Computer Networks Lab 01

Course: Computer Networks (CL3001) **Semester:** Spring 2025
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Note:

- Maintain discipline during the lab.
- Listen and follow the instructions as they are given.
- Just raise hand if you have any problem.
- Completing all tasks of each lab is compulsory.
- Get your lab checked at the end of the session.

Network

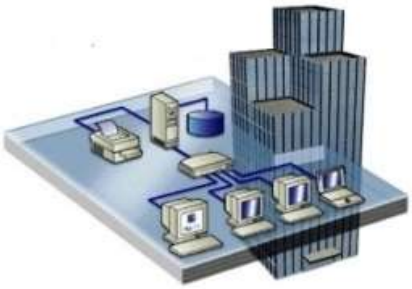
A group or system of interconnected people or things.

Computer Network

A computer network or data network is a telecommunications network which allows nodes to share resources. In computer networks, networked computing devices exchange data with each other using a data link. The connections between nodes are established using either cable media or wireless media.

Types of Computer Network

Some of the different networks based on size are LAN, MAN, WAN.



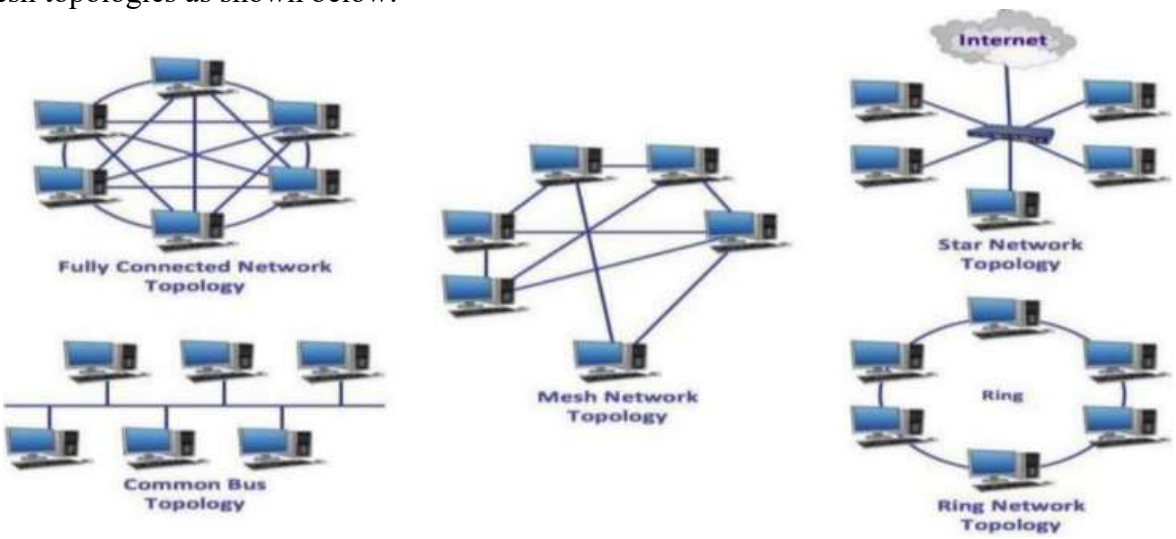
LAN

Host

Computer to be connected to a network. A host in a network refers to any device, such as a computer or server, that connects to and communicates within the network. Each host typically has a unique identifier, like an IP address, allowing data exchange in the network.

