

# Lecture (01)

## Introduction to Computer Networking Concepts

Dr. Ahmed M. ElShafee

## Agenda

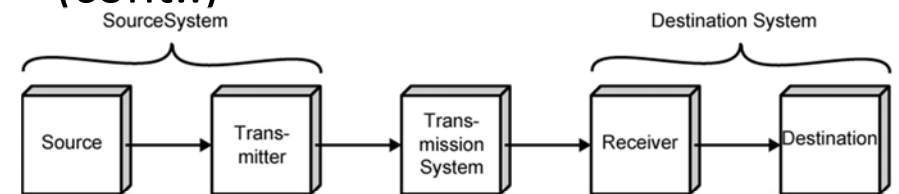
- Network & data communication.
- Perspectives on Networking
- Eight simple steps to develop a computer network
- What about the real network?
- Local area network
- Wide area network
- Metropolitan area network
- Perspectives on internet

## Network & Data Communication

### Data communication

- Deals with data or information transfer between a source and a receiver.
- Data Communication is interested in the transfer of data, the method of transfer and the preservation of the data during the transfer process.
- Data communication focuses on the following topics:
  - data encoding and decoding
  - Modulation
  - Error correcting codes
  - Data Encryption and decryption

## Network & Data Communication (cont..)



(a) General block diagram



(b) Example

# Network & Data Communication (cont,..)

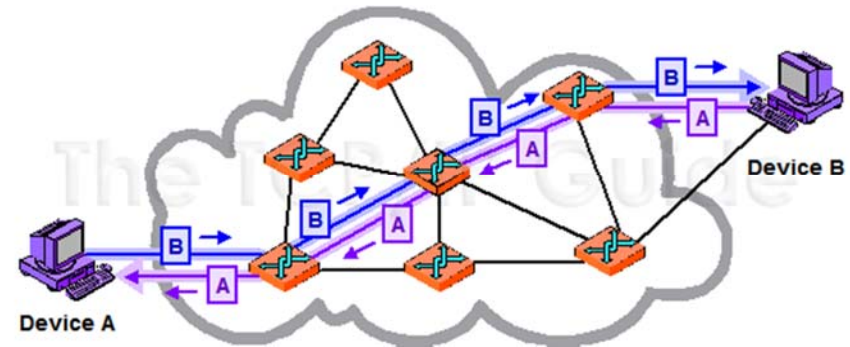
## Networking

- Is interested in "connectivity", connecting computers together to share resources.
- Even though the computers can have different disk operating systems, languages, cabling and locations, they still can communicate to one another and share resources.
- provide the rules and regulations that allow computers with different disk operating systems, languages, cabling and locations to share resources.
- The rules and regulations are called protocols and standards in network

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# Network & Data Communication (cont,..)



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# Perspectives on Networking

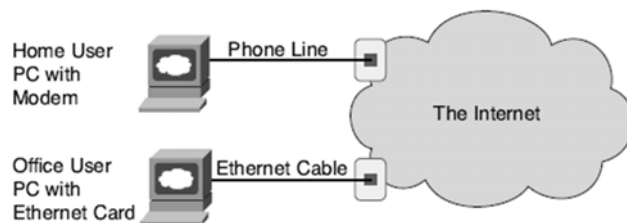
## End-User Perspective on Networks

The user plugs in the phone line from the wall into a modem in a PC.

The user plugs PC network card to ADSL modem.

Uses his laptop to connect ADSL modem through wireless LAN.

So user is directly connected the internet.



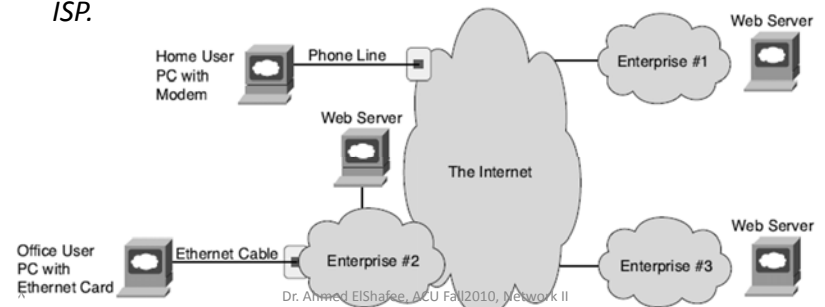
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# Perspectives on Networking (2)

