## Chapter 4 Network Layer: Data Plane

1. What are the two key network-layer functions?

a) Routing and switching

b) Forwarding and routing

c) Addressing and encapsulation

d) Segmentation and reassembly

Answer: b) Forwarding and routing

2. What does the data plane in the network layer determine?

a) How datagrams are routed among routers

b) How a datagram is forwarded from input to output port on a single router

c) The network-wide logic of packet transmission

d) The end-to-end path of a packet

Answer: b) How a datagram is forwarded from input to output port on a single router

3. In the context of the network layer, what does SDN stand for?

a) Secure Data Networking

b) System Defined Nodes

c) Software-Defined Networking

d) Structured Data Navigation

Answer: c) Software-Defined Networking

4. Which of the following is NOT an example of a service for individual datagrams?

a) Guaranteed delivery

b) Guaranteed delivery with less than 40 msec delay

c) In-order datagram delivery

d) Guaranteed minimum bandwidth to flow

Answer: c) In-order datagram delivery

5. What is the service model of the Internet according to the network-layer service model table?

a) Constant Bit Rate

b) Available Bit Rate

c) Best effort

d) Guaranteed service

Answer: c) Best effort

6. What does the Internet's "best effort" service model guarantee?

a) Bandwidth

b) Loss prevention

c) Order of delivery

d) None of the above

Answer: d) None of the above

7. Which layer encapsulates segments into datagrams?

a) Application layer

b) Transport layer

c) Network layer

d) Link layer

Answer: c) Network layer

8. What is the main function of routers in the network layer?

a) Generate application data

b) Encrypt data packets

c) Examine header fields and move datagrams between ports

d) Establish end-to-end connections

Answer: c) Examine header fields and move datagrams between ports

9. What are the two main components of the network layer?

a) Physical layer and link layer

b) Data plane and control plane

c) Input ports and output ports

d) Routing and forwarding

Answer: b) Data plane and control plane

10. Which of the following is NOT a function of the input port in a router?

a) Bit-level reception

b) Link layer processing

c) Decentralized switching

d) Packet transmission

Answer: d) Packet transmission

11. What is the goal of input port processing in a router?

a) To maximize queuing delay

b) To complete processing at line speed

c) To slow down packet forwarding

d) To increase buffer size

Answer: b) To complete processing at line speed

12. What is the purpose of the forwarding table in a router's input port?

a) To store incoming packets

b) To look up the output port for a packet

c) To encrypt packet data

d) To compress packet headers

Answer: b) To look up the output port for a packet

13. What is destination-based forwarding?

a) Forwarding based on the source IP address

b) Forwarding based only on the destination IP address

c) Forwarding based on the packet's content

d) Forwarding based on the router's location

Answer: b) Forwarding based only on the destination IP address

14. What is the longest prefix matching rule used for?

a) Determining the packet's priority

b) Selecting the most specific forwarding table entry

c) Calculating the shortest path to the destination

d) Measuring the distance between routers

Answer: b) Selecting the most specific forwarding table entry

15. What type of memory is often used for longest prefix matching in routers?

a) RAM

b) ROM

c) TCAM

d) Flash memory

Answer: c) TCAM

16. What does TCAM stand for?

a) Ternary Content Addressable Memory

b) Total Cache Access Memory

c) Temporary Content Access Module

d) Time-based Content Addressing Method

Answer: a) Ternary Content Addressable Memory

17. What is the switching rate of a router?

a) The rate at which packets are dropped

b) The rate at which packets can be transferred from inputs to outputs

c) The rate at which new routes are learned

d) The rate at which the forwarding table is updated

Answer: b) The rate at which packets can be transferred from inputs to outputs

18. Which of the following is NOT a type of switching fabric?

a) Bus

b) Memory

c) Optical

d) Interconnection network

Answer: c) Optical

19. In first-generation routers, what limited the switching speed?

a) CPU processing power

b) Memory bandwidth

c) Bus contention

d) Interconnection network capacity

Answer: b) Memory bandwidth

20. What is a potential issue with bus-based switching fabrics?

a) High power consumption

b) Complex wiring

c) Bus contention

d) Slow memory access

Answer: c) Bus contention

21. What technique is used to exploit parallelism in multistage interconnection networks?

a) Packet replication

b) Load balancing

c) Fragmentation and reassembly of datagrams

d) Dynamic routing

Answer: c) Fragmentation and reassembly of datagrams

22. What is HOL blocking in input port queuing?

a) A security feature that blocks malicious packets

b) A queued datagram at the front preventing others from moving forward

c) A method to prioritize high-priority packets

d) A technique to reduce buffer overflow

Answer: b) A queued datagram at the front preventing others from moving forward

23. What causes the need for output port queuing?

a) Slow input processing

b) Insufficient switching fabric capacity

c) Datagrams arriving faster than the link transmission rate

d) Large packet sizes

Answer: c) Datagrams arriving faster than the link transmission rate

24. What is the primary function of the Network Layer?

a) Data encryption

b) Data transmission

c) Data plane and control plane operations

d) User interface management

Answer: c) Data plane and control plane operations

25. How many bits are in an IPv4 address?

a) 16 bits

b) 32 bits

c) 64 bits

d) 128 bits

Answer: b) 32 bits

26. What does CIDR stand for?

a) Centralized Internet Data Routing

b) Classless InterDomain Routing

c) Controlled IP Data Regulation

d) Comprehensive Internet Domain Registry

Answer: b) Classless InterDomain Routing

27. Which protocol is used for dynamically obtaining an IP address?

a) HTTP

b) FTP

c) DHCP

d) SMTP

Answer: c) DHCP

28. What is the primary purpose of NAT?

a) To encrypt network traffic

b) To share one IPv4 address among multiple devices

c) To increase internet speed

d) To block malicious websites

Answer: b) To share one IPv4 address among multiple devices

29. How many bits are in an IPv6 address?

a) 32 bits

b) 64 bits

c) 96 bits

d) 128 bits

Answer: d) 128 bits

30. What is the main advantage of IPv6 over IPv4?

a) Faster processing speed

b) Better security features

c) Larger address space

d) Improved routing capabilities

Answer: c) Larger address space

31. What is a subnet?

a) A type of internet service provider

b) A group of device interfaces that can physically reach each other without passing through a router

c) A security protocol for networks

d) A type of network cable

Answer: b) A group of device interfaces that can physically reach each other without passing through a router

32. What does ICANN stand for?

a) International Computer and Network Corporation

b) Internet Corporation for Assigned Names and Numbers

c) Integrated Communications and Network Control

d) Internet Control and Network Navigation

Answer: b) Internet Corporation for Assigned Names and Numbers

33. What is tunneling in the context of IPv6 transition?

a) A method of encrypting data

b) Carrying IPv6 datagrams as payload in IPv4 datagrams

c) A way to increase network speed

d) A technique for reducing network latency

Answer: b) Carrying IPv6 datagrams as payload in IPv4 datagrams

34. What is the main concept of generalized forwarding?

a) Source-based routing

b) Match plus action abstraction

c) Destination-based forwarding only

d) Random packet forwarding

Answer: b) Match plus action abstraction

35. In the flow table abstraction, what does "flow" refer to?

a) Water movement

b) Traffic congestion

c) Defined by header field values

d) Network speed

Answer: c) Defined by header field values

36. Which of the following is NOT a possible action in generalized forwarding?

a) Drop packet

b) Forward packet

c) Modify packet

d) Encrypt packet

Answer: d) Encrypt packet

37. What is used to disambiguate overlapping patterns in the flow table?

a) Counters

b) Priority

c) Match fields

d) Actions

Answer: b) Priority

28. What does OpenFlow use to define its entries?

a) Flow tables

b) Routing tables

c) ARP tables

d) MAC address tables

Answer: a) Flow tables

29. In OpenFlow, which field is used for destination-based forwarding?

a) MAC src

b) IP Src

c) IP Dst

d) TCP s-port

Answer: c) IP Dst

30. Which layer does MAC address-based forwarding belong to?

a) Layer 1

b) Layer 2

c) Layer 3

d) Layer 4

Answer: b) Layer 2

31. What does NAT stand for in the context of network devices?

a) Network Address Translation

b) New Addressing Technique

c) Network Analysis Tool

d) Node Allocation Table

Answer: a) Network Address Translation

32. Which of these is NOT a typical action in OpenFlow?

a) Forward

b) Drop

c) Modify

d) Replicate

Answer: d) Replicate

33. What are the three major types of switching fabrics?

a) Bus, memory, and interconnection network

b) Input port, output port, and control plane

c) Ethernet, IP, and TCP

d) TCAM, DRAM, and SRAM

Answer: a) Bus, memory, and interconnection network

34. What is the purpose of longest prefix matching in IP forwarding?

a) To minimize power consumption

b) To increase security

c) To determine the most specific matching entry in the forwarding table

d) To reduce latency

Answer: c) To determine the most specific matching entry in the forwarding table

35. What is a TCAM used for in routers?

a) Storing routing protocols

b) Performing longest prefix matching

c) Managing buffer memory

d) Encrypting data packets

Answer: b) Performing longest prefix matching

36. What is Head-of-the-Line (HOL) blocking?

a) A security feature that blocks malicious packets

b) A queueing phenomenon where the first packet prevents others from moving forward

c) A method to prioritize high-importance packets

d) A technique to reduce packet loss

Answer: b) A queueing phenomenon where the first packet prevents others from moving forward

37. What is the recommended buffer size according to the RFC 3439 rule of thumb?

a) 1 GB for all routers

b) Equal to the link capacity

c) Average RTT times link capacity

d) 10% of the total memory

Answer: c) Average RTT times link capacity