

# TCP/IP Quick Guide [www.Rahbordco.net](http://www.Rahbordco.net)

## OSI MODEL

### Layer 7: Application Layer

- Defines interface to user processes
- Provides standardized network services

### Layer 6: Presentation Layer

- Specifies architecture-independent data transfer format
- Encodes and decodes data; Encrypts and decrypts data; Compresses and decompresses data

### Layer 5: Session Layer

- Manages user sessions and dialogues
- Controls establishment and termination of logical links between users

### Layer 4: Transport Layer

- Provides reliable and sequential end-to-end packet delivery
- Provides connectionless oriented packet delivery

### Layer 3: Network Layer

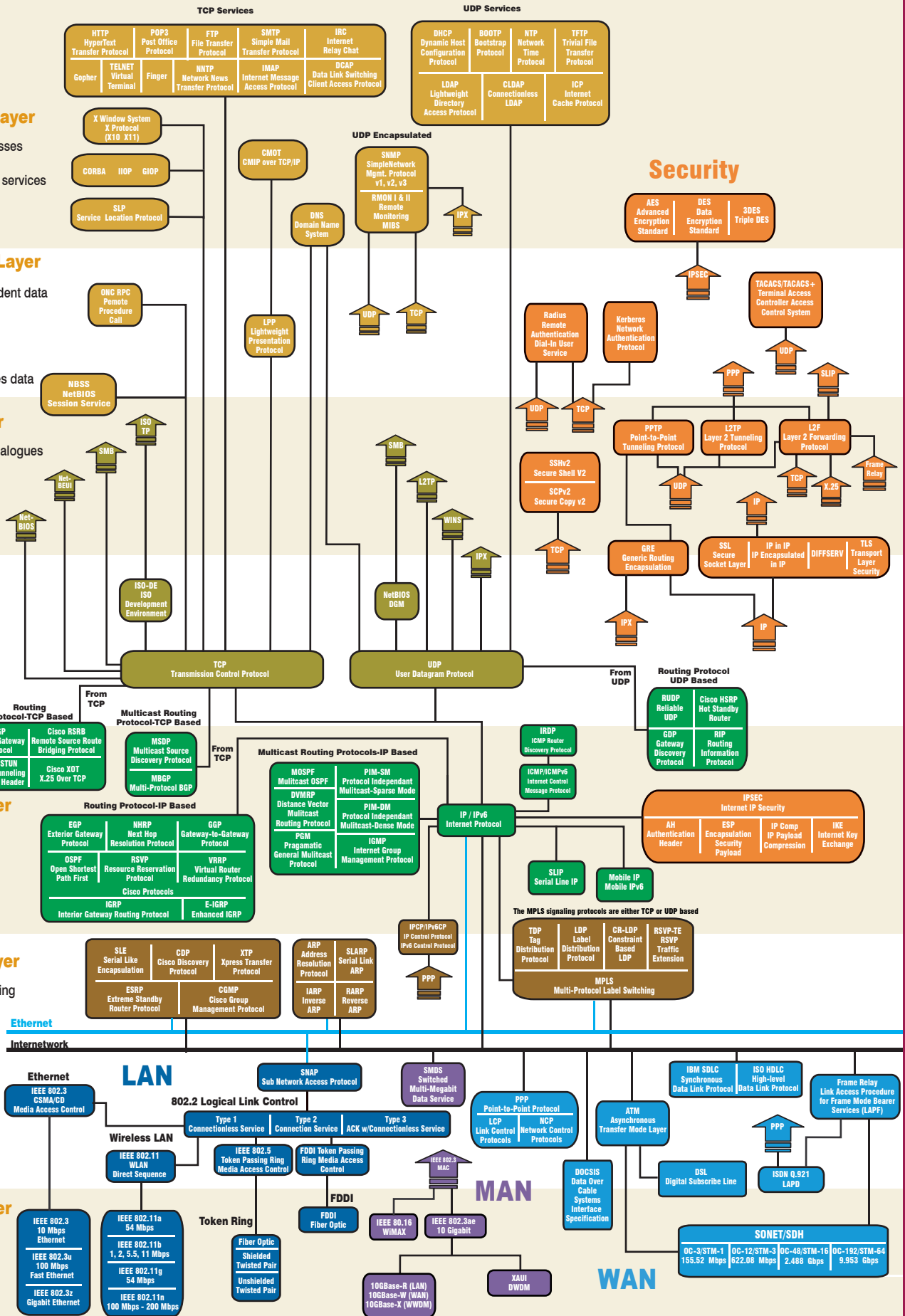
- Routes packets according to unique network addresses

