COMPUTER SCIENCE TRIPOS Part IB – 2017 – Paper 5

5 Computer Networking (AWM)

(a) A router vendor is interested in building an ultra low-cost router. Analysis reveals that the total build-costs are 90% for linecards and 10% for control processors. The router vendor focuses on reducing linecard costs.

Discuss which of the following strategies would help the vendor achieve this goal. Keep in mind that high-speed memory is expensive.

(i) Develop a faster implementation of Dijkstra's algorithm. [2 marks]

(ii) Convince the IETF to eliminate IPv4 fragmentation support. [2 marks]

(iii) Convince the IETF to abolish multi-homing. [2 marks]

(iv) Convince operating systems vendors to implement packet "pacing" so end hosts will not generate bursts of back-to-back packets. [2 marks]

(b) You are running a TCP-based movie streaming service called MeTube. Several of your users are complaining about poor performance. You call in your team of three engineers to examine the problem. They all observe that the 10Gbps access link to the MeTube server is only 25% utilised, and that the server's CPU is only 15% utilised. Each engineer then independently reports back with the following conclusions and suggestions for improvements.

Consider each of the engineers' conclusions and discuss why it is correct or not.

(i) Engineer Phil notices that a number of packets are being retransmitted multiple times. Phil recommends the TCP implementation be modified reducing both the timeout period and the fast retransmit threshold from 3 to 2 dupAcks (duplicate Acknowledgments). While this may lead to even more retransmissions, Phil concludes this is OK as the server's access link is only 25% utilised. With these changes, users will receive lost packets faster and hence will definitely see improved performance. [4 marks]

(ii) Engineer Leslie runs traceroute from the MeTube server to impacted users and finds that a router R1 along the path repeatedly drops her traceroute messages. Leslie concludes that the high packet drop rates at R1 are the cause of their performance problems. [4 marks]

(iii) Engineer Chris notes that users reporting problems have IP addresses belonging to the Classless Inter-Domain Routing (CIDR) block allocated to Tiny-Telco. She believes the problem may be due to high loss rates involving Tiny-Telco's network. Chris recommends they contact Tiny-Telco and ask them to diagnose and fix the problem. [4 marks]