Announcements

- Reading
  - Chapter 6 (6.1 & 6.2)
- Project #3
  - Is on the web
- Midterm #1
  - Next Tuesday Oct. 9
  - Cover material through Tuesday's lecture

Border Gateway Protocol (BGP)

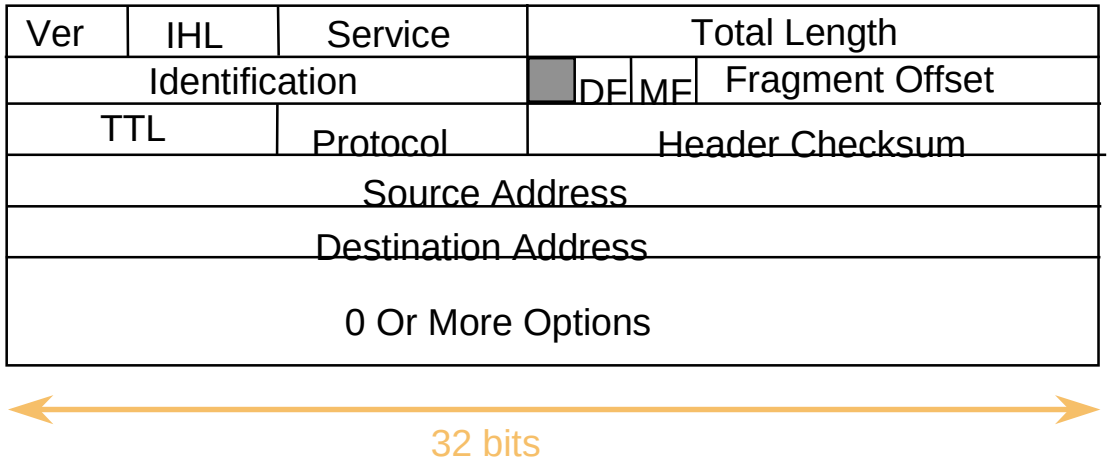
- Used to route between AS's
  - concerned with politics and turf battles
  - supports specific policies
    - don't send my packets of network X
    - don't send packets through me
- Two types of nodes
  - stub networks (one connection to BGP)
  - multi-connected networks (more than one connection)
    - might also be transit networks (carry traffic for others)
- Uses Distance Vector
  - but includes complete path in table and sent to neighbors
  - uses "scoring" function to select among possible routes

Fragmentation

- Sometimes need to split packets into smaller units
  - limits of the hardware being used
  - operating system buffer constraints
  - protocol limits (max permitted packet is x bytes)
  - reduce channel occupancy (head of link blocking)
- Fragmentation
  - where to split it into smaller packets
    - source (requires end-to-end information on max size)
    - when it reaches boundary
  - how to represent split packets
    - need to encode fragment offset
- Reassembly
  - where to re-combine packets
    - destination (may result in poor performance)
    - at the gateway to the subnet that supports the full size

