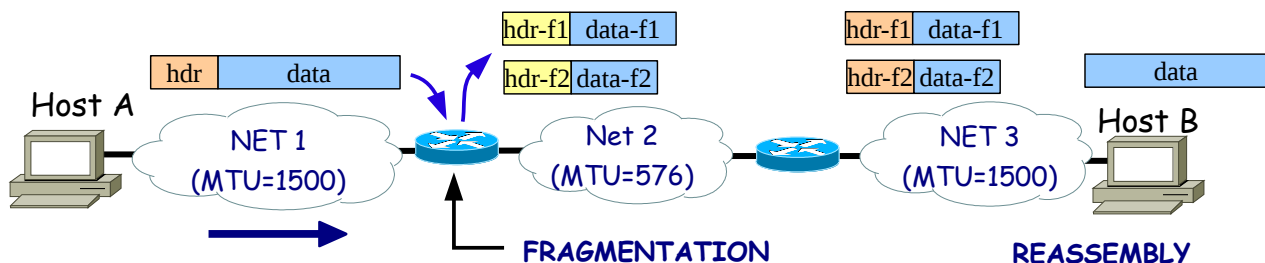


Lab#2B: IP fragmentation

Please read Kurose 4.4.1.

1. Intro

IP fragmentation happens both in hosts and in routers when datagrams are too large to fit into a single packet. Different networks allow different maximum size for a packet called MTU. (*Maximum Transfer Unit*). On Ethernet MTU=1,500 bytes, on PPPoE is 1,492 bytes on FDDI is 4,470 bytes.



Reassembly only happens at the receiving host. But fragmentation may happen on the sending host and on any router through the destination host.

2. Ipv4 Fragmentation

See http://en.wikipedia.org/wiki/IPv4#Fragmentation_and_reassembly

You can see an example of fragmentation:

<http://teal.gmu.edu/~lichen/TCOM509/lects/FragmentationExample.doc>

Exercise#1: A 3500 bytes-long datagram is to be transmitted over a network whose MTU=1500 bytes.

- How many fragments there is? Why?
- What is the fragment offset for each one? (remember it is divided by eight).
- If we assumed it's a UDP datagram. How many transmitted bytes correspond to headers and how many to data? Assuming link-layer protocol uses a 16-byte header, what is the overhead this transmission experiences? Reminder: IP header 20bytes, UDP header 8 bytes.

3. Traffic analysis

While fragmentation on routers cannot be observed easily, it is possible to see how our own computer does fragmentation. Next exercise will use ping command for sending various sizes of

ICMP datagrams while traffic is captured by wireshark software.

Exercise#2: Open wireshark and initiate a capture of ICMP traffic between your computer and anyone else. Next open a shell window and run:

```
> ping -c 1 -s 3972 zoltar.redes.upv.es
```

Option -c 1 will send just one ICMP datagram. Option -s 3972 creates a datagram with that data size, too large to fit into our lab's MTU, so fragmentation will be triggered.

a) Write down all the different values for each fragment created.

<i>Id</i>	<i>DF Flag</i>	<i>MF Flag</i>	<i>offset</i>	<i>length</i>

- b)** What is the value for protocol column for each fragment? Should it be the same for all?
- c)** What is the value of the fragmentation offset of the second fragment? Wireshark shows one value but the transmitted one is different.
- d)** What is the ICMP data size if we wanted to obtain four fragments of maximum sized.
- e)** How many IP data bytes are present on each fragment?