IPv6 and User Datagram Protocol (UDP)

1) Your computer “fastnet” wants to send a PING packet to a server “www” at Google. Your computer is connected through an IEEE 802.11 access point to the sub-network 134.226.62.0. The two sub-networks 134.226.62.0, 134.226.32.0, etc are separate Ethernet broadcast domains, connected through a router in the School of Computer Science and Statistics with a number of interfaces with the addresses ending in .254 for the individual sub-networks e.g. 134.226.62.254. The computers in the sub-networks use these addresses as the addresses for the default gateway.

   Describe the packets that are involved in the PING exchange. The description should include the information that is necessary for the computers and routers to process the IPv4 packets e.g. ARP requests, DNS requests, etc. You can assume that the routers have a full view of the internal network of TCD and do not have to update their routing information.

fastnet.scss.tcd.ie	134.226.62.183
ns.scss.tcd.ie	134.226.32.58
ns.google.com	216.239.32.10
www.google.com	74.125.24.104

> route –n on fastnet:

Subnet	Gateway	Netmask	Interface
134.226.62.0	0.0.0.0	255.255.255.0	eth1
0.0.0.0	134.226.62.254	0.0.0.0	eth1

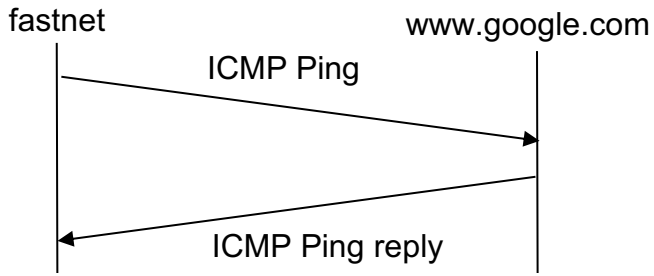

Figure 1: Conceptual view of communication between fastnet and www.google.com

2) Assume that a node A intents to communicate with a node E over a number of intermediate nodes, B to D, as shown in figure 2. The IPv4 addresses and hardware addresses of the interfaces of the individual nodes are shown in figure 3. Node B acts as a NAT gateway.
   a) Describe the information that node B will keep in order to act as NAT gateway and how this information is used by B to process incoming and outgoing IPv4 packets.
   b) Describe the IPv4 packet that A would issue and the routing process of the IPv4 packet from A to E, at the intermediate hops.
   c) Describe the Link layer frames encapsulating the IPv4 packet assuming that all links use Ethernet and the resolution of the IPv4 addresses to Ethernet addresses at every hop.

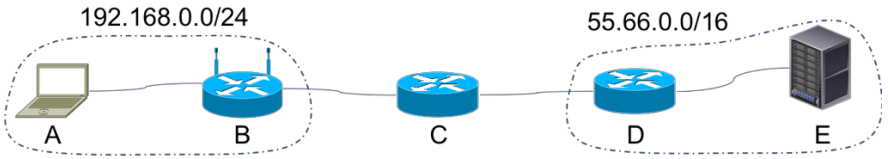

Figure 2: Topology with 5 nodes, A to E, that could represent a connection of a home network to a server over a 1-hop interconnecting network.

A
192.168.0.160
0F:0E:0D:AA:CC:BB

Destination	Port Out	Next Hop Address
192.168.0.0	1	-
0.0.0.0	1	192.168.0.1

B
Inside: 192.168.0.1
0D:0E:AA:90:00:AB
Outside: 75.50.25.1
0D:0E:AA:90:00:0D

Destination	Port Out	Next Hop Address
192.168.0.0	1	-
0.0.0.0	2	1.2.3.4

C
1.2.3.4
0D:0E:AA:90:00:0B

Destination	Port Out	Next Hop Address
75.50.25.1	1	75.50.25.1
55.66.0.0	2	55.66.0.1

D
55.66.0.1
0D:0E:AA:90:00:0B

Destination	Port Out	Next Hop Address
55.66.0..0	1	-
0.0.0.0	2	1.2.3.4

E
55.66.0.100
0D:0E:AA:90:00:0B

Destination	Port Out	Next Hop Address
55.66.0.0	1	-
0.0.0.0	1	55.66.0.1

Figure 3:IP addresses, hardware addresses and routing information of the nodes shown in figure 2.

3) Draw a diagram of the individual headers i.e. UDP, IP, Ethernet header, of an Ethernet packet that includes an UDP packet addressed to an application on host 156.202.34.43 port 21 from the local application on address 134.226.34.85 port 10567. Assume values for fields of the individual headers if these values are not given above. For each value give a short explanation why you chose this particularly value.