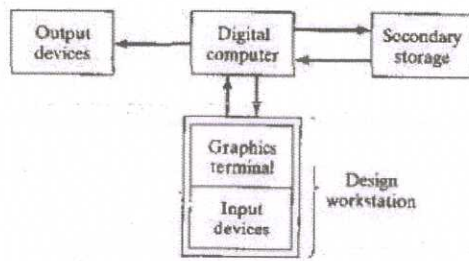


SCHEME OF VALUATION

Scoring indicators

Revision	2015	Course Code :	6024		
course title	CAD-CAM	Spit Up Score	sub total	Total	
Qn No	Scoring Indicators				
Part A					
1	1	<ul style="list-style-type: none"> ▪ Increased design productivity ▪ Increased available geometric forms in the design ▪ Improved quality of design ▪ Improved design documentation ▪ Creation of manufacturing data baseDesign standardization 	Any two*1	2	10
	2	<p>Computer aided manufacturing is the effective use of computer technology in the manufacturing planning and control</p> <p>The use of computer system to plan, manage and control the operation of manufacturing plant through either direct or indirect computer interface with the plant's production resources</p>	2	2	
	3	<ul style="list-style-type: none"> ▪ The part program tape and tape reader are used only once – improved reliability ▪ Tape editing at the machine site ▪ Metric conversion ▪ Greater flexibility ▪ User written programs ▪ Tool manufacturing system 	Any four *0.5	2	
	4	<p>These drives have large power to size ratio and provide stepless motion with great accuracy. But these are difficult to maintain and are bulky. Generally they employ petroleum based hydraulic oil which may have fire hazards at upper level of working temperatures. Also hydraulic elements need special treatment to protect them against corrosion</p>	2	2	
	5	<ul style="list-style-type: none"> ▪ APT stands for automatically programmed tools. This is the most widely used and most comprehensive part programming language available. APT is a three-dimensional system which can be used to control up to five axes. In programming using APT, it is assumed that the workpiece remains stationary and cutting tool does all the moving. ▪ The APT part program consists of four types of statements. (i) Geometry statements: These are also called definition statements and are used to define geometric elements like point, circle, arc, plane, etc. (ii) Motion statements: The motion statements are used to define the cutter path. (iii) Post processor statements: These statements are 	1+1	2	

		applicable to specific machine tools and are used to define machining parameters like feed, speed, coolant on/ off, etc. (iv) Auxiliary statements: These are miscellaneous statements used to identify the part, tools, tolerances, etc.		
		Part B		
II	1	<p>The workstation is the interface between computer and user in the CAD system. Its functions are the following:</p> <ol style="list-style-type: none"> (1) communicate with the CPU. (2) continuously generate a graphic image. (3) provide digital descriptions of the image, (5) translate user commands into operating functions, and (6) facilitate interaction between the user and the system. <p>The design of the CAD workstation and its available features have an important influence on the convenience, productivity, and quality of the user's output. The workstation must include a graphics display terminal and a set of user input devices. The display terminal must be capable of showing both graphic and alphanumeric text. It is the principal means by which the system communicates with the user. For optimum graphics display, the monitor should have a large colour screen with high resolution.</p> <p>The user input devices permit the operator to communicate with the system. To operate the CAD system, the user must be able to accomplish the following: (1) enter alphanumeric data, (2) enter commands to the system (0 perform various graphics operations, and (3) control the cursor position on the display screen. To enter alphanumeric data, an alphanumeric keyboard is provided. A conventional type writer like keyboard allows the designer to input numerical and alphabetic characters into the system. The alphanumeric keyboard can also be used to enter commands and instructions to the system. However, other input devices accomplish this function more conveniently. Special <i>function keypads</i> have been developed to allow entry of a command in only one or two keystrokes. These special keypads have from 10 to 50 function keys, depending on the system. However, each key provides more than one function, depending on the combination of keys pressed or which software is being used. Another input device for entering commands to a CAD system is the <i>electronic tablet</i>, an electronically sensitive board on which an instruction set is displayed, and commands are entered using a puck or electronic pen.</p> <p>Cursor control permits the operator to position the cursor on the screen to identify a location where some function is to be executed. For example, to draw a straight line on the screen, the endpoints of the line can be identified by locating the cursor in sequence at the two points and giving the command to construct the line. There are various cursor control devices used in CAD, including pucks, mouse's, joysticks, trackballs, thumbwheels, light pens, and electronic tablets.</p>	4	6



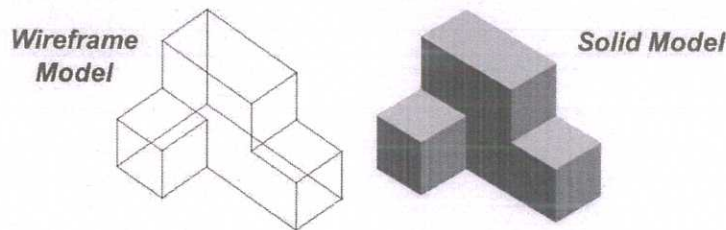
Configuration of a typical CAD system.

2

A solid model of an object provides more complete representation than its surface model. The database of the solid model stores geometric data and topological information of the corresponding object. Geometry is the actual dimension that defines entities of the object whereas topology on the other hand is the connectivity and associativity of the object. For creating solid models of objects various representation schemes have been designed and developed. Such schemes are, Half space model, Boundary representation, Constructive solid geometry, Sweeping, Analytic Solid modeling, Cell decomposition, Spatial enumeration, Octree Encoding, Primitive Instancing. Boundary representation, Constructive solid geometry, Sweeping are the most commonly used schemes. Representation of solids are built and interacted via algorithm

4

6



2

The variant CAPP method

In variant CAPP approach, a process plan for a new part is created by recalling, identifying and retrieving an existing plan for a similar part and making necessary modifications for the new part. Sometimes, the process plans are developed for parts representing a family of parts called 'master parts'. The similarities in design attributes and manufacturing methods are exploited for the purpose of formation of part families. A number of methods have been developed for part family formation using coding and classification schemes of group technology (GT), similarity-coefficient based algorithms and mathematical programming models.

3

3

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The variant process planning approach can be realized as a four-step process;

1. Definition of coding scheme
2. Grouping parts into part families
3. Development of a standard process plan
4. Retrieval and modification of standard process plan

A number of variant process planning schemes have been developed and are in use. One of the most widely used CAPP system is CAM-I developed by

