

Internet Addressing

- ▣ Today's topics:
 - What are Internet addresses?
 - Why do we need them?
 - How are they used?

Universal Communication Service

- ▣ *A universal communication service* allows any host to communicate with any other host
- ▣ This requires a globally accepted method of identifying each host connected to the internet
- ▣ Internetworking strives to provide an universal communication service

How to Uniquely Identify a Host?

- ▣ Name – what an object is
 - Well suited for humans
 - Example: `www.cs.jmu.edu`
- ▣ Address – where an object is
 - Well suited for machines
 - Example: `134.126.20.50`
- ▣ Route – how to get to an object

Internet Addresses

- ▣ Also called *IP addresses*
- ▣ 32-bit integers
- ▣ Global host identifiers
- ▣ Chosen to make routing efficient
- ▣ IP address = (netid, hostid)

The Original Classful Addressing Scheme

	0	1	2	3	4	8	16	24	31	
Class A	0	netid				hostid				
Class B	1	0	netid				hostid			
Class C	1	1	0	netid				hostid		
Class D	1	1	1	0	multicast address					
Class E	1	1	1	1	reserved for future use					

Classes of IP Addresses (cont)

- ▣ A small number ($\sim 2^7$) of class A networks with a large number ($\sim 2^{24}$) of hosts
- ▣ A medium number ($\sim 2^{14}$) of class B networks with a medium number ($\sim 2^{16}$) of hosts
- ▣ A large number ($\sim 2^{21}$) of class C networks with a small number ($\sim 2^8$) of hosts

Addresses Specify Network Connections

- ▣ What is R1's address?



- ▣ R1 is a *multi-homed host* (has connections to more than one physical network)
- ▣ R1 requires multiple IP addresses

Addresses Specify Network Connections (cont)

- ▣ Each address corresponds to **one** of the machine's connections
- ▣ Because IP addresses encode both a network and a host on that network, they do not specify an individual computer, but a connection to a network
- ▣ A router connecting n networks has n distinct IP addresses

IP Addresses Conventions

- ▣ The smallest hostid (all 0's) is never assigned to an individual host, instead it is used to refer to the network
- ▣ IP addresses can refer to hosts or networks
- ▣ Examples:
 - (6,8) = host #8 on network #6
 - (9,0) = network #9

IP Addresses Conventions (cont)

- ▣ The largest hostid (all 1's) is never assigned to an individual host, instead it is used to refer to a *directed broadcast*
- ▣ Example:
 - (00000101,11111111111111111111111111) = all hosts on network #5

IP Addresses Conventions (cont)

- ▣ There is also a limited broadcast address (all 1's for both netid and hostid) that broadcasts on the local network

- ▣ Example:
 - ▣ (11) = all hosts on the local network

IP Addresses Conventions (cont)

- ▣ Summary:
 - A field of all 1's can be interpreted to mean "all"
 - ▣ (00000100,11111111111111111111111111) = all hosts on network #4
 - A field of all 0's can be interpreted to mean "this"
 - ▣ (00000000,00000000000000000000000011) = host # 3 on this network