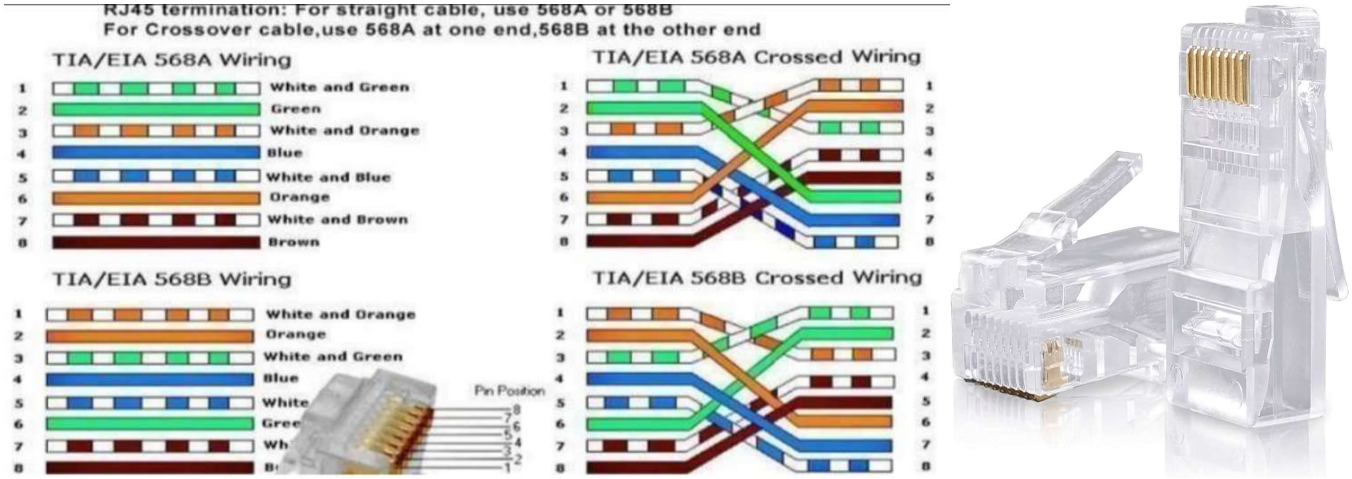
Topology

Network topology is the arrangement of the various elements (links, nodes, etc.) of a computer network. Essentially, it is the topological structure of a network and may be depicted physically or logically.
The basic examples of network topologies used in local area networks include bus, ring, star, and tree and mesh topologies as shown below:



RJ45 Connector

An 8-pin/8-position plug or jack is commonly used to connect computers onto Ethernet-based local area networks (LAN). Two wiring schemes–T568A and T568B–are used to terminate the twisted-pair cable onto the connector interface as shown below:



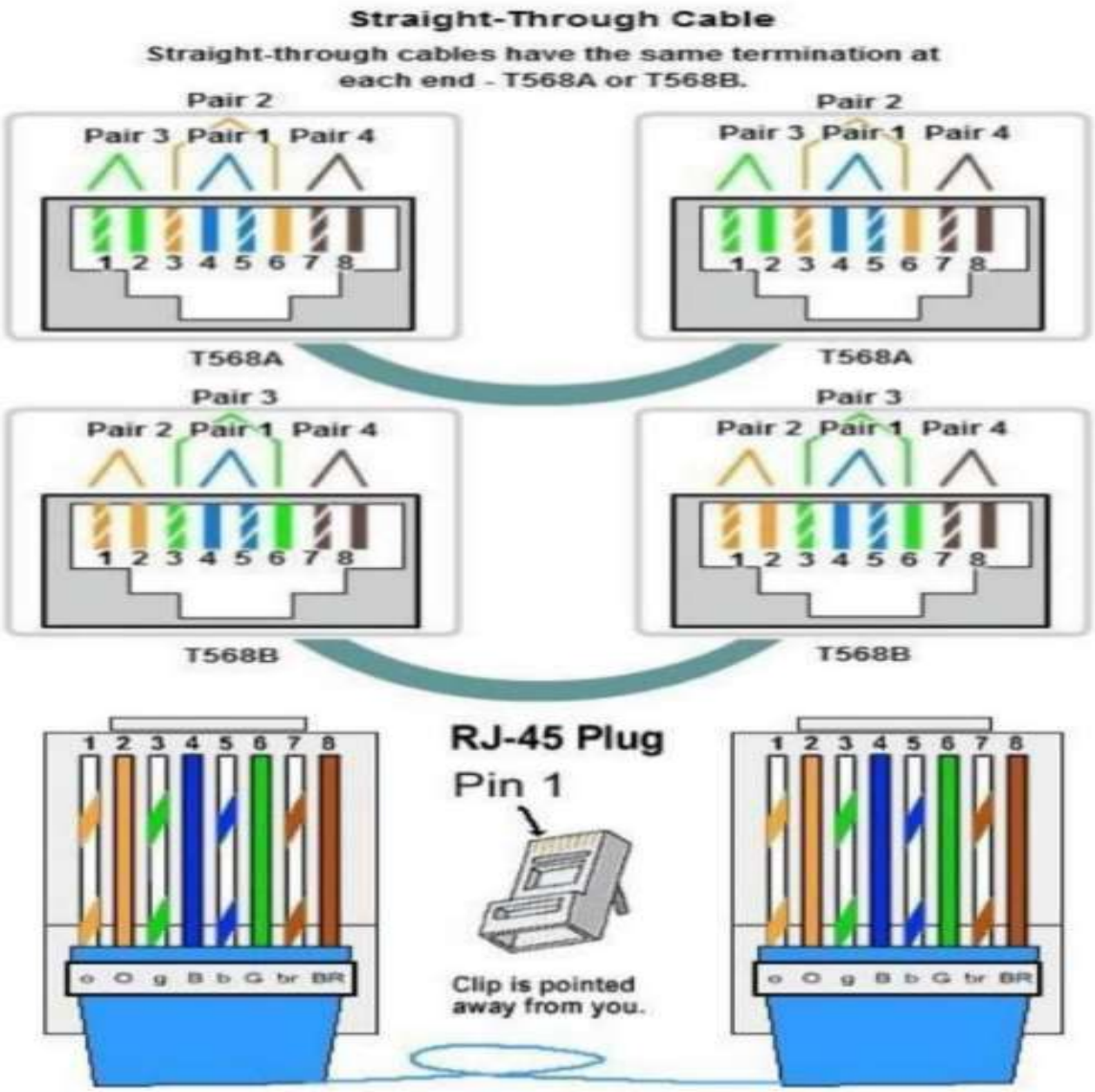
Types of Cables

1) Straight Cable

You usually use straight cable to connect **different type of devices**. This type of cable will be used most of the time and can be used to:

1) Connect a computer to a switch/hub's normal port.
2) Connect a computer to a cable/DSL modem's LAN port.
3) Connect a router's WAN port to a cable/DSL modem's LAN port.
4) Connect a router's LAN port to a switch/hub's uplink port (normally used for expanding network).
5) Connect 2 switches/hubs with one of the switch/hub using an uplink port and the other one using normal port.

If you need to check how straight cable looks like, it's easy. Both sides (side A and side B) of cable have wire arrangement with same color.

