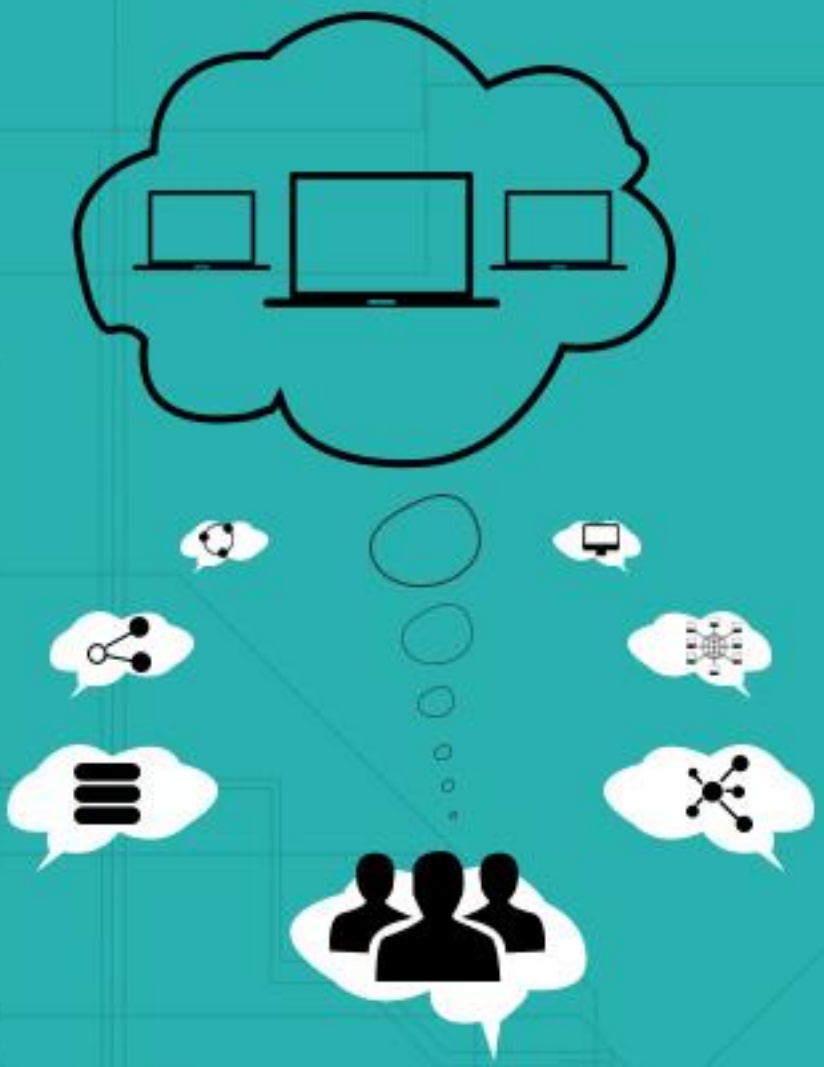

DCN

data communication and computer network

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About the Tutorial

Data communications refers to the transmission of digital data between two or more computers. A computer network or data network is a telecommunications network that allows computers to exchange data. The physical connection between networked computing devices is established using either cable media or wireless media. The best-known computer network is the Internet.

This tutorial should teach you basics of Data Communication and Computer Network (DCN) and will also take you through various advance concepts.

Why to Learn Data Communication & Computer Network?

Network Basic Understanding

A system of interconnected computers and computerized peripherals such as printers is called computer network. This interconnection among computers facilitates information sharing among them. Computers may connect to each other by either wired or wireless media.

Network Engineering

Network engineering is a complicated task, which involves software, firmware, chip level engineering, hardware, and electric pulses. To ease network engineering, the whole networking concept is divided into multiple layers. Each layer is involved in some particular task and is independent of all other layers. But as a whole, almost all networking tasks depend on all of these layers. Layers share data between them and they depend on each other only to take input and send output.

Internet

A network of networks is called an internetwork, or simply the internet. It is the largest network in existence on this planet. The internet hugely connects all WANs and it can have connection to LANs and Home networks. Internet uses TCP/IP protocol suite and IP as its addressing protocol. Present day, Internet is widely implemented using IPv4. Because of shortage of address spaces, it is gradually migrating from IPv4 to IPv6.

Internet enables its users to share and access enormous amount of information worldwide. It uses WWW, FTP, email services, audio and video streaming etc. At huge level, internet works on Client-Server Model.

Internet uses very high speed backbone of fiber optics. To inter-connect various continents, fibers are laid under sea known to us as submarine communication cable.

Applications of Communication & Computer Network

Computer systems and peripherals are connected to form a network. They provide numerous advantages:

- Resource sharing such as printers and storage devices
- Exchange of information by means of e-Mails and FTP

- Information sharing by using Web or Internet
- Interaction with other users using dynamic web pages
- IP phones
- Video conferences
- Parallel computing
- Instant messaging

Audience

This tutorial has been prepared for the computer science graduates to help them understand the basic to advanced concepts related to Data Communication and Computer Networking. After completing this tutorial, you will find yourself at a moderate level of expertise in Data Communication and Computer Networking from where you can take yourself to next levels.

