**IP Encapsulation, Fragmentation and Reassembly**

Chapter 21

**Encapsulation**
- An IP packet (datagram) in encapsulated inside a frame for transmission across a physical network.
- The physical network does not understand the IP number of the destination.

**Transmission Across an Internet**
- The frame header only serves the function of getting the datagram across a physical network.
- At each router, the header is discarded.
- A new header is attached to allow the datagram to cross the next network.

**MTU and Datagram Size**
- Maximum Transmission Unit (MTU) – maximum amount of data in a hardware frame.
- Not all hardware networks have the same MTU.

**MTU and Datagram Size**
- IP routers use fragmentation to split up large packets to fit in some hardware frames.
  - Marked by a bit in FLAGS field.
  - FRAGMENT OFFSET values used to reassemble.

**Reassembly**
- Fragments are reassembled by the destination ultimate host.
  - In the example a packet from H1 to H2 is split by R1 and reassembled by H2 (not by R2).
- It uses the IDENTIFICATION field to identify fragments in the same Packet.
- It uses the FRAGMENT OFFSET field to reassemble in the proper order.
Reassembly (continued)

• If one or more fragments are lost, the entire packet is lost.
  – Timer is started when the first fragment arrives.
  – If timer expires before all fragments are received the fragments received so far are discarded.
  – There is no mechanism for a receiver to tell a sender which fragments arrived.
• It is possible for a router to fragment a fragment.