Management Information System
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Lecture - 10
Hardware and Software Overview – II

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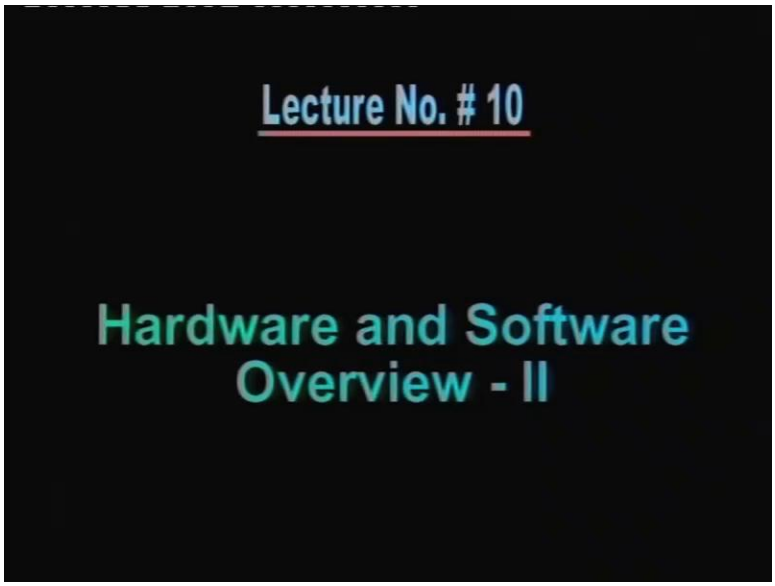

Well, good morning everyone. We have already discussed the first part of our hardware and software. Now, let us now continue with our hardware and software overview.

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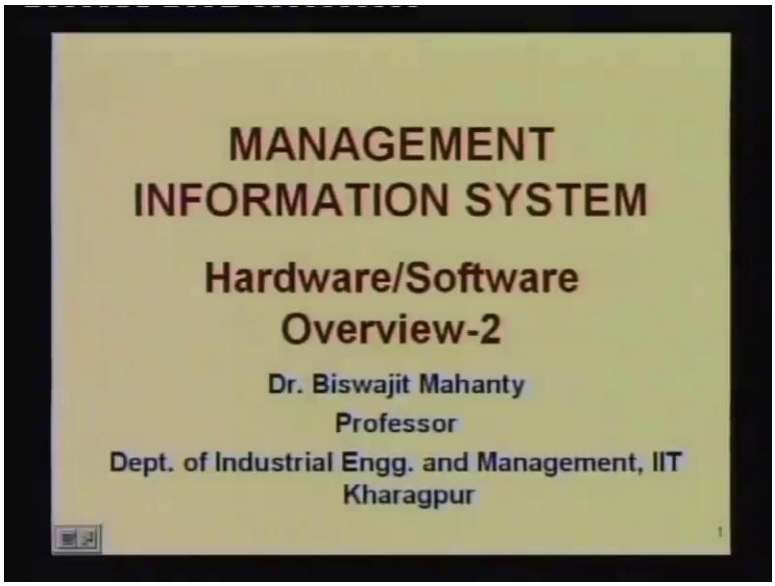

In this particular lecture we shall continue with the software details and then we shall discuss the networking ideas.

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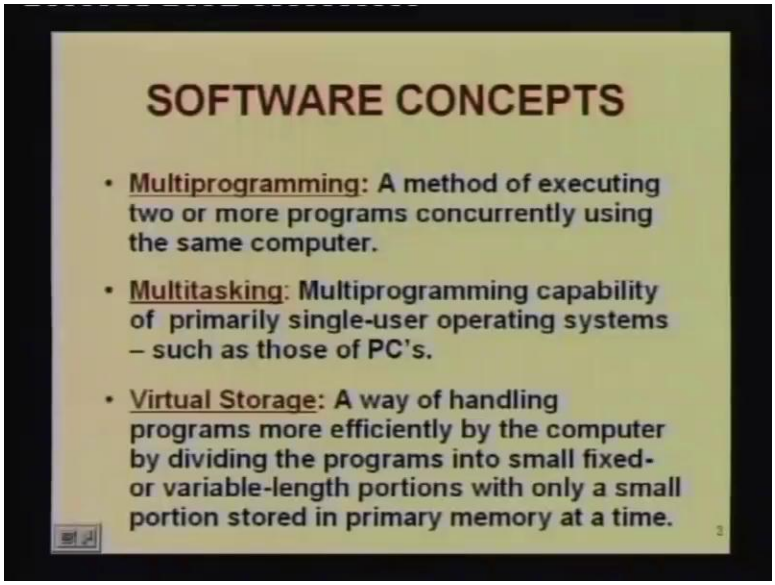

Software concepts we have already seen that there are software such as system software and the application software and there is a difference between the two. Now specifically about application software that is our focus area certain important concepts are here. The first one is

the multiprogramming. Multiprogramming is the method of executing two or more programs concurrently using the same computer right. Multitasking is multiprogramming capability of primarily single user operating system such as those of PCs. So usually what happens that in Unix based system or even Linux based system we have multi terminals right. So wherever there are multiple terminals the idea is that a number of users are connected to the same server of the computer the main computer and then executing their programs right. So this basically can be called as multiprogramming. So basically the multiprogramming idea is connected with you know the multi terminal concepts as well.

However we have seen that today's personal computers have the capability of multiprogramming in a single user operating system, even though you are using the same PC, but you can fire more than one job. You know you can have number of windows and in each window you can have a different program running so this you can call as multitasking. Virtual storage is a way of handling programs more efficiently by the computers by dividing the programs into small fixed or variable length portions with only a small portion stored in the primary memory at a time. So what happens when you have multitasking or multiprogramming naturally the RAM you know even if you have a very big size RAM, even then if a large number of programs are running, it may not be possible in an most efficient manner to use the RAM by keeping everything loaded there all right. So it is better that if we think of a concept of a virtual storage and put some of those programs which are not currently running into the virtual storage. So that is the basic idea of the virtual storage.

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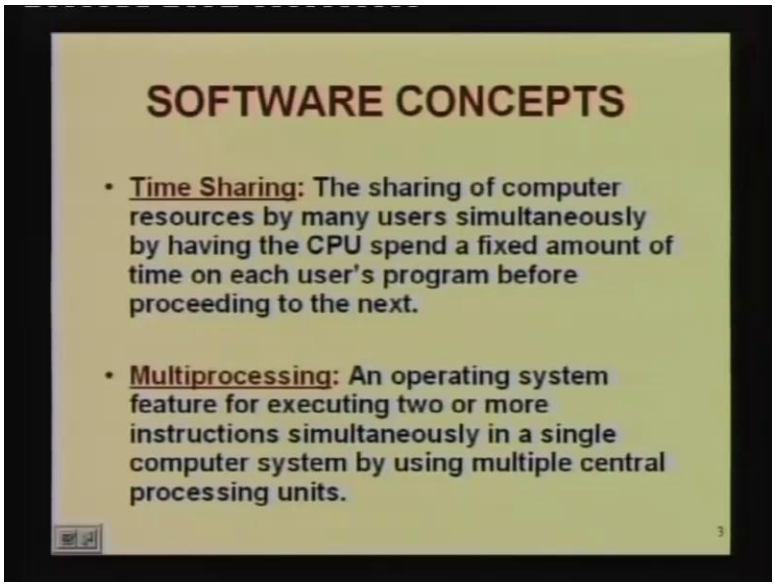

Then time sharing the time sharing idea is the sharing of the computer resources by many users simultaneously. By having the CPU spend a fixed amount of time on each user's program before proceeding to the next. So you see when we have a number of processors number of computers programs running and vying for the same computer resource naturally what will happen you cannot run all the programs at the same time right. So you have to have a time sharing method by which the CPU spends a fixed amount of time on each user's program, so that gives us brings us to the concept of multiprocessing an operating system feature for executing two or more instructions simultaneously in a single computer system by using multiple central processing units right. So this is an operating system feature where you are executing two or more instructions simultaneously by basically there are it's a kind of parallel processing.

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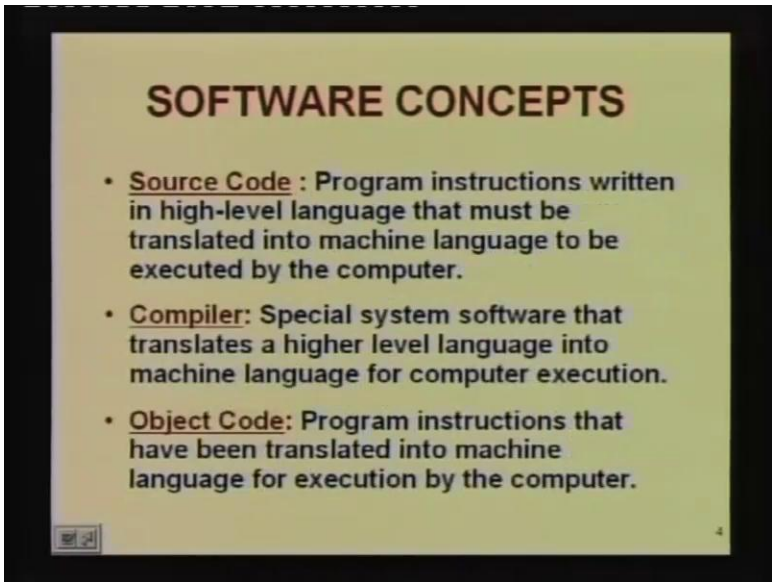

Then we have the basic idea of the source code compiler and the object code source codes are the program instructions a program which you have written in the high level language. And it has to be translated to the machine language for execution by the computer and these particular translation, is done by a complier right. So what does the compiler does it translates the source code into an object code the object code therefore is the program instructions that have been translated into machine language for execution by the computer.

