IK2215 Advanced Internetworking Exam Part A-1

November 3, 2023

1 True or False

1) In IPv4, fragmentation can occur either in the sending host or in routers between sending and receiving host. True

2) The IP checksum covers both the IP header and the payload. False

3) UDP provides a connection-oriented best-effort service. False

4) If the optional UDP checksum is used, UDP will retransmit lost packets. False

5) In UDP there is an optional checksum covering header and data. True

6) All BGP speakers send/receive routing updates over the All-BGP-routers multicast group. False

7) BGP runs on top of TCP. True

8) BGP sends UPDATE messages periodically to its BGP peers. True

9) PIM sparse mode uses IGMP to select a designated router. False

10) IGMP is a multicast routing protocol used to build delivery trees for multicast packets in the Internet. False

11) A host periodically sends IGMP membership queries to request a router for multicast data. False

12) Equal-cost multi-path routing (ECMP) can be used with most routing protocols because it is a per-hop local decision made independently at each router. True

2 Multiple choice

1) What is the role of a designated parent router in RPM (Reverse Path Multicasting)?
The designated parent router is a rendez-vous point in the forwarding tree.
The designated parent router can forward packets onto a link. ✓
The designated parent router can remove branches from the forwarding tree.
The designated parent router can add branhes to the forwarding tree.

3 short answer

1) Assume that you own the address block 172.16.0.0/16.
What is the longest prefix for aggregating 172.16.34.0/24 and 172.16.37.0/24 to one single prefix?
Your answer must not contain any white space before or after the aggregate prefix. Otherwise, it is considered as a wrong answer
Answer: 172.16.32.0/21

2) Assume that you own the address block 10.0.0.0/8.
What is the longest prefix for aggregating 10.11.12.0/24 and 10.13.14.0/24 to one single prefix?
Your answer must not contain any white space before or after the aggregate prefix. Otherwise, it is considered as a wrong answer.
Answer: 10.8.0.0/13

3) Assume that you own the address block 172.16.0.0/16.
What is the longest prefix for aggregating 172.16.10.0/24 and 172.16.12.0/24 to one single prefix?
Your answer must not contain any white space before or after the aggregate prefix. Otherwise,it is considered as a wrong answer.
Answer: 172.16.8.0/21

4) Assume that you own the address block 1.0.0.0/8.
What is the longest prefix for aggregating 1.2.3.0/24 and 1.3.4.0/24 to one single prefix?
Your answer must not contain any white space before or after the aggregate prefix. Otherwise,it is considered as a wrong answer.
Answer: 1.2.0.0/15

5) Compare RIP and OSPF from the design goal perspective, and identify the protocol (RIP or OSPF) that best fulfills the design goal below.

Design goal	Protocol
Fast convergence	OSPF
Scalability in terms of network size	OSPF
Resource required on network device	RIP
Simplicity	RIP
scalability in terms of network size	OSPF

6) Compare a source-based tree and a group-shared tree, and identify which type of multicast tree is better in terms of different performance and characteristics below.

performance and characteristics	multicast tree
resource consumption	group shared tree
Latency	source based tree

7) Compare data-plane and control-plane characteristics. Identify which is the best fit for the characteristics below.

Characteristics	Plane of operation
hardware implementation	data-plane
global scope	control-plane
packet forwarding	data-plane
local scope	data-plane

8) At a given time, a TCP sender has a congestion window of 1400 bytes and a receiver-advertised window of 1600 bytes. What is the maximum number of bytes that the sender can transmit before waiting for an ACK? Answer with a number only.
Answer: 1400

9) At a given time, a TCP sender has a congestion window of 2000 bytes and a receiver-advertised window of 1800 bytes. What is the maximum number of bytes that the sender can transmit before waiting for an ACK? Answer with a number only.
Answer: 1800

10) At a given time, a TCP sender has a congestion window of 2000 bytes and a receiver-advertised window of 2400 bytes. What is the maximum number of bytes that the sender can transmit before waiting for an ACK? Answer with a number only.
Answer: 2000

11) In the topology above, host A is multicasting a video stream to two receivers: host B and host C. Assume that RIP is used for the unicast routing protocol and PIM-SM is used for the multicast routing protocol with R5 as the rendezvous point.
Identify the path that multicast packets will take from node A to each receiver in scenarios when the following multicast trees are used:
· A source-based tree
· A group-shared tree
If a router has equal-cost paths in its routing table, it always prefers the path via the router with the lowest number.
IMPORTANT: You must specify the intermediate routers of every hop the video stream data traverses. Your answer should contain only the router number. For example, R1 should be written with just 1. If there are multiple intermediate routers, you must use only single white space between the router number.
Example of correct answers:
1 2 3 4
5 3 7
Example of wrong answers:
R1 R2 R3 R4 (you must use only the router numbers without ”R”)
1 2 3 4 (you must use only a single white space between router numbers)
1-2-3-4 (you must use only a single white space between router numbers)
1.1.1.1 2 3 4 5.5.5.5 (your answer must contain only intermediate router numbers)

