Management Information System
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Lecture - 9
Hardware and Software Overview – I

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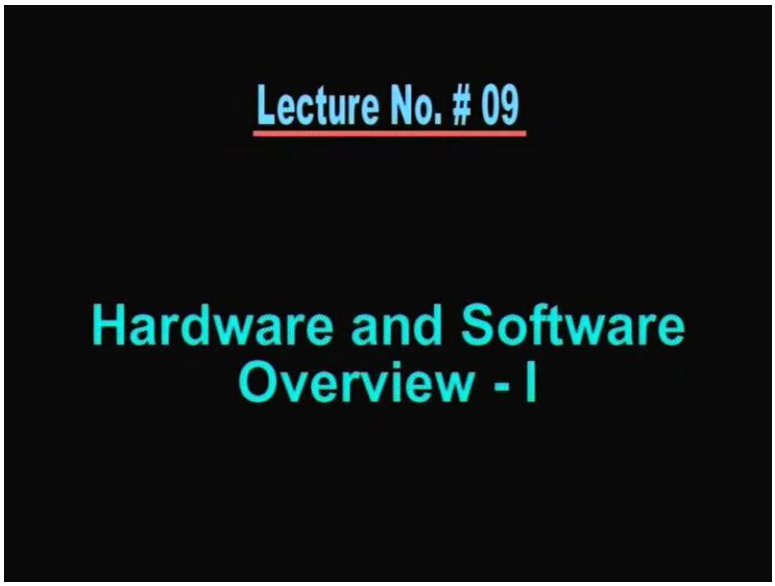

Good Morning. Today let us begin new chapter on hardware and software overview.

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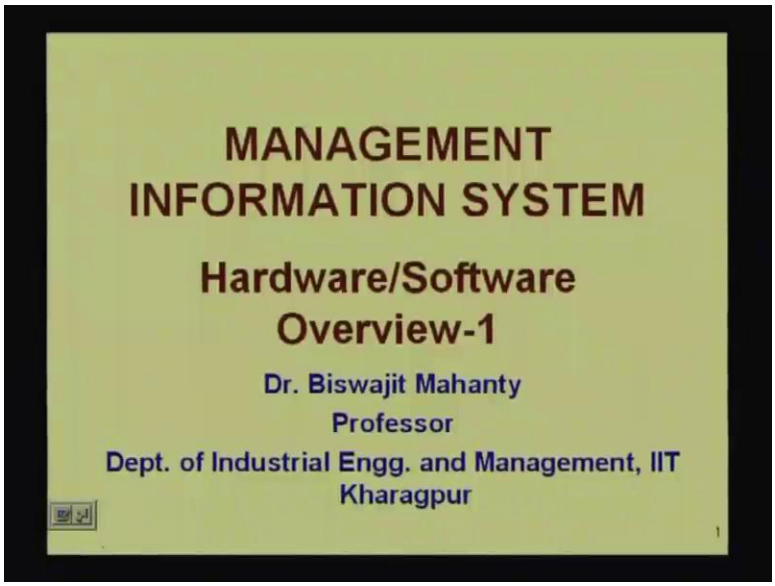

In hardware and software overview, we shall basically cover three broad topics. First of all the hardware concepts, then the software concepts and finally the networking concepts and spanning two lectures. First let us see the hardware concepts.

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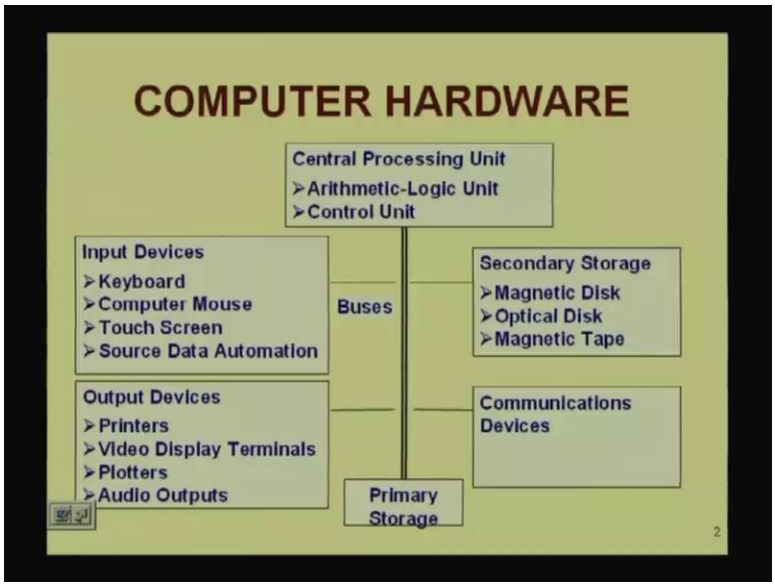

Computer hardware as we all know essentially has the following components. There is a central processing unit consisting of an arithmetic logic unit and a control unit. Then we have the input devices such as key board, computer mouse, touch screen, source data automation, etcetera. Output devices like printers, plotters, etcetera. Secondary storage magnetic disk, optical disk, magnetic tape, etcetera. Communication devices and a primary storage. Basically the random access memory and the connection with the central processing unit to all these different devices are done through the different buses.

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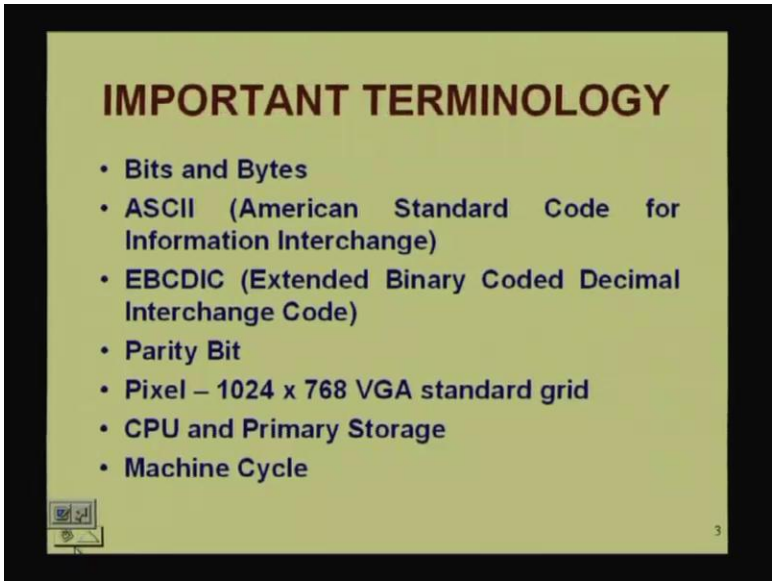

So as you can see here then important terminologies that are important in this context are the first of all bits and bytes, ASCII American Standard Code for Information Interchange. EBCDIC, Extended Binary Coded Decimal Interchange Code, the different kinds of parity bits, then pixel 1024 into 768 just for example VGA standard grid then CPU and primary storage machine cycle.

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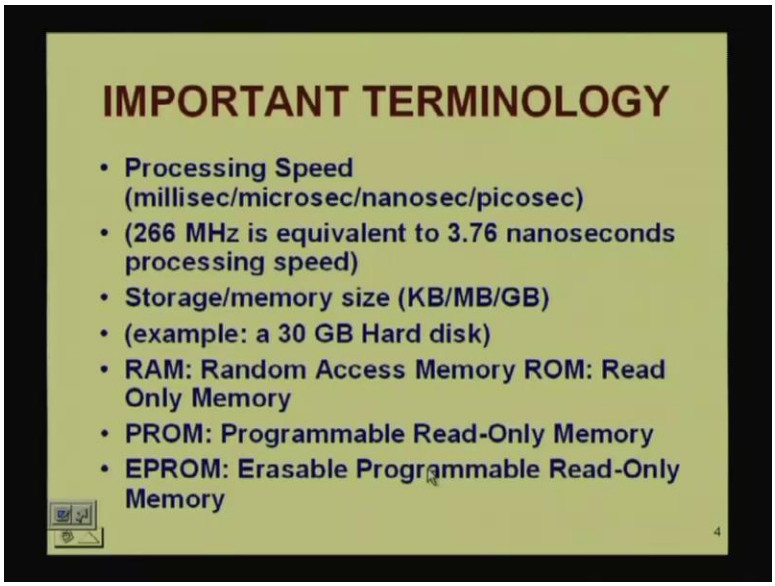

Processing speed the millisecond, micro second, nanosecond, picosecond, etcetera. Storage or memory size, random access memory read only memory programmable read only memory and finally erasable programmable read only memory. So let us just quickly try to understand the concepts. Basically everything about computer are consisting of zeros and ones. So they can be called as bits. Now essentially when eight bits combine together you can call it a byte and one byte is usually used to code one alphabet or one letter. So the various systems are there like the famous ASCII code the American standard code for information interchange or the EBCDIC code extended binary coded decimal interchange code. They are basically codes how to write the alphabets and letters and also numbers special symbols etcetera using a byte of information.

Now sometimes what happens usually a parity bit is also added the parity bit as you have seen is like a redundancy. So if there is an error in transmission this transmission error can be taken care of with the help of the parity bit. The pixel on the other side is a point on the terminal. So basically a VGA standard grid has 1024 into 768. So many points or pixels by which we have the particular terminal screen. Then CPU and the primary storage these are very important that main computer processing takes place with the help of the primary storage and the central processing unit. And we know that while these calculations go on the time taken is absolutely fixed there cannot be any variation every addition process will take the same amount of time. And it

depends on the machine cycle right. So these machine cycles is basically related to the processing speed.

So suppose we have something like 266 megahertz which in today's standard is quite low is equivalent to 3.676 nanoseconds processing speed. So the processing speed in milliseconds, microseconds, nanoseconds or picoseconds is equivalent to the clock right so we know that every system has a clock with a given clock speed and these particular clock speed is related to the processing speed as well. Then the storage or the memory size such as the kilo byte, megabyte, and gigabyte. For example 30 GB hard disks then we have different types of memory such as the random access memory the volatile memory which does not exist once the power goes off. Read only memory a ROM the ROM is something which you know you can just write once and then you cannot use it you cannot write anything anymore. So essentially the basic idea of a ROM is keeping some system specific instructions which along with the hardware constitute the basic operating system. Then, PROM. PROM, programmable read only memory that part of the read only memory which you can program erasable programmable read only memory or a PROM.