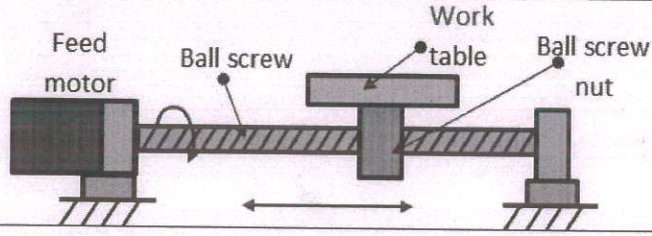
	<p>McDonnell-Douglas Automation Company. This system can be used to generate process plan for rotational, prismatic and sheet-metal parts.</p>		
	<p><u>The generative CAPP method</u> The next stage of evolution is towards generative CAPP. In the generative CAPP, process plans are generated by means of decision logic, formulas, technology algorithms and geometry-based data to perform uniquely many processing decisions for converting part from raw material to finished state. There are two major components of generative CAPP; a geometry-based coding scheme and process knowledge in form of decision logic data. The geometry-based coding scheme defines all geometric features for process related surfaces together with feature dimensions, locations, tolerances and the surface finish desired on the features. The level of detail is much greater in a generative system than a variant system. For example, details such as rough and finished states of the parts and process capability of machine tools to transform these parts to the desired states are provided. Process knowledge in form of in the form of decision logic and data matches the part geometry requirements with the manufacturing capabilities using knowledge base. It includes selection of processes, machine tools, jigs or fixtures, tools, inspection equipment and sequencing operations. Development of manufacturing knowledge base is backbone of generative CAPP. The tools that are widely used in development of this database are flow-charts, decision tables, decision trees, iterative algorithms, concept of unit machined surfaces, pattern recognition techniques and artificial intelligence techniques such as expert system shells.</p>	3	
4	<p>3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. The term 3D printing covers a variety of processes in which material is joined or solidified under computer control to create a three-dimensional object, with material being added together (such as liquid molecules or powder grains being fused together), typically layer by layer.</p> <p>The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object.</p> <p>3D printing is the opposite of subtractive manufacturing which is cutting out / hollowing out a piece of metal or plastic with for instance a milling machine.</p> <p>3D printing enables you to produce complex (functional) shapes using less material than traditional manufacturing methods.</p>	4	6
	<p>TYPES</p> <ul style="list-style-type: none"> ▪ Stereolithography (SLA) ▪ Digital Light Processing (DLP) ▪ Fused deposition Modeling (FDM) ▪ Selective Laser Sintering (SLS) ▪ Selective Laser Melting (SLM) ▪ Electronic Beam Melting (EBM) ▪ Laminated Object Manufacturing (LOM) ▪ Binder Jetting (BJ) ▪ Material Jetting (MJ) ▪ Drop on Demand (DOD) 	2	

<u>NC Machine</u>	<u>CNC Machine</u>
Here NC stands for Numerical Control	CNC stands for Computer Numerical Control.
It is defined as the machine which is controlled by the set of instructions in the form of numbers, letters and symbols. The set of instructions is called as program.	It is defined as the machine which is used to control the motions of the workpiece and tool with the help of prepared program in computer. The program is written in alphanumeric data.
In NC machine the programs are fed into the punch cards.	In CNC machine the programs are fed directly into the computer by a small key board similar to our traditional keyboard.
Modification in the program is difficult.	Modification in the program is very easy.
High skilled operator is required.	Less skilled operator is required.
Cost of the machine is less.	Cost of the CNC machine is high.
Maintenance cost is less	Maintenance cost is high.
The programs in the NC machine cannot be stored.	In CNC machines, the programs can be stored in the computer and can be used again and again.
It offers less flexibility and computational capability.	It offers additional flexibility and computational capability.
The accuracy is less as compared with the CNC.	It has high accuracy.
It requires more time for the execution of the job.	It takes very less time in the execution of the job.
It is not possible to run it continuously.	It can be run continuously for 24 hours of a day.

5

Any
six *1

6

6	<p>Adaptive control system is a logical extension of the CNC-mechanism. In CNC mechanism the cutting speed and feed rates are prescribed by the part programmer. The determination of these operating parameters depends on the Knowledge and experience regarding the work piece, tool materials, coolant conditions and other factors. By contrast in adaptive control machining, there is improvement in the production rate and reduction in the machining cost as a result of calculating and setting of optimal parameters during machining. This calculation is based on measurements of process variables in real time and followed by a subsequent on-line adjustment of the parameters subjected to machining constraints in order to optimize the performance of the overall system</p> <p>Adaptive control possesses attributes of both feedback control and optimal control. Like a feedback system measurement are taken on certain process variables. Like an optimal system, an overall measure of performance is used. In adaptive control, this measure is called the index of performance (IP). The feature that distinguishes adaptive control from other two types is that an adaptive system is designed to operate in a time varying environment. It is not usual for a system to exist in environments that change over the course of time. An adaptive control system is designed to operate for the changing environment by monitoring its performance and altering accordingly, some aspects of its control mechanism to achieve optimal or near optimal routine. The feedback and optimal systems operate in a known or deterministic environment. If the environment changes significantly, these systems might not respond in the manner intended by the designer. On the other hand, the AC system evaluates the environment, more accurately. It evaluates its performance within the environment and makes the necessary changes in its control characteristics or if possible, to optimize its performance.</p>	3+3	6	
7	<p>These are used to drive the slide or a table. The requirements of an ideal feed drive are as follows.</p> <ul style="list-style-type: none"> • The feed motor needs to operate with constant torque characteristics to overcome friction and working forces. • The drive speed should be extremely variable with a speed range of about 1: 20000, which means it should have a maximum speed of around 2000 rpm and at a minimum speed of 0.1 rpm. • The feed motor must run smoothly. • The drive should have extremely small positioning resolution. • Other requirements include high torque to weight ratio, low rotor inertia and quick response in case of contouring operation where several feed drives have to work simultaneously. • Variable speed DC drives are used as feed drives in CNC machine tools. However now-a-days AC feed drives are being used. 	3	6	
	 <p>The diagram illustrates a feed drive mechanism. On the left, a 'Feed motor' is shown. A 'Ball screw' extends from the motor to the right. At the end of the ball screw, there is a 'Ball screw nut'. This nut is connected to a 'Work table'. A double-headed arrow below the work table indicates its horizontal movement.</p>	3		

Part C

- Definition: The CRT is a display screen which produces images in the form of the video signal. It is a type of vacuum tube which displays images when the electron beam through electron guns are strikes on the phosphorescent surface. In other Words, the CRT generates the beams, accelerates it at high velocity and deflect it for creating the images on the phosphorous screen so that the beam becomes visible.

- Working of CRT

The working of CRT depends on the movement of electrons beams. The electron guns generate sharply focused electrons which are accelerated at high voltage. This high-velocity electron beam when strikes on the fluorescent screen creates luminous spot

After exiting from the electron gun, the beam passes through the pairs of electrostatic deflection plate. These plates deflected the beams when the voltage applied across it. The one pair of plate moves the beam upward and the second pair of plate moves the beam from one side to another. The horizontal and vertical movement of the electron are independent of each other, and hence the electron beam positioned anywhere on the screen.

The working parts of a CRT are enclosed in a vacuum glass envelope so that the emitted electron can easily move freely from one end of the tube to the other.

- Construction of CRT

The Electrons Gun Assembly, Deflection Plate Assembly, Fluorescent Screen, Glass Envelope, Base are the important parts of the CRT. The electron gun emits the electron beam, and through deflecting plates, it strikes on the phosphorous screen. The detail explanation of their parts is explained below.

Electrons Gun Assembly

The electron gun is the source of the electron beams. The electron gun has a heater, cathode, grid, pre-accelerating anode, focusing anode and accelerating anode. The electrons are emitted from the highly emitted cathode. The cathode is cylindrical in shape, and at the end of it, the layer of strontium and barium oxide is deposited which emit the high emission of electrons at the end of the tube.

The electron passes through the electron in the small grid. This control grid is made up of nickel material with a centrally located hole which is coaxial with the CRT axis. The electron which is emitted from the electron gun and passes through the control grid have high positive potential which is applied across the pre-accelerating and accelerating anodes.

The beam is focused by focusing anode. The accelerating and focusing electrodes are cylindrical in shape which has a small opening in the centre of each electrode. After exiting the focusing anode, the beams passes through the vertical and horizontal deflecting plates.

The pre-accelerating and accelerating anode are connected to the positive high voltage of about 1500V and the focusing anode are connected to the lower voltage of about 500V. There are two methods of focusing the electron beam. They are the Electrostatic Focussing Beam and the Electromagnetic Focusing.

