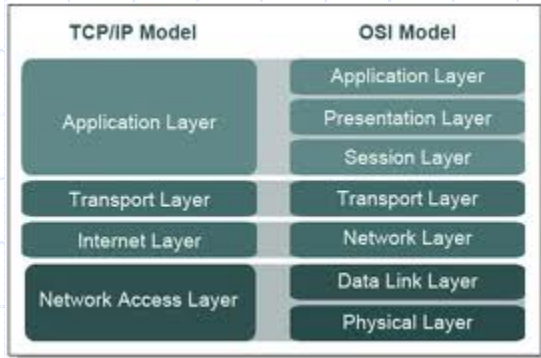
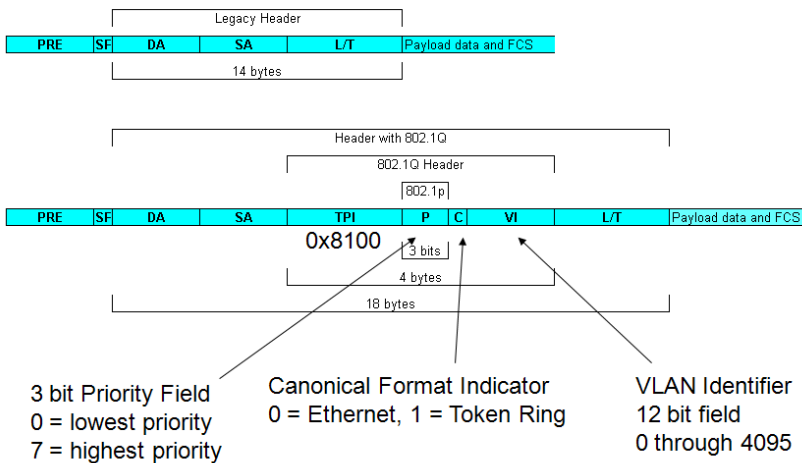


