TCP/IP Training

INTRODUCTORY FOR FIRE ALARM TECHNICIANS

Goals of this Training

- Understand how IP addresses are assigned
- Field application and installation.
- Learn about IP trouble shooting tools.
- Understand the information on the network information card.

TCP/IP Suite of Protocols

- A protocol is a set of rules for communicating.
- Network protocols are concerned with sending messages between hosts.
- IP – Internet Protocol.
- TCP – Transaction Control Protocol.
- The suite also includes HTTP, FTP, DHCP, DNS, SMTP and many others.

IP Addresses

- IP addresses are routable. Each device does not need to know where all other devices are.
- To make routing manageable, IP addresses are divided into a network address and a host address.

Binary Math

- Computers only understand ones and zero.
- An IP address is 32 bit number.
- 32 bits allows for values between 0 - 4,294,796,296. But many of these are reserved for special uses.
- For convenience IP addresses are divided into 4 octets.
- An octet is 8 bits or one byte.
- 8 bits allow for numbers from 0 to 255.
- IP addresses are written as 4 octets separated by dots 255.255.255.255
- In binary an IP address would look like this 11111111.11111111.1111111.11111111

Boolean “AND” Truth Table

Input 1	Input 2	Result
0	0	0
0	1	0
1	0	0
1	1	1

Masking

- Masking filters out unneeded bits by performing a Boolean “AND” operation between an input and the mask.

Input	1	0	1	0	1	0	1	0
Mask	1	1	1	1	0	0	0	0
Output	1	0	1	0	0	0	0	0

Specifying the network address and host address

- IP address is 192.168.3.5 and subnet is 255.255.255.0
- Subnet converts to 11111111.11111111.11111111.00000000
- Network id is 192.168.3.0
- Host id is 0.0.0.5
- Another way to specify the mask is with CIDR notation as 192.168.3.5/24

Address Classes

- Class A – First octet has 0 as its first bit. Class A allowed for 126 networks of 16,277,214 hosts each.
- Class B – First octet has 10 as first two bits of the first octet. Class B allowed for 16,384 networks of 65,534 hosts each.
- Class C – First octet has 110 as first three bits of first octet. Class B allowed for 2,097,152 networks of 254 hosts each.

Private Ranges

- Not Routed
- Used on private intranets.
- One Class A Block – 10.x.x.x
- One Class B Block – 172.16.x.x
- 256 Class C Blocks – 192.168.x.x

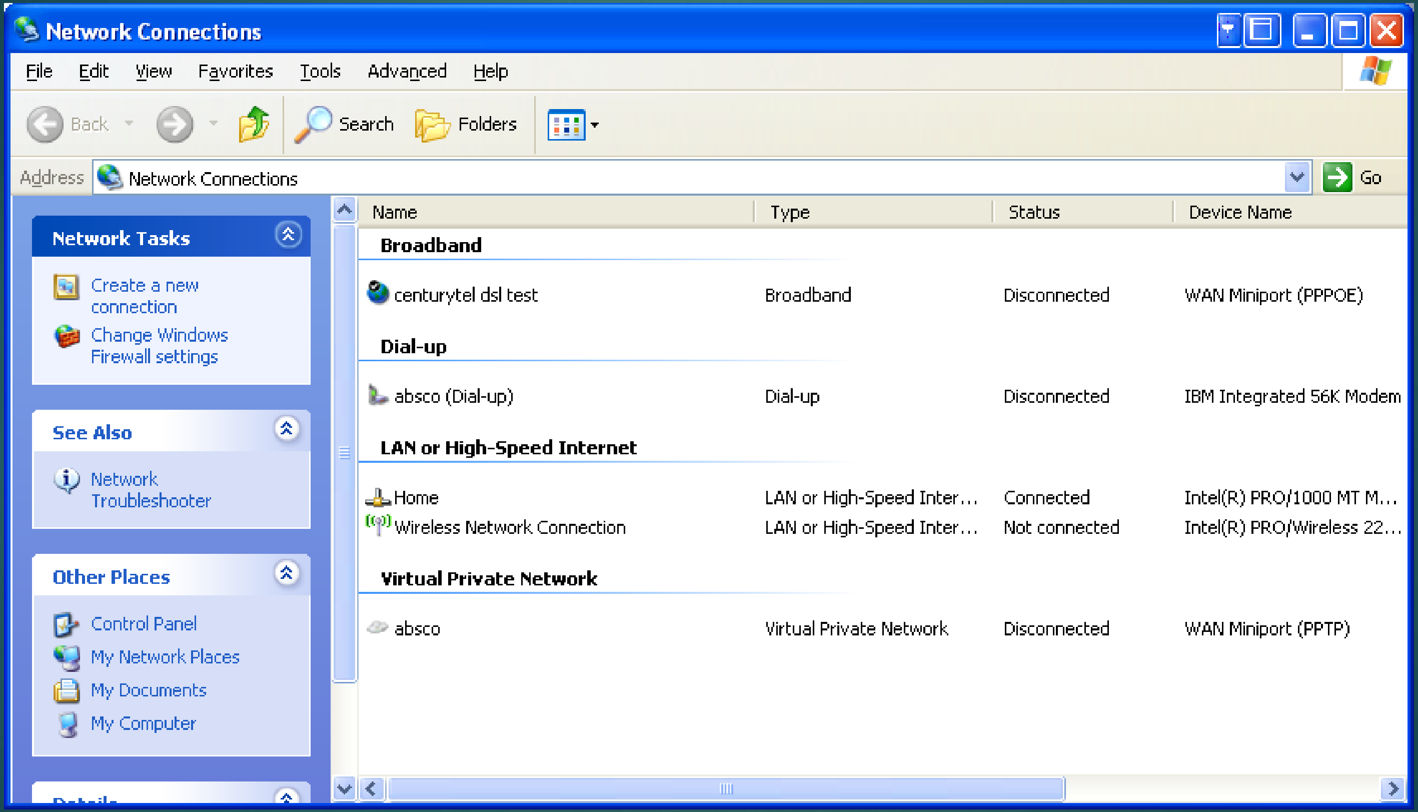
Routers no longer use Classes

- Class scheme was causing IP addresses to be used up too quickly.
- Routing tables were too large and inefficient.
- Class system was replaced by classless system that looks like subnetting.
- Classless Inter Domain Routing (CIDR) notation was introduced which uses a /n notation to specify how many bits are the network address.

How does a host get an IP address?

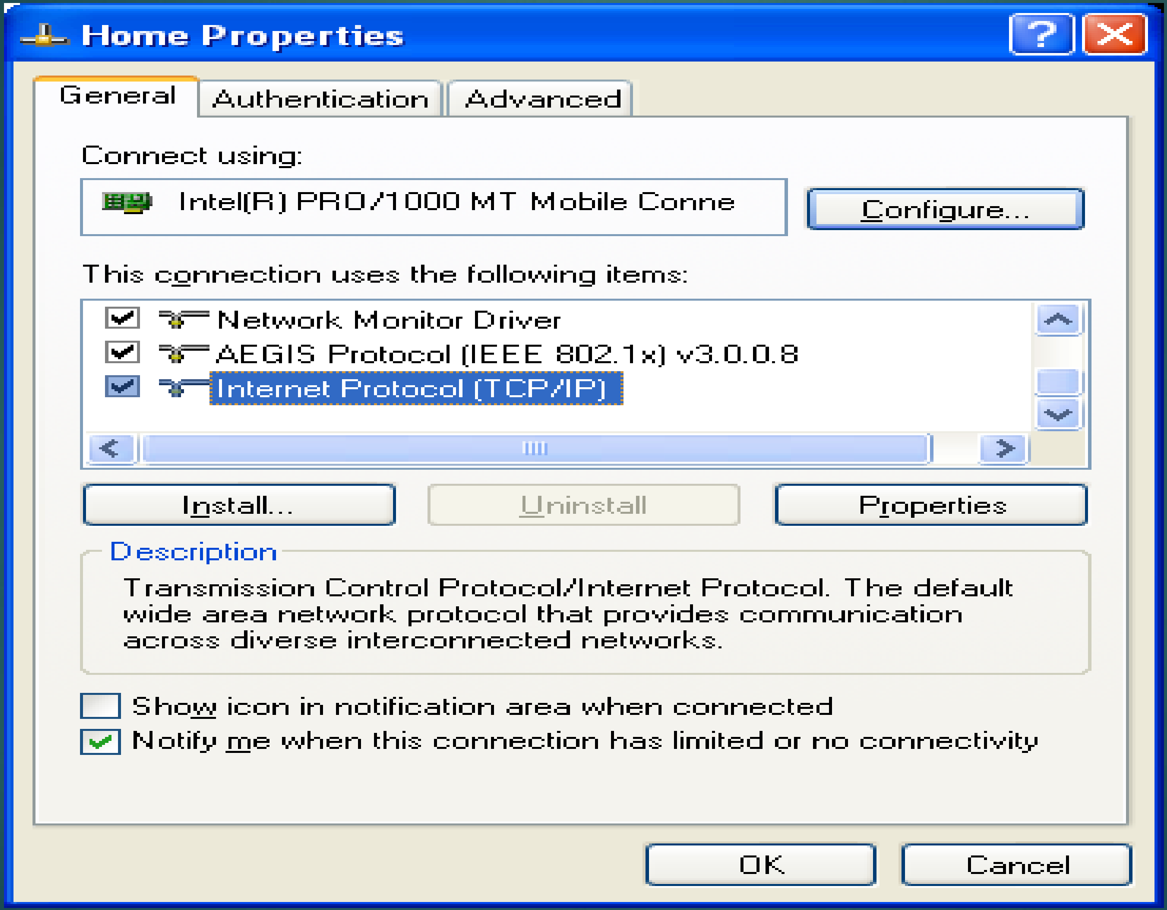
- Static Assignment – Specify the IP address and subnet mask.
- DHCP/BOOTP – Assigned by a DHCP/BOOTP server. DHCP evolved from BOOTP and the protocols are compatible.
- APIPA – 169.224.xxx.xxx – This protocol assigns an address if dynamic addressing is set and no DHCP/BOOTP server is found. An APIPA address is almost never what you want.

