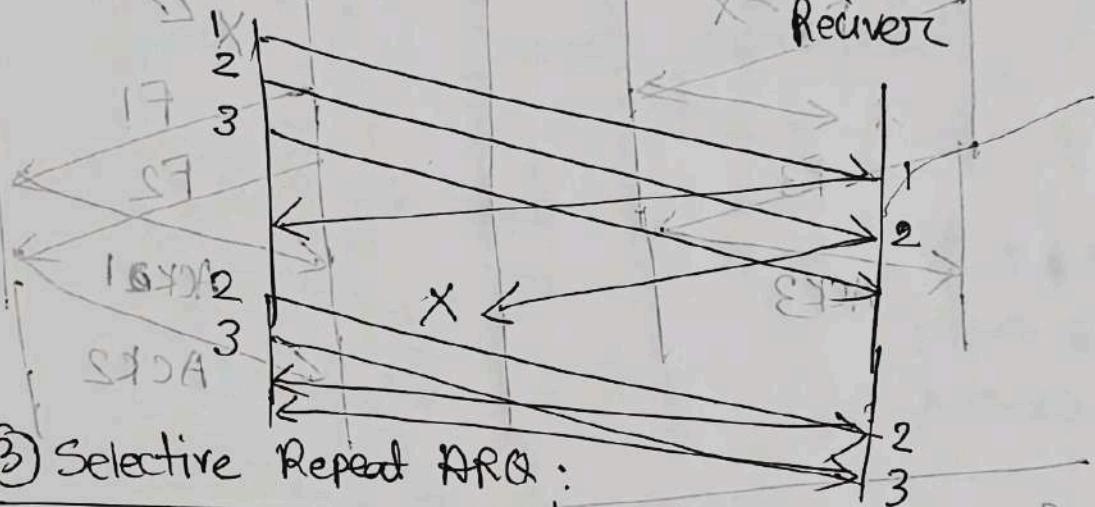
Receiver



## ② Go back N ARQ

- ① Sender send multiple frame. If there is an error then it resend from the bad frame onward  
 ② Moderate efficiency  
 ③ Moderate cost  
 ④ Moderate