## Enterprises Perspective on Networks and the Internet

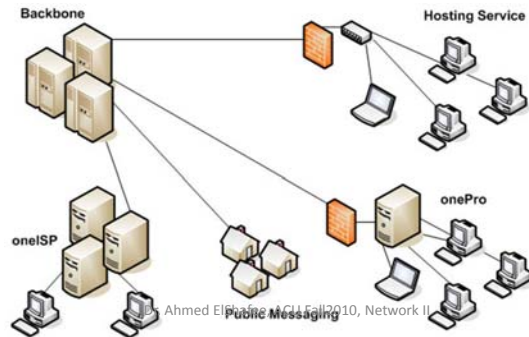
When you go to your collage or your job and connect to "the network," you are most likely connecting to the private network, or enterprise network, for that school or company. That network, in turn, is connected to the Internet through an ISP.



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## Perspectives on Networking (3)

The Internet itself is really a collection of ISPs that, in turn, connect to each other. By having the various enterprise networks / users connect to the Internet, most computer users around the world can use applications to communicate with each other—worldwide.



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## Perspectives on Networking (4)

### *Network engineer Perspective on Networks*

1.

A network engineer, who works for an enterprise, is responsible of the following:

- operating and maintaining enterprise network (servers and workstations) and its internet connectivity in appropriate way and with acceptable quality.
- Network operation, includes providing support of applications (DBs, web applications, mail exchanges) and OS (windows server, workstations ) that run on enterprise servers and workstations.

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## Perspectives on Networking (5)

2.

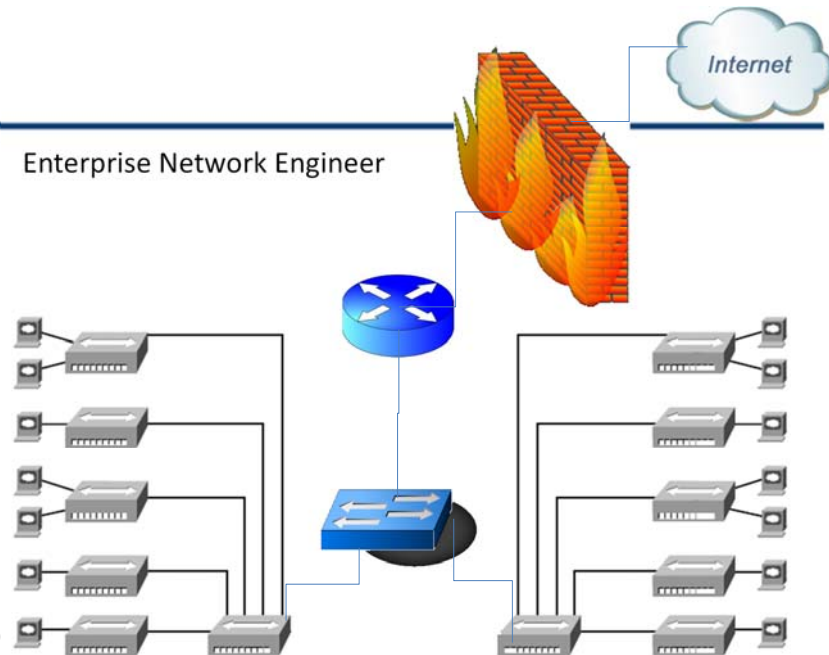
A network engineer, who works for network service providers, is responsible of one of the following

- Establishing, configuring and high level maintenance of clients network (enterprises or individuals users).
- Providing connectivity between enterprises premises (leased lines or VPNs), or connectivity of enterprises to internet (ISP).

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• Enterprise Network Engineer

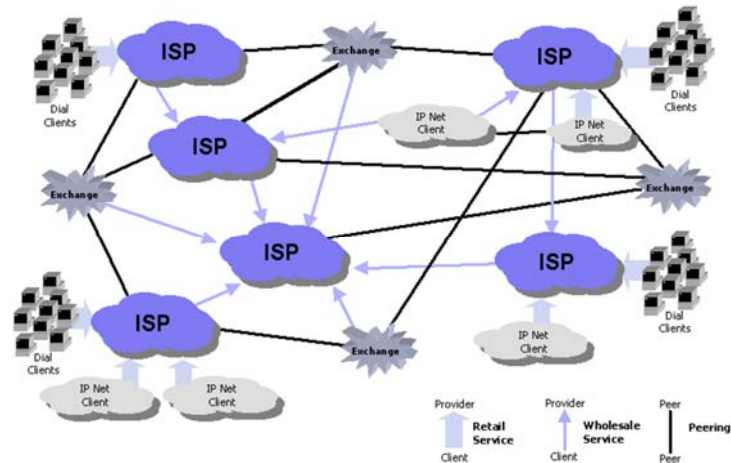


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## Perspectives on Networking (6)

A much larger number of people work on enterprise networks than ISP networks.

