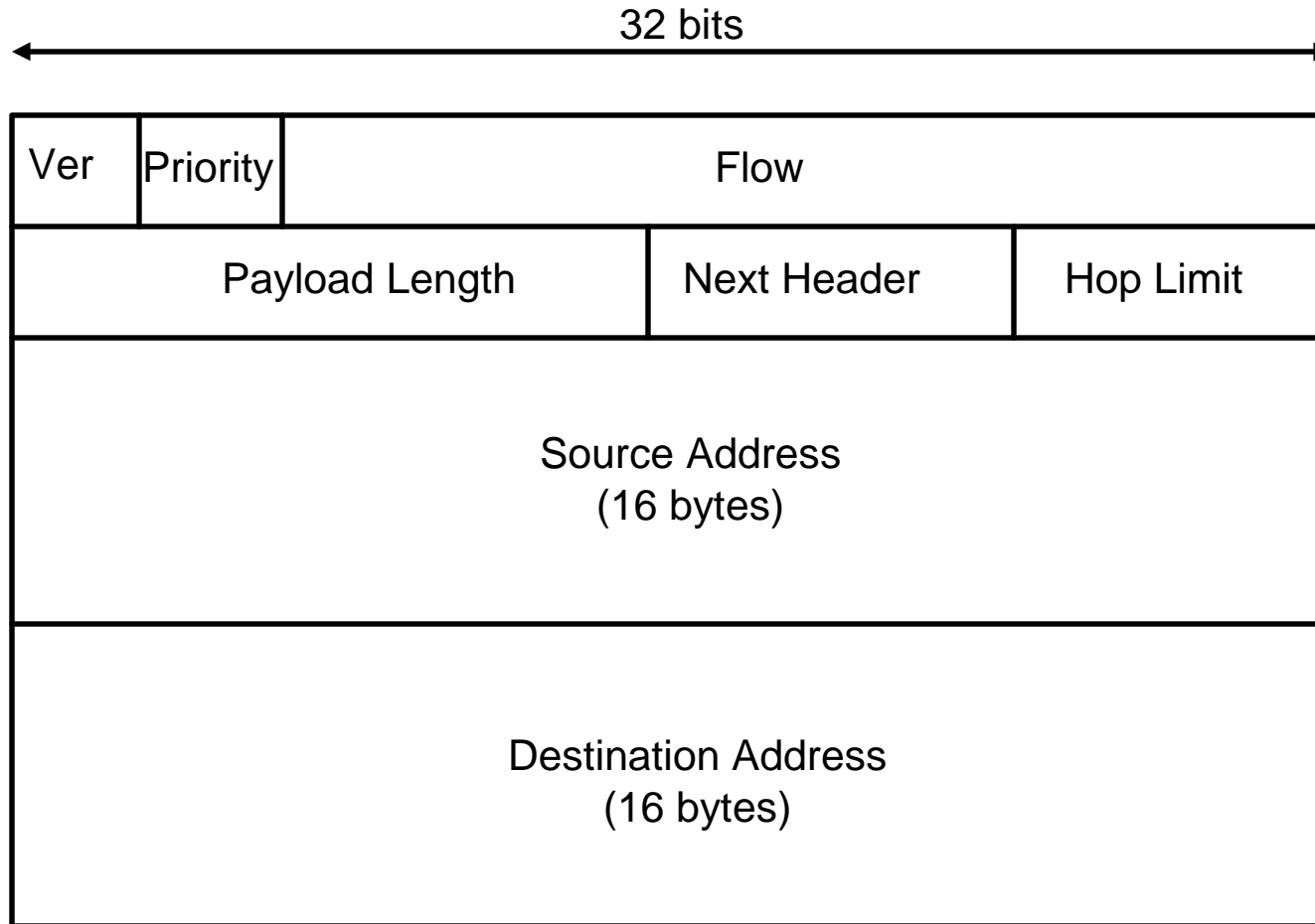# Announcements

- **Reading**
  - Today: Chapter 5 (5.5)
  - Thursday: Chapter 6 (6.1 & 6.2)
- **Midterms were returned**
  - mean 74.7
  - standard Deviation 16.6
  - All requests for re-grade due by Tuesday 10/19
- **Program #1 grades on the Web**
- **HW #1 (Due Tuesday 10/19)**
  - Tanenbaum: 3-5, 3-25, 5-11, 5-16, 5-24

