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Försättsblad Prov Original

Kurskod	Provkod	Tentamensdatum
DT066A	T101	2024-01-12
Kursnamn	Datateknik AV, TCP/IP-nät	
Provnamn	Tentamen	
Ort	Sundsvall	
Termin		
Ämne		

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Exam

DT052A / DT066A TCP/IP Internetworking

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Instructions

Carefully read the questions before you start answering them. Note the time limit of the exam and plan your answers accordingly. Only answer the question, do not write about subjects remotely related to the question. The questions are *not* sorted by difficulty. Clearly show which answer you are giving your solution to, *Always motivate your answers and show your calculations.*.

Time 5 hours.

Exam Aids Non-programmable calculator.

Maximum points 30

Questions 10

Preliminary grades

The following grading criteria applies: E $\geq$ 50%, D $\geq$ 60%, C $\geq$ 70%, B $\geq$ 80%, A $\geq$ 90%.

Questions

(3p) 1. Answer the following questions while motivating your answer.

- How wireless communication is different from wired communication in terms of signal propagation, medium access, and interference?
- Explain why Error Detection and Correction is preferred in WLANs and not in Ethernet. Justify from reliability and overhead perspectives.

(3p) 2. Answer the following questions.

- A handoff occurs when a mobile station changes its association from one base station (BS) to another during a call. List two reasons for the need for a handoff.
- What is the basic difference between 3G and 4G/5G cellular network architectures?

(3p) 3. Answer the following questions.

- Compare and contrast the properties of a link state and a distance vector routing protocol. Giving an example of a routing protocol that takes a link state and a distance vector approach.
- Compare and contrast static and dynamic routing algorithms.

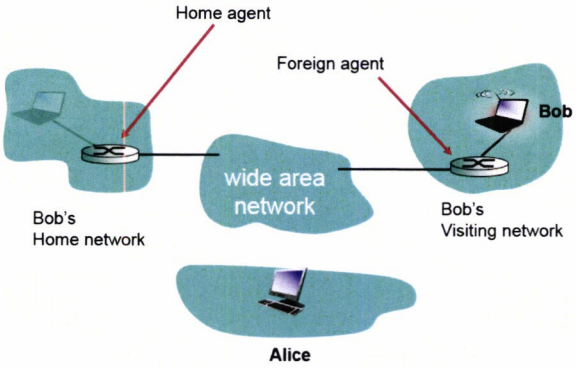

Figure 1: Mobility management: direct routing

(3p) 4. What is congestion at the transport layer, and how does it impact network performance? What are the congestion control techniques employed by TCP, and could you explain each of them in detail?

(3p) 5. Explain the concept of Network Address Translation (NAT) and its purpose in computer networking. Include the different types of NAT and their respective functionalities.

(3p) 6. What is Software Defined Networking (SDN)? Discuss the control plane and data plane concepts related to SDN architecture. Provide the basic SDN architecture figure. Describe the benefits and advantages of SDN compared to traditional networking.

(3p) 7. Answer the following questions.

- How does packet loss impact a transport layer protocol that aims to achieve reliable delivery over an unreliable channel? What mechanisms are employed to manage packet loss in such protocols?
- What is the effect of duplicate acknowledgements on a transport layer protocol striving for reliable delivery over an unreliable channel? How does the protocol handle duplicate acknowledgements to ensure proper management of the issue?
- Explain how congestion affects a transport layer protocol designed for reliable delivery over an unreliable channel. What mechanisms and algorithms are utilized to manage congestion in such protocols and maintain reliable communication?

(3p) 8. Assume that Alice wants to communicate with Bob while Bob is currently residing in a network that is not his home network (see Figure 1). How Alice can communicate with Bob in the visiting network using **indirect routing**? List and clearly state all the steps needed to connect Alice to Bob.

(3p) 9. Consider a data stream between two workstations A and B. The data stream consists of packets generated at workstation A at a rate of 95 packet/s and immediately transmitted to workstation B. A and B are able to communicate via a router that stores and forwards the packets. Assume that all packets are correctly received by B and that there is no packet loss. Finally, the measured average end-to-end delay between A and B is $T = 190$ ms.

- Find N, the average number of packet that are in transit from A to B.
- Model the system as an M/M/1 queue (i.e. exponential service time and inter-arrival time) with arrival rate $\lambda = 95$ packet/s, and average end-to-end delay $T = 190$ ms. Calculate the service rate μ, the utilization factor ρ, and the average queuing delay W.

(3p) 10. Consider that only a single TCP (Reno) connection uses one 54 Mbps wireless link which does not buffer any data. Suppose that this link is the only congested link between the sending and receiving hosts. Assume that the TCP sender has a huge file to send to the receiver, and the receiver's receive buffer is much larger than the congestion window.

We also make the following assumptions: each TCP segment size is 536 bytes; the two-way propagation delay of this connection is 6 msec; and this TCP connection is always in the congestion avoidance phase, that is, ignore slow start.

- What is the maximum window size (in segments) that this TCP connection can achieve?
- What is the average window size (in segments) and average throughput (in bps) of this TCP connection?
- How long would it take for this TCP connection to reach its maximum window again after recovering from a packet loss?