Electrostatic Deflection Plates

The deflection plate produces the uniform electrostatic field only in the one direction. The electron beam entering into the deflection plates will accelerate

III a

1+1+3

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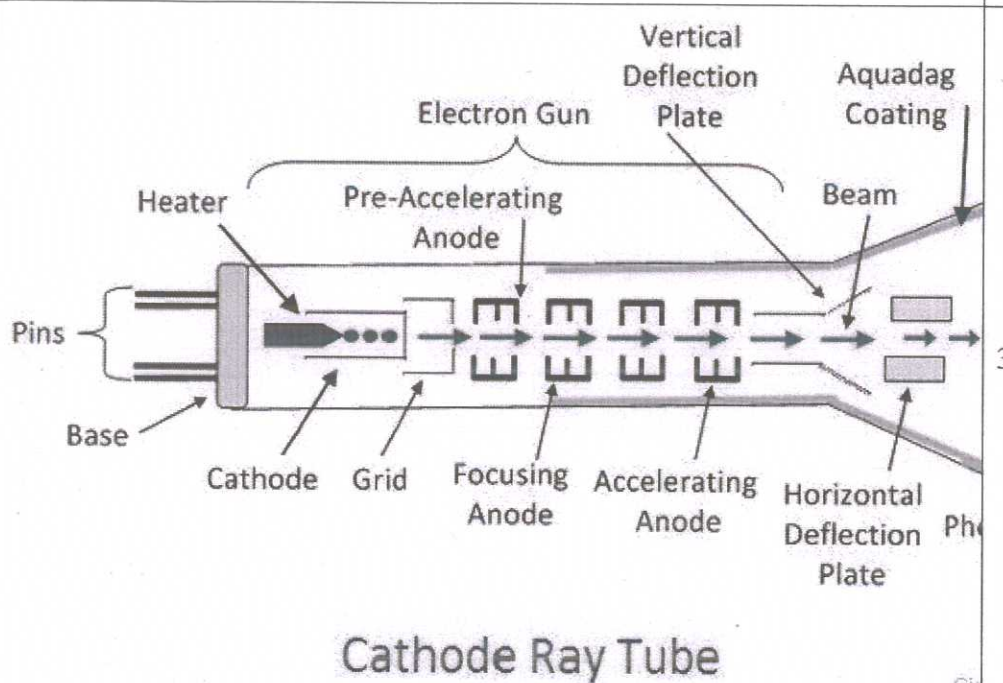
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only in the one direction, and hence electrons will not move in the other directions.

Screen For CRT

The front of the CRT is called the face plate. The face plate of the CRT is made up of entirely fibre optics which has special characteristics. The internal surface of the faceplate is coated with the phosphor. The phosphorous converts the electrical energy into light energy. The energy level of the phosphorous crystal raises when the electron beams strike on it. This phenomenon is called cathodoluminescence.

The light which is emitted through phosphorous excitation is called fluorescence. When the electron beam stop, the phosphorous crystal regain their original position and release a quantum of light energy which is called phosphorescence or persistence.



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

Generally, networks are distinguished based on their geographical span. A network can be as small as distance between your mobile phone and its Bluetooth headphone and as large as the internet itself, covering the whole geographical world.

b

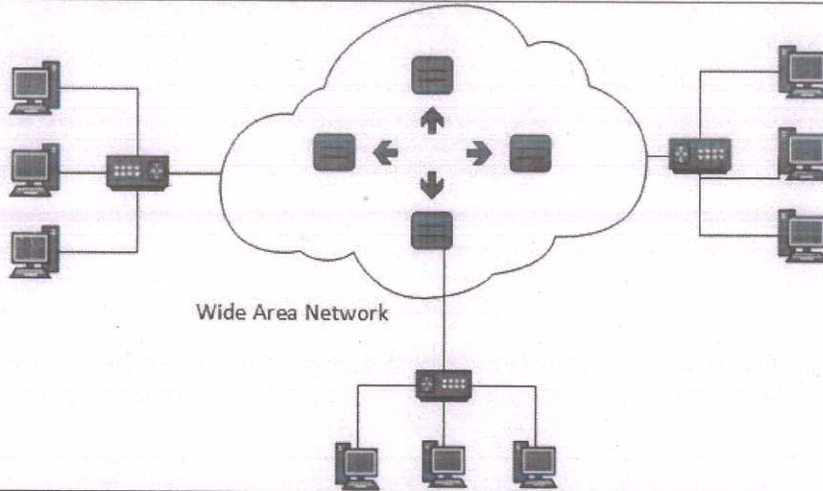
Personal Area Network : A Personal Area Network (PAN) is smallest network which is very personal to a user. This may include Bluetooth enabled devices or infra-red enabled devices. PAN has connectivity range up to 10 meters. PAN may include wireless computer keyboard and mouse, Bluetooth enabled headphones, wireless printers, and TV remotes. For example, Piconet is Bluetooth-enabled Personal Area Network which may contain up to 8 devices connected together in a master-slave fashion.

1

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networks provide connectivity to MANs and LANs. Since they are equipped with very high-speed backbone, WANs use very expensive network equipment.

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

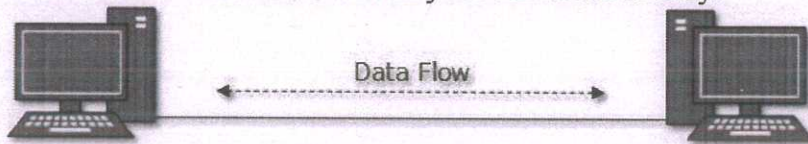


1

A Network Topology is the arrangement with which computer systems or network devices are connected to each other. Topologies may define both physical and logical aspect of the network. Both logical and physical topologies could be same or different in a same network.

Point-to-Point

Point-to-point networks contains exactly two hosts such as computer, switches, routers, or servers connected back to back using a single piece of cable. Often, the receiving end of one host is connected to sending end of the other and vice versa. If the hosts are connected point-to-point logically, then may have multiple intermediate devices. But the end hosts are unaware of underlying network and see each other as if they are connected directly.



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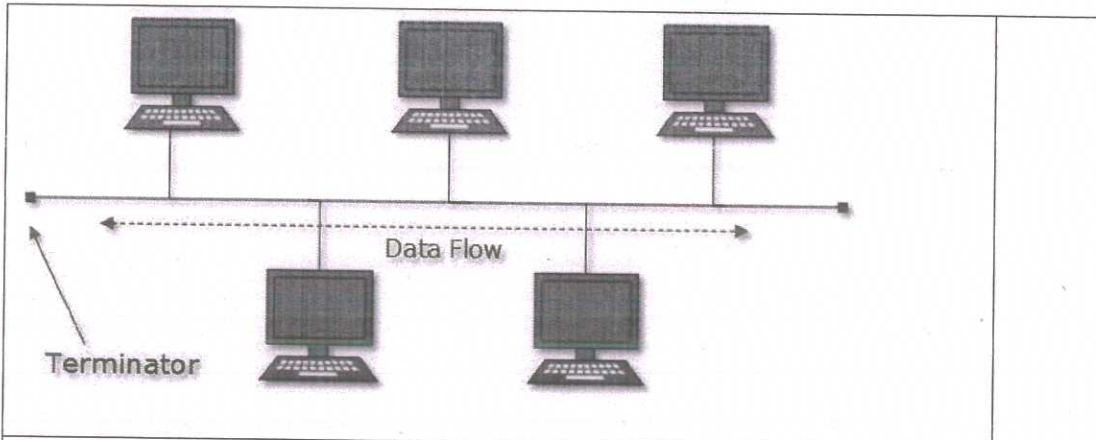
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Bus Topology

In case of Bus topology, all devices share single communication line or cable. Bus topology may have problem while multiple hosts sending data at the same time. Therefore, Bus topology either uses CSMA/CD technology or recognizes one host as Bus Master to solve the issue. It is one of the simple forms of networking where a failure of a device does not affect the other devices. But failure of the shared communication line can make all other devices stop functioning.