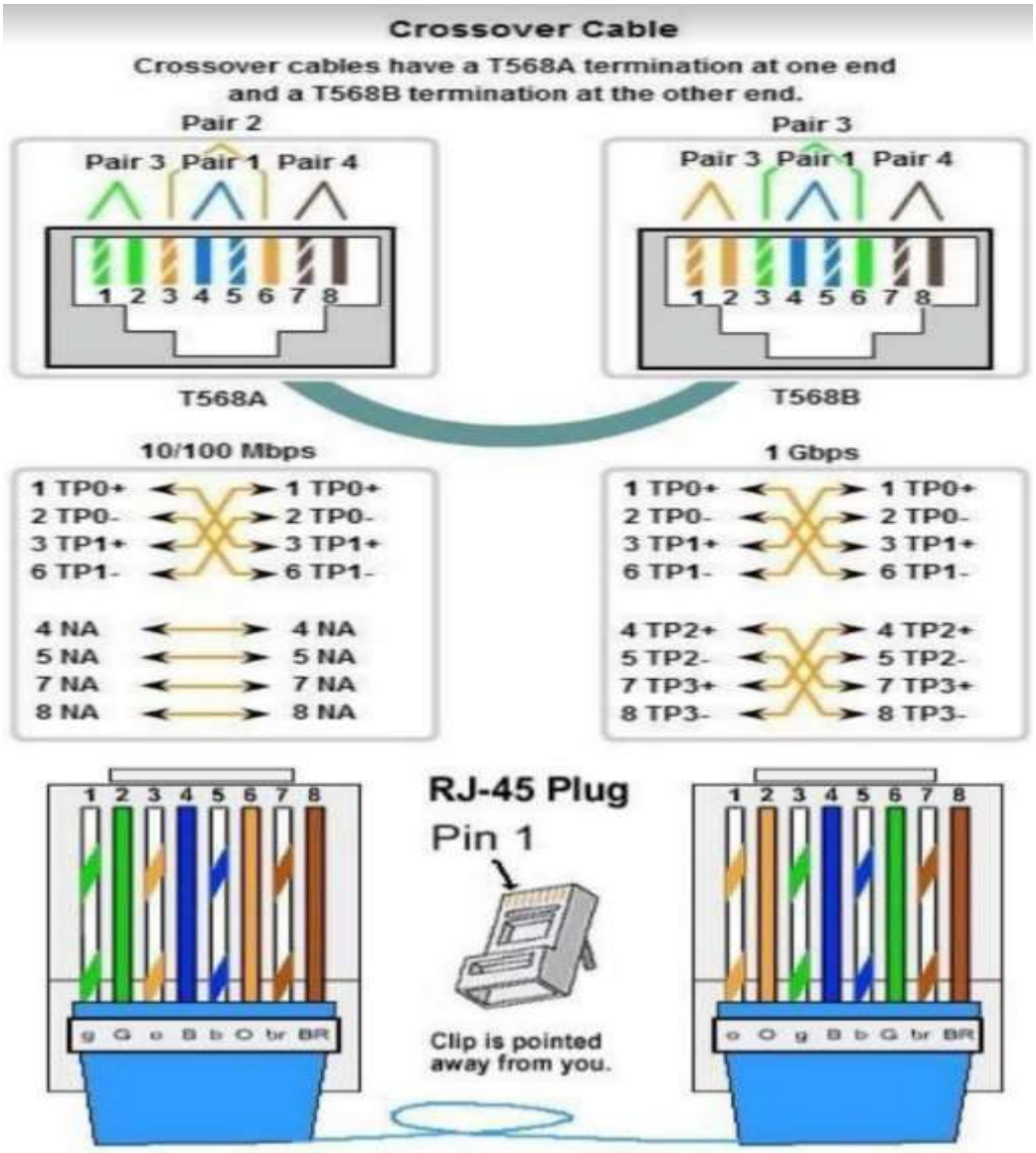


2) Crossover Cable

Sometimes you will use crossover cable, it's usually used to connect **same type of devices**. A crossover cable can be used to:

1) Connect 2 computers directly.
2) Connect a router's LAN port to a switch/hub's normal port. (normally used for expanding network).
3) Connect 2 switches/hubs by using normal port in both switches/hubs.

If you need to check how crossover cable looks like; both sides (side A and side B) of cable have wire arrangement with following different color:



Note: If there is auto MDI/MDI-X feature support on the switch, hub, network card or other network devices, you don't have to use crossover cable in the situation which is mentioned above. This is because crossover function would be enabled automatically when it's needed.