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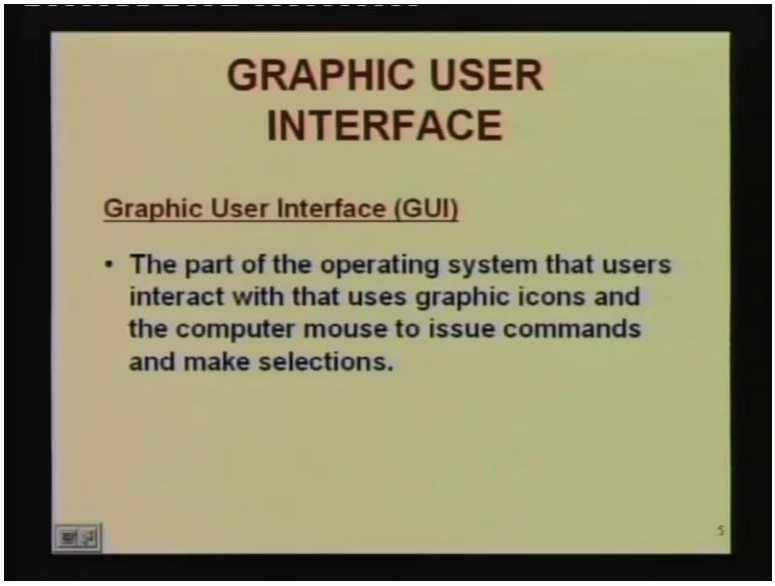

Then we have the graphic user interface GUI. GUI is that part of the operating system that users interact with that uses graphic icons and the computer mouse to issue commands and makes selections. So GUI you know a contrast with CUI character user interface most of today's modern computer systems are essentially GUI best that is a graphic user interface based and basic advantage of graphic user interface is that it is not necessary like Unix to know a large number of commands. It is not the command line interface what is happening here is that you know you can click on icons and you know use a navigated menu system and therefore do your tasks without really you know knowing too much about the system. So very good for the novice users but for experienced users sometimes they feel the system is rather too slow right. So it is also important when you are giving a graphic user interfaces you should give shortcuts to people who are already experienced.

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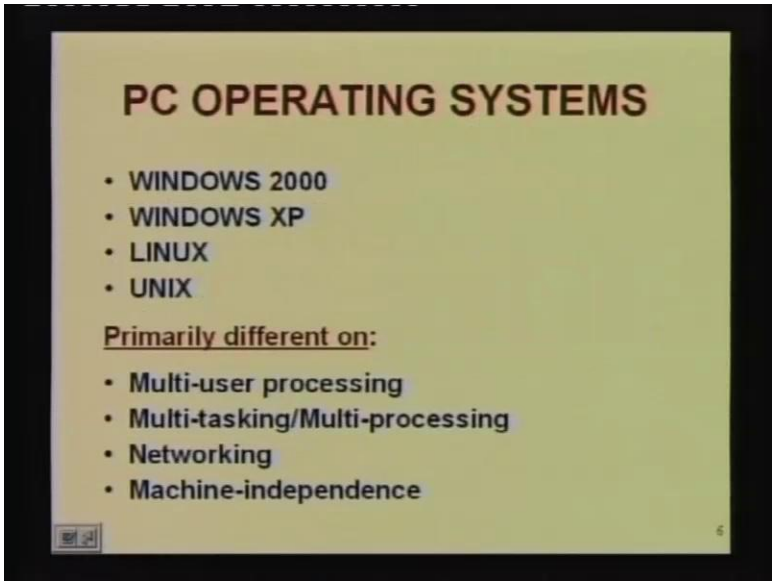

There are various kinds of PC operating systems such as the windows two thousand windows XP Linux then Unix they are primarily different on multiuser processing multitasking multiprocessing networking and machine independence. See the machine independence is very important thing most of the operating system you know they should try to make a situation try to make condition precondition. So that the resulting operating system environment is independent

of the machine hardware because you see there are so many different configurations of computers that are actually possible depending on what kind of machine configuration one is using it is possible to have you know various different hardware configurations.

Now if your program will run only in one computer and not in another there will be some hitches then it is not a very good thing to happen. The general users they should not be bothered about the nitigrities of hardware. So all these basically the operating system should take care off. What the operating system should do it should provide an machine independent environment to the user. That means if the operating system runs the hardware is fine you do not have to worry about the hardware at all. Now the operating system takes over all right so when we are writing our programs if the operating system is there we should know that our program will run. Again we need not bother that we have to put that ware hardware we have to put that hardware. The operating system itself should prompt to us on that level.

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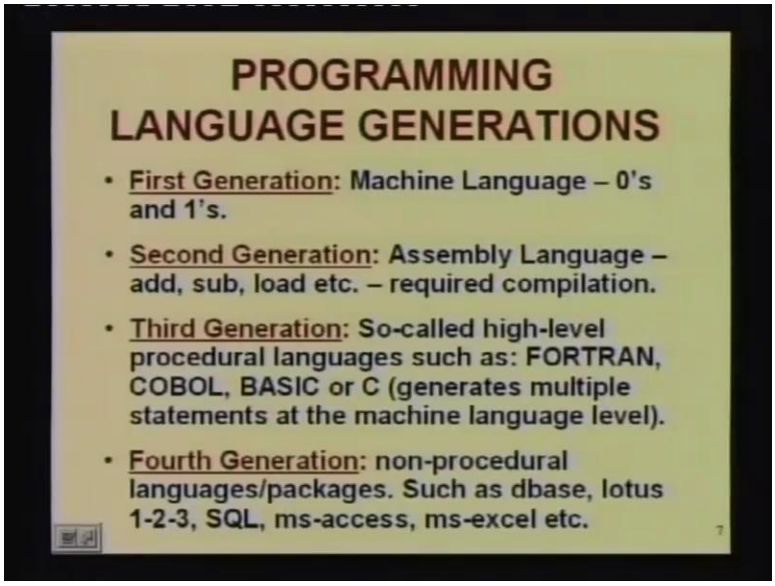

Then like the generations of hardware we also have the generations of programming languages, we have the first generation languages, second generation, third generation and also the fourth generation programming languages. The first one is the first generation which is basically the machine language machine languages in terms of zeros and ones. So essentially the machine

languages are cannot be understood by general people or anybody for that matter until unless we try to obtain patterns in them. The second generation languages are called the assembly language unlike you see we are not giving any years it is not that the machine languages were first assembly languages are next it is really not that way. It is all the generation of languages are present at the same time. Even today we have the assembly language we have the machine language we have the high level procedural languages and also the non-procedurals that the fourth generation languages. So all the generations of languages are present at a given point of time it is only the level at which you are operating all right.

So if you are using first generation or second generation programming most likely you are working at the hardware level most likely you are writing system software. If you are using third generation and fourth generation languages it is likely that you are using application software and you are writing applications for specific organizational needs right. So then you see the third generation languages are called procedurals because, these languages follow procedure. Procedure in the sense that the programming instructions there is a control flow logic right. So if you want a matrix multiplication you have to understand that matrix multiplication can be possible only when you have row wise and column wise you know take the elements multiply them sum that up and put it as a in a third matrix which is the multiplied matrix and put the values. Similarly do for every element. So the entire procedure has to be done with the help of for or you know some kind of while or some do while or do until some kind of looping construct has to be put and they have to be sequentially calculated one after the other only then the actual matrix multiplication will take place. There is no other way you can actually think of doing these if you are using a programming language such as a third generation language like Fortran Cobol basic or C to do your particular task.

The fourth generation languages are different these are called the non-procedural languages or packages. These are like SQL, MS-Access, MS-Excel. You know these kinds of software basically the fourth generation languages. The idea is that here we are using we are really not going into the nitigrities how this will be done. A particular SQL statement like select star from employee it will show all the records from employee one after the other. If you have to write a program in any language you have to basically write procedural steps whereas the SQL which is

just a single line command these command is interpreted by data base. So you see the data base has got the capability to understand SQL basically it must have an SQL preprocessor right. So this is very important that a procedural language has to be understood by the resulting package in which supports it. So these actually it is like you know precompiled program available somewhere and you are just writing a single one or two line statements in a nonprocedural manner. The advantages are tremendous, you do not have to write huge amount of code and lot of details the nitigrities are hidden from you.

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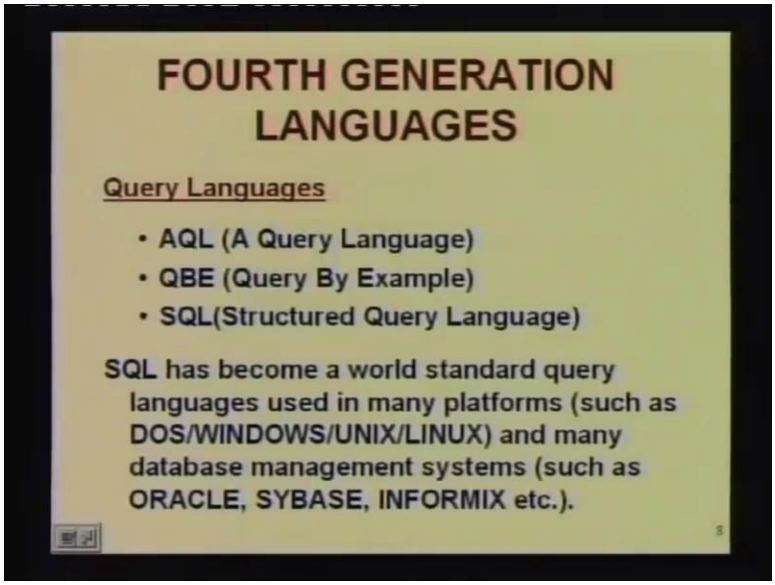

So that is why the fourth generations are popular but obviously they may not be possible to optimize to that extent and therefore they may not be as quick as other program executions. Some of the query languages like AQL, QBE or SQL or structured query language itself. SQL has become a world standard query language used in many platforms like DOS windows Unix Linux and many data base management systems such as oracle Sybase Informix and so on. So we have now SQL like a world standard and we can use SQL almost anywhere. So SQL is a very important component of a data base system every time you write you know you want to do very simple processing with the data base you can make use of SQL's. Then we have a fourth generation languages apart from SQL.

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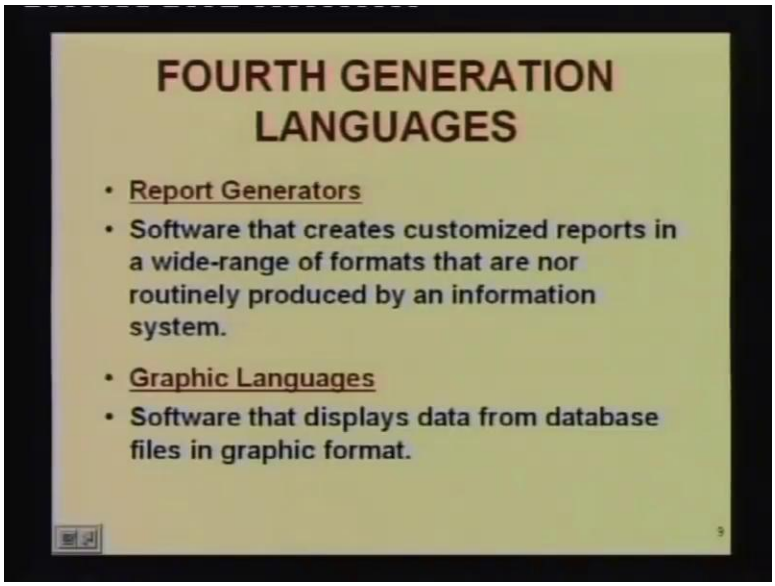

We have different types of report generators and the graphic languages. The report generators are software that creates customized report in a wide range of formats that are not routinely produced by an information system. So basically what is happening in a report generator it is like a program which when executes gives you a particular report right. So it is like a report generator see advantage here is that again you see every report generator generates a program. So you are just writing certain or selecting from menu certain preconditions and using those preconditions specifying the variables or specifying the data base from which the report is to be generated you can actually create the particular report graphic languages. These are software that displays data from data base files in the graphic formats.