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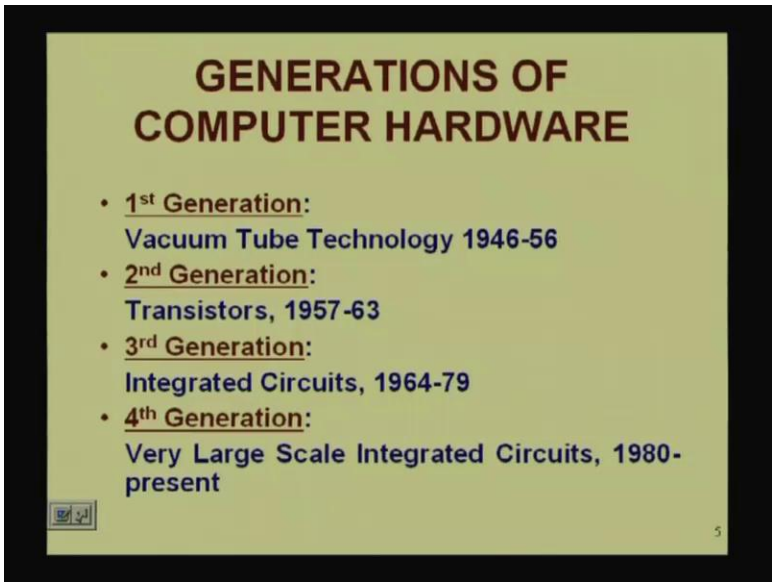

Then once we see all these important terminologies. Then let us see the various generations of computer hardware. So let us talk about four generation of computer hardware. In the very first generation we had the vacuum tube technology. It is a very old 1946 to 1956 and at that time, a computer used to you know cover an entire room all together. It is a very large room covering only one computer. Then we have the transistors the second generator generation computers 57 to 63, third generation using integrated circuits 64 to 79, then from 80 onwards we have the fourth generation computers are very large scale integrated circuits. So these are the various generations of computer evolution has taken place in a tremendous manner at one point of time when the DOS the so called disk operating system was first began 640 Kb was sought to be a good enough memory area for random access. Today even 640 Mb is found to be less right. So you see a jump from 640 kilo byte to 640 Megabyte has just happened in last 20 years or so. So you can see how the entire computer hardware changes are taking place in an exponential manner.

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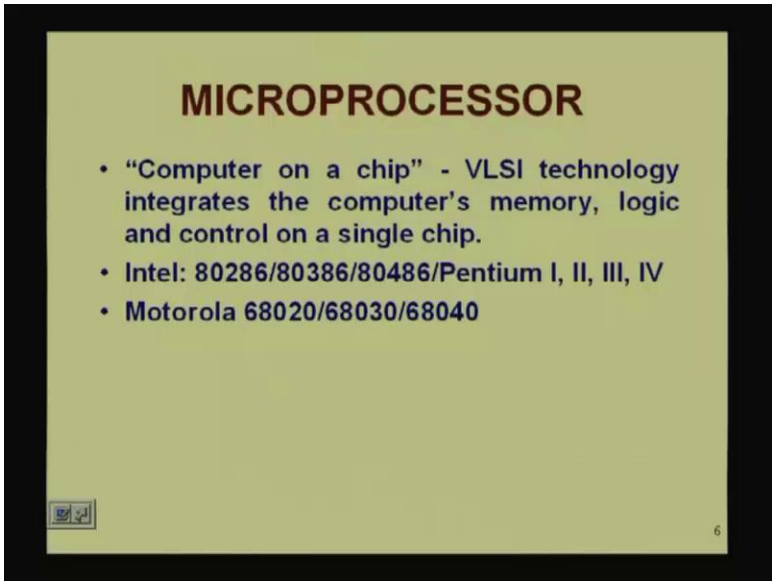

Then microprocessor the basic idea of microprocessor is you know in a very simply you can define the computer on a chip VLSI technology integrates the computer's memory logic and control on a single chip. So there are various microprocessor chips the 80286, 80386, 80486. Then we have Pentium 1, 2, 3, 4, etcetera. Similarly some numbers from Motorola. So these are basically can be called as microprocessor.

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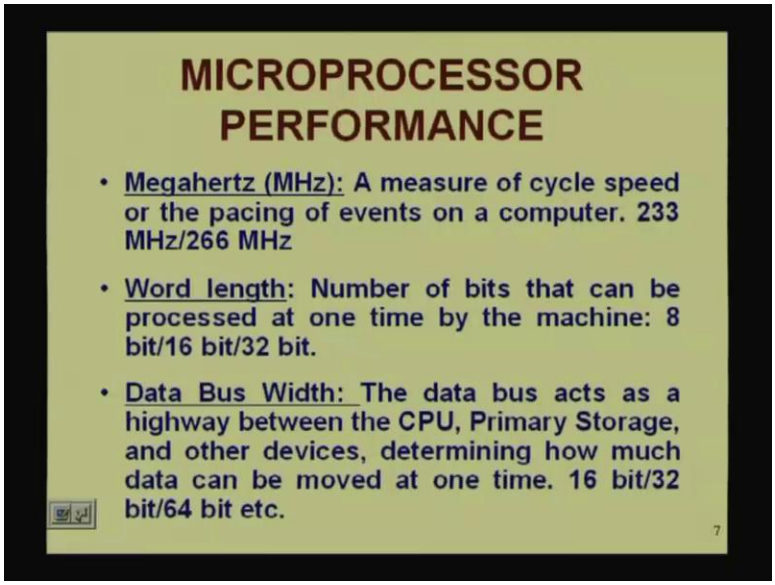

Then the microprocessor performance some important terms. Here megahertz word, word length data bus width. The first of all the megahertz is a measure of cycle speed or the pacing of events on a computer. So basically whenever the system clock is there an every time you are processing something. Let us say adding two numbers it has to go through some very well specified steps. And these well specified steps or the time taken therefore will be define by the whatever is the system clock and this system clock or the cycle speed will depend how much time it will take on the megahertz. Then word length number of bits that can be processed at one time by the machine.

So you can have 8 bit, 16 bit or even 32 bit word lengths right. Data bus width the data bus acts as a highway between the CPU primary storage and other devices determining how much data can be moved at one time 16 bit, 32 bit, 64 bit etcetera all right. So more you have the data bus

width more information can flow. So essentially we have basically two important things one is the processing speed and the IO speed. You see the processing speed depends on the word length on the megahertz the frequency. Now you see that if the word length is more if the megahertz clock speed is more then what will happen you can process your system faster right. The system is faster as for as processing is concerned but again every processing. So if you see that original diagram may be it will help us little bit.

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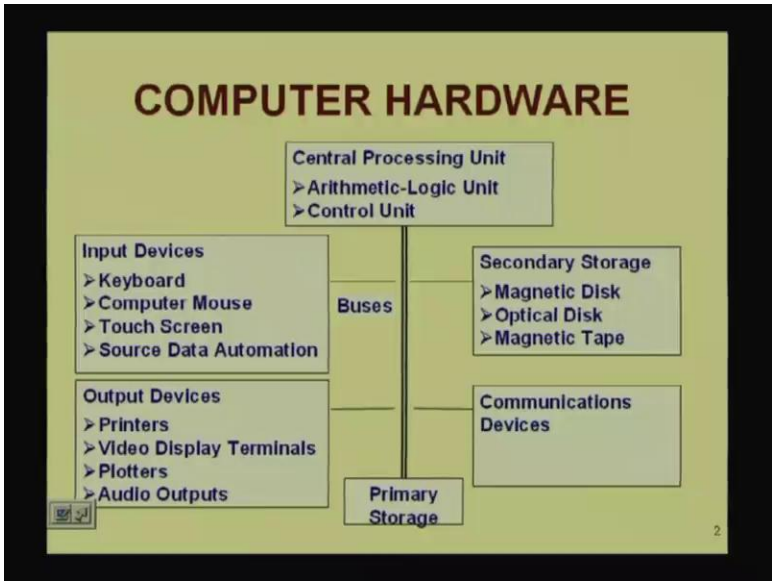

You see if the processing actually goes on in the central processing unit itself right. Then things are pretty fast because processing speeds are very, very fast. Whereas if you have to keep on getting data from the primary storage it will be slightly slower. But even then nothing much because after all these is in the main bus and you know the speed is very, very high. But every time you have to bring some data from input device or put it to the output device or bring it from communication device or secondary storage then the speed drops drastically. So essentially if you want the computer processing time so you know the differences could be almost 1 is to 1000. That means if some is processing goes on directly, in the central processing unit along with the primary storage the time taken is one the any processing that has to take place along with the input device output device or secondary storage or communication device can be order of 100 to 1000.

So you can see that to that extent the speed varies to that extent the speed varies and therefore even if there are two IO operations and 100, what you call processing operations the speed is guided by the IO operation because it is 100 to 1000 times slower right. So that is why you know the computer speed irrespective of very good clock speed and very good you know everything from the processer point of view the parallel processor and so on. If the IO speed is not good the computer performance will not appear very drastically different because end of the day that will guide the ultimate time taken by the computer for certain operations. So therefore the data bus width is very important as for as IO speed is concerned.

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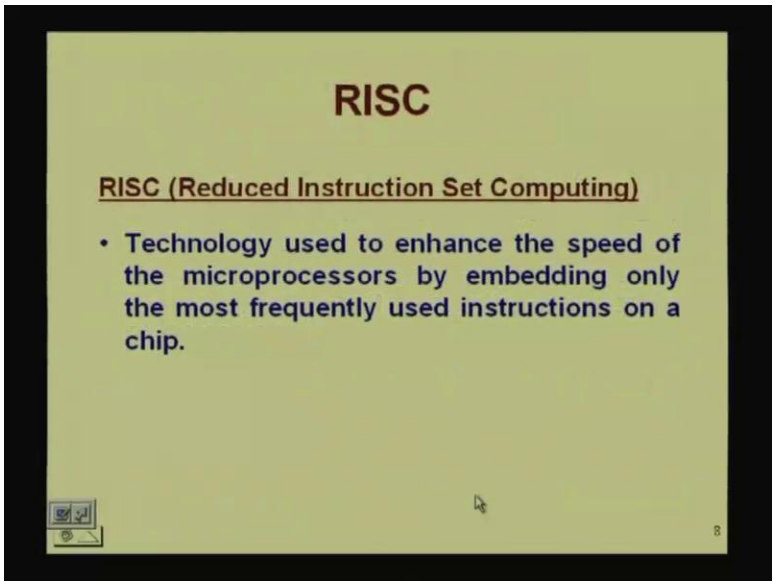

Then we have some times we have the RISC computers the reduced instruction set computing technology used to enhance the speed of the microprocessor by embedding only the most frequently used instructions on a chip right. So instead of the crowding the chip with too many instructions you have only reduced instructions set because you have the reduced instructions set and rests of it through computation then the machine can become actually faster. So this is the special type of instruction set.