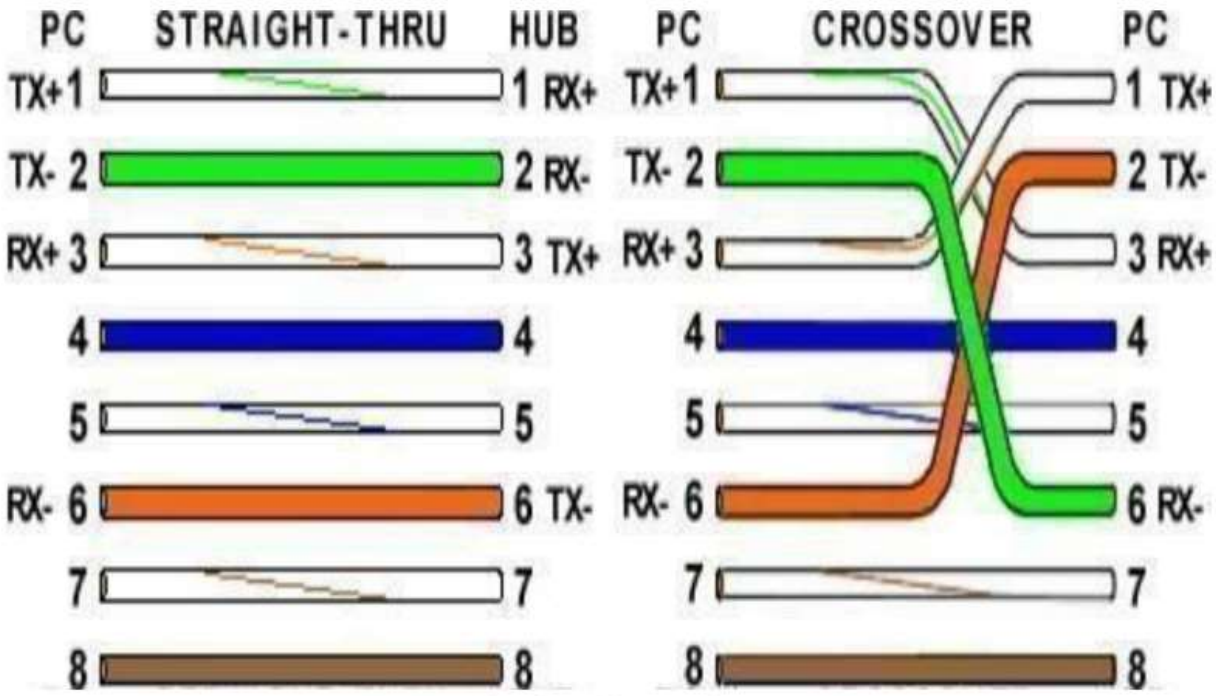


Figure 6 Straight and Crossover Comparison

Network Terminologies

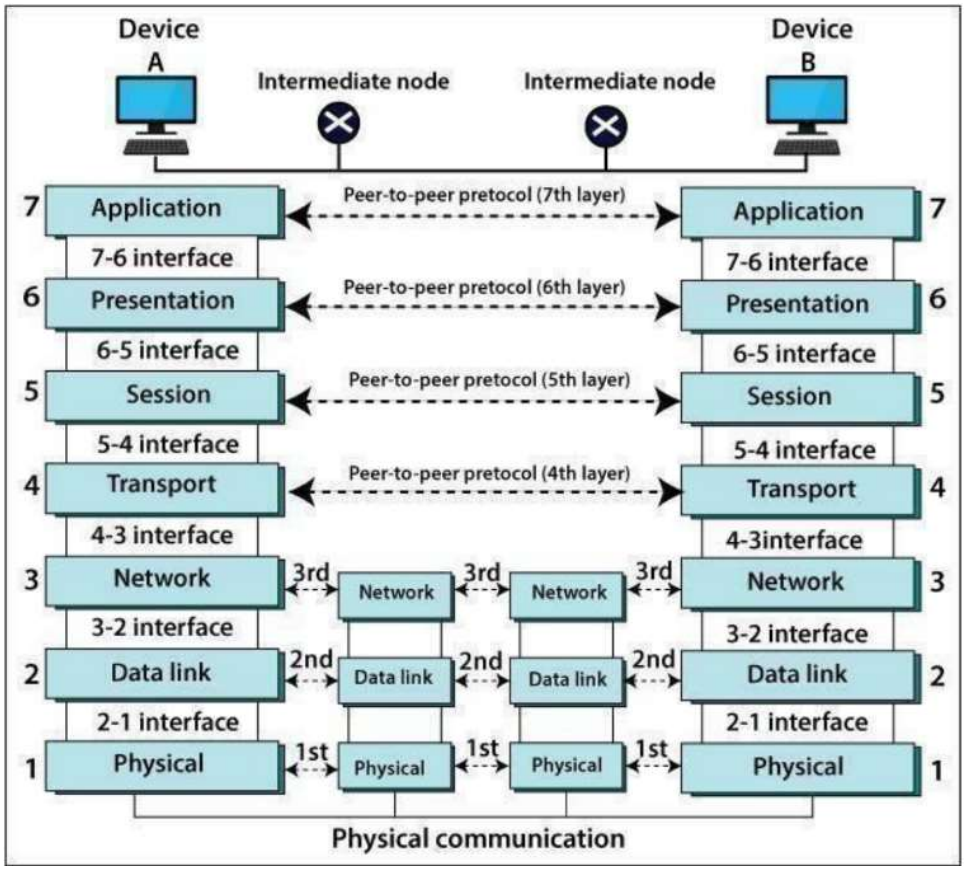
S.No	Network Terminologies	Definition
1	NIC	Network Interface Card. The hardware interface from a host to the network.
2	MAC	MAC stands for Medium Access Control, also known as physical address of any device. For example: 00:C0:9F:9B:D5:46
3	Hub	A hub is the most basic networking device that connects multiple other network devices together. Unlike a network switch or router, a has no routing tables or intelligence on where to send information all network data across each connection.
4	Switch	Switch is a computer networking device that connects devices together on network, by using packet switching to receive, process and forward destination device.
5	Router	A device that decides where a packet should be sent in order to get outside a network. Routers range from simple gateways between backbone routers of the Internet proper.
6	IP Address	All hosts and routers have an IP address consisting of four decimals. For example: 192.168.0.1 and 131.170.40.33
7	Port Address	Every host has 65,535 ports each of which can be connected to a specific application that sends and receives data packets from the network.