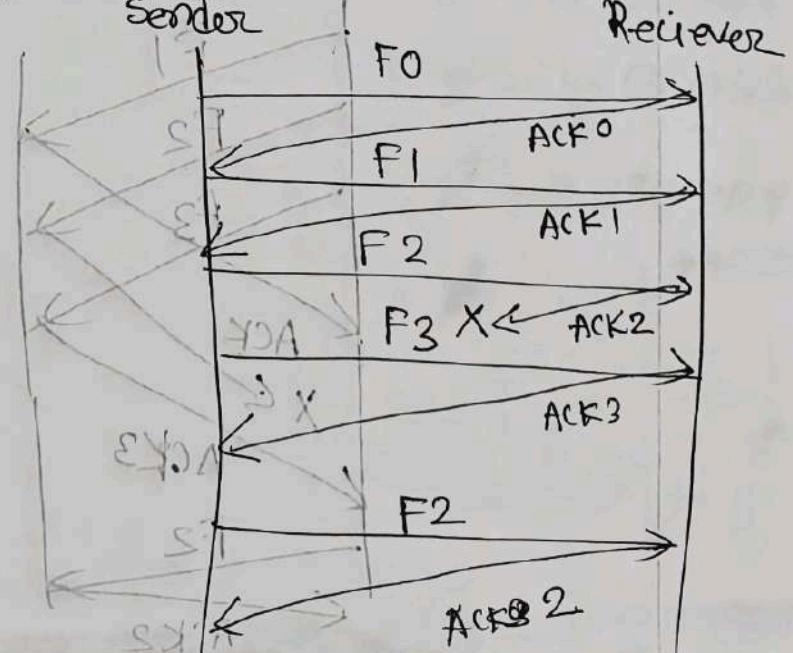
Sender



## ③ Selective Repeat ARQ:

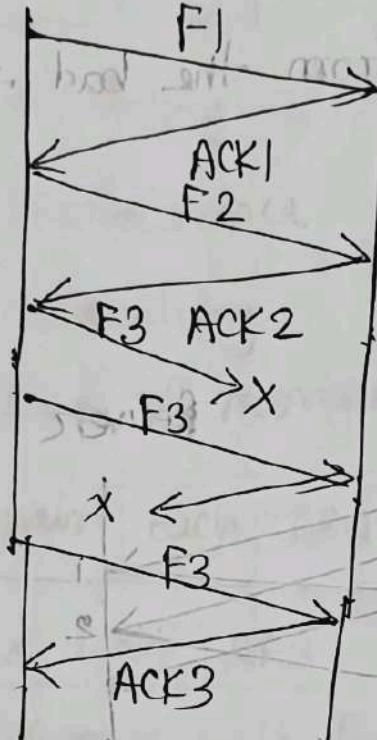
- ① Resends only the bad frames  
 ② Best efficiency  
 ③ High cost  
 ④ Complex

