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THE UNIVERSITY OF BIRMINGHAM

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06 26951

Networks

RESIT

September 2016 2 hours

[Answer ALL questions]

Turn Over

1. IPv6 uses 128-bit addresses to identify hosts and routers.
 - (a) IPv6 addresses are typically spoken of as having “prefixes”, of for example 40, 48 or 64 bits. What is the reason for prefixes having different sizes? **[4%]**
 - (b) IPv6 addresses can be allocated to machines on a network using DHCPv6. Alternatively, a protocol called SLAAC may be used. Briefly explain the similarities and differences between these two protocols. **[6%]**
 - (c) IPv6 does not support fragmentation, while IPv4 does. Explain the concept of fragmentation in IPv4, and discuss why it is now regarded as being harmful to performance and reliability. **[6%]**

2. Over the years, ethernet has developed from a short-range protocol running at 10Mbps or less to a globe-spanning protocol capable of being used at 40Gbps or more.
 - (a) Name and describe one of the improvements to ethernet which enabled this expansion of performance. Do **not** discuss simple increases in bitrate. **[6%]**
 - (b) Ethernet can be carried over a variety of physical layers, one of which is optical fibre. The utilisation of the fibre can be improved using DWDM. Explain the meaning of this term, and describe why it increases the bandwidth that can be carried by a single fibre. **[6%]**
 - (c) Ethernet packets can be carried over ATM networks. What difficulties are there when carrying 1500 byte ethernet frames over ATM? **[4%]**

3. TCP uses a “Receive Window” to control how much data can be sent at any given time.
 - (a) What is the range of values that the Receive Window can have? **[2%]**
 - (b) What units is the Receive Window measured in? **[1%]**
 - (c) The range of the receive window can be insufficient to deal with networks that have a large bandwidth-delay product. Explain the concept of a bandwidth-delay product, and explain how affects the range of receive window sizes that might be needed. **[6%]**
 - (d) What facilities does TCP offer to extend the range of the receive window, without causing problems with duplicate sequence numbers? Explain the operation of these facilities. **[8%]**
 - (e) The advertising of a large receive window may cause a sender to transmit a large amount of data, in an attempt to use all of the available window. What impact might this have on nearby routers, and what facility is a compulsory part of a TCP implementation which reduces the risk of this happening? Briefly explain the operation of this facility. **[8%]**

4. The DNS protocol is used to map between names and network addresses, and to provide information about the location of servers for commonly used protocols such as DNS and SMTP.
- (a) Explain the meaning of the terms *zone* and *resource record* when discussing DNS servers. **[5%]**
 - (b) Describe the purpose of the TTL field in a resource record. How is this used by recursive resolvers? **[5%]**
 - (c) Why might an administrator decide to set a small (for example, 300) value for the TTL of an address record associated with a web server? **[4%]**
5. Virtual LANs permit the carrying of traffic which is logically distinct over a single physical link.
- (a) Describe a situation in which this would be advantageous for the connection linking a computer to the network. **[2%]**
 - (b) Describe a situation in which this would be advantageous for a connection linking two network switches. **[2%]**
 - (c) As well as being used over a single cable, VLANs can be used over other media capable of carrying ethernet packets. Describe such a link which would offer more reliability and performance than a single cable. **[4%]**
6. SMTP and FTP are commonly used network protocols.
- (a) What is the purpose SMTP is used for? **[1%]**
 - (b) SMTP is often used in conjunction with MX records in the DNS. Explain the role of MX records in the operation of SMTP. **[4%]**
 - (c) FTP has an “active” and “passive” mode, the latter better suited to operation through firewalls and network address translation points. Distinguish between the two modes, and explain why “active” mode is problematic in today’s networks. **[6%]**
 - (d) Network Address Translation (NAT) permits the sharing of an IPv4 address between multiple hosts. Briefly explain its operation with reference to both TCP and UDP traffic. Why is NAT not required for IPv6 networks? **[10%]**