Which protocol is used for sending email?

a) IMAP

b) POP3

c) SMTP

d) HTTP

Answer: c

Which of the following is NOT a benefit of using HTTPS?

a) Encrypted communication

b) Authentication of the server

c) Faster data transfer

d) Data integrity

Answer: c

Which protocol is used for streaming audio and video content?

a) RTSP

b) FTP

c) SMTP

d) DNS

Answer: a

What is the purpose of the "Cache-Control" header in HTTP?

a) To specify caching directives for the request/response

b) To indicate the preferred language for the response

c) To set the maximum size of the response

d) To define the encoding of the response body

Answer: a

Which of the following is NOT a type of DNS server?

a) Root server

b) TLD server

c) Authoritative server

d) Cache server

Answer: d

What is the main purpose of the "Content-Type" header in HTTP responses?

a) To specify the MIME type of the response body

b) To indicate the size of the response body

c) To set the compression method for the response

d) To define the caching policy for the response

Answer: a

Which protocol is used for secure file transfer?

a) FTP

b) SFTP

c) HTTP

d) SMTP

Answer: b

How does a UDP socket on the receiving host direct incoming segments?

a) By source IP address

b) By destination port number

c) By a 4-tuple of IP addresses and port numbers

d) By application name

Answer: b

In TCP, how is a socket identified?

a) By source port number only

b) By destination IP address only

c) By a 4-tuple: source IP address, source port number, destination IP address, destination port number

d) By application layer protocol

Answer: c

What is the difference between UDP and TCP in terms of demultiplexing?

a) UDP uses only the destination port, while TCP uses a 4-tuple

b) TCP uses only the destination port, while UDP uses a 4-tuple

c) Both use the same demultiplexing method

d) UDP doesn't perform demultiplexing

Answer: a

Which layer does the transport layer rely on and enhance?

a) Application layer

b) Network layer

c) Data link layer

d) Physical layer

Answer: b

What is the main difference between network layer and transport layer communication?

a) Network layer is between processes, transport layer is between hosts

b) Transport layer is between processes, network layer is between hosts

c) They both communicate between processes

d) They both communicate between hosts

Answer: b

Which layer of the OSI model does UDP operate on?

a) Application layer

b) Network layer

c) Transport layer

d) Data link layer

Answer: c) Transport layer

What type of applications are best suited for UDP?

a) Applications requiring reliable data transfer

b) Applications sensitive to delay

c) Applications requiring in-order delivery

d) Applications with large data transfers

Answer: b) Applications sensitive to delay

How does UDP handle flow control?

a) By using a sliding window

b) By implementing congestion avoidance

c) By using acknowledgments

d) It doesn't handle flow control

Answer: d) It doesn't handle flow control

What happens if the UDP checksum at the receiver doesn't match the sent checksum?

a) The packet is automatically resent

b) An error is detected

c) The packet is always discarded

d) The checksum is recalculated

Answer: b) An error is detected

Which of the following is NOT a reason to use UDP?

a) Simple protocol with no connection state

b) Small header size

c) Ability to blast away data as fast as desired

d) Guaranteed reliable transfer

Answer: d) Guaranteed reliable transfer

What does UDP do if a segment is lost during transmission?

a) Automatically retransmits the segment

b) Notifies the sender to resend

c) Nothing, it's up to the application layer to handle

d) Sends an error message to the receiver

Answer: c) Nothing, it's up to the application layer to handle

Which version of HTTP uses UDP?

a) HTTP/1.1

b) HTTP/2

c) HTTP/3

d) None of the above

Answer: c) HTTP/3

How is reliability added to applications using UDP?

a) By modifying the UDP protocol

b) By adding reliability at the application layer

c) By switching to TCP

d) By increasing the packet size

Answer: b) By adding reliability at the application layer

What is the main advantage of UDP over TCP for real-time applications?

a) Higher throughput

b) Guaranteed delivery

c) Lower latency

d) Better congestion control

Answer: c) Lower latency

How many steps are involved in the TCP connection establishment handshake?

a) 2

b) 3

c) 4

d) 5

Answer: b) 3

What does SYN stand for in the context of TCP connection establishment?

a) Synchronize

b) Syntax

c) System

d) Synergy

Answer: a) Synchronize

In the TCP 3-way handshake, what does the client send in the first step?

a) SYN

b) ACK

c) SYN-ACK

d) FIN

Answer: a) SYN

How is a TCP connection typically closed?

