CSC4200/5200 – COMPUTER NETWORKING

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ROUTING - CONTINUED

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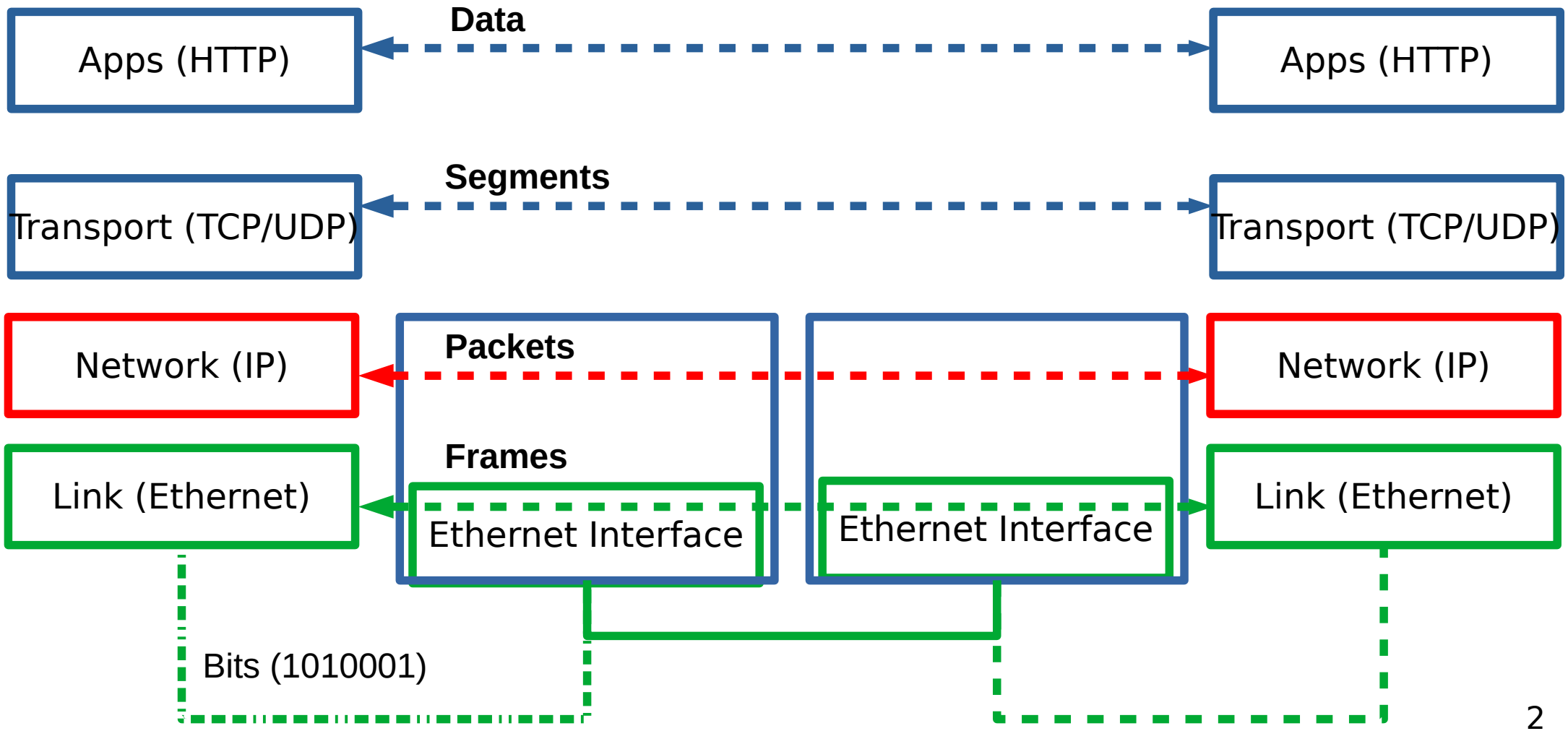
Tennessee TECH


