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THE UNIVERSITY OF BIRMINGHAM

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Networks

RESIT

September 2015 2 hours

[Answer ALL questions]

Turn Over

1. IPv6 uses 128-bit addresses to identify hosts and routers.

   (a) Explain the meaning of a "prefix" in an IPv6 address. Why is this significant for routing? **[4%]**

   (b) IPv6 addresses are often allocated by the use of *SLAC*. State the meaning of this acronym, and describe the process by which a device uses SLAC to obtain an IPv6 address. **[5%]**

   (c) Describe the operation of DHCP (either in its v4 or v6 forms). What makes this protocol more challenging to implement than SLAC? **[8%]**

2. Over the years, network protcols have evolved which use bus, ring and star topologies.

   (a) Name one technology associated with each of these three toplogies. **[3%]**

   (b) Modern ethernet uses switches. Distinguish between hubs and switches. **[5%]**

   (c) Ethernet is often described in terms of its collision-detection model. With reference to the concept of "full duplex" ethernet, describe why today collisions are rare events. **[2%]**

3. TCP uses a "Receive Window" to control how much data can be sent at any given time. A naive implementation of TCP might initially send data that completely fills the Receive Window.

   (a) What impact might this have on intermediate routers between the two communicating nodes, particularly routers close to the sender? **[4%]**

   (b) Such an implementation would not be regarded as best practice today. What is the name of the techique that would be used to control the initial sending of data? **[1%]**

   (c) Describe the operation of this technique with reference to the sending of a ten kilobyte file with a 1000 byte maximum segment size and a constant receive window of 40 kilobytes. **[8%]**

   (d) If two successive TCP packets are lost between sender and receiver, why might only one, or in some cases zero, additional packets be sent when the data is retransmitted? **[4%]**

   (e) A TCP implementation successively receives packets containing bytes 0 to 999, 1000 to 1999 and 3000 to 3999 of a data stream, spaced one second apart. What acknowledgements are sent? **[3%]**

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) Describe the purpose of A, AAAA, PTR and MX records in DNS zone files. **[8%]**

(b) A client looks up the IPv4 address name `somename.dom.ain.com` by talking to a nearby recursive nameserver. Describe the flow of packets which culminates in the client receiving a response. You do not need show the precise contents of the packets, just indicate the information carried in each. **[10%]**

5. Link aggregation is used to combine multiple networking links into one logical path.

   (a) Describe a scenario in which Link Aggregation would be worthwhile. **[3%]**

   (b) A router is connected to a network switch with two cables, each carrying one logical network. How would you combine Link Aggregation and VLANs to provide fault tolerance without purchasing additional hardware? **[3%]**

   (c) You are tasked with providing additional performance for a university research project that has dedicated access to a 10Gbps Internet connection. You configure Link Aggregation between a computer and a network switch to increase the bandwidth available to the computer from 1Gbps to 4Gbps. You find that although it improves performance to other machines within the data centre, performance over the Internet has not been improved. What would you investigate, what tools would you use, and what do you think is most likely to be the problem? **[12%]**

6. SNMP is a commonly used protocol for monitoring and, less commonly, configuring network hardware.

   (a) The SNMP v2c security model relies on "community strings". Explain what this means, and why it is extremely insecure. **[4%]**

   (b) The SNMP v3 security model allows for cryptographic authentication. Explain how MD5 or SHA1 are used to ensure that only authorised users can send packets to an SNMP agent. **[5%]**

   (c) SNMP uses the concept of "walking" a tree of objects using the GET-NEXT operation. Explain how an SNMP manager would obtain a complete dump of an SNMP agent's Management Information Base using GET-NEXT. Explain why this is slow over higher latency networks, and describe the facility provided in SNMP to perform large downloads. **[8%]**