NETWORK FUNDAMENTALS

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RSCE/ICTS/NETWORK FUNDAMENTALS

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Topics covered.

- Introduction to networks
- Communication medium
- Types of networks
- Packet switching
- Network components
- Network management systems
- Lab practical's

What's in for me?

- Understand the meaning of networks
- Know about communication mediums
- What makes up a network
- Learn about different ways of managing a network

Part II fiber optics

- Learn about fiber optics
- Know different types of fiber optic cables
- Learn how to splice optic fiber cables
- Safety practices in deploying fiber optic cable
- Know how to test for loss in fiber optics

Network failure video

Introduction to networks

Today the world scenario is changing a set of devices often mentioned as nodes connected by media link is called a Network.

Introduction to Networks

Define a node:

A node can be a device which is capable of sending or receiving data generated by other nodes on the network like a computer, printer etc.

A good network must meet the following criteria;

Performance

Reliability

Scalability.

Networking

Computer network

A collection of computing devices connected in order to communicate and share resources

Connections between computing devices can be physical using wires or cables or wireless using radio waves or infrared signals

Network resources

Network design criteria

Performance: Is measured in the following ways;

Transmit time: i.e. the time taken to transmit a message from one device to another.

Response time: is the time elapsed between enquiry and response.

Network design criteria

Other ways to measure performance include;

Efficiency of software, number of users and capability of connected hardware.

Reliability:

It decides the frequency at which network failure takes place….the more the failures are, the less the network's reliability.

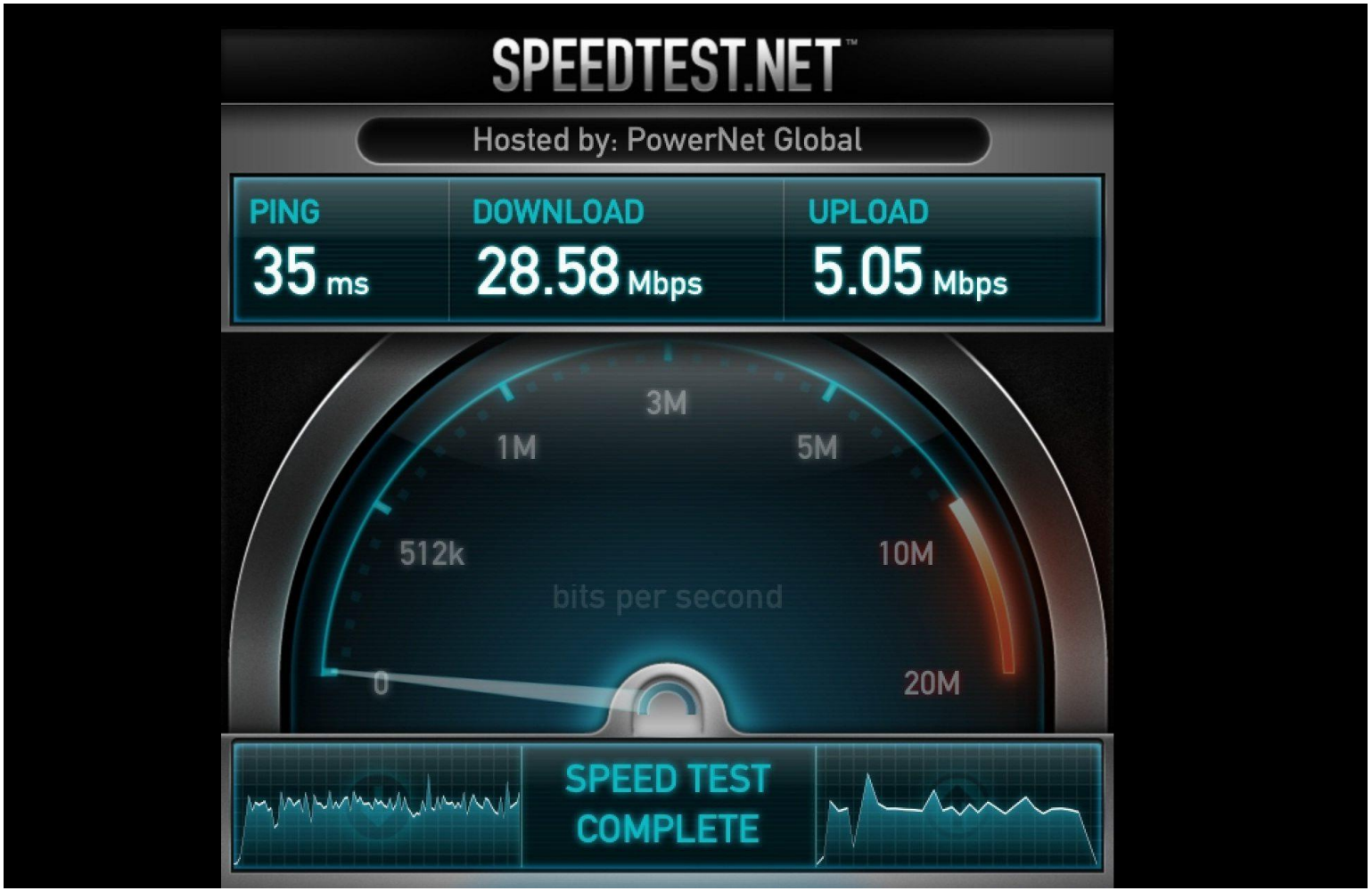
Network design criteria

Network Security:

It refers to the protection of data from the unauthorized user or access. While travelling through network, data passes through many layers of network, and data can be traced if attempted.