Windows Configuration



Name	Type	Status	Device Name
Broadband			
centurytel dsl test	Broadband	Disconnected	WAN Miniport (PPPOE)
Dial-up			
absco (Dial-up)	Dial-up	Disconnected	IBM Integrated 56K Modem
LAN or High-Speed Internet			
Home	LAN or High-Speed Inter…	Connected	Intel(R) PRO/1000 MT M…
Wireless Network Connection	LAN or High-Speed Inter…	Not connected	Intel(R) PRO/Wireless 22…
Virtual Private Network			
absco	Virtual Private Network	Disconnected	WAN Miniport (PPTP)

Windows Configuration



Connect using:

Intel(R) PRO/1000 MT Mobile Conne

This connection uses the following items:

- ☑ Network Monitor Driver
- ☑ AEGIS Protocol (IEEE 802.1x) v3.0.0.8
- ☑ Internet Protocol (TCP/IP)

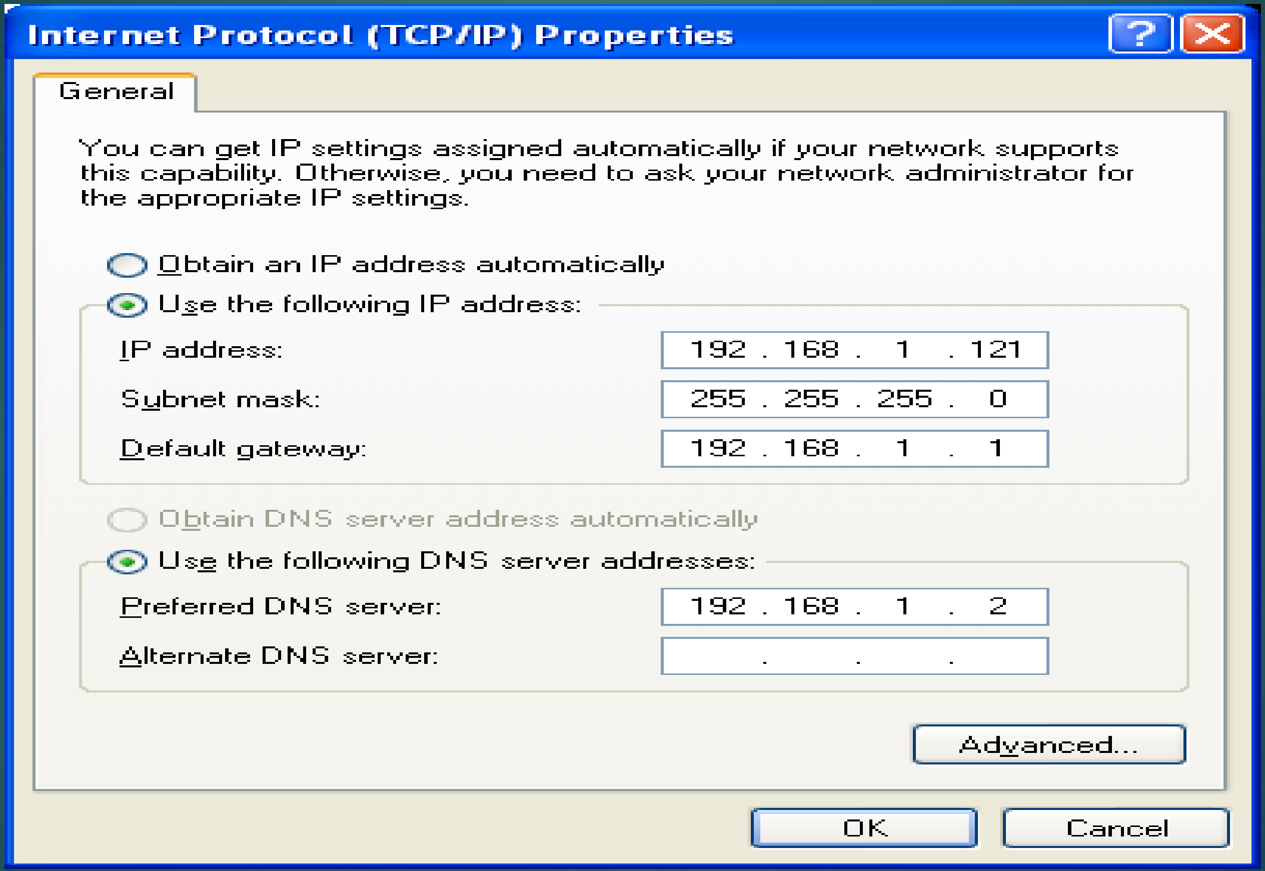
Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

☐ Show icon in notification area when connected

☑ Notify me when this connection has limited or no connectivity

Windows Configuration



Internet Protocol (TCP/IP) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

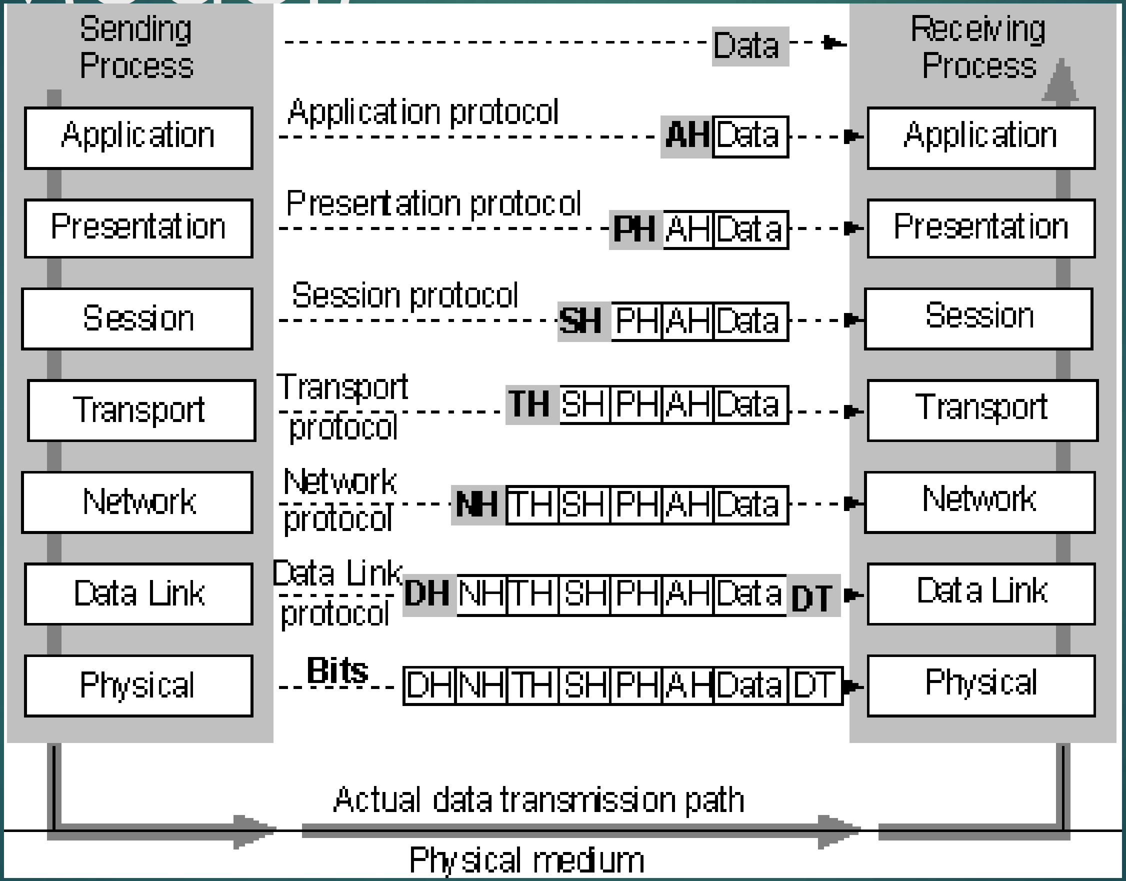
IP address:	192 . 168 . 1 . 121
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	192 . 168 . 1 . 1

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

Preferred DNS server:	192 . 168 . 1 . 2
Alternate DNS server:	. . .