Prerequisites

Before you start proceeding with this tutorial, I'm making an assumption that you are already aware about basic computer concepts like what is keyboard, mouse, monitor, input, output, primary memory and secondary memory etc. If you are not well aware of these concepts then I will suggest to go through our short tutorial on Computer Fundamentals.

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DCN Tutorial

1. Computer Network Overview

What is a Computer Network?

A computer network is a collection of computing devices that are connected with each other for the purpose of information and resource sharing among a wide variety of users.

A system of interconnected computers and computerized peripherals such as printers is called computer network. This interconnection among computers facilitates information sharing among them. Computers may connect to each other by either wired or wireless media.

Features of Computer Network

The features of a computer network are as follows –

- **Sharing** – Computer networks enable sharing of files, software, hardware resources, and computing capabilities.
- **Speed:** The communication speed among the components is fast enough to be comparable with a centralized system.
- **Scalability** – Sizes of computer networks dynamically increase with time. The networks have to be scalable so that they can evolve adequately for future deployments.
- **Integration** – All the components of the network work in a coordinated manner for a seamless user experience.
- **Security** – Networks allow security and access rights to the users for restricted sharing of resources and information.
- **Cost Effectiveness** – Networking reduces the deployment cost of hardware and software of a centralized system.

Classification of Computer Networks

Computer networks are classified based on various factors. They include:

- Geographical span
- Inter-connectivity
- Administration
- Architecture

Geographical Span

Geographically a network can be seen in one of the following categories:

- It may be spanned across your table, among Bluetooth enabled devices, ranging not more than few meters.
- It may be spanned across a whole building, including intermediate devices to connect all floors.

- It may be spanned across a whole city.
- It may be spanned across multiple cities or provinces.
- It may be one network covering whole world.

Inter-Connectivity

Components of a network can be connected to each other differently in some fashion. By connectedness we mean either logically, physically , or both ways.

- Every single device can be connected to every other device on network, making the network mesh.
- All devices can be connected to a single medium but geographically disconnected. This type of connection create bus like structure.
- Each device is connected to its left and right peers only, creating linear structure.
- All devices connected together with a single device, creating star like structure.
- All devices connected arbitrarily using all previous ways to connect each other, resulting in a hybrid structure.

Administration

From an administrator's point of view, a network can be private which belongs a single autonomous system and cannot be accessed outside its physical or logical domain. A network can be public which is accessed by all.

Network Architecture

Computer networks can be discriminated into various types such as client-server, peer-to-peer or hybrid, depending upon its architecture.

- There can be one or more systems acting as server. Other being client, requests the server to serve requests. Server takes and processes requests on behalf of Clients.
- Two systems can be connected in Point-to-Point, or back-to-back fashion. They both reside at the same level and called peers.
- There can be hybrid network which involves network architecture of both the above types.

Network Applications

Computer systems and peripherals are connected to form a network. They provide numerous advantages:

- Resource sharing such as printers and storage devices
- Exchange of information by means of e-Mails and FTP
- Information sharing by using Web or Internet
- Interaction with other users using dynamic web pages
- IP phones
- Video conferences
- Parallel computing

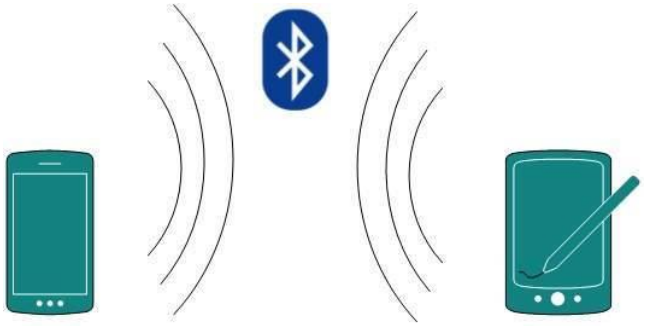
- Instant messaging

2. Computer Network Types

Generally, networks are distinguished based on their geographical span. A network can be as small as distance between your mobile phone and its Bluetooth headphone and as large as the internet itself, covering the whole geographical world. Here we will discuss about different types of networks in detail.

Personal Area Network

A Personal Area Network (PAN) is the smallest network which is very personal to a user. This may include Bluetooth-enabled or infra-red enabled devices. PAN has connectivity range up to 10 meters. PAN may include wireless computer keyboard and mouse, Bluetooth-enabled headphones, wireless printers and TV remotes.

