CS 360

Lecture 4

I forgot how much I like IP

(picture)

Network Layer

- Define how two hosts communicate

    - IP Address

- Define how to move data from one host to another
    - forwarding
    - routing

Routing vs Forwarding

Hardware

- Routers

- Switches

Network Layer Guarantees

Types

- Virtual Circuit
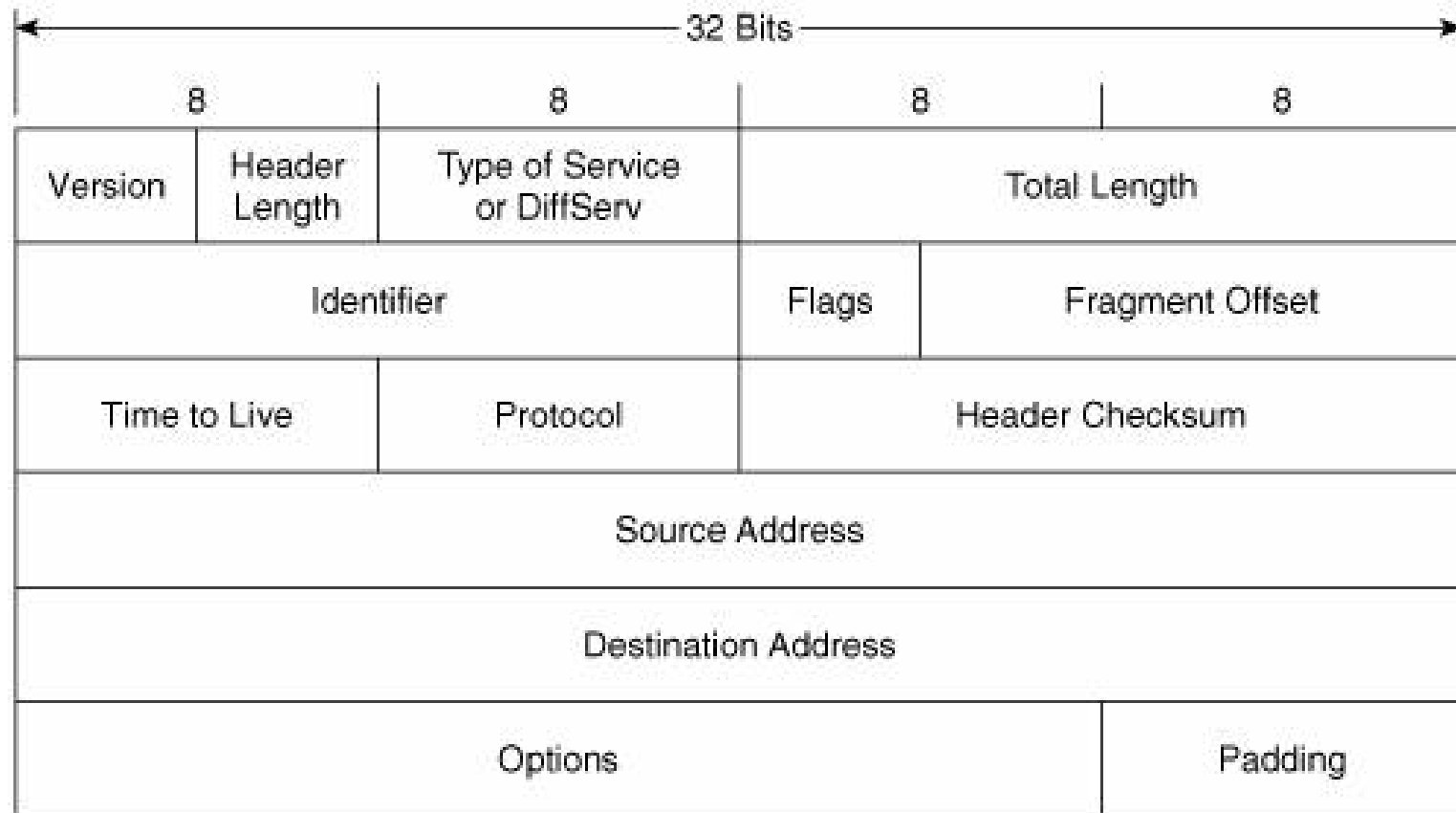
- Datagram

4.3 What's inside a router?

- We'll come back to this.