Both ends of the shared channel have line terminator. The data is sent in only one direction and as soon as it reaches the extreme end, the terminator removes the data from the line.

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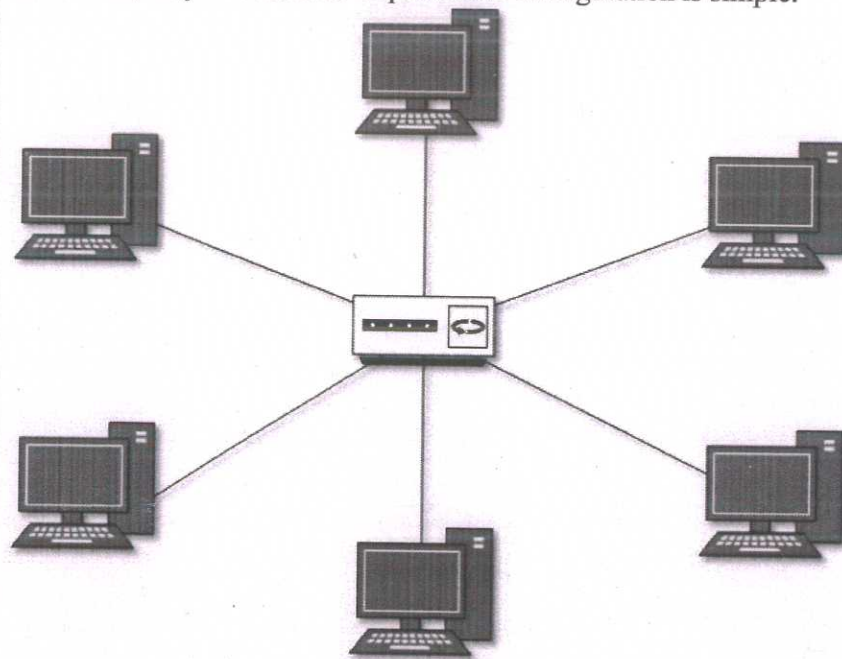


Star Topology

All hosts in Star topology are connected to a central device, known as hub device, using a point-to-point connection. That is, there exists a point to point connection between hosts and hub. The hub device can be any of the following:

- Layer-1 device such as hub or repeater
- Layer-2 device such as switch or bridge
- Layer-3 device such as router or gateway

As in Bus topology, hub acts as single point of failure. If hub fails, connectivity of all hosts to all other hosts fails. Every communication between hosts takes place through only the hub. Star topology is not expensive as to connect one more host, only one cable is required and configuration is simple.



1

Ring Topology

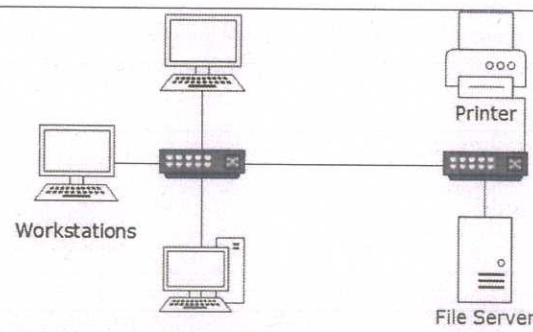
In ring topology, each host machine connects to exactly two other machines, creating a circular network structure. When one host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts. To connect one more host in the existing structure, the administrator may need only one more extra cable.

1

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

LAN provides a useful way of sharing the resources between end users. The resources such as printers, file servers, scanners, and internet are easily sharable among computers. LANs are composed of inexpensive networking and routing equipment. It may contains local servers serving file storage and other locally shared applications. It mostly operates on private IP addresses and does not involve heavy routing. LAN works under its own local domain and controlled centrally. LAN uses either Ethernet or Token-ring technology. Ethernet is most widely employed LAN technology and uses Star topology, while Token-ring is rarely seen. LAN can be wired, wireless, or in both forms at once.

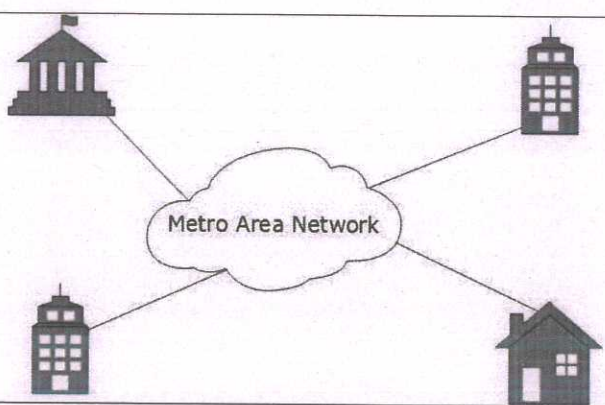
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Metropolitan Area Network: The Metropolitan Area Network (MAN) generally expands throughout a city such as cable TV network. It can be in the form of Ethernet, Token-ring, ATM, or Fiber Distributed Data Interface (FDDI). Metro Ethernet is a service which is provided by ISPs. This service enables its users to expand their Local Area Networks. For example, MAN can help an organization to connect all of its offices in a city. Backbone of MAN is high-capacity and high-speed fiber optics. MAN works in between Local Area Network and Wide Area Network. MAN provides uplink for LANs to WANs or internet.

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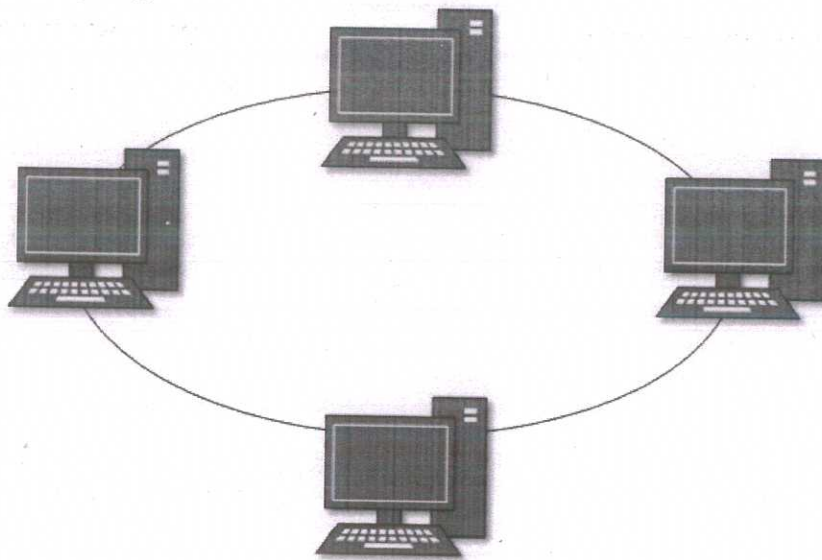


1

Wide Area Network: As the name suggests, the Wide Area Network (WAN) covers a wide area which may span across provinces and even a whole country. Generally, telecommunication networks are Wide Area Network. These