- ISP network engineer



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## Eight simple steps to develop a computer network

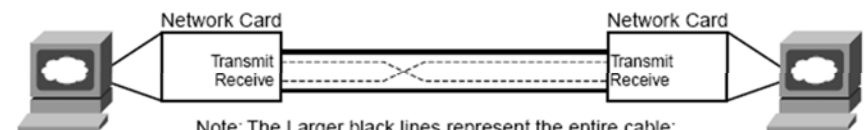
### **Mission statement**

1. Everyone to be able to exchange files without having to get up from their desks.
2. Everybody is able to simply type in the name of a file and the name of the person, the file appears on the his computer.
3. workers to be able to take their PCs with them and just have to plug the computer into a wall socket so that they can send and receive files from the new office they moved to.
4. This network thing to be like the electrical power thing a plug in the wall near every desk, and if you plug in, you're on the network!

## Eight simple steps to develop a computer network (2)

1<sup>st</sup> Step: Connecting 2 PCS

*Two PCs Transfer Files in the Lab*



Note: The Larger black lines represent the entire cable; the dashed lines represent the two wires inside the cable. The Network cards reside inside the computer.

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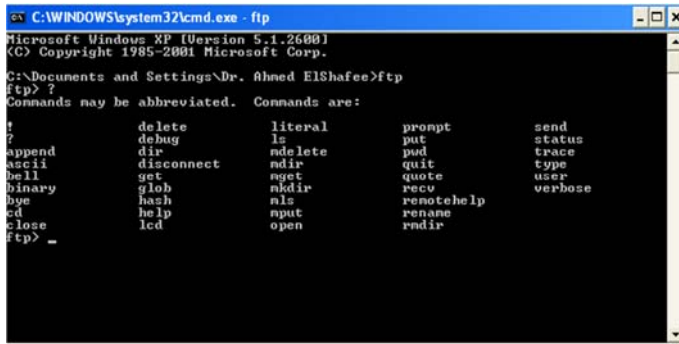
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## Eight simple steps to develop a computer network (3)

2<sup>nd</sup> step, write a software program "GetFile"

GetFile <Owner name> <filename>



```
C:\WINDOWS\system32\cmd.exe - ftp
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Dr. Ahmed ElShafee>ftp
ftp> ?
Commands may be abbreviated.  Commands are:

?          delete      literal     prompt      send
?          debug       ls          put          status
append    dir          ndelete    pwd          trace
ascii     disconnect  ndir       quit         type
bell      get          nget       quote        user
binary    glob        nkdir      recu         verbose
bye       hash        nis        remotehelp
cd        help        nput       rename
close    lcd         open       rmdir

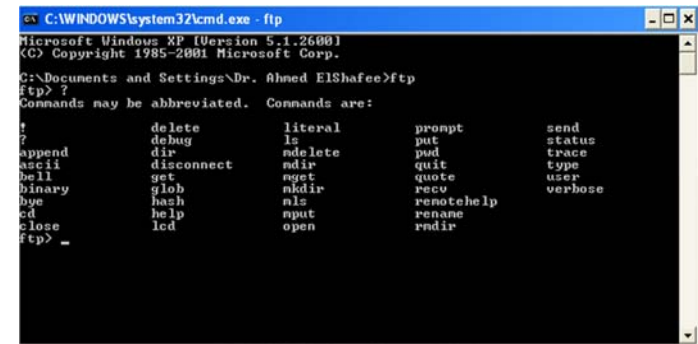
ftp> _
```

## Eight simple steps to develop a computer network (3.2)

2<sup>nd</sup> step, write a software program "ExplorFiles"