Sender



### Stop & wait ARQ:

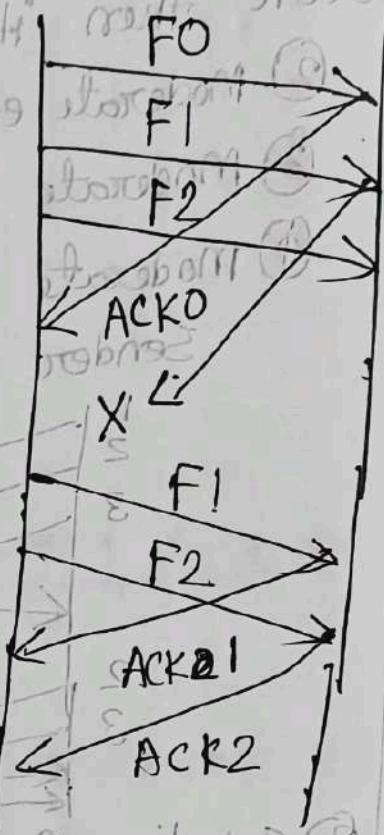
Sender      Receiver



### Go Back N ARQ:

Sender

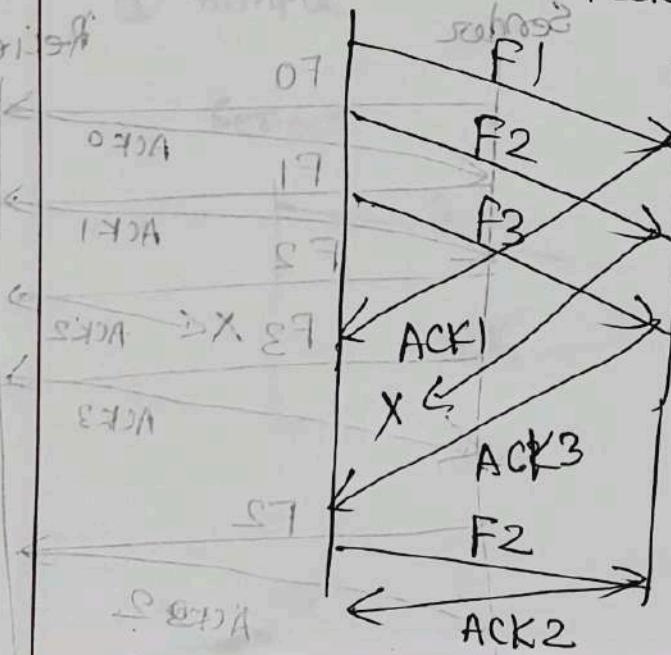
Receiver



### Selective Repeat ARQ:

Sender

Receiver



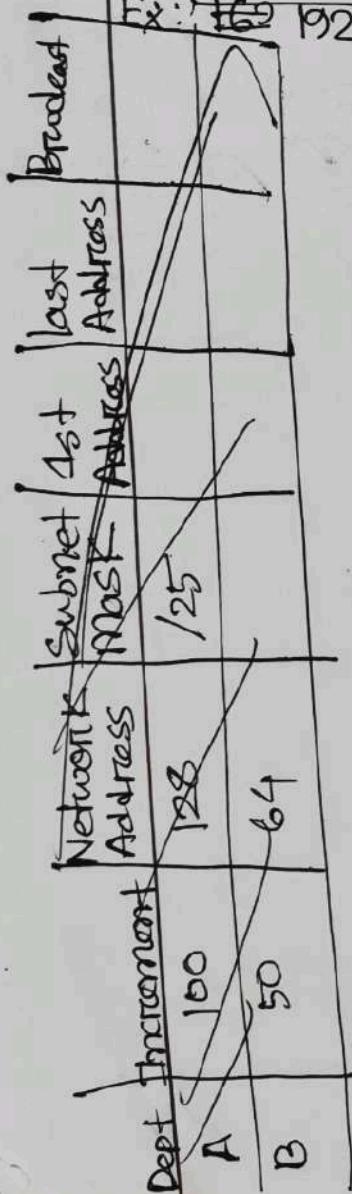
④ Explain VLSM technique with example

### VLSM technique:

1. list host in desc order
2. Find  $2^n$
3. Find Network address
4. Find subnet ~~address~~ Mask
5. Find 1st Address
6. Find last address
7. Find broadcast

Dept	Host	Instrument	Network Address	Subnet Mask	1st Address	Last Address	Broadcast

Ex: 162 192.168.10.0/24



$$\begin{aligned}
 2^0 &\rightarrow 1 \rightarrow 122 \\
 2^1 &\rightarrow 2 \rightarrow 120 \\
 2^2 &\rightarrow 4 \rightarrow 130 \\
 2^3 &\rightarrow 8 \rightarrow 129 \\
 2^4 &\rightarrow 16 \rightarrow 128
 \end{aligned}$$