8	Gateway Address	Every host needs to know the address of the router which connects a network to other networks and the Internet.
9	Domain Name	Hosts may have a domain name which maps onto an IP address. For example, www.google.com is mapped to IP address 66.102.7.104.
10	DNS Server	Domain Name System Server. Every host needs access to a DNS server so it can convert between IP address and domain name.
11	DHCP	Dynamic Host Configuration Protocol. A DHCP can give a host a unique IP address whenever the host restarts thus saving IP addresses. A DNS address is also provided.

OSI Model

To define the OSI model in one sentence: the OSI model is a concept-based model that defines, and sets standards for, the way in which a computing or telecommunication system functions. The goal of the OSI model is to achieve interoperability, through the use of standards, amongst a diverse set of communications. A Layer-Based System.

There are seven distinct layers in the OSI model. They are:



Introduction to Windows & Linux Commands

Most computers will be running Linux or MS Windows operating systems (OS).

LINUX

LINUX is an excellent operating system to understand and play with networks for several reasons:

1) Free and open source.
2) Open source lessens the likelihood of deliberate security weaknesses.
3) Dominates the web server market and it is the basis of many networking boxes such as routers.
4) More powerful command line than Windows thus making script file operations more powerful and flexible.

In Linux, there are a number of simple commands that can be used to examine, debug and play with a network. To see all, use the manual pages (eg man ping) of the info pages (info ping).
Many commands require root privileges, or the programs reside in paths that root knows about but not users. It may be easier to log onto Linux as a user and open a root terminal.

WINDOWS

1) Dominates the desktop market.
2) More users are familiar with Windows. (95% of desktop PCs run on Windows) has GUI which provides easier usage. However, recent KDE and GNOME desktops under Linux have been shown to be equivalently easy to use.

Windows has a number of command line programs and GUI programs that can be used to view and alter network configuration. To see all, type hh ntcmds.chm in your terminal window, and to see all options for a command line, type –h, /?, -help, or ?

Note – Every engineer with networking knowledge should be familiar with both OS.

Some commonly used Linux and Windows commands are as follows:

S.No	Linux Commands	Windows Commands	Usage/Affect
1	Ifconfig	ipconfig	To find ip address of the computer/host.
2	hostname	hostname	To display the hostname.
3	nslookup	nslookup	To list variety of info about DNS and the computers/hosts that have joined the domain.
4	Ping	ping	To check if a host can be accessed (by IP or hostname)
5	traceroute	tracert	to trace route from a host through internet router to a destination. Useful to discover why a network cannot get access to internet, and internet routing problems.
6	Netstat	Netstat	To print status of network ports, routing tables and more.