Project Notes

- Will be done individually, not in teams
- General Outline of project
  - P3 - routing and host discovery
  - P4 - packet forwarding
    - ICMP: ping, traceroute
    - UDP
    - garbler
  - P5 - Transport layer
    - reliable byte stream
  - P6 - Security and application
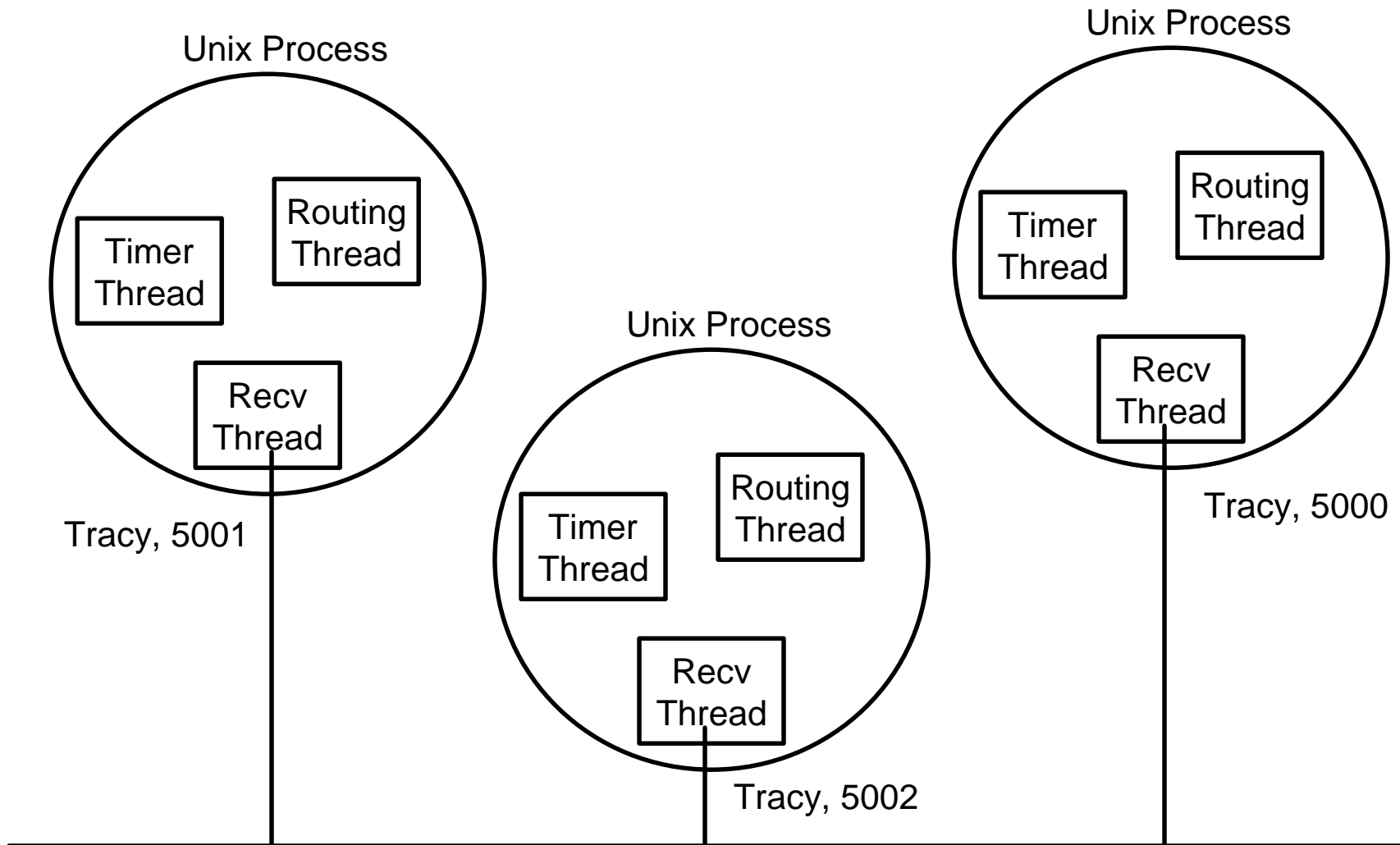 - demos after P4 and P6

IPv6 Packet Format

32 bits

Ver	Priority	Flow		
Payload Length			Next Header	Hop Limit
Source Address (16 bytes)				
Destination Address (16 bytes)				

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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

Unix Process

Routing Thread

Timer Thread

Recv Thread

Tracy, 5001

Unix Process

Routing Thread

Timer Thread

Recv Thread

Tracy, 5002

Unix Process

Routing Thread

Timer Thread

Recv Thread

Tracy, 5000

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)
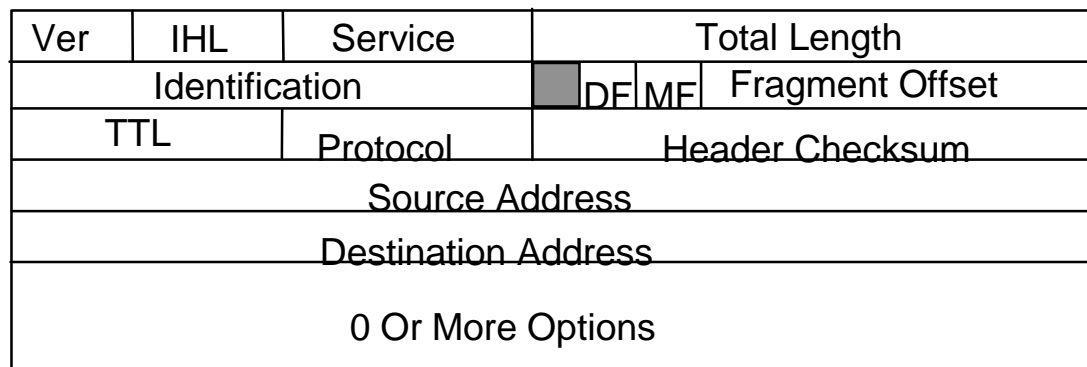   - at the gateway to the subnet that supports the full size

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

Ver	IHL	Service	Total Length		
Identification				DF MF	Fragment Offset
TTL		Protocol		Header Checksum	
Source Address					
Destination Address					
0 Or More Options					

32 bits

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