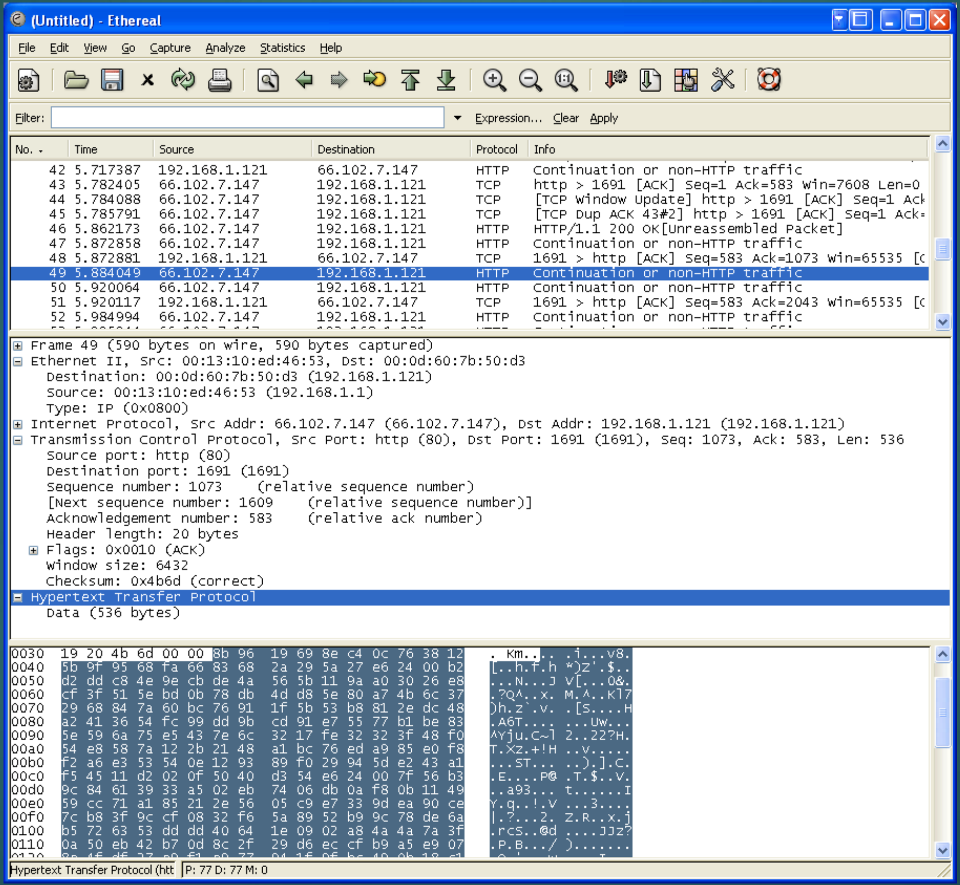
Open System Interconnect Reference Model (OSI Model)



TCP/IP and the OSI Model

#	Layer	Role	Protocol
1	Physical	Send bit over wire	
2	Data Link	Physical addressing	Ethernet
3	Network	Logical Addressing	IP and ICMP
4	Transport	Process level addressing	TCP and UDP
5	Session	Session management	Sockets
6	Presentation	Compression and encryption.	SSL
7	Application	User applications	DHCP, DNS, SMTP, HTTP

Sample HTTP Message



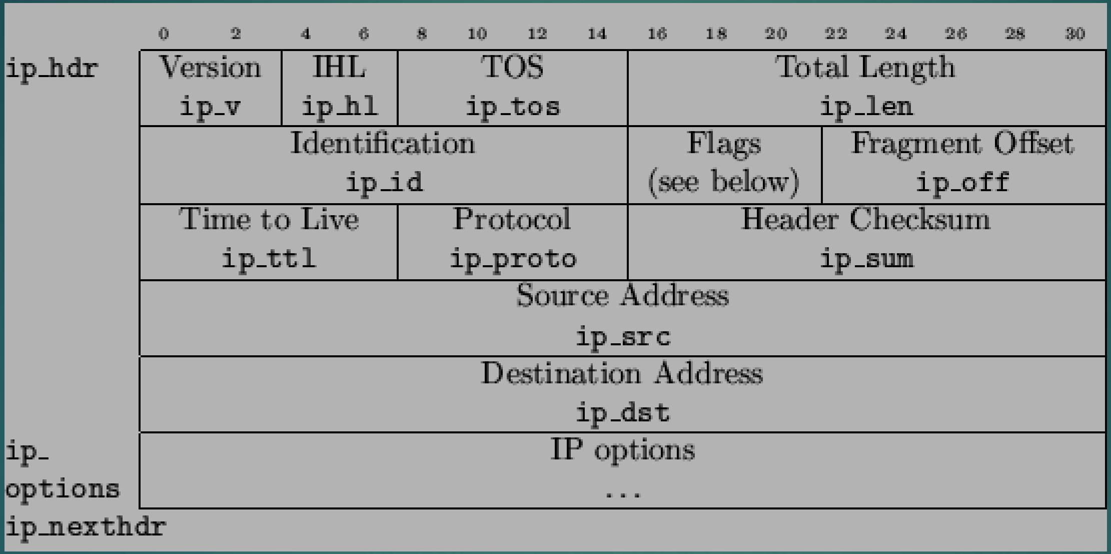
```
No.  Time       Source          Destination     Protocol Info
  42 5.717387   192.168.1.121   66.102.7.147    HTTP     Continuation or non-HTTP traffic
  43 5.782405   66.102.7.147    192.168.1.121   TCP      http > 1691 [ACK] Seq=1 Ack=583 Win=7608 Len=0
  44 5.784088   66.102.7.147    192.168.1.121   TCP      [TCP Window Update] http > 1691 [ACK] Seq=1 Ack
  45 5.785791   66.102.7.147    192.168.1.121   TCP      [TCP Dup ACK 43#2] http > 1691 [ACK] Seq=1 Ack=
  46 5.862173   66.102.7.147    192.168.1.121   HTTP     HTTP/1.1 200 OK[Unreassembled Packet]
  47 5.872858   66.102.7.147    192.168.1.121   HTTP     Continuation or non-HTTP traffic
  48 5.872881   192.168.1.121   66.102.7.147    TCP      1691 > http [ACK] Seq=583 Ack=1073 Win=65535 [C
  49 5.884049   66.102.7.147    192.168.1.121   HTTP     Continuation or non-HTTP traffic
  50 5.920064   66.102.7.147    192.168.1.121   HTTP     Continuation or non-HTTP traffic
  51 5.920117   192.168.1.121   66.102.7.147    TCP      1691 > http [ACK] Seq=583 Ack=2043 Win=65535 [C
  52 5.984994   66.102.7.147    192.168.1.121   HTTP     Continuation or non-HTTP traffic
```

```
⊞ Frame 49 (590 bytes on wire, 590 bytes captured)
⊟ Ethernet II, Src: 00:13:10:ed:46:53, Dst: 00:0d:60:7b:50:d3
    Destination: 00:0d:60:7b:50:d3 (192.168.1.121)
    Source: 00:13:10:ed:46:53 (192.168.1.1)
    Type: IP (0x0800)
⊞ Internet Protocol, Src Addr: 66.102.7.147 (66.102.7.147), Dst Addr: 192.168.1.121 (192.168.1.121)
⊟ Transmission Control Protocol, Src Port: http (80), Dst Port: 1691 (1691), Seq: 1073, Ack: 583, Len: 536
    Source port: http (80)
    Destination port: 1691 (1691)
    Sequence number: 1073    (relative sequence number)
    [Next sequence number: 1609    (relative sequence number)]
    Acknowledgement number: 583    (relative ack number)
    Header length: 20 bytes
  ⊞ Flags: 0x0010 (ACK)
    Window size: 6432
    Checksum: 0x4b6d (correct)
⊟ Hypertext Transfer Protocol
    Data (536 bytes)
```

```
0030  19 20 4b 6d 00 00 8b 96  19 69 8e c4 0c 76 38 12   . Km.... .i...v8.
0040  5b 9f 95 68 fa 66 83 68  2a 29 5a 27 e6 24 00 b2   [..h.f.h *)Z'.$..
0050  d2 dd c8 4e 9e cb de 4a  56 5b 11 9a a0 30 26 e8   ...N...J V[...0&.
0060  cf 3f 51 5e bd 0b 78 db  4d d8 5e 80 a7 4b 6c 37   .?Q^..x. M.^..Kl7
0070  29 68 84 7a 60 bc 76 91  1f 5b 53 b8 81 2e dc 48   )h.z`.v. .[S....H
0080  a2 41 36 54 fc 99 dd 9b  cd 91 e7 55 77 b1 be 83   .A6T.... ...Uw...
0090  5e 59 6a 75 e5 43 7e 6c  32 17 fe 32 32 3f 48 f0   ^Yju.C~l 2..22?H.
00a0  54 e8 58 7a 12 2b 21 48  a1 bc 76 ed a9 85 e0 f8   T.Xz.+!H ..v.....
00b0  f2 a6 e3 53 54 0e 12 93  89 f0 29 94 5d e2 43 a1   ...ST... ..).].C.
00c0  f5 45 11 d2 02 0f 50 40  d3 54 e6 24 00 7f 56 b3   .E....P@ .T.$..V.
00d0  9c 84 61 39 33 a5 02 eb  74 06 db 0a f8 0b 11 49   ..a93... t......I
00e0  59 cc 71 a1 85 21 2e 56  05 c9 e7 33 9d ea 90 ce   Y.q..!.V ...3....
00f0  7c b8 3f 9c cf 08 32 f6  5a 89 52 b9 9c 78 de 6a   |.?...2. Z.R..x.j
0100  b5 72 63 53 dd dd 40 64  1e 09 02 a8 4a 4a 7a 3f   .rcS..@d ....JJz?
0110  0a 50 eb 42 b7 0d 8c 2f  29 d6 ec cf b9 a5 e9 07   .P.B.../ ).......
```