Why do you think security is an important aspect of a network and Who is vulnerable?

Measuring networks speed



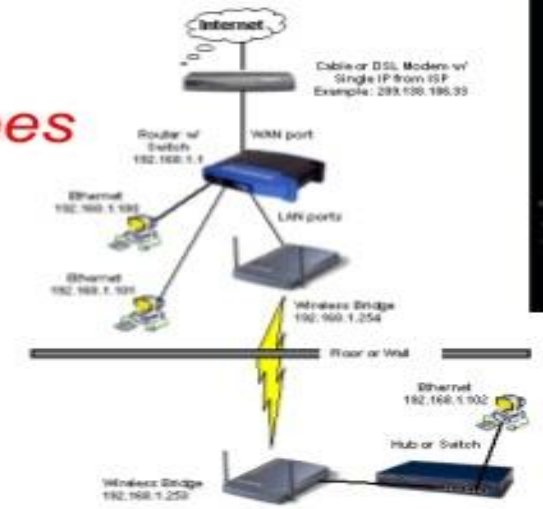
Network Mediums

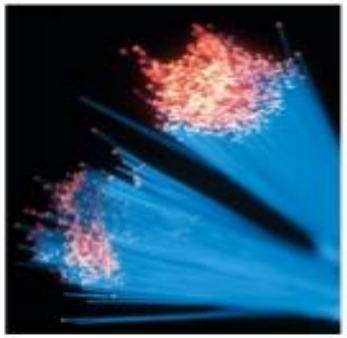
Network Media

- the actual path over which data/signal travels as it moves from one component to another.

Network Media Types

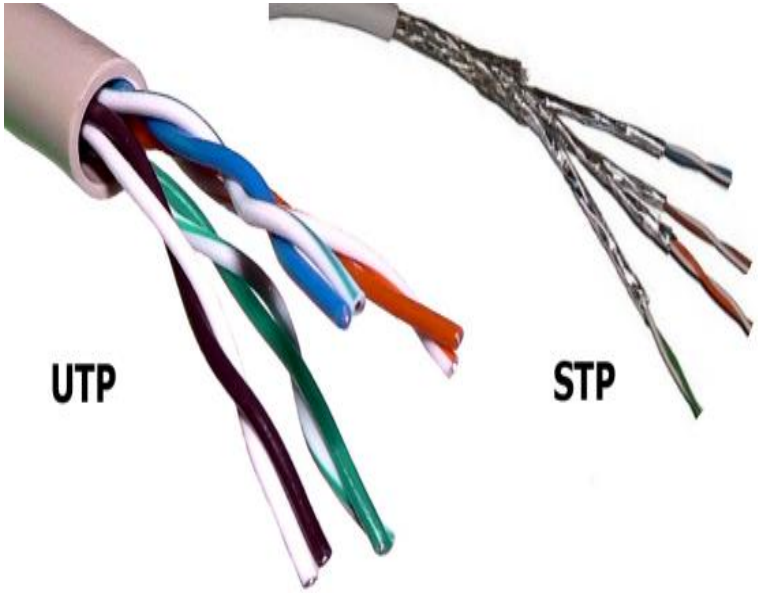
- Copper – Wired
- Glass – Wired
- Air – wireless
- Radio - Wireless