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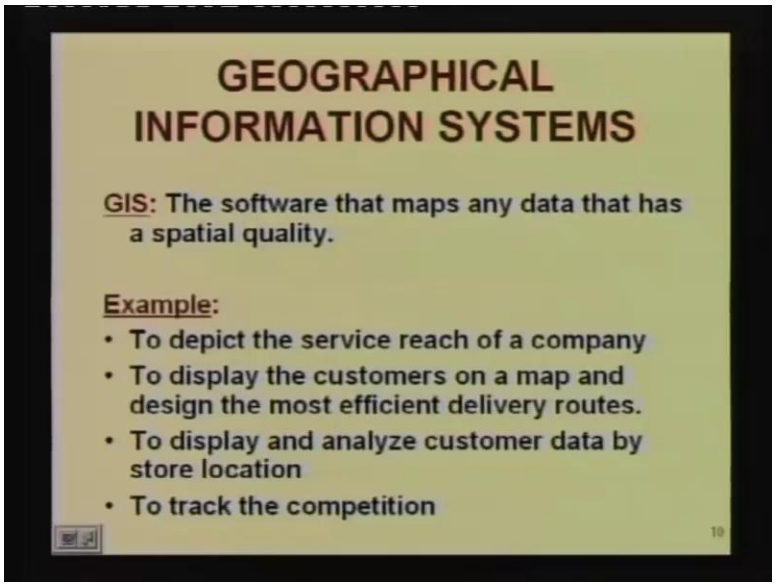

Then all important geographical information systems geographical information systems are basically software that maps any data that has a special quantity. So basically you know the advantage of GIS is in sometimes you know categorizing the data on a geographical basis. So some examples like to depict the service reach of a company to display the customers on a map and design the most efficient delivery routes to display and analyze customer data by store location and to track the competition. So you know you know there could be various possibilities. For example let us take a simple example of a GIS.

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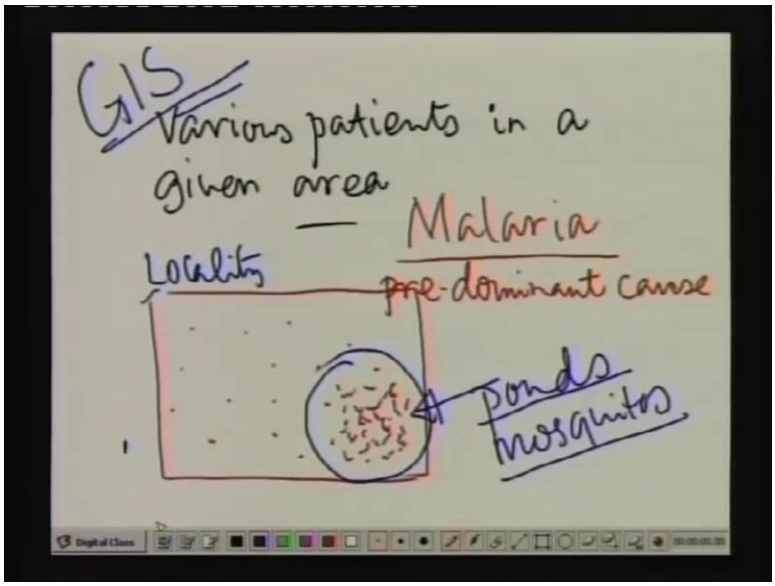

See we have the data of you know the various patients in a given area. Now we come to by a preliminary analysis, we find that all these all these patients are really suffering from malaria. Now any amount of data analysis if you do probably nothing more could be revealed all that you basically get that there are various patients in a given area and the malaria is the predominant cause. So that is what we find that malaria is the predominant cause. Now if you do a geographical analysis, suppose this is the geographical area in which these patients are. See in this geographical area if you plot the patients. That means the houses of the patients so you can see. So these dots are basically houses of the patients who are having malaria. Now you see a very peculiar pattern that this is the point where the patients are actually clustered. So that means out of the total locality. This is the complete locality then this is the area where most of the malaria patients are coming from all right and if you really analyze you may see that in these areas we have ponds and generally the mosquitoes there is a huge growth of mosquitoes.

So immediately we know that we have to have a very special attention on this particular area right. So this analysis is possible because of GIS all right. So it is basically the basic focus area of GIS is that we can actually we can actually find out the advantages of geographically clustering the data right which is usually not done in normal data base analysis right. So you can see that you can find out the service reach you can find out the delivery routes, you can display

the customer data by stored location. So now even the transport now with the advantages of mobile technology it is also possible to track down track down the suppliers track down the supply event. So maybe you see that we may we may find a situation where our tracks are coming from very you know far off location and we can actually track them that where are our supplies at a given point of time.

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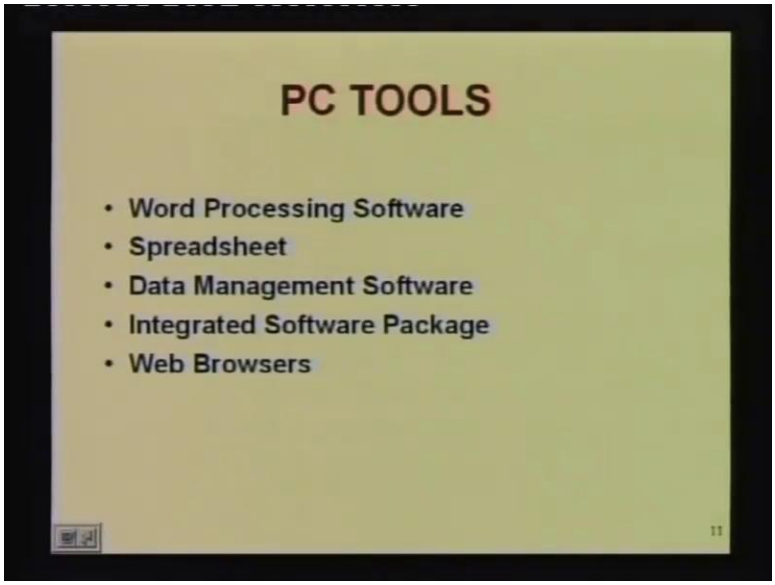

Then there are various kinds of other software like word processing software, the spreadsheets, the data management software, integrated software packages, web browsers. So these are all important other tools which are very much useful in the personal computing environment.

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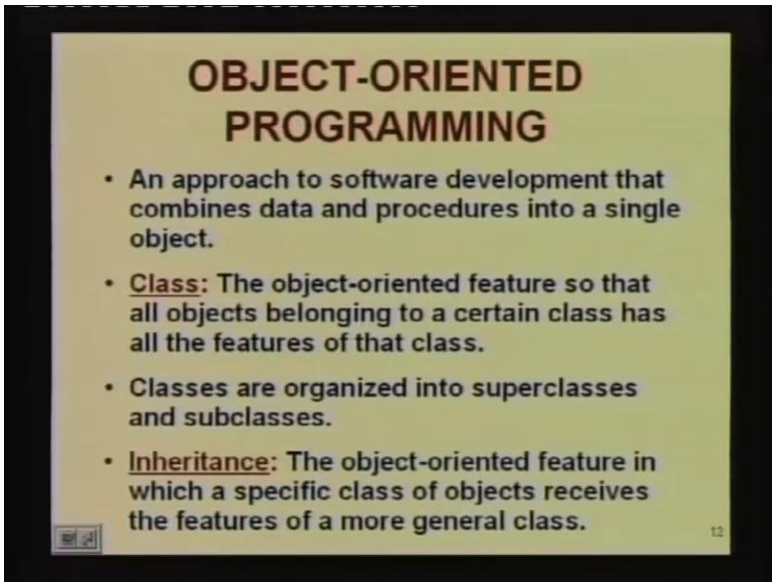

Then, a very important concept of object oriented programming objects oriented programming is an approach to software development that combines data and procedures into a single object. See there are basic advantages of these object oriented programming is that, since we use the so called classes which are object oriented features so that all objects belonging to a certain class has all the features of that class. We can have the facility of inheritance see basically the advantages of inheritance is that or the idea of inheritance is that suppose we have,

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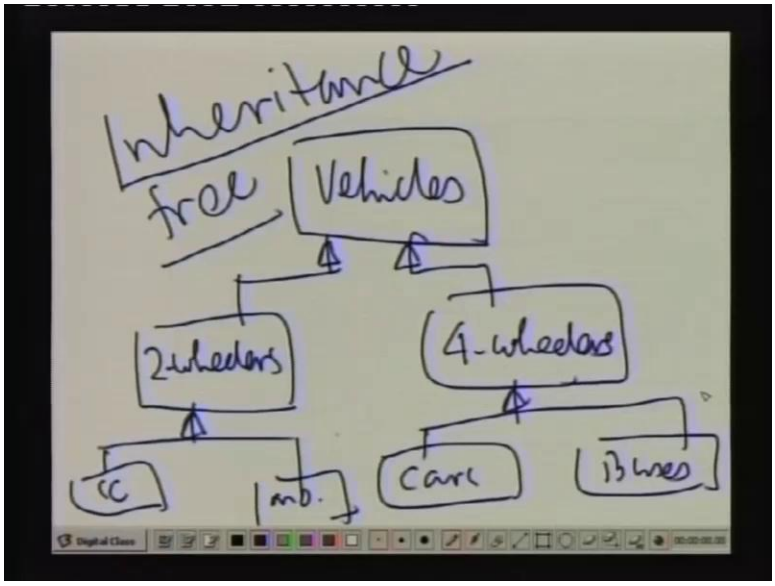

Say various types of say we have the various types of see we can call vehicles, see vehicles. Now we can see that we have the two wheelers and we have the four wheelers then within the two wheelers. Again we have different kinds of scooters motor cycles and four wheelers also we have cars buses trucks and so on. Now interesting thing here is that so we can call it an inheritance tree. Now the advantages that we get is that see there are certain properties which are always true for irrespective of whether it is a scooter or motor cycle cars or buses, it is a vehicle because it is a vehicle it has to have a license plate it has to have a registration number right it has to have an owner and it has to have a license. So you see those kinds of properties can be grouped together and put it under a generalized class called vehicles. Then there are certain properties peculiar to two wheelers alone or general properties of four wheelers alone they can be put here and they can be put here and then specific properties can be actually there in the cars or buses.

