

CSC411: Advanced Networks

IP Queuing & Forwarding

Note: This class lecture will be recorded!

If you do not consent to this recording, please do not ask questions via your video, audio or public chat; send your question to the instructor using the private chat.

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Basic Queuing

- ▶ Input queuing
- ▶ Output queuing

Priority Mechanisms

- ▶ Priority processing
 - Queues
- ▶ Queuing discipline
- ▶ Drop packets
 - Tail drop
 - RED

Queuing Disciplines

- ▶ Priority Queuing
 - Strict priority order
 - Disadvantage?
- ▶ Weighted Round Robin
 - Avoid previous disadvantage
 - Sequences through queues
 - Disadvantage: average packet size estimation
 - Queue may not be serviced ideally

Queuing Disciplines, cont.

- ▶ Weighted Fair Queuing
 - Allocate service more accurately
 - Simulates CPU timeslicing discipline
 - Generalized Processor Sharing (GPS)
 - Packets are discrete (time is continuous)
 - Each packet assigned a Finish Number
 - Smallest finish number selected
 - Disadvantage: overhead

Address Lookup

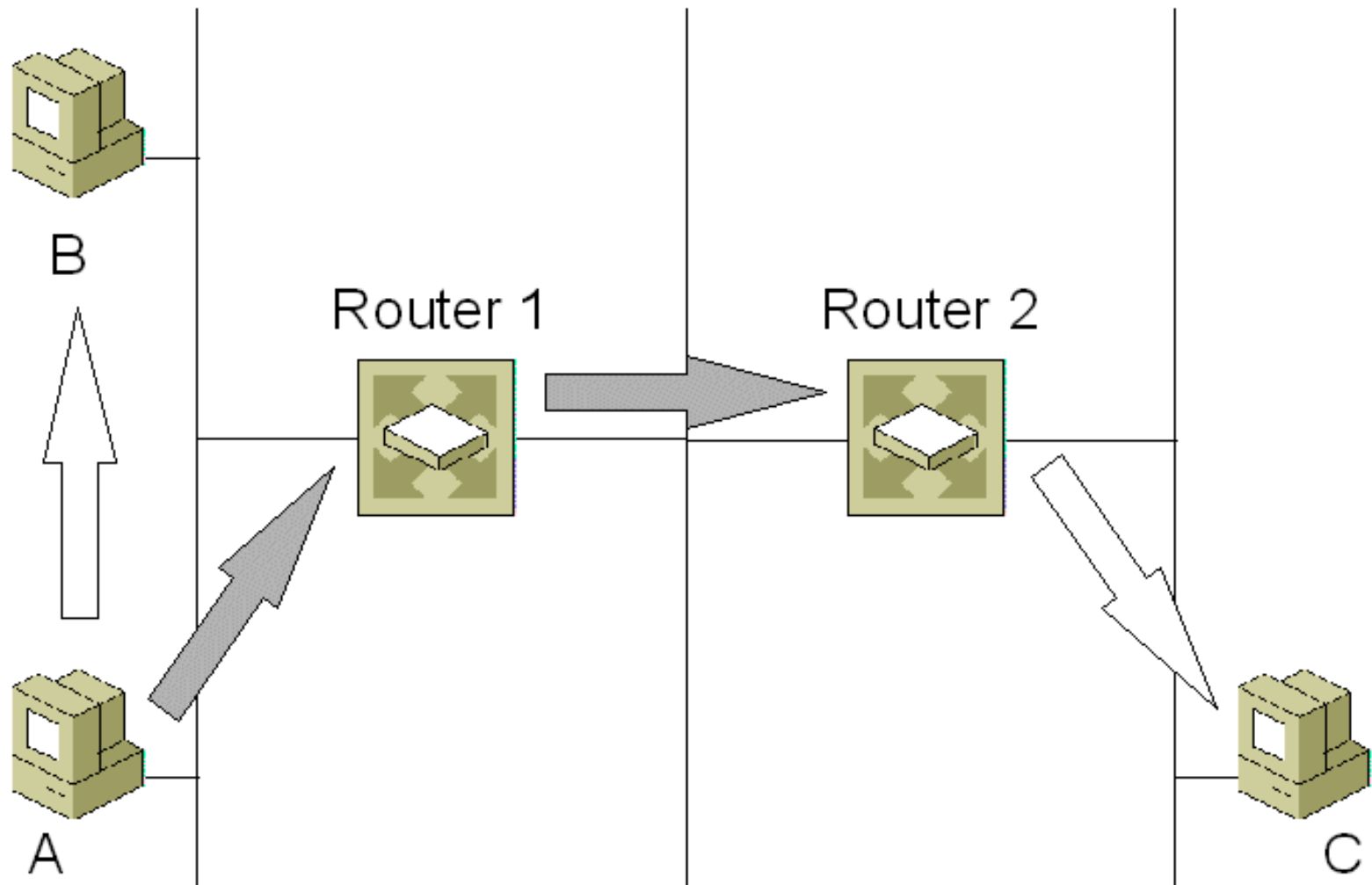
- ▶ Forwarding
- ▶ Layer-2 → exact match
- ▶ Layer-3 → longest prefix match