Ethernet cable

Ethernet cable type



RJ-45 Connector

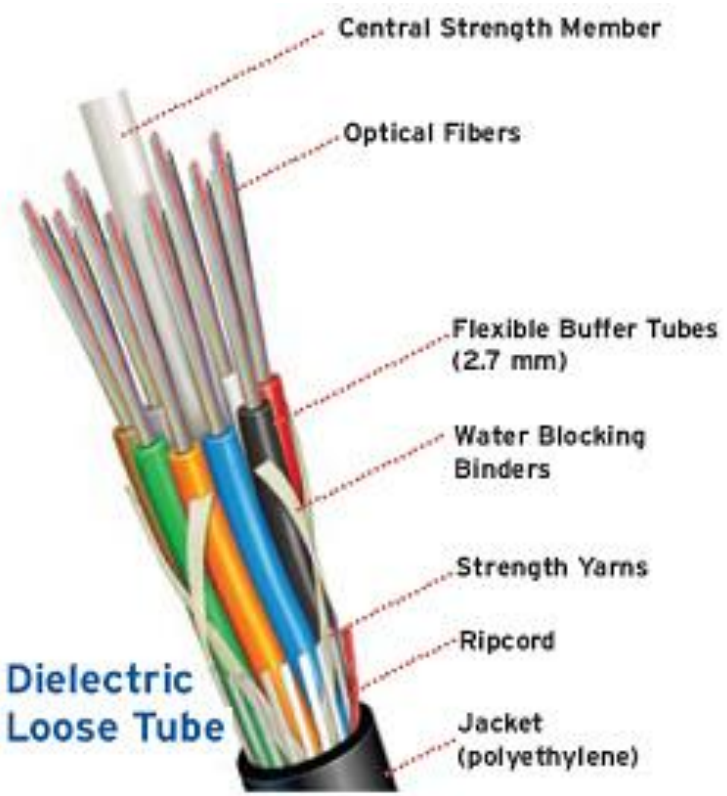
Ethernet coupler

Ethernet cable categories and Speeds

Category	Cable Type	Max-Speed
Category 3	UTP	10 Mbps
Category 5	UTP	10/100 Mbps
Category 5 e	UTP	1000 Mbps
Category 6	UTP or STP	1000 Mbps

