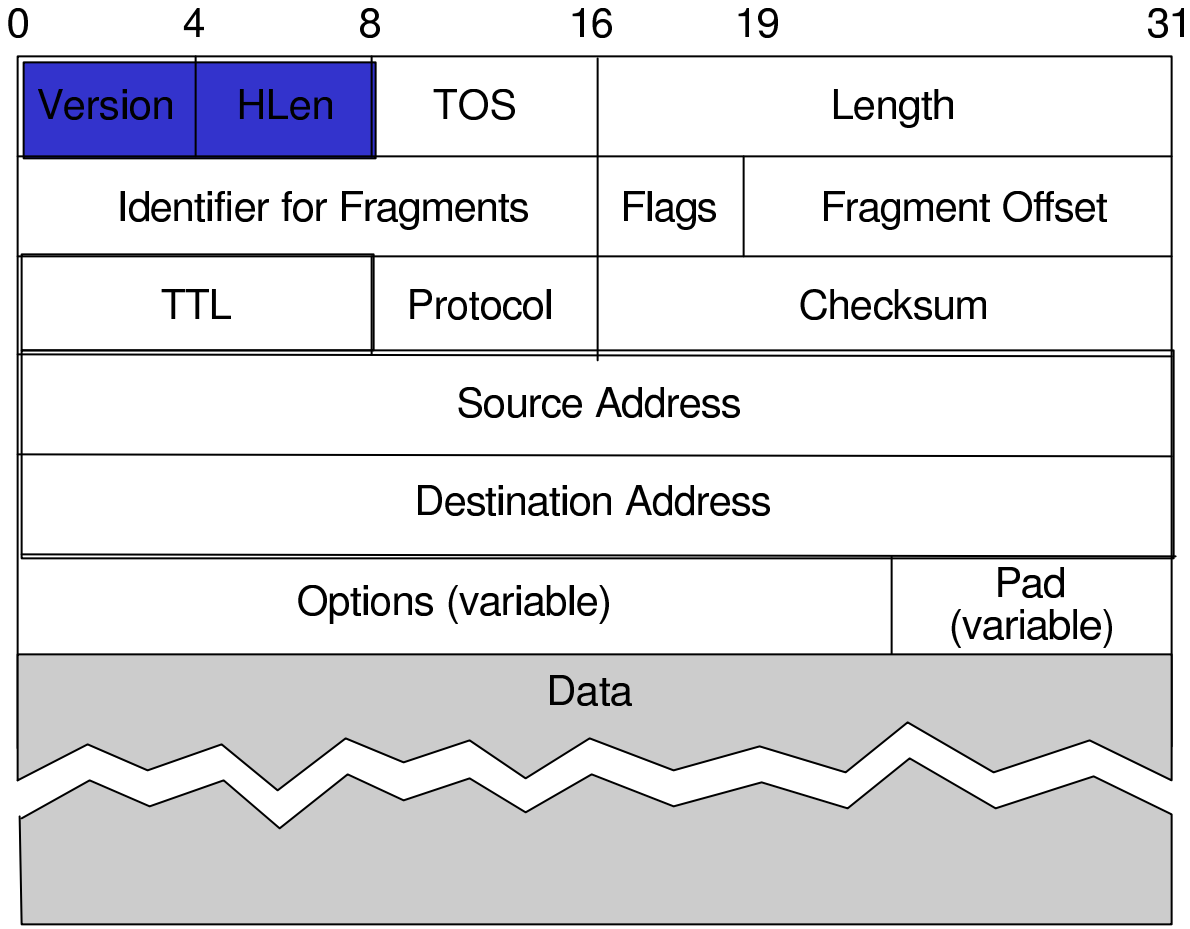
Midterm

- Wednesday, February 13th (next week)
- 8.5x11 sheet of notes, front and back
- Cover everything up to (but not including) Congestion control.
- Some (not not necessarily all) possible topics
  - Link Layer
  - Network Scaling
    - CIDR
    - Bridging(basic)
  - IP
  - Routing
  - Reliable transport/TCP

IPv4 Packet Format



Common ICMP Messages

- Destination unreachable
  - "Destination" can be host, network, port or protocol
- Redirect
  - To shortcut circuitous routing
- TTL Expired
  - Used by the "traceroute" program
- Echo request/reply
  - Used by the "ping" program

- ICMP messages include portion of IP packet that triggered the error (if applicable) in their payload

ICMP Restrictions

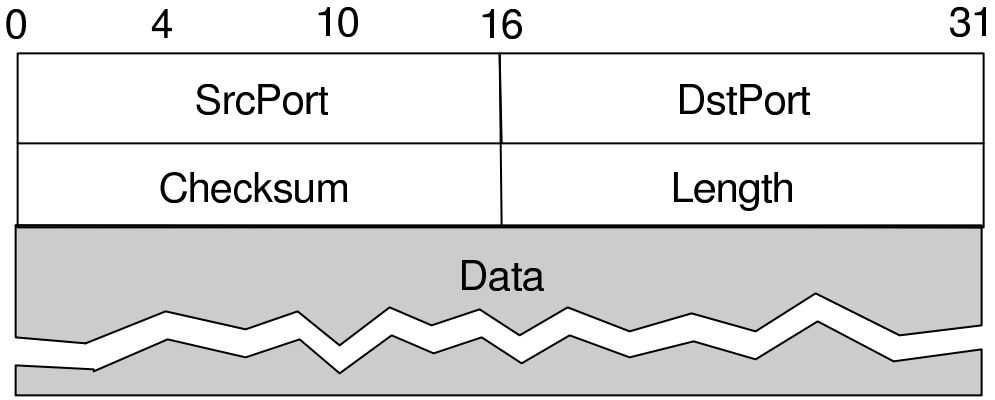
- The generation of error messages is limited to avoid cascades … error causes error that causes error!