### Layer 2: Data Link Layer

- Defines procedures for operating the communication link
- Provides framing and sequencing

### Layer 1: Physical Layer

- Defines physical means of sending data over network devices



# IP: Internet Protocol

## IPv4: Internet Protocol version 4

IPv4 is defined in IETF RFC 791.

### IPv4 Packet Format

|                     |          |                 |                 |  |
|---------------------|----------|-----------------|-----------------|--|
| 4                   | 8        | 16              | 32bit           |  |
| Version             | IHL      | Type of service | Total length    |  |
| Identification      |          | Flags           | Fragment offset |  |
| Time to live        | Protocol | Header checksum |                 |  |
| Source address      |          |                 |                 |  |
| Destination address |          |                 |                 |  |
| Option + Padding    |          |                 |                 |  |
| Data                |          |                 |                 |  |

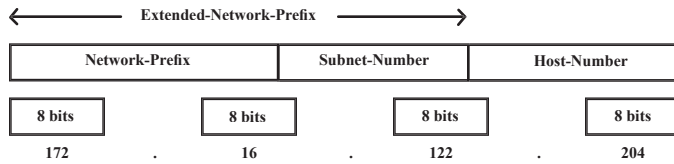
- Version – the version of IP (4 for IPv4).
- IP Header Length (IHL) – number of 32-bit words that points to the beginning of the data. It is between 5 (20bytes) to 15 (60 bytes).
- Type-of-Service – indicates the quality of service desired.
 

|                              |                            |
|------------------------------|----------------------------|
| Type of service              | Differentiated Services    |
| Precedence (000 – 111)       | 000                        |
| D (1 = minimize delay)       | 0                          |
| T (1 = maximize throughput)  | 0                          |
| R (1 = maximize reliability) | 0                          |
| C (1 = minimize cost)        | 1 = ENC capabl             |
| x (reserved and set to 0)    | 1 = congestion experienced |
- Total Length – the length of the entire IP packet in bytes. Maximum length is 65,535.
- Identification – an integer that identifies the current datagram.
- Flags – a 3-bit field of which the two low-order bits control fragmentation.
 

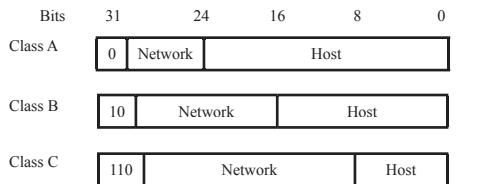
|                           |  |
|---------------------------|--|
| X (reserved and set to 0) |  |
| D (1 = don't fragment)    |  |
| M (1 = more fragment)     |  |
- Fragment Offset – indicates the position of the fragment's data relative to the beginning of the data in the original datagram.
- Time-to-Live – a counter that gradually decrements down to zero, at which point the datagram is discarded.
- Protocol - indicates which upper-layer protocol receives incoming packets after IP processing is complete. Some sample protocols:
 

|         |          |         |          |
|---------|----------|---------|----------|
| 1 ICMP  | 2 IGMP   | 6 TCP   | 9 IGRP   |
| 17 UDP  | 47 GRE   | 50 ESP  | 51 AH    |
| 57 SKIP | 88 EIGRP | 89 OSPF | 115 L2TP |
- Header Checksum – ensures IP header integrity.
- Source Address – 32 bits field specifies the sending node.