Fiber optic cable

Fiber optic makeup



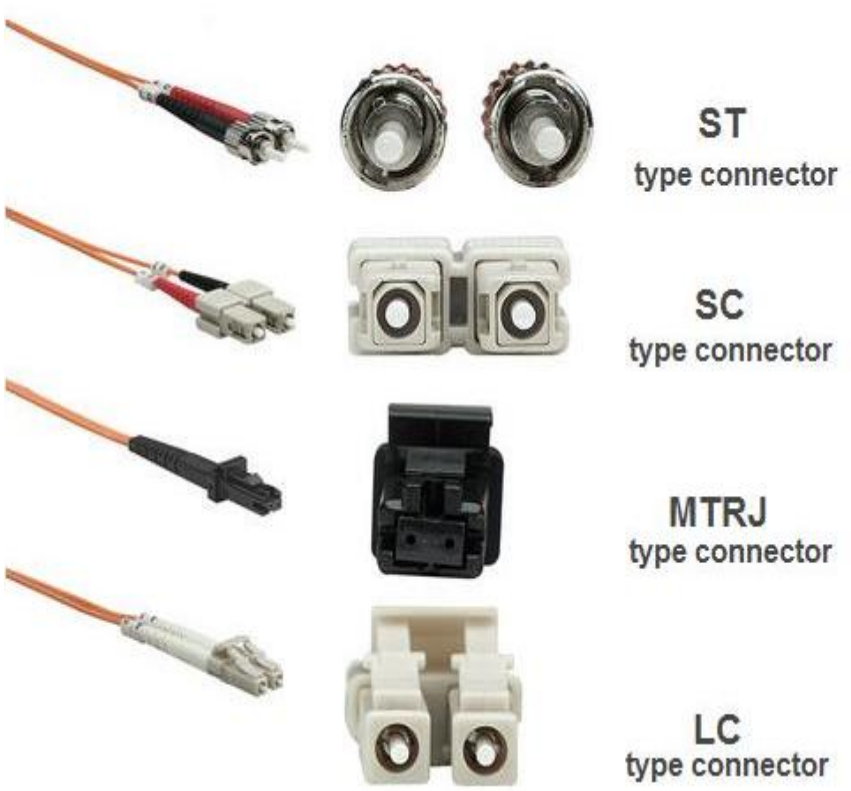
Types of fiber optic cables

- Single mode fiber
- Multi-mode fiber

Types of fiber optic cables connectors

- LC
- FC
- ST
- SC
- MT-RJ, MT, MPO/MTP

Optic fiber connectors



Types of Networks

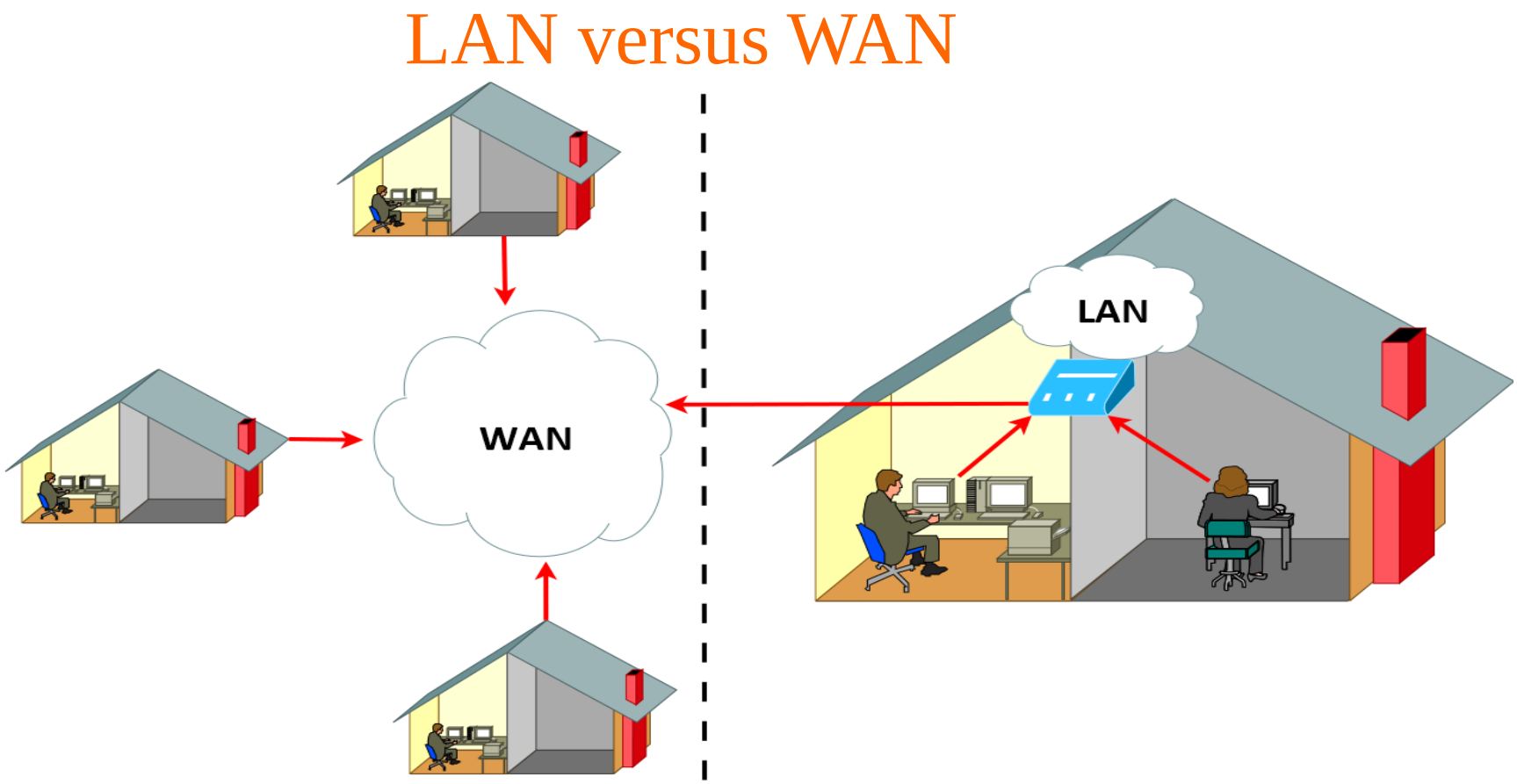
Local Area Network (LAN)

A network that connects a relatively small number of machines in a relatively close geographical area

Wide Area Network (WAN)

A network that connects more than two LANs. It normally interconnects branches to head offices, and several campus networks together.

Types of networks



Types of Networks

Define a topology?

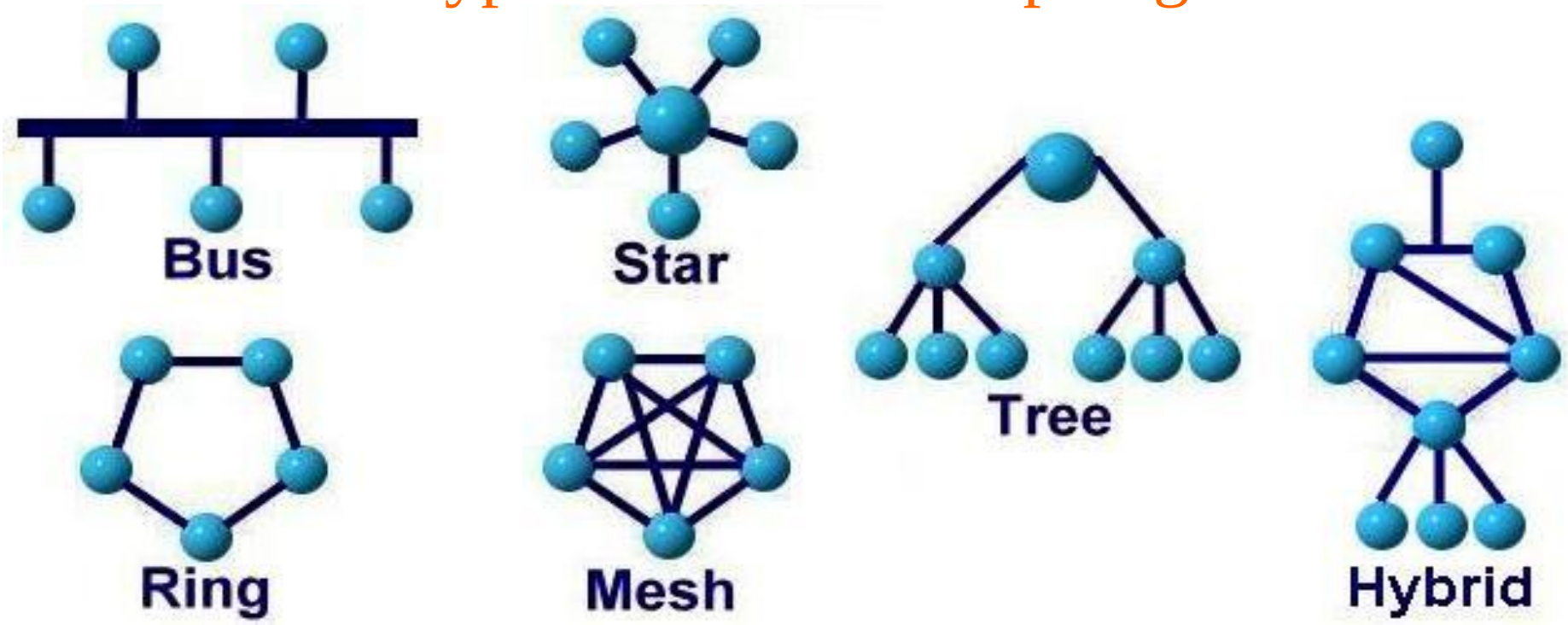
Star topology centers around one node to which all others are connected and through which all messages are sent.