- Section 4.3.4 talks about RED, AQM, etc.

Network Layer (IPv4) p331

- IPv4 Protocol
  IPv6 Protocol

- ICMP Protocol

- Routing Protocols

IPv4

- RFC 791

32 Bits

8	8	8	8
Version / Header Length	Type of Service or DiffServ	Total Length	
Identifier		Flags	Fragment Offset
Time to Live	Protocol	Header Checksum	
Source Address			
Destination Address			
Options			Padding

https://advancedinternettechnologies.wordpress.com/ipv4-header/

IPv4 header

Fragmentation

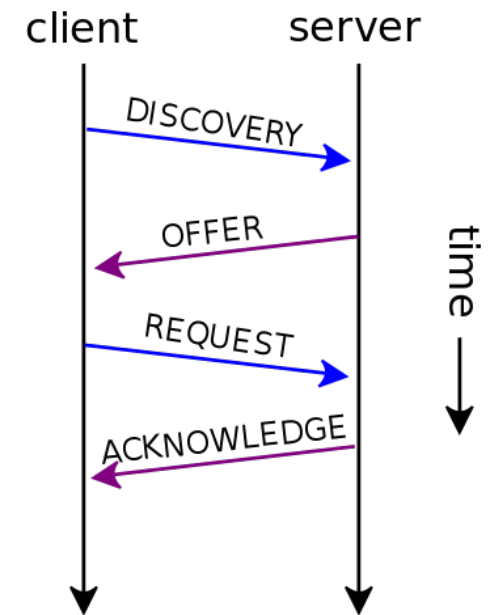- IPv4
  - not IPv6

(text)