### IPv4 Address Format



### IPv4 Address Classes



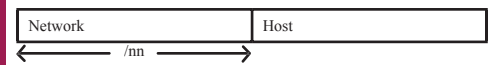
| Address Class | # Network Bits | # Hosts Bits | Decimal Address Range | Number of Usable IP |
|---------------|----------------|--------------|-----------------------|---------------------|
| Class A       | 8 bits         | 24 bits      | 1-126                 | 16,777,216 (1 A)    |
| Class B       | 16 bits        | 16 bits      | 128-191               | 1,048,544 (16 B)    |
| Class C       | 24 bits        | 8 bits       | 192-223               | 65,534 (256 C)      |
| Class D       | Multicast      |              | 224 - 239             |                     |
| Class E       | Experimental   |              | 240 - 255             |                     |

- Destination Address – 32 bits field specifies the receiving node.
- Options – allows IP to support various options.
 

|                        |                         |
|------------------------|-------------------------|
| 0 End of option list   | 1 No operation (PAD)    |
| 7 Record route         | 68 timestamp            |
| 131 Loose source route | 137 Strict source route |
- Data – contains upper-layer information.

### CIDR

CIDR: Classless and Subnet Address Extensions and Supernetting



| CIDR prefix length | Dotted Decimal Netmask | Number of Classfull Networks | Number of Usable IPs |
|--------------------|------------------------|------------------------------|----------------------|
| /1                 | 128.0.0.0              | 128 As                       | 2,147,483,646        |
| /2                 | 192.0.0.0              | 64 As                        | 1,073,741,822        |
| /3                 | 224.0.0.0              | 32 As                        | 536,870,910          |
| /4                 | 240.0.0.0              | 16 As                        | 268,435,454          |
| /5                 | 248.0.0.0              | 8 As                         | 134,217,726          |
| /6                 | 252.0.0.0              | 4 As                         | 67,108,862           |
| /7                 | 254.0.0.0              | 2 As                         | 33,554,430           |
| /8                 | 255.0.0.0              | 1 A or 256 Bs                | 16,777,214           |
| /9                 | 255.128.0.0            | 128 Bs                       | 8,388,606            |
| /10                | 255.192.0.0            | 64 Bs                        | 4,194,302            |
| /11                | 255.224.0.0            | 32 Bs                        | 2,097,150            |
| /12                | 255.240.0.0            | 16 Bs                        | 1,048,574            |
| /13                | 255.248.0.0            | 8 Bs                         | 524,286              |
| /14                | 255.252.0.0            | 4 Bs                         | 262,142              |
| /15                | 255.254.0.0            | 2 Bs                         | 131,070              |
| /16                | 255.255.0.0            | 1 B or 256 Cs                | 65,534               |
| /17                | 255.255.128.0          | 128 Cs                       | 32,766               |
| /18                | 255.255.192.0          | 64 Cs                        | 16,382               |
| /19                | 255.255.224.0          | 32 Cs                        | 8,190                |
| /20                | 255.255.240.0          | 16 Cs                        | 4,094                |
| /21                | 255.255.248.0          | 8 Cs                         | 2,046                |
| /22                | 255.255.252.0          | 4 Cs                         | 1,022                |
| /23                | 255.255.254.0          | 2 Cs                         | 510                  |
| /24                | 255.255.255.0          | 1 C                          | 254                  |
| /25                | 255.255.255.128        | 1/2 C                        | 126                  |
| /26                | 255.255.255.192        | 1/4 C                        | 62                   |
| /27                | 255.255.255.224        | 1/8 C                        | 30                   |
| /28                | 255.255.255.240        | 1/16 C                       | 14                   |
| /29                | 255.255.255.248        | 1/32 C                       | 6                    |
| /30                | 255.255.255.252        | 1/64 C                       | 2                    |
| /31                | 255.255.255.254        | 1/128 C                      | 0                    |
| /32                | 255.255.255.255        | 1/256 C                      | 0                    |

## IPv6: Internet Protocol version 6

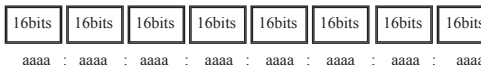
IPv6 is defined in IETF RFC 1883 and RFC 2460.

