2a) Source-based tree.

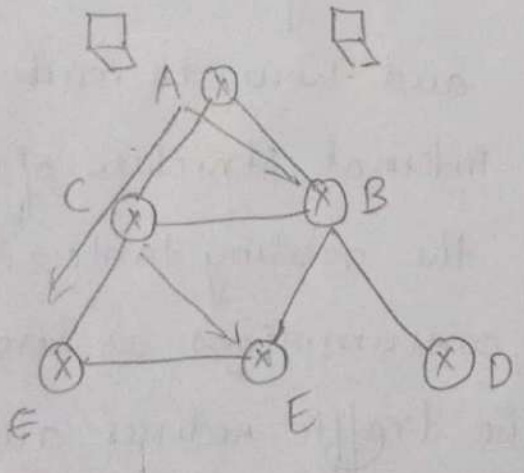
* Each router maintains one shortest path for each group

* Separate multicast tree for every multicast source

* Rooted at source

* Needs to be dynamically updated.

* Decentralized approach is used to build tree.



Group-shared tree

* Only one router called centre core or rendezvous router, takes responsibility of multicast routing

* The core router itself has m shortest path in its routing table. Other have none.

* Routed at core router.

* If router recieves the multicast packet it encapsulates in a unicast packet and sends to core router.

* Centre-based approach is used to create the tree

*

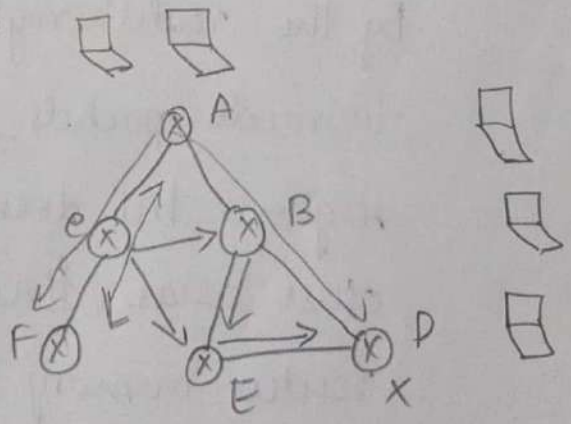


Fig No-02

* It contains multiple individual trees
* One tree from one router.

2b. ii) As network size increases the routing table size increases with the complex protocol information for each route increases. Each router cannot afford such huge memory space to store it and can't have such high computing powers. Routers memory, CPU time and more bandwidth consumed to send status reports about them. The Distance-Vector algorithm would never converge and exchanging link state-packets would take or consume a lot of bandwidth and increase the traffic in the network.

Therefore routers are divided into area. Cluster of routers form the areas or region. Every router is identified by the router's region. A router in a region knows how to route packets in its area and how to reach other regions but does not know internal structure of the other areas. Hence reducing the routing table size, routers memory and CPU consumptions as lesser power is consumed. So the traffic reduces and bandwidth required is less.

iii.) yes it's related to subnetting. As networks are divided into smaller ones by grouping them. The areas are also created for adminstrative purposes to secure the internal network and let the organization use network at its please. Therefore in subnetting this notion helps and the subnet is in administrative control. they can route packets as they wish within the subnet.

i). OSPF can't route packets across two different autonomous systems. They can route only within the network. It operates within AS. If network size increases then it can't scale that much.

2c) Node A to all network nodes.
NH- next hop D- destination C- cost

Step1: Send "HELLO" packets to neighbors and update the cost.

A's table

Dest	cost	Next hop.
C	3	-
D	8	-

C's table

Dest	Cost	Next hop
F	6	-
E	1	-
A	3	-

D's table.

Dest	Cost	NH.
A	8	-
E	2	-

B's table

D	C	NH
E	2	-

E's table

D	C	NH
C	1	-
B	2	-
D	2	-

F's table.

D	C	NH.
C	6	-

Step2: Exchange packets with it's neighbors.

A with C.

(i) A's table.

D	C	NH.
C	3	-
D	8	-
F	9	C
E	4	-

C with E

(ii) C's table.

D	C	NH
F	6	-
B	3	E
D	3	E

A with C.

(iii) AS table

D	C	N.
C	3	-
D	6	C, E
B	6	C, E
F	9	C
E	4	C

Similarly other tables also exchange

Step 3: Final A's table :

Dest	Cost	Next-hop
A	0	–
C	3	–
E	4	C
B	6	C, E
D	6	C, E
F	9	C

(b) ICMP has companion with IP. There are two types of messages. i) Error-reporting ii) Query messages.

