

Question 1.

(25 marks)

Give the sequence of events that might occur if an organisation decides to make available some audio and video event as a multicast transmission over the internet.

You can assume that a multicast capable IP network exists, and is correctly operating, and reaches the entire intended audience of the event.

Explain what needs to be done to establish the multicast session, and how each of the necessary steps may be accomplished.

Include all major steps from the initial decision to broadcast the event using multicast over the internet, until the event has concluded.

In the explanations, you need^{to} mention only one recipient, it can be assumed that any others perform similar acts in similar ways.

Question 2.

(15 marks)

- A) In IGMP versions 1 & 2, and MLD v1, most nodes suppress REPORT messages after receiving a QUERY.
Explain the method by which this is accomplished.

[5 marks]

- B) Explain why it was considered both acceptable, and a good design choice, to specify and implement this mechanism.

[5 marks]

- C) Why do IGMP v3, and MLD v2, not continue with this procedure?

[5 marks]

Question 3.

(5 marks)

In the Internet Group Management Protocol, version 3 (IGMPv3) (and in Multicast Listener Discovery, version 2, MLDv2, for IPv6) a host can request to receive a multicast group, but only from a particular set of senders, or only from sources not in a given set of senders.

- A) What requirement does this place on the multicast routing protocol if it desires to maximise efficiency of the network? [3 marks]

- B) Give an example of a multicast routing protocol that can take advantage of this IGMPv3 (MLDv2) feature, and one that cannot. [2 marks]

Question 4.

(15 marks)

- A) Scalable Reliable Multicast (SRM) uses random delays as part of the operation of the protocol. Explain the purpose of those delays, and what benefits they bring to the operation of the protocol.

What are the costs of this approach?

[10 marks]

- B) Two nodes (**A** and **B**) are both delaying before sending a Negative Acknowledge (NAK) for the same missing packet, one (**A**) selecting a random delay in the interval $[0..2]$ seconds, and the other (**B**) in the interval $[0..5]$ seconds.

From this information, what, if anything, might you be able to conclude about the relationship between **A**, **B** and **S** (the sender of the multicast packets) ?

[5 marks]

Question 5.

(15 marks)

- A) Explain why the existence of a standard multicast address allocation method is desirable, and what the consequences would be without one.

[6 marks]

- B) Why is this a difficult problem in general?

[2 marks]

- C) How does the introduction of Source Specific Multicast (SSM) alter the address allocation problem (where it is used)?

[2 marks]

- D) Explain the suggested IPv6 multicast address allocation mechanism, for Any Source Multicast (ASM) addresses. Include in your answer an explanation why it is simple, and reliable.

Consider the issues created by a large network (the whole Internet) when answering this question, and contrast IPv6 with IPv4 address allocation mechanisms for the same problem area.

[5 marks]

Question 6.

(8 marks)

Multicast sessions are often advertised using the Session Description Protocol (SDP).

SDP data is most commonly carried as the payload of Session Advertisement Protocol (SAP) packets.

Give an example (or examples) of other ways of distributing SDP data, explain how that way works, (or those ways work,) and give any advantages or disadvantages of using an alternative to SAP.

Question 7.

(10 marks)

Some protocols use multicast to avoid needing to send packets to multiple recipients many times, or otherwise arrange redistribution points. These protocols often work without difficulty using unicast if only two parties are involved.

Other protocols fail to function usefully if multicast is not available, regardless of how many nodes participate.

Give examples of this second class of protocols, and explain why multicast is essential for them.

Question 8.

(7 marks)

- A) Explain the purpose of the Real Time Control Protocol (RTCP) when used in conjunction with the Real Time Protocol (RTP).

Include in your answer an indication what information is available to RTCP participants in a multicast session that would not be available without it.

[4 marks]

- B) There are three main RTCP packet types (Receiver Reports, Sender Reports, and Source Description.) Indicate which types of nodes send, and which types of nodes receive, each of those packet types.

[3 marks]