### IPv6 Packet Format

|                                |   |                  |           |        |
|--------------------------------|---|------------------|-----------|--------|
| 4                              | 12  | 16               | 24        | 32 bit |
| Version                        | Traffic Class   | Flow label       |           |        |
| Payload length                 |   | Next header type | Hop limit |        |
| Source address (128 bits)      |   |                  |           |        |
| Destination address (128 bits) |   |                  |           |        |
| Next header                    | Extension Header Information (optional and variable length) |                  |           |        |
| Data (Variable Length)         |   |                  |           |        |

- Version – Internet Protocol Version number (IPv6 is 6).
- Traffic class – enables a source to identify the desired delivery priority of the packets.
- Flow label – used by a source to label packets for special handling by the IPv6 router.
- Payload length – the length of the data portion of the packet.
- Next header – identifies the type of header immediately following the IPv6 header. It is similar to the “protocol” field in IPv4.
- Hop limit – specifies the maximum number of routers (hops) through which a packet can traverse before discarded.
- Source address – 128-bit address of the originator of the packet.
- Destination address – 128-bit address of the intended recipient of the packet.
- Extension Header Information – an optional field (not included in the basic header) with variable length.
  - Routing
  - Fragmentation
  - Authentication
  - Encapsulation
  - Hop-by-Hop Option
  - Destination Options

### IPv6 Address Format



### IPv6 Address Types

IPv6 address is classified in three types: Unicast, Multicast and Anycast.

**Unicast Address: applied to one network interface.**

The common global unicast address divisions:

|                                |                       |                        |
|--------------------------------|-----------------------|------------------------|
| Global Routing Prefix (N bits) | Subnet ID (64-N bits) | Interface ID (64 bits) |
|--------------------------------|-----------------------|------------------------|

Link-local unicast address divisions:

|                     |                   |                        |
|---------------------|-------------------|------------------------|
| 111111010 (10 bits) | 0x00...0 (54bits) | Interface ID (64 bits) |
|---------------------|-------------------|------------------------|

Site-local unicast address divisions:

|                     |         |                        |                        |
|---------------------|---------|------------------------|------------------------|
| 111111011 (10 bits) | 0x0...0 | Site Level Aggregation | Interface ID (64 bits) |
|---------------------|---------|------------------------|------------------------|

(Interface ID is based on hardware MAC address.)

**Multicast Address: applied for multiple network interfaces, and communication is conducted with all hosts with the same address.**

|               |               |                |                     |
|---------------|---------------|----------------|---------------------|
| 0xFF (8 bits) | Flag (4 bits) | Scope (4 bits) | Group ID (112 bits) |
|---------------|---------------|----------------|---------------------|

**Anycast Address: applied for multiple network interfaces, but actual communication is conducted with one of them. It has the same format as the Unicast address.**

**IPv4-mapped IPv6 address:**

|                    |                   |                        |
|--------------------|-------------------|------------------------|
| 0x00...0 (80 bits) | 0xFFFFF (16 bits) | IPv4 Address (32 bits) |
|--------------------|-------------------|------------------------|

**IPv4-compatible IPv6 address:**

|                    |                  |                        |
|--------------------|------------------|------------------------|
| 0x00...0 (80 bits) | 0x0000 (16 bits) | IPv4 Address (32 bits) |
|--------------------|------------------|------------------------|