Apps (HTTP)
Data
Apps (HTTP)
Transport (TCP/UDP)
Segments
Transport (TCP/UDP)
Network (IP)
Packets
Network (IP)
Link (Ethernet)
Frames
Ethernet Interface
Ethernet Interface
Link (Ethernet)
Bits (1010001)

So far…

- Midterm → 10/11 → 1:15 to 2:30. Location: Still TBA
  - Chapter 1 – 3 (Up to page 164 in the Ebook)
  - Pay attention to why and how, rather than memorizing

- Routing – Link state

Tying it all together in the network layer

SRC	2.2.2.2
DST	5.5.5.5

Decapsulate IP packet

SRC	bbbb
DST	dddd

SRC	2.2.2.2
DST	5.5.5.5

L1H1
2.2.2.2
Ether: cccc

SRC	2.2.2.2
DST	5.5.5.5

Youtube
5.5.5.5
Ether: dddd

ARP: WHO HAS 5.5.5.5?

youtube: I do!
Ethernet address: dddd

DHCP server

Iface 1:
2.2.2.1
Ether: aaaa

Iface 2:
5.5.5.1
Ether: bbbb

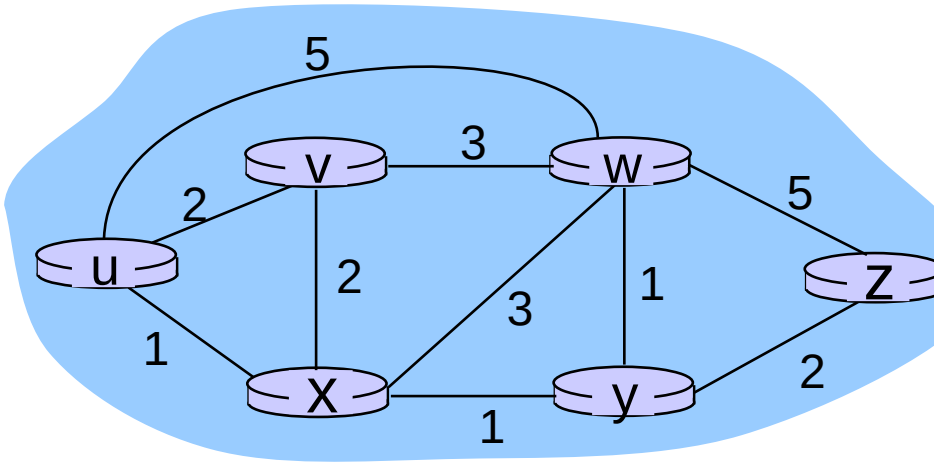
SRC	2.2.2.2
DST	5.5.5.5

Routing Table

We are populating this!!!

5.5.5.0/8	IF: 2
2.2.2.0/8	IF: 1

Why bother?

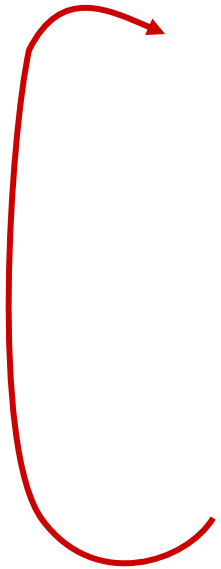


- Quality of path affects performance
  - Longer path = more delay
- Balance path usage, avoid congested paths
- Deal with failures

SubnetNumber	SubnetMask	NextHop
128.96.34.0	255.255.255.128	Interface 0
128.96.34.128	255.255.255.128	Interface 1
128.96.33.0	255.255.255.0	R2

