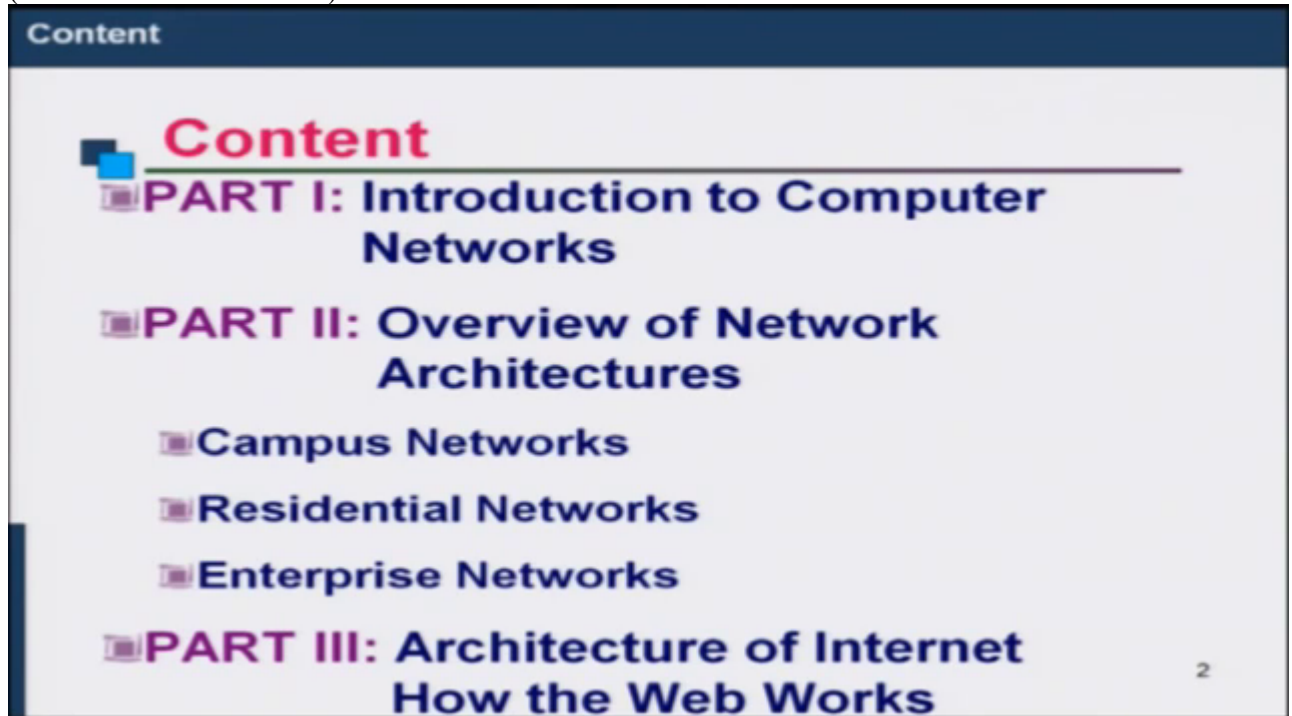


Network Architectures – Part 1

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Hello everybody. In this lecture we will talk about network architectures and specifically about the architecture of Internet and how the web works.

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What I have done is that I have divided this lecture into three parts. The part one we'll talk about what is computer network. I will give an introduction of what component networks are. What are the applications of computer networks? In Part 2 I'll give you an overview of different types of network architectures in which we'll talk about how a campus network is architected, how residential networks work and how corporate enterprise networks work. And in Part 3, we'll talk about architecture of Internet and how the web works.

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Computer Networks

Computer network connects two or more autonomous computers.

The computers can be geographically located anywhere.



So starting with the first part the computer network introduction, the classical definition of a computer network is that if you can interconnect two or more autonomous computers such that they can communicate and share resources it is called as a computer network. This is the definition of a computer network. The geographical spread of a computer network could be anything. It could be computers connected in one room. It could be one building. It could be one campus. It could be a city. It could be across multiple cities or the whole globe. Size could be anything, but if multiple computers are interconnected such that they can communicate with each other and they can share resources it is called as a computer network. (Refer Slide Time: 01:45)

LAN, MAN & WAN

Network in small geographical Area (Room, Building or a Campus) is called LAN (Local Area Network)

Network in a City is call MAN (Metropolitan Area Network)

Network spread geographically (Country or across Globe) is called WAN (Wide Area Network)

