CS519: Computer Networks

Lecture 3, Part 1: Feb 11, 2004

IP Forwarding Table

Routing and Forwarding Revisited

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- We separate notion of "routing" and "forwarding"
- Routing algorithm is what a router does in the "background" to figure out where each prefix should be forwarded
  - Address prefixes, next hops, link costs, distances, etc.
- Forwarding is what a router does when a packet arrives
  - Address prefixes, next hops, interface, subnet address

Routing and Forwarding Revisited

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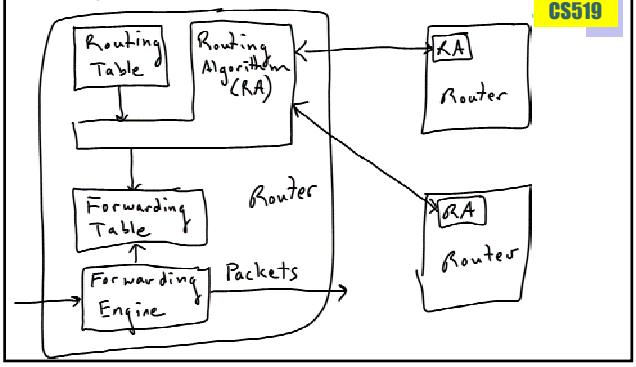

A simple example

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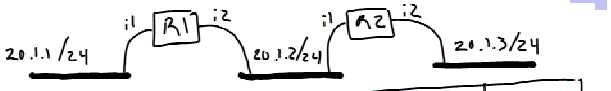

addr	mask	Next Hop	iface	subnet addr
20.1.1.0	255.255.255.0	local	i1	x
20.1.2.0	255.255.255.0	local	i2	x
20.1.3.0	255.255.255.0	R2	i2	1:2:3:4:5:6

R1 forwarding table (FIB)

Simple (naïve) forwarding rule

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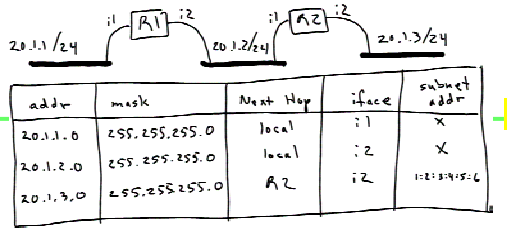
- Step through table from top to bottom
- At each step, apply mask to FIB address and packet address. If results match, then use FIB entry to forward packet
  - If (FIB-addr && FIB-mask) ==
  - (PK-addr && FIB-mask)
  - then use entry
- FIB = Forwarding Information Base
  - i.e. Forwarding Table
  - Routing Table also called RIB



addr	mask	Next Hop	iface	subnet addr
20.1.1.0	255.255.255.0	local	:1	X
20.1.2.0	255.255.255.0	local	:2	X
20.1.3.0	255.255.255.0	R2	:2	1:2:3:4:5:6

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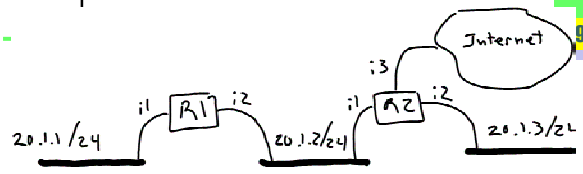
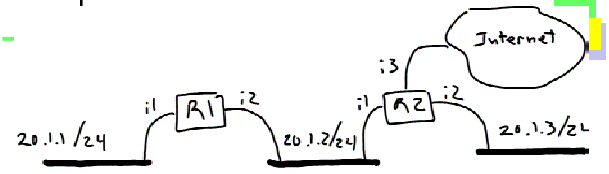
Simple example with default



20.1.1.0	255.255.255.0	:1
20.1.2.0	255.255.255.0	:2
20.1.3.0	255.255.255.0	R2
0.0.0.0	0.0.0.0	R2

But default entry must be last!



0.0.0.0	0.0.0.0	R2
20.1.1.0	255.255.255.0	:1
20.1.2.0	255.255.255.0	:2
20.1.3.0	255.255.255.0	R2

A more complex example (a site with 500 hosts)

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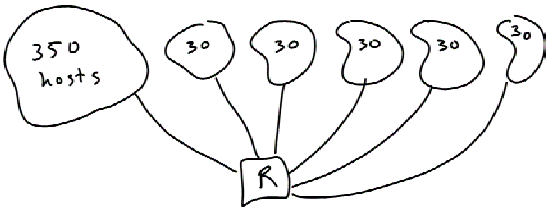
- How do we assign prefixes (addr and mask) in this case???



