

ECE453 – Introduction to Computer Networks

Lecture 11 – Network Layer III – IP Protocol

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Recap

- ◆ Network core: packet switching vs. circuit switching
- ◆ Network service: connectionless
 - Best effort, no guarantee
 - Datagram subnet
- ◆ Adaptive Routing
 - Decentralized routing (distance vector routing)
 - Global routing (link state routing)
 - Hierarchical routing
- ◆ Internet routing
 - Intra-domain routing (OSPF, RIP)
 - Inter-domain routing (BGP)

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Names, Addresses, Route

- ◆ Name: identify *what* an object is
- ◆ Address: identify *where* it is
- ◆ Route: tell *how* to get there
- ◆ Each host on a TCP/IP internet is assigned a unique 32-bit binary address (IPv4) for computation and is used in all communications with that host

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Internet Addressing Authority

- ◆ The Internet Corporation for Assigned Names and Numbers (ICANN) has ultimate control over number assigned
 - Allocate IP addresses
 - Manage DNS root servers

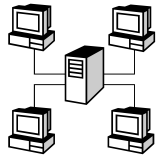
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Hierarchy Within IP Address

- ◆ netid
- ◆ hostid
- ◆ Dotted decimal notation

1000000 00001010 00000010 00011110
is written as 128.10.2.30

- ◆ One address for one host?



Implement Hierarchy of IP Address

	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	0	Reserved for future use				

Class	Lowest address	Highest address
A	0.1.0.0	126.0.0.0
B	128.0.0.0	191.255.0.0
C	192.0.1.0	223.255.255.0
D	224.0.0.0	239.255.255.255
E	240.0.0.0	247.255.255.255

Classless Internet Address

- ◆ To divide an IP address at an arbitrary boundary
- ◆ Address masks
 - Use (A,M) pairs in routing table, given a destination address D
 - $A = (D \& M)$
- ◆ E.g. 128.10.0.0/16
- ◆ RFC 1519, 1518 (CIDR)

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Special IP Addresses

- ◆ single-**network** broadcast address:
 - 255.255.255.255
- ◆ unconfigured address:
 - 0.0.0.0
- ◆ loopback address:
 - 127.X.X.X, typically 127.0.0.1
- ◆ private internets:
 - 10.0.0.1 through 10.255.255.254 (10/8)
 - 172.16.0.1 through 172.31.255.254 (172.16/12)
 - 192.168.0.1 through 192.168.255.254 (192.168/16)

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Assigning Addresses

- ◆ Manual configuration (fixed IP address)
 - /etc/resolv.conf (name server)
 - /etc/sysconfig/network (gateway)
 - /etc/network-scripts/ifcfg-eth0 (IP address, netmask, network)
 - Control-panel
- ◆ Dynamic host configuration protocol (DHCP)
 - DHCP server
 - Client obtains an IP address dynamically

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Examples

```
IPADDR=160.36.30.108  
NETMASK=255.255.254.0  
NETWORK=160.36.30.0  
BROADCAST=160.36.31.255
```

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