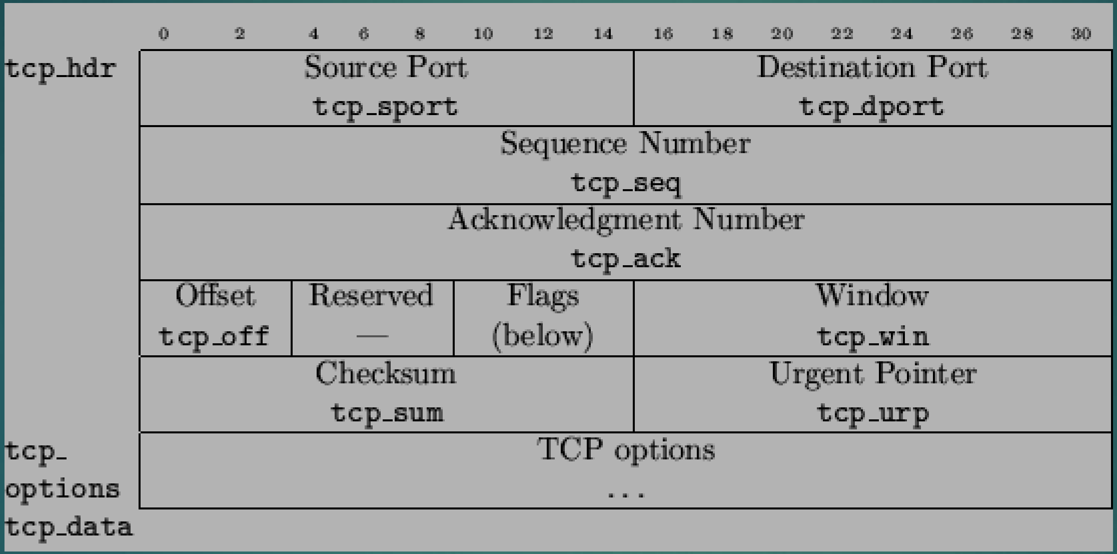
Hypertext Transfer Protocol (htt | P: 77 D: 77 M: 0

IP Header



<table>
<tr><th></th><th>0</th><th>2</th><th>4</th><th>6</th><th>8</th><th>10</th><th>12</th><th>14</th><th>16</th><th>18</th><th>20</th><th>22</th><th>24</th><th>26</th><th>28</th><th>30</th></tr>
<tr><td>ip_hdr</td><td colspan="2">Version
ip_v</td><td colspan="2">IHL
ip_hl</td><td colspan="4">TOS
ip_tos</td><td colspan="8">Total Length
ip_len</td></tr>
<tr><td></td><td colspan="8">Identification
ip_id</td><td colspan="3">Flags
(see below)</td><td colspan="5">Fragment Offset
ip_off</td></tr>
<tr><td></td><td colspan="4">Time to Live
ip_ttl</td><td colspan="4">Protocol
ip_proto</td><td colspan="8">Header Checksum
ip_sum</td></tr>
<tr><td></td><td colspan="16">Source Address
ip_src</td></tr>
<tr><td></td><td colspan="16">Destination Address
ip_dst</td></tr>
<tr><td>ip_
options</td><td colspan="16">IP options
...</td></tr>
<tr><td>ip_nexthdr</td><td colspan="16"></td></tr>
</table>

TCP Header



0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

tcp_hdr	Source Port tcp_sport			Destination Port tcp_dport
	Sequence Number tcp_seq			
	Acknowledgment Number tcp_ack			
	Offset tcp_off	Reserved —	Flags (below)	Window tcp_win
	Checksum tcp_sum			Urgent Pointer tcp_urp
tcp_ options	TCP options . . .			
tcp_data				

Routing

- If the destination network doesn't match your hosts network then the message is sent to the default gateway (router).
- Routers have routing tables that specify next hop in routing each range of IP addresses.
- Your local host also has a routing table. At a minimum it specifies a default gateway (router).

TCP and UDP use ports to direct traffic to applications

- Well known ports below 1024 are reserved for common applications.
- Some well known ports are 25 for SMTP, 80 for HTTP, 443 for HTTP.
- Reserve Ports are for specific application and are reserved with IANA.
- Reserved ports include 1433 for SQL server and 2025 for Velocity.
- Dynamic of ephemeral port are also used.

Ethernet

- Most common carrier of IP data.
- Each network card has a unique MAC Address.
- Address Resolution Protocol. ARP maps IP addresses to MAC addresses (also called physical or ethernet addresses).

Routing And Switching Hardware

- HUB – Traffic is broadcast to all listeners. Noise for one is noise for all.
- Switch – Use MAC address to send data directly to the destination machine.
- Router – Routes traffic to another network
- Firewall – Similar to a router, but filters messages.

DNS

- It is easier for a person to remember a host name instead of an IP address.
- Domain Name Service (DNS) resolves host names to IP addresses.

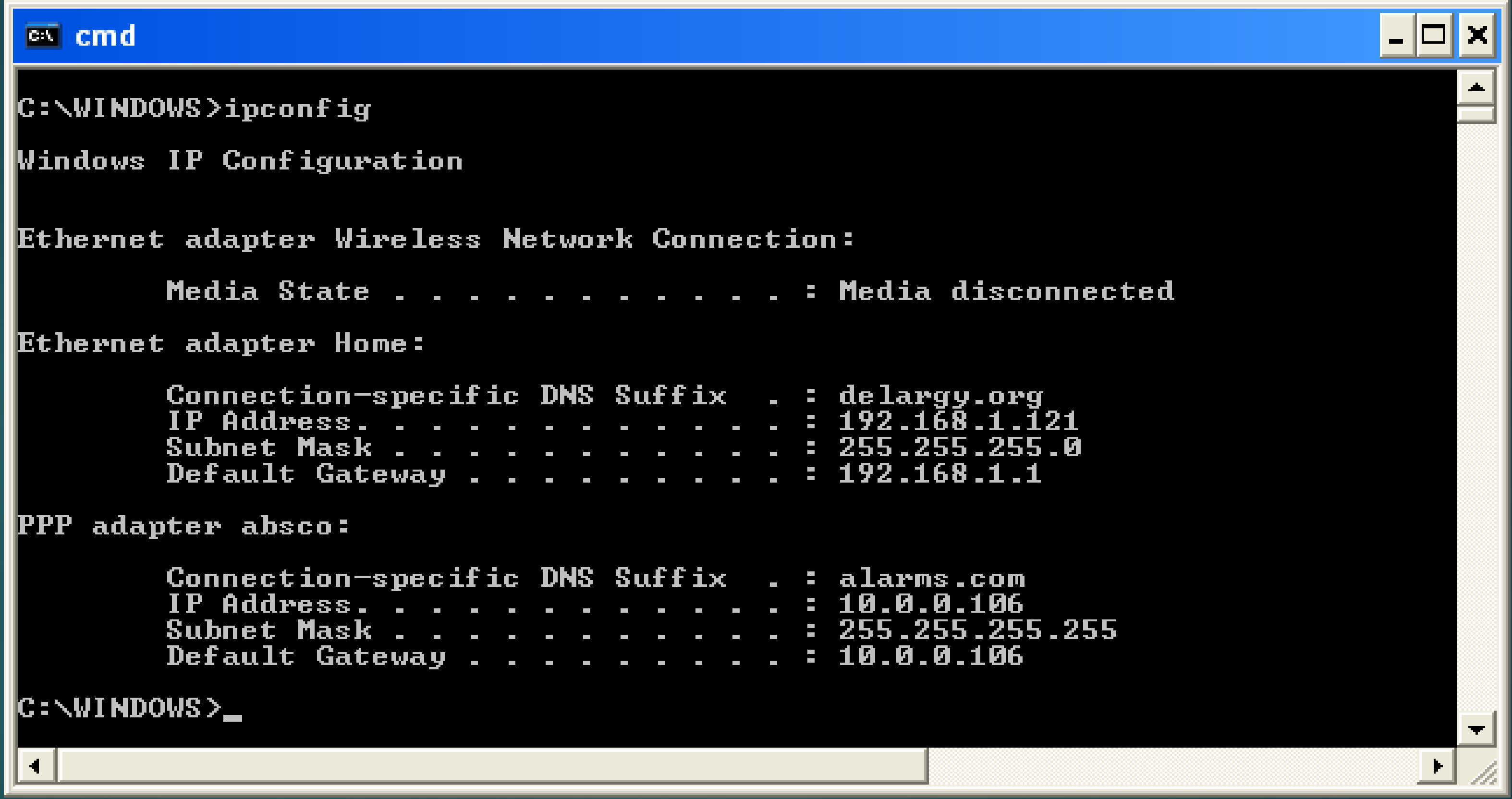
Tools

- ipconfig – displays ip address of network cards. The /all switch all DHCP, DNS Server and Gateway information.
- ping – sends icmp echo to host.
- tracert – traces route to a destination can be used to find where a connection is failing.
- netstat – displays a list of ports that are being used. With the –nr option it list the route table.
- telnet – connects to a port on a remote computer.
- arp – displays or modifies the IP to physical address (MAC address) translation table.