Query messages occurs in pairs i.e request and response. Whenever the state of router is ~~to~~ to be known query is sent and response is collected.

Query messages:

i) Echorequest and reply -> To check if device is alive or not we use it. Source sends Echo message to destination and destination replies with the Echo Reply if it's alive.

Hence source understands destination is alive.

ii) Time Stamp Request or Reply: For Different timezones to synchronize (Eg: live broadcast of Test Matches). ICMP. timestamp request and reply messages are used.

iii) Addess mask Request or reply:
Used for finding out the subnet addess of the destination network where packet has to be send.

iv) Router Solicitation or Advertisement → Any routing table updates are communicated via ICMP messages

2) Error-Reporting Messages:

i) Destination Unreachable. → Whenever the packet isn't received at the destination the sender is notified as "Destination Unreachble"

ii) Source Quench. → One host asks another to slow down the speed at packets are sent because receiving host is burdened and can't let overflow happen. This is a type of flow-control mechanism.

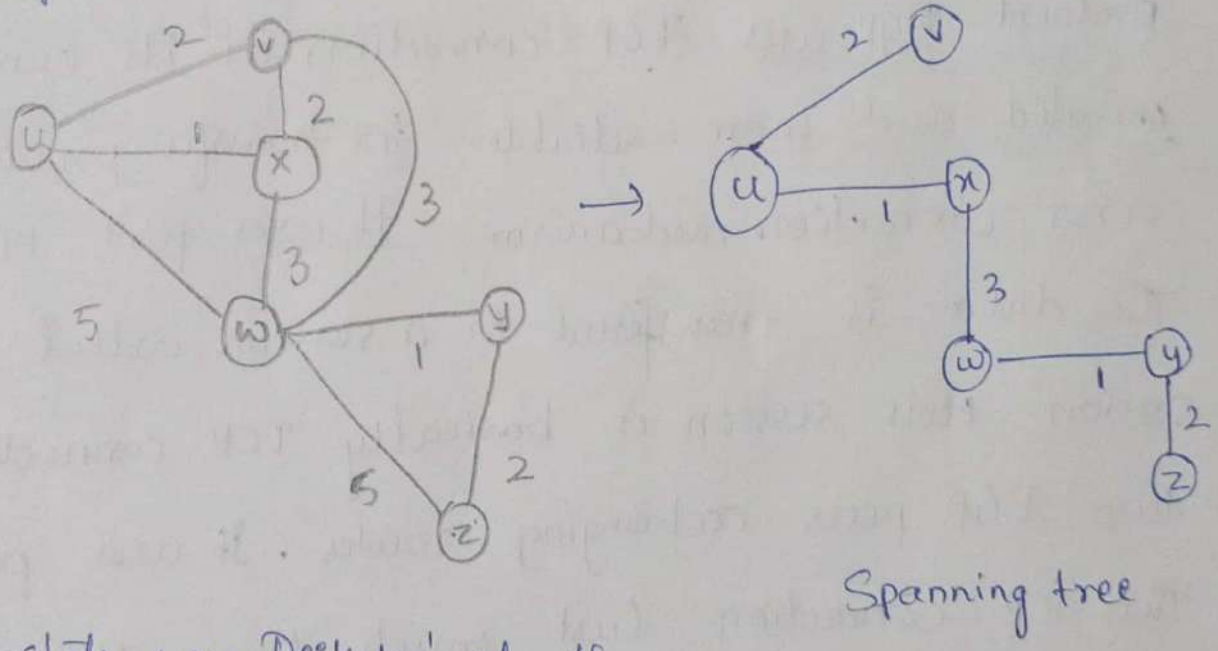
iii) TTL : Time to Live. Time to Level is time till which packets keep moving in network. It might in ms or hop count (No. of subnets between sender to reciever)

It decides how long packets should live. It helps infinite time forwarding of packets.

iv) Parameter problems: When problems are in parameter.

v) ICMP Redirects: It is a redirect messages direct a host to deliver the next packet for the same destination IP address to a different router

(c) Graph.