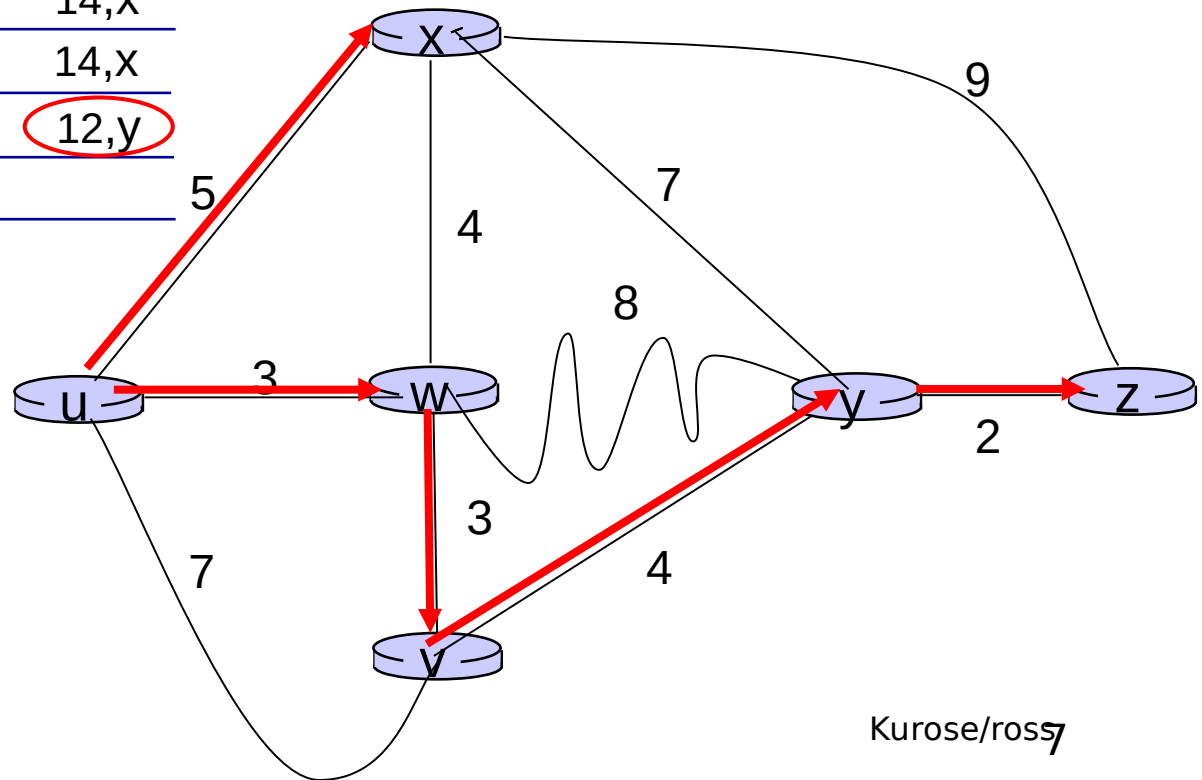
Dijsktra's Algorithm

```
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'
```



Dijkstra's algorithm: example

Step	N'	D(v) p(v)	D(w) p(w)	D(x) p(x)	D(y) p(y)	D(z) p(z)
0	u	7,u	3,u	5,u	∞	∞
1	uw	6,w		5,u	11,w	∞
2	uwx	6,w			11,w	14,x
3	uwxv				10,v	14,x
4	uwxvy					12,y
5	uwxvyz					

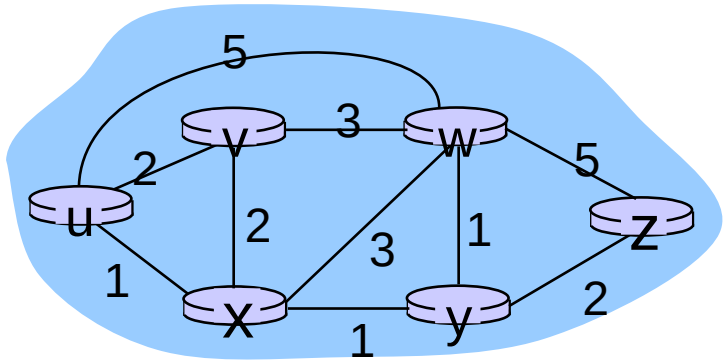


notes:

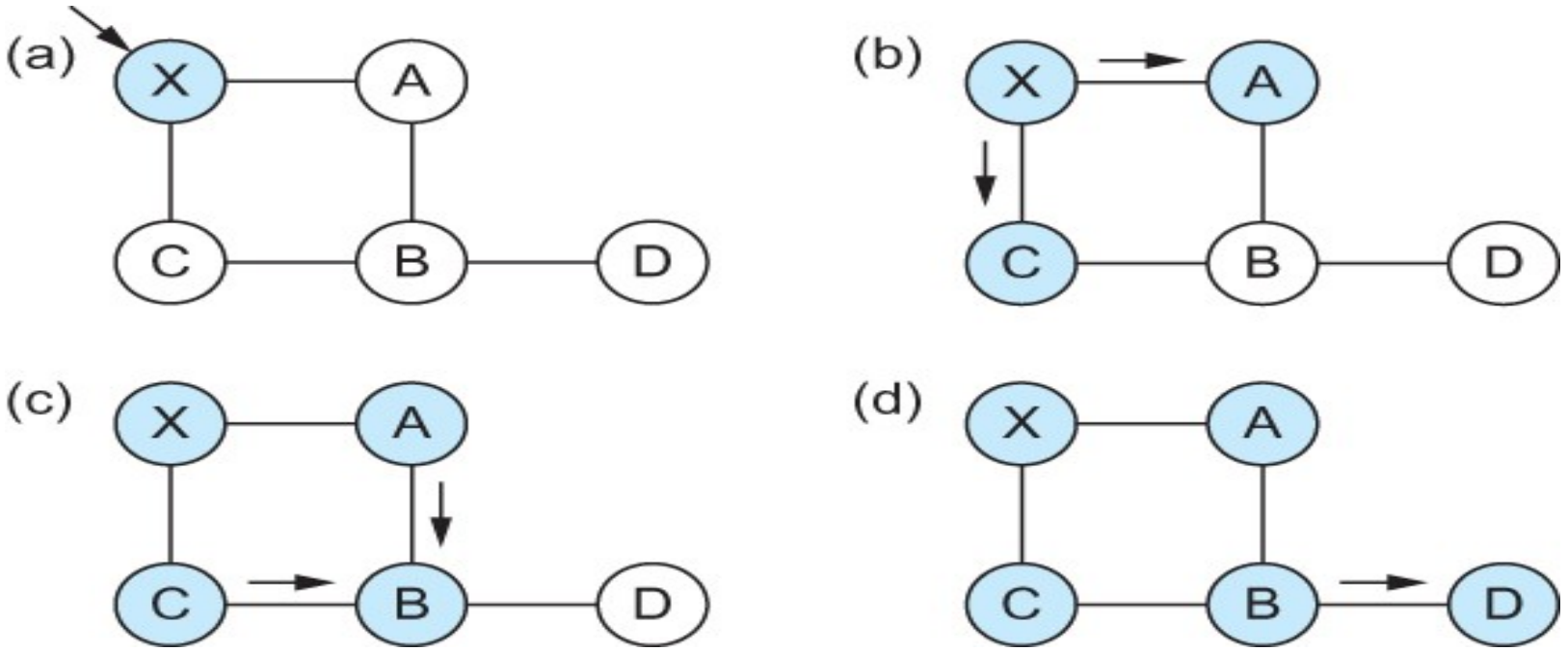
- construct shortest path tree by tracing predecessor nodes
- ties can exist (can be broken arbitrarily)

Dijsktra’s Algorithm usage→ Link State Routing

- Each node keeps track of adjacent links
- Each router broadcasts it’s state
- Each router runs Dijkstra’s algorithm
- Each router has complete picture of the network
- Example: Open Shortest Path First (OSPF)