ipconfig

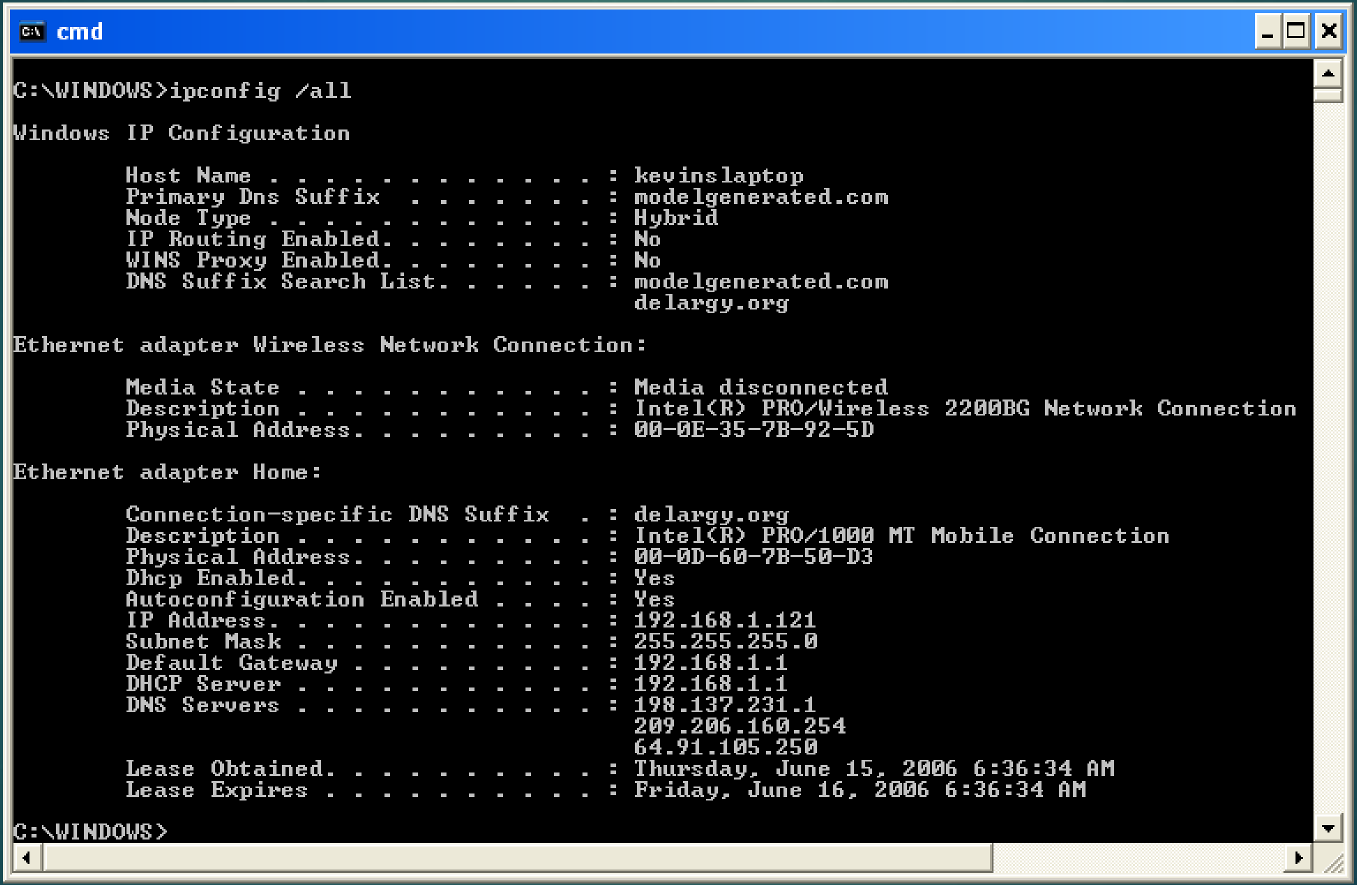
- Displays IP adress, subnet mask
- /all option displays DNS, DHCP info.
- /release release DHCP lease.
- /renew renews current DHCP lease or obtains a new one.
- /displaydns shows cached DNS entries

ipconfig



```
C:\WINDOWS>ipconfig

Windows IP Configuration


Ethernet adapter Wireless Network Connection:

        Media State . . . . . . . . . . . : Media disconnected

Ethernet adapter Home:

        Connection-specific DNS Suffix  . : delargy.org
        IP Address. . . . . . . . . . . . : 192.168.1.121
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 192.168.1.1

PPP adapter absco:

        Connection-specific DNS Suffix  . : alarms.com
        IP Address. . . . . . . . . . . . : 10.0.0.106
        Subnet Mask . . . . . . . . . . . : 255.255.255.255
        Default Gateway . . . . . . . . . : 10.0.0.106

C:\WINDOWS>_
```

ipconfig /all

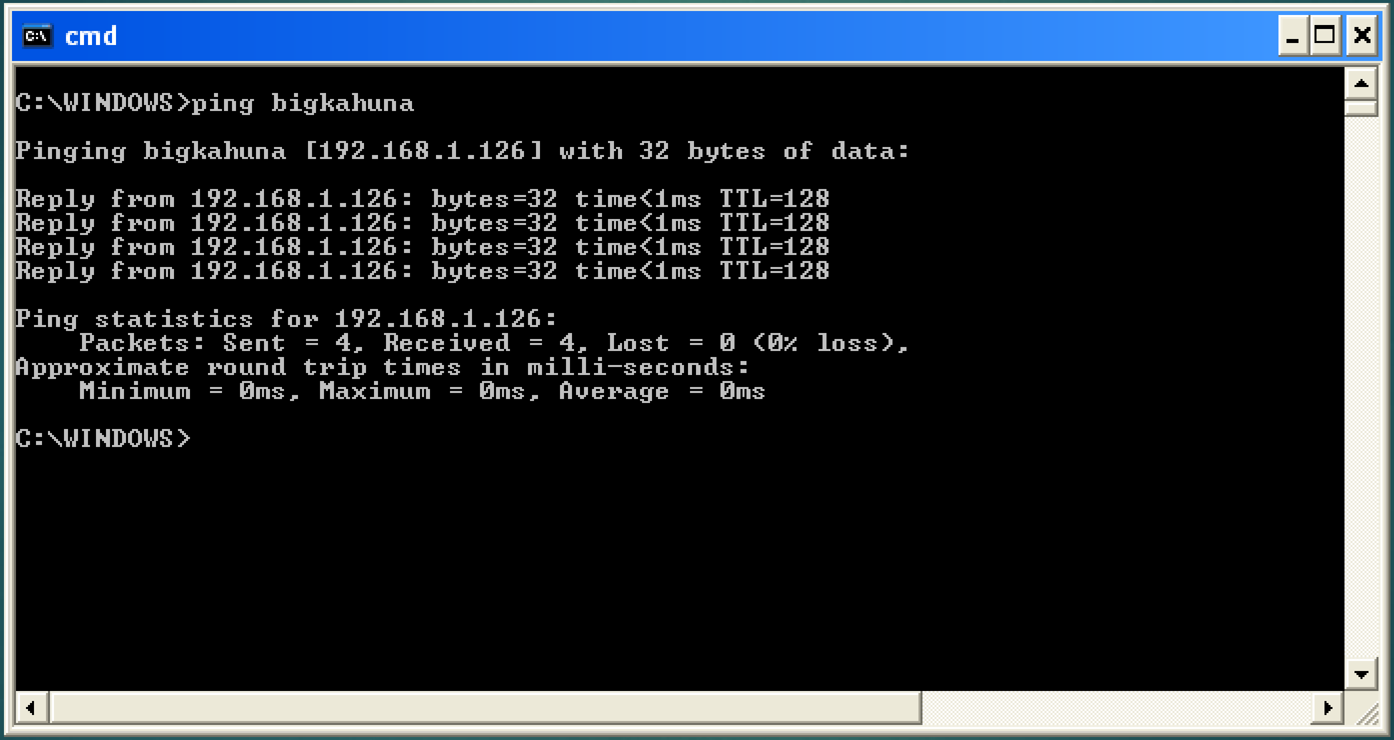


```
C:\WINDOWS>ipconfig /all

Windows IP Configuration

        Host Name . . . . . . . . . . . . : kevinslaptop
        Primary Dns Suffix  . . . . . . . : modelgenerated.com
        Node Type . . . . . . . . . . . . : Hybrid
        IP Routing Enabled. . . . . . . . : No
        WINS Proxy Enabled. . . . . . . . : No
        DNS Suffix Search List. . . . . . : modelgenerated.com
                                            delargy.org

Ethernet adapter Wireless Network Connection:

        Media State . . . . . . . . . . . : Media disconnected
        Description . . . . . . . . . . . : Intel(R) PRO/Wireless 2200BG Network Connection
        Physical Address. . . . . . . . . : 00-0E-35-7B-92-5D

Ethernet adapter Home:

        Connection-specific DNS Suffix  . : delargy.org
        Description . . . . . . . . . . . : Intel(R) PRO/1000 MT Mobile Connection
        Physical Address. . . . . . . . . : 00-0D-60-7B-50-D3
        Dhcp Enabled. . . . . . . . . . . : Yes
        Autoconfiguration Enabled . . . . : Yes
        IP Address. . . . . . . . . . . . : 192.168.1.121
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 192.168.1.1
        DHCP Server . . . . . . . . . . . : 192.168.1.1
        DNS Servers . . . . . . . . . . . : 198.137.231.1
                                            209.206.160.254
                                            64.91.105.250
        Lease Obtained. . . . . . . . . . : Thursday, June 15, 2006 6:36:34 AM
        Lease Expires . . . . . . . . . . : Friday, June 16, 2006 6:36:34 AM

C:\WINDOWS>
```

ping

- Sends an echo message to another host.
- If ping returns “Ping request could not find host *hostname*.” Either you are using the wrong name of there is a DNS problem.