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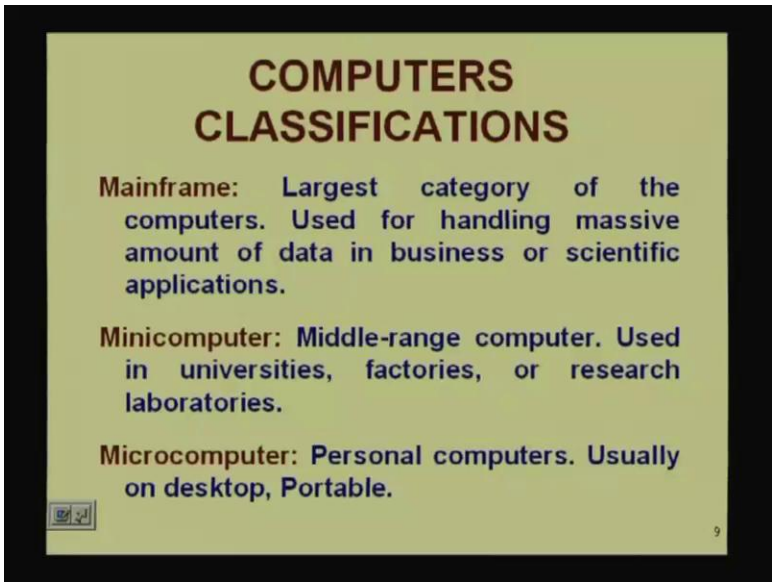

Then in the earlier days it is for historical reason we should know that we used to differentiate between mainframe computers the minicomputers and the microcomputers all right. So mainframe, mini and micro. But today these differences has actually vanished because whatever was caught to be the mainframe computing power the mainframe computing power is now available even in the microcomputer in the personal computers all right. So these differences has really vanished the computers. Now earlier the mainframe or mini computers used to have specialized operating system such as Unix Solaris and so on.

Today we can have Linux in micro computers or even personal computers configuration. That is Intel based configuration where you can almost get the same facility. So basically I would say that today if you do computer classification we should differentiate not by main mini or micro but by low end and high end right. You can in the low end you may not bother about parallel processing you may not bother about you know large data storage you may not bother about very good data bus width and so on and therefore the loading Linux you know able to support multiple terminals. So those are the basic criteria and the price differential can also be pretty high you know it can be as high as 10 to 20 times then a low in computer personal computer which one would like to use for personal purpose.

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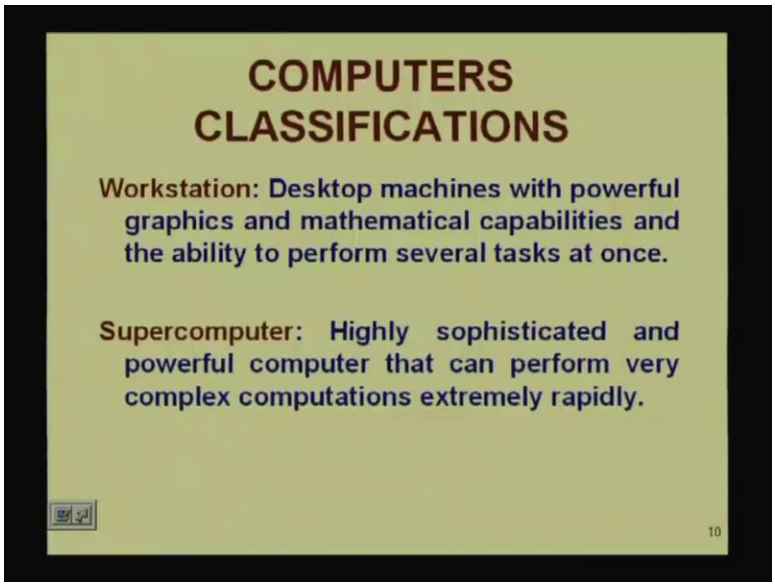

Then some of the important thing you know the like workstation. Workstations are desktop machines with powerful graphic and mathematical capability and the ability to perform several tasks at once. So that is the concept of workstation today even the ability to perform several tasks at once is also available in the latest windows systems. That means the multitasking capability. The supercomputers are highly sophisticated and powerful computer that can perform very complex computations extremely rapidly because supercomputers are used in specific applications of, let us say astronomical calculations then finite element analysis you know the kind of problems where you have very large amount of calculations to be done.

Sometimes if you really calculate the time requirement sometimes you may find the time requirement could be in year's together right. If you use an ordinary computer and to solve the problem it might requires somewhere around five years. So you know you cannot really wait years together so you have to find ways and means by which you can solve the problem in reasonably short time may be few days. So you basically require super computers for those kind of problems. Regular day to day problems I do not think supercomputers are really necessary the basic idea of supercomputers basically you know one very important thing is parallel computer computations right distributed computations.

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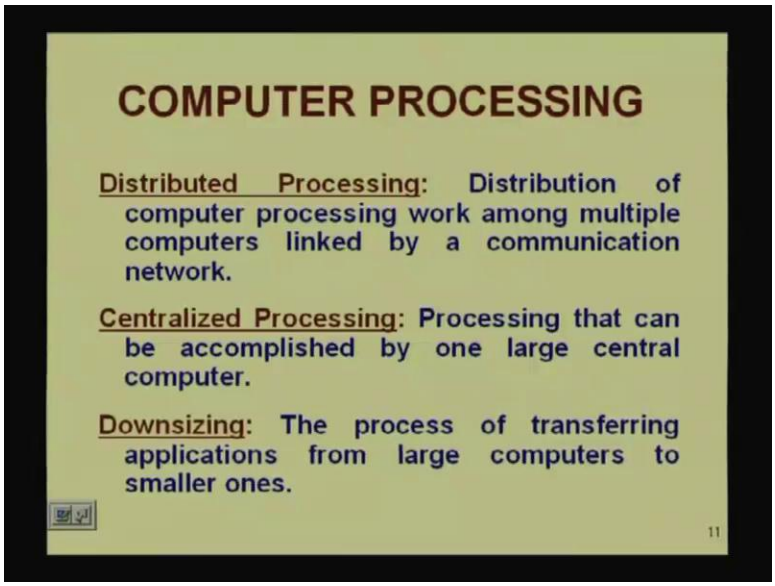

So we brings us there distributed processing distribution of computer processing work among multiple computers linked by a communication network. So distributed processing is only possible only when you can break down the problem into you know small modular sizes. So you have say for example if it is a matrix computation we know that most of the matrix computation requires similar operations all right. So if you do matrix multiplication let us say very large multiplication. It is basically multiply element to the corresponding element and finally summing them up all these multiplications. So if we you know distribute the job of multiplying each computation to each processor, then every processor will compute and everything will be fetched and summed in another processer so it can save time right. So instead of one particular processor doing the whole thing in a serial manner then we have the centralized processing the processing that can be accomplished by one large central computer is not the proper idea today. Downsizing the process of transferring applications from large computers to smaller ones.

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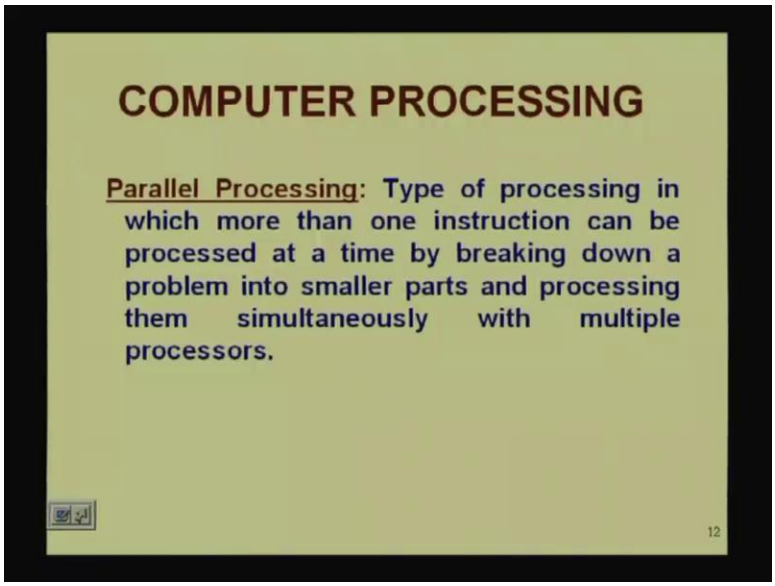

Then parallel processing the type of processing in which more than one instruction can be processed at a time by breaking down a problem into smaller parts and processing them simultaneously with multiple processors. Let me repeat once again parallel processing is a type of processing in which more than one instruction can be processed at a time by breaking down a problem into smaller parts and processing them simultaneously with multiple processors.

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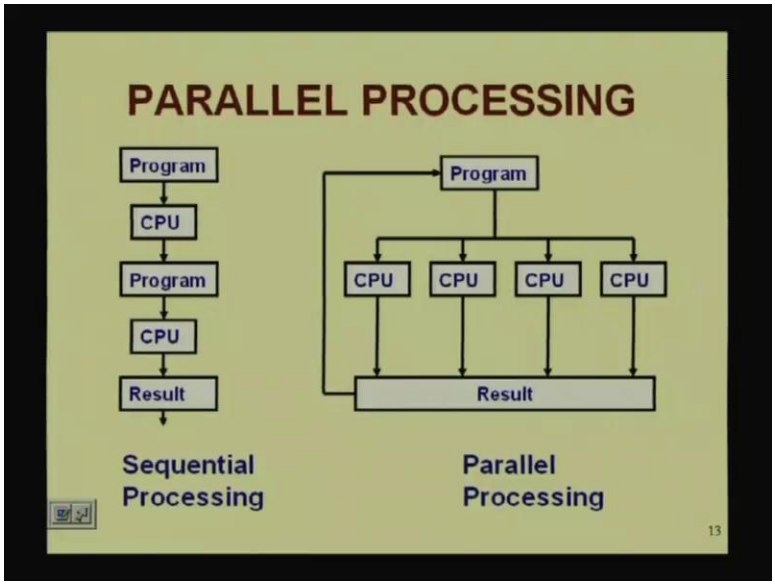

So here is an example of the parallel processing in the sequential processing we have the program to CPU to program to CPU to result right. So program to CPU you know if we have to fetch parameters and things like that that is happening in the same computer and it is called sequential processing. In case of parallel processing the program you know breaks the problem into different parts and individual CPU parallel processes the various tasks. And the result is you know combined out of the four the results of four CPU and that are fed back to the program. So that will definitely save time that is the basic idea.