1

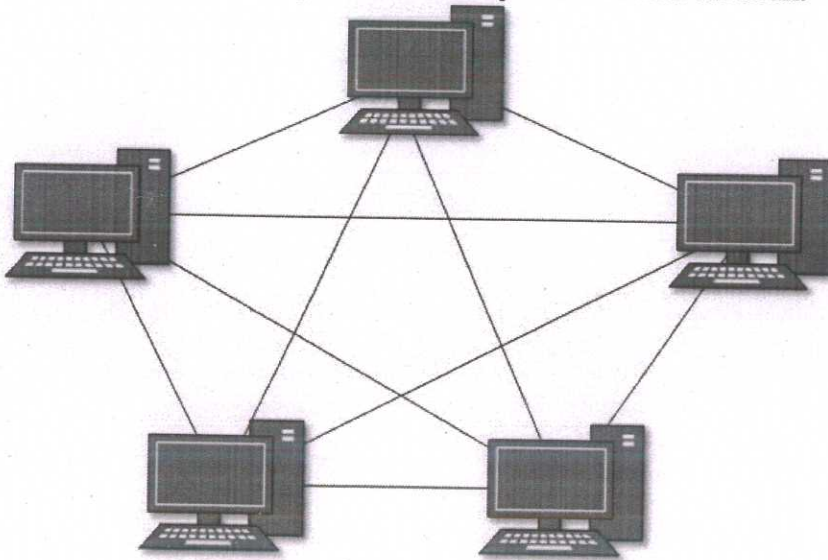
Failure of any host results in failure of the whole ring. Thus, every connection in the ring is a point of failure. There are methods which employ one more backup ring.



Mesh Topology

In this type of topology, a host is connected to one or multiple hosts. This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection with few hosts only. Hosts in Mesh topology also work as relay for other hosts which do not have direct point-to-point links. Mesh technology comes into two types:

- **Full Mesh:** All hosts have a point-to-point connection to every other host in the network. Thus for every new host $n(n-1)/2$ connections are required. It provides the most reliable network structure among all network topologies.
- **Partially Mesh:** Not all hosts have point-to-point connection to every other host. Hosts connect to each other in some arbitrarily fashion. This topology exists where we need to provide reliability to some hosts out of all.

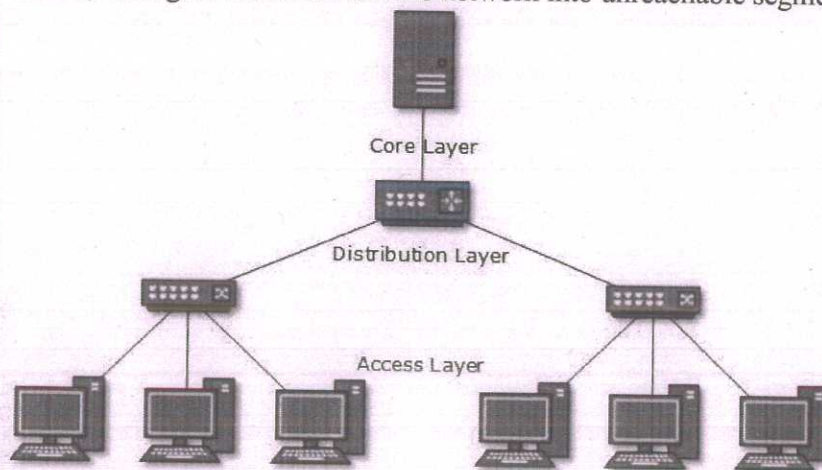


Tree Topology

Also known as Hierarchical Topology, this is the most common form of network topology in use presently. This topology imitates as extended Star topology and inherits properties of Bus topology.

This topology divides the network into multiple levels/layers of network. Mainly in LANs, a network is bifurcated into three types of network devices. The lowermost is access-layer where computers are attached. The middle layer is known as distribution layer, which works as mediator between upper layer and lower layer. The highest layer is known as core layer, and is central point of the network, i.e. root of the tree from which all nodes fork.

All neighboring hosts have point-to-point connection between them. Similar to the Bus topology, if the root goes down, then the entire network suffers even though it is not the single point of failure. Every connection serves as point of failure, failing of which divides the network into unreachable segment.



1

Daisy Chain

This topology connects all the hosts in a linear fashion. Similar to Ring topology, all hosts are connected to two hosts only, except the end hosts. Means, if the end hosts in daisy chain are connected then it represents Ring topology.

Each link in daisy chain topology represents single point of failure. Every link failure splits the network into two segments. Every intermediate host works as relay for its immediate hosts.

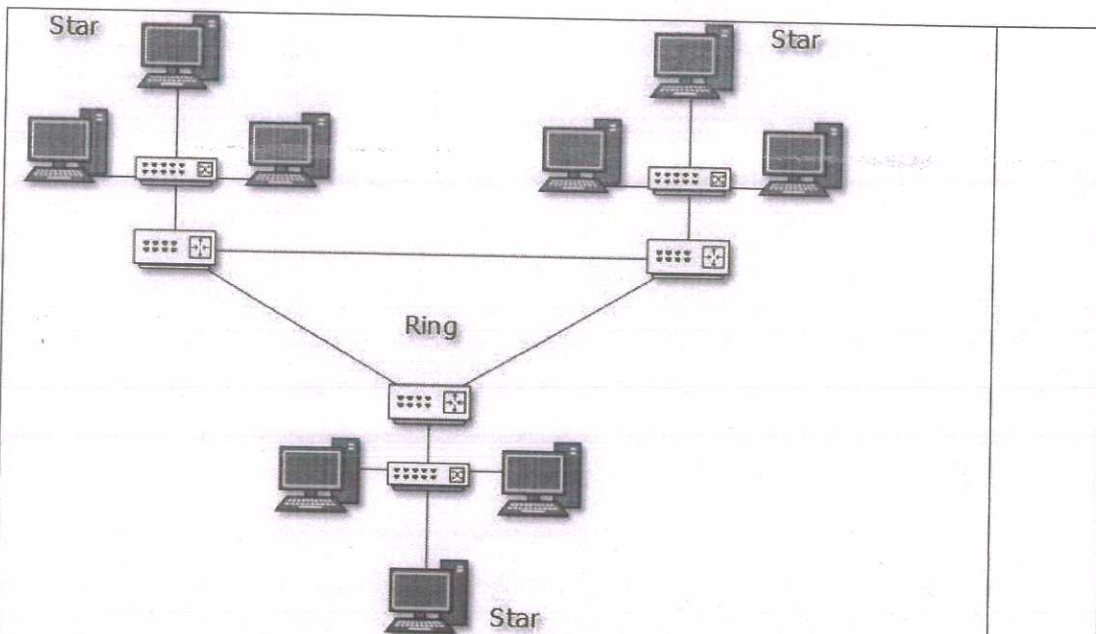


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Hybrid Topology

A network structure whose design contains more than one topology is said to be hybrid topology. Hybrid topology inherits merits and demerits of all the incorporating topologies.

1



The above picture represents an arbitrarily hybrid topology. The combining topologies may contain attributes of Star, Ring, Bus, and Daisy-chain topologies. Most WANs are connected by means of Dual-Ring topology and networks connected to them are mostly Star topology networks. Internet is the best example of largest Hybrid topology

Secondary Storage Devices are essential as the size of Primary storage or main memory in every computer is limited. With this, the computer can only accommodate a limited sized program and data. To carry out big jobs like commercial data processing, it becomes essential that data be held in some expansive form of storage. This is achieved through secondary storage Devices. It is also called as external storage, and can hold data either sequentially or at random. It should be kept in in mind that data in secondary storage devices is not directly accessible and has to be routed through the main storage for processing.