$$2^5 \rightarrow 32 \rightarrow 127$$

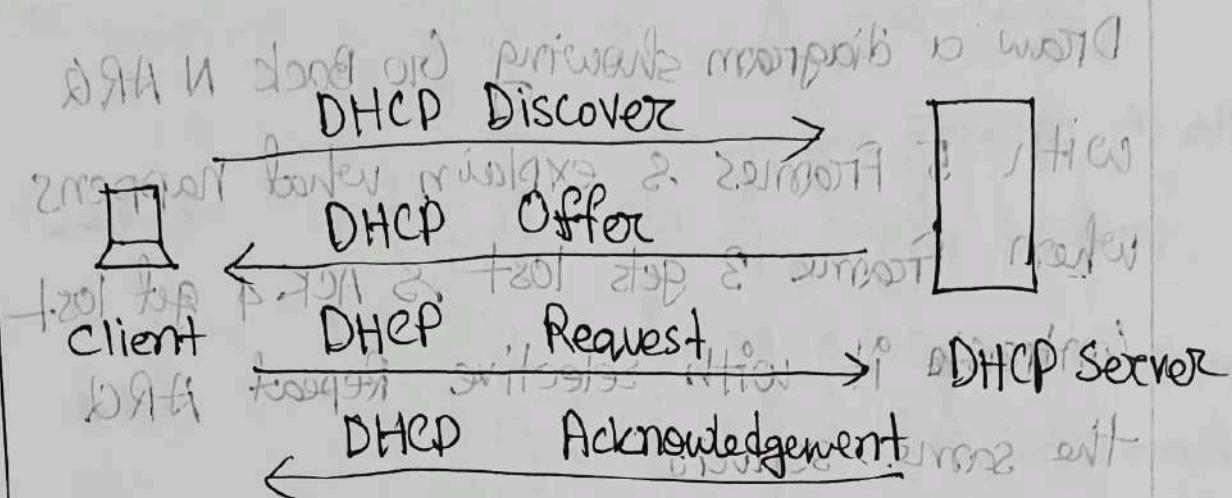
$$2^6 \rightarrow 64 \rightarrow 126$$

$$2^7 \rightarrow 128 \rightarrow 125$$

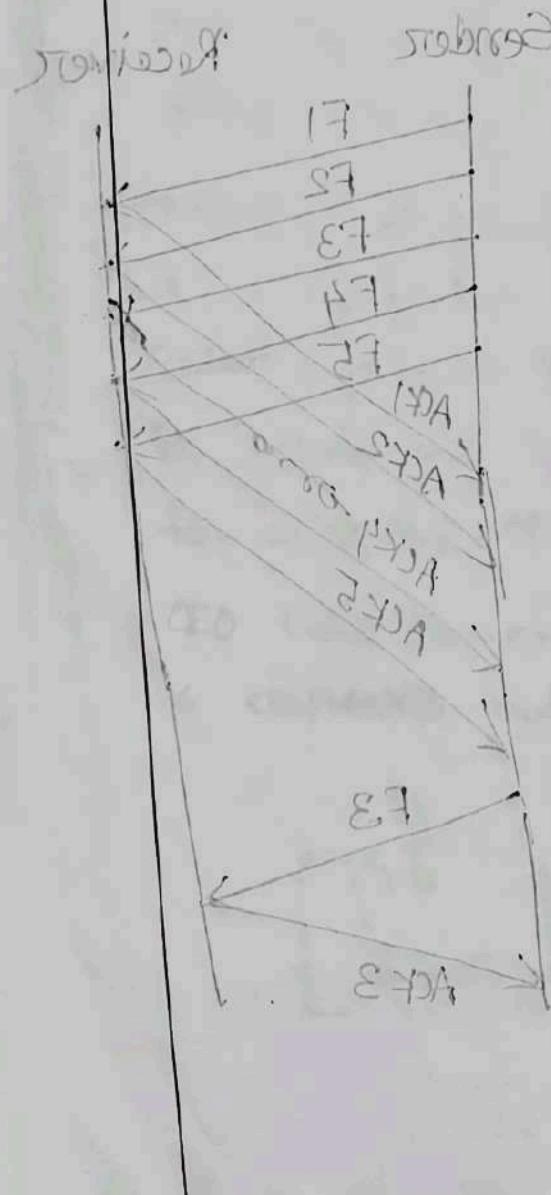
$$\rightarrow 255.255.255.128$$

Dept	Instrument	Host	Address
A	100	100	192.168.10.100
B	50	50	192.168.10.50

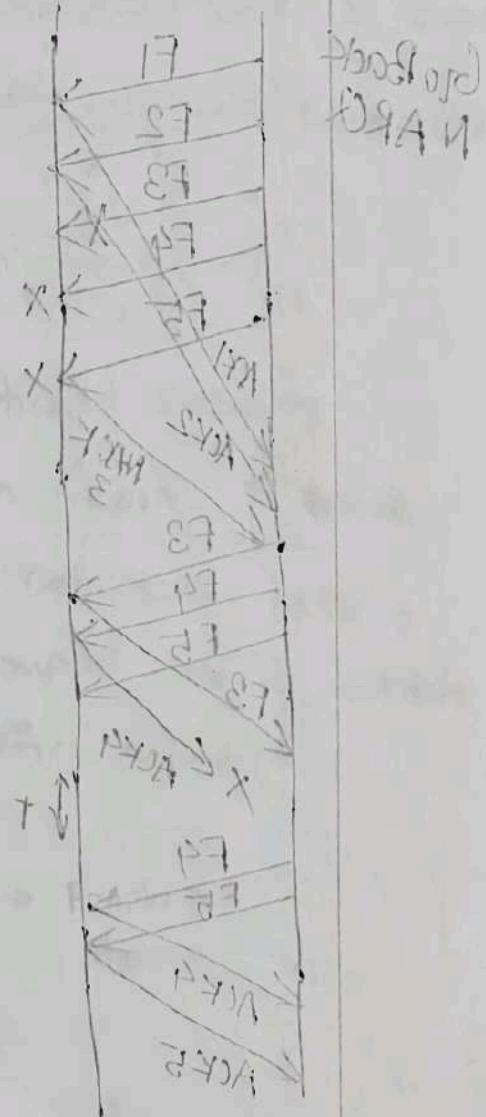
## 5) Dora Process Diagram:



Directional arrows



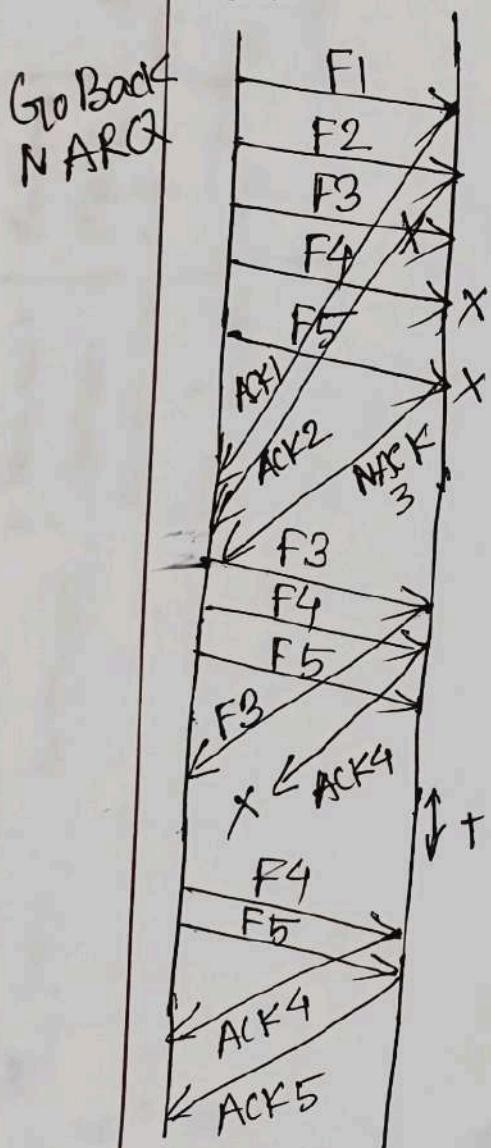
Directional arrows



## ARQ Practice:

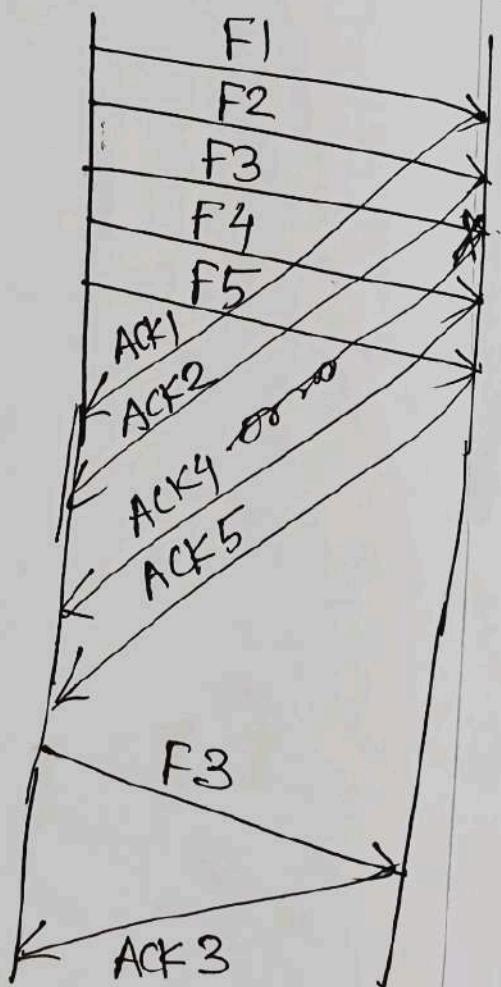
Draw a diagram showing Go Back N ARQ with 5 frames & explain what happens when frame 3 gets lost & ACK 4 get lost. Contrast it with Selective Repeat ARQ the same scenario.