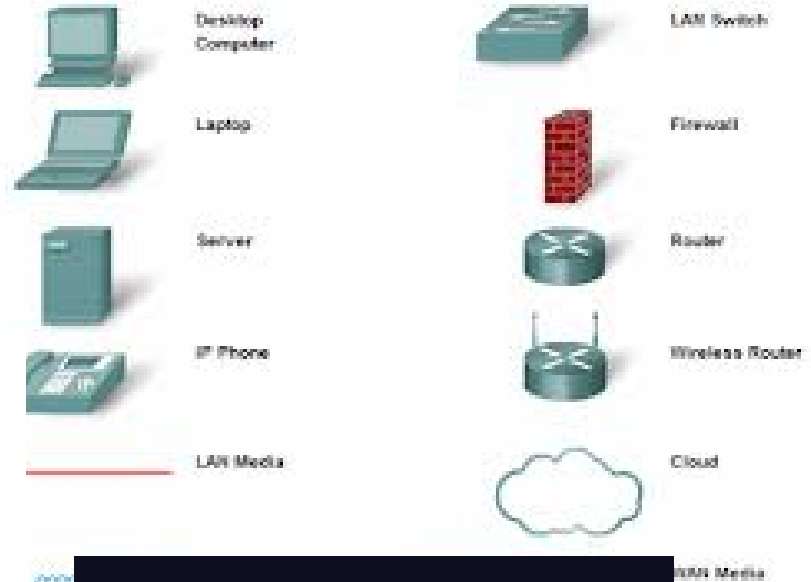
# Network Basics Training



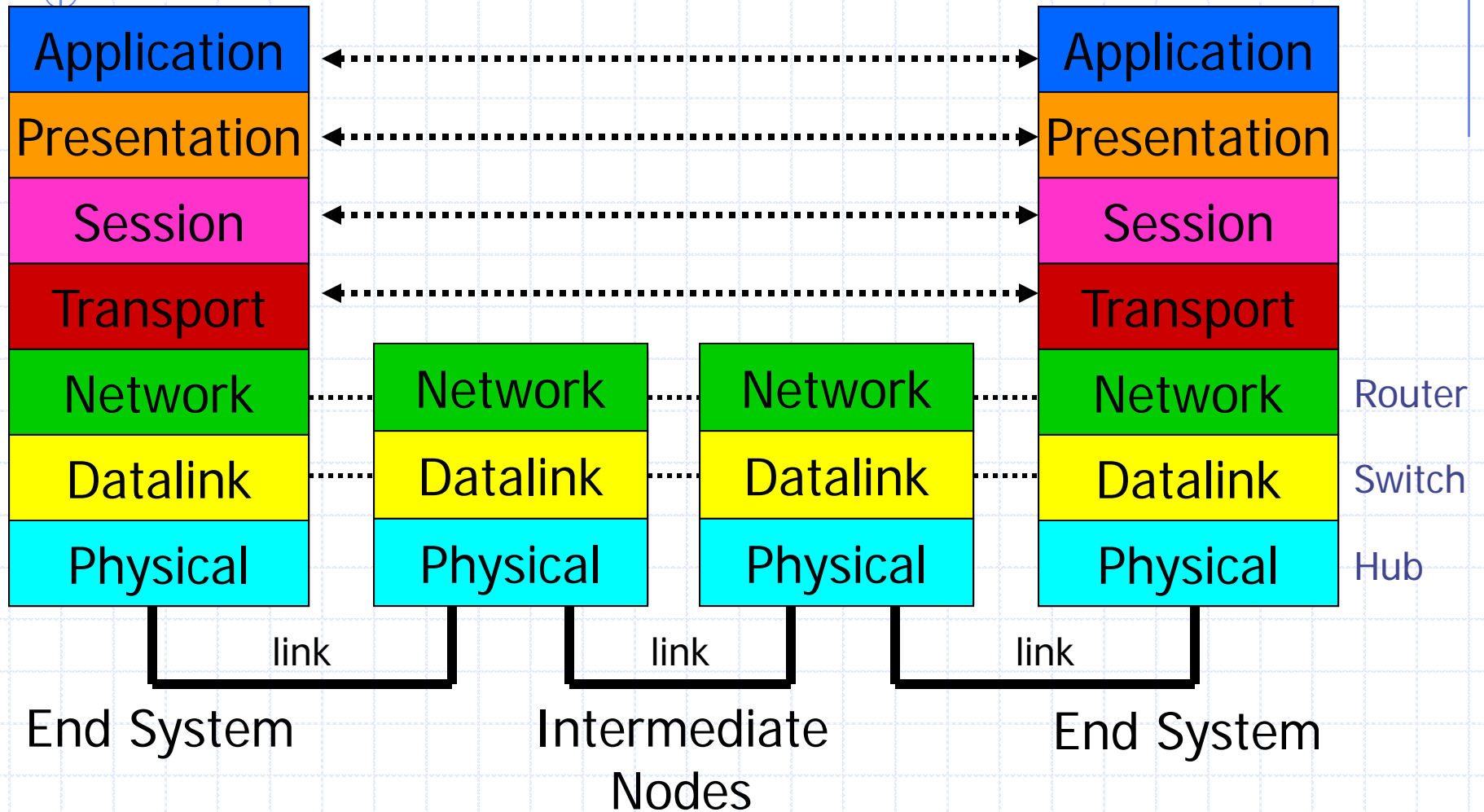
802.1Q,p



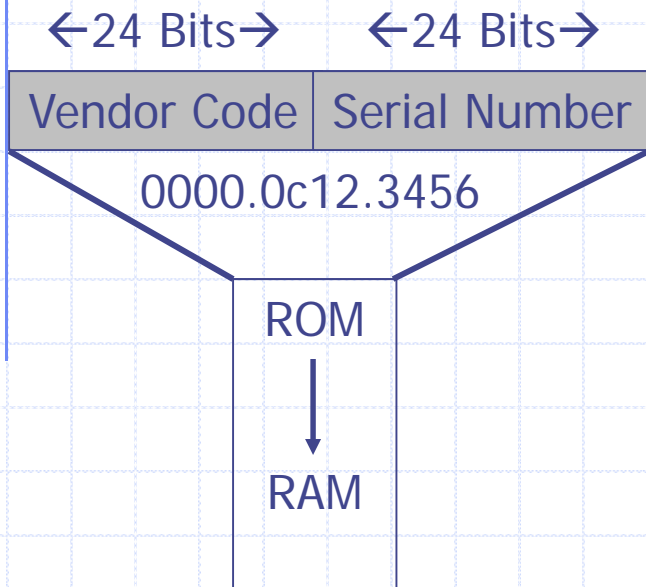
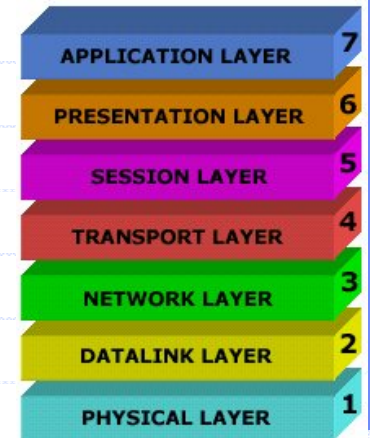
## Common Data Network Symbols



