(1)  
a) Examples of “random” MAC protocols:   
- slotted ALOHA  
- CSMA/CA (Carrier Sense Multiple Access / Collision Avoidance)  
- CSMA/CD (Carrier Sense Multiple Access / Collision Detection)

b) Nope, CSMA can’t completely avoid collisions, it just “listens” before transmitting. If idle, then send. There will be case whether 2 nodes “listen” channel as idle and transmit together. Hence, will result in collision.

c)

|  |  |
| --- | --- |
| CSMA/CD (Collision Detection) | CSMA/CA (Collision Avoidance) |
| * Use on Ethernet (wired network) * Detect collision, colliding transmission will get aborted to reduce wastage | * Use on WiFi (wireless network) * Unable to detect collision * Use “Inter-frame space” & “contention window” to avoid collision. |

(2)

a) The source / destination IP address will not change in entire transmission. Remain the same whereas source IP = 111.111.111.111, and destination IP as 222.222.222.222

b) The source & destination MAC address will change when it traverses though router R.

source MAC = 1A-23-F9-CD-06-9B, destination MAC = 49-BD-D2-C7-56-2A

(3)

a)

|  |  |
| --- | --- |
| Network Layer | Data Link Layer |
| * Host to host transmission * Using IP address * Router as network layer device | * Hop to Hop transmission. * Using MAC address * Switches as data link layer device |

b)

|  |  |
| --- | --- |
| IP address | MAC address |
| * For Network layer * It’s beyond LAN * Assigned by network | * For Data Link layer * It’s for LAN (local area network) * Each device has a unique MAC address |

(4)

|  |  |
| --- | --- |
| Link State based algorithm | Distance Vector based algorithm |
| * Centralized routing algorithm * Detailed information about all links is exchanged among routers, forming a Link-State Database (LSDB). * Use Dijkstra algorithm to get shortest path distance. * Generally faster convergence due to complete knowledge of the network. * Eg : OSPF | * Decentralized routing algorithm * Routers exchange information only about their directly connected neighbors, sharing routing tables. * Use Bellman-Ford equation to get least cost path. * Slower convergence due to iterative updates and potential for counting-to-infinity issues. * Eg : BGP |

(5)A table with text on it

Description automatically generated

(6)

a)

A table of functions with numbers and symbols

Description automatically generated with medium confidence

b)

The Distance Vector-based algorithm is expected to converge at a slow pace in this scenario. More precisely, relying on the local distance vector from router Z, router Y might be misguided by the information presented in router Z's distance vector. This misinformation could lead router Y to believe that router X is still accessible via router Z with 6. Consequently, router Y gradually adjusts its distance to router X, incrementally increasing it by the size of 2 (i.e., the distance between router Y and router Z).