ping

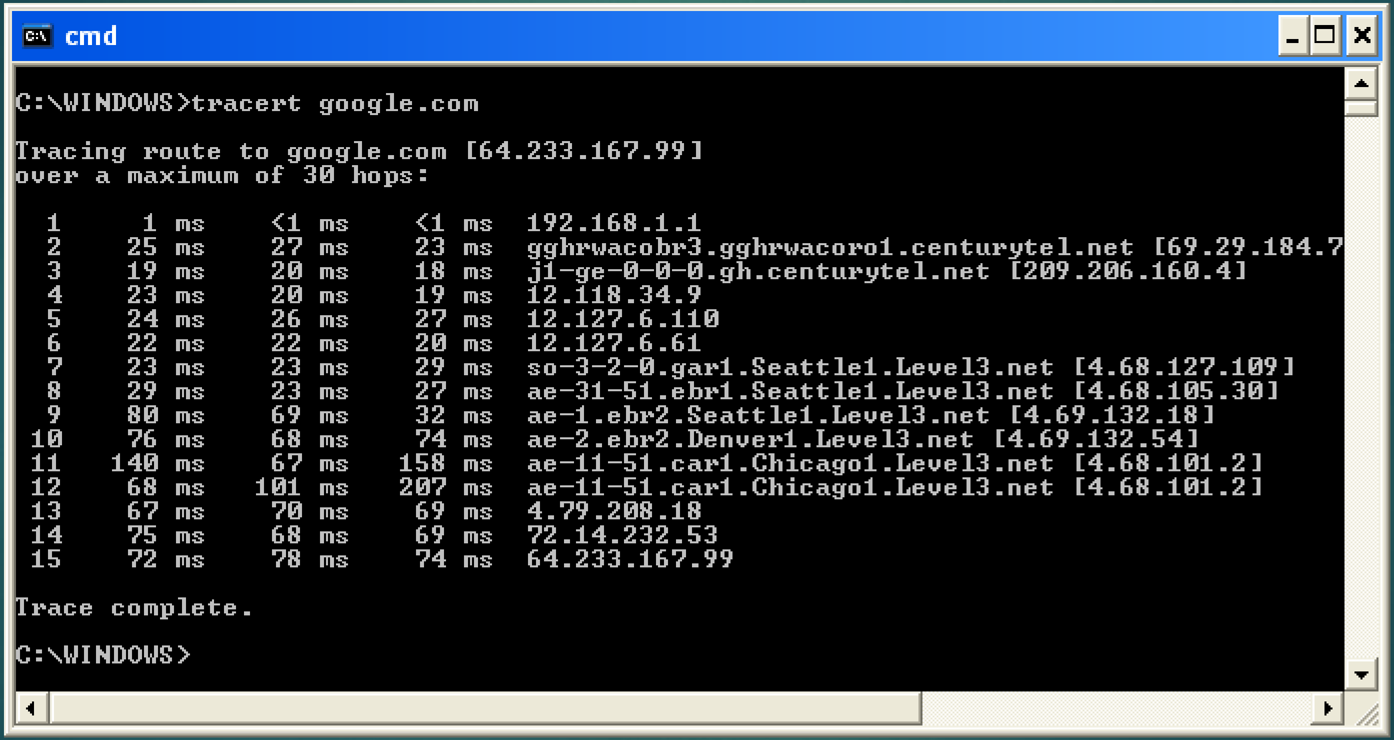


```
C:\WINDOWS>ping bigkahuna

Pinging bigkahuna [192.168.1.126] with 32 bytes of data:

Reply from 192.168.1.126: bytes=32 time<1ms TTL=128
Reply from 192.168.1.126: bytes=32 time<1ms TTL=128
Reply from 192.168.1.126: bytes=32 time<1ms TTL=128
Reply from 192.168.1.126: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.126:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\WINDOWS>
```

tracert

- Traces route to a destination.
- Used to test connection to computers beyond a router
- Can be used to find where a connection is slow.
- Velocity requires connections faster than 200ms

tracert

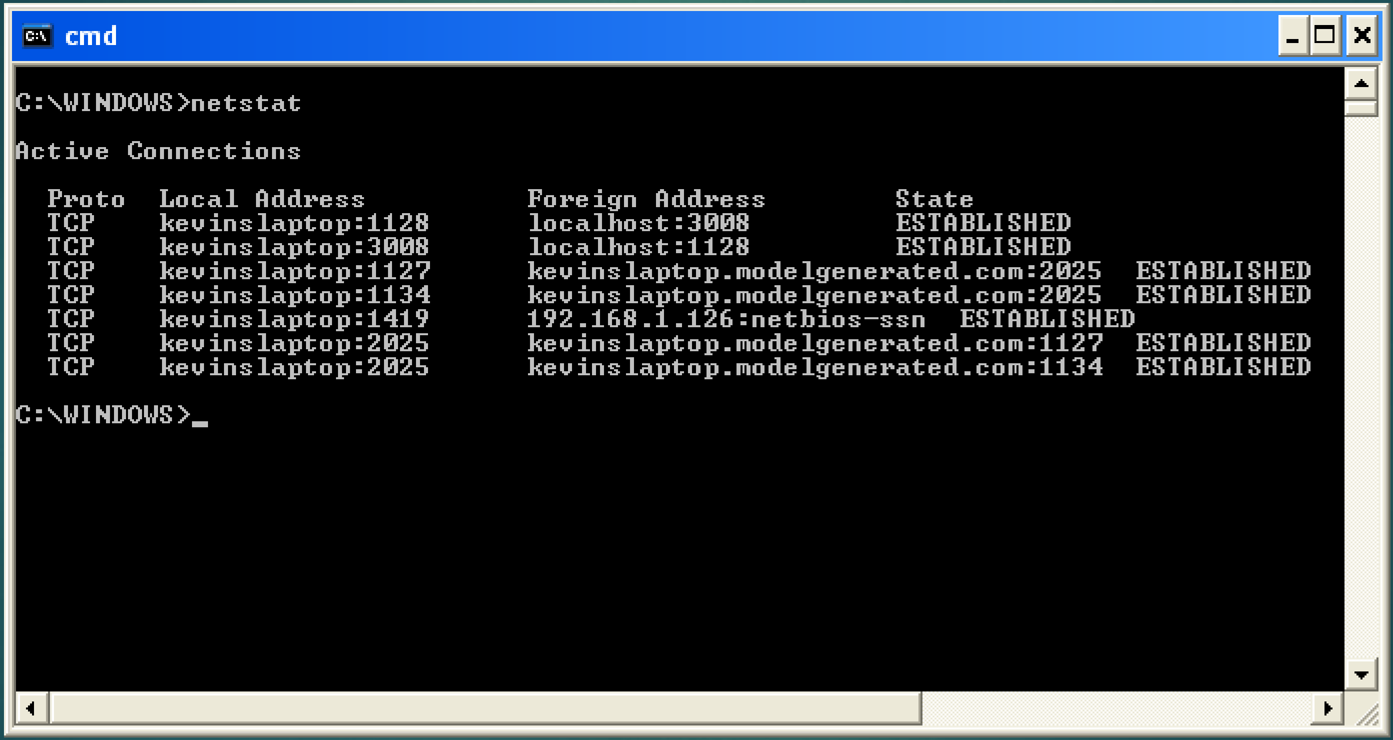


```
C:\WINDOWS>tracert google.com

Tracing route to google.com [64.233.167.99]
over a maximum of 30 hops:

  1     1 ms    <1 ms    <1 ms  192.168.1.1
  2    25 ms    27 ms    23 ms  gghrwacobr3.gghrwacoro1.centurytel.net [69.29.184.7
  3    19 ms    20 ms    18 ms  j1-ge-0-0-0.gh.centurytel.net [209.206.160.4]
  4    23 ms    20 ms    19 ms  12.118.34.9
  5    24 ms    26 ms    27 ms  12.127.6.110
  6    22 ms    22 ms    20 ms  12.127.6.61
  7    23 ms    23 ms    29 ms  so-3-2-0.gar1.Seattle1.Level3.net [4.68.127.109]
  8    29 ms    23 ms    27 ms  ae-31-51.ebr1.Seattle1.Level3.net [4.68.105.30]
  9    80 ms    69 ms    32 ms  ae-1.ebr2.Seattle1.Level3.net [4.69.132.18]
 10    76 ms    68 ms    74 ms  ae-2.ebr2.Denver1.Level3.net [4.69.132.54]
 11   140 ms    67 ms   158 ms  ae-11-51.car1.Chicago1.Level3.net [4.68.101.2]
 12    68 ms   101 ms   207 ms  ae-11-51.car1.Chicago1.Level3.net [4.68.101.2]
 13    67 ms    70 ms    69 ms  4.79.208.18
 14    75 ms    68 ms    69 ms  72.14.232.53
 15    72 ms    78 ms    74 ms  64.233.167.99

Trace complete.

C:\WINDOWS>
```

netstat

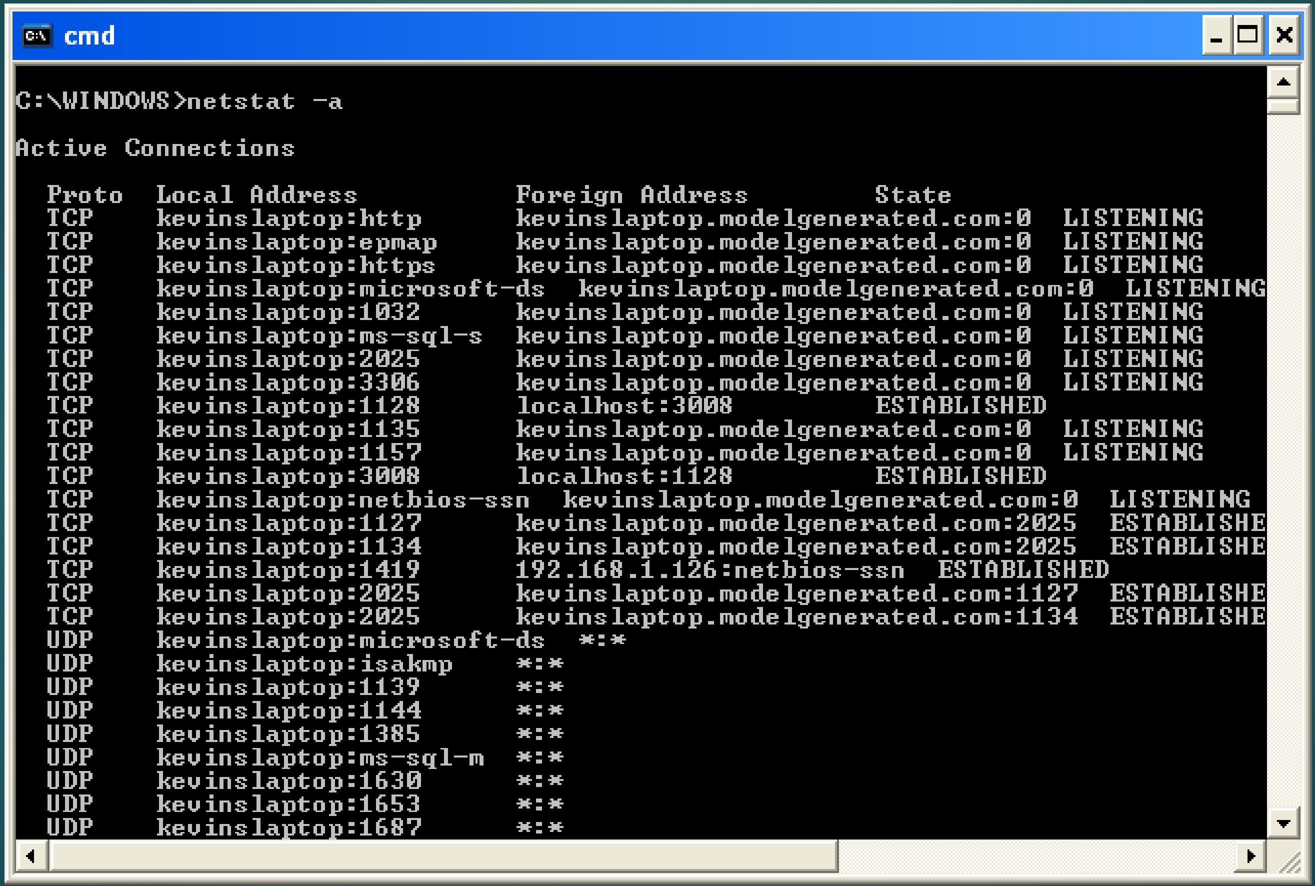
- Shows ports used by the local machines.
- -a – Also show ports that you computer is listening on.
- -vb – show the application that has the connection or that is listening on each port