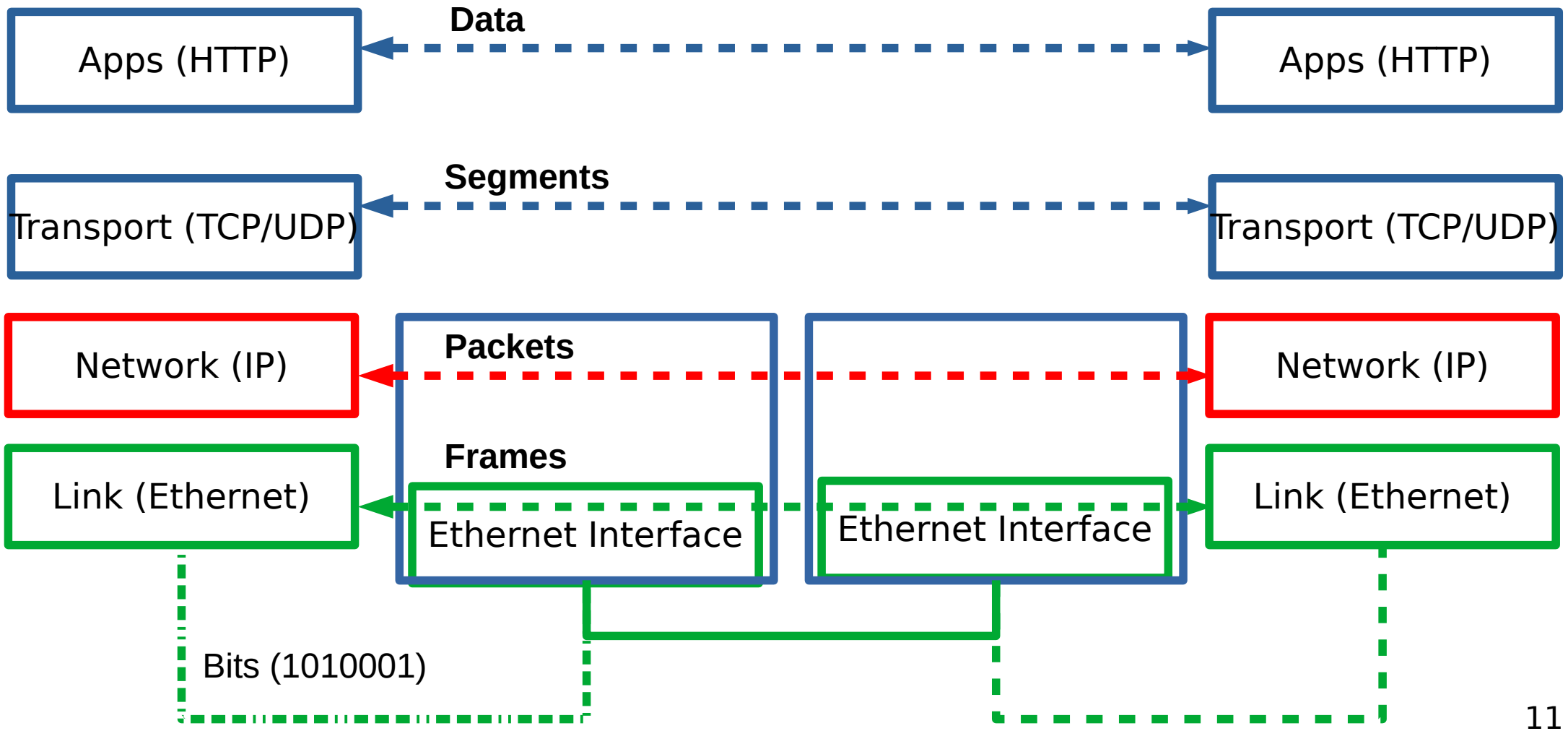
Link State Routing – controlled flooding



Flooding of link-state packets. (a) LSP arrives at node X; (b) X floods LSP to A and C; (c) A and C flood LSP to B (but not X); (d) flooding is complete

Link State Routing – controlled flooding

- Flood when topology changes or link goes down
  - Detected by periodic hello messages
  - If message missed → link down
- Refresh and flood periodically
- Problems?
  - High computational cost
  - Reliable flooding may not be reliable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Next Steps

Homework 1 and 2 review
Programming assignment 1 review

Distance vector
Monday – Midterm review!!!!