IP ADDRESS

An IP address class is a categorical division of internet protocol addresses in IPv4- based routing. Separate IP classes are used for different types of networks. Some are used for public internet-accessible IPs and subnets, that is, those networks behind a router (as in classes A, Band C).

The subnet mask for a default, unsubnetted class A, B or C network has 1s for each bit that is used for network ID or subnet ID, and 0s for the host ID bits. Of course, we just said we aren't subnetting, so there are no subnet ID bits.

IP Address Classes

Class A	1 – 127	(Network 127 is reserved for loopback and internal testing) Leading bit pattern	0	00000000.00000000.00000000.00000000 Network . Host . Host . Host
Class B	128 – 191	Leading bit pattern	10	10000000.00000000.00000000.00000000 Network . Network . Host . Host
Class C	192 – 223	Leading bit pattern	110	11000000.00000000.00000000.00000000 Network . Network . Network . Host
Class D	224 – 239	(Reserved for multicast)		
Class E	240 – 255	(Reserved for experimental, used for research)		

Private Address Space

Class A	10.0.0.0 to 10.255.255.255
Class B	172.16.0.0 to 172.31.255.255
Class C	192.168.0.0 to 192.168.255.255

Default Subnet Masks

Class A	255.0.0.0
Class B	255.255.0.0
Class C	255.255.255.0

Class Exercise: Address Class Identification

Address	Class
10.250.1.1	A
150.10.15.0	B
192.14.2.0	
148.17.9.1	
193.42.1.1	
126.8.156.0	
220.200.23.1	
230.230.45.58	
177.100.18.4	
119.18.45.0	
249.240.80.78	
199.155.77.56	
117.89.56.45	
215.45.45.0	
199.200.15.0	
95.0.21.90	
33.0.0.0	
158.98.80.0	
219.21.56.0	

Class Exercise: Host & Network Identification

Circle the network portion of these addresses:	Circle the host portion of these addresses:
177.100.18.4	10.15.123.50
119.18.45.0	171.2.199.31
209.240.80.78	198.125.87.177
199.155.77.56	223.250.200.222
117.89.56.45	17.45.222.45
215.45.45.0	126.201.54.231
192.200.15.0	191.41.35.112
95.0.21.90	155.25.169.227
33.0.0.0	192.15.155.2
158.98.80.0	123.102.45.254
217.21.56.0	148.17.9.155
10.250.1.1	100.25.1.1
150.10.15.0	195.0.21.98
192.14.2.0	25.250.135.46
148.17.9.1	171.102.77.77
193.42.1.1	55.250.5.5
126.8.156.0	218.155.230.14
220.200.23.1	10.250.1.1

Class Exercise: Network Addresses

Using the IP address and subnet mask shown write out the network address:

188.10.18.2
255.255.0.0 — 188 . 10 . 0 . 0

10.10.48.80
255.255.255.0 — 10 . 10 . 48 . 0

192.149.24.191
255.255.255.0 —

150.203.23.19
255.255.0.0 —

10.10.10.10
255.0.0.0 —

186.13.23.110
255.255.255.0 —

223.69.230.250
255.255.0.0 —

200.120.135.15
255.255.255.0 —

Class Exercise: Host Addresses

Using the IP address and subnet mask shown write out the host address:

188.10.18.2 255.255.0.0	0 . 0 . 18 . 2
10.10.48.80 255.255.255.0	0 . 0 . 0 . 80
222.49.49.11 255.255.255.0	
128.23.230.19 255.255.0.0	
10.10.10.10 255.0.0.0	
200.113.123.11 255.255.255.0	
223.169.23.20 255.255.0.0	
203.20.35.215 255.255.255.0	

Class Exercise: Default Subnet Masks

Write the correct default subnet mask for each of the following addresses:

177.100.18.4	255 . 255 . 0 . 0
119.18.45.0	255 . 0 . 0 . 0
191.249.234.191	
223.23.223.109	
10.10.250.1	
126.123.23.1	
223.69.230.250	
192.12.35.105	
77.251.200.51	
189.210.50.1	