IPv4 Addressing

- Old style: classful

- Current Style: classless

CIDR

DHCP

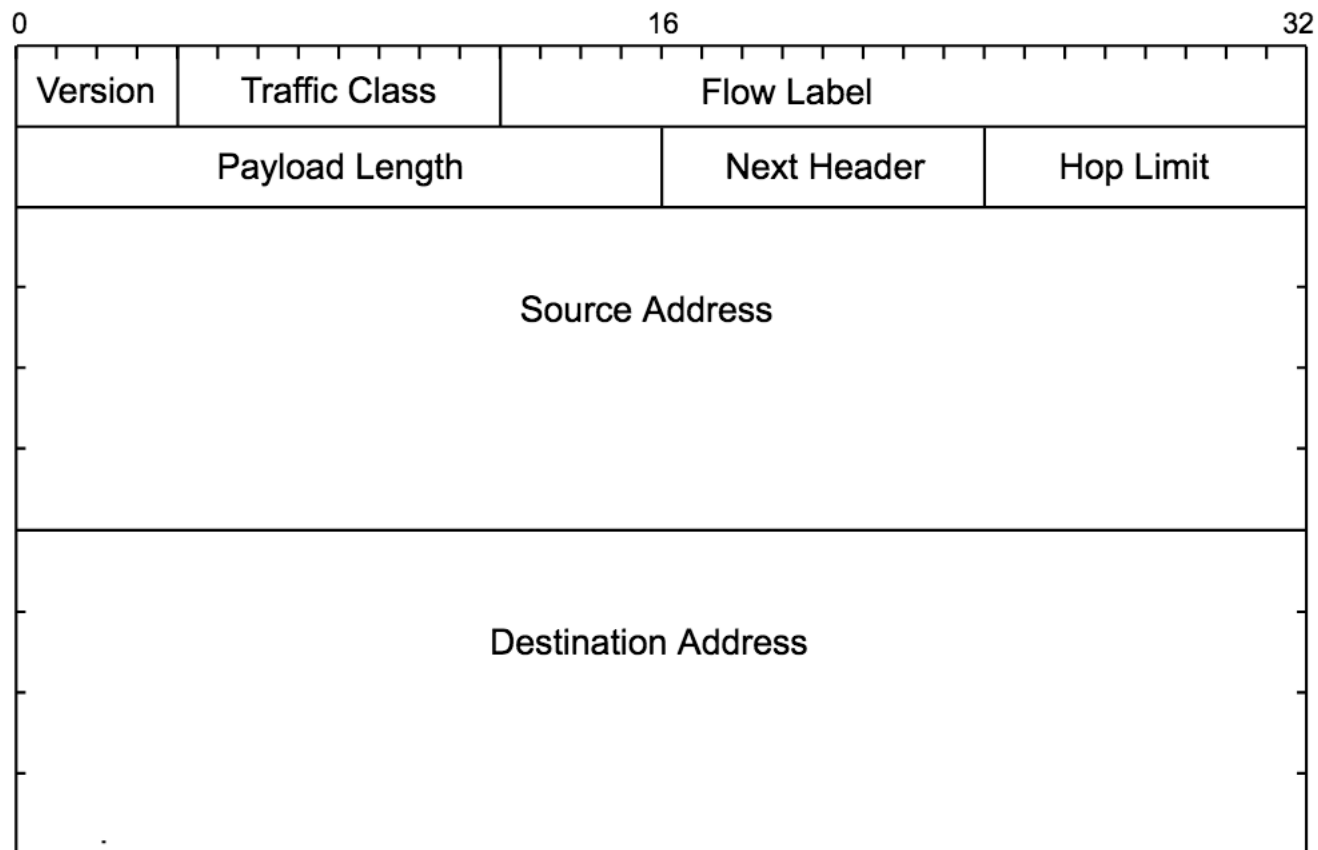- Dynamic Host Configuration Protocol

NAT

ARP

- Address Resolution Protocol
- Mapping IP address to Ethernet addresses

ICMP

- Internet Control Message Protocol
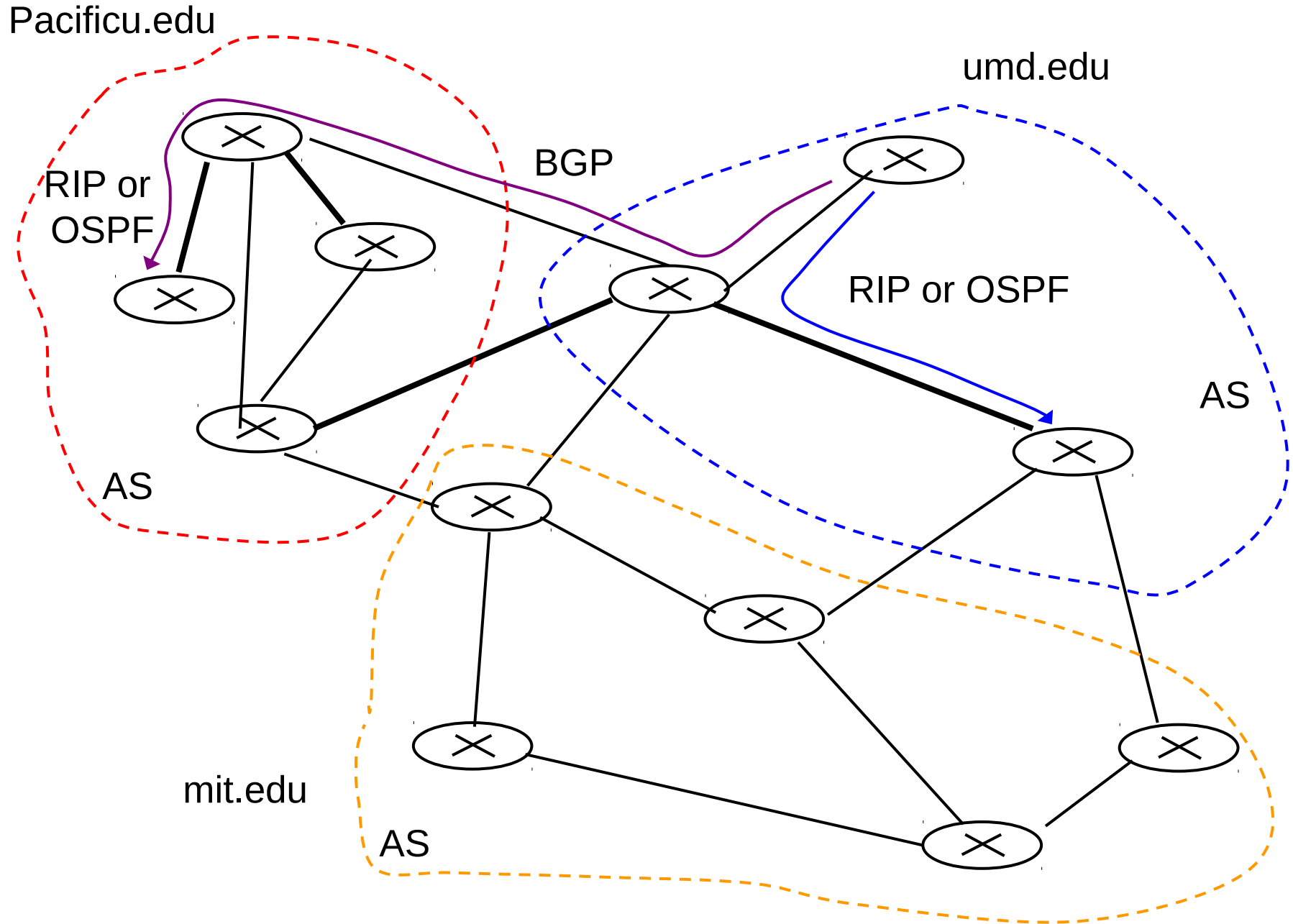 - hosts and router send network layer information to each other

