

Problems

P1 – Design and describe an application-level protocol to be used between an automatic teller machine and a bank's centralized computer. Your protocol should allow a user's card and password to be verified, the account balance (which is maintained at the centralized computer) to be queried, and an account withdrawal to be made (that is, money disbursed to the user). Your protocol entities should be able to handle the all-too-common case in which there is not enough money in the account to cover the withdrawal. Specify your protocol by listing the message exchange and the action taken by the automatic teller machine or bank's centralized computer on transmission and receipt of message. Sketch the operation of your protocol for the case of a simple withdrawal with no errors, a diagram similar to that given in the class. Explicitly state the assumptions made by your protocol about the underlying end-to-end transport service. Draw as well the FSM of your protocol.

P2 – What is the key distinguishing difference between a tier-1 ISP and a tier-2 ISP?

P3 – Review the car-caravan analogy. Assume a propagation speed of 100 km/hour.

- a) Suppose the caravan travels 150 km, beginning in front of one tollbooth, passing, through a second tollbooth, and finishing just after a third tollbooth. What is the end-to-end delay?
- b) Repeat (a), now assuming that there are eight cars in the caravan instead of ten.

P4 - This elementary problem begins to explore propagation delay and transmission delay, two central concepts in data networking. Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters, and suppose the propagation speed along the link is s meters/sec. Host A is to send a packet of size L bits to host B.

- a) Express the propagation delay, d_{prop} , in terms of m and s .
- b) Determine the transmission time of the packet, d_{trans} , in terms of L and R .
- c) Ignoring processing and queuing delays, obtain an expression for the end-to-end delay.