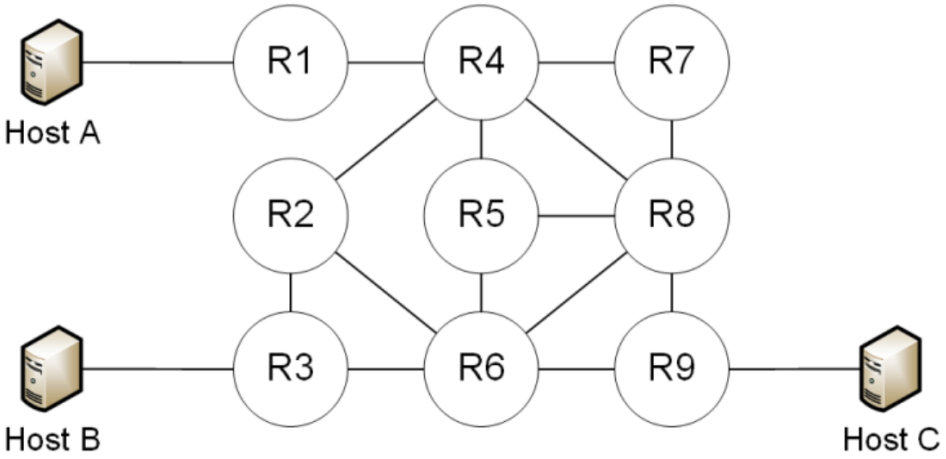

Figure 1: topology

Now, answer which path multicast packets will take in the following scenarios:
1. A source-based tree from Host A to Host B: 1 4 2 3
2. A source-based tree from Host A to Host C: 1 4 8 9
3. A group-shared tree with R5 as a rendezvous point from Host A to Host B: 1 4 5 6 3
4. A group-shared tree with R5 as a rendezvous point from Host A to Host C: 1 4 5 6 9

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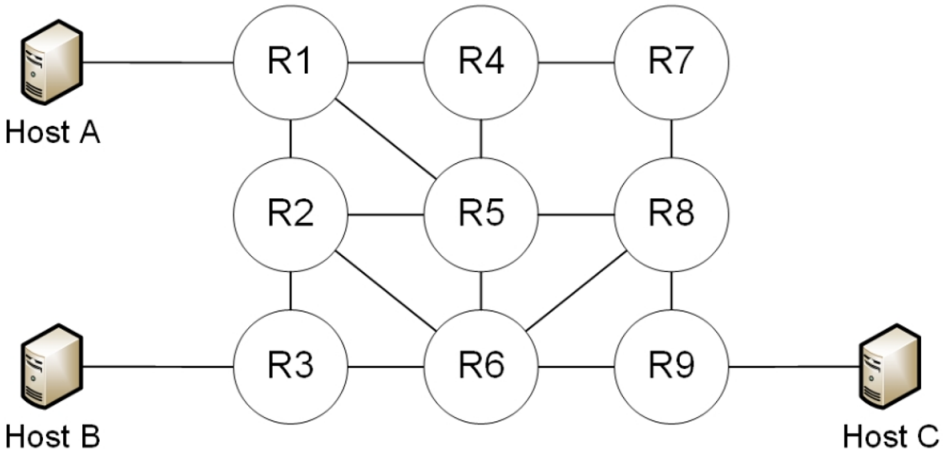

Figure 2: topology

Now, answer which path multicast packets will take in the following scenarios:
1. A source-based tree from Host A to Host B: 1 2 3
2. A source-based tree from Host A to Host C: 1 2 6 9
3. A group-shared tree with R5 as a rendezvous point from Host A to Host B: 1 5 2 3
4. A group-shared tree with R5 as a rendezvous point from Host A to Host C: 1 5 6 9

13) Explain what type of protocols may run on the routers of an Autonomous system. (2pt)

14) 1. Explain why TCP Reno is not fair to different RTTs. (1pt)
2. Explain why a buffer is needed at a bottleneck link to achieve high throughput with TCP Reno. (1pt)

15) 1. Explain the slow convergence problem with TCP Reno.
2. Explain how BBR increases the transmission rate to discover the available bandwidth in the

PROBE_BW phase.

16) 1. Explain the main difference between link-state routing and distance-vector routing.
    2. Explain why all routers running link-state routing must use the same best-path calculation.