Sender      Receiver



Selective Repeat ARQ

Sender      Receiver



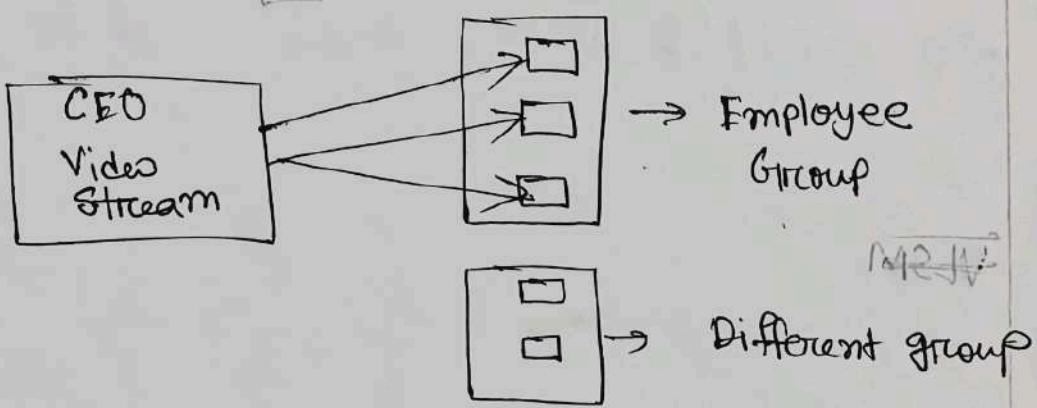
## Addressing method practice:

Multinational company have 3 use cases:

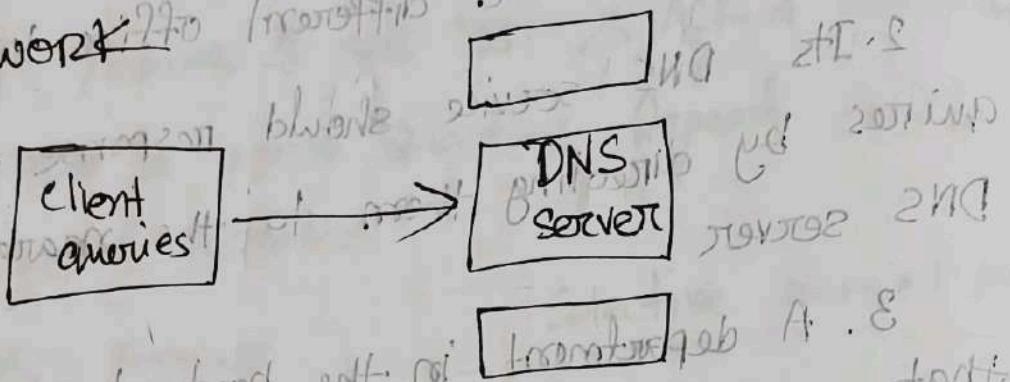
1. It needs to send CEO video stream to all employees across the different office location
2. Its DNS service should respond to client queries by directing them to the nearest available DNS server
3. A department in the headquarters uses a system that announce printer availability to all connected devices in the local subnet.