- ▶ IP forwarding
 - $f(\text{datagram, routing table}) \rightarrow (\text{next hop, interface})$

Routing Table

- ▶ Why is it necessary in IP routing to use just the network prefix and not the complete IP address for the destination?

Destination Address	Address Mask	Next-Hop Address	Interface Number
192.4.45.0	255.255.255.0	128.210.30.5	2
128.10.0.0	255.255.0.0	120.210.141.12	1
0.0.0.0	0.0.0.0	128.210.30.5	2

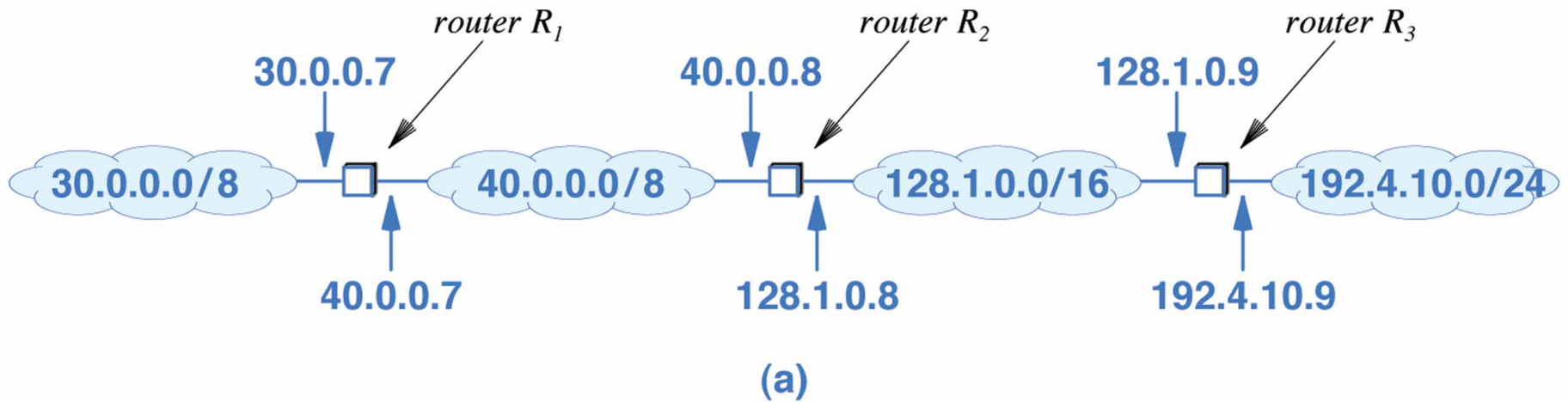


Direct Delivery



Indirect Delivery





Destination	Mask	Next Hop
30.0.0.0	255.0.0.0	40.0.0.7
40.0.0.0	255.0.0.0	deliver direct
128.1.0.0	255.255.0.0	deliver direct
192.4.10.0	255.255.255.0	128.1.0.9

(b)

Figure 22.3 (a) An example internet with four networks, and (b) the forwarding table found in router R_2 .

Longest Prefix Match

- ▶ Algorithm complexity
 - Tables grow large
 - Default route
 - Host-specific routes
 - Address ambiguity
 - 128.10.0.0 /16
 - 128.10.2.0 / 24
- ▶ Examine entries with longest prefix first

IP Forwarding Algorithm

Given: destination address A and routing table R .

Find: a next hop and interface used to route datagrams to A .

For each entry in table R {

 Set $MASK$ to the Address Mask in the entry;

 Set $DEST$ to the Destination Address in the entry;

 If $(A \& MASK) == DEST$ {

 Stop; use the next hop and interface in the entry;

 }

}

If this point is reached, declare error: no route exists;

IP Forwarding Problem

NetMaskLength	NextHop
C4.50.0.0/12	A
C4.5E.10.00/20	B
C4.60.00.00/12	C
C4.68.00.00/14	D
80.00.00.00/1	E
40.00.00.00/2	F
00.00.00.00/2	G

What is the next hop for each of the following?

a) C4.5E.13.87

d) 5E.43.91.12

b) C4.5E.22.09

e) C4.6D.31.2E

c) C3.41.80.02

f) C4.6B.31.2E

Binary Trie