So by so doing what we are able to do is we are able to classify, first of all we get a classification and not only that. We are able to allocate the most general tasks to a super class like vehicle or two wheeler with regard to scooter and motorcycle and keep only the very specific properties to the sub classes right. So it is not necessary to generate the redundancy can be reduced to a great extant. Not only that. Not only apart from redundancy the general routine can be actually it therefore helps in what is known as reuse. You know you can you can have the generalized features because you are able to do generalized class libraries. These class libraries can be used later on. And this is where another advantage of object oriented programming comes that object oriented programming does what is known as encapsulation. Encapsulation. See the idea of encapsulation is that.

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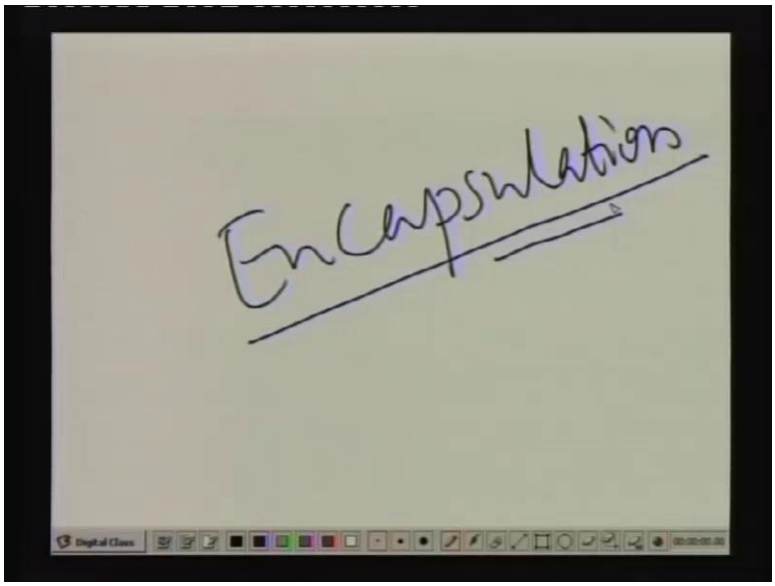

Encapsulation. So every object has got certain data and methods and these data and methods are basically encapsulated inside the object boundary and really one cannot change those data and the methods and they can only come by through a message passing. So in that sense every object has a boundary which you cannot cross. So therefore it is also good that you cannot change an object just like that because you cannot change the object define the object in the most generalized manner and use them again in a different application all right. So the entire application package which you are using in the object oriented software we have developed many parts of it can actually be made use of in another context. So that is the basic advantage of this kind of software development.

So that is why we see that the object oriented programming has become so popular essentially because of code reuse essentially because of encapsulation. Essentially because also that is the way we think because if you really see the education process right from the childhood. A child is basically associates the world with objects with their behavior the behavior of the objects and the classification of the objects right. So that is the basic advantages of object oriented programming. Then also we have what is known as visual programming visual programming is a construction of software program by selecting and arranging programming objects rather than by writing program code. See advantage that comes out of the visual programming is that we have.

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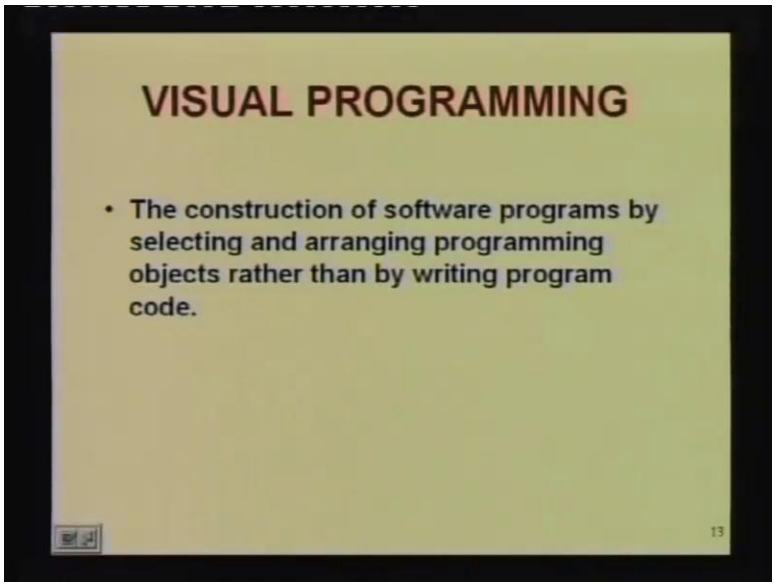

When we are doing visual programming since we have already defined well defined icons well defined objects. So the entire software that you want to develop they can be, you know putting together it is like the modules are given. You arrange the modules together and decide what you want to do all right. So if you have to, if you have been given all parts of the you know small modules and you have to choose your modules and build your thing so that is the idea of visual programming. Definitely it makes things easier and I mean it is difficult you know sometimes it is difficult to the people who have already learned a different technique. But to a person who is new for him it will appear that much simpler.

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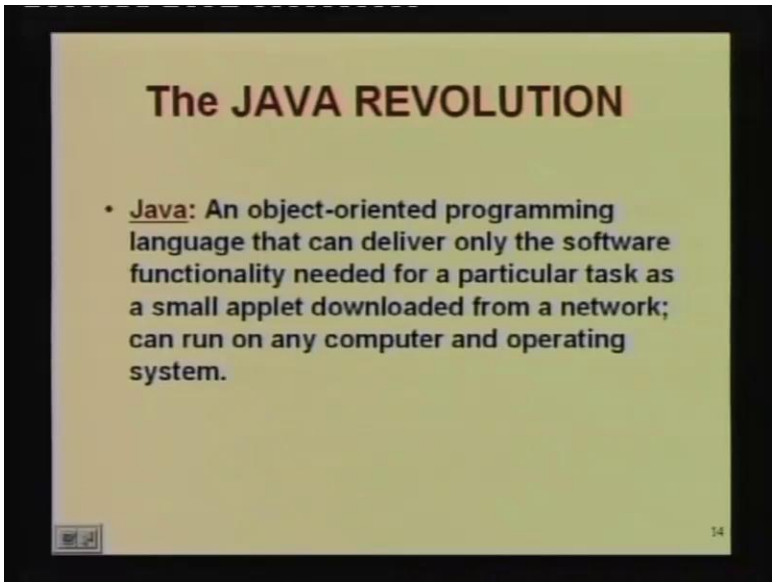

Let us now discuss a very important issue with regard to software that is the so called java revolution. The java is an object oriented programming language that can deliver only the software functionality needed for a particular task as a small applet downloaded from a network can run on any computer and operating system. So the most important thing about java is a platform independence right.

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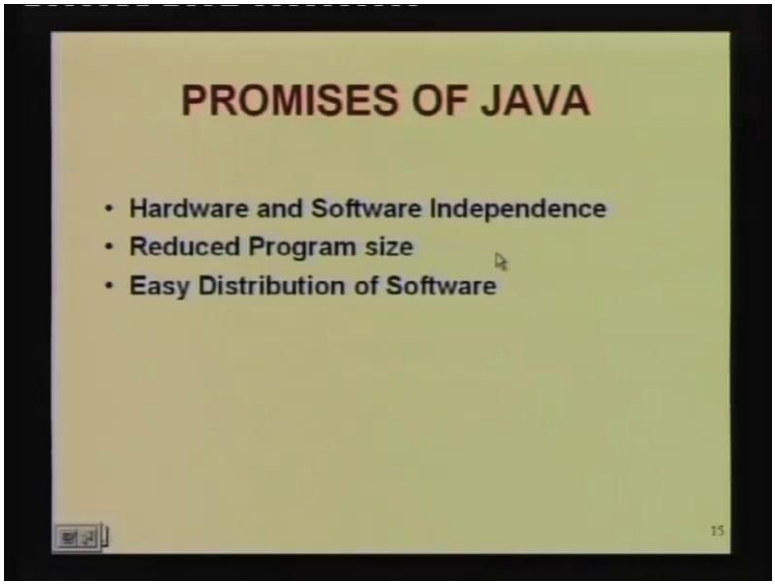

So what is you? Let us see what is the basic advantage of java this is hardware and software independence reduced program size and easy distribution of software. Now I think without java the internet would not have been this much popular as it has been today. So how it is happening? Basically you see that if you want to write everything think of, suppose some hundred people or even thousands and why hundred thousands of people they all are coming to your website and basically trying to obtain information out of it. What will happen invariably, what will happen? Your system will be clattered and the processing speed will be extremely slow right. Because all 1000 programs are trying to run in your computer and your computer cannot run. So many computers. So many programs and we have seen that even 20 to 30 programs, if it runs in one computer it becomes quite slow. What will happen if thousands or even more programs start running in your program? So there should be some efficient way it has to be done and that is what is accomplished with the help of java.

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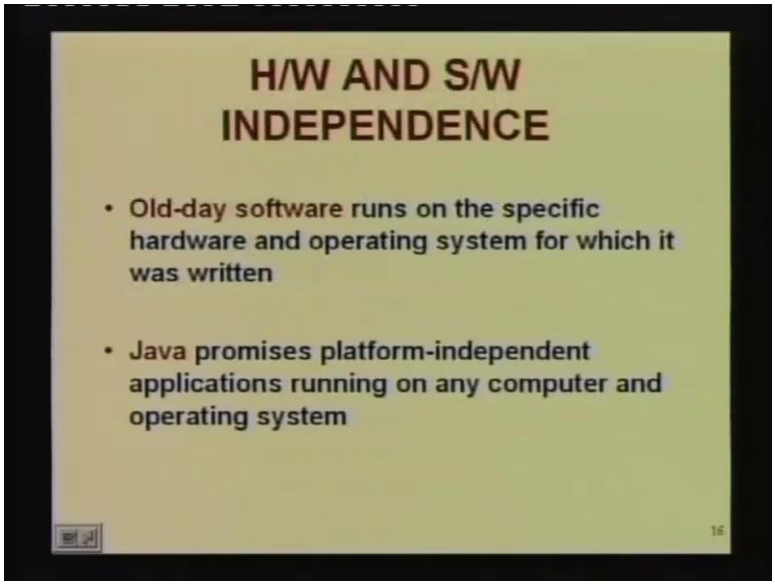

The old day software runs on specific hardware and operating system for which it was written. Java promises platform independent applications running on any computer and operating system. So how java has done? This basically java done java whenever you write a java program or whenever you load a java basically it creates what is known as a java virtual machine JVM. So basic idea of the java virtual machine is creates a given environment over and above the

particular operating system on which you are operating. So you may be operating Linux or you may be operating windows 2000 windows NT or windows XP or any other software platform. Basically if you have now an equivalent you know the similar kind of system working then the java code can also run in that particular environment. So suppose you are in windows 2000 with JVM, Windows NT with JVM, Linux with JVM, and UNIX with JVM. They all should give a similar platform to the java application which you are downloading and since you are downloading that it will simply run equally irrespective of the platform that is the basic advantage.