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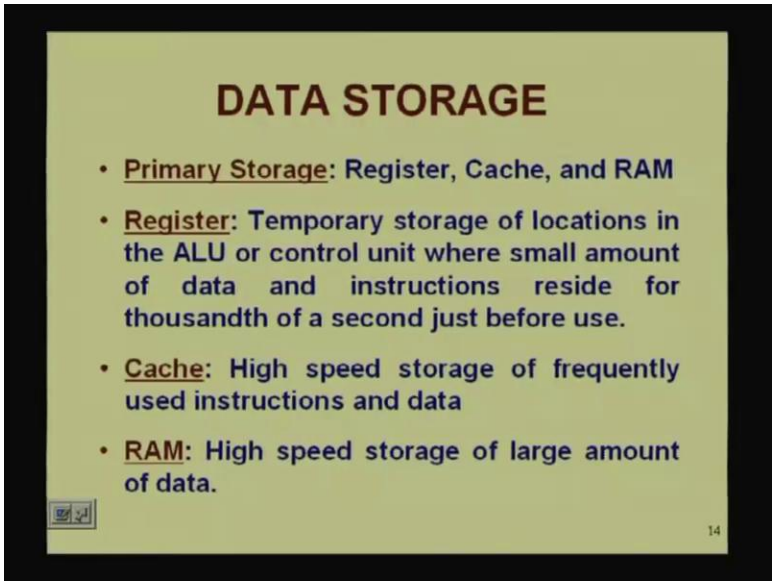

Then the various kinds of data storage. Now again we have to differentiate between primary storage and secondary storage first let us see the primary storage. The primary storage are basically three types the register cache and the RAM register temporary storage of locations in the ALU arithmetic logic unit or the control unit where small amount of data and instructions reside for thousands of a second just before use. So essentially suppose you bring some you know data elements on instruction into the computer CPU. You have to hold them somewhere and these holding is done in the various registers right. So that is actually registers the registers are totally volatile. That means that is used only for the you know thousands of a second just before use so it is like fetch and calculate it is used in the next cycle step. So those are usually called registers.

So you know if you really look at the registers, contents of a computer you will see it is changing all the time, all the time right. It is not at all static. Not at all cache. On the other side the high speed storage of frequently used instructions and data. So it is it is really not permanent but it is also you can call it temporarily permanent something like that. That is something you know you can if you analyze the register contents you will find that some register contents are such which are more or less you know they are you are bringing the same thing over and over again. So the question is why bring the same thing same instruction and data over and over again store it somewhere in the CPU and make use of them all right. So probably it will reduce time.

So some calculations has been done and it has been found out that if we define some cache area where you store these kind of you know frequently use instructions and data then probably you can actually speed up the whole thing. Please remember everything is happening in the primary storage. We are not talking about hard disk or input output devices or communication devices. You know because they are all low speed they are highly low speed and because of their low speed you know every time you fetch from low speed device like a hard disk, the computation time will go up tremendously to the tune of hundred to thousand times you know those if they are slow to that extent. So that is where the cache comes in right that you have registers and registers are overcrowded. So make use of cache. RAM is the high speed storage of large amount of data everything happens inside that RAM.

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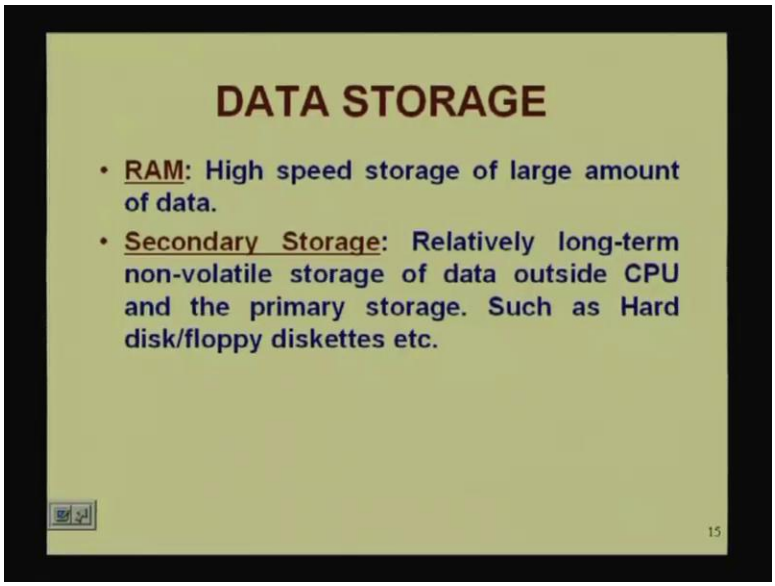

So that is RAM and then we have the secondary storage. The secondary storage is relatively long term non-volatile storage of data outside CPU and the primary storage such as hard disk, floppy diskettes, optical disks, etcetera. The secondary storage is really necessary because you cannot carry all your information and CPU is volatile. It will go away moment power is switched off. So you have to store your results you have store your programs you have to store your data bases somewhere you know that is your secondary storage.

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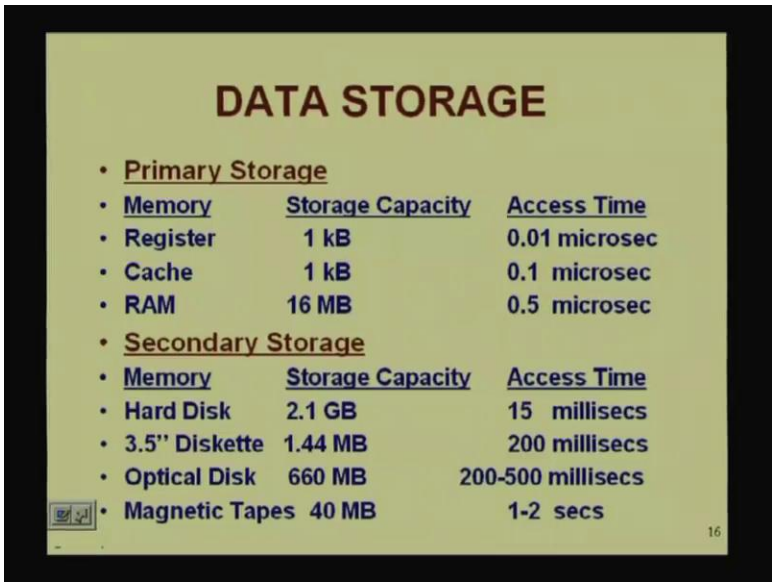

So little bit you know values some simple values may not be up to date. But at least it will give some indication. So some primary and secondary storage values, so register storage capacity say 1 Kb and access time 0.01 cache, 1 kb, 0.1 micro second RAM 16 mb, 0.5 micro second. So you can see that register's access time is very low whereas look at the access times for hard disk and diskettes optical disk magnetic tape etcetera they are in milliseconds. So and even seconds for magnetic tape so you can understand well understand if you have to fetch data from hard disk and then calculate then you know the maximum time will go here. If you have to read and write that will go 30 milliseconds and even if there are 1000s of operation all together there may be one or two milliseconds. So total processing time is 32 milliseconds where thirty milliseconds is IO time. So IO time is the major time in computation and any program that you know misutilizes the IO time will be highly inefficient.

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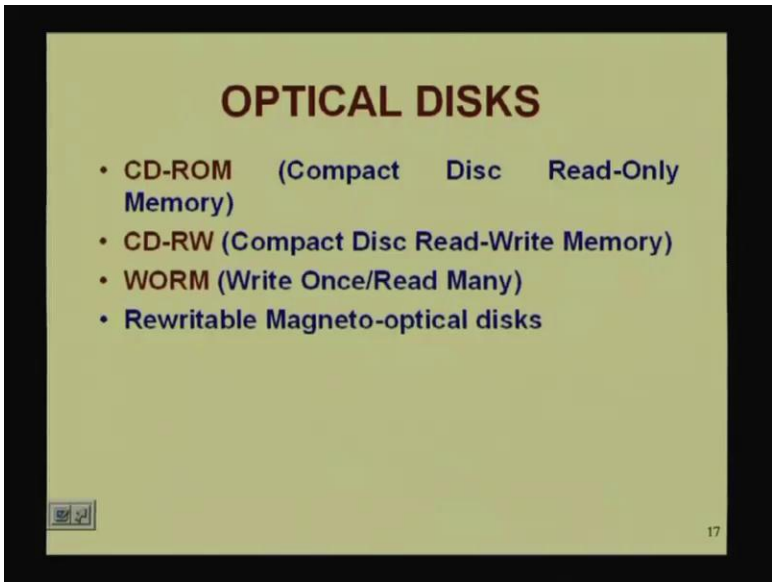

Then the various kinds of optical disks like CD ROM compact disk read only memory CD read write then WORM write once read many rewritable magneto optical disks. So now I think the future is here that more and more of different kinds of optical disks should come in and day will come when we shall may not even like to use hard disks. We should have our removable high capacity optical disk with us and moment we put it in the standard computer then we get the environment we desire. See ultimately you know even today you go to a particular computer and you have to worth in as per the hard disk of that computer which you cannot touch. But if you carry your own hard disk all you do you insert your own hard disk and immediately that computer becomes exactly the way you want it to be all right. So that is how the future is.