The IP Protocol

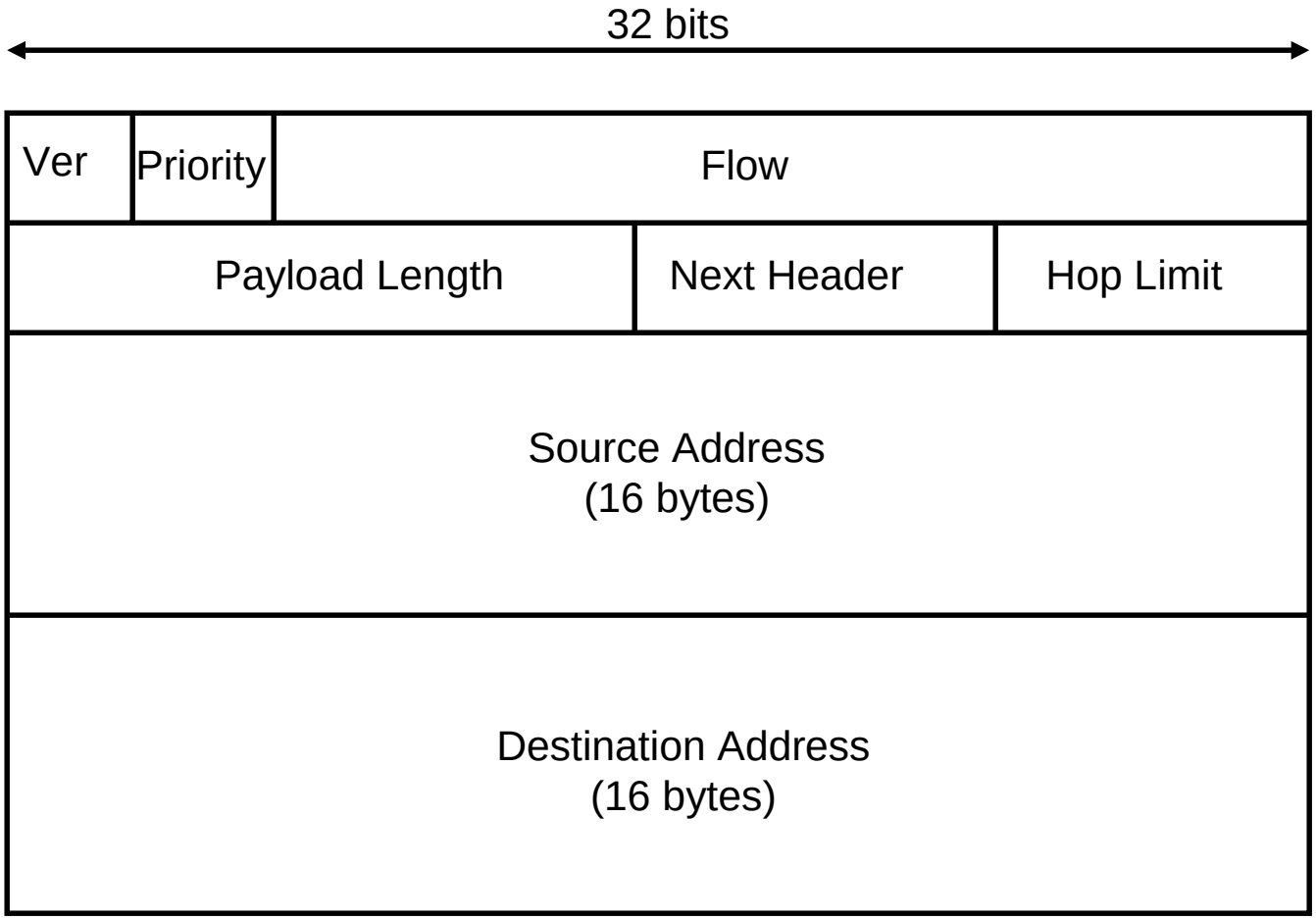
- IP Header
  - source, destination address, total length
  - version, ihl (header length in 32-bit words), ttl, protocol
  - fragmentation support: identification, df, mf, frag. offset
- Options
  - variable length
  - defined options
    - loose source routing
    - timestamp
    - record path



Fragmentation in IP

- ID of all fragments is the same
- Fragment offset
  - expressed in fragment units (8 bytes)
  - Supports a maximum of 65536 byte packets
- DF – do not fragment
  - Must remain as a full unit
- MF – more fragment
  - Indicates that there is more data in a fragment after this one