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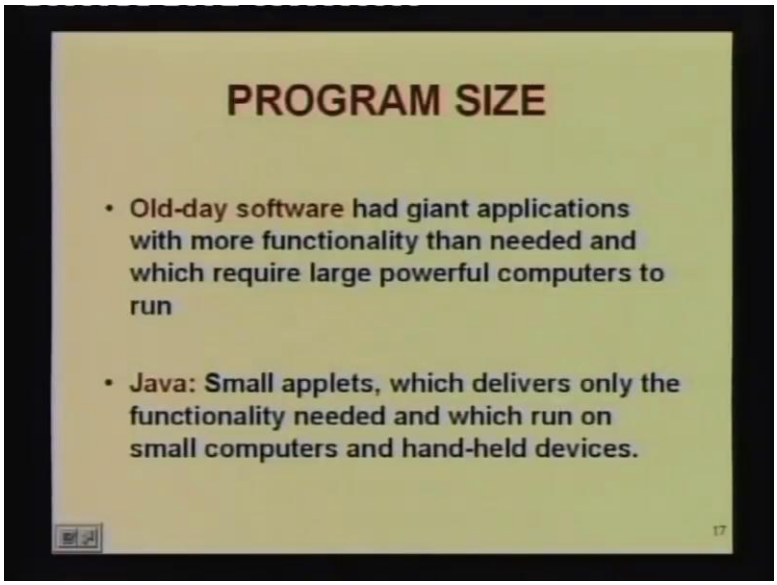

Then program size old day software has giant applications with more functionality than needed and which require large powerful computers to run. Whereas java has a small applet which delivers only the functionality needed and which run on small computers and hand held device. So, you see the basic idea in java is that the size is tremendously small. It is so small and basically when you are going to another computer. All that is you are doing you are just taking away or downloading a java program to your machine. So actually when 1000 programs are coming to a particular website the 1000 programs are not running in that computer where the website is over state. The actually the computer program is running in the clients own computer. So if you are downloading something you are, if you are you are basically running the program

in your computer not in that computer. So that is the basic difference how where did you get the program the program you are simply downloaded. So all that the server is doing server is giving you a computer program. That is the java applet all right. Since that is how the whole thing works the even with 1000 users the web server can still give you information and does not become inordinately slow. Then the software distribution in the old day software we have the vast costly distribution chain including packaging wholesaler, retailers, advertising and catalog companies with users needing to upgrade every two years. Whereas the java the distribution chain eliminated software comes to desktop from network as needed with latest upgrade so that is the another advantage of java.

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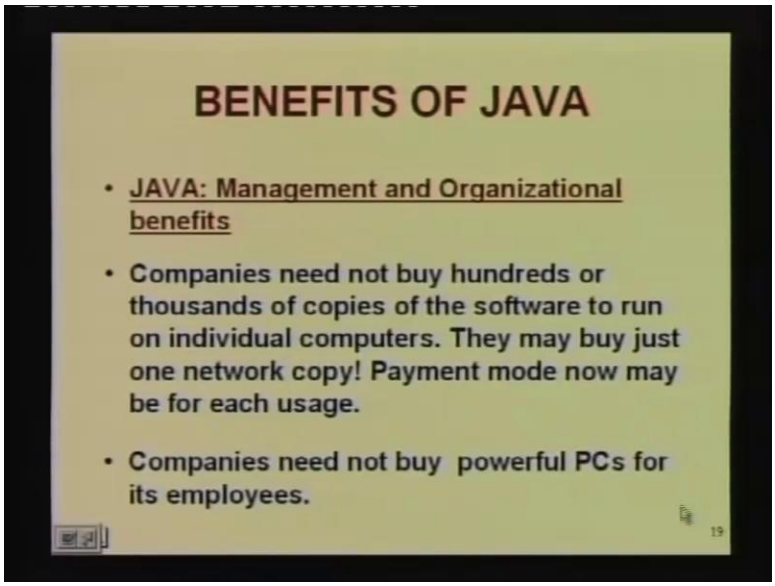

So management and organizational benefits companies need not buy hundreds or thousands of copies of the software to run on individual computers. They may buy just one network copy. Payment mode now may be for each usage company need not buy powerful PCs for its employees all right.

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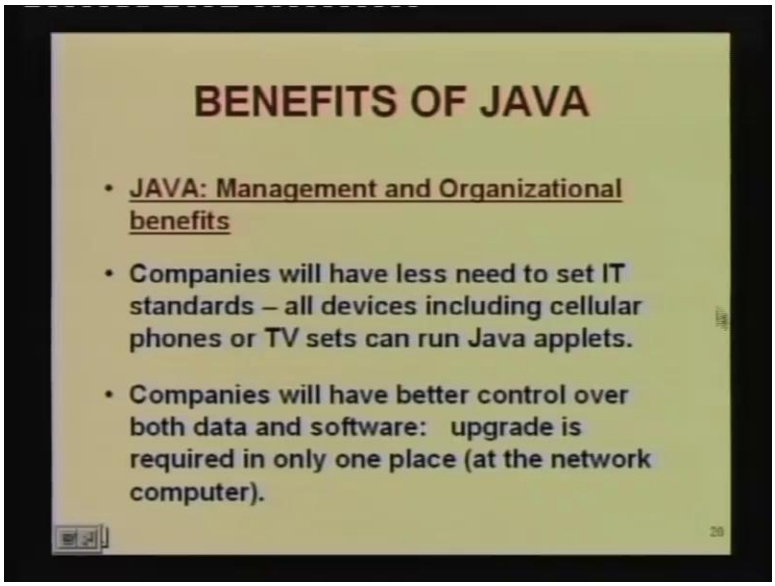

So companies will have less need to set IT standards all devices including cellular phones or TV sets can run java applets. Companies will have better control over both data and software upgrade is required in only one place that is at the network computer.

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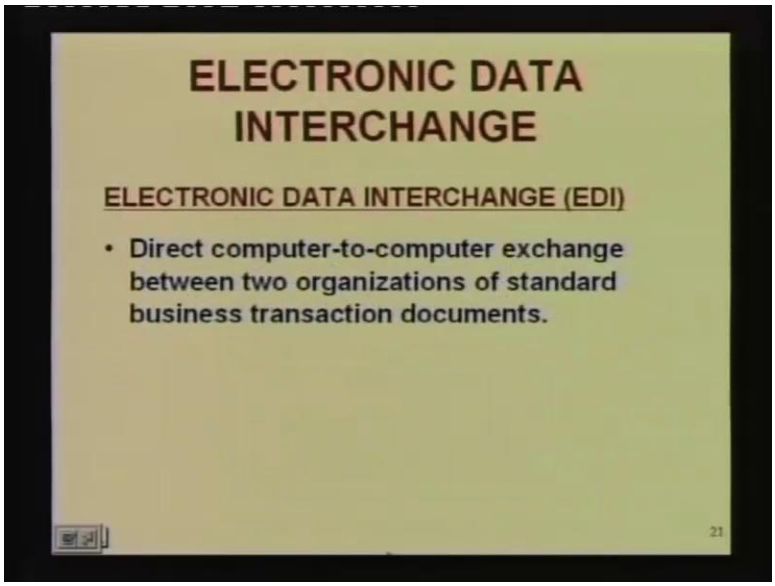

Now another very important concept that are electronic data interchange EDI. See direct computer to computer exchange between two organizations of standard business transaction documents. Basic idea of EDI let us try to understand.

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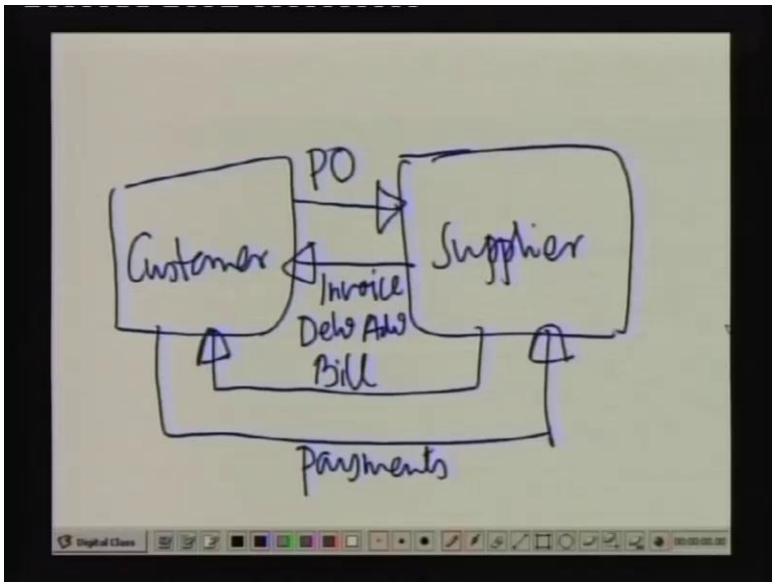

You see suppose this is one company this is another company. So this is the let us say supplier company and this is the customer company. So we have the customer and we have the supplier, now you see whenever the customer is purchasing something customer gives a purchase order purchase order. Supplier sends the material along with an invoice and a delivery advice then it also gives a bill and customers finally make payments. So customer has to make a purchase order print. It process print it give it to supplier. Now supplier may be following a computer system where the purchase, because you see the supplier is dealing with many customers and many customers are giving many different kind of purchase orders. So supplier has to come to make them in a standard form enter into the computer and prepare invoice all right. After the invoice is prepared the customer gets it. Now customer is getting many different kinds of invoices from various suppliers put it in the appropriate form and make it ready. Then again supplier sends the bill and this bill may be again customer has to make it in equivalent form and put it and then process and make payments again when supplier gets the payments they have to again make their own processing. So in these entire process of interaction between the customer and supplier for

each customer supplier pair, you see the there is a lot of time that goes in preparation of purchase order invoice bill payment delivery advice not only at the customer end but also at the supplier.

And so if customer has made all these preparations all these work for the purchase order preparation why should supplier again resolve it. That is where electronic data interchange comes in what the electronic data interchange does what the electronic data interchange does that it basically is a third party interchange with sets certain standards. So the standard says if it is a purchase order it has to be like this if it is an invoice it has to be like this; if it is a bill it has to be like this. So once these standards are set then the supplier company and the customer company they have to confirm and if they confirm through computer like an you know the purchase order can be sent and since both the companies are using similar computer. What you call standards then the purchase order is accepted by the computer as it is no change is required no processing is required and the invoice can be immediately generated and send to the parent company the customer. So the processing is reduced by at least half all right. You do not have to again make extra efforts to put the customers PO into your computer and since the exchange are happening in an electronic manner. All the transport delays are cut. Tremendous time is saved in terms of you know cutting down the delays of transportation and preprocessing of purchase order, invoice bills, payment details, etcetera. So that is the basic idea of electronic data interchange.