a) With a 2-way handshake

b) With a 3-way handshake

c) By sending a FIN bit

d) By timing out

Answer: c) By sending a FIN bit

What does ACK stand for in TCP?

a) Acknowledge

b) Access

c) Account

d) Activate

Answer: a) Acknowledge

Which field in the TCP segment contains the acknowledgment number?

a) Sequence number

b) Acknowledgement number

c) Window size

d) Checksum

Answer: b) Acknowledgement number

What is the purpose of the checksum in a TCP segment?

a) To encrypt the data

b) To compress the data

c) To detect errors in the segment

d) To prioritize the segment

Answer: c) To detect errors in the segment

What does RTT stand for in the context of TCP?

a) Real-Time Transfer

b) Round-Trip Time

c) Reliable Transfer Time

d) Remote Transfer Technology

Answer: b) Round-Trip Time

Which of the following is NOT a state in TCP connection management?

a) LISTEN

b) SYN SENT

c) ESTABLISHED

d) WAITING

Answer: d) WAITING

In TCP slow start, how does cwnd initially increase?

a) Linearly

b) Exponentially

c) Logarithmically

d) Remains constant

Answer: b

When does TCP switch from slow start to congestion avoidance?

a) When cwnd reaches its maximum value

b) When a timeout occurs

c) When cwnd gets to 1/2 of its value before timeout

d) After a fixed number of RTTs

Answer: c

What is ssthresh in TCP congestion control?

a) Slow start threshold

b) Segment size threshold

c) Sender speed threshold

d) System stability threshold

Answer: a

Which TCP variant uses a cubic function to increase the congestion window?

a) TCP Reno

b) TCP Tahoe

c) TCP CUBIC

d) TCP Vegas

Answer: c

What is the main advantage of TCP CUBIC over classic TCP?

a) Lower throughput

b) Higher throughput in many scenarios

c) Simpler implementation

d) Better security

Answer: b

What is the bottleneck link in TCP congestion control?

a) The fastest link in the path

b) The link with the highest capacity

c) The link that is almost always busy and sometimes overflows

d) The first link in the path

Answer: c

What is the goal of delay-based TCP congestion control?

a) To maximize delay

b) To keep the end-to-end pipe just full, but not fuller

c) To increase packet loss

d) To reduce throughput

Answer: b

What is RTTmin in delay-based TCP congestion control?

a) The maximum observed RTT

b) The average RTT

c) The minimum observed RTT (uncongested path)

d) The RTT with maximum congestion

Answer: c

What is Explicit Congestion Notification (ECN)?

a) A technique where routers drop packets to indicate congestion

b) A method where end systems detect congestion without network assistance

c) A mechanism where routers mark packets to indicate congestion

d) A protocol that replaces TCP for congestion control

Answer: c

How many bits in the IP header are used for ECN?

a) 1 bit

b) 2 bits

c) 4 bits

d) 8 bits

Answer: b

What is the fairness goal in TCP congestion control?

a) To give all connections equal bandwidth regardless of their needs

b) To prioritize certain connections over others

c) To give K TCP sessions sharing a bottleneck link of bandwidth R an average rate of R/K each

d) To maximize the throughput of a single connection

Answer: c

Under which conditions is TCP considered fair?

a) Different RTTs and variable number of sessions

b) Same RTT and fixed number of sessions only in congestion avoidance

c) Different RTTs and fixed number of sessions

d) Same RTT but variable number of sessions

Answer: b

Why do some multimedia applications often use UDP instead of TCP?

a) UDP is more reliable

b) UDP has built-in congestion control

c) They don't want their rate throttled by congestion control

d) UDP provides better quality of service guarantees

Answer: c

What can an application do to potentially get more bandwidth when using TCP?

a) Switch to UDP

b) Open multiple parallel TCP connections

c) Increase the packet size

d) Reduce the sending rate

Answer: b

Which of the following is true about TCP CUBIC?

a) It's rarely used in practice

b) It's the default TCP variant in Windows

c) It's the default TCP variant in Linux

d) It performs worse than classic TCP in all scenarios

Answer: c

Which of the following is NOT a feature of QUIC?

a) Error control

b) Congestion control

c) Multiple application-level streams

d) Mandatory use of TCP

Answer: d) Mandatory use of TCP

What problem does QUIC solve with its stream multiplexing approach?

a) Packet loss

b) High latency

c) Head-of-line (HOL) blocking

d) Encryption overhead

Answer: c) Head-of-line (HOL) blocking

In TCP throughput calculation, what does W represent?