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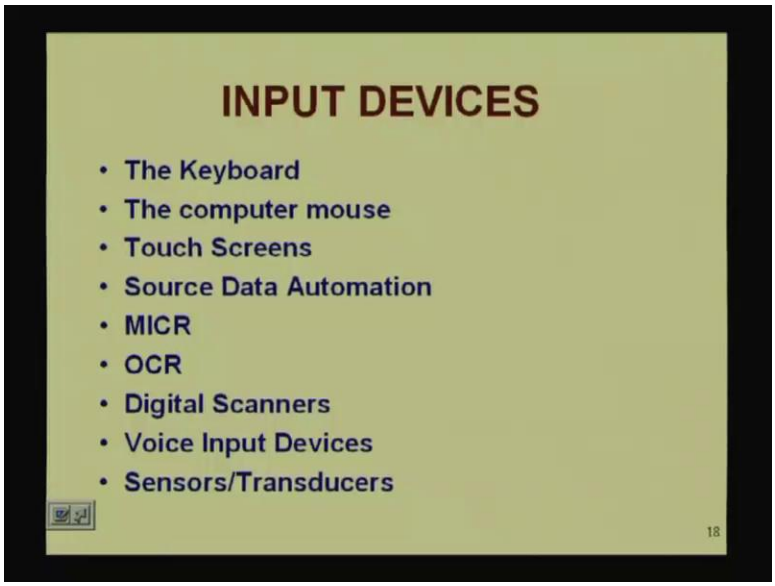

Then there are various kinds of input devices like the keyboard the computer mouse various kinds of touch screens source data automation some way. For example the electric meter you can probably take it from palm top and if you enter it in your palm top or even today in your mobile phone, itself may be and there is some way by which you connect your mobile phone to the computer then the source data is taken in an automatic manner. Then MICR magnetic ink character recorder OCR optical character recorder the digital scanners voice input devices various kinds of sensors and transducers which are used in scientific experiments all right to read temperature pressure and similar type of data.

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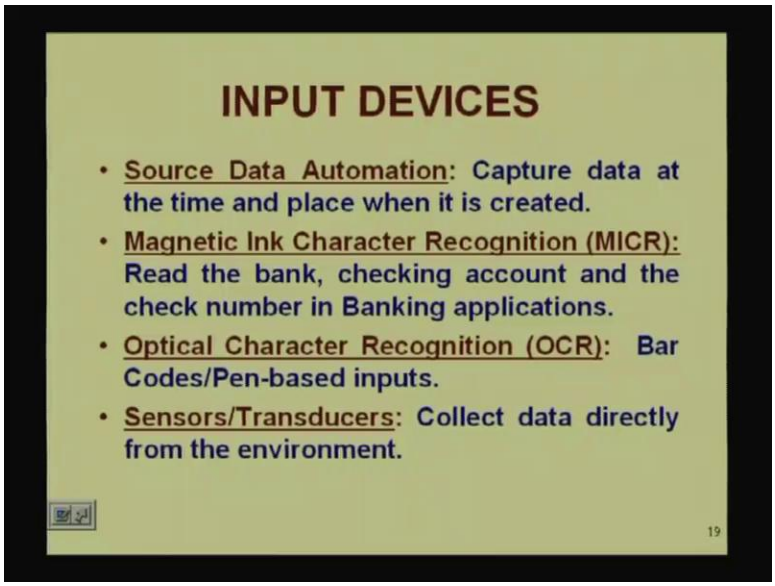

Then we have little bit explanation source data automation, capture data at the time and place when it is created like the as I said the mobile phone or the palm tops. Magnetic ink character recognition, read the bank checking account and the check number in banking application. Optical character recognition bar codes, pen-based inputs collect data directly from the environment.

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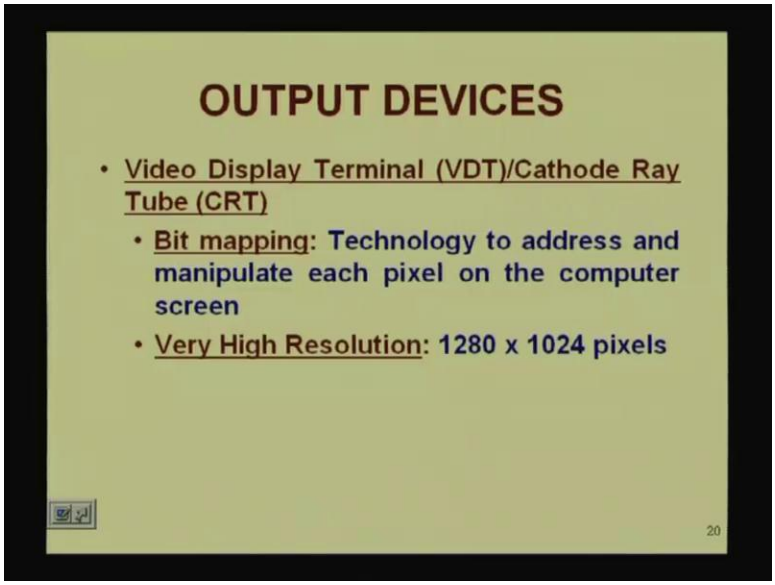

Then output devices very simple output devices, the video display terminal or the cathode ray tube. We have used what is known as the bit mapping technology to address and manipulate each pixel on the computer screen and we may even go up to very high resolution computer terminals.

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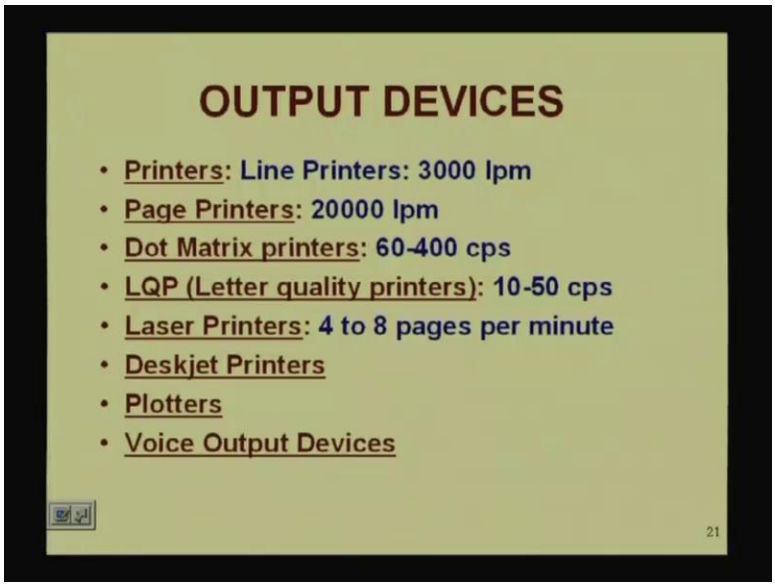

Then we have the printers like line printers, you can have page printers, we can have dot matrix printer, which are no more in not so much popular any more. The letter quality printers the laser printers of various types the desk jet printers various kinds of plotters the voice output devices and so on.

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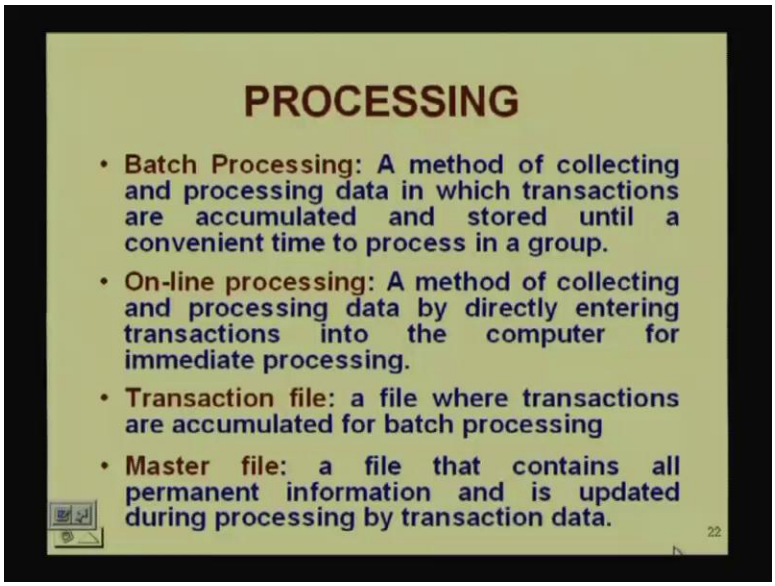

Now let us come to an important discussion that is on the processing here whenever we think of computer processing, essentially we should differentiate between what is known as the batch processing versus online processing. The idea of a batch processing is that batch processing is a method of collecting and processing data in which transactions are accumulated and stored until a convenient time to process in a group. Online whereas is a method of collecting and processing data by directly entering transactions into the computer for immediate processing. So basic difference between the two is that suppose in a banking application what is happening you have your bank account and you have your various withdrawal and deposit that is taking place all the time your salary is being deposited you are withdrawing some money. Now at any point of time usually what is happening in the bank it is processed online. Moment you deposited some money immediately, it is updated into the database your balance is calculated and you know your updated balance at a given point of time.

Suppose a same thing would have been done in the batch mode what would have happened you would not be able to know your balance at a given point of time. All your deposits and all your withdrawals will be stored as transactions and your opening balance of the month will be also available like we do in accounting and at the end of the month, we calculate what is the total withdrawal. You also calculate what is the total recite, and then we can calculate the closing

balance. So this is one simple way it can be done. So this is usually called batch processing. Now you can see the batch processing is useful in some situations specifically in month end applications like accounting financial accounting which you may not be interested in intermediate figures at every now and then you may also use it for payroll purposes. Salaries usually are a month end activity. So whenever you do what you call so called batch processing we have the transaction file we have the master file.

The transaction file is a file where transactions are accumulated for batch processing right the master file is a file that contains all permanent information and is updated during processing by transaction data right. So that is the basic idea the master file and the transaction file master file is that file which is like your payroll master or your account master or your bank balance you know costumer details. So basically what happens all your balance information which you are updating which you want to know at an instant of time they are like master information? Whereas all those withdrawals all those deposits which are like transactions they will be accumulated in the transaction file. We use the transaction file to update the master file here is an example of batch processing, batch processing what happens all the transactions they are accumulated and these accumulated transactions are sorted.