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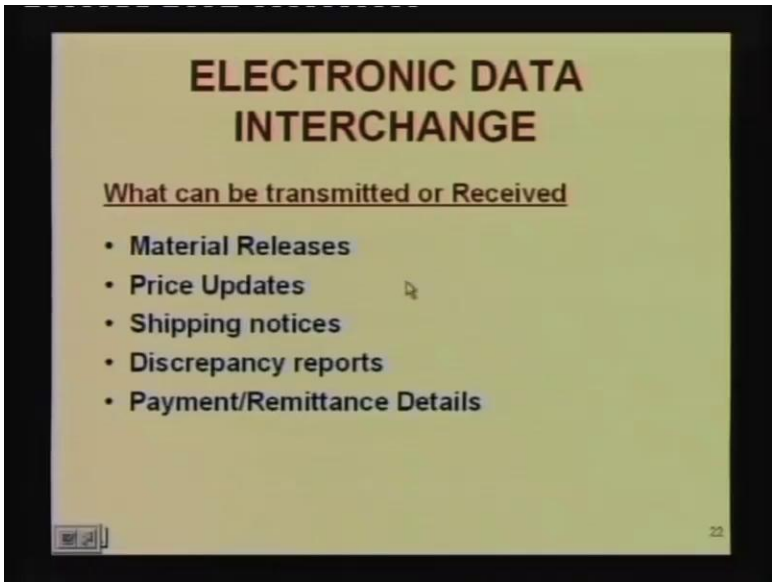

And it is a very popular thing as the very important part of a company's ERP. So what can be transmitted or received material releases price updates shipping notices discrepancy reports payment or remittance details.

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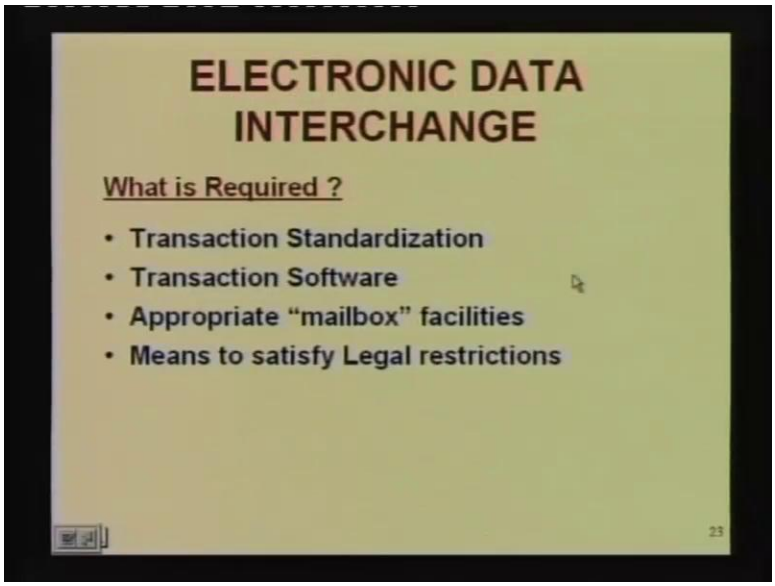

What is required transactions standardization transaction software appropriate mail box facilities means to satisfy legal restrictions right. So these are quite important for an electronic data

interchange to be successful. Now let us try to go and check the various data communication details.

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Data communication entails electronically exchanging data or information. That is the primary goal of any data communication.

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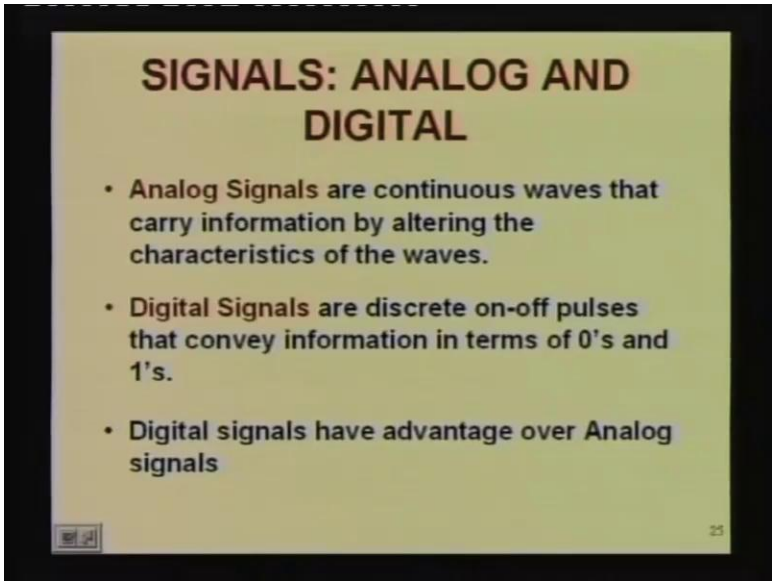

So first and foremost we must differentiate between analog signals and digital signals analog signals are continuous waves that carry information by altering the characteristics of the waves. Digital signals are discrete on off pulses that convey information in terms of zeros and ones. Digital signals have advantage. Why it is advantageous? Let us see that.

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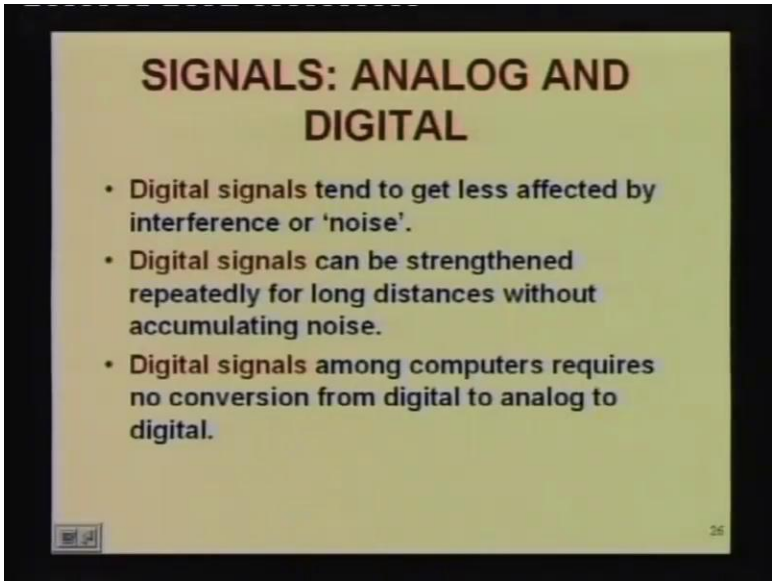

Digital signals tend to get less affected by interference or noise. Digital signals can be strengthened repeatedly for long distances without accumulating noise. Digital signals among computers requires no conversion from digital to analog to digital whereas analog signals require it. Basically the biggest advantage of digital signals is that it does not accumulate noise. Why because, it is in terms of zeros and ones. So if there is a noise then by using certain methods like parity bits or any other method you can actually correct it. So that is the biggest advantage. But analog signals will always there you know affected by interference and their accumulate noises.

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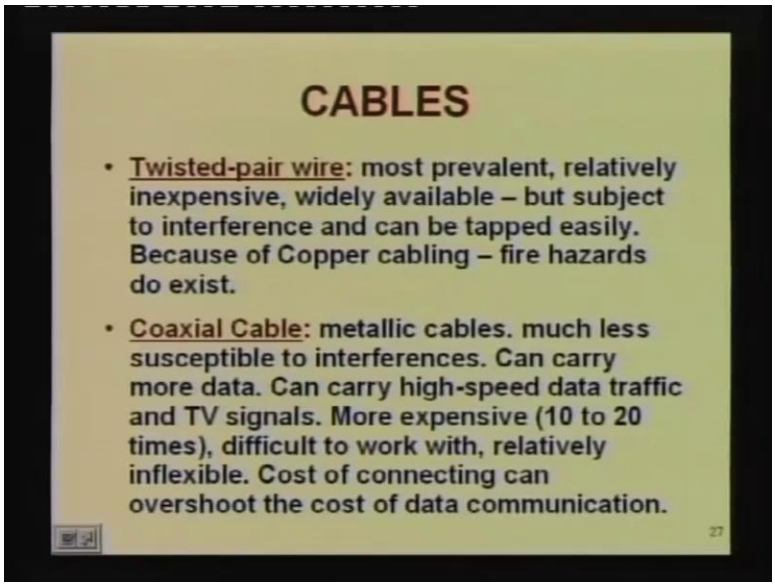

Another very important thing the cables there are various kinds of cables that are important for data transfer or communication. The old once were twisted pair cables most prevalent relatively inexpensive widely available. But subject to interference and can be tapped easily because of copper cables fire hazards also exist. Coaxial cables, these are metallic cables much less susceptible to interference can carry more data can carry high speed data traffic and TV signals more expensive difficult to work with relatively inflexible cost of connecting can overshoot the cost of data communication. There are some difficulties with coaxial cables as well.

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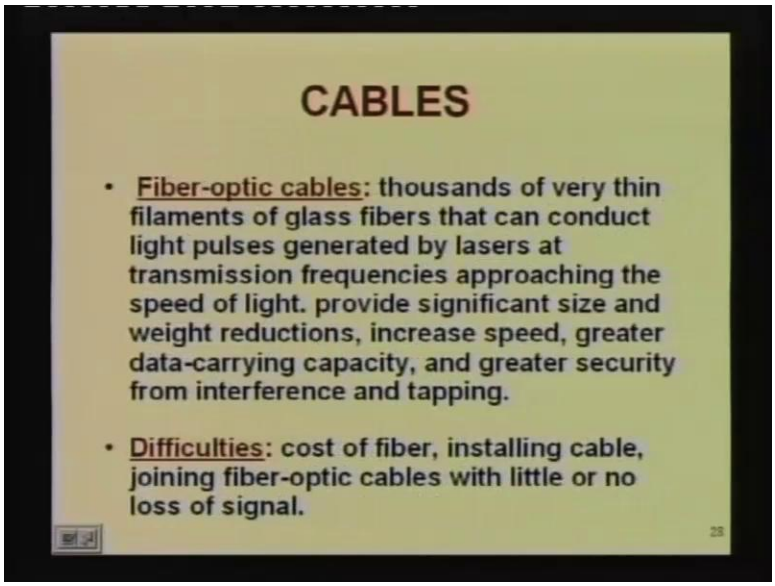

Then the recent trend is fiber optic cables thousands of very thin filaments of glass fibers that can conduct light pulses generated by lasers at transmission frequencies approaching the speed of light right. Provide significant size and weight reductions increase speed greater data carrying capacity and greater security from interference and tapping. But some difficulties because cost of fiber, obviously it has come down in recent years installing cable then joining fiber optic cables with little or no loss of signals. These are difficult these are so usually whenever we talk of fiber optic cables. We want fiber optical cables for kilometers together something like 100 kilometers long fiber optic cable without any joints right. So some difficulties are there but even then because the very fact that they are so simple to operate and so light weight and so much of speed they have become more or less the world standard today when is communications and mobile computing.