ExplorFiles <Remote PC name>

You will get a list of all available files in remote PC



```
C:\WINDOWS\system32\cmd.exe - ftp
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

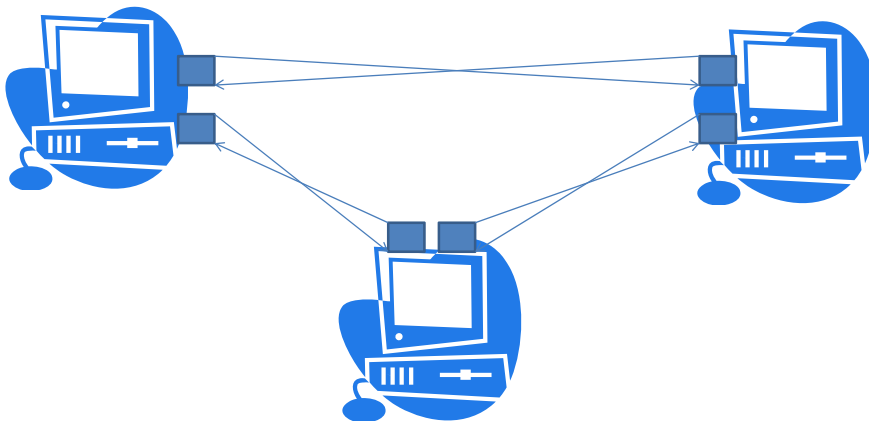
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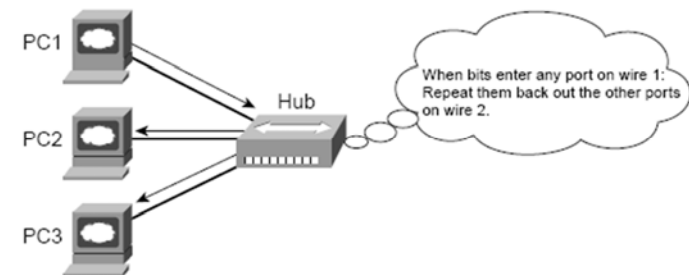
## Eight simple steps to develop a computer network (4)

3<sup>rd</sup> step: connecting 3 PCs



## Eight simple steps to develop a computer network (5)

4<sup>th</sup> step: connecting 3 PCs again



## Eight simple steps to develop a computer network(6)

5<sup>th</sup> step: security; software concerns regarding sharing and security

>>ExplorFiles <<Owner name/address>>

>>GetFile <<Owner name/address>> <file name>



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## Eight simple steps to develop a computer network (7)

6<sup>th</sup> step: security a hardware consern; unique network ID, translate each ID into pc i



\* If you changed network card, or pc at all, just update network with your new network ID, and users will reach you by name

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## Eight simple steps to develop a computer network (8)

7<sup>th</sup> step: establishing enterprise network

- Cable cost concern
- Cable length and signal strength concern

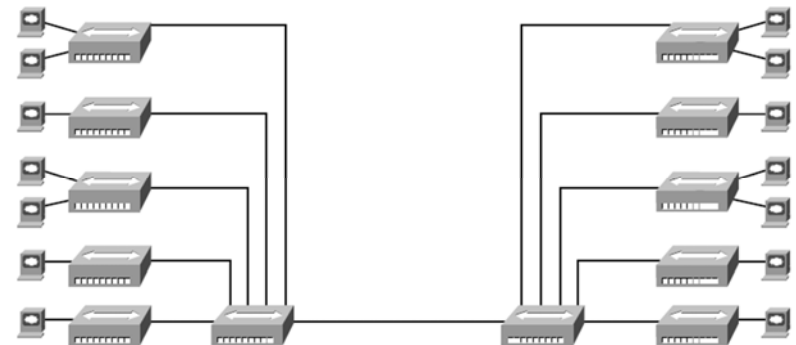