- Don’t generate ICMP error in response to:
  - An ICMP error
  - Broadcast/multicast messages (link or IP level)
  - IP header that is corrupt or has bogus source address
  - Fragments, except the first

- ICMP messages are often rate-limited too.

UDP Packet Header

- Source, destination ports
- Checksum
- Length

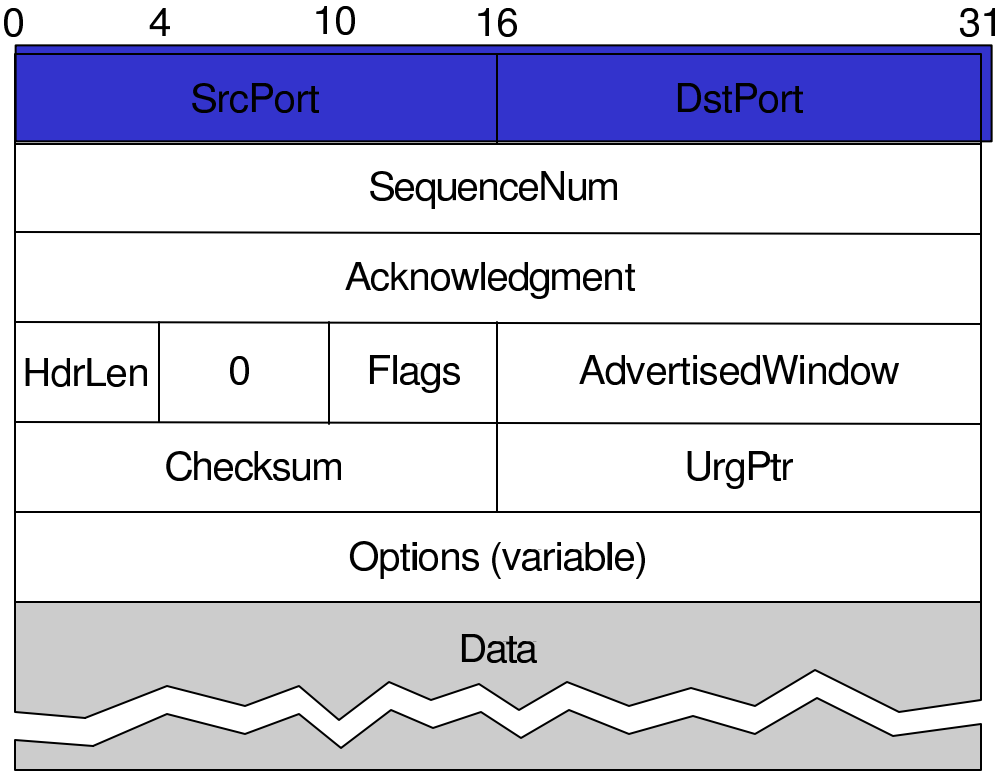


TCP

- What else would we like?
  - Programming model we understand
    - IP is packet oriented, but apps don't want to deal with packets.
    - Stream oriented programming model
    - Connection between sender and receiver
  - Reliable/In order
    - We never get the same piece of a message twice, and if we get any piece, we also got everything up to that piece.
  - Flow control
    - Is the receiver getting behind?
  - Later: congestion control

TCP Packet Header

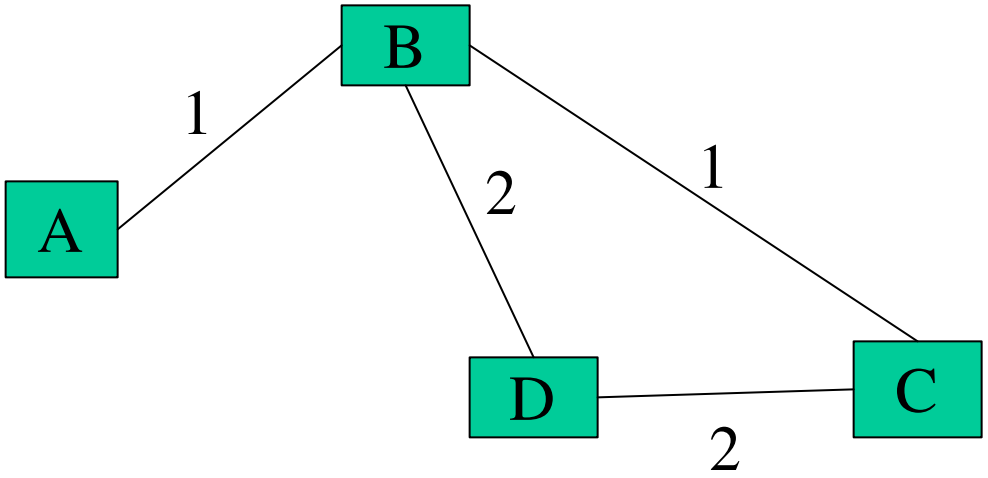
- Source, destination ports
- Sequence # (bytes being sent)
- Ack # (next byte expected)
- Receive window size
- Checksum
- Flags: SYN, FIN, RST