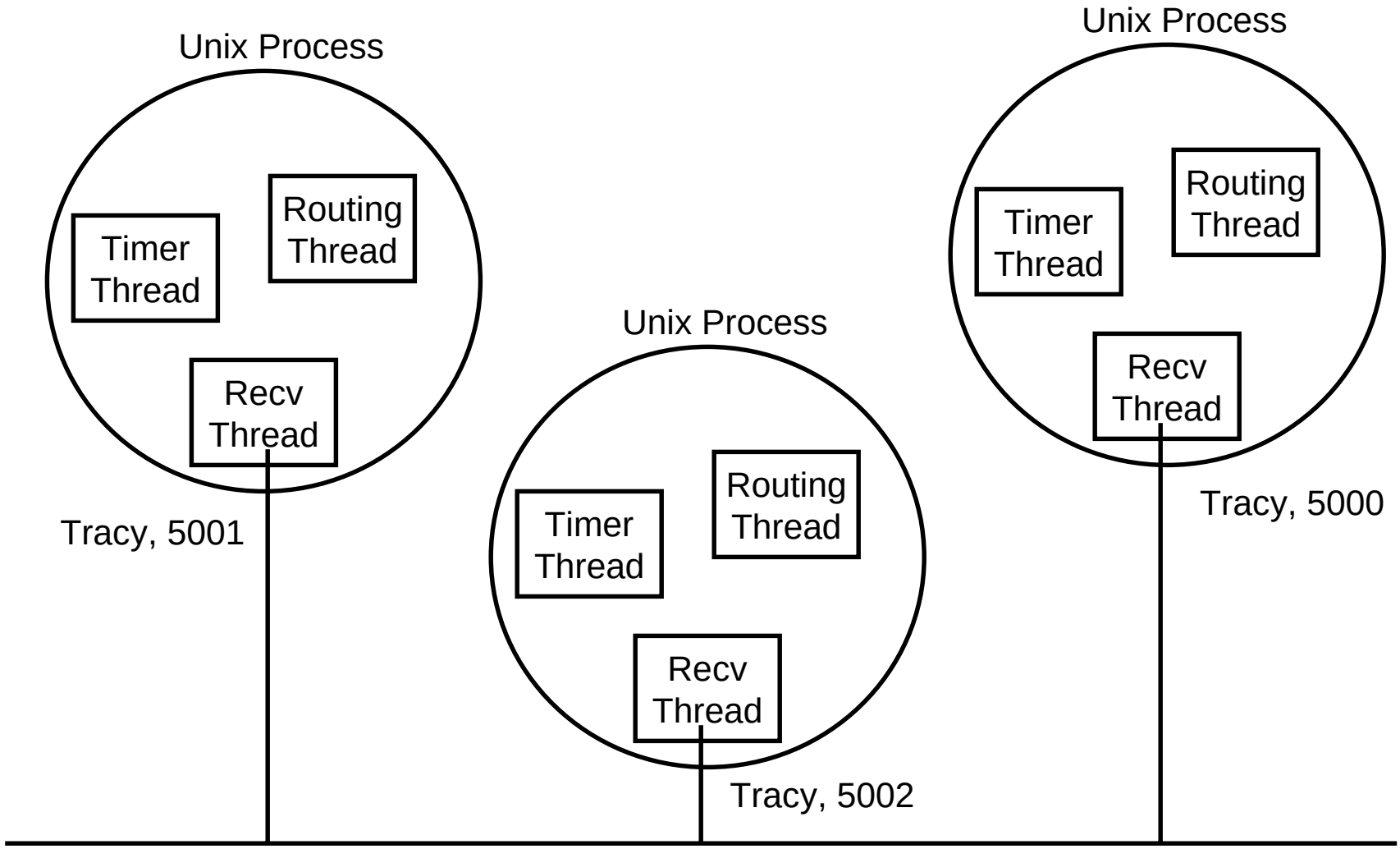
IPv6 Packet Format



IPv6 Addresses

- Each address is 16 bytes long
  - Divided into several ranges
    - 0000 0000 - Reserved (including IPv4) 1/256
    - 010 - provider based addresses (1/8)
    - 100 - geographic addresses (1/8)
    - 1111 1110 10 link local (1/1024)
    - 1111 1110 11 site local use (1/1024)
  - Notation
    - Hex in groups of 16 bits
      - fec0:0000:0000:0000:0000:0000:0000:0001
    - Can use :: (once) to indicate string of zeros
      - fec0::0001 or fec0::1

Project Architecture



Project Components

- Shortest path computation
  - Use Diksta's algorithm
- Topology discovery
  - Send hello packets around
- Timer thread
  - Extends project #2
- Each thread will have an event driven main loop