Identify addressing method with figure.  
→ Router interface is visible on the left

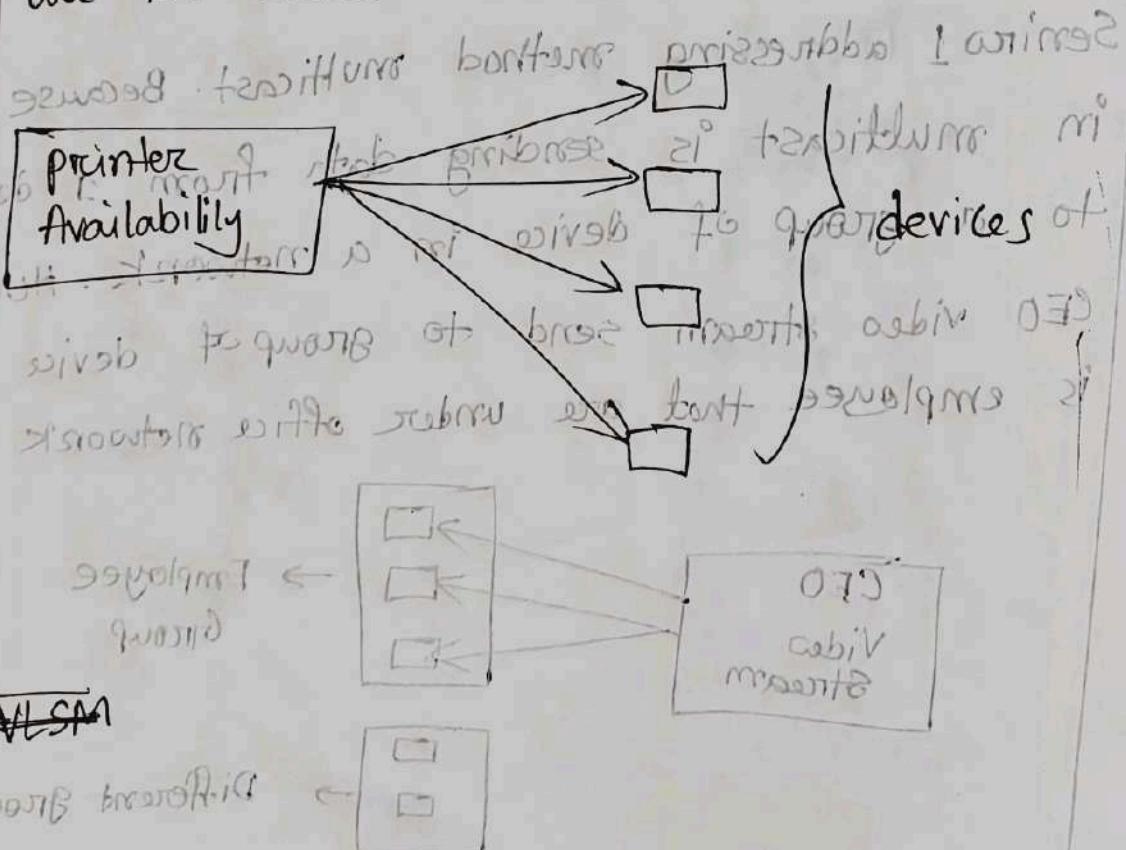
Senior addressing method multicast. Because in multicast is sending data from 1 device to 2 or group of device in a network. Here CEO video stream send to group of device which is employee that are under office network



Seniro 2 is addressing method is unicast  
 because unicast is sending data from one device to another single specific device in network



Seniro 3 is broadcast because broadcast is sending data from one device to all the devices in the network