Now depending on the geographical spread of the network computer networks are classified into three categories; LAN, MAN and WAN. If the geographical spread is small let us say one building or one small campus then it is called as LAN or local area network, because the spread is local. If the spread is a city then it is called as MAN or Metropolitan Area Network. And if the spread is much larger interconnecting multiple cities across the whole globe it is called as WAN or Wide Area Network. Now the reason we categorize it into three categories is that depending on the geographical spread the technology that is used to set up this network is different. So the technology that we use in LAN is different, in MAN is different and in WAN is different. And as we go along I will give you a brief introduction of different type of technologies which are used to implement LAN, MAN AND WANs.
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The slide is titled "Introduction to Computer Networks" and "Applications of Networks". It lists the following applications:

- Resource Sharing**
 - Hardware (computing resources, disks, printers)
 - Software (application software)
- Information Sharing**
 - Easy accessibility from anywhere (files, databases)
 - Search Capability (WWW)
- Communication**
 - Email, Chat, VoIP
 - Message broadcast
- Remote computing**
- Distributed processing (GRID Computing)**

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Now coming to applications of computer networks as I said that the core application of computer networks is that it provides communication and resource sharing, so in terms of resource sharing we could share hardware or software. I'll give you some examples. If I have a printer connected to a computer then any other computer connected over network to this computer can access that printer. So I could share my printer across multiple computers which are connected over a network. Or I could also have a network printer which can directly connect on the network and through the network any computer on the network can access that printer. So this is an example of hardware resource sharing.

Another example of hardware resource sharing could be sharing a disk. I could have some files maybe some movies on a disk of a computer and it can be accessed across other computers over the network. So I could share that drive over the network and through the shared drive I can access that movie or files from other computers. Similarly I could access software. I could share a software resource. So I could have a software running on a computer or a server and all computers connected to this server over the network can use that software. So this is an example of resource sharing.

Similarly information sharing is another very important application of computer networks and every day we use world-wide-web or the internet browsing that we do is the biggest example of application of computer networks. In this the information is stored in a server called that worldwide web server or www server and any client machine across the internet can access that server and hence access the information stored in that server. And this information is searchable. So as we go along we'll talk about how the World Wide Web works and this is searchable information on the Internet which people can access.

Similarly lot of examples of communication over networks. So every day we use email. We use chatting. We use voice-over-IP, phone calls which work on the Internet. These are examples of communication over the networks or Internet. Another important scientific application is remote computing. So if I have a high end server computer anywhere on the network remotely I can log in to this compute server and run my application programs. These are typically scientific application programs related to computation and I can remotely access servers and run my programs. I don't have to physically go to the server and run those programs.

Another very important scientific application of networks is GRID Computing or distributed processing or computing. In this, what we do is that we combine large number of servers into one GRID or Distributed Computing System and compute applications run individually on all these individual computers and the results from individual computers can be combined to create a final application result. Most of the modern supercomputers which we have today are constructed using this concept of distributed processing in which large number of small servers are interconnected over a small computer network and combined together they form a very high computational capacity machine which is called as a Supercomputer. So these are various applications of computer networks in general.

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Network Components

- Physical Media
- Interconnecting Devices
- Computers
- Networking Software
- Applications

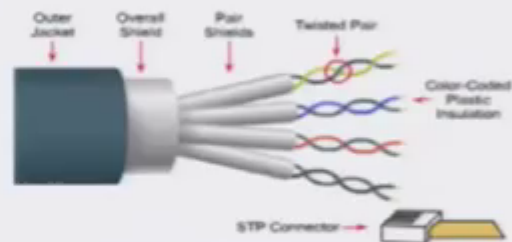
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If we talk about different components that go on to constitute a computer network then there are five key components; the physical media which interconnects the computer, the interconnecting devices which provide this connectivity, the computers or end devices themselves, the networking software which provides communication between these computers, and finally the applications that run on this networks. Let me very briefly go through each of them.

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Networking Media

- Networking media can be defined simply as the means by which signals (data) are sent from one computer to another (either by cable or wireless means).



- Speed and throughput: 10-100 Mbps
- Cost per mile: Moderately expensive
- Media and connector size: Medium to Large
- Maximum cable length: 100m (ohart)

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The first component which is used to construct a computer network as a physical media which provide the connectivity. There are three types of key physical medias; the first is copper cables which are used for short distance communication and you might have heard of



UTP cables which are used for providing computer network connectivity. There are also fiber optic cables which are used for long-distance communication. On fiber optic cable you can send signals up to 100 kilometres without using a repeater. So long-distance communication we use fiber optic cables. And a third important media is the wireless media where air is used as a medium and across this wireless media you can provide connectivity. So you have cable media's and wireless media's which are used for providing interconnection between computing devices.