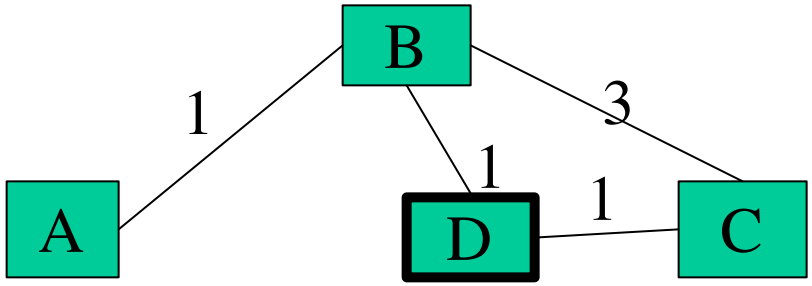


Routing topics

- Routing
  - Link State
  - Distance Vector
  - Path Vector

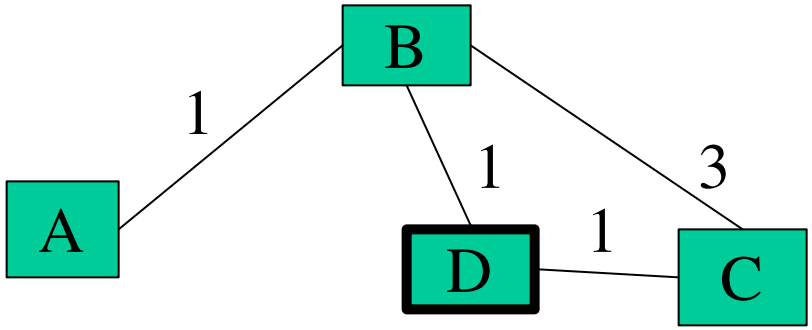
What information will be known at D?





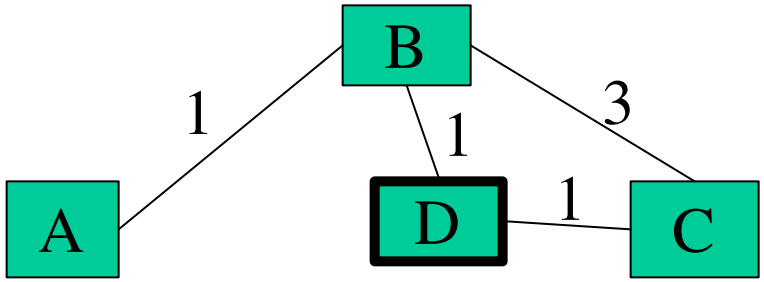
In distance vector, usually only remember the Best route(in gray) and ALWAYS only pass best on.

Destination	Next Hop	Cost
A	B	2
	C	4
B	B	1
	C	3
C	B	3
	C	1
D	D	0
	B	2
	C	2



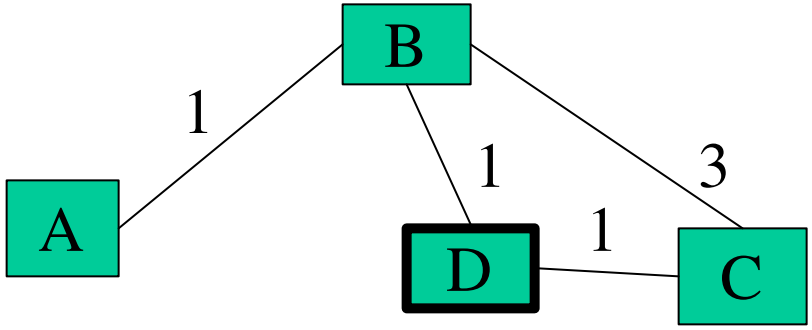
Split horizon/poison reverse squelches some advertisements that could cause loops

Destination	Next Hop	Cost
A	B	2
	C	∞
B	B	1
	C	∞
C	B	∞
	C	1
D	D	0
	B	∞
	C	∞



In Path vector, often remember all routes heard (but only pass on the best one)

Destination	Next Hop	Cost	Path
A	B	2	->B->A
	C	4	->C->B->D->B->A
B	B	1	->B
	C	3	->C->D->B
C	B	3	->B->D->C
	C	1	->C
D	D	0	
	B	2	->B->D
	C	2	->C->D



Link	Weight
BD	1
DC	1
BC	3
AB	1

Use Dijkstra's shortest path algorithm