# IPv4 vs. IPv6

| Subjects              | IPv4   | IPv6   | IPv6 Advantages  |
|-----------------------|--|--|--|
| Address Space         | 4 Billion Addresses  | 3.4 x 10 <sup>38</sup> addresses   | 79 Octillion times the IPv4 address space  |
| Configuration         | Manual or use DHCP   | Universal Plug and Play (UPnP) with or without DHCP                                      | Lower Operation Expenses and reduce error  |
| Broadcast / Multicast | Uses both  | No broadcast and has different forms of multicast  | Better bandwidth efficiency  |
| Anycast support       | Not part of the original protocol                          | Explicit support of anycast  | Allows new applications in mobility, data center                                       |
| Routing efficiency    | Need to process Option and Checksum fields by every router | No checksum; Extended header for options.  | Improved support for extensions and options and better routing efficiency.             |
| Network Configuration | Mostly manual and labor intensive                          | Facilitate the re-numbering of hosts and routers   | Lower operation expenses and facilitate migration                                      |
| QoS support           | ToS using DIFFServ   | Flow classes and flow labels   | More Granular control of QoS   |
| Security              | Uses IPsec for Data packet protection                      | IPsec becomes the key technology to protect data and control packets                     | Unified framework for security and more secure computing environment                   |
| Mobility              | Uses Mobile IPv4   | Mobile IPv6 provides fast handover, better router optimization and hierarchical mobility | Better efficiency and scalability; Work with latest 3G mobile technologies and beyond. |

## TCP: Transmission Control Protocol

TCP is defined by IETF RFC 793.

### TCP Header Format

| 16                     |      |   |   |   |                  |   |   |        |  | 32 bit |  |
|------------------------|------|---|---|---|------------------|---|---|--------|--|--------|--|
| Source port            |      |   |   |   | Destination port |   |   |        |  |        |  |
| Sequence number        |      |   |   |   |                  |   |   |        |  |        |  |
| Acknowledgement number |      |   |   |   |                  |   |   |        |  |        |  |
| Offset                 | Rsvd | U | A | P | R                | S | F | Window |  |        |  |
| Checksum               |      |   |   |   | Urgent pointer   |   |   |        |  |        |  |
| Option + Padding       |      |   |   |   |                  |   |   |        |  |        |  |
| Data                   |      |   |   |   |                  |   |   |        |  |        |  |

- Source port – Identifies points at which upper-layer source process receives TCP services.
- Destination port – Identifies points at which upper-layer Destination process receives TCP services.
- Sequence number – Specifies the number assigned to the first byte of data in the current message.
- Acknowledgment number – Contains the sequence number of the next byte of data the sender to receive.
- Offset – Indicates where the data begins.
- Reserved – Reserved for future use. Must be zero.
- Control bits (Flags) – Carry a variety of control information. The control bits may be:
  - U (URG) Urgent pointer field significant.
  - A (ACK) Acknowledgment field significant.
  - P (PSH) Push function.
  - R (RST) Reset the connection.
  - S (SYN) Synchronize sequence numbers.
  - F (FIN) No more data from sender.
- Window – Specifies the size of the sender's receive window.
- Checksum – Indicates whether the header was damaged in transit.
- Urgent Pointer – Points to the first urgent data byte in the packet.
- Option + Padding – Specifies various TCP options.
  - 0 End of Option List
  - 1 No operation (pad)
  - 2 Maximum segment size
  - 3 window scale
  - 4 Selective ACK ok
  - 8 Timestamp
- Data – contains upper-layer information.

## UDP: User Datagram Protocol

UDP is defined by IETF RFC 768.

### UDP Header Format

| 16          |  | 32 bit           |  |
|-------------|--|------------------|--|
| Source port |  | Destination port |  |
| Length      |  | Checksum         |  |
| Data        |  |                  |  |

- Source port – An optional field indicates the port of the sending process.
- Destination port – Identifies points at which upper-layer Destination process receives UDP services.
- Length – The length in octets of the user datagram, including the header and the data (Minimum is 8).
- Checksum -- Indicates whether the header was damaged in transit.
- Data – Contains upper-level information.

## TCP/IP Utilities

### ICMP

ICMP: Internet Message Control Protocol. ICMP for IPv4 is defined in IETF RFC 792 and ICMP for IPv6 is defined in IETF RFC 2463.