Bus topology nodes are connected to a single communication line that carries messages in both directions

Mention other examples of Network topologies?

Types of Networks

Other types of Network Topologies



Types of Networks

Internet:

A wide area network that spans the planet

Intranet:

A local or restricted communications network, especially a private network created using World Wide Web software.

So, who owns the Internet?

Internet Connections

Internet backbone

A set of high-speed networks that carry Internet traffic, provided by companies such as AT&T, Liquid Telecom, GTE, British Telecom, and TEAM

Mention other forms of internet connection?

Internet Connections

Wireless network

A network in which devices communicate with other nodes through a wireless access point

Wired network

Is a common type of **wired** configuration. Most **wired networks** use Ethernet cables to transfer data between connected PCs

Internet Connections

Mobile computing: Various technologies available to connect a home computer to the Internet

Phone modem converts computer data into an analog audio signal for transfer over a telephone line, and then a modem at the destination converts it back again into data

Internet connections

Broadband

A connection in which transfer speeds are faster than 17 Mbs per second.

Satellite connections for example LEO low earth orbit e.g. O3B, and Geostationary Orbit e.g. INTELSAT36.

Internet connections

The speed for **downloads**

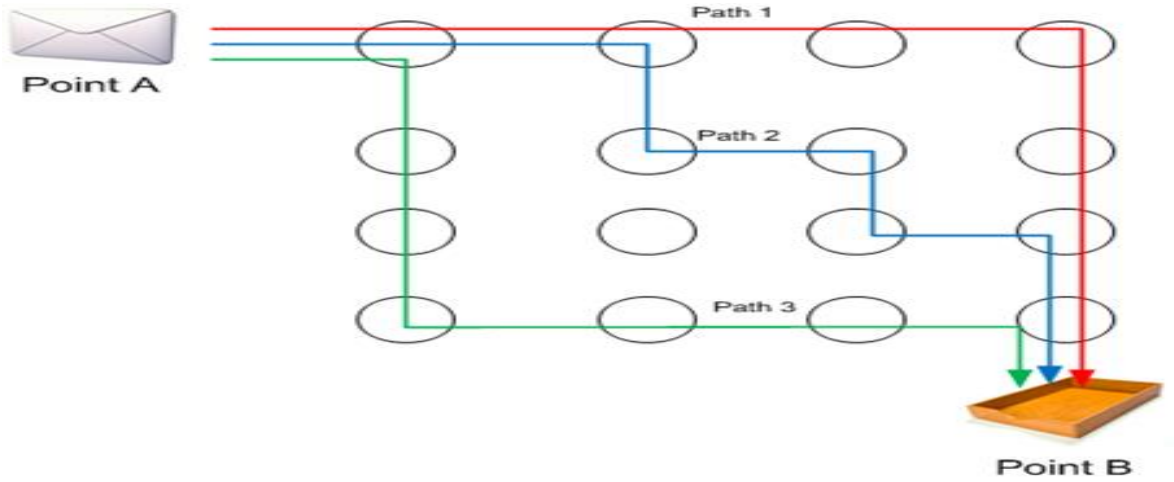
Getting data from the Internet to your home computer may not be the same as **Uploads** (sending data from your home computer to the Internet)

How can one improve on the speed of downloads or uploads?

Packet switching

Packet switching

A mode of data transmission in which a message is broken into a number of parts that are sent independently, over whatever route is optimum for each packet, and reassembled at the destination.



