

CS 422 - Quiz 2

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Spring 2023

Quiz Instructions I have read the instructions. PUID: 0032690213.

Question 1 Cumulative acknowledgement is when the receiving host on a TCP connection waits to acknowledge more than one packet at the same time. It helps reduce retransmissions by allowing the host that sent the packets to only retransmit those that were not acknowledged.

Question 2 The sliding window provides a flow control mechanism in which the receiving host advertizes a window size to the sending host. Then, the sending host will take into account un-acknowledged packets (i.e. ones that are still in transit) and only send so much new data to the receiving host as to not overwhelm it. This maximizes the amount of data being transmitted without the a server overwhelming a client's resources. The sliding window also allows multiple packets to be in transit at the same time since they contain enough information to be ordered independent of when they arrive.

Question 3 The three way handshake is the initialization sequence that starts a TCP connection. It ensures that both the sender and receiver are ready to communicate. In terms of performance, it is the contains the shortest number of steps to initialize a connection that guarantees all packets will be delivered and will be in order from an application's viewpoint. However, it still adds some overhead compared to UDP where such a handshake is not present, but it does not guarantee all packets will be delivered.

In that sense, it is impossible to build a reliable communication protocol without some form of handshake since it establishes necessary parameters that allow for guaranteed packet delivery and ensures both hosts are ready to communicate. For example, it would not be possible to synchronize both hosts to guarantee they are both receiving all data and interpreting it correctly.

Question 4 Flow control is when senders limit how much data they send to not overwhelm the receiver. Congestion control is preventing too much data being inserted into a network. In that sense, networks can become congested in many ways. For example, if there are too many devices the network can become congested. This can also happen if there is a link that is heavily used and becomes a bottleneck (e.g. a bridge in terms of a graph).

Question 5 The data plane is where the actual data transferring takes place i.e. the actual physical components of the network. On the other hand, the control plane is responsible for making decision on how the data should be forwarded. For example, restricting traffic within a sing VLAN is a control plane's job. With that in mind, a SDN the control plane is separated from the data plane by introducing centralized controllers and network hardware that only worries about the data plane which are managed by the controllers.

Question 6 One application is VLAN which ensures traffic only stays within the same VLAN. For example, a host on VLAN 1 cannot communicate with a host on VLAN 2. More generally, we can say that one of the control plane's application is to control the access of a group or peer have to the network's resources. Another application is for routing protocols which determine the best path for traffic. In that sense, the centralized controller enables routers to get information about the topology and state of the network and thus make better decision by using protocols such as OSPF which require a global network map.

Question 7 A forwarding table is used to store information about the next hop for a given destination address. For example, a forwarding table would store that for a given address A the next hop is to go to B. In that sense, the forwarding table has specific details on how to forward a packet to a given address. On the other hand, the routing table stores information about the topology of the network and the paths packets have to reach their destination. In that sense, the routing table gets populated by BGP and allows the router to make forwarding decisions.

With that in mind, it is clear that the router needs both tables because they each have a different application. Without the forwarding table, the router would not know how to forward a packet to address A and without the routing table, the router would not know how to reach a destination since it would not know of any available routes to get to that destination.

Question 8 The key difference is that while distance-vector protocol keeps track about the number of hops (i.e. distance) and direction to all other networks by exchanging information with its neighbors the link-state protocol involves each router exchanging information about its connections (i.e. who it can reach) with all other routers in the entire network and then constructing a map of the network used to determine the best path to each destination.

Split horizon with poison reverse is a method for distance-vector protocols which prevent infinite routing loops. In that sense, in split horizon, a router will not advertize a route back to the router that gave it that information. For example, if A tells B about C, B will not tell A about C. Moreover, with poison reverse when a router sees a destination is unreachable it immediately tells that to the neighbor that originally advertized the route. Using the same example, if B sees that C is now unreachable, it immediately tells A about that so it avoids forwarding packets towards that unreachable destination.