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## Eight simple steps to develop a computer network(9)

8<sup>th</sup> step: re-establishing Enterprise network



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## What about the real network?

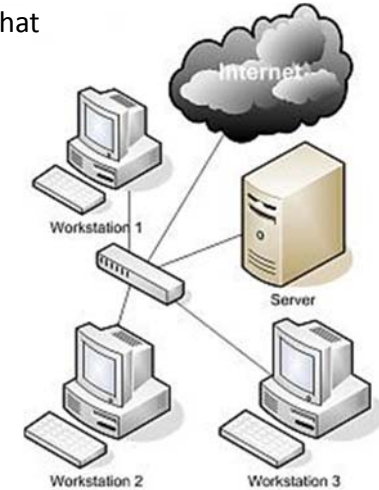
- Ethernet networks use cards inside each computer.
- The cards have unique addresses, similar to our networking cards.
- Ethernet cables connect PCs to Ethernet hubs—hubs that repeat each received signal out all other ports.
- The cabling is typically run in a star configuration—in other words, all cables run from a cubicle to a wiring closet.

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## Local Area Networks (LAN)

- LAN is a communications network that interconnects a variety of device, providing means for information exchange among these devices.



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## LAN (2)

- Characteristics
  1. Small scope, building, or cluster.
  2. Owned by organization which need communication facility.
  3. Data rate very high.

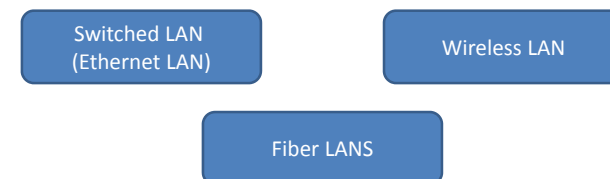


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## LAN (3)

- Configuration, and types:

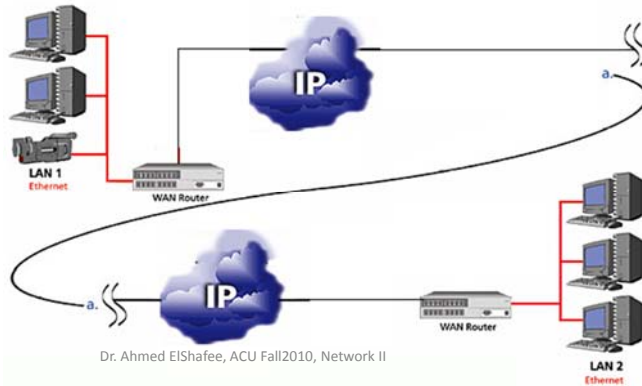


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# Wide Area Networks (WAN)

Consists of number of interconnected switching nodes, providing data exchange between different LANs or terminals over huge geographical area