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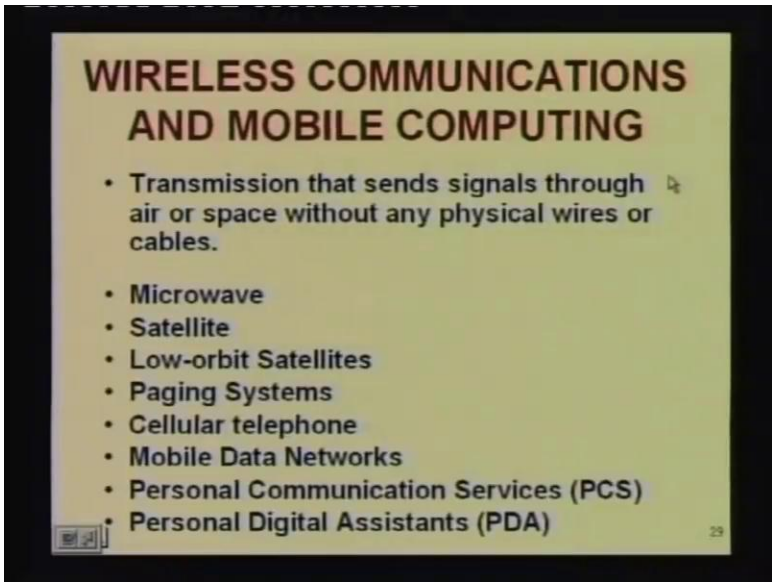

Transmissions that sends signals through air or space without any physical wires or cables. So some of these like microwave, satellite, low orbit satellites, paging systems, cellular telephones, mobile data networks, personal communication services, personal digital assistants. So there are various wireless communication systems that have come and they have become very important today in today's communication systems.

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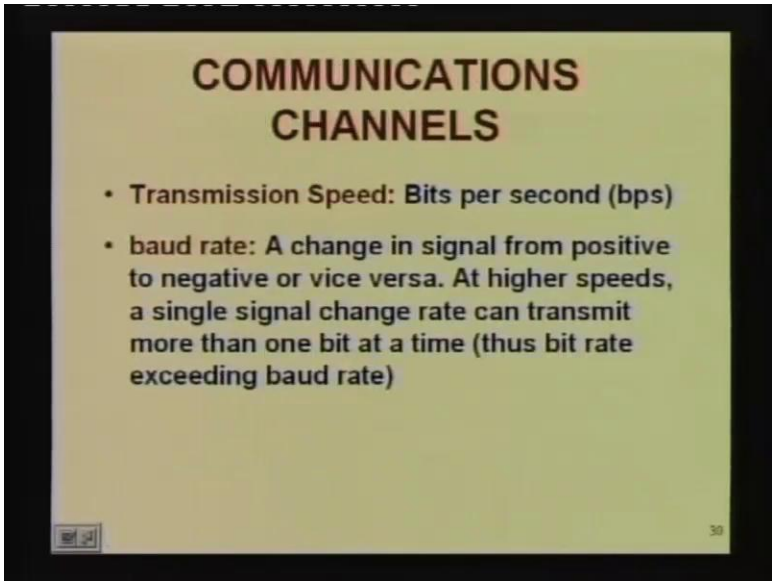

Some of the communication channel details a transmission speed is measures in terms of bits per second, BPS concept of baud rate. A baud rate is a change in signal from positive to negative or vice versa at higher speeds a single signal change rate can transmit more than one bit at a time. That bit rate sometimes exceeds baud rate all right. So whereas the transmission speed is bits per second the baud rate is a change in signal from positive to negative all right. So how much it is changing that is basically baud rate.

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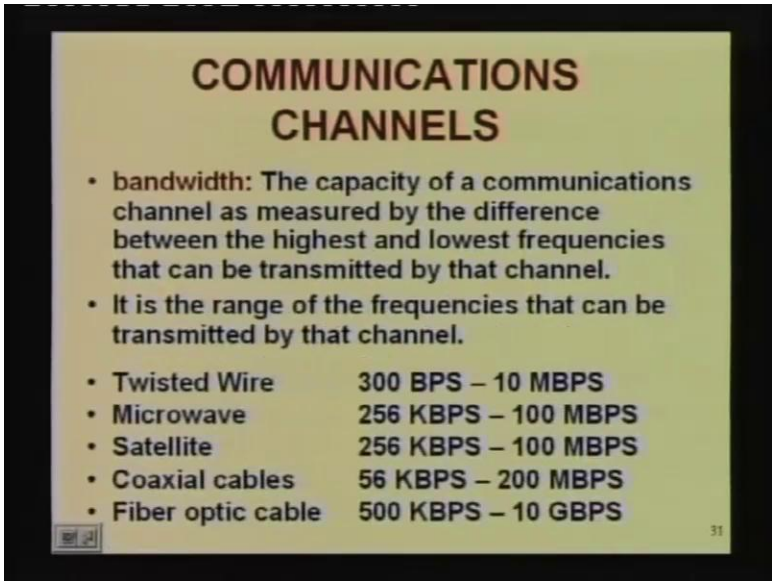

Then the concept of bandwidth the bandwidth is capacity of communication channel as measured by the difference between the highest and lowest frequencies that can be transmitted by the channels. So what are the range of frequencies which can actually be transmitted bigger it is bigger is the bandwidth. So it is the range of frequencies and we always want high bandwidth for higher data transmission. So we have something like twisted wire microwave satellite coaxial cable. Fiber optic cable as we can see that fiber optic cable the speed is the bandwidth could be very, very high all right. So it could be as high as 10 GBPS.

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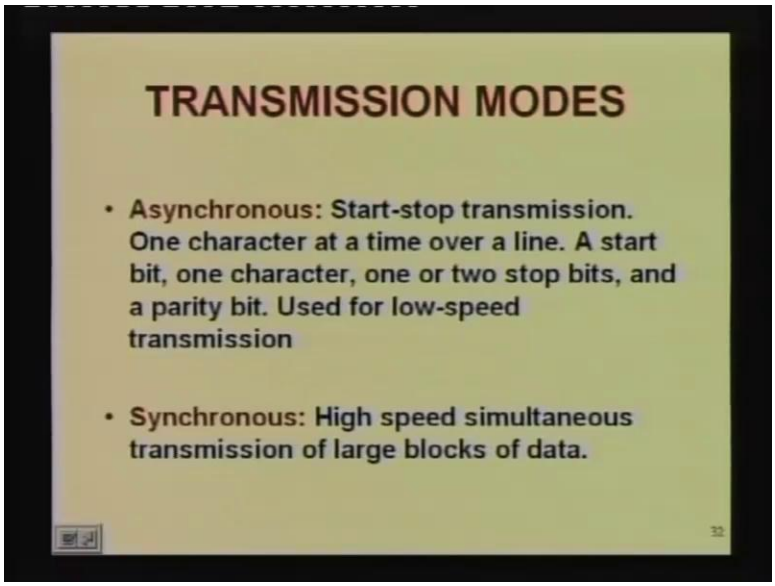

Then there are transmission modes. The transmission mode can be asynchronous or synchronous. Asynchronous which is like a start stop transmission one character at a time a start bit one. Character one or two stop bits and a parity bit. But these are possible only for low speed transmission. Synchronous high speed simultaneous transmission of large blocks of data all right. It is not a start stop transmission it is a continuous stream of data that are going so is a called synchronous transmission modes.

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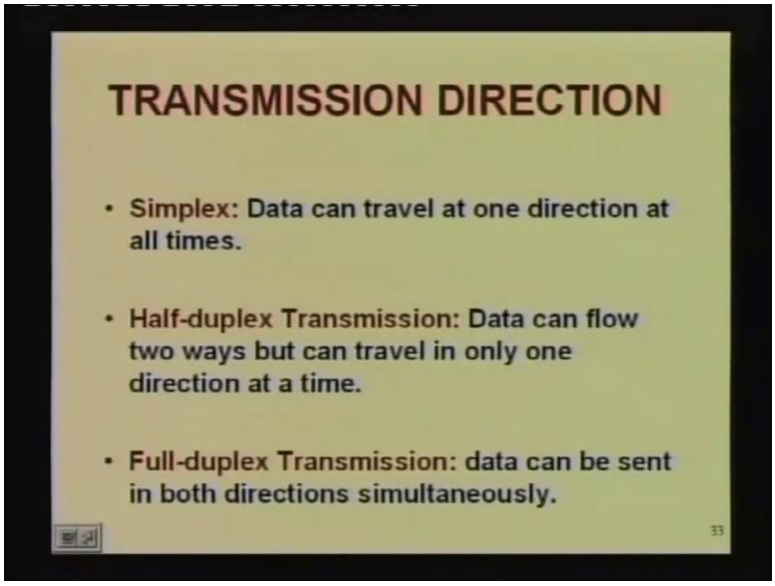

Then the difference between simplex half duplex and full duplex transmission simplex data can travel at one direction at all times. Half duplex transmission data can flow two ways. But can travel only in one direction at a time full duplex transmission is only those where data can be sent in both directions simultaneously. So that is another thing that whether it is simplex half duplex or full duplex.

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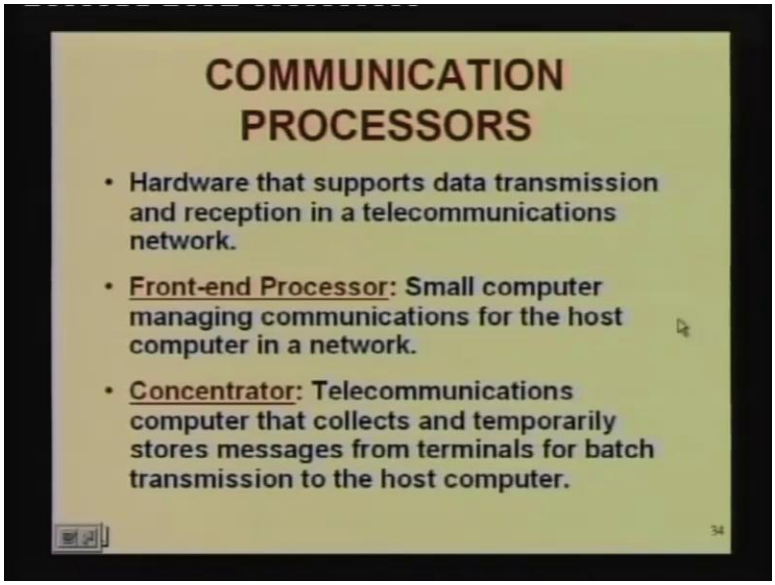

Then there are various kinds of communication processors which are usually used whenever we are having data communication needs hardware that supports data transmission and reception in a telecommunication network front end processor small computers managing communications for the host computer in a network. A concentrator telecommunications computer that collects and temporarily stores messages from terminals for batch transmission to the host computer. So these are the concentrators are basically you know they are collectors which are temporarily storing messages from terminals to the host computers.

