

Internet Protocol Subnets

COMP476/ELEN647

Internet Addresses

- An Internet Address is composed of two parts, a netid and a hostid.
- The hostid identifies the particular host on a network.
- The netid identifies the network where the host is connected.
- A computer physically connected to two networks needs two Internet addresses.

Internet Address Classes

class				
A	NetID	hostID	hostID	hostID
B	NetID	NetID	hostID	hostID
C	NetID	NetID	NetID	hostID

IP Routing Procedure

Assume computer **A** wants to send one datagram to computer **B**

1. **A** sends a DNS request to the local Domain Name Server asking for the IP address of **B**.
2. The DNS sends the IP address of **B** to **A**.
3. The netid portion of **A**'s IP address is compared with the netid portion of **B**'s IP address.

4. If the netid of the sender and receiver are the same, then the destination is on the same network. **A** can send the packet directly to **B**.
5. If the netids are different, **A** must send the packet to the gateway.
6. The gateway will forward the packet to another gateway that is closer to the destination's domain.
7. The gateway at the destination's domain will send the frame to **B**

Subnet Masks

- To separate the local host's NetID, the IP address can be logically ANDed with bit mask that has 1 bits for the NetID and 0 bits for the HostID.

class A 255. 0 . 0 .0
class B 255.255. 0 .0
class C 255.255.255.0

Source Address Netid

152.8.251.41 source IP address

10011000.00001000.11111011.00101001
AND 11111111.11111111.00000000.00000000
10011000.00001000.00000000.00000000

Destination Address Netid

15.181.0.31 destination IP address

00001111.10110101.00000000.00011111
AND 11111111.11111111.00000000.00000000
00001111.10110101.00000000.00000000

The results are different so the datagram must be sent to the gateway.

Hierarchical Routing

- The Internet Protocol routes IP datagrams to the destination domain or network.
- Once a packet arrives in the destination network, it is assumed that the packet will find its way to the destination host over bridges and repeaters.

Address Resolution Protocol (ARP)

- Used by a computer to find the MAC or physical address of another computer on the **same** network.
- To find a MAC address, ARP broadcasts a request containing the desired IP address to all computers.
- The computer with the matching IP address replies with its MAC address.
- Every computer on the network is involved.

IP Subnets

- Internet Protocol Subnets is a method of dividing a large domain into smaller subdomains.
- Packets are routed following the same rules used for domains.
- Some of the bits of the HostID are used locally as an extension of the NetID.
- The world still routes packets by the usual NetID, but locally the NetID is extended to create sub-domains

Extending the NetID

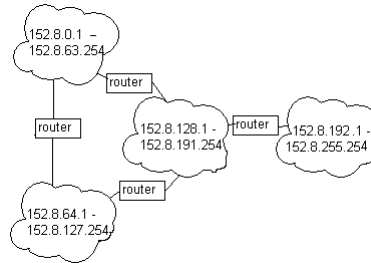
- A domain can be physically separated into multiple subdomains.
- Subdomains are connected by routers.
- For N subdomains, $\log_2 N$ upper bits of the HostID are locally used with the NetID.
- All IP addresses in a physical subdomain must have the same $\log_2 N$ upper bits.

subnet mask for 4 sub-domains

255.255.192.0 =
11111111.11111111.11000000.00000000

Two bits of the Hostid portion of the address
are used to separate the subnets.

Example Subnet



152.8.251.41 to 152.8.244.21

152.8.251.41 source IP address

10011000.00001000.11111011.00101001
AND 11111111.11111111.11000000.00000000
10011000.00001000.11000000.00000000

152.8.251.41 to 152.8.244.21

152.8.244.21 destination IP address

10011000.00001000.11110100.00010101
AND 11111111.11111111.11000000.00000000
10011000.00001000.11000000.00000000

The results of the two ANDs are identical.
The destination is in the same subdomain.

Example 152.8.251.41 to 152.8.47.14

152.8.251.41 source IP address

10011000.00001000.11111011.00101001
AND 11111111.11111111.11000000.00000000
10011000.00001000.11000000.00000000

Example 152.8.251.41 to 152.8.47.14

152.8.47.14 destination IP address

10011000.00001000.00101111.00001110
AND 11111111.11111111.11000000.00000000
10011000.00001000.00000000.00000000

The results of the two ANDs are different.
The destination is in another subdomain.

Subnet Masks

What is the subnet mask for a:

- Class A network with 16 subnets
- Class C network with 4 subnets
- Class B network with 5 subnets

Subnet Masks

What is the subnet mask for a:

- Class A network with 16 subnets
255.240.0.0
- Class C network with 4 subnets
255.255.255.192
- Class B network with 5 subnets
255.255.224.0