Spanning tree

Link-state uses Dijkstra's algorithm

Node u.

	v	x	w	y	z
u	2	(1)	5	∞	∞
ux	(2)	–	4	∞	∞
uxv	–	–	(4)	∞	∞
uxvw	–	–	–	(5)	7
uxvwy	–	–	–	–	7

1a), BGP is used in Internet backbone to exchange route between two different autonomous systems (AS) Only eBGP can be used for Inter-Domain Routing As data is crossing ones ouon AS that is designed for security purpose to hide network it must ensure that this route exchange b/w two different ASs should be secure enough. Hence the application layer protocol BGP uses TCP connection as it's connection oriented and more reliable for transfer provides error correction mechanism. It uses port 179. The data is transferred in a session called eBGP session this session is basically TCP connection b/w two BGP peers exchanging routes. It uses port 179. This TCP connection last much longer than usual ones so are also called semi-permanent connections which makes it way reliable.

→ RIP uses UDP. RIP is firstly very complex, iterative, asynchronous and converges slowly. In it's Iterative process if it take TCP too it becomes way slower as TCP connection establishment is time consuming whereas UDP is connectionless no

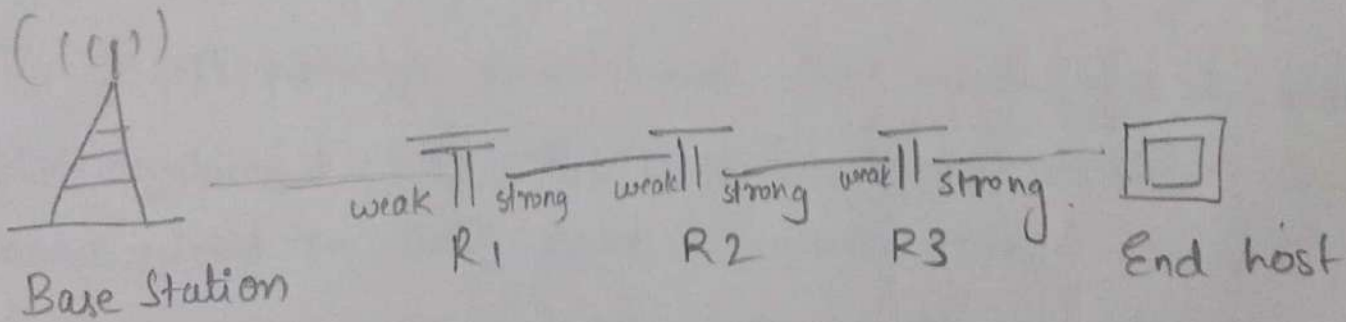
time is wasted for connection establishment. And RIP is intradomain so need not be more secure or reliable to use TCP. So goes better with lesser overhead UDP.

→ OSPF runs over IP. OSPF is real time routing protocol and includes variety of attributes like bandwidth TTL etc. So it requires IP information to work with this efficiency. In current networks development. IP also provides error detection and provides feature for better routing.. Matrix is bandwidth.

4a) First action -> Increase the transmission power so that we can reach farther distances but there is limit. As increases in power could lead us live in sea of electromagnetic waves which are harmful. The government doesn't allow to increase the power indefinitely to infinity for co-existence purpose.