1

1.MAGNETIC TAPE:

- Tapes are used for recording and storing data for computer processing. It is plastic reel similar to long lengths of movie film. A tape is usually 1/2" wide and 2400 feet in length and it is coated with particles of ferric oxide on which data can be recorded magnetically.
- The process of reading and writing of data is carried out on a device called Tape Drive and the records on magnetic tape are stored in sequential order. For example: if the payroll file is to be stored on a magnetic tape, the records would likely to be stored in the sequence of employee numbers. Hence, magnetic tapes are referred to as sequential access device.

2.MAGNETIC DISK:

- Magnetic disk is another type of secondary storage device known as random (direct) access as it permits direct accessing of data. An individual disk is a circular metal plate coated on both side by ferrous oxide material.
- Data is recorded in the form of magnetized spots on the tracks of the disk, a spot representing the presence by "1" and its absence by "0" enabling representing of data in binary form.

6*1

7

b

- The surface of the magnetic disk is divided into number of invisible concentric circles called “tracks” and these tracks are further subdivided into “sectors”, “blocks” etc. each its own unique addresses to facilitate the location of data and the Disk moves on a vertical rotating spindle.
- Reading /writing on the disks is accomplished by means of series of read/write heads which are placed close to the surfaces of the disks.
- It is good to know that data on the magnetic disk can be accessed again and again. It can also be recorded erasing the older information.

3. MAGNETIC DRUM:

- It is a metallic cylinder coated with a special magnetic alloy.
- Data is stored in this surface as minute magnetized spoke arranged in binary form in a series of parallel circular tracks.
- The drum rotates at a constant speed and data is recorded (or) retrieved by the read/write head. One for each track.
- The magnetic drum provides random access storage.

4. CD-ROM

- ◆ CD-ROM (Compact Disc Read Only Memory) is a Compact Disc contains data accessible by a computer. While the Compact Disc format was originally designed for music storage and play back, the format was later adapted to hold any form of binary data.
- ◆ The CR-ROM is also known as a laser disc, which is shiny metal like disk. The diameter of the disk is 5.25 inches or 12 cm disk. Information of 650 MB can be stored which is equal to nearly 2, 50,000 pages of printed text.
- ◆ The data is recorded as deep holes on the disk surface or burning microscopic bits.
- ◆ The plain and shiny disk surface and the microscopic bits help to represent the binary numbers 0 and 1, as required by the concentric tracks.
- ◆ CD-ROMs are popularly used to distribute computer software, including games and multimedia applications, though any data can be stored.
- ◆ Some CDs hold both computer data and audio with the latter capable of being played on a CD player, while data is only usable on a computer. These are called Enhanced CDs.
- ◆ The CD-ROMs are pre-recorded disks used for storing a large amount of data and information. Hence, the CD-ROM drive has become a standard peripheral device used for retrieval of stored data on the CD-ROM.
- ◆ A CD-ROM sector contains 2352 bytes, divided into 98 [ninety-eight], 24-byte frames.
- ◆ A mode-1 CD-ROM, which has the full three layers of error correction data, contains a net 2048 bytes of the available 2352 per sector.
- ◆ On a mode-2 CD-ROM, which is mostly used for video files, there are 2336 user available bytes per sector. A device called CD-Writer is necessary to record information onto a CD-ROM.

5. HARD DISK

- ◆ A hard disk drive [HDD], commonly referred to as a hard drive, hard disk or fixed disk drive. It is a non-volatile secondary storage device which stores digitally encoded data on rapidly rotating platters with magnetic surfaced. The hard disk is an electro mechanical device. The hard disk is also known as Winchester disk. HDDs record data by magnetizing a ferromagnetic material

directionally to represent either a "0" or "1" binary digit. They read the data by detecting the magnetization of the material.

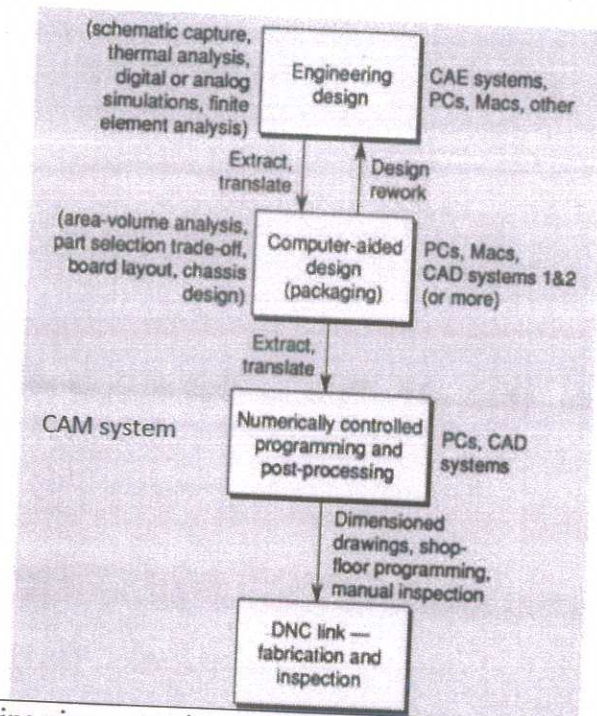
- ◆ The magnetic hard disk is an electro-mechanical device which consists of some smooth metal plates and disks coated on either sides or surfaces with a thin-film of magnetic material. The set of such magnetic disks are fixed on one spindle, one above the other, like a stack of disks. This is called a disk pack, which is sealed into one unit and mounted on a disk drive.
- ◆ The hard disk drive has a set of magnetic heads or read/write heads for both surfaces of each disk, on the spindle.
- ◆ The disk drive consists of a motor to rotate the disk pack at a speed of about 3600 revolutions per minute [rpm] about a spindle.
- ◆ Each magnetic head (or) magnetic read/write heads mounted on arm can move in and out rapidly on the disk surface to perform read and write operations. The information is recorded and stored or retrieved that is read from the magnetic recording surface, while the disk rotates about the spindle at high-speed.
- ◆ The information is stored on the magnetic surfaces as bits 0's and 1's on the concentric circles as tracks.
- ◆ Each track is divided into sectors of the same density.
- ◆ The set of corresponding tracks of all the surfaces of all the disks constitute a cylinder.
- ◆ The magnetic disk pack is connected to controller by an electronic circuit called as a disk controller (or) hard disk controller HDC. The controllers accept control signals from the control unit of the computer for specific read and write operation.
- ◆ Now days the capacity of hard disk begins from 20 GB, 40 GB and so on, to fulfill the need of large data information storage.
- ◆ Hard disk drives are sealed to prevent dust and other sources of contamination from interfering with the operation of the hard disk heads.
- ◆ The hard drives are not air tight, but rather utilize an extremely fine air filter, to allow for air inside the hard drive enclosure. The spinning of the disks causes the air to circulate forcing any particulars to become trapped on the filter. The same air currents also as a gas bearing which enables the heads to float on a cushion of air above the surfaces of the disks.

6. FLOPPY DISKS

These are also called as flexible disks. These are used in the smallest micro computer systems as well as mini computers. Floppy disks have higher storage capacity and offer direct access capability. The floppy disk is permanently sealed in a plastic coated jacket and the whole package is inserted the floppy drive for data recording and retrieval.

The jacket of the disk has a small slot to permit the read/write head to contact the disk. They are 5.25 inch (or) 3.5 inch in diameter. They come in single and double density and recorded on one or both surface of the diskette. The capacity of a 5.25 inch floppy is 1.2 mega bytes whereas for 3.5 inch floppy it is 1.44 mega bytes.