One way to assign prefixes…

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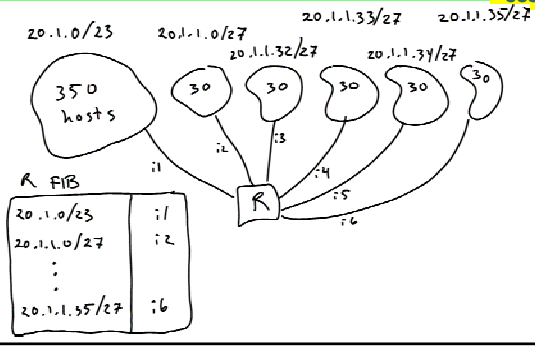

The view from the global Internet: 6 FIB entries!

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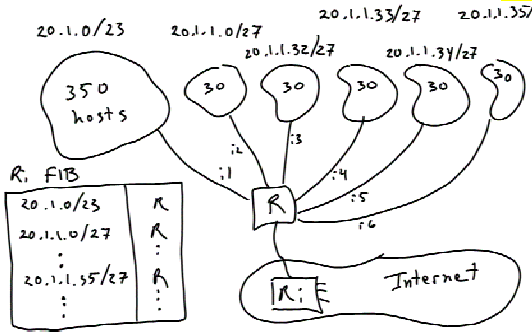

We can shrink that to one FIB entry!

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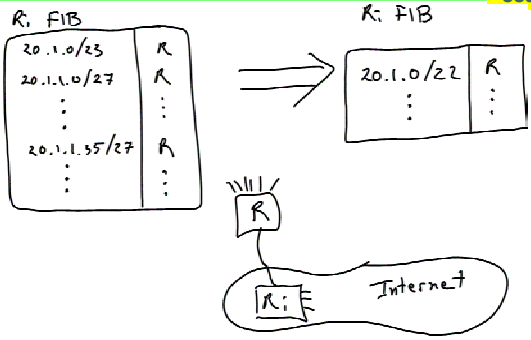

1024 addresses to address 500 hosts! What a waste…

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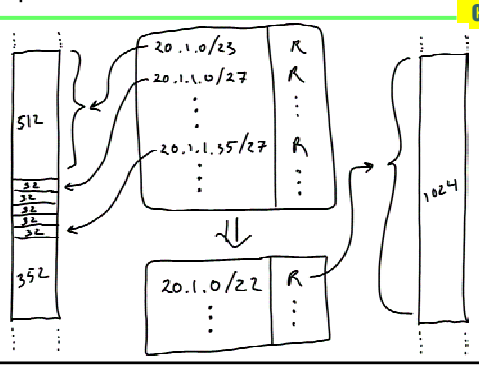

What about this prefix assignment approach instead?

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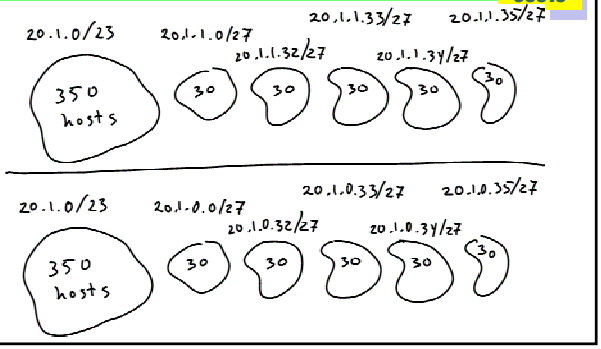

Now 500 addresses fit into a 512 address block!

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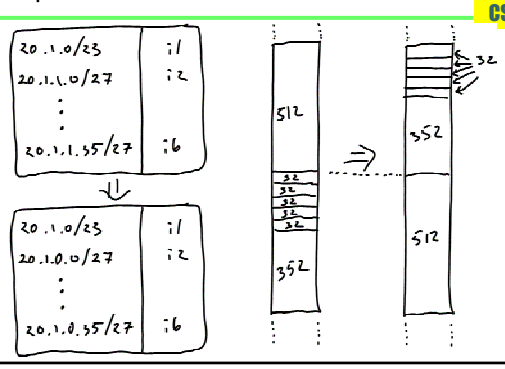

But now our forwarding rules fail (like with the default)

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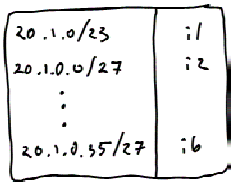

Longest-prefix match

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- Since multiple entries may match, we prefer the entry with the longest mask (prefix)
- Two ways:
  1. Go through the whole FIB, remembering the matching entriey with the longest prefix
  2. Sort FIB in order of longest prefix first, and select first match

First-match Longest-prefix

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