ECE 465: Computer Network Protocols and Applications
Homework 1
Solution
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Chapter 1 Review Questions

3. A networking program usually has two programs, each running on a different host, communicating with each other. The program that initiates the communication is the client. Typically, the client program requests and receives services from the server program.

8. In a packet switched network, the packets from different sources flowing on a link do not follow any fixed, pre-defined pattern. In TDM circuit switching, each host gets the same slot in a revolving TDM frame.

9. At time t_0 the sending host begins to transmit. At time $t_1 = L/R_1$, the sending host completes transmission and the entire packet is received at the router (no propagation delay). Because the router has the entire packet at time t1, it can begin to transmit the packet to the receiving host at time t_1. At time $t_2 = t_1 + L/R_2$, the router completes transmission and the entire packet is received at the receiving host (again, no propagation delay). Thus, the end-to-end delay is $L/R_1 + L/R_2$.

Chapter 1 Problems

Problem 1.

There is no single right answer to this question. Many protocols would do the trick. Here's a simple answer below:

Messages from ATM machine to Server

Msg name	purpose
HELO <userid>	Let server know that there is a card in the ATM machine ATM card transmits user ID to Server
PASSWD <passwd>	User enters PIN, which is sent to server
BALANCE	User requests balance
WITHDRAWL <amount>	User asks to withdraw money
BYE	user all done

Messages from Server to ATM machine (display)

Msg name	purpose
PASSWD	Ask user for PIN (password)

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OK                  last requested operation (PASSWD, WITHDRAWL)
                    OK
ERR                 last requested operation (PASSWD, WITHDRAWL)
                    in ERROR
AMOUNT <amt>        sent in response to BALANCE request
BYE                 user done, display welcome screen at ATM
```

Correct operation:

```
client                          server

HELO (userid)    -------------->  (check if valid userid)
                 <--------------   PASSWD
PASSWD <passwd>  -------------->  (check password)
                 <--------------   OK (password is OK)
BALANCE          -------------->
                 <--------------   AMOUNT <amt>
WITHDRAWL <amt>  -------------->  check if enough $ to cover
                                  withdrawl
                 <--------------   OK
ATM dispenses $
BYE              -------------->
                 <--------------   BYE
```

In situation when there's not enough money:

```
HELO (userid)    -------------->  (check if valid userid)
                 <--------------   PASSWD
PASSWD <passwd>  -------------->  (check password)
                 <--------------   OK (password is OK)
BALANCE          -------------->
                 <--------------   AMOUNT <amt>
WITHDRAWL <amt>  -------------->  check  if  enough  $  to  cover
withdrawl
                 <--------------   ERR (not enough funds)
error msg displayed
no $ given out
BYE              -------------->
                 <--------------   BYE
```

Problem 3.

a) We can *n* connections between each of the four pairs of adjacent switches. This gives a maximum of *4n* connections.

b) We can *n* connections passing through the switch in the upper-right-hand corner and another *n* connections passing through the switch in the lower-left-hand corner, giving a total of *2n* connections.

Problem 5.

a) The time to transmit one packet onto a link is $(L+h)/R$. The time to deliver the packet over Q links is $Q(L+h)/R$. Thus the total latency is $t_s + Q(L+h)/R$.

b) $Q(L+2h)/R$

c) Because there is no store-and-forward delays at the links, the total delay is

$$t_s + (h+L)/R.$$