It is cheaper than that of any other secondary storage devices and is portable too. The floppy is a low-cost device particularly suitable for personal computer system. Once data has been recorded, a floppy disk reader can be used to enter



3

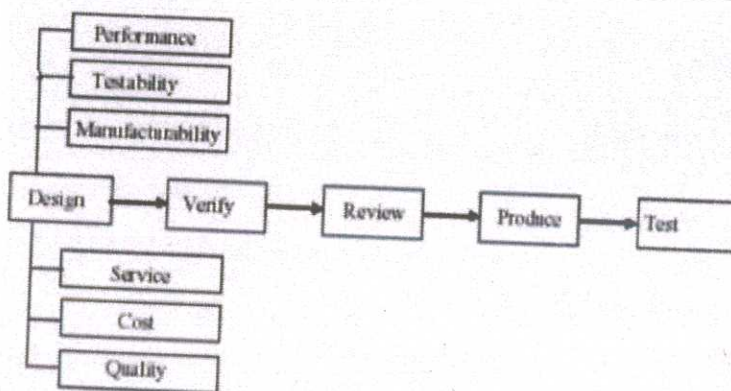
Concurrent engineering, sometimes called simultaneous engineering, or parallel engineering has been defined in several ways by different authors. One of the most popular one is that by Winner et al. (1988), who state that concurrent engineering 'is a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support.' This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and user requirements. Therefore, CE represents an organisation's ability to carry out product development as a series of overlapping phases, which delivers product on time, to provide customer satisfaction at the right price .

Therefore concurrent engineering can be defined as:

- 1) A philosophy of product development: Integrating multiple design issues
- 2) A method of product design: Integration of multidisciplinary folks into design team
- 3) A method to lead people: Design issues are represented in the people
- 4) What is not concurrent engineering: a) It is not the "over the wall" b) Nor "off the wall" (it's being used and is here to stay)

2

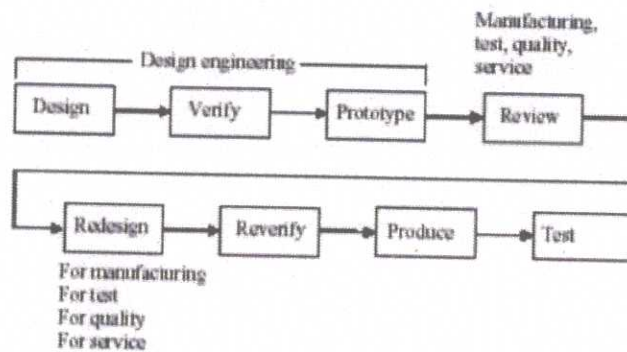
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1.5

Sequential engineering, also known as serial engineering, is characterized by downstream departments supplying information to design only after a product has already been designed, verified and prototyped, in order to change what design engineering did wrong, or what could have been improved. In serial engineering, the various functions such as design, manufacturing, and customer service are separated. The information in serial engineering flows in succession from phase to phase. For example, the prototype model, verified by either simulation or prototyping or both, is reviewed for manufacturing, quality and service. Usually, some changes are suggested after the review. If the suggested changes in the design are made, there are increases in the cost and time to develop the product, resulting in delays in marketing the product. If the changes cannot be made because of market pressure to launch the product quickly, or the fact that the design is already behind schedule, then specialists in other functional areas or managers from manufacturing, quality, and service, among others, are informed of the impending problems. In sequential engineering a department starts working only when the preceding one has finished, and, once a department has finished working on a project, or part of a project, this is not planned to come back: information flow is only one way.

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1.5

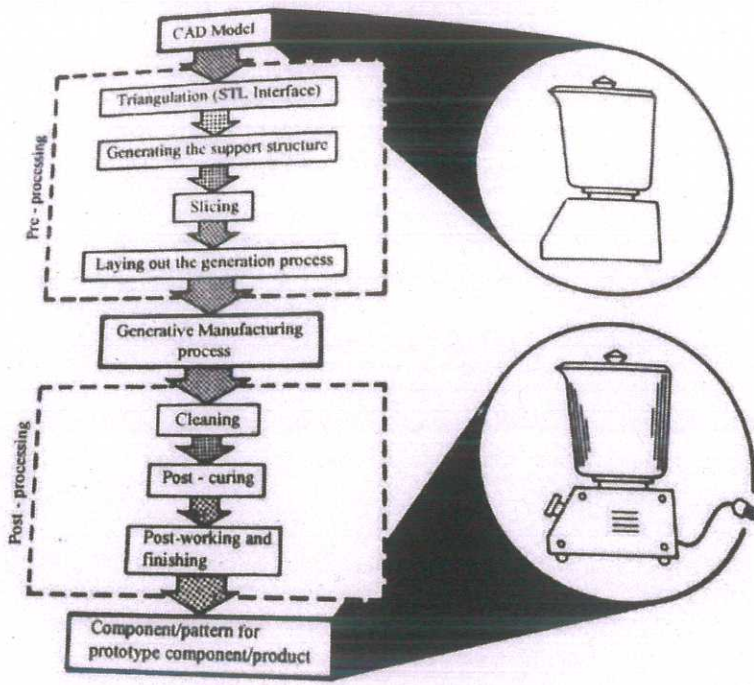
A family of unique fabrication processes developed to make engineering prototypes in minimum lead time based on a CAD model of the it.

In this process a solid object with prescribed shape, dimension and finish can be directly produced from the CAD based geometric model data stored in a computer without human intervention

Rapid prototyping can be of two types:

- The parts obtained by RP technology can form the prototype directly without requiring any further processing.
- The parts obtained by RP technology can be used to make moulds for casting the prototype component. This type is needed because till today, the commercially available RP machines are non-metallic materials with low strength and low melting temperature.

In general this technology is called as Generative manufacturing Process (GMP) as the shape of the work piece is not obtained by removal of chips or forming or casting. It is achieved by addition of material without any prior recognizable form or shape and no tool is necessary. In all types of GMPs the CAD model is split into layers. The slice thickness and slicing direction can be varied for convenience of generation. To generate an object of same shape as that of sliced CAD model, the distance between the slicing planes must be equal to the thickness of the corresponding layers during the actual generation process.



Steps involved in rapid prototyping

VI a

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4

data into CPU. Again, the disk is loaded and rotated at a constant speed inside its envelope. Tiny magnetic heads in the disk reader access data through the slot in the jacket.

In this type of organization manufacturing is directly lined with the design and analysis process. The data required for various functions are passed from one application software to another in a seamless manner. For example, the product data is created during design. This data has to be transferred from the modeling software to manufacturing software without any loss of data. Here the design of a product are made using computer aided design software, which is in turn directed to analysis for using computer software, known as computer aided engineering. If there are any area of concern the desine is send back to cad system and further modifications are made. After necessary changes the design is again sent to the CAE for analysis. If there are no further area of concern the design is sent to the cad system from where it is send to CAM system for manufacturing. And if needed to drafting also.

There are many benefits to computer design system, little of which can be measured. Some of these benefits are intangible, reflected on the improvement of the quality of work, and there are tangible benefits, but it does not seem obvious in the design stages, but can be observed in the production-stages. We can mention some of these benefits are as follows:

1. Increase the productivity of the designer and this is achieved by the computer helps the designer, introduced product, and also reduce the time required in the installation and analysis.
2. Improve the quality of the design: The computerized design system allows the designer to a deep and accurate analysis of the design as well as provides a large number of alternative designs that can be tested, and the design errors less because of the high precision provided by the system.
3. Improve the exchange of ideas: engineering drawing international language transcends barriers translator and that the use of the system leads to charges having standard specifications and reduce-errors.
4. Provide the data base for manufacturing: When the fee for a product (the development dimensions of the product and its parts and determine the lists of materials and specifications), it is available data can be used in many manufacturing processes.