# WAN (2)

- Transmission is being routed through these nodes to the destination device.
- Nodes are not concerned with contents of the data, their purpose is to provide a switching facility that will move the data from node to node.

# WAN (3)

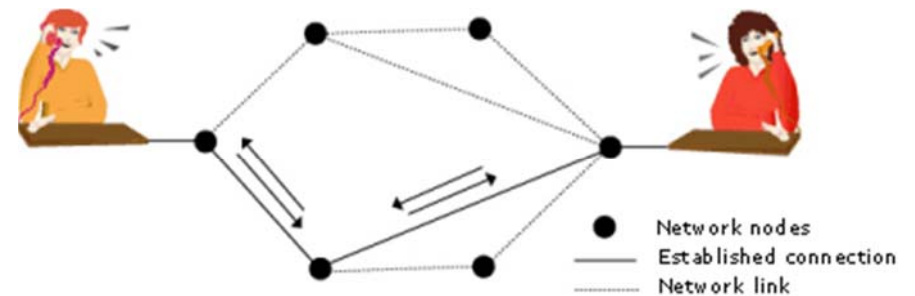
## Switching Technology:

### 1. Circuit Switching

- A dedicated communication path (physical path between nodes) is established between the two stations through nodes of the network.
- Data transmitted as rapid as possible.
- Immediate routing and switching without delay.

# WAN (4)

- Common example is telephone network.





## WAN (5)

### 2. Packet switching

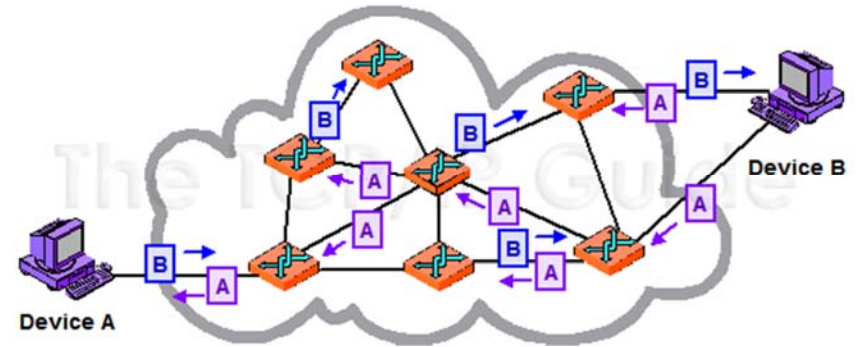
- Data is sent in small chunks called packets, each is passed through the network from node to node till reaching the destination.
- At each node, packet is stored then transmitted to the next node.
- Each packet carries destination address.
- Physical channel capacity is shared between different communication process.

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## WAN (6)

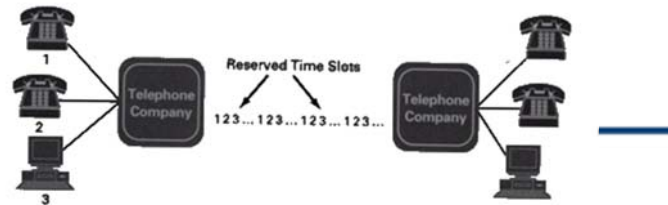
- Used for terminal/computer, and computer/computer communication.



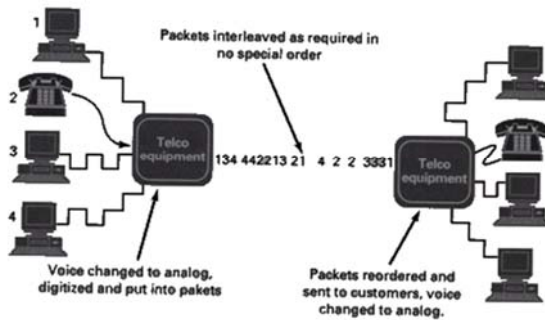
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## WAN



Circuit Switching



Packet Switching