# ISO's OSI Reference Model



# MAC Address at Datalink Layer



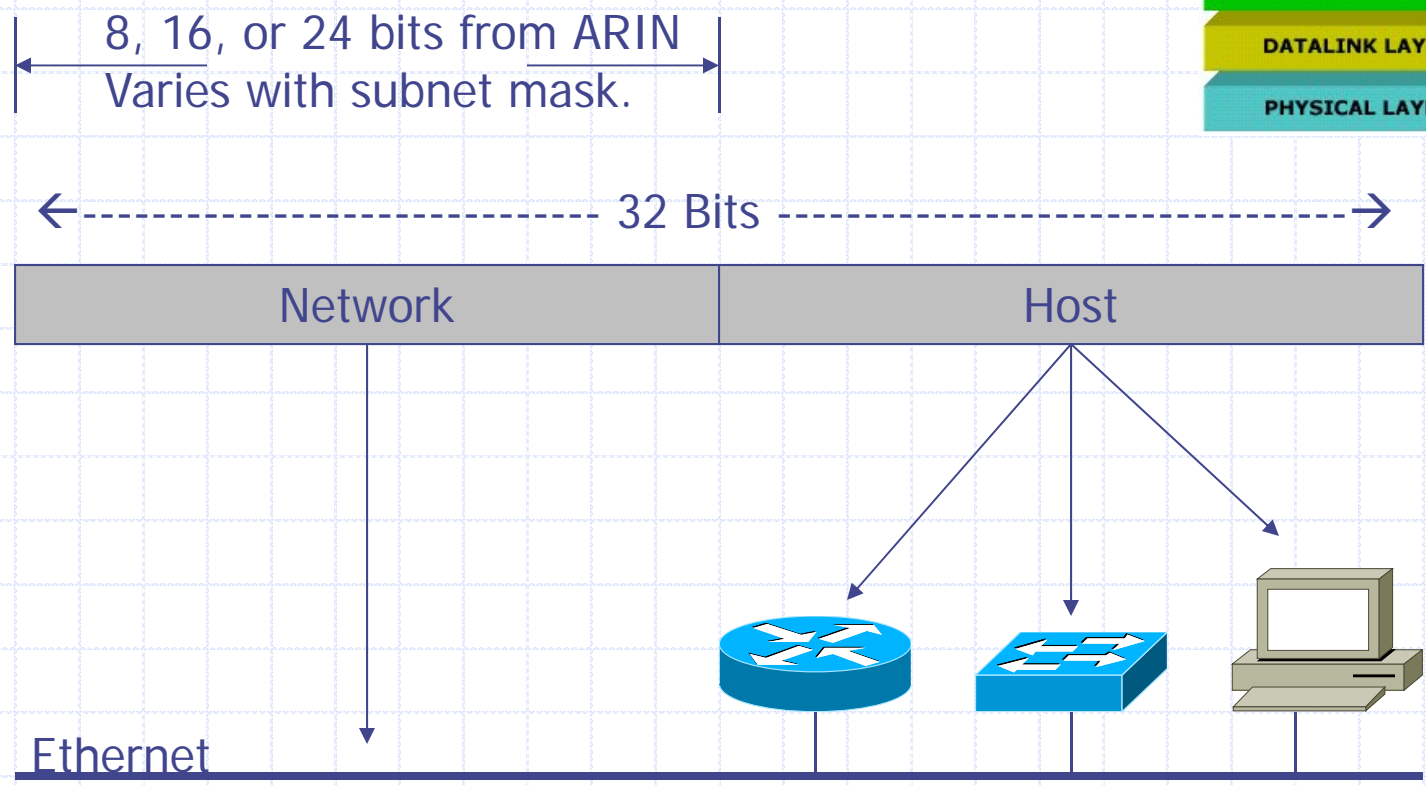
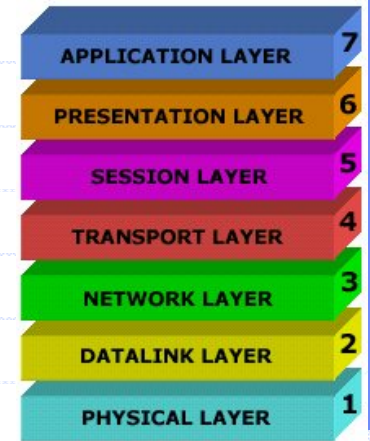
Could also be displayed as follows:

00-00-0c-12-34-56

00.00.0c.12.34.56

- The MAC address is burned into ROM on a network interface card
- DOS prompt> ipconfig /all
- IEEE assigned Vendor Code portion

# IP Address at Network Layer



- ARIN: American Registry for Internet Numbers

# Basics

The Subnet Mask represents how large an IP subnetwork is.  
 The first IP address within the subnet is called Network ID IP address.  
 The last IP address within the subnet is called Broadcast IP address.  
 We don't use the first and last IP address within the subnet by convention.

Powers of 2
$2^0 = 1$
$2^1 = 2$
$2^2 = 2 \times 2 = 4$
$2^3 = 2 \times 2 \times 2 = 8$
$2^4 = 2 \times 2 \times 2 \times 2 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$

10.12.16.0/30 10.12.16.1→3	4 Hosts and used for point to point links between routers
10.12.16.4/30 10.12.16.5→7	4 Hosts
10.12.16.8/30 10.12.16.9→11	4 Hosts
10.12.16.12/30 10.12.16.13→15	4 Hosts
10.12.16.16/28 10.12.16.17→31	16 Hosts and used for PMU subnets (/28 must start on a 16 host boundary)
10.12.16.32/30 10.12.16.33→35	4 Hosts (/30 must start on a 4 host boundary)
etc...	

Hosts	Mask	Mask	Binary	
1	/32	255.255.255.255	11111111.11111111.11111111.11111111	Known as a host mask
2	/31	255.255.255.254	11111111.11111111.11111111.11111110	
4	/30	255.255.255.252	11111111.11111111.11111111.11111100	
8	/29	255.255.255.248	11111111.11111111.11111111.11111000	
16	/28	255.255.255.240	11111111.11111111.11111111.11110000	
32	/27	255.255.255.224	11111111.11111111.11111111.11100000	
64	/26	255.255.255.192	11111111.11111111.11111111.11000000	
128	/25	255.255.255.128	11111111.11111111.11111111.10000000	
256	/24	255.255.255.0	11111111.11111111.11111111.00000000	
512	/23	255.255.254.0	11111111.11111111.11111110.00000000	
1024	/22	255.255.252.0	11111111.11111111.11111100.00000000	etc...

# IPv4 Addressing

**Network** part of address in **BLUE n**  
and **Host** part of address in **RED h**

Binary counting is necessary!

Classful Mask

0nnnnnnn.hhhhhhhh.hhhhhhhh.hhhhhhhh

Class A

255.0.0.0

10nnnnnnn.nnnnnnnn.hhhhhhhh.hhhhhhhh

Class B

255.255.0.0

110nnnnn.nnnnnnnn.nnnnnnnn.hhhhhhhh

Class C

255.255.255.0

1110xxxx.xxxxxxxx.xxxxxxxx.xxxxxxxx

Class D

Multicast Addresses

2 <sup>7</sup>	2 <sup>6</sup>	2 <sup>5</sup>	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
128	64	32	16	8	4	2	1

# IP Masks

How to determine the Network part of an address versus the Host part.

128	192	224	240	248	252	254	255
128	64	32	16	8	4	2	1

How many networks and hosts for any given mask and the IP 10.20.31.0?