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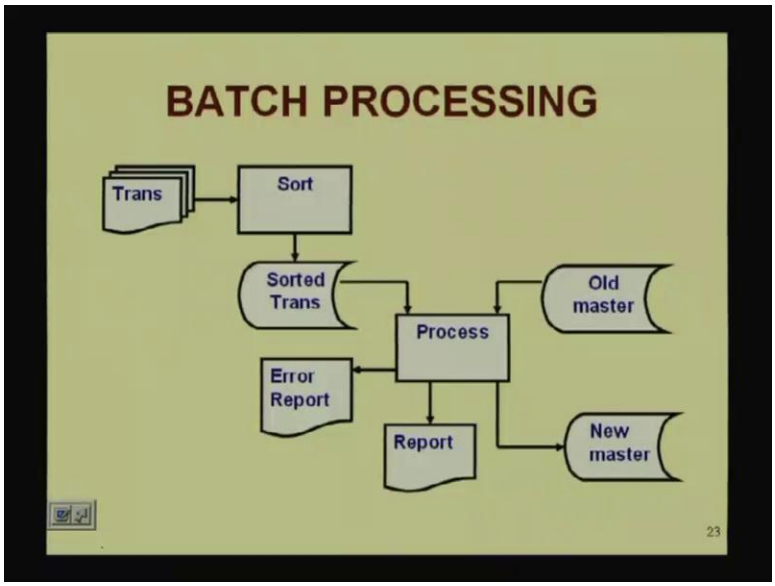

And after sorted we have the sorted transactions and on the other side we have the master right. So we have the sorted transaction we have the master and we process when you process we get the new master we get a report and we also get an error report. So this is a very, very conventional batch processing diagram probably, it is age old right it is age old. But even today it has some use because obviously the old master new master concepts has been abolished we use a data base today. So we have a data base and we have the process and it is an update basically you see why old master and new master was used the basic idea was the old master if you keep you can have what is known as a historical image.

Now due to whatever reason suppose your these particular process goes wrong like power goes off or something happens and you were somewhere in the middle. Then naturally you cannot, you know neither your old master is if you are updating in the same file or in the same data base suppose power goes in between. Then you can you get back the master before the transaction was taking place if this is not possible then you are in a situation where you do not know how far of the transaction has been actually updated. Now it is very easy to say why not run the whole transactions again? But the point is once some money has been deposited to your account by depositing those amounts again will not get the correct figure you know your account figures will vary. So running same transaction twice is not the answer is there should be a facility to rolling back rolling back the file or the data base to a condition where it was before the transactions were actually being done.

So that is why in the old days we using sequential file they use to keep the old master and new master separate and most of the Cobol applications of old age are written in this manner right. In today's context most of the modern data bases they have what is called roll back facility. Again the roll back facility is done with the help of transaction images. So whenever you have transactions you have the transaction images already kept you have the check point or the sink points. So all these are used to basically roll back that data base as if the transaction has not taken place in other words from an intermediate master you can get back the old master right so that facility is available. Now file based processing you may not be able have this kind of facilities so these are the basic ideas.

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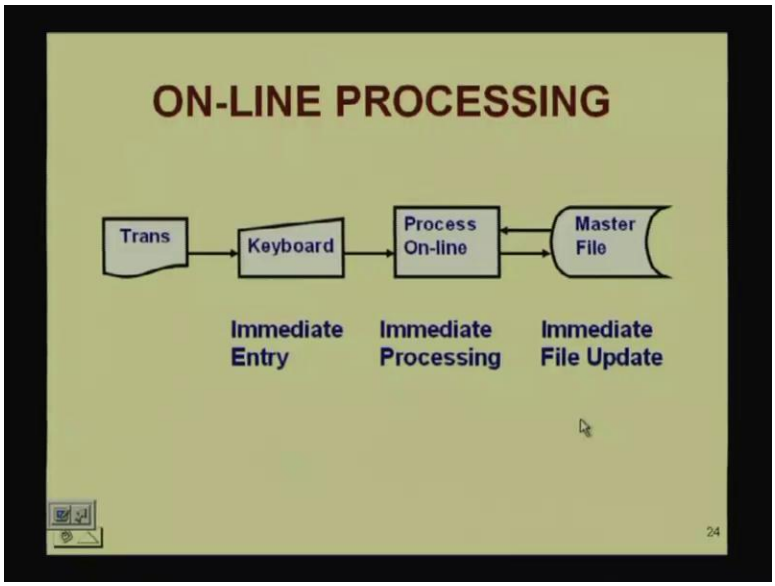

On the other hand in online processing you can you can see that you have a transaction you do an immediate entry through the keyboard you are processing immediately and you are updating the file the master file of the data base immediately as and when the data is available, so that is the difference between batch and online.

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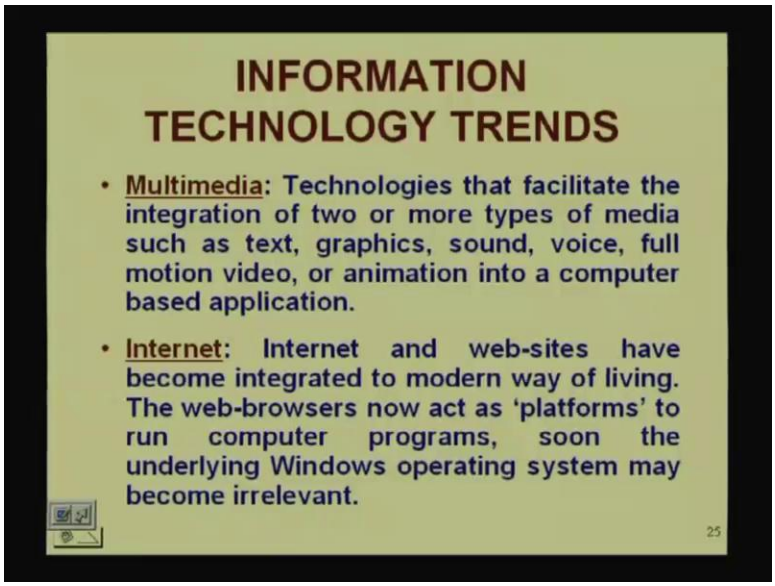

Information technology trends. So you can see here that essentially we have various new concepts that are coming up like multimedia the technologies that facilitate the integration of two or more types of media such as text graphics sound voice full motion video or animation into a computer based application, internet and websites have become integrated to modern ways of living. The web browsers now act as platforms to run computer programs and soon the underline windows operating system may become irrelevant. So window internet can be defined as a network of networks right the basic idea of the internet is that it is not that you know somebody has created an internet and updating it and we just go there and we find our information it is not that way it is basically it is a network of networks do you want to join that or you do not want to join that. So if you join that there are certain pre conditions is that you are giving access to your files to everybody in the world all right. So that means by getting connected by getting connected here does not mean that you browse somebody else site with the help of web browsers.

What I mean by getting connected is you have a server and you have kept certain information in the server and these particular information you want to you have an address towards it that you have defined and you want it to be accessible to anybody who want to see it all right. Now naturally what you are showing that is basically your discretion. It is not the discretion of somebody else. Obviously there are some authorities who will determine what kind of website address you will give otherwise if there is a complete chaos then everybody may use the same address again all right. So you just cannot use any address you have to find your own address and that address there is some mechanism but beyond that the material that you are posting in your particular server in your location absolutely no control is possible there obviously you are guided by your country's laws. So what basically happens you put up your pages in the internet similarly everybody has put their pages of internets on the internet and all these are connected through a network.

So yours is a network everybody else is or also a network and all the networks are connected in a network so we have a network of networks and which we can call as internet right. So it is like a huge mask and growing at a tremendous speed and the basic idea therefore is like a platform where you can search you can search the good things you may even search the bad things. The most difficult part about internet is that you can get almost anything on internet. Suppose even if

you want basically to know about MIS you may get many things in the internet. But please be aware that many of those things may even not be genuine. All right because anybody can put in an anything all right. So we have to be careful while using internet and we should have the ability or the capability to understand what is genuine and what is not.

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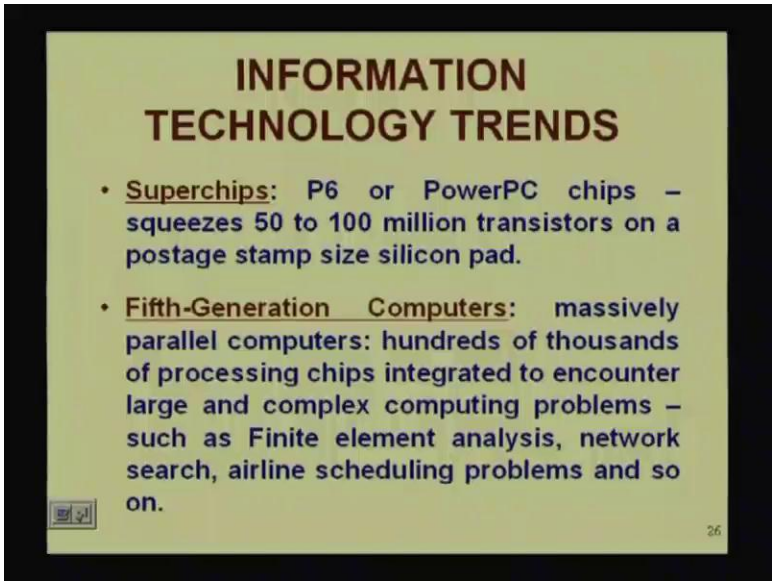

Then the superchips; the superchips the P6 x or the power PC chips you know the modern chips they squeezes 50 to 100 million transistors on a postage stamp size silicon pad. So basically these things keep updated basic idea here is that the chip size is becoming smaller and smaller and a day will come where you may have a small handled device with the tremendous amount of computational power. Then fifth generation computers which will be massively parallel computers hundreds of thousands of processing chips integrated to encounter very large and complex computing problem such as finite element analysis network search airline scheduling problems and so on.

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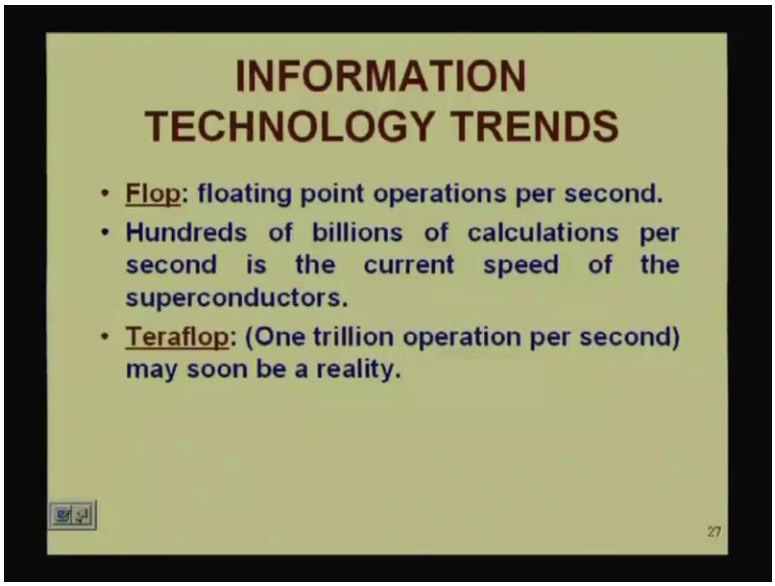

Flops; Floating Point Operations per Second, Hundreds of billions of calculations per second is the current speed of the superconductors. Then we can have super computers we have Teraflops may come and soon be a reality which could be one trillion operations per second.