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## WAN (8)

### 3. Frame Relay

- Today's communication facilities has a minor error rate, and higher speed than old facilities.
- Frame relay was developed to gain that advantage, by removing all redundant bits (used for error recovery) from packet switching technique, providing high data rate up to 2 Mbps.

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## WAN (9)

### 4. ATM (Asynchronous Transfer Mode) (Cell relay)

- ATM uses the same principles of frame relay (viewed as an evolution from frame relay), technique, providing higher speed up to 10 or 100 Mbps (maybe Gbps), and provides fixed data rate like circuit switching technique.
- ATM allows to define a multiple virtual channels with dynamic and fixed data rate.

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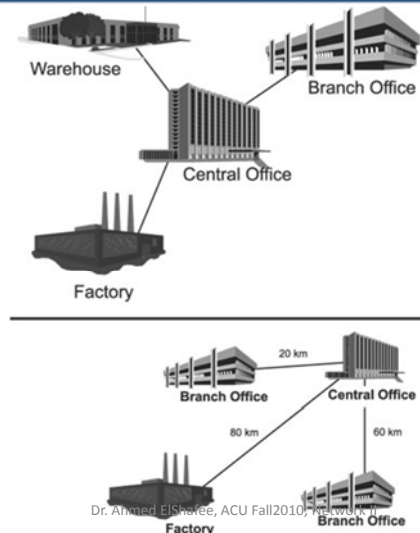
## Metropolitan Area Networks (MAN)

- middle ground between LAN and WAN
- private or public network
- large area
  
- It has two forms
  - Leased line
  - Terrestrial links

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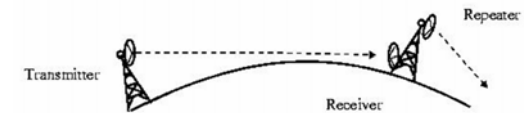
## MAN (2)



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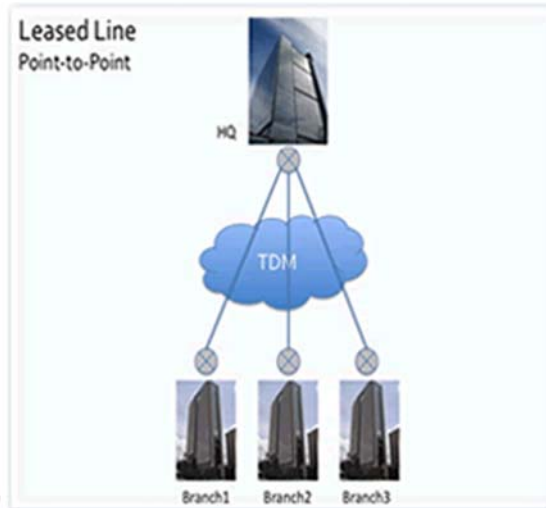
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## MAN (3)



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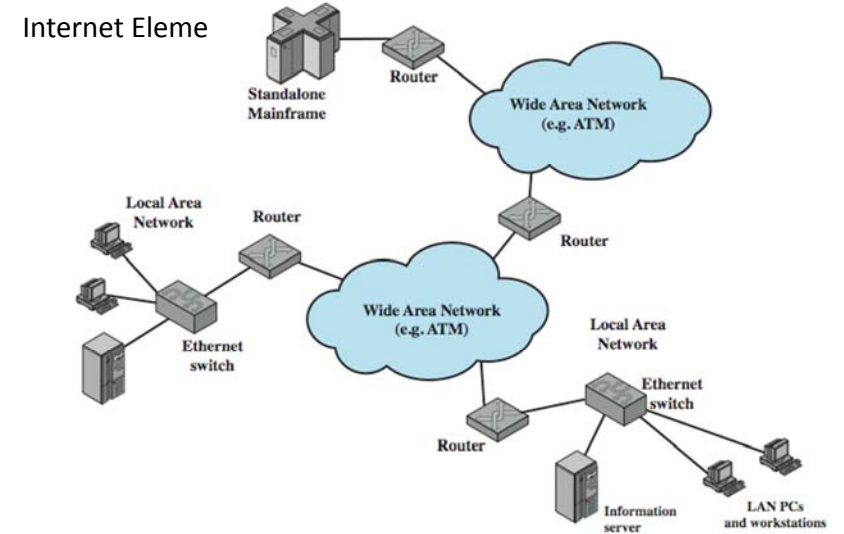
