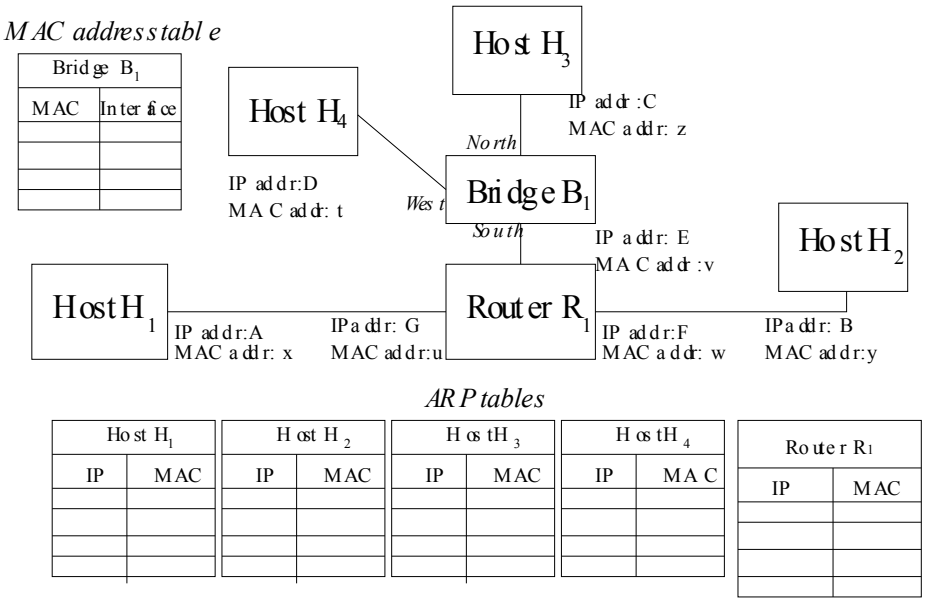
# EP2120 Internetworking/Internetteknik
# DD2392 Internets Protokoll och Principer

## Homework assignment 2
## (Solutions due 17:00, Wednesday, 2010.Sept.14)
## (Review due 17:00, Friday, 2010.Sept.16)

### *1. ARP (20/100)*




The figure above illustrates four hosts $H_1$, $H_2$, $H_3$ and $H_4$ connected by an inter-network running IPv4. The hosts are on three Ethernet networks, which are connected by router $R_1$. Note the learning bridge $B_1$ that connects hosts $H_3$, $H_4$ and router $R_1$. The figure shows the IP and MAC addresses of the hosts and the router's interfaces, and the interface names of the bridge. It also shows the ARP caches of the hosts and the router, and the MAC address table of the learning bridge. Assume that the ARP caches and the MAC address table are initially empty and that no packets have been sent yet. The forwarding tables of all hosts and the router are correctly configured. All hosts know each others' IP addresses.
Consider that host $H_4$ sends an IPv4 unicast datagram to host $H_1$.

a) Provide the state of the five ARP caches as they will appear after the IPv4 unicast datagram has been delivered to host $H_1$, that is, after dynamic ARP resolution has been made (16p).

b) Provide the state of the bridge's MAC address table as it will appear after the IPv4 unicast datagram has been delivered to host $H_1$, that is, after dynamic ARP resolution has been made. (4p)

### *2. UDP and fragmentation (20/100)*

Assume a 802.11g wireless network (WiFi) with MTU 2272 bytes and a UDP datagram with 6400 bytes of application layer data. IPv4 is used at the network layer.

a) How many fragments are transmitted? (10p)

b) Give the values of the MF bit, the offset and the total length field of the IP header of each fragment! (10p)

## 3. TCP session management (10/100)

Consider the TCP SYN Flooding Attack.

a) What kind of attack is this? (1p)
b) How is the attack done? (2p)
c) What damage is caused? (2p)
d) How can a server alleviate the effects of the attack? Describe one solution in sufficient detail such that it becomes clear why it alleviates the attack. (5p)

## 4. TCP 2 (30/100)

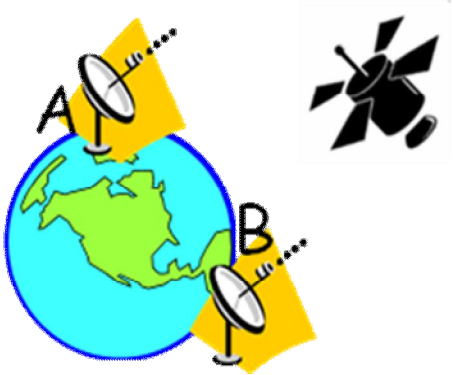
Consider a long lived TCP flow (i.e., the next segment is not the first one in the connection). A segment is sent at 4:30:20 from the sender to the receiver. The sender does not receive an acknowledgement. At 4:30:28 it retransmits the segment (this is the first retransmission of this segment). It receives an acknowledgement at 4:30:30. It sends another segment at 4:30:30, and receives the corresponding acknowledgement at 4:30:32. The smoothed RTT (sRTT) was 4 seconds when the first mentioned TCP segment was sent.
Give the values of the smoothed RTT (sRTT), the variation (RTTvar ) and the retransmission timeout (RTO)

a) after the transmission of the first mentioned segment (4:30:20), (10p)
b) after the first retransmission (4:30:28), (5p)
c) after the reception of the first acknowledgement (4:30:30), (5p)
d) after the reception of the second acknowledgement (4:30:32). (10p)

(Consult RFC 2988 for details on how to calculate these values).

## 5. TCP 3 (20/100)

Stations A and B are connected via a 100Mbps link between the Earth and a communication satellite at an altitude of 36,000 km. Assume that the signal propagation speed equals the speed of light (300000km/s).




a) Calculate the minimum round trip time (RTT) for the link. (2p)
b) Calculate the bandwidth-delay product of the link. Explain the meaning of this product. (8p)

An image file of 25 MB should be transferred from station A to station B.

c) What is the minimum time to transfer the file from A to B? Include the connection establishment time. Consider the transfer finished when the last ACK has arrived at the sender. Assume that there are no losses. Use the RTT value computed above. (10p)
(Hint: which is the first segment that can be used to send data?)