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Then there are controllers which are specialized computer that supervises communication traffic between CPU and the peripheral devices in a telecommunication system and the multiplexer which is a device that enables a single communication channel to carry data transmissions from multiple sources simultaneously. So these are different communication processors that are represent.

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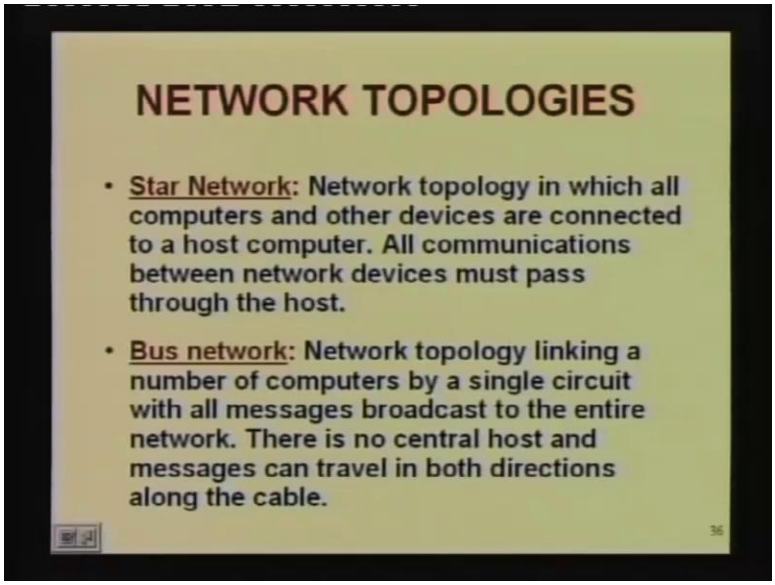

Then we have various network topologies like the star or the bus the star network. Network topology, were all are connected to a host computer as if in a star. The host computer is in middle and all the other computers they are radiating from the host computers. So here the disadvantage you can easily see that all communications must pass through the host computer. So by any chance if the host computer goes out then entire network thing will be also out right. The bus network the bus network is a network topology that links a number of computers by a single circuit with all messages broadcast to the entire network. There is no central host and messages can travel in both directions along the cable right. So basically the messages are broadcast to the entire network and since it is a network type of thing. What can happen since if there are redundancies, even if one or two computers fail, the network may still be working.

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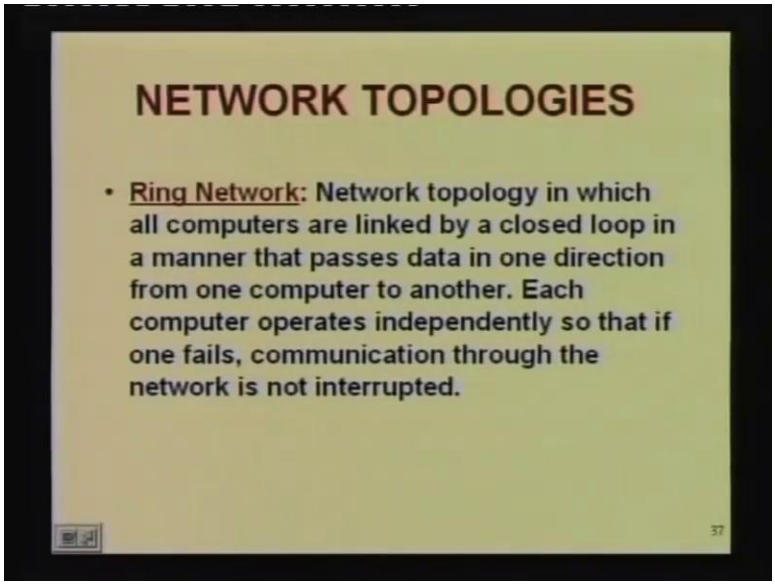

Then we have the ring network it is a network topology in which all computers are linked by a closed loop in a manner that passes data in one direction from one computer to another. Each computer operates independently. So that if one fails communication through the network is not interrupted.

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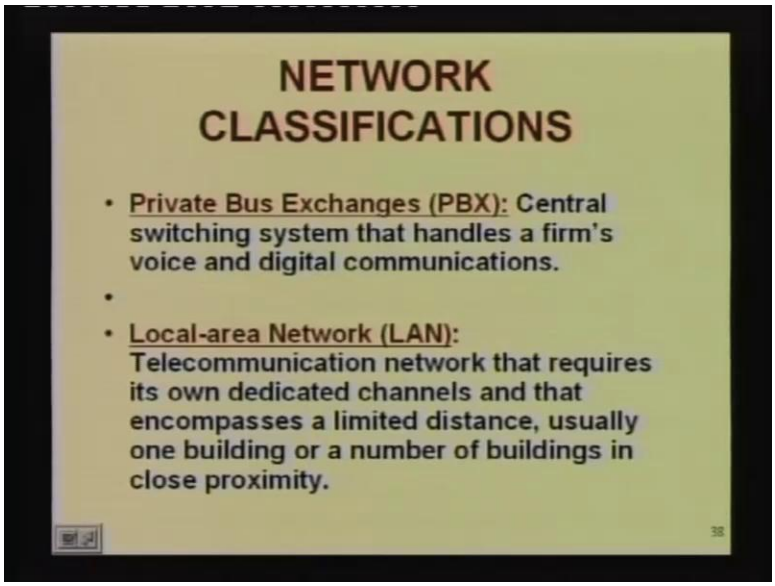

Then we have various classifications like private bus exchange which is like a switching system. We have a local area network that requires its own dedicated channels and encompasses a limited distance usually one building or a number of buildings in close proximity.

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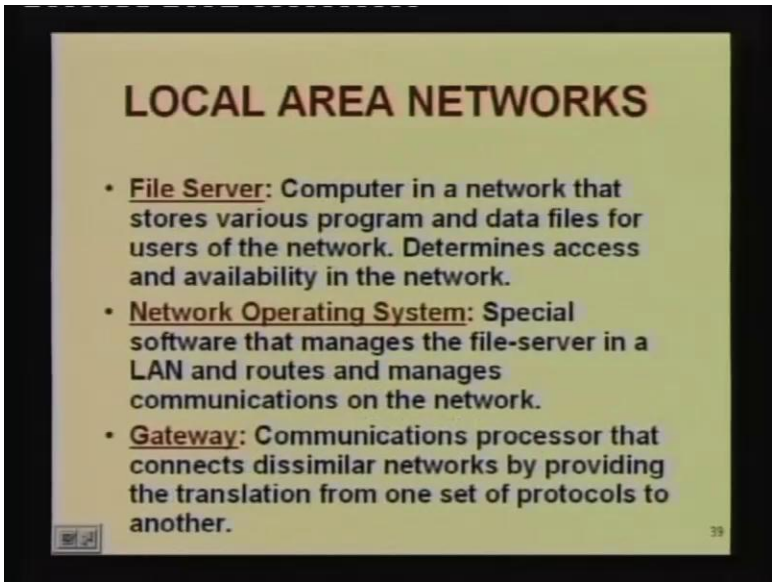

Local area network requires a file server a network operating system and a gateway.

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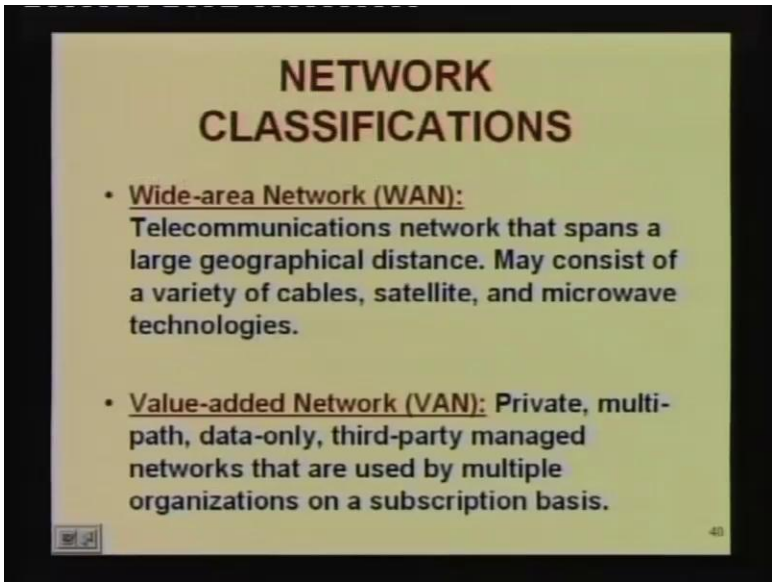

Then we have wide area network telecommunications network that spans a large geographical distance may consist of a variety of cables satellites and microwave technology. We have value added network which is private multi path data only third party managed network that are used by multiple organizations.

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Finally the telecommunications competitive advantage. The organizational use of telecommunications for competitive advantage. For communication coordination and speeding of flow of transactions message and information throughout business firms.

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So that is very important. What are the things we have the electronic mail, the voice mail, the fax machines, digital information services, teleconferencing, data conferencing, video conferencing, EDI.

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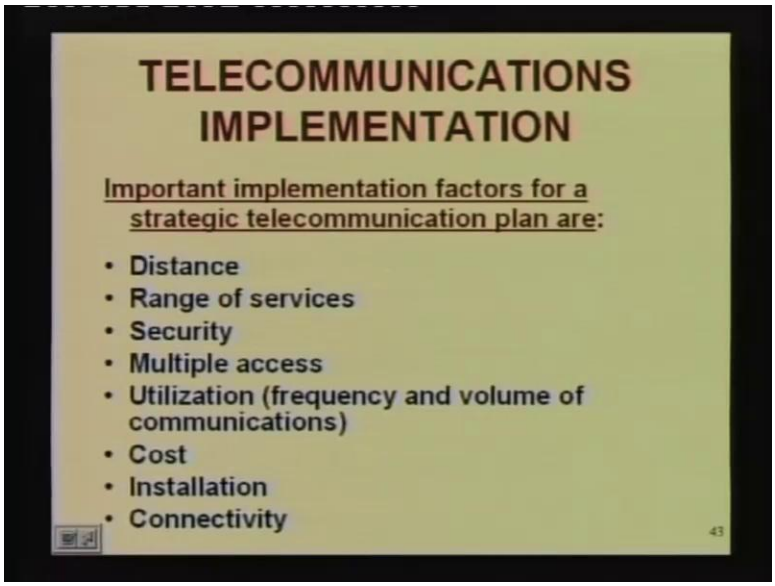

We also have certain very important implementation factors like distance, range of services, security, multiple access, utilization, cost, installation and connectivity. So these are some of the important implementation factors for a strategic telecommunication plan. So thank you very much.