Homework 2. InternerWorking, Pierre FLEITZ

1) ARP :

a) *State of the five ARP caches after the IPv4 unicast datagram has been delivered to host H2 :*

H1		
IP	MAC	Port
A	a	North

H3		
IP	MAC	Port
B	b	North

R1		
IP	MAC	Port
E	e	West
D	d	East

H2		
IP	MAC	Port
A	a	South

H4		
IP	ARP	Port
E	e	South

b) *State of the bridges B1's MAC address table after the IPv4 unicast datagram has been delivered to host H2*

B1 MAC Address table	
MAC	Port
d	South
a	East

2) UDP and Fragmentation :

a) 7400 / 1480 = 5. Then we gonna have 5 fragments.

b) *Each fragment has its own header with most of the fields repeated, but some changed :*

Fragment	MF	Offset	Length
Number 1	1	0	1480 bytes (bytes 0 to 1479)
Number 2	1	185	1480 bytes (bytes 1480 to 2959)
Number 3	1	370	1480 bytes (bytes 2960 to 4439)
Number 4	1	555	1480 bytes (bytes 4440 to 5919)
Number 5	0	740	1480 bytes (bytes 5920 to 7399)

3) Routing :

a) *Initial routing state of D :*

Destination	Metric	Next-Hop
208.218.2.0/24	1	-
208.218.4.0/24	1	-

b) *Routing state of D after it has received the initial distance-vector from E :*

Destination	Metric	Next-Hop
208.218.2.0/24	1	-
208.218.4.0/24	1	-
208.218.5.0/24	2	208.218.4.2

c) *RIP messages :*

Reminder : Type of RIP msg : (see p.294, Figure 11.11 and example Figure 11.13 p296 from TCP/IP book, I will not represent the two "spaces" between Network and Distance)

<table>
<tr><td>Command</td><td>Version</td><td>/</td></tr>
<tr><td colspan="2">Family</td><td>/</td></tr>
<tr><td colspan="3">Network</td></tr>
<tr><td colspan="3">Distance</td></tr>
</table>

From A to B, so 208.218.1.1 to 208.218.1.2, interface used East :

<table>
<tr><td rowspan="4">Msg1</td><td>2</td><td>1</td><td>/</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.2.0/24</td></tr>
<tr><td colspan="3">1</td></tr>
<tr><td rowspan="4">Msg2</td><td>2</td><td>1</td><td>/</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.4.0/24</td></tr>
<tr><td colspan="3">1</td></tr>
<tr><td rowspan="4">Msg3</td><td>2</td><td>1</td><td>/</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.5.0/24</td></tr>
<tr><td colspan="3">2</td></tr>
</table>

From A to D, so 208.218.2.1 to 208.218.2.2, interface used South :

<table>
<tr><td rowspan="4">Msg1</td><td>2</td><td>1</td><td>/</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.1.0/24</td></tr>
<tr><td colspan="3">2</td></tr>
<tr><td rowspan="4">Msg2</td><td>2</td><td>1</td><td>/</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.2.0/24</td></tr>
<tr><td colspan="3">2</td></tr>
<tr><td rowspan="4">Msg3</td><td>2</td><td>1</td><td>/</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.4.0/24</td></tr>
<tr><td colspan="3">2</td></tr>
<tr><td rowspan="4">Msg4</td><td>2</td><td>1</td><td>/</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.5.0/24</td></tr>
<tr><td colspan="3">2</td></tr>
</table>

From A to E, so 208.218.2.1 to 208.218.2.3, interface used South :

<table>
<tr><td rowspan="4">Msg1</td><td>2</td><td>1</td><td>/</td><td></td></tr>
<tr><td colspan="2">2</td><td>/</td><td></td></tr>
<tr><td colspan="3">208.218.1.0/24</td><td></td></tr>
<tr><td colspan="3">1</td><td></td></tr>
<tr><td rowspan="4">Msg2</td><td>2</td><td>1</td><td>/</td><td></td></tr>
<tr><td colspan="2">2</td><td>/</td><td></td></tr>
<tr><td colspan="3">208.218.2.0/24</td><td></td></tr>
<tr><td colspan="3">1</td><td></td></tr>
<tr><td rowspan="4">Msg3</td><td>2</td><td>1</td><td>/</td><td rowspan="8">The message is prepared with the combinaison of split horizon and poison reverse, in minde. A obtened information about these 2 networks by router E. Here A sends an update to E so it replaces the actual value of the hop count for the 2 networks with 16 (infinity) to prevent any confusion for E</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.4.0/24</td></tr>
<tr><td colspan="3">16</td></tr>
<tr><td rowspan="4">Msg4</td><td>2</td><td>1</td><td>/</td></tr>
<tr><td colspan="2">2</td><td>/</td></tr>
<tr><td colspan="3">208.218.5.0/24</td></tr>
<tr><td colspan="3">16</td></tr>
</table>

d) *Routing states of D and E after they havec received the distance-vector from A :*

Routing state of D		
Destination	Metric	Next-Hop
208.218.1.0/24	2	208.218.2.1
208.218.2.0/24	1	-
208.218.4.0/24	1	-
208.218.5.0/24	2	208.218.4.2

Routing state of E		
Destination	Metric	Next-Hop
208.218.1.0/24	2	208.218.2.1
208.218.2.0/24	1	-
208.218.4.0/24	1	-
208.218.5.0/24	1	-

4) ICMP :

a) The source host, here H1, sends ICMP echo request messages (type : 8, code : 0) ; the destination, here H2, will respond with an ICMP echo reply message.

b) *Traceroute from H1 to H3 :*

H1 to A	
Type	Echo Request
TTL	1
@ Dest	90.59.5.2

A to H1	
Type	Time exceeded (type: 11, code: 0)
@ Dest	90.59.1.2

H1 to B	
Type	Echo Request
TTL	2
@ Dest	90.59.5.2

B to H1	
Type	Time exceeded (type: 11, code: 0)
@ Dest	90.59.1.2

H1 to C	
Type	Echo Request
TTL	3
@ Dest	90.59.5.2

C to H1	
Type	Time exceeded (type: 11, code: 0)
@ Dest	90.59.1.2

H1 to H3	
Type	Echo Request
TTL	4
@ Dest	90.59.5.2

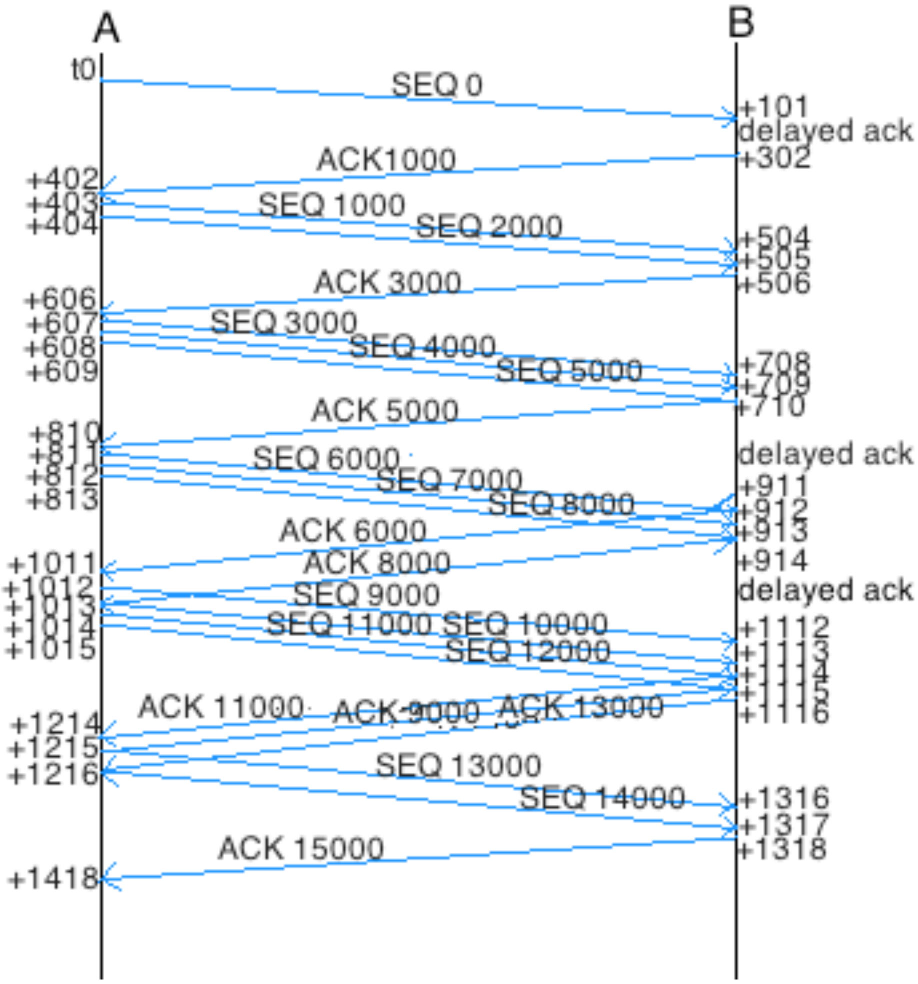
H3 to H1	
Type	Destination unreachable (type: 3, code: 3)
@ Dest	90.59.1.2

5) TCP :

a) MSS = Maximum Segment Size. The MSS used by TCP is :
MSS = MTU – 20 (IP header) - 20 (TCP header) = 1040 – 20 – 20 = 1000 bytes

b) To calcul the bandwidth delay product we need to do : RTTxBW. So here we have : Bandwidth-delay product = ((100*2)*10^3)*(4*10^6)=800KB. Therefore the received window is not big enough ! If we want A to be able to fully utilize the channel, The received window should be at least 800KB.

c)



Sorry for the quality of the schema, kind of hard to do something clean with a chronogramme like this… Hope you will understand what I tried to do.

When we are after connection establishment we have : RTO = max (2,5+G, 3) = 3s, at T0. SRTT = RTTVAR = 0.

Values of SRTT, RTTVAR and RTO for the 4 first segement sent by A :

- Segment 1 : SRTT = 0s, RTTVAR = 0s, RTO = 3s.
- Segment 2 :

We can see in the precedent figure that the ACK for the first segment is received at t0+402. Then we have RTT = 402 ms (delayed ack..). Therefore SRTT = 0,402 s and RTTVAR = 0,402/2 = 0,201 s. (Because this is the first measurement made on this connection !).
And RTO = SRTT + max(G,4*RTTVAR) = 0,402 + 0,804 = 1,206.

So Segment 2 : SRTT = 0,402s , RTTVAR = 0,201s, RTO = 1,206s

- Segment 3 : (Same thing) SRTT = 0,402s , RTTVAR = 0,201s, RTO = 1,206s.
- Segment 4 :

We can see in the precedent figure that the ACK for the fourth segment is received at t0+606 and the segment was sent at to+404. Then we have RTT = 202 ms.
SRTT' = 7/8 * SRTT + 1/8 * RTT = 0,377 s
RTTVAR = 0,75*0,201 + 0,25*|0,402-0,202| = 0,2008 s.
And RTO = SRTT + max(G,4*RTTVAR) = 0,377 + 0,803 = 1,18s.

So Segment 4 : SRTT = 0,377s , RTTVAR = 0,2008s , RTO = 1,18s.

d) At t0+1418ms.