netstat



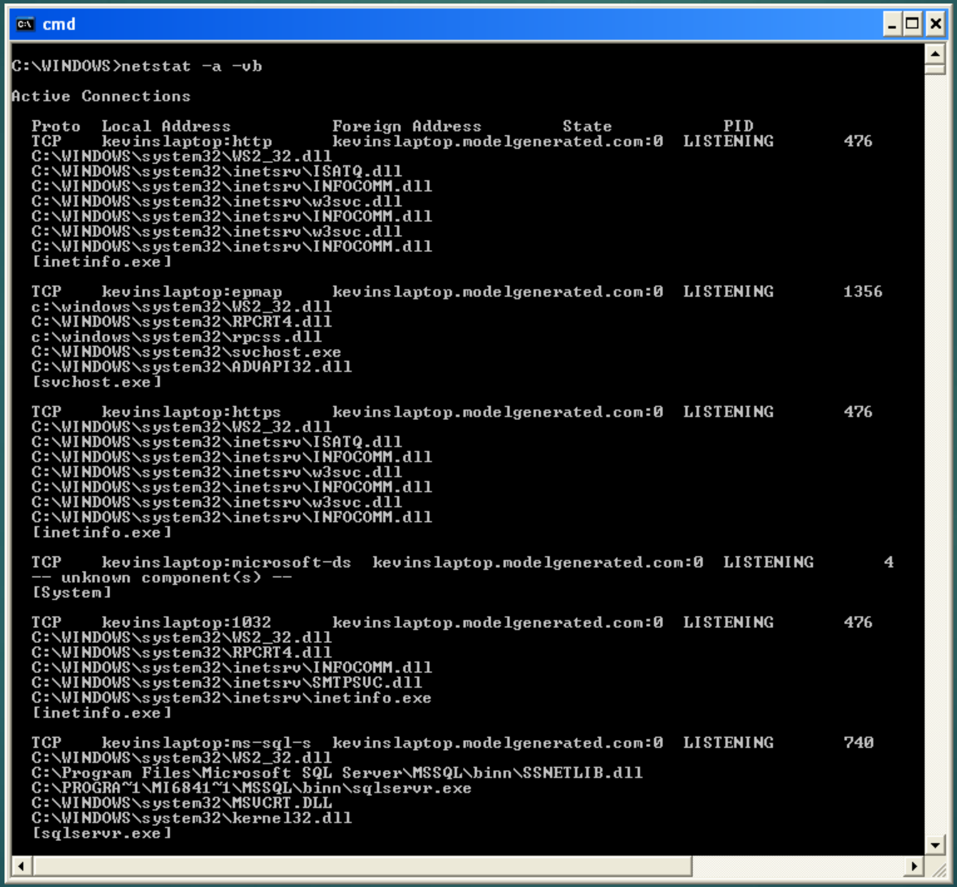
```
C:\WINDOWS>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    kevinslaptop:1128      localhost:3008         ESTABLISHED
  TCP    kevinslaptop:3008      localhost:1128         ESTABLISHED
  TCP    kevinslaptop:1127      kevinslaptop.modelgenerated.com:2025  ESTABLISHED
  TCP    kevinslaptop:1134      kevinslaptop.modelgenerated.com:2025  ESTABLISHED
  TCP    kevinslaptop:1419      192.168.1.126:netbios-ssn  ESTABLISHED
  TCP    kevinslaptop:2025      kevinslaptop.modelgenerated.com:1127  ESTABLISHED
  TCP    kevinslaptop:2025      kevinslaptop.modelgenerated.com:1134  ESTABLISHED

C:\WINDOWS>_
```

netstat



```
C:\WINDOWS>netstat -a

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    kevinslaptop:http      kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:epmap     kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:https     kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:microsoft-ds  kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:1032      kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:ms-sql-s  kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:2025      kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:3306      kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:1128      localhost:3008         ESTABLISHED
  TCP    kevinslaptop:1135      kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:1157      kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:3008      localhost:1128         ESTABLISHED
  TCP    kevinslaptop:netbios-ssn  kevinslaptop.modelgenerated.com:0  LISTENING
  TCP    kevinslaptop:1127      kevinslaptop.modelgenerated.com:2025  ESTABLISHE
  TCP    kevinslaptop:1134      kevinslaptop.modelgenerated.com:2025  ESTABLISHE
  TCP    kevinslaptop:1419      192.168.1.126:netbios-ssn  ESTABLISHED
  TCP    kevinslaptop:2025      kevinslaptop.modelgenerated.com:1127  ESTABLISHE
  TCP    kevinslaptop:2025      kevinslaptop.modelgenerated.com:1134  ESTABLISHE
  UDP    kevinslaptop:microsoft-ds  *:*
  UDP    kevinslaptop:isakmp    *:*
  UDP    kevinslaptop:1139      *:*
  UDP    kevinslaptop:1144      *:*
  UDP    kevinslaptop:1385      *:*
  UDP    kevinslaptop:ms-sql-m  *:*
  UDP    kevinslaptop:1630      *:*
  UDP    kevinslaptop:1653      *:*
  UDP    kevinslaptop:1687      *:*
```

netstat

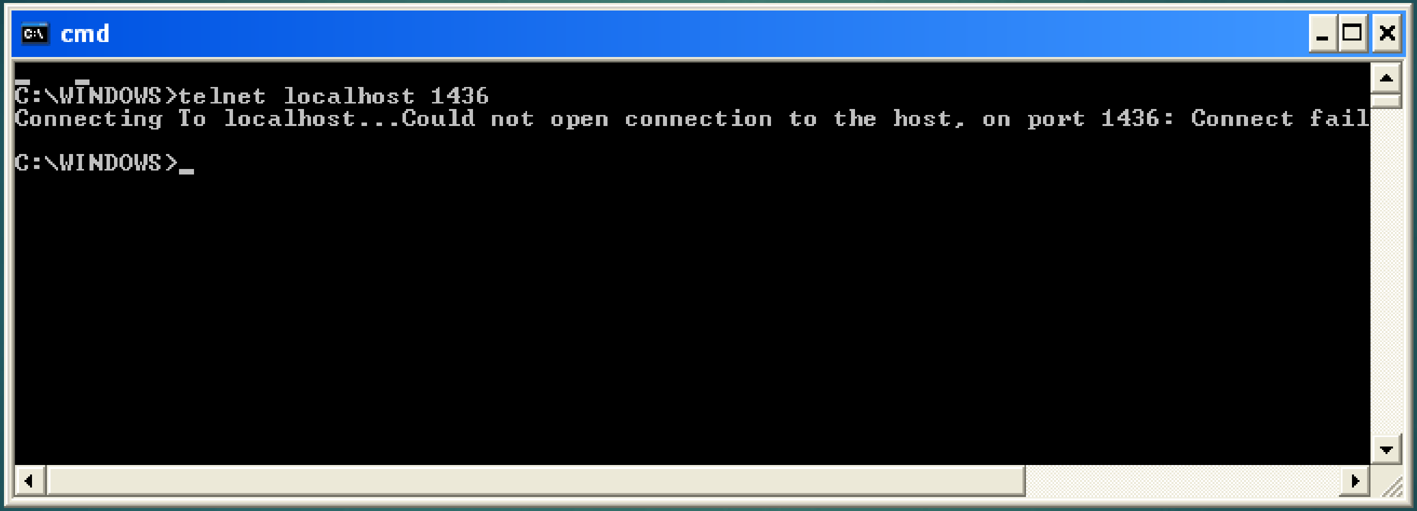


```
C:\WINDOWS>netstat -a -vb

Active Connections

  Proto  Local Address          Foreign Address        State           PID
  TCP    kevinslaptop:http      kevinslaptop.modelgenerated.com:0  LISTENING       476
  C:\WINDOWS\system32\WS2_32.dll
  C:\WINDOWS\system32\inetsrv\ISATQ.dll
  C:\WINDOWS\system32\inetsrv\INFOCOMM.dll
  C:\WINDOWS\system32\inetsrv\w3svc.dll
  C:\WINDOWS\system32\inetsrv\INFOCOMM.dll
  C:\WINDOWS\system32\inetsrv\w3svc.dll
  C:\WINDOWS\system32\inetsrv\INFOCOMM.dll
  [inetinfo.exe]

  TCP    kevinslaptop:epmap     kevinslaptop.modelgenerated.com:0  LISTENING       1356
  c:\windows\system32\WS2_32.dll
  C:\WINDOWS\system32\RPCRT4.dll
  c:\windows\system32\rpcss.dll
  C:\WINDOWS\system32\svchost.exe
  C:\WINDOWS\system32\ADVAPI32.dll
  [svchost.exe]

  TCP    kevinslaptop:https     kevinslaptop.modelgenerated.com:0  LISTENING       476
  C:\WINDOWS\system32\WS2_32.dll
  C:\WINDOWS\system32\inetsrv\ISATQ.dll
  C:\WINDOWS\system32\inetsrv\INFOCOMM.dll
  C:\WINDOWS\system32\inetsrv\w3svc.dll
  C:\WINDOWS\system32\inetsrv\INFOCOMM.dll
  C:\WINDOWS\system32\inetsrv\w3svc.dll
  C:\WINDOWS\system32\inetsrv\INFOCOMM.dll
  [inetinfo.exe]

  TCP    kevinslaptop:microsoft-ds  kevinslaptop.modelgenerated.com:0  LISTENING       4
  -- unknown component(s) --
  [System]

  TCP    kevinslaptop:1032      kevinslaptop.modelgenerated.com:0  LISTENING       476
  C:\WINDOWS\system32\WS2_32.dll
  C:\WINDOWS\system32\RPCRT4.dll
  C:\WINDOWS\system32\inetsrv\INFOCOMM.dll
  C:\WINDOWS\system32\inetsrv\SMTPSVC.dll
  C:\WINDOWS\system32\inetsrv\inetinfo.exe
  [inetinfo.exe]

  TCP    kevinslaptop:ms-sql-s  kevinslaptop.modelgenerated.com:0  LISTENING       740
  C:\WINDOWS\system32\WS2_32.dll
  C:\Program Files\Microsoft SQL Server\MSSQL\binn\SSNETLIB.dll
  C:\PROGRA~1\MI6841~1\MSSQL\binn\sqlservr.exe
  C:\WINDOWS\system32\MSVCRT.DLL
  C:\WINDOWS\system32\kernel32.dll
  [sqlservr.exe]
```