ICMP Header Format.

| 8            |      | 16              |  | 32 bit |  |
|--------------|------|-----------------|--|--------|--|
| Type         | Code | Checksum        |  |        |  |
| Identifier   |      | Sequence number |  |        |  |
| Address mask |      |                 |  |        |  |

| Type                      | Code  |
|---------------------------|---|
| 0 Echo Reply              | 0   |
| 3 Destination Unreachable | 0 Net Unreachable<br>1 Host Unreachable<br>2 Protocol Unreachable<br>3 Port Unreachable<br>4 Fragmentation Needed & DF Set<br>5 Source Route Failed<br>6 Destination Network Unknown<br>7 Destination Host Unknown<br>8 Source Host Isolated<br>9 Network Administratively Prohibited<br>10 Host Administratively Prohibited<br>11 Network Unreachable for TOS<br>12 Host Unreachable for TOS<br>13 Communication Administratively Prohibited |
| 4 Source Quench           | 0   |
| 5 Redirect                | 0 Redirect Datagram for the Network<br>1 Redirect Datagram for the Host<br>2 Redirect Datagram for the TOS & Network<br>3 Redirect Datagram for the TOS & Host  |
| 8 Echo                    | 0   |
| 9 Router Advertisement    | 0   |
| 10 Router Selection       | 0   |
| 11 Time Exceeded          | 0 Time to Live exceeded in Transit<br>1 Fragment Reassembly Time Exceeded   |
| 12 Parameter Problem      | 0 Pointer indicates the error<br>1 Missing a Required Option<br>2 Bad Length  |
| 13 Timestamp              | 0   |
| 14 Timestamp Reply        | 0   |
| 15 Information Request    | 0   |
| 16 Information Reply      | 0   |
| 17 Address Mask Request   | 0   |
| 18 Address Mask Reply     | 0   |
| 30 Traceroute             | 0   |

### TCPDUMP

**tcpdump – dump traffic on a network**

**tcpdump** [-aenStvx] [-c count] [-F file] [-i int] [-l file] [-s snaplen] [-w file] [-e filter\_expression]

- a Convert network and broadcast addresses to names
  - c Exit after receiving count packets
  - F Filter expression in file
  - i Listen on interface
  - n Don't convert IP addresses to names
  - r Read packets from file
  - s Get snaplen bytes from each packet
  - t Don't print timestamp
  - v Verbose mode
  - w Write packets to file
  - x Display in hex
  - X Display in hex and ASCII
- filter\_expression Selects which packets will be dumped.

### PING

**ping - send ICMP ECHO\_REQUEST to network hosts**

**ping** [-LRUbdnqrVaAB] [-c count] [-i interval] [-l preload] [-p pattern] [-s packetsize] [-t ttl] [-w deadline] [-F flowlabel] [-I interface] [-M hint] [-Q tos] [-S sndbuf] [-T timestamp option] [-W timeout] [hop ...] destination

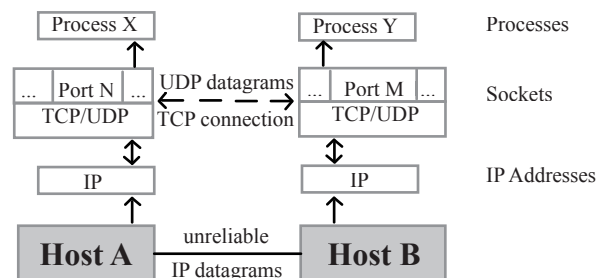
- a Audible ping.
- A Adaptive ping.
- b Allow ping to a broadcast address.
- B Do not allow ping to change source address.
- c count Stop after sending count ECHO\_REQUEST packets.
- d Set the SO\_DEBUG option on the socket being used.
- F flow label Allocate 20 bits flow label on echo request packets (Only ping6)
- f Flood ping.
- i interval Wait interval seconds between sending each packet.
- I interface address Set source address to specified interface address.
- l preload Sends [preload] packets not waiting for reply.
- L Suppress loopback of multicast packets.
- n Numeric output only.
- p pattern Specify (up to 16) "pad" bytes to fill out the out packet.
- Q tos Set Quality of Service-related bits in ICMP datagrams.
- q Quiet output.
- R Record route.
- r Bypass routing tables and send to a host on an attached interface.
- s packetsize Specify the number of data bytes to be sent.
- S sndbuf Set socket sndbuf.
- t ttl Set the IP Time to Live.
- T timestamp option Set special IP timestamp options
- M hint Select Path MTU Discovery strategy.
- U Print full user-to-user latency.
- v Verbose output.
- V Show version and exit.
- w deadline Specify a timeout (seconds) before ping exits.
- W timeout Time to wait for a response (seconds).