Packet Switching

Switching vs Routing

Switching	Routing
path set up at connection time	can work as connectionless
simple table look up	complex routing algorithm
table maintainance via signaling	table maintainance via protocol
no out of sequence delivery	out of sequence delivery likely
lost path may lose connection	robust: no connections lost
much faster than pure routing	significant processing delay
link decision made ahead of time, and resources allocated then	output link decision based on packet header contents - at every node

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Network addresses

Hostname

A name made up of words separated by dots that uniquely identifies a computer on the Internet

IP address

An address made up of four one-byte numeric values separated by dots that uniquely identifies a computer on the Internet

Network Protocols

Transmission Control Protocol (TCP)

Software that breaks messages into packets, hands them off to the IP software for delivery, and then orders and reassembles the packets at their destination

Internet Protocol (IP)

Software that deals with the routing of packets through the maze of interconnected networks to their final destination

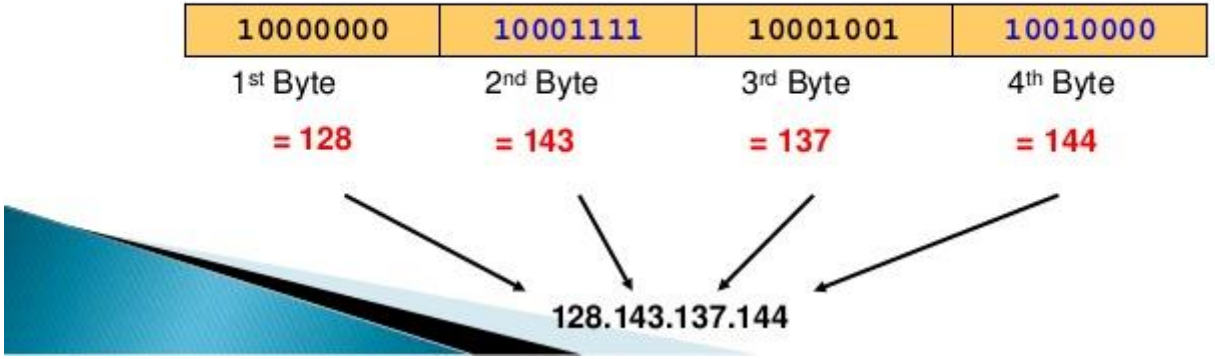
IP Addressing

IP Address

- What is an IP address…?
  - An IP address is a unique global address for a network interface