Mask	Networks	Hosts
255.255.254.0		
255.255.255.0		
255.255.255.240		
255.255.255.252		

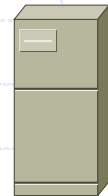
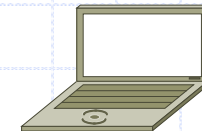
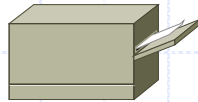


# IP Rules, ALL devices adhere to!

## The 3 Golden Parameters:

IP Address  
IP Mask  
Default Gateway (Router)

[Done by DHCP for laptops...  
Dynamic Host Config Protocol]

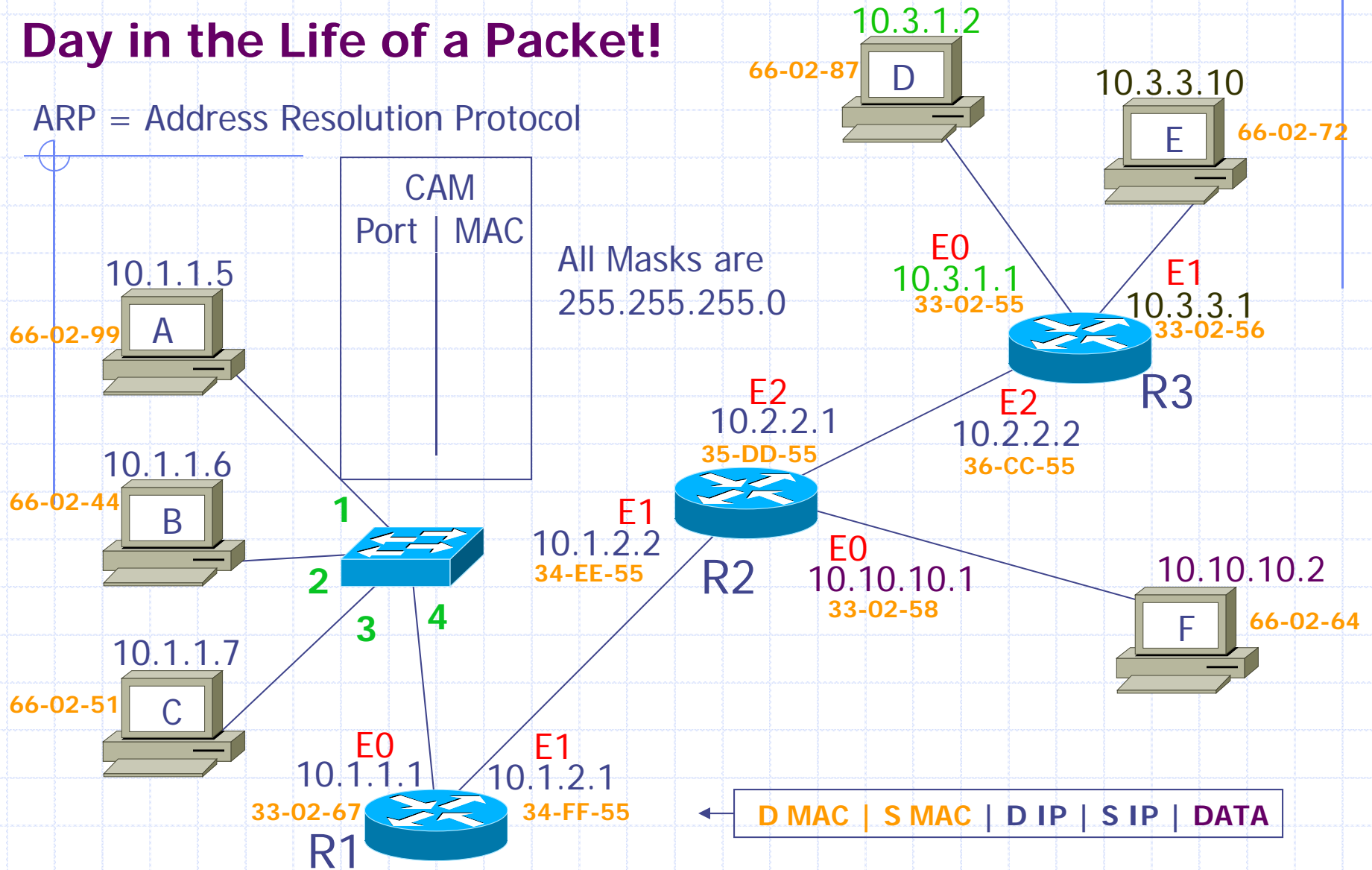


1. A device is told to communicate to an IP Address via user input.
2. The device compares the local IP Address with the destination IP Address using the IP Mask.
3. The device then chooses from the following options:
  - a. If the two network portions of the IP Address are the same, deliver the packet without assistance from the Default Gateway.
  - b. If the two network portions of the IP Address are different, send the packet to the Default Gateway, and let the router worry about delivery.