# The Mostly Used TCP/UDP Port Numbers

| Port No. | Protocol | Service Name | Aliases        | Comment                                   |
|----------|----------|--------------|----------------|---|
| 1        | TCP      | tcpmux       |                | TCP Port Service Multiplexer              |
| 2        | TCP/UDP  | compressnet  |                | Management Utility                        |
| 3        | TCP/UDP  | compressnet  |                | Compression Process                       |
| 7        | TCP/UDP  | echo         |                | Echo                                      |
| 13       | TCP/UDP  | daytime      |                | Daytime                                   |
| 19       | TCP/UDP  | chargen      | ttyst source   | Character generator                       |
| 20       | TCP      | ftp-data     |                | File Transfer                             |
| 21       | TCP      | ftp          |                | FTP Control                               |
| 22       | TCP      | ssh          |                | SSH remote login protocol                 |
| 23       | TCP      | telnet       |                | Telnet                                    |
| 25       | TCP      | smtp         | mail           | Simple Mail Transfer                      |
| 37       | TCP/UDP  | Time         |                | Time                                      |
| 39       | UDP      | RLP          | resource       | Resource Location Protocol                |
| 42       | TCP/UDP  | nameserver   | name           | Host Name Server                          |
| 43       | TCP      | nicname      | whois          | Who Is                                    |
| 49       | UDP      | TACACS       |                | TACACS: Login Host Protocol               |
| 53       | TCP/UDP  | domain       | DNS            | Domain Name Server                        |
| 67       | UDP      | bootps       | dhcps          | Bootstrap Protocol Server                 |
| 68       | UDP      | bootps       | dhcpc          | Bootstrap Protocol Client                 |
| 69       | UDP      | TFTP         |                | Trivial File Transfer Protocol            |
| 70       | TCP      | gopher       |                | Gopher                                    |
| 79       | TCP/UDP  | finger       |                | Finger                                    |
| 80       | TCP/UDP  | http         | www, http      | World Wide Web                            |
| 88       | TCP/UDP  | kerberos     | krb5           | Kerberos                                  |
| 101      | TCP      | hostname     | hostnames      | NIC Host Name Server                      |
| 102      | TCP      | iso-tsap     |                | ISO-TSAP Class 0                          |
| 107      | TCP      | rtelnet      |                | Remote Telnet Service                     |
| 110      | TCP      | pop3         | postoffice     | Post Office Protocol - Version 3          |
| 111      | TCP/UDP  | sunrpc       | rpcbnd portmap | SUN Remote Procedure Call                 |
| 113      | TCP      | Auth         | ident tap      | Authentication Service                    |
| 117      | TCP      | uucp-path    |                | UUCP Path Service                         |
| 118      | TCP      | sqlserv      |                | SQL Services                              |
| 119      | TCP      | nntp         | usenet         | Network News Transfer Protocol            |
| 123      | UDP      | ntp          |                | Network Time Protocol                     |
| 135      | TCP/UDP  | epmap        | loc-srv        | DCE endpoint resolution                   |
| 137      | TCP/UDP  | netbios-ns   | nbname         | NETBIOS Name Service                      |
| 138      | UDP      | netbios-dgm  | nbdatagram     | NETBIOS Datagram Service                  |
| 139      | TCP      | netbios-ssn  | nbssession     | NETBIOS Session Service                   |
| 143      | TCP      | imap         | imap4          | Internet Message Access Protocol          |
| 158      | TCP      | pcmail-srv   | repository     | PC Mail Server                            |
| 161      | UDP      | snmp         | snmp           | SNMP                                      |
| 162      | UDP      | snmptrap     | snmp-trap      | SNMP TRAP                                 |
| 170      | TCP      | Print-srv    |                | Network PostScript                        |
| 179      | TCP      | BGP          |                | Border Gateway Protocol                   |
| 194      | TCP      | irc          |                | Internet Relay Chat Protocol              |
| 213      | UDP      | ipx          |                | IPX over IP                               |
| 389      | TCP      | ldap         |                | Lightweight Directory Access Protocol     |
| 401      | TCP/UDP  | UPS          |                | Uninterruptible Power Supply              |
| 443      | TCP/UDP  | https        | MCom           | http protocol over TLS/SSL                |
| 445      | TCP/UDP  | CIFS         |                | Microsoft-ds (CIFS)                       |
| 464      | TCP/UDP  | kpasswd      |                | Kerberos (v5)                             |
| 500      | UDP      | isakmp       | ike            | Internet Key Exchange (IPSec)             |
| 513      | TCP      | login        |                | Remote Login                              |
| 513      | UDP      | who          | whod           | Database of who's logged on, average load |
| 514      | TCP      | cmd          | shell          | Automatic Authentication                  |
| 514      | UDP      | syslog       |                |   |
| 515      | TCP      | printer      | spooler        | Listens for incoming connections          |
| 517      | UDP      | tals         |                | Establishes TCP Connection                |