# MAN (4)



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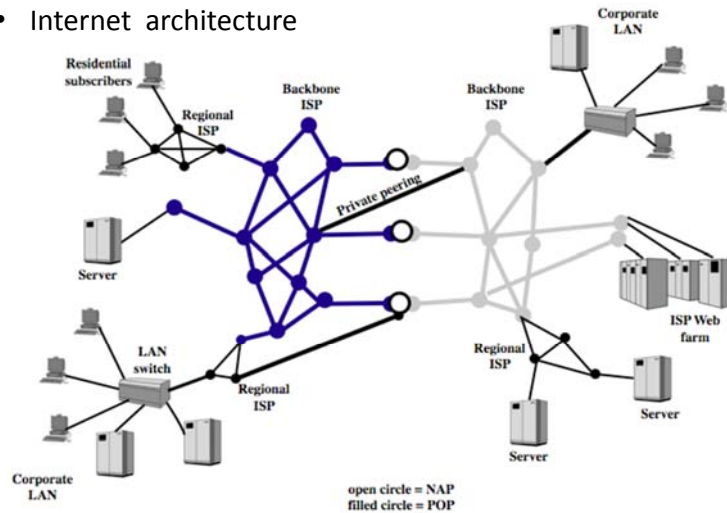
# Perspectives on internet



# Internet (2)

POP (point of presence) ,  
 CPE (customer premises equipment)  
 CO (Central office)  
 NAP (Network Access Point)

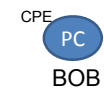
- Internet architecture



# Internet (3)

POP (point of presence) ,  
 CPE (customer premises equipment)  
 CO (Central office)  
 NAP (Network Access Point)

- Example



# Internet (3)

POP (point of presence) ,  
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NAP (Network Access Point)

- Example



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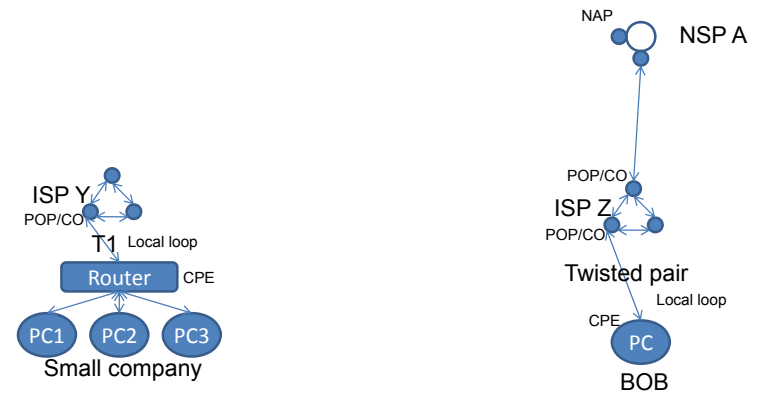
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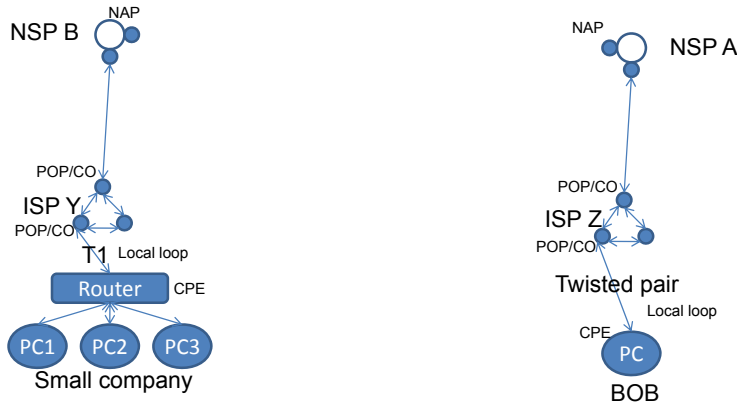
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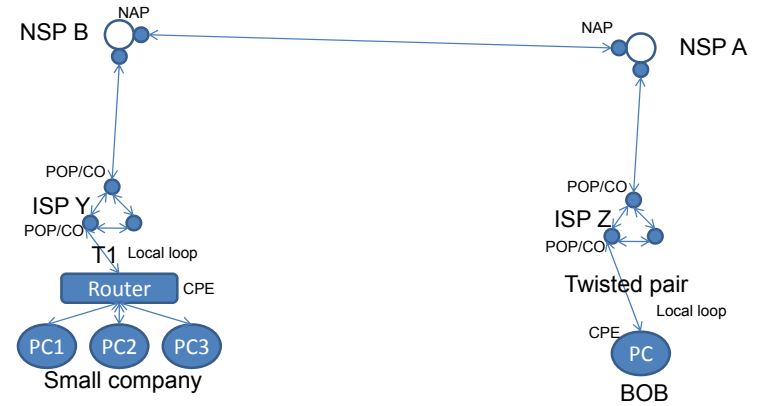
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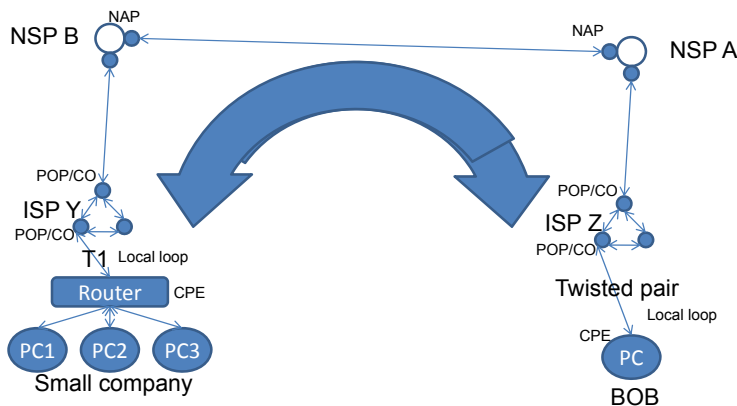
- Example



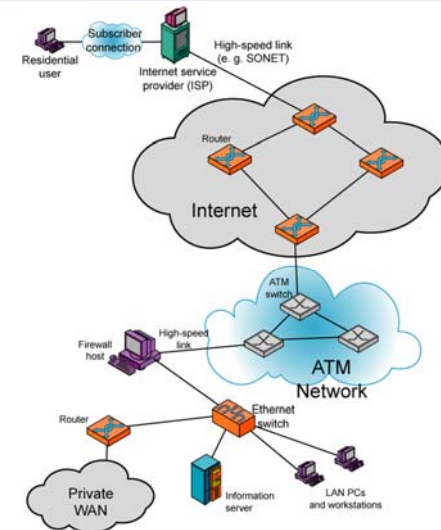
# Internet (3)

POP (point of presence) ,  
 CPE (customer premises equipment)  
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 NAP (Network Access Point)

- Example



# Example Configuration



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Thanks,..  
See you next week (ISA),...