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Introduction to Computer Networks

Networking Devices

HUB, Switches, Routers, Wireless Access Points, Modems etc.



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The second component are the networking devices themselves which are used for providing this interconnectivity. So you might have heard about switches, routers, modems, wireless dongles, all these devices are the interconnecting devices which connect the computers with each other and provide the interconnection.

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Computers: Clients and Servers

In a client/server network arrangement, network services are located in a dedicated computer whose only function is to respond to the requests of clients.

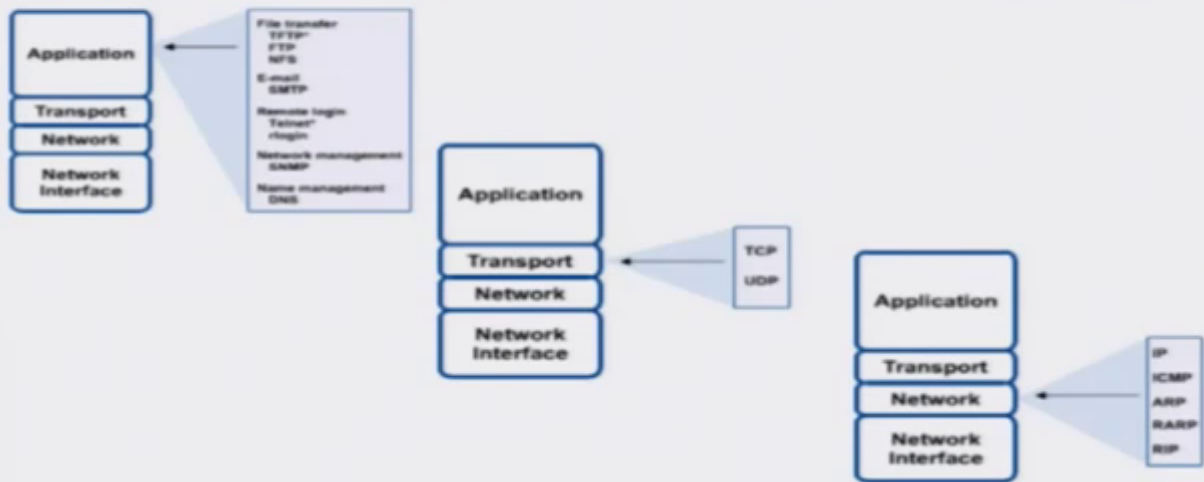
The server contains the file, print, application, security, and other services in a central computer that is continuously available to respond to client requests.



The third component are the computers or end devices themselves. They could be desktop. They could be servers. It could be laptops, and today very popularly your smartphones which have also become an end devices which connect over the network and provide you networking applications. These computers are typically or the end devices are divided into two categories; servers and clients. So servers are the machines which provide the resource or the information. And clients are the machines which access the resource or the information. So servers are high-end systems which have hardware or software resources or applications running on them which they serve to other client computers and clients are the machines which access the server to access any hardware or software resource or use them for intercommunication.

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Networking Protocol: TCP/IP



The fourth component is the networking protocol or the networking software which provides the communication between servers and clients and end devices. The protocol that is popularly used in computer networks is called as a TCP/IP protocol and this protocol provides intercommunication between computers. So the information that flows from one computer to other computer flows in the form of what is called as packets. So every packet has got certain information content which it takes from the source machine to the destination machine and brings back the information from the destination machine back to the source machine and this communication protocol definition is given by the TCP/IP protocol which is used on the networks or internet in general.

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Applications

- E-mail
- Searchable Data (Web Sites)
- E-Commerce
- News Groups
- Internet Telephony (VoIP)
- Video Conferencing
- Chat Groups
- Instant Messengers
- Internet Radio



And finally the fifth component are the application which reside on this computer networks. So for all practical purpose as an end-user the networking architecture is transparent to the end-user. I do not care what protocol you are using or what networking interconnecting devices are being used or what is the physical media being used. As a user the only thing I'm concerned about or I care about are the application that I am using, and I've already talked about various kind of applications that are there starting from email to the internet radio or internet TV which is the most current application that people use. So as an end user I use applications over the computer network which has got multiple components and an architecture underlying it.

So this completes the Part 1 of my lecture. In the second part I'll talk about what is the architecture of this underlying network that we use to provide these applications. Thank you.