| Port No. | Protocol | Service Name | Aliases        | Comment                           |
|----------|----------|--------------|----------------|-----------------------------------|
| 520      | TCP      | efs          |                | Extended File Name Server         |
| 520      | UDP      | Routing      | router routed  | RIPv.1, RIPv.2                    |
| 521      | UDP      | Routing      | router routed  | RIPng                             |
| 525      | UDP      | Timed        | timeserver     | Timeserver                        |
| 526      | TCP      | Tempo        | newdate        | Newdate                           |
| 530      | TCP/UDP  | Courier      | rpc            | RPC                               |
| 531      | TCP      | conference   | chat           | IRC Chat                          |
| 532      | TCP      | netnews      | readnews       | Readnews                          |
| 533      | UDP      | Netwall      |                | For emergency broadcasts          |
| 540      | TCP      | Uucp         | uucpd          | Uucpd                             |
| 543      | TCP      | Klogin       |                | Kerberos login                    |
| 544      | TCP      | Kshell       | krcmd          | Kerberos remote shell             |
| 550      | UDP      | new-rwho     | new-who        | New-who                           |
| 554      | UDP      | rtsp         |                | Real Time Stream Control Protocol |
| 556      | TCP      | remotefs     | rfs rfs_server | Rfs Server                        |
| 560      | UDP      | rmonitor     | rmonitord      | Rmonitor                          |
| 561      | UDP      | monitor      |                |                                   |
| 636      | TCP      | Ldaps        | sldap          | LDAP over TLS/SSL                 |
| 749      | TCP/UDP  | kerberos-adm |                | Kerberos administration           |
| 750      | UDP      | Kerberos-iv  |                | Kerberos version IV               |
| 1080     | TCP/UDP  | socks        |                | socks                             |
| 1812     | TCP      | RADIUS       |                | RADIUS                            |
| 1813     | TCP      | RADIUS       |                | RADIUS accounting                 |

## TCP/UDP Ports



Well Known Ports: from 0 through 1023  
 Registered Ports: from 1024 through 49151  
 Dynamic and/or Private Ports: from 49152 through 65535

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