Lecture 7 - Routers Quiz ANS

1. Conceptually, what is a router best described as?
A) A simple switch that connects two computers
B) A specialized computer optimized for forwarding packets
C) A server that hosts websites
D) A database for storing network logs

ANS: B
A router is essentially a computer specialized for forwarding packets. It has input/output ports, a processor (controller), and specialized hardware (linecards) to handle high-speed traffic.

2. Which of the following is NOT one of the three main 'planes' of a router?
A) Data Plane
B) Control Plane
C) Security Plane
D) Management Plane

ANS: C
The three distinct planes are the Data plane (forwarding), Control plane (routing protocols), and Management plane (configuration/monitoring). Security is often a function within these, but not a separate architectural plane in this context.

3. What is the primary function of the Data Plane?
A) Running routing protocols like OSPF or BGP
B) Configuring the router's IP address
C) Forwarding packets from input ports to output ports
D) Monitoring the temperature of the chassis

ANS: C
The Data Plane operates locally and handles the actual forwarding of packets on a nanosecond time scale. It does not coordinate with other routers; that is the job of the Control Plane.

4. On what time scale does the Control Plane typically operate?
A) Nanoseconds
B) Seconds
C) Hours
D) Microseconds

ANS: B
The Control Plane handles routing protocols and topology changes, which happen on the order of seconds. In contrast, the Data Plane operates on nanoseconds.

5. Which physical component provides the high-bandwidth interconnection between linecards?
A) The CPU
B) The Controller Card
C) The Switch Fabric
D) The Ethernet Cable

ANS: C

The Switch Fabric (or simply Fabric) is the internal hardware that connects all linecards, allowing packets to move from an input linecard to an output linecard at high speeds.

6. Why is the forwarding table stored on the linecards rather than just the main controller?
A) To save memory on the controller
B) Because the controller is too busy running games
C) To enable distributed, high-speed forwarding without bottlenecking the controller
D) It is only stored on the linecards for backup purposes

ANS: C
Linecards have specialized forwarding chips and local copies of the forwarding table to process packets immediately (fast path) without sending every packet to the central controller (which would be too slow).

7. What are 'User Packets' in the context of router traffic types?
A) Packets containing commands for the router administrator
B) Packets destined for the router itself
C) Traffic that the router simply forwards toward a destination
D) Malformed packets that must be dropped

ANS: C
User packets are the most common traffic type. They are simply passing through the router to get to a destination (e.g., your Netflix stream or email). Ideally, these stay entirely in the hardware 'fast path'.

8. What is 'Punt Traffic'?
A) Traffic used for sports analytics
B) Packets requiring extra processing (exception handling) by the controller
C) Packets sent between two routers to exchange routing tables
D) Encrypted packets that cannot be read

ANS: B
'Punting' refers to sending a packet from the fast hardware path to the slower software controller. This happens for exceptions like TTL expiration, fragmentation needed, or IP options that hardware can't handle.

9. Why must modern routers implement forwarding in hardware rather than software?
A) Hardware is cheaper than software
B) Software is too error-prone
C) General-purpose CPUs cannot handle the scale (billions of packets per second)
D) Hardware is easier to update than software

ANS: C
At 400 Gbps line rates, a router must process a packet every few nanoseconds. General-purpose CPUs (software) are too slow for this volume; specialized ASICs (hardware) are required.

10. In the forwarding pipeline, what does the 'Lookup' stage do?
A) Decodes the optical signal into bits
B) Finds the next hop output port for the destination address
C) Decrements the Time-To-Live (TTL) field

D) Places the packet into a queue

ANS: B
The Lookup stage uses the destination IP address to query the forwarding table and determine which output port the packet should be sent to. This is the core 'routing' decision for that packet.

11. Which of the following operations is considered 'hard' to do in hardware at line rate?
A) Decrementing TTL
B) Updating the header checksum
C) Reading specific bits of the packet
D) Handling packet fragmentation if the packet is too big

ANS: D
Simple arithmetic like TTL decrement or checksum updates are easy in hardware. Complex logic like fragmentation (splitting one packet into multiple) is hard and is usually punted to the software controller.

12. What problem does the 'Longest Prefix Match' (LPM) solve?
A) It ensures the longest packet gets priority
B) It resolves overlaps where an address matches multiple entries in the forwarding table
C) It finds the path with the most bandwidth
D) It prevents loops in the network

ANS: B
Forwarding tables often contain overlapping ranges (e.g., 10.0.0.0/8 and 10.1.0.0/16). LPM dictates that the most specific match (the one with the longest mask/prefix) is the correct one to use.

13. What data structure is commonly used to implement efficient Longest Prefix Match?
A) Linked List
B) Hash Map
C) Trie (Prefix Tree)
D) Stack

ANS: C
A Trie (or prefix tree) allows for efficient lookup by walking down the tree bit-by-bit. It handles overlapping prefixes naturally and provides deterministic lookup times based on address length.

14. What is the time complexity of looking up an IPv4 address in a Trie?
A) O(N) where N is the number of entries in the table
B) O(1) / Constant (bounded by the number of bits in the address)
C) O(log N) where N is the number of routers in the world
D) O(N^2) effectively random

ANS: B
For IPv4, a lookup requires at most 32 steps (one for each bit). Since 32 is a fixed constant regardless of table size, the operation is O(1) or constant time relative to the number of table entries.

15. If a packet arrives and matches NO entries in the forwarding table, what typically happens?
A) It is broadcast to all ports

B) It is sent back to the sender
C) It uses the default route; if no default route exists, it is dropped
D) The router crashes

ANS: C
Routers usually have a 'default route' (0.0.0.0/0) for unmatched traffic. If even that is missing, the packet is discarded (dropped) to prevent it from circulating endlessly.