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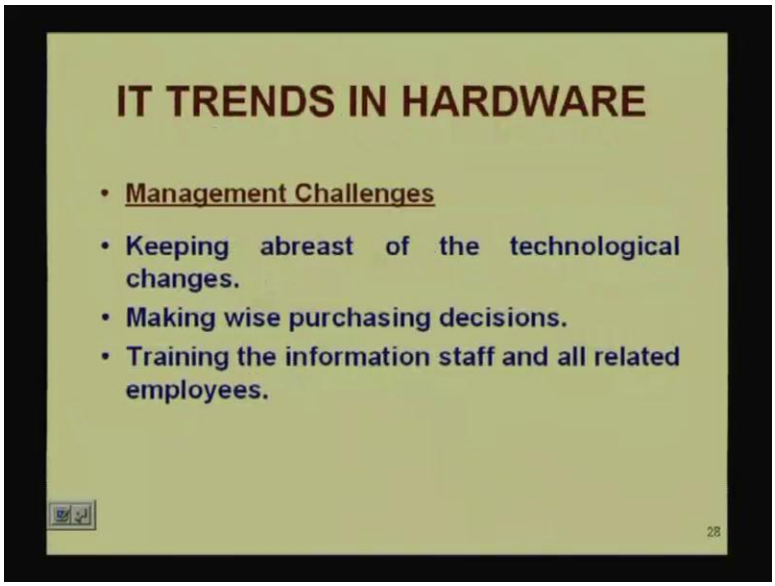

Now let us see some of the management challenges with the information technology trends in hardware. Now you see most of the people who have reached the very top of organizations are

they who can be called as constituting the top management of an organization. Most of them they have got their degrees or education long back may be 25 years ago or even more. So at the time we had a very ordinary kind of computer systems. So these people they have not studied the hardware and software developments but they have witnessed.

So their learning is on the job but what may happen depending on the kind of designation or depending on the job title it may happened that it the technology might have passed some of them. So keeping abreast of the technological changes is a very big challenge for the management and if that is not done they may not be able to make wise purchasing decisions. Because ultimately the top management approval is very important for you know an IT, IT long term IS plan to become successful. So that similarly training the information staff and all related employees are also going to be very important.

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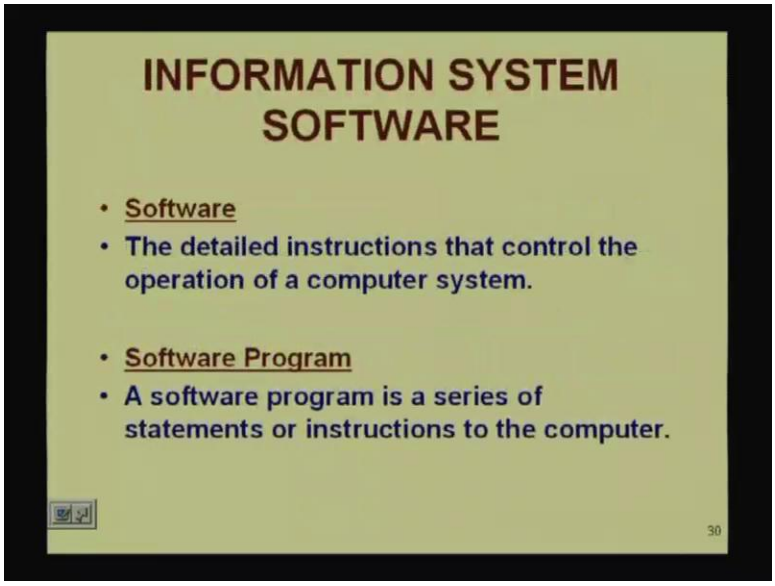

Then after that let us come to the information system software. Okay let us come to the information system software, software on the, you know compared to the hardware is a slightly different thing. Here the basic difference about the hardware and software considerations is that hardware considerations are more of what do you call you know like a facility. Whereas the software is more of how you use it because a facility is definitely you know programming

capabilities but how you use is very important. So here lot of customization is very, very much required. If you do not have good hardware in your organization naturally you cannot support is a pre-condition that you must have good hardware. But many people think that if I have good hardware we have very good information architecture, but sadly this is not. So what is happening as time is passing earlier the hardware costs are prohibitive the very high cost of hardware say even a simple PC used to cost a 11.5 lakhs.

You cannot think of a high end machine if you do not have 15 to 20 lakhs of rupees. Today even with you know few thousand, 10, 15, 20 thousand of rupees. You can get a low end PC and you even can think of an high end machine Intel based around 1 or 2 lakhs rupees. So it is you can procure hardware but software on the other side many people thought that it is available freely it is not. The hardware costs might have gone down, but software costs are going up because you see the today the hardware has become more specialized. The hardware has become more capable to use the capability of the hardware. So software also has to come up so that much extra efforts should be put in the software and these extra efforts is being put in software. So the price has to be proper if the price is not proper why should people develop software by so you see to take the full capability of hardware you have to write software which is much more sophisticated more complex and therefore require much more effort. If anything requires much more effort naturally it has to be that much costly and you should be ready to pay that price. So this is the basic dilemma of software that today the software cost on the rise and may be the hardware costs and software costs they may be almost equal.

But many organizations are really not ready to put that much money in software what is happening because of this the organizations information technology is actually suffering right. So this is the key thing that we must keep in mind that the hardware and software the two different things hardware is the basic capability. But software on the other side is you know to use the software it is not that you have to customize it. You have to make it your own to make it your own you have to understand the software and you have to get the right software. So if you ignore that okay. Software is something what is there the people will develop it. You are mistaken. It is not easy. It is not even easy to obtain good software developing people. They are also very precious commodity and even if you get them you cannot keep them with you until

unless you give them the right kind of job and the right kind of compensation. So with that let us try to understand certain key features of software. First of all the software is the detailed instruction that controls the operations of a computer system. A software program is a series of statements or instructions to the computer.

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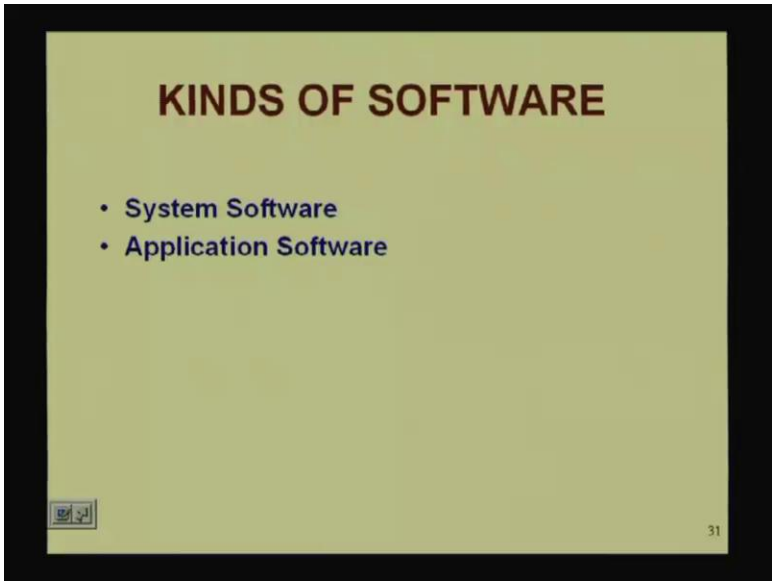

There are two types of software on a very broad basis the system software and the application software.

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Let us first see the system software system software is a set of generalize programs that manage the resources of the computer such as the central processor, communication links and peripheral devices. The various types of system software like the operating system interpreter compiler and utility programs. So there are various types let us see them one by one.

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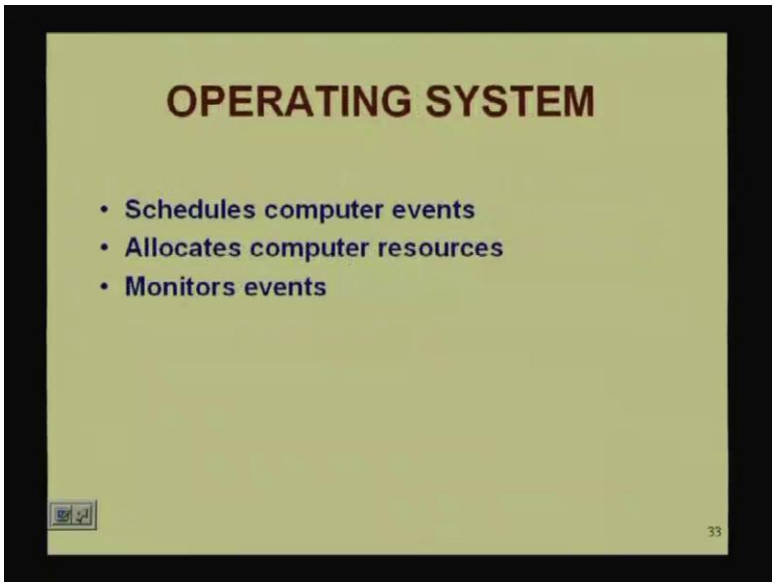

An operating system like your Unix, like your Linux, like your windows, schedules computer events allocates computer resources and monitors events right.

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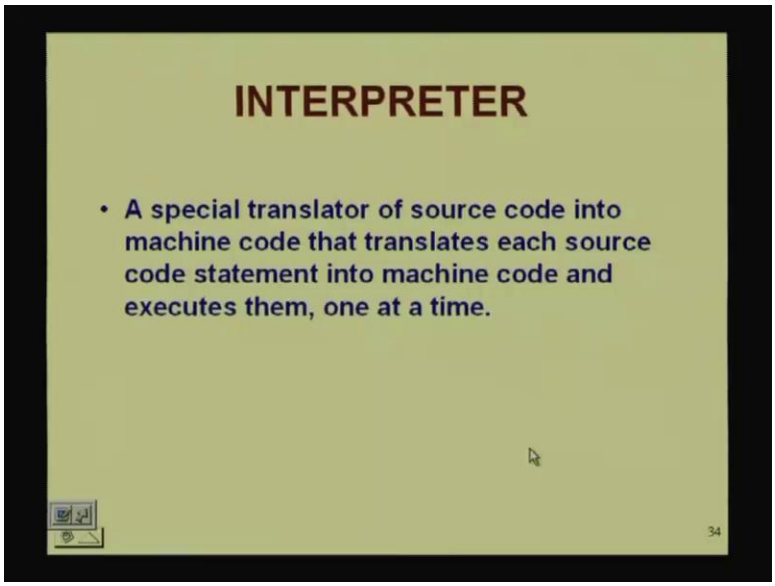

Interpreter is a special translator of source code into machine code that translates each source code statement into machine code and executes them one at a time. So you see the interpreters are those kind of software which does not you do not compile them. Basically whenever you compile something the source code become an object code. Here the source code does not become object code for an interpreter. Here every source code taken one at a time converted to machine code executed one at a time and it everything happens in the run time. So with an interpreter program you do not have to compile it but because you are not compiling it is slow.