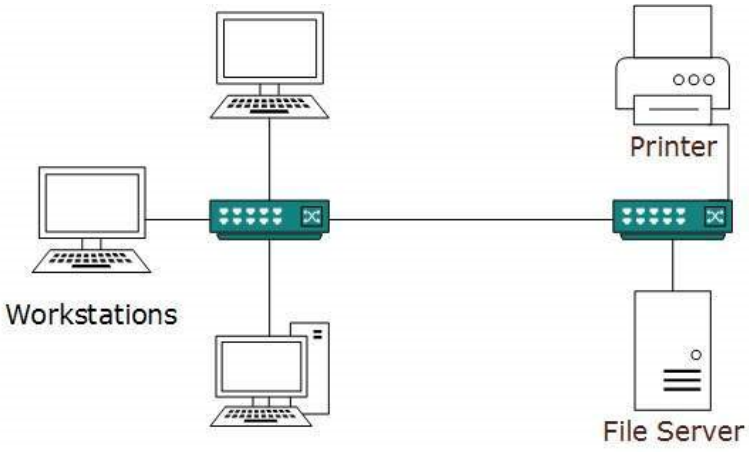


For example, Piconet is Bluetooth-enabled Personal Area Network which may contain up to 8 devices connected together in a master-slave fashion.

Local Area Network

A computer network spanned inside a building and operated under single administrative system is generally termed as Local Area Network (LAN). Usually, LAN covers an organization' offices, schools, colleges or universities. Number of systems connected in LAN may vary from as least as two to as much as 16 million.

LAN provides a useful way of sharing the resources between end users. The resources such as printers, file servers, scanners, and internet are easily sharable among computers.



LANs are composed of inexpensive networking and routing equipment. It may contain local servers serving file storage and other locally shared applications. It mostly operates on private IP addresses and does not involve heavy routing. LAN works under its own local domain and controlled centrally.

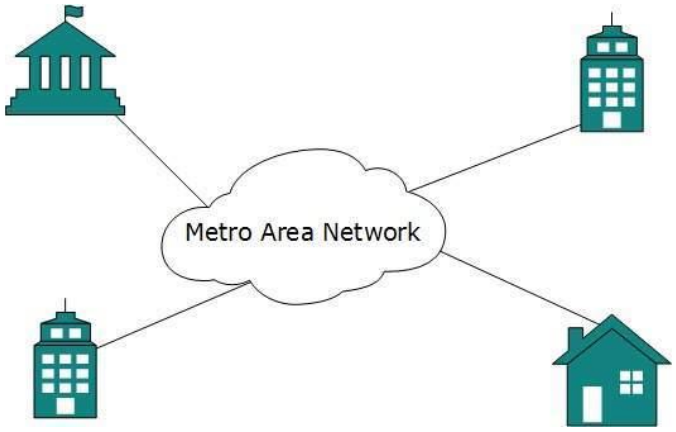
LAN uses either Ethernet or Token-ring technology. Ethernet is most widely employed LAN technology and uses Star topology, while Token-ring is rarely seen.

LAN can be wired, wireless, or in both forms at once.

Metropolitan Area Network

The Metropolitan Area Network (MAN) generally expands throughout a city such as cable TV network. It can be in the form of Ethernet, Token-ring, ATM, or Fiber Distributed Data Interface (FDDI).

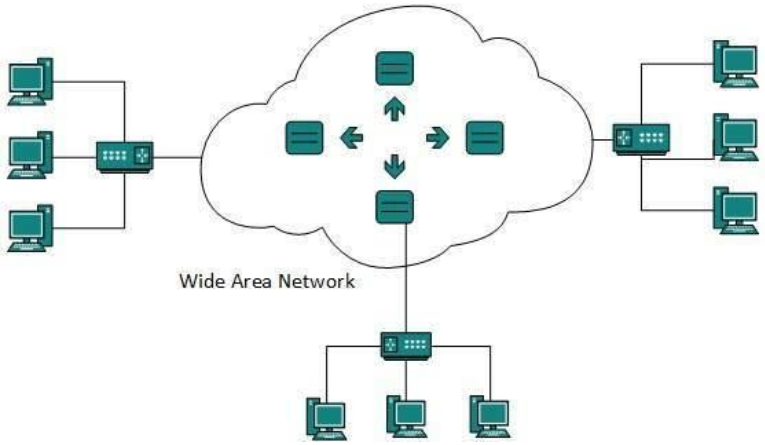
Metro Ethernet is a service which is provided by ISPs. This service enables its users to expand their Local Area Networks. For example, MAN can help an organization to connect all of its offices in a city.



Backbone of MAN is high-capacity and high-speed fiber optics. MAN works in between Local Area Network and Wide Area Network. MAN provides uplink for LANs to WANs or internet.

Wide Area Network

As the name suggests, the Wide Area Network (WAN) covers a wide area which may span across provinces and even a whole country. Generally, telecommunication networks are Wide Area Network. These networks provide connectivity to MANs and LANs. Since they are equipped with very high speed backbone, WANs use very expensive network equipment.



WAN may use advanced technologies such as Asynchronous Transfer Mode (ATM), Frame Relay, and Synchronous Optical Network (SONET). WAN may be managed by multiple administration.

Internetwork

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Internet is widely deployed on World Wide Web services using HTML linked pages and is accessible by client software known as Web Browsers. When a user requests a page using some web browser located on some Web Server anywhere in the world, the Web Server responds with the proper HTML page. The communication delay is very low.

Internet is serving many proposes and is involved in many aspects of life. Some of them are:

- Web sites
- E-mail
- Instant Messaging
- Blogging
- Social Media
- Marketing
- Networking
- Resource Sharing
- Audio and Video Streaming

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