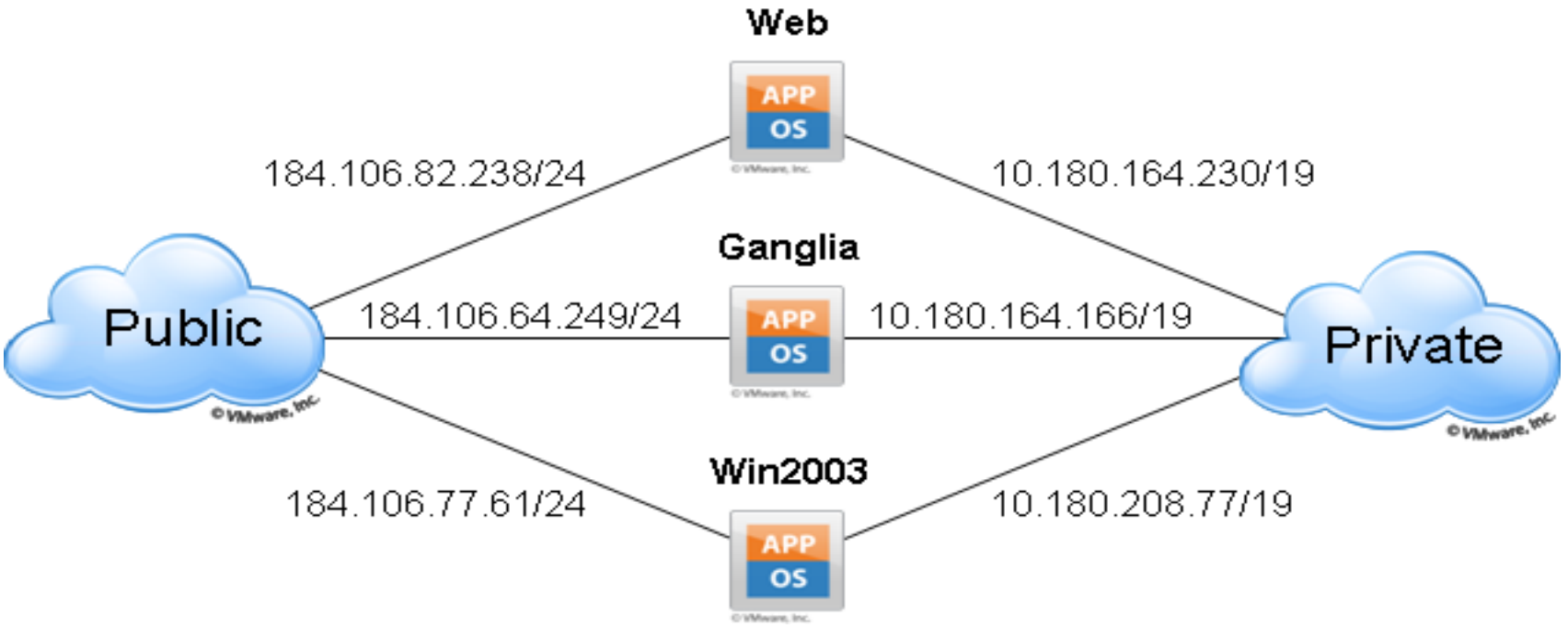
– is a **32 bit long** identifier

– encodes a network number (**network prefix**) and a **host number**



IP Address

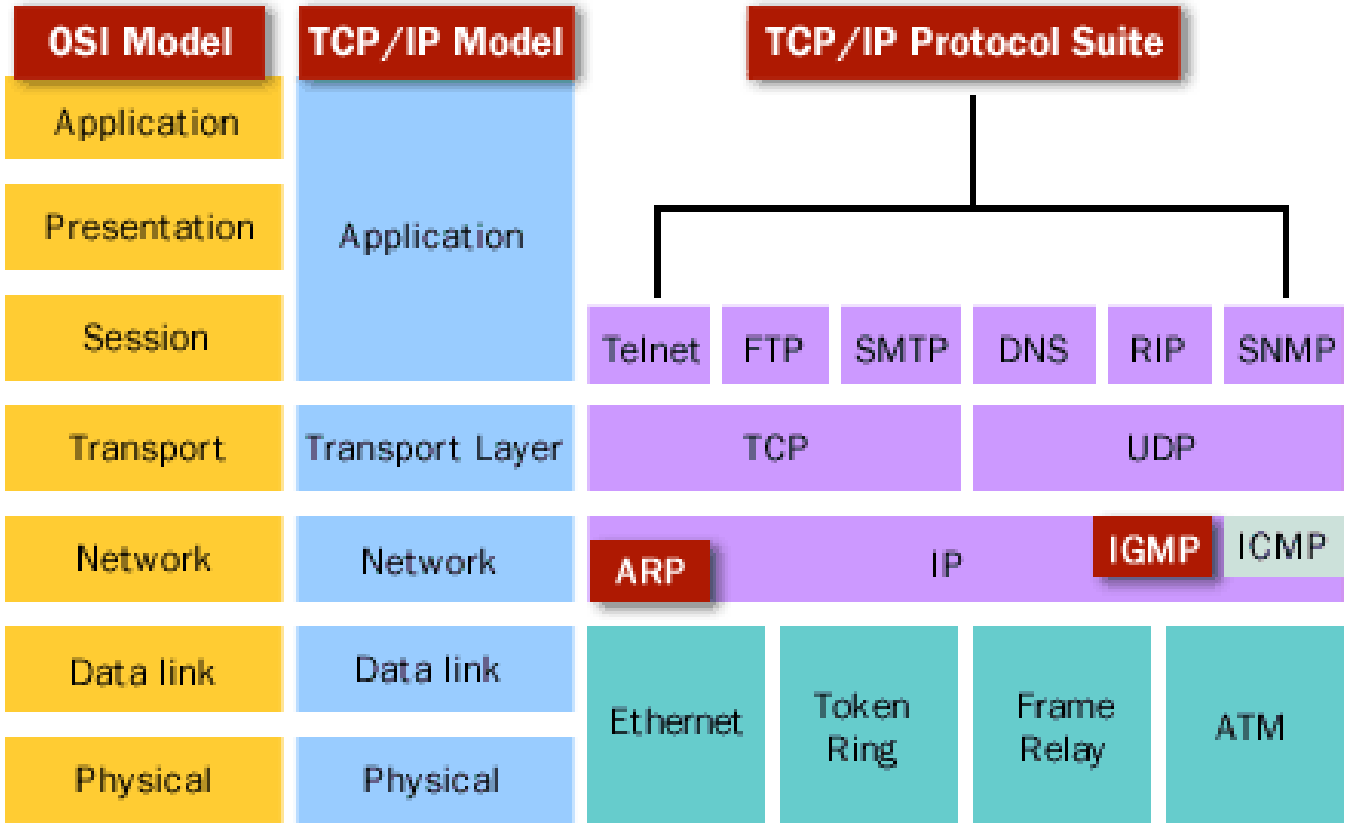
Public vs. Private IP address



IP Addresses

Class	Address Range	Supports
Class A	1.0.0.1 to 126.255.255.254	Supports 16 million hosts on each of 127 networks.
Class B	128.1.0.1 to 191.255.255.254	Supports 65,000 hosts on each of 16,000 networks.
Class C	192.0.1.1 to 223.255.254.254	Supports 254 hosts on each of 2 million networks.
Class D	224.0.0.0 to 239.255.255.255	Reserved for multicast groups.
Class E	240.0.0.0 to 254.255.255.254	Reserved for future use, or Research and Development Purposes.