a) Window size where loss occurs

b) Average round-trip time

c) Number of packets sent

d) Bandwidth of the connection

Answer: a) Window size where loss occurs

According to the TCP throughput formula for "long, fat pipes", what is the relationship between throughput and segment loss probability (L)?

a) Directly proportional

b) Inversely proportional

c) Inversely proportional to the square root of L

d) Directly proportional to the square root of L

Answer: c) Inversely proportional to the square root of L

Which of the following is NOT mentioned as a principle behind transport layer services?

a) Multiplexing and demultiplexing

b) Reliable data transfer

c) Flow control

d) Packet switching

Answer: d) Packet switching

What are the two key network-layer functions?

a) Routing and switching

b) Forwarding and routing

c) Addressing and encapsulation

d) Fragmentation and reassembly

Answer: b) Forwarding and routing

What is the purpose of DHCP?

a) To assign IP addresses dynamically

b) To route packets between networks

c) To encrypt network traffic

d) To compress data for transmission

Answer: a) To assign IP addresses dynamically

What is the main difference between IPv4 and IPv6 address lengths?

a) IPv4 uses 32-bit addresses, IPv6 uses 64-bit addresses

b) IPv4 uses 32-bit addresses, IPv6 uses 128-bit addresses

c) IPv4 uses 64-bit addresses, IPv6 uses 128-bit addresses

d) IPv4 uses 16-bit addresses, IPv6 uses 32-bit addresses

Answer: b) IPv4 uses 32-bit addresses, IPv6 uses 128-bit addresses

In the analogy of taking a trip, what does forwarding correspond to?

a) Planning the entire journey

b) Getting through a single interchange

c) Choosing the mode of transportation

d) Calculating the total distance

Answer: b) Getting through a single interchange

Which of the following is a characteristic of the control plane?

a) Local, per-router function

b) Determines how datagrams are forwarded within a router

c) Network-wide logic

d) Implemented only in end hosts

Answer: c) Network-wide logic

In Software-Defined Networking (SDN), where are the forwarding tables computed?

a) In each router

b) In end hosts

c) In a remote controller

d) In the link layer devices

Answer: c) In a remote controller

Which of the following is NOT mentioned as a possible service for a flow of datagrams?

a) In-order datagram delivery

b) Guaranteed minimum bandwidth

c) Restrictions on changes in interpacket spacing

d) Guaranteed maximum latency

Answer: d) Guaranteed maximum latency

What does ATM stand for in the network service model table?

a) Automated Teller Machine

b) Asynchronous Transfer Mode

c) Advanced Traffic Management

d) Adaptive Timing Mechanism

Answer: b) Asynchronous Transfer Mode

Which service model potentially provides bandwidth guarantees according to the table?

a) Internet best effort

b) ATM Available Bit Rate

c) Internet Intserv Guaranteed

d) Both b and c

Answer: d) Both b and c

What is one of the reasons given for the success of the best-effort service model?

a) Complex mechanisms

b) Guaranteed quality of service

c) Simplicity of mechanism

d) Limited adoption

Answer: c) Simplicity of mechanism

Which of the following is NOT mentioned as a component of the "Network layer: data plane" roadmap?

a) What's inside a router

b) IP: the Internet Protocol

c) Generalized Forwarding, SDN

d) Transport layer protocols

Answer: d) Transport layer protocols

According to the document, what helps in the context of best-effort service?

a) Guaranteed bandwidth allocation

b) Congestion control of "elastic" services

c) Strict timing guarantees

d) Mandatory quality of service implementations

Answer: b) Congestion control of "elastic" services

Which of the following is true about the Internet's best-effort service model?

a) It guarantees packet delivery

b) It ensures in-order packet arrival

c) It provides timing guarantees

d) It doesn't provide any specific guarantees

Answer: d) It doesn't provide any specific guarantees

According to RFC 3439, how much buffering is recommended on average?

a) 1% of the link capacity

b) Equal to the typical RTT times link capacity

c) 10 times the packet size

d) Half of the available memory

Answer: b) Equal to the typical RTT times link capacity

What is a potential issue with too much buffering in routers?

a) Increased throughput

b) Better security

c) Increased delays for real-time applications

d) Lower power consumption

Answer: c) Increased delays for real-time applications

What is tail drop in buffer management?