IPv6

https://intronetworks.cs.luc.edu/current/html/ipv6.html#index-9

IPv6

IPsec

Routing!

Network with Routers

Pacificu.edu

RIP or
OSPF

BGP

umd.edu

RIP or OSPF

AS

AS

mit.edu

AS

(picture)

Forward Table

Link State

Link State

Packets
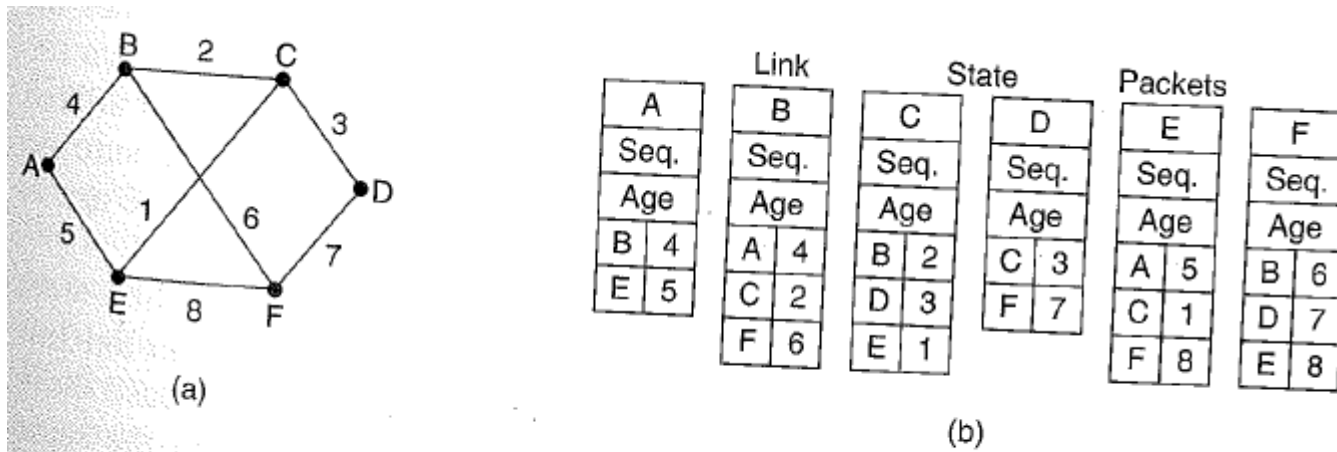
Figure 5-12. (a) A network. (b) The link state packets for this network.

Tanenbaum, Computer Networks, 5th edition

Dijkstra's Algorithm

1 *Initialization:*
2   N' = {u}
3   for all nodes v
4   if v adjacent to u
5   then D(v) = c(u,v)
6   else D(v) = ∞
7
8 *Loop*
9   find w not in N' such that D(w) is a minimum
10   add w to N'
11   update D(v) for all v adjacent to w and not in N' :
12   **D(v) = min(D(v), D(w) + c(w,v))**
13   /* new cost to v is either old cost to v or known
14   shortest path cost to w plus cost from w to v */
15 *until all nodes in N'*

Distance Vector

Hierarchical Routing

Intra-AS

- RIP
- OSPF

RIP

OSPF

Inter-AS

- BGP

Spanning Trees

Splay Trees

- Locality of Reference
  - bring accessed item to the top