Network protocol\ Model



TCP/IP

Ping

A program used to test whether a particular network computer is active and reachable

Traceroute

A program that shows the route a packet takes across the Internet

Network Components

There are a number of network physical components used to network computers.

These include; NIC, Cables, Switches, Routers, Bridges, Hubs, Access points, firewalls, servers etc.

Briefly define each of the above components?

Firewall

Firewall

A gateway machine and its software that protects a network by filtering the traffic it allows

Access control policy

A set of rules established by an organization that specifies what types of network communication are permitted and denied.

Network Management System

A network management system (NMS)

Is a set of hardware and/or software tools that allow an IT professional to supervise the individual components of a network within a larger network management framework.

List examples of network management software or hardware?

Lab practical's

- Basic router configuration
- Interface configuration
- Troubleshooting common port issues
- VLAN configurations

Cisco Router basic configuration

	Command	Purpose
Step 1	configure terminal Example: Router> enable Router# configure terminal Router(config)#	Enters global configuration mode, when using the console port. Use the following to connect to the router with a remote terminal: telnet router name or address Login: login id Password: ********* Router> enable
Step 2	hostname name Example: Router(config)# hostname RSCE RSCE(config)#	Specifies the name for the router.
Step 3	enable secret password Example: RSCE(config)# enable secret cr1ny5ho Router(config)#	Specifies an encrypted password to prevent unauthorized access to the router.
Step 4	no ip domain-lookup Example: RSCE(config)# no ip domain-lookup RSCE(config)#	Disables the router from translating unfamiliar words (typos) into IP addresses.

Interface configuration

	Command	Purpose
Step 1	interface gigabitethernet slot/port Example: RSCE(config)# interface gigabitethernet 0/1 RSCE(config-if)#	Enters the configuration mode for a Gigabit Ethernet interface on the router.
Step 2	ip address ip-address mask Example: RSCE(config-if)# ip address 192.162.16.3 255.255.255.0 RSCE(config-if)#	Sets the IP address and subnet mask for the specified GE interface.
Step 3	no shutdown Example: RSCE(config-if)# no shutdown RSCE(config-if)#	Enables the GE interface, changing its state from administratively down to administratively up.
Step 4	Exit Example: RSCE(config-if)# exit RSCE(config)#	Exits configuration mode for the GE interface and returns to global configuration mode.

Common Port Issues- Troubleshooting

- Check the physical media to ensure there are no damaged parts.
- Verify that the SFP (small form-factor pluggable) devices in use are those authorized by Cisco and that they are not faulty.
- Verify that you have enabled the port by right-clicking the port in Device Manager and selecting enable or by using the no shut CLI command.

Common Port Issues- Troubleshooting

- Right-click the port in Device Manager or use the show interface CLI command to verify the state of the interface

- Use **show interface** command to show the running interfaces.

VLAN configurations

- VLAN is a switched network that is logically segmented by function, project team, or application, without regard to the physical locations of the users.

- VLANs have the same attributes as physical LANs, but you can group computers even

VLAN configurations

- If they are not physically located on the same LAN segment.
- Any switch port can belong to a VLAN, and unicast, broadcast, and multicast packets are forwarded and flooded only to end stations in the VLAN.
- Each VLAN is considered a logical network, and packets destined for stations that do not belong to the VLAN must be forwarded through a router or bridge or layer 3 switches.

VLAN commands

- Switch>enable
- Switch#configure terminal
- Switch(config)#hostname SW2
- Switch(config)#interface Vlan 2
- SW2(config)#vlan 2
- SW2(config-vlan)#name SIGNALS
- Switch(config-if)#ip address 10.4.3.4 255.255.255.0
- Switch(config-if)#no shutdown

Configuring multiple VLANs

- SW2(config-vlan)#vlan 3
- SW2(config-vlan)#name RSCE
- SW2(config-vlan)#vlan 4
- SW2(config-vlan)#name UNMISS
- SW2(config-vlan)#
- SW2(config)#interface fastEthernet 0/5
- SW2(config-if)#switchport mode access
- SW2(config-if)#switchport access vlan 2
- SW2(config-if)#exit

Configuring multiple VLANs

- SW2(config)#interface gigaethernet 0/6
- SW2(config-if)#switchport mode access
- SW2(config-if)#switchport access vlan 2
- SW2(config-if)#
- OR
- SW2(config)#interface range fastEthernet 0/2-4
- SW2(config-if-range)#switchport mode access
- SW2(config-if-range)#switchport access vlan 4
- SW2# exit