telnet

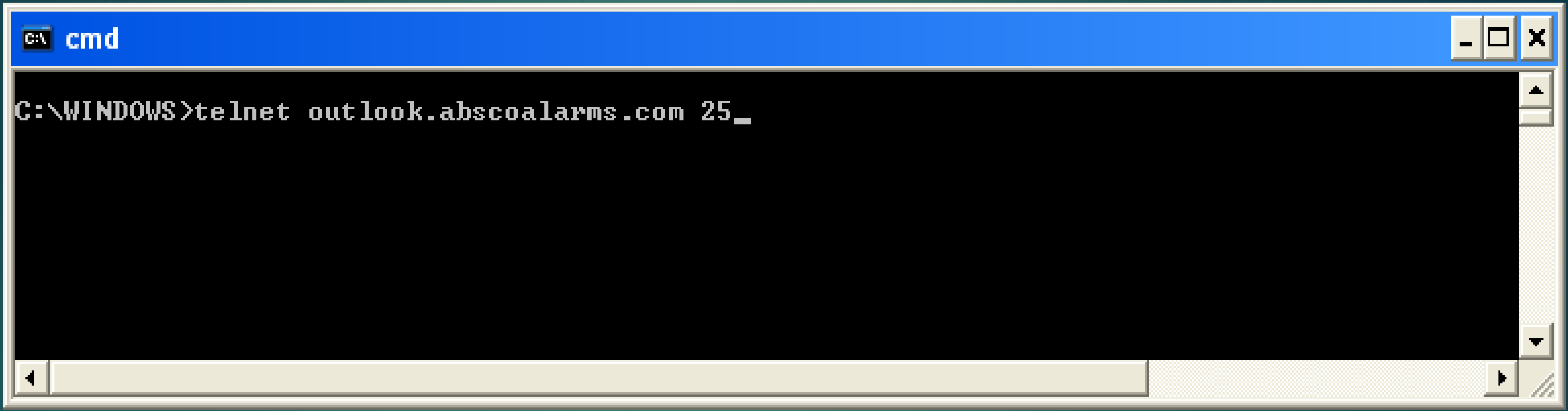
- Connects to a port on a target computer.
- If successful connection is made you may see a banner or just a blank page.

telnet to bogus port

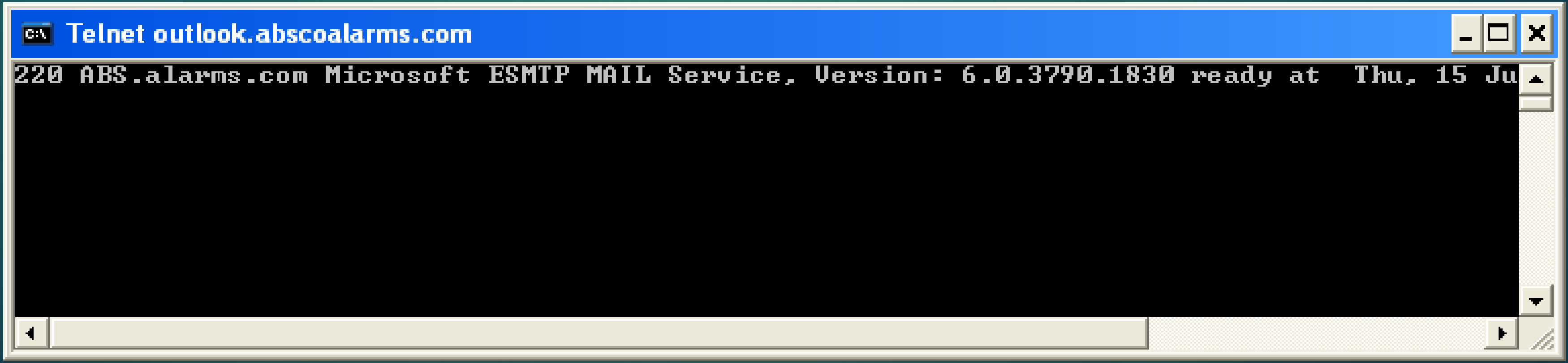


```
C:\WINDOWS>telnet localhost 1436
Connecting To localhost...Could not open connection to the host, on port 1436: Connect fail

C:\WINDOWS>_
```

telnet



```
C:\WINDOWS>telnet outlook.abscoalarms.com 25_
```

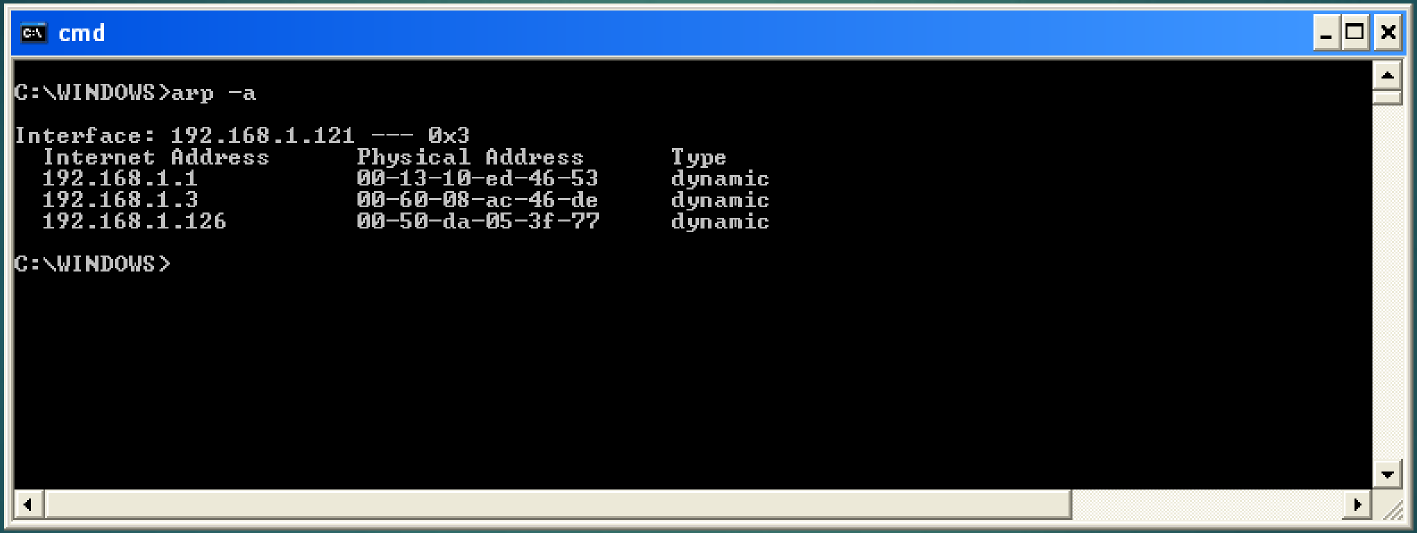


```
220 ABS.alarms.com Microsoft ESMTP MAIL Service, Version: 6.0.3790.1830 ready at  Thu, 15 Ju
```

arp

- Displays current arp table which maps IP addresses to MAC (Physical) addresses.
- Arp entries that are dynamically added are temporary and will expire.
- Can be used to add or remove entries for the arp table
- Some devices allow an IP address to be assigned using arp –s.

arp



```
C:\WINDOWS>arp -a

Interface: 192.168.1.121 --- 0x3
  Internet Address      Physical Address      Type
  192.168.1.1           00-13-10-ed-46-53     dynamic
  192.168.1.3           00-60-08-ac-46-de     dynamic
  192.168.1.126         00-50-da-05-3f-77     dynamic

C:\WINDOWS>
```