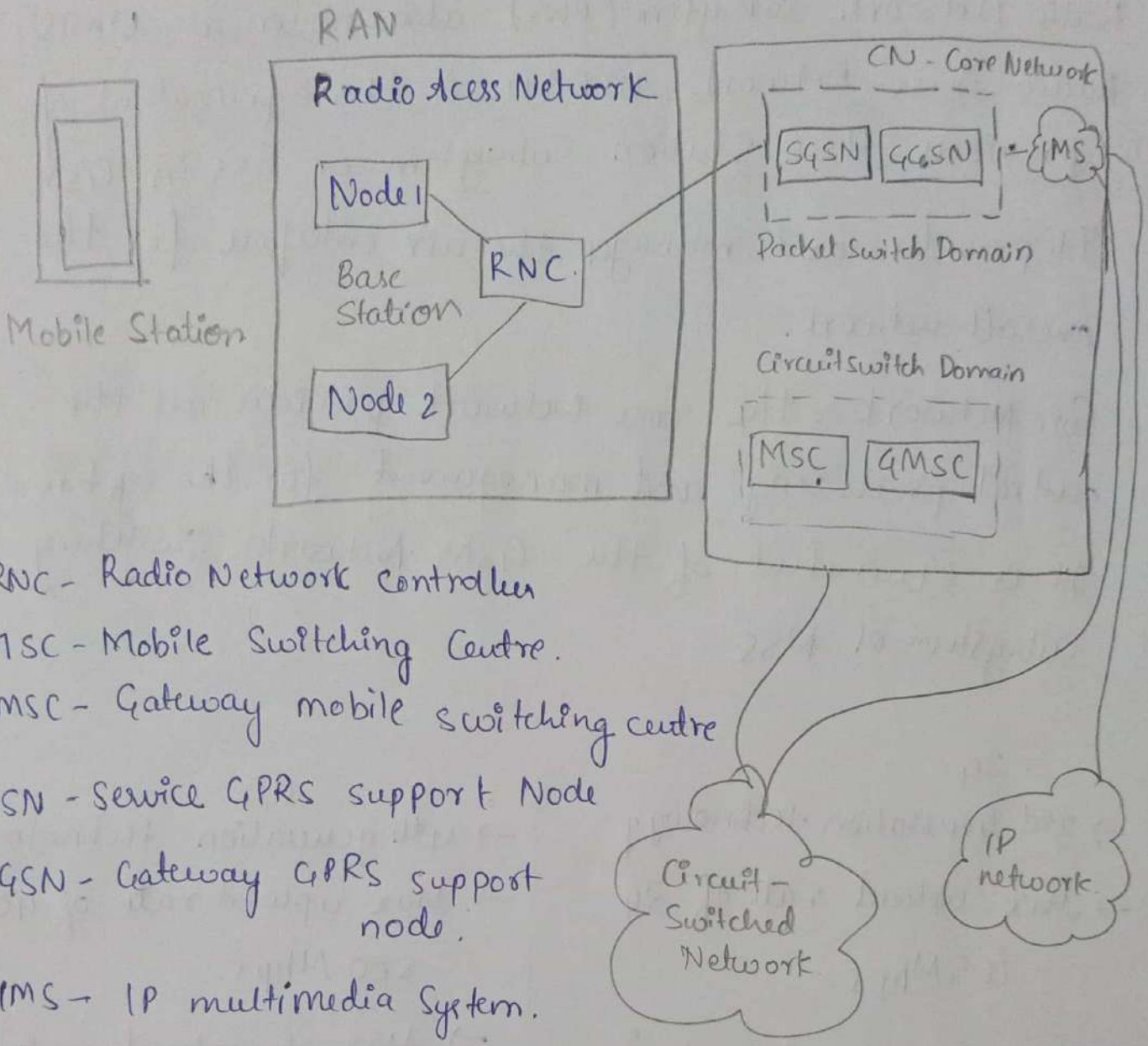
Second Action → Add base stations at regular distances. But installing base stations is costlier

Third action → Repeaters. Repeaters are not base stations they just take signals amplify it or increase the strength and retransmit it again. So no. of repeaters could be placed in between



R1, R2, R3 are repeaters

(b)



RNC - Radio Network controller

MSC - Mobile Switching Centre.

GMSC - Gateway mobile switching centre

SGSN - Service GPRS support Node

GGSN - Gateway GPRS support node.

IMS - IP multimedia System.

3G UMTS network constituents. And made of 3 elements.

User Equipment (UE): The User Equipment or UE is the name given to what was previous termed the mobile. The new name was chosen because the considerably great functionality that the UE could have. It could also be anything between a mobile phone used for talking to a data terminal attached to a computer with no voice capability.

Radio Network Subsystem (RNS) also known as UMTS Radio Access Network, UTRAN, is the equivalent of previous Base Station Subsystem or BSS in GSM. It provides and manages the air interface for the overall network.

Core Network: the core Network provides all the cental processing and management for the system. It is equivalent of the GSM Network Switching Subsystem or NSS

3G	4G
→ 3rd Generation technology	→ 4th generation technology.
→ Max upload rate of 3G is 5 Mbps	→ Max upload rate of 4G is 500 Mbps.
→ Max download rate is 21 Mbps	→ Max download rate is 1 Gbps
→ Uses packet switching technique.	→ Packet as well as message switching.
→ Frequency range of 3G is 1.8 GHz to 2.5 GHz	→ Frequency range is 2 GHz to 8 GHz.
→ Lenient horizontally	→ Lenient horizontally as well as vertically.

→ It is wired area cell based network architecture	→ It is the integration of wireless LAN as well as wide Area cell based network architecture.
→ Here is turbo codes are used for error correction in 3G	→ Uses concatinated codes for error correction