a) Dropping the last packet in the queue

b) Dropping the incoming packet when the buffer is full

c) Dropping packets based on their priority

d) Dropping packets with expired TTL

Answer: b) Dropping the incoming packet when the buffer is full

What does ECN stand for in the context of buffer management?

a) Enhanced Congestion Notification

b) Error Correction Network

c) Explicit Congestion Notification

d) Extended Control Negotiation

Answer: c) Explicit Congestion Notification

What is FCFS in packet scheduling?

a) First Come, First Served

b) Fast Congestion-Free Scheduling

c) Forced Capacity Flow System

d) Flexible Capacity Forwarding Scheme

Answer: a) First Come, First Served

In priority scheduling, how are packets within the same priority class handled?

a) Randomly

b) Based on packet size

c) FCFS

d) Round Robin

Answer: c) FCFS

What is the main characteristic of Round Robin (RR) scheduling?

a) It always prioritizes the highest priority queue

b) It cyclically serves each class queue in turn

c) It drops packets from overflowing queues

d) It only serves queues with the most packets

Answer: b) It cyclically serves each class queue in turn

How does Weighted Fair Queuing (WFQ) differ from Round Robin?

a) It doesn't use classification

b) It only serves high-priority queues

c) It assigns weights to different classes

d) It uses a random selection process

Answer: c) It assigns weights to different classes

What does the weight in WFQ determine?

a) The packet size limit for each class

b) The drop probability for each class

c) The minimum bandwidth guarantee for each class

d) The maximum number of packets per class

Answer: c) The minimum bandwidth guarantee for each class

What is generalized forwarding in the context of router input port functions?

a) Forwarding based only on the destination IP address

b) Forwarding based on any set of header field values

c) Forwarding without using a forwarding table

d) Forwarding using only the source IP address

Answer: b) Forwarding based on any set of header field values

What is the purpose of the switching fabric in a router?

a) To store the routing table

b) To process packet headers

c) To transfer packets from input ports to output ports

d) To encrypt network traffic

Answer: c) To transfer packets from input ports to output ports

In the context of router architecture, what does "line speed" refer to?

a) The speed of the physical connection

b) The rate at which the input port can process packets

c) The clock speed of the router's CPU

d) The speed of the switching fabric

Answer: b) The rate at which the input port can process packets

What is a potential consequence of output port buffer overflow?

a) Increased packet processing speed

b) Improved load balancing

c) Packet loss

d) Enhanced security

Answer: c) Packet loss

Which of the following is NOT mentioned as a packet scheduling policy in the document?

a) First come, first served

b) Priority

c) Round robin

d) Shortest job first

Answer: d) Shortest job first

What is the main advantage of using TCAMs for longest prefix matching?

a) Low power consumption

b) Large storage capacity

c) Fast lookup speed

d) Easy programmability

Answer: c) Fast lookup speed

What is the purpose of a subnet mask?

a) To identify the network portion of an IP address

b) To encrypt network traffic

c) To increase network speed

d) To block unwanted traffic

Answer: a) To identify the network portion of an IP address

Which of the following is NOT a function of a router?

a) Packet forwarding

b) Route determination

c) Data encryption

d) Buffer management

Answer: c) Data encryption

What is the main purpose of ICMP?

a) File transfer

b) Email communication

c) Error reporting and router signaling

d) Web browsing

Answer: c) Error reporting and router signaling

What is the purpose of the "hop limit" field in IPv6?

a) To limit the number of hops a packet can take

b) To increase network speed

c) To encrypt the packet

d) To identify the packet's destination

Answer: a) To limit the number of hops a packet can take

What is the main advantage of NAT?

a) It increases network speed

b) It provides better security

c) It allows multiple devices to share one public IP address

d) It improves data encryption

Answer: c) It allows multiple devices to share one public IP address

What is the purpose of the "flow label" field in IPv6?

a) To identify packets belonging to the same flow

b) To encrypt the packet

c) To specify the packet's destination

d) To indicate the packet's priority

Answer: a) To identify packets belonging to the same flow

Which organization is responsible for allocating IP addresses?

a) IEEE

b) IETF

c) ICANN

d) W3C

Answer: c) ICANN

What is the main challenge in transitioning from IPv4 to IPv6?

a) Lack of available hardware

b) Incompatibility with existing applications

c) Need for simultaneous operation of both protocols

d) Higher cost of IPv6 addresses

Answer: c) Need for simultaneous operation of both protocols

What is the purpose of counters in the flow table abstraction?