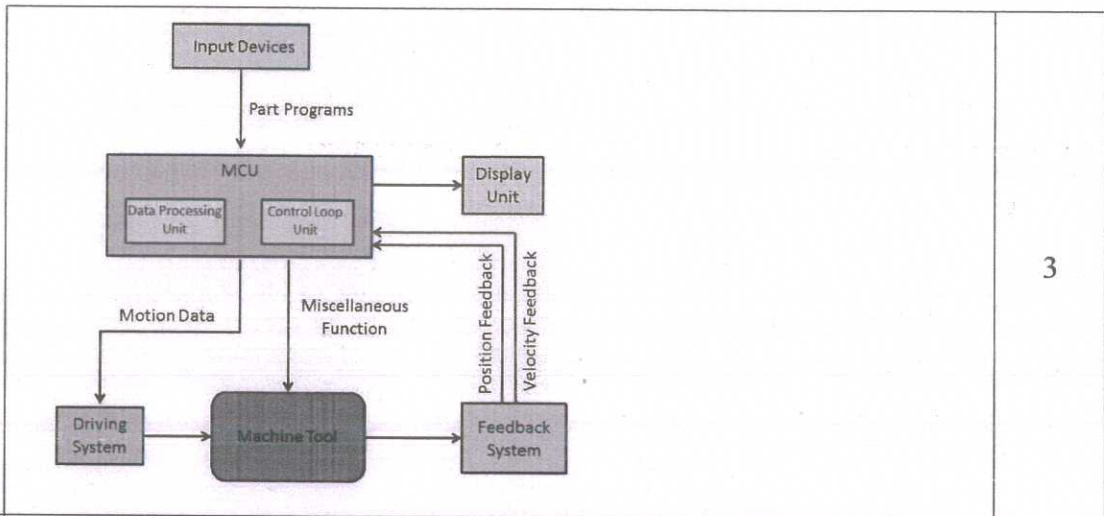
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	<p>Master Production Scheduling (MPS) is used to generate a master plan for what you need to produce, how much and when to produce it, based upon one's supply and demand. A production plan is an aggregate plan that schedules product families in relatively long time intervals.</p> <p>Master production schedule is used for individual end products and in shorter time intervals.</p> <p>MPS is important in the following aspects:</p> <ol style="list-style-type: none"> 1. It is the link between what is expected (production planning) and what is actually to be built, i.e., material requirement planning and final assembly schedule (FAS, to be discussed). 2. It develops data to drive the detailed planning, MRP. MPS is a priority plan for manufacturing. It keeps priorities valid. 3. It is the basis for calculating the resources available (capacity) and the resources needed (load). It provides devices to reconcile the customers' demand and the plant's capability. 4. It makes possible reliable delivery promises. It provides salespeople information on available-to-promise (ATP) indicating when end products are available. ATP will be discussed later. 5. It is a tool that can be used to evaluate the effects of schedule changes. It is a device for communication and a basis to make changes consistent with the demands of the marketplace and manufacturing capacity. 6. It is a contract between marketing and manufacturing departments. It is an agreed-upon plan. It coordinates plans and actions of all organizational functions and is a basis to measure the functions' performance. 7. It provides management with the means to authorize and control all resources needed to support integrated plans. 8. In the short horizon, MPS serve as the basis for planning material requirement, production of components, order priorities, and short-term capacity requirements. 9. In the long horizon, MPS serves as the basis for estimating long-term demands on the company resources such as people, equipment, warehousing, and capital 	Any 7*1	7	
VII	<p>a</p> <p>CNC (Computer Numerical Control) machining is a subtractive manufacturing technology: parts are created by removing material from a solid block (called the blank or the workpiece) using a variety of cutting tools.</p> <p>The basic CNC process can be broken down into 3 steps. The engineer first designs the CAD model of the part. The machinists then turns the CAD file into a CNC program (G-code and M-code) and sets up the machine. Finally, the CNC system executes all machining operations with little supervision, removing material and creating the part. The following are the principles of CNC operation.</p> <ul style="list-style-type: none"> • Movement of X, Y, Z axis are controlled by motor which supplies either Alternating current or Direct current. • Movement of machine is done by giving commands. • All the operations are carried out by codes like speed, feed, depth of cut, etc. • For each operation separate code is available. • Warning system is available to save guard the various operations and components. 	5	8	15



3

A vertical machining centre has its spindle on a vertical axis relative to the work table. A vertical machining centre (VMC) is typically used for flat work that requires tool access from top.. Its milling cutters are held in the spindle and it rotates on its axis. Generally, the spindle could be extended to allow plunge cuts and drilling, although the table could also be lowered or raised. The vertical machining centres have two subcategories. These categories are the bedmill and the turret mill. E.g. mould and die cavities, Large components of aircraft

3

b A horizontal machining centre (HMC) is used for cube shaped parts where tool access can be best achieved on the sides of the cube. Horizontal spindle models are used for applications where parts are more suitably machined on this type of machine tool. Horizontal machining centres are often used to mill grooves and slots. It may also be used to shape flat surfaces . An example is automotive wheel lug hole pattern drilling

3

7

A universal machining centre (UMC) has a work head that swivels its spindle axis to any angle between horizontal and vertical making this a very flexible machine tool. E.g.: Aerofoil shapes, Curvilinear geometries

1

VIII

a

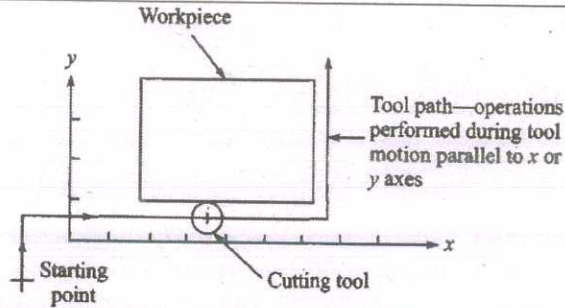
DNC is a manufacturing system in which a number of machines are controlled by a computer through direct- connection and in real time. DNC is a system connecting a set of NC machines to a common memory for part program or machine program storage with provision for on- demand distribution of data to machines. Involves data connection and processing from the machine tool back to the computer.
 Components
 1. Central computer
 2. Bulk memory which stores the NC part programs
 3. Telecommunication lines
 4. Machine Tools.
 A central computer connected to a number of machine tools and control them. Part program of all machine tools are stored in the memory of the central computer and transmitted on direct transmission lines on demand. Two-way information flow take place in real time. Various machine tools can communicate with the computer in real time. Programs in full or segment can be transferred to NC machines. Computer can be used for program editing. No tape readers are used. No limitation for the number or size of programs stored

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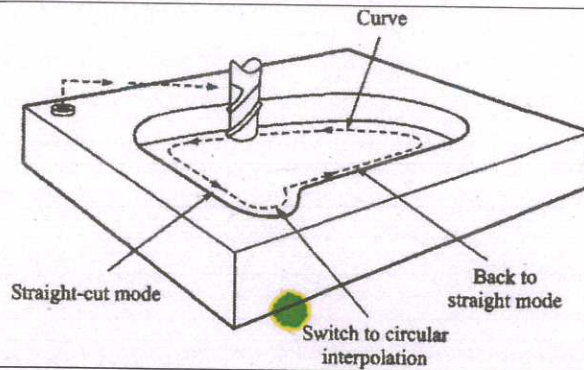
operation to fabricate work pieces of rectangular configurations. With this type of NC system it is not possible to combine movements in more