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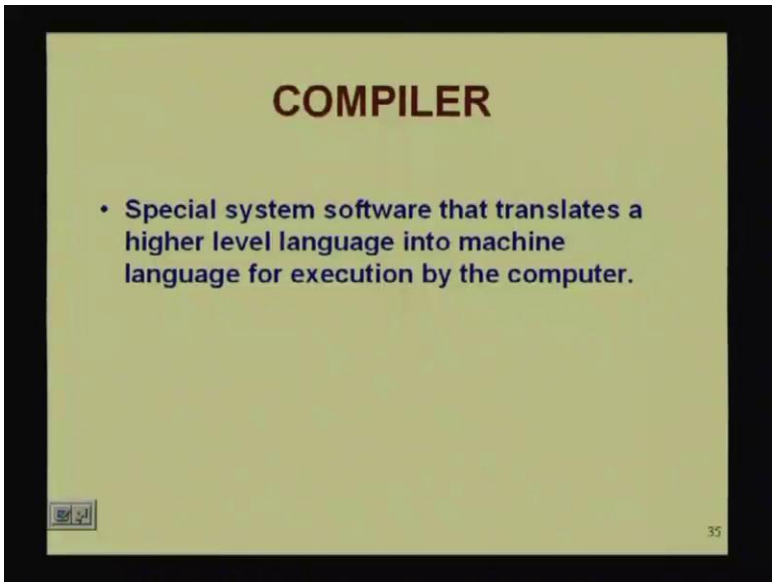

Compilers special system software that translates a higher level language into machine language per execution by the computer. So whenever you say for example a java program when you compile you get compiled object code and these object code actually executes whenever you are executing this particular program.

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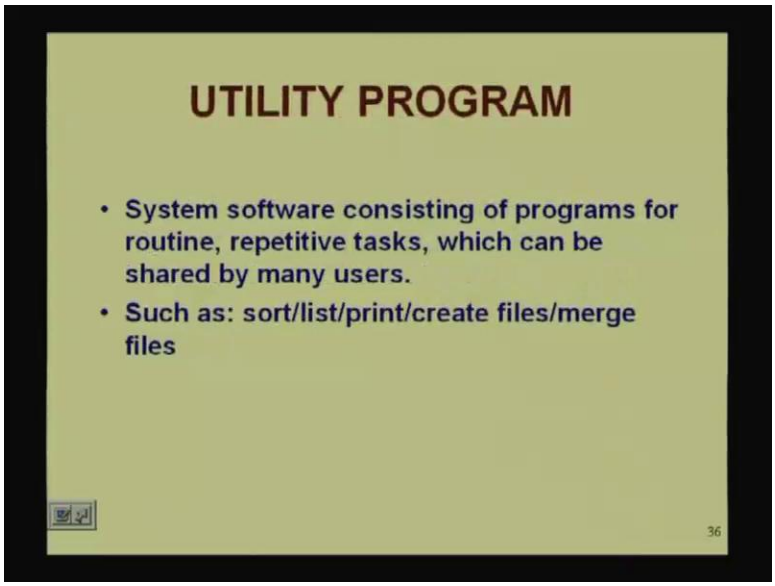

Then the utility program utility program is system software consisting of programs for routine repetitive tasks which can be shared by many users such as a sort list print create file merge file etcetera. So there are various kinds of utility programs and this is also a type of system software.

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Application software on the other side programs written for a specific application to perform function specified by the end-user.

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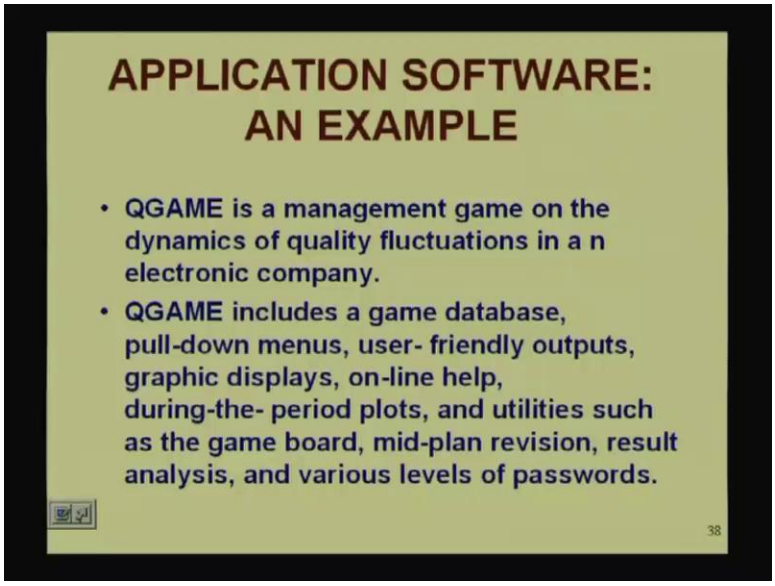

So there are various application software. For example you have the payroll, the financial accounting, you have software for materials management software, for marketing. So you know you can have almost all transaction processing systems can be called as application software why transaction even to that extent even decisions support system basically MIS deals with the application software domain. Let us take a simple example of application software. This is a management game on dynamics of quality fluctuations in an electric electronic company in an electronic company. So it includes a game database, pull-down menus, user friendly outputs, graphic displays, online help, during the period plots and utilities such as a game board, mid-plan revision, result analysis and various levels of passwords.

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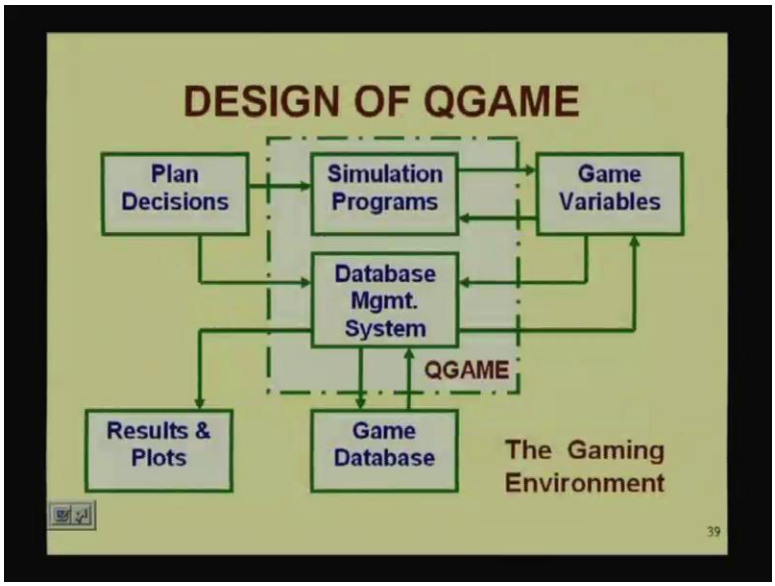

So here is a simple game environment basically what happens in this particular application software. We have in the game proper we have a data base management system and the simulation programs all right. This is basically interacting with a game data base the results and plots, the plan decisions and the game variables. So in this particular game, what happens all these utilities whatever we have talked about like online help graphic displays. During the period plots game board mid plan revision facility result analysis and various levels of passwords. So basically what happens as a player enters the plan decisions, the plan decisions are entered into the data base management system which in turn stores them in the game data base and also

entered in the simulation program and the simulation program along with the game variables which are stored in the program itself you know execute. So after the execution is done naturally what happens the results that are obtained these game variables two game variables results that are obtained the data base management system uses them and updates these results in terms of results and plots. So these results and plots are viewed by the participants and accordingly they enter their next plan decision.

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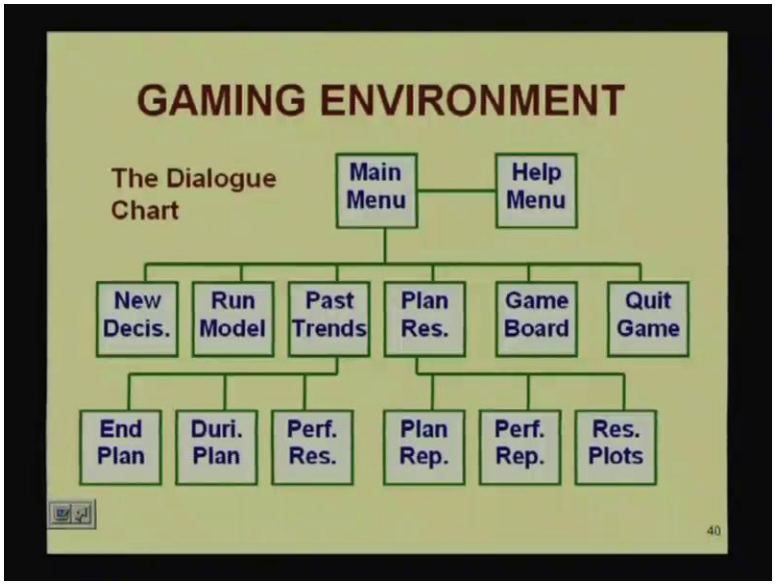

This is a dialogue chart what really happens in this particular application software. We have the main menu, we have the help menu. Connected to that the main menu has got these following options, new decisions run the model past trends plan results game board quit game right. The plan results can be plan report performance report and the result resulting plots whereas past trends could be that of end plan during plan and the performance results. So Q game is simple application software basically used for playing with some management participants and is simple application software. I just discussed a little bit about its design details and you can see there any good application software that we have to develop has to consider the programming part, the data handling part, the data base part. The data base is very important here there should be data base and particularly for transaction processing system database plays a very important role. So application programming is all about how you handle your data base in the most effective

manner. Obviously there will be processing but stress should be more on the data handling. So thank you very much. We will continue this in the second session.