CS 118 - Homework 8

Kuruvilla Cherian, Jahan
UID: 104436427
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Problem 1

A bit time is defined by the bandwidth of the NIC of the machine, and in this instance is 10Mbps. We consider only the time spent in the exponential backoff stage, thus ignoring effects of signal jamming. The idea is that once the collision is detected, the collision counter is incremented and the NIC goes into an exponential backoff based on K, which is a value in the range based on the collision counter. Assuming the worst case, means $K = 2^n - 1$, where n is the collision count. After waiting for this time, the system goes back to sensing the channel, and if sensed idle, will go back into this sequence. Assuming 6 consecutive collisions, we have the following bit time delay:

$$\sum_{n=1}^{6} 2^n - 1 \rightarrow 120 \cdot 512 = 61440 \textit{ bit times}$$

Problem 2

We can draw out a time table representing the time for each frame and wait. Note that we must consider the time taken to send the jam signal before which we can begin the re-transmission $245+48 = 293$. Based on the table below, we can answer the given questions. There is a possibility

Time (bit times)	**Event**
0	A and B start their transmission
245	A and B detect collision
293	A and B finish sending their jam signals
$293 + 245 = 538$	Last bit of B's frame and A detects an idle channel
$538 + 96 = 634$	A finishes waiting for IFS and begins transmitting
$293 + 512 = 805$	B finishes exponential backoff and returns to Step 2
$634 + 245 = 879$	Last bit of A's transmitted frame reaches B

Table 1: Table representing the associated event to the given time

for collision upon re-transmission. The scenario would be that both finish sending the jam signals, and then they choose the exact same exponential back-off times. This would cause A and B to be in-phase in their waiting periods to result in another collision. But this is why the back-off timer is exponential and random, to make this happen far less (decreases the probability of collision by increasing the range of choice), and upon this, another collision would be detected and would continue until the back off timers are different. In the end CSMA/CD will make sure to avoid the collision upon re-transmission.
B will schedule its re-transmission when it finishes its exponential back-off, which would be at $805 + 96 = 901$.
A begins its transmission at 634 as highlighted in the table above.
A's signal reaches B at 879, as shown in the table above.
B does refrain from sending its frame at its scheduled time, because at 879 it will sense the channel to be busy because A is finishing its transmission to B, and also, we notice that its scheduled time is after A is done retransmitting (thus avoiding collision in this scenario). B will ideally wait an IFS (96 bit times) after receiving A's transmission to make sure the channel is idle for 96 bit times thus rescheduling its transmission time.

Problem 3

a

The image below represents the infrastructure required for the routing of datagrams between H1 and H2.

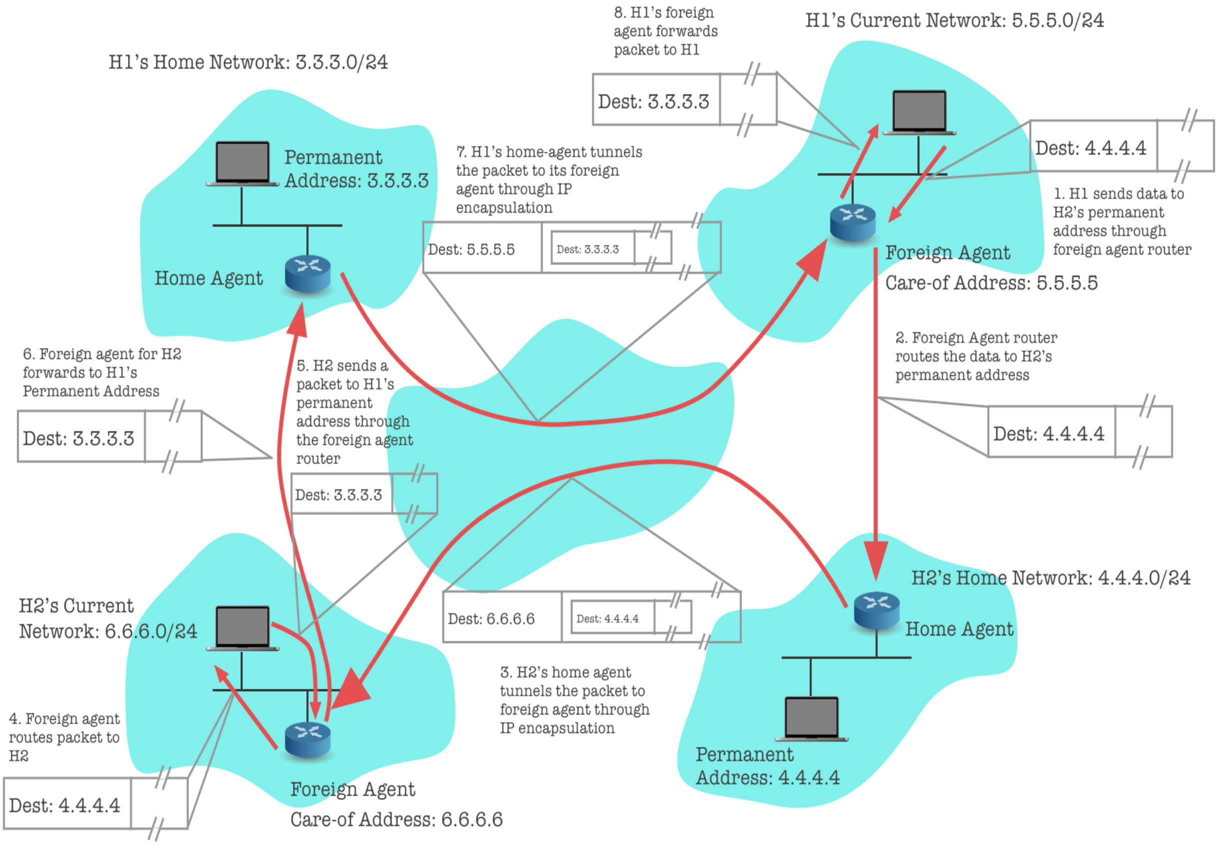

Figure 1: Diagram representing IP Mobility through Indirect Routing between H1 and H2

b

The image above shows the 8 different datagrams that are passed transmitted in order to perform the IP mobility with explanations.

Datagram information	Event in routing
Dest: 4.4.4.4	H1 mobile device sends packet to foreign agent to route to H2's Permanent Address
Dest: 4.4.4.4	H1's foreign agent router, routes the packet to H2's Permanent Address
Dest: 6.6.6.6 Dest: 4.4.4.4	H2's home agent tunnels the packet by wrapping it in a header with H2's Care-of address
Dest: 4.4.4.4	Foreign Agent for H2 routes packet to H2 within this network
Dest: 3.3.3.3	H2 receives H1's packet and responds by sending packet to H1's Permanent Address through its foreign agent

Dest: 3.3.3.3	H2's foreign agent routes packet to H1's permanent address
Dest: 5.5.5.5 Dest: 3.3.3.3	H1's home-agent tunnels packet by wrapping it in a header with H1's Care-of address
Dest: 3.3.3.3	H1's foreign agent router routes H2's packet to H1 within its network