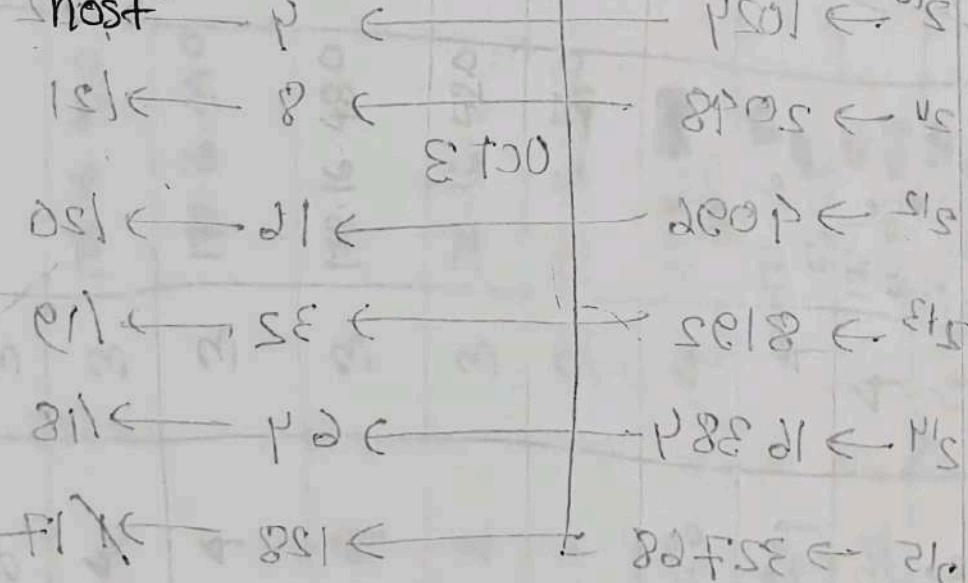


## VLSM Practice :

IP Block 172.16.0.0/16

Dept	Host	Dept	Host	Dept	Host
CSE	5000	Pharmacy	600	Eco	56
EEE	1000	Architecture	356	Bengali	28
BBA	950	Law	200	P.O	10
Textile	750	English	120	Others	2

Show subnet IP, Subnet MASK, Network address, Broadcast address, first Host, last Host Maximum no. of host



Host		1000	1000	1000	1000	1000
$2^0 \rightarrow 1$						
$2^1 \rightarrow 2$						
$2^2 \rightarrow 4$						
$2^3 \rightarrow 8$						
$2^4 \rightarrow 16$	OCT 4 record					
$2^5 \rightarrow 32$	with 4 bits					
$2^6 \rightarrow 64$	new					
$2^7 \rightarrow 128$	new					

$2^8 \rightarrow 256$	size of work	1	→ 124			
$2^9 \rightarrow 512$	→ 2	→ 123				
$2^{10} \rightarrow 1024$	→ 4	→ 122				
$2^{11} \rightarrow 2048$	→ 8	→ 121				
$2^{12} \rightarrow 4096$	OCT 3	→ 16	→ 120			
$2^{13} \rightarrow 8192$		→ 32	→ 119			
$2^{14} \rightarrow 16384$		→ 64	→ 118			
$2^{15} \rightarrow 32768$		→ 128	→ 117			

## 172.16.0.0

Dept	Host	Interface Octet	Network Address	Subnet mask	Test address	Last address	Breakfast
CSE	59000	32	172.16.0.0	/40	172.16.0.1	172.16.31.254	172.16.31.31. 255
EEC	1000	8	172.16.32.0	/21	172.16.32.1	172.16.32.30.	172.16. 255
BBA	950	4	172.16.40.0	/22	172.16.40.1	172.16.41.254	172.16. 255
Textile	750	4	172.16.44.0	/22	172.16.44.1	172.16.45.254	172.16. 255
pharm	600	4	172.16.48.0	/22	172.16.48.1	172.16.51.254	172.16. 255
Arch	356	2	172.16.52.0	/23	172.16.52.1	172.16.53.254	172.16. 255
Laws	200	1	172.16.54.0	/24	172.16.54.1	172.16.54.254	172.16. 255
English	120	128	172.16.55.0	/25	172.16.55.1	172.16.55.126	172.16. 255
Flo	56	64	172.16.55.4	/26	172.16.55.129	172.16.55.193	172.16. 255
Bangla	28	32	172.16.55.8	/27	172.16.55.193	172.16.55.225	172.16.55. 223
Po	10	16	172.16.55.12	/28	172.16.55.225	172.16.55.298	172.16.55. 239
Co	2	4	172.16.55.240	/30	172.16.55.241	172.16.55.242	172.16.55.242