a) To count the number of flows

b) To measure network latency

c) To count bytes and packets

d) To track user activity

Answer: c) To count bytes and packets

What does SDN stand for in the context of networking?

a) Secure Digital Network

b) Software-Defined Networking

c) System Distribution Node

d) Synchronized Data Network

Answer: b) Software-Defined Networking

In OpenFlow, what action is taken for unmatched packets?

a) Always dropped

b) Always forwarded

c) Sent to the controller

d) Duplicated and sent to all ports

Answer: c) Sent to the controller

Which of these is NOT a typical matching field in OpenFlow?

a) IP address

b) MAC address

c) TCP port

d) CPU usage

Answer: d) CPU usage

What is the main advantage of generalized forwarding over traditional forwarding?

a) Faster packet processing

b) Lower hardware costs

c) More flexible network programming

d) Improved security

Answer: c) More flexible network programming

In the OpenFlow abstraction, what does a switch primarily match on?

a) IP address

b) MAC address

c) TCP port

d) VLAN ID

Answer: b) MAC address

What is the primary matching criteria for a router in the OpenFlow abstraction?

a) Shortest IP prefix

b) Longest destination IP prefix

c) Random IP selection

d) Source IP address

Answer: b) Longest destination IP prefix

Which layer(s) can be involved in matching fields for generalized forwarding?

a) Only network layer

b) Only link layer

c) Link, network, and transport layers

d) Application layer only

Answer: c) Link, network, and transport layers

What does the term "match plus action" refer to in generalized forwarding?

a) Matching packets to users

b) Matching packet headers to predefined patterns and taking specified actions

c) Matching network speeds to user requirements

d) Matching security protocols to applications

Answer: b) Matching packet headers to predefined patterns and taking specified actions

What is the main limitation of bus-based switching fabrics?

a) High power consumption

b) Limited by bus bandwidth

c) Inability to handle IPv6

d) Poor security

Answer: b) Limited by bus bandwidth

In Weighted Fair Queueing (WFQ), what does the weight of a queue determine?

a) The maximum packet size

b) The encryption strength

c) The minimum bandwidth guarantee

d) The queue's physical location in memory

Answer: c) The minimum bandwidth guarantee

What is the purpose of buffer management in routers?

a) To optimize power consumption

b) To decide which packets to drop or mark when buffers are full

c) To encrypt packet payloads

d) To perform routing table updates

Answer: b) To decide which packets to drop or mark when buffers are full

Which of the following is NOT a function performed at the input port of a router?

a) Physical layer reception

b) Link layer processing

c) Forwarding table lookup

d) Packet scheduling

Answer: d) Packet scheduling

What is the purpose of using multiple switching planes in parallel in router design?

a) To increase security

b) To reduce power consumption

c) To improve scalability and increase switching capacity

d) To support multiple routing protocols

Answer: c) To improve scalability and increase switching capacity

What is the primary cause of queueing at input ports?

a) Slow link layer processing

b) Insufficient buffer memory

c) Switch fabric slower than combined input port speeds

d) Encryption overhead

Answer: c) Switch fabric slower than combined input port speeds

Which scheduling policy serves packets in the order they arrive?

a) Priority scheduling

b) Round Robin

c) Weighted Fair Queueing

d) First Come, First Served (FCFS)

Answer: d) First Come, First Served (FCFS)

What is the purpose of marking packets in buffer management?

a) To indicate packet priority

b) To signal congestion (e.g., ECN, RED)

c) To identify the source of the packet

d) To indicate packet encryption status

Answer: b) To signal congestion (e.g., ECN, RED)

What is the main advantage of using TCAMs for longest prefix matching?

a) Low power consumption

b) High storage capacity

c) Fast lookup speed (one clock cycle)

d) Low cost

Answer: c) Fast lookup speed (one clock cycle)

Which of the following is NOT a packet scheduling policy mentioned in the document?

a) First Come, First Served (FCFS)

b) Priority scheduling

c) Least Recently Used (LRU)

d) Weighted Fair Queueing (WFQ)

Answer: c) Least Recently Used (LRU)

What is the primary function of the switching fabric in a router?

a) To encrypt data

b) To transfer packets from input ports to output ports

c) To perform routing table lookups

d) To manage buffer memory

Answer: b) To transfer packets from input ports to output ports

What is the purpose of packet classification in routers?

a) To determine the packet's destination

b) To assign packets to different priority queues

c) To encrypt the packet payload

d) To compress packet headers

Answer: b) To assign packets to different priority queues