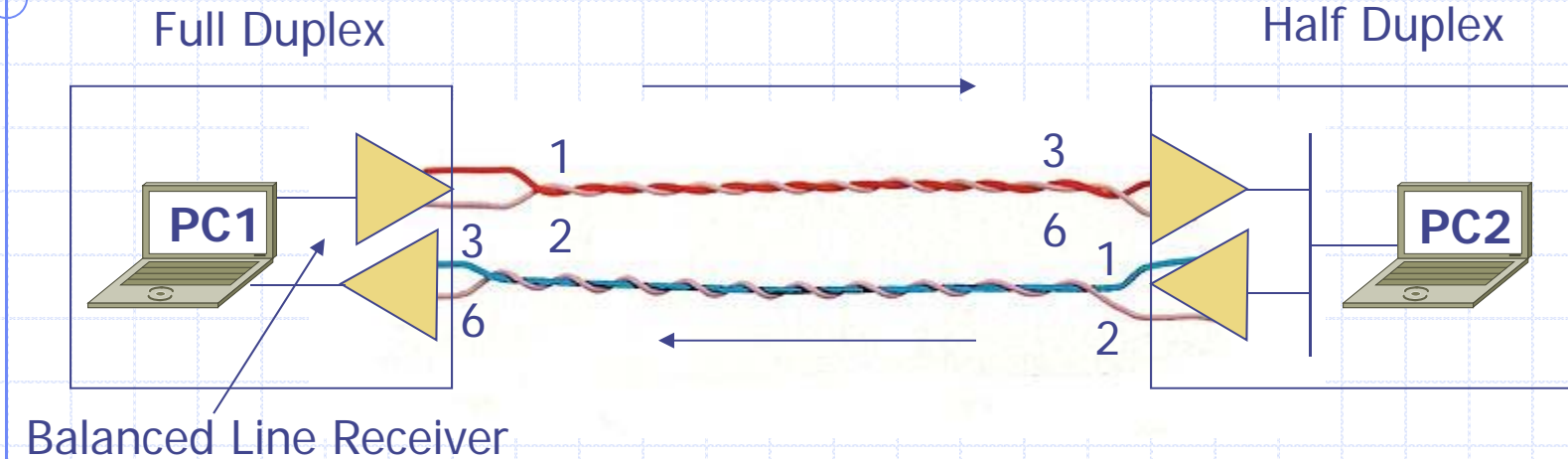
# Day in the Life of a Packet!

ARP = Address Resolution Protocol

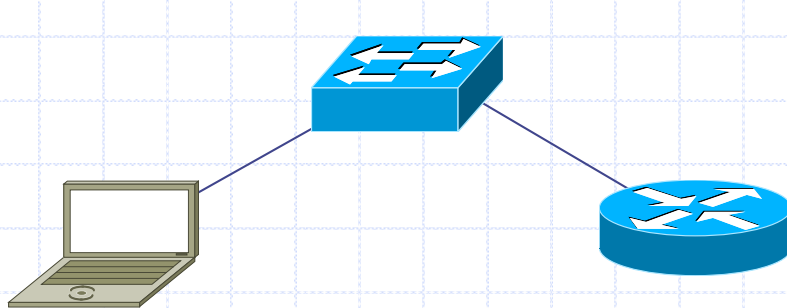


The default gateway is always a router's interface on the same subnet as the device.

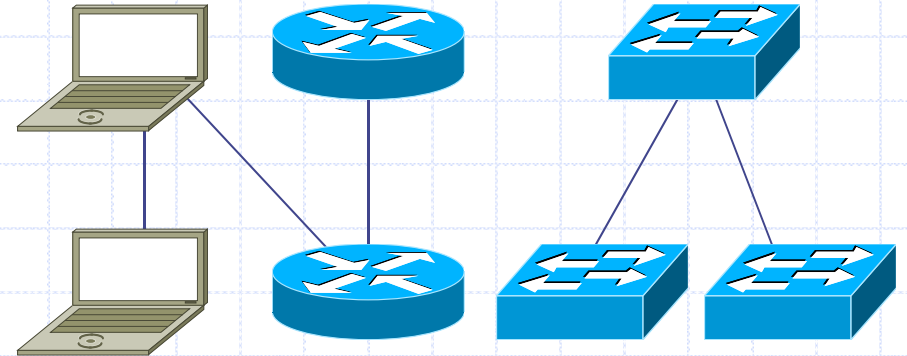
# Half/Full Duplex & Cable Issues!



Use a straight through cable

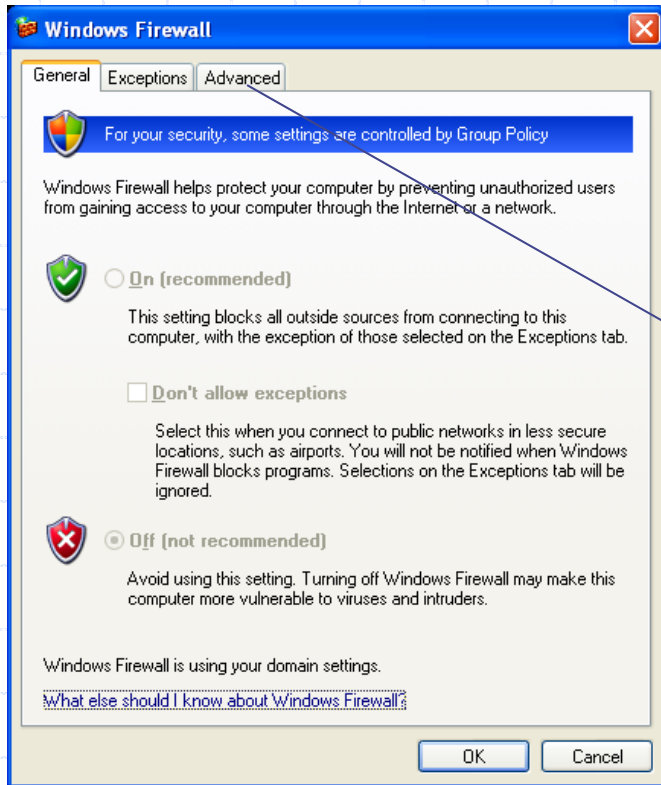


Use a **cross-over** cable

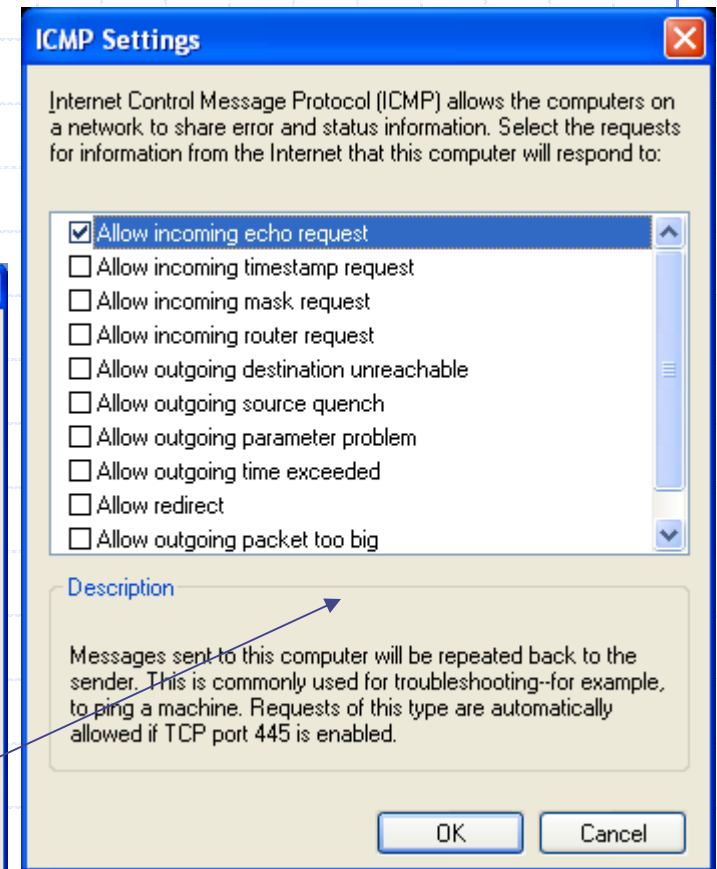
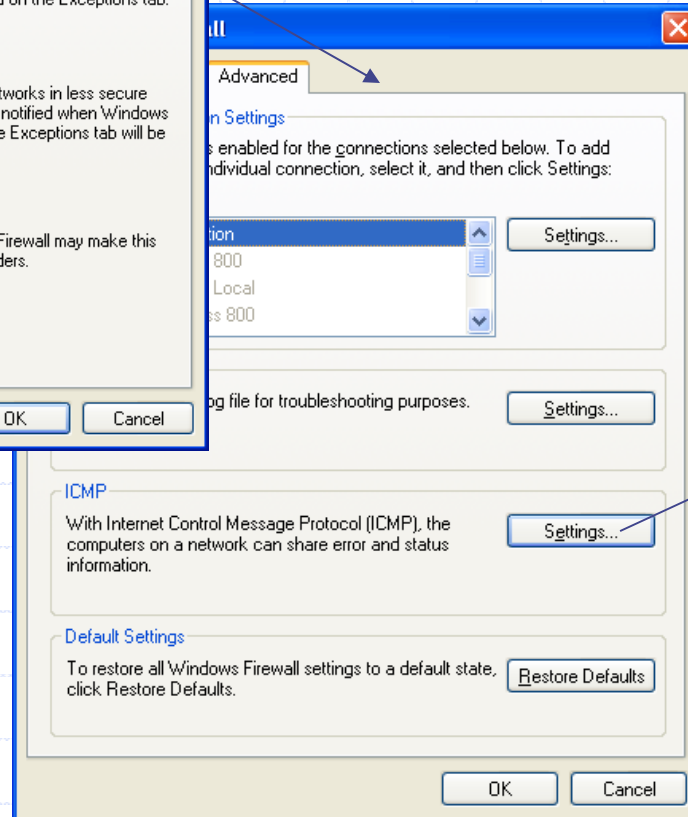


IP Server

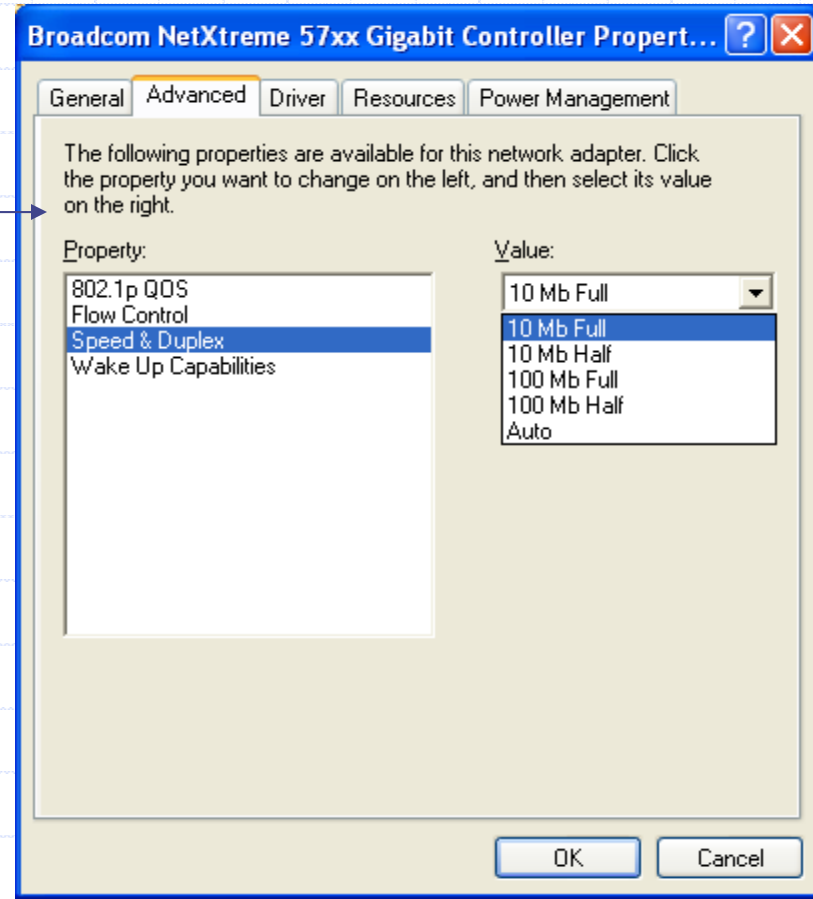
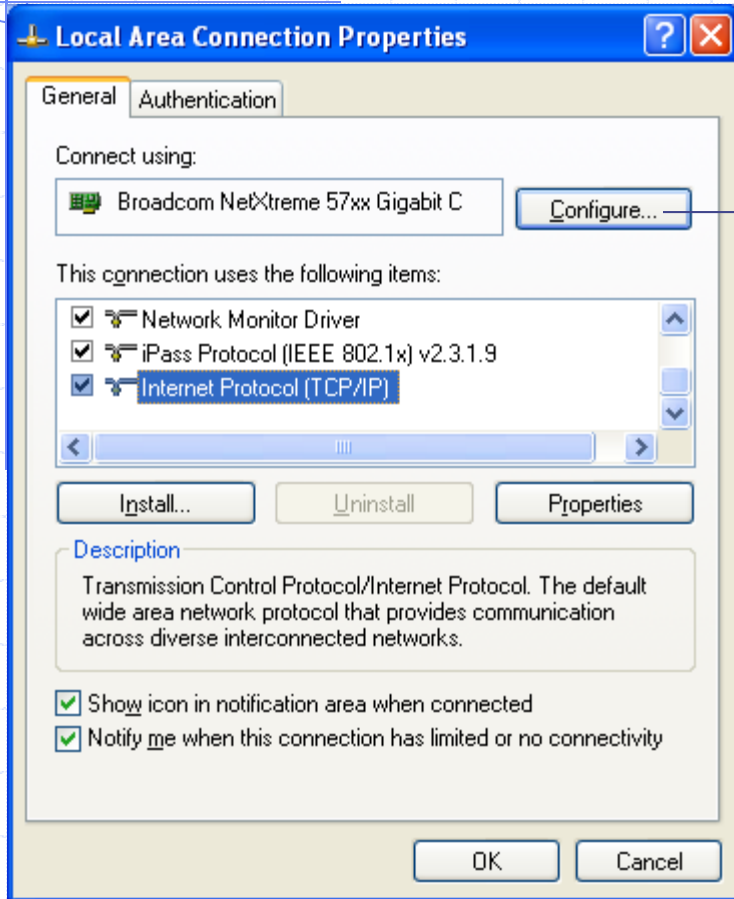
# Is Your PC Firewall ON?



Start  
Control Panel  
Windows Firewall



# Checking the PC's Speed & Duplex Settings



# How is my PC set up? DOS> ipconfig /all

```
C:\ Command Prompt
C:\Documents and Settings\jna1155>ipconfig/all

Windows IP Configuration

    Host Name . . . . . : L4001065
    Primary Dns Suffix . . . . . : bud.bpa.gov
    Node Type . . . . . : Unknown
    IP Routing Enabled. . . . . : Yes
    WINS Proxy Enabled. . . . . : Yes
    DNS Suffix Search List. . . . . : fin.bpa.gov
                                        bpa.gov
                                        bud.bpa.gov

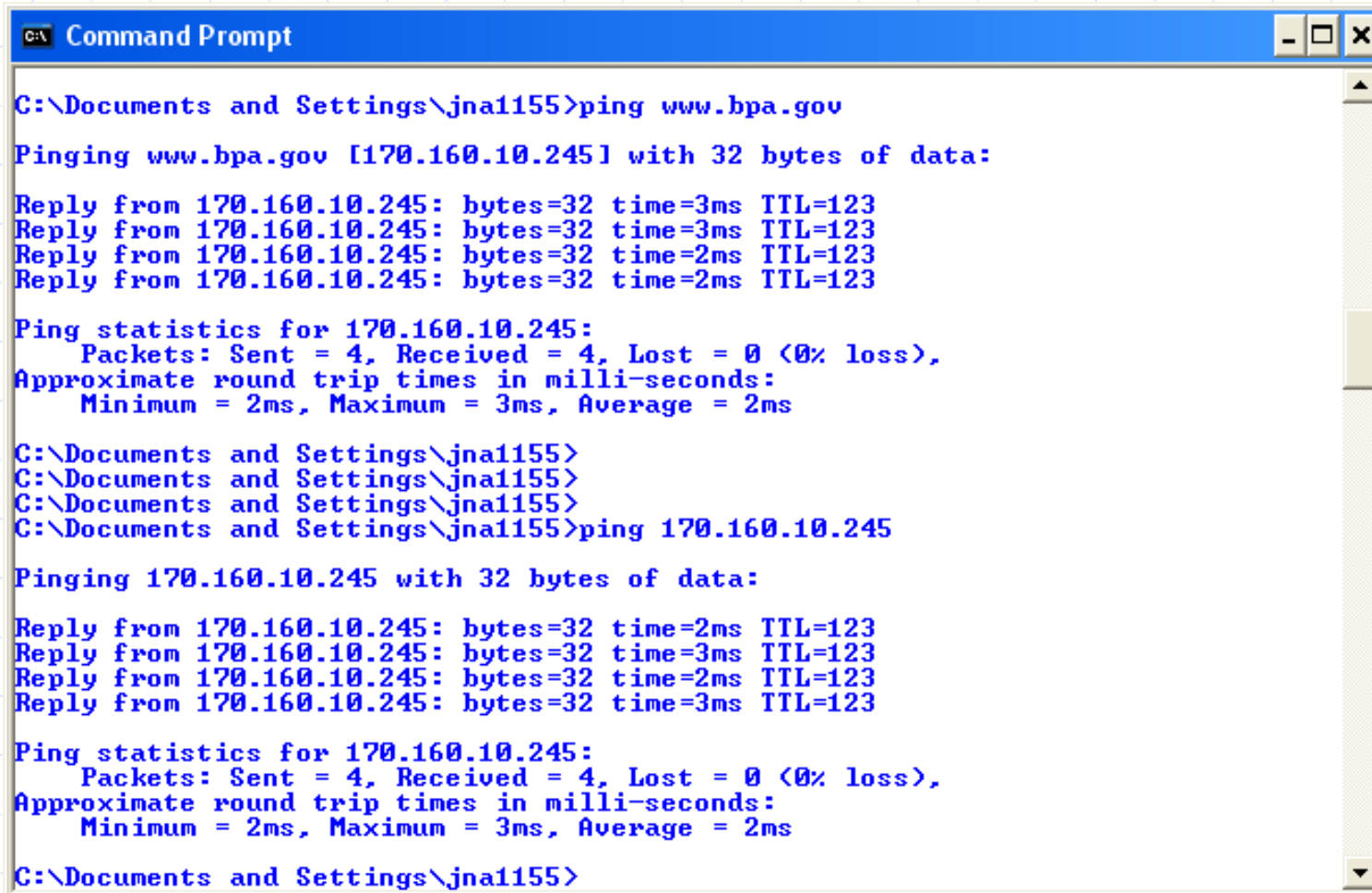
Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . : bud.bpa.gov
    Description . . . . . : Broadcom NetXtreme 57xx Gigabit Cont
roller
    Physical Address. . . . . : 00-15-C5-BC-1C-9A
    Dhcp Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IP Address. . . . . : 10.38.6.28
    Subnet Mask . . . . . : 255.255.252.0
    Default Gateway . . . . . : 10.38.4.1
    DHCP Server . . . . . : 10.33.255.66
    DNS Servers . . . . . : 10.3.8.241
                            10.33.138.211
                            10.99.8.241
    Primary WINS Server . . . . . : 10.33.255.66
    Secondary WINS Server . . . . . : 10.1.255.66
                            10.99.8.253
    NetBIOS over Tcpip. . . . . : Disabled
    Lease Obtained. . . . . : Thursday, August 06, 2009 3:08:06 AM

    Lease Expires . . . . . : Monday, August 17, 2009 3:08:06 AM

C:\Documents and Settings\jna1155>
```

# Testing Connectivity with...Ping and Tracert



```
C:\> Command Prompt

C:\Documents and Settings\jna1155>ping www.bpa.gov

Pinging www.bpa.gov [170.160.10.245] with 32 bytes of data:

Reply from 170.160.10.245: bytes=32 time=3ms TTL=123
Reply from 170.160.10.245: bytes=32 time=3ms TTL=123
Reply from 170.160.10.245: bytes=32 time=2ms TTL=123
Reply from 170.160.10.245: bytes=32 time=2ms TTL=123

Ping statistics for 170.160.10.245:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 3ms, Average = 2ms

C:\Documents and Settings\jna1155>
C:\Documents and Settings\jna1155>
C:\Documents and Settings\jna1155>
C:\Documents and Settings\jna1155>ping 170.160.10.245

Pinging 170.160.10.245 with 32 bytes of data:

Reply from 170.160.10.245: bytes=32 time=2ms TTL=123
Reply from 170.160.10.245: bytes=32 time=3ms TTL=123
Reply from 170.160.10.245: bytes=32 time=2ms TTL=123
Reply from 170.160.10.245: bytes=32 time=3ms TTL=123

Ping statistics for 170.160.10.245:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 3ms, Average = 2ms

C:\Documents and Settings\jna1155>
```

# Testing Connectivity with...Ping and Tracert

```
C:\> Command Prompt

C:\Documents and Settings\jna1155>tracert 170.160.10.245

Tracing route to pwww.bpa.gov [170.160.10.245]
over a maximum of 30 hops:

  0  <1 ms    <1 ms    <1 ms    10.38.4.1
  1  <1 ms    <1 ms    <1 ms    10.38.251.1
  2  2 ms     2 ms     2 ms     10.0.251.1
  3  3 ms     2 ms     2 ms     dam-8.bpa.gov [170.160.8.3]
  4  3 ms     2 ms     2 ms     pwww.bpa.gov [170.160.10.245]

Trace complete.

C:\Documents and Settings\jna1155>tracert www.google.com

Tracing route to www.l.google.com [74.125.53.103]
over a maximum of 30 hops:

  0  <1 ms    <1 ms    <1 ms    10.38.4.1
  1  <1 ms    <1 ms    <1 ms    10.38.251.1
  2  2 ms     2 ms     2 ms     10.0.251.1
  3  3 ms     2 ms     2 ms     dam-8.bpa.gov [170.160.8.3]
  4  163 ms   4 ms     291 ms   170.160.9.2
  5  4 ms     3 ms     3 ms     s4-1-1.gw03.ptld.eli.net [216.190.151.209]
  6  4 ms     4 ms     4 ms     tg9-1.cr02.ptleorte.integra.net [209.63.114.157]

  7  *        4 ms     5 ms     ge7-0.br01.ptldorpb.integra.net [209.63.98.34]
  8  4 ms     4 ms     5 ms     bb01.pdx01.google.com [216.190.0.18]
  9  11 ms    7 ms     7 ms     209.85.250.146
 10  *        9 ms     7 ms     216.239.48.167
 11  11 ms    14 ms    18 ms    72.14.232.70
 12  8 ms     6 ms     10 ms    pw-in-f103.google.com [74.125.53.103]

Trace complete.

C:\Documents and Settings\jna1155>_
```



# Layer De-capsulation A TCP/IP Example

