Lab Assignment 3:

Task 1:

The first task was to modify the PnetChannel class (pnet-channel.cc) so as to get the propagation delay between the sender and every other node. The implementation till now was that the same propagation delay was applied to all the nodes. The propagation delay was calculated by using the mobility model to find out the distances and dividing them by the speed of light ($3x10^8$ m/s). The figure below shows the result displayed on the terminal which shows the distance between the nodes in meter and the propagation delay in nanoseconds.

```
MyPnetMac:MyPnetMac(0x10f6440)
MyPnetMac:SetAddress(00:00:00:00:00:01)
MyPnetMac:SetPhy(0x10f6440)
MyPnetMac:MyPnetMac(0x10f6970)
MyPnetMac:SetAddress(00:00:00:00:00:02)
MyPnetMac:SetPhy(0x10f6970)
At time 2s client sent 256 bytes to 10.1.1.2 port 9
Node id1
Distance between 0 to node  1 is 51.1811 and the time delay is 170.604 ns

Node id0
Distance between 1 to node  0 is 51.1813 and the time delay is 170.604 ns

Node id1
Distance between 0 to node  1 is 51.1816 and the time delay is 170.605 ns

At time 2.00165s server received 256 bytes from 10.1.1.1 port 49153
At time 2.00165s server sent 256 bytes to 10.1.1.1 port 49153
Node id0
Distance between 1 to node  0 is 51.2108 and the time delay is 170.703 ns

Node id1
Distance between 0 to node  1 is 51.211 and the time delay is 170.703 ns

Node id0
Distance between 1 to node  0 is 51.2113 and the time delay is 170.704 ns

At time 2.01131s client received 256 bytes from 10.1.1.2 port 9
pnet@pnet-VirtualBox:~/ns-allinone-3.25/ns-3.25$
```

Task 2:

The first part of task 2 was to send positive acknowledgment for each packet, and having a timeout for each of the acknowledgment. Changes were made to my-pnet-mac.cc. The maximum number of retransmissions considered were 2. Three new functions were created. SendAck( ),starttimeout( ) and Retransmit(). The purpose of SendAck( ) method as it's name suggests was to send the acknowledgments when the data packets are received.

The purpose of starttimeout( ) method was to schedule the timeout (I,e start the counter) when the data packet is sent. If an acknowledgement is not received within the given scheduled time, then the retransmit function is called. The retransmit function also has scheduler which keeps track of the time. If an

acknowledgement is not received within the given time the data packet is again retransmitted. The number of retransmissions is specified to 2 at the start.

The figure below shows the snippet of the terminal where it can be seen that the back off counter starting time and the acknowledgment being sent.

```
MyPnetMac:MyPnetMac(0x1ffe440)
MyPnetMac:SetAddress(00:00:00:00:00:01)
MyPnetMac:SetPhy(0x1ffe440)
MyPnetMac:MyPnetMac(0x1ffe970)
MyPnetMac:SetAddress(00:00:00:00:00:02)
MyPnetMac:SetPhy(0x1ffe970)
At time 2s client sent 256 bytes to 10.1.1.2 port 9
Backoffcounter started +2013581770.0ns
Backoffcounter started +2013663540.0ns
Sending acknowledgement from 00:00:00:00:00:01 to 00:00:00:00:00:02

At time 2.00165s server received 256 bytes from 10.1.1.1 port 49153
At time 2.00165s server sent 256 bytes to 10.1.1.1 port 49153
Sending acknowledgement from 00:00:00:00:00:02 to 00:00:00:00:00:01

Backoffcounter started +2023236680.0ns
Backoffcounter started +2023318450.0ns
Sending acknowledgement from 00:00:00:00:00:02 to 00:00:00:00:00:01

At time 2.01131s client received 256 bytes from 10.1.1.2 port 9
Sending acknowledgement from 00:00:00:00:00:01 to 00:00:00:00:00:02

pnet@pnet-VirtualBox:~/ns-allinone-3.25/ns-3.25$
```

Here it can be seen that there are four back off counters and four acknowledgements being sent. Two back off counter and acknowledgements are for the data packets, while the other two are for ARP.

In order to check the retransmissions, a line from the ReceiveFrame ( ) function was commented *{//SendAck(ackpacket, header.GetSource( ), header.GetDestination( ));}*. After this it was observed that the retransmissions were successful as it can be seen from the snippet below.

```
MyPnetMac:MyPnetMac(0x14aa440)
MyPnetMac:SetAddress(00:00:00:00:00:01)
MyPnetMac:SetPhy(0x14aa440)
MyPnetMac:MyPnetMac(0x14aa970)
MyPnetMac:SetAddress(00:00:00:00:00:02)
MyPnetMac:SetPhy(0x14aa970)
At time 2s client sent 256 bytes to 10.1.1.2 port 9
Backoffcounter started +2013581770.0ns
Backoffcounter started +2013663540.0ns
At time 2.00165s server received 256 bytes from 10.1.1.1 port 49153
At time 2.00165s server sent 256 bytes to 10.1.1.1 port 49153
Backoffcounter started +2023236680.0ns
Backoffcounter started +2023318450.0ns
At time 2.01131s client received 256 bytes from 10.1.1.2 port 9
At time +2013663540.0ns frame is being retransmitted from 00:00:00:00:00:01 to 00:00:00:00:00:02

 Backoffcounter started again +2026163540.0ns
At time +2023318450.0ns frame is being retransmitted from 00:00:00:00:00:02 to 00:00:00:00:00:01

 Backoffcounter started again +2035818450.0ns
At time +2026163540.0ns frame is being retransmitted from 00:00:00:00:00:01 to 00:00:00:00:00:02

At time +2035818450.0ns frame is being retransmitted from 00:00:00:00:00:02 to 00:00:00:00:00:01

pnet@pnet-VirtualBox:~/ns-allinone-3.25/ns-3.25$
```

Task 3:

Task 3 required us to make changes in the MyPnetPhy class so as to indicate whether the Phy layer is transmitting, receiving or in idle state. We also had to check for collisions. Following changes has been for each state:-

a) Transmitting state:- We calculated the time at which the transmission will stop using txduration and Simulator::Now(). If the current time is less than the time at which the transmission will stop then it means the channel is transmitting.

b) Receiving state:- We calculated the time at which the reception will stop using rxduration and Simulator::Now(). If the current time is less than the time at which the reception will stop then it means the channel is receiving.

c) Collision state:- We used a variable (p) to find out the number of packets being received currently. If the number is greater than 1 then collision is happening.

```
The channel is idle
The channel is idle
At time 2.01631s client received 256 bytes from 10.1.1.2 port 9
The channel is idle
The Channel is transmitting
At time 3s client sent 256 bytes to 10.1.1.2 port 9
The Channel is transmitting
At time 3s client sent 256 bytes to 10.1.1.2 port 9
The channel is receiving
Collision is happening
The channel is receiving
The channel is receiving
The channel is receiving
The channel is idle
The channel is idle
At time 3.00049s server received 256 bytes from 10.1.1.3 port 49153
The Channel is transmitting
At time 3.00049s server sent 256 bytes to 10.1.1.3 port 49153
The channel is idle
At time 3.00049s server received 256 bytes from 10.1.1.1 port 49153
The Channel is transmitting
At time 3.00049s server sent 256 bytes to 10.1.1.1 port 49153
Collision is happening
The channel is receiving
The channel is idle
The channel is receiving
Collision is happening
The channel is receiving
Collision is happening
The channel is receiving
The channel is idle
The channel is idle
At time 3.00098s client received 256 bytes from 10.1.1.2 port 9
The channel is idle
The channel is idle
At time 3.00098s client received 256 bytes from 10.1.1.2 port 9
pnet@pnet-VirtualBox:~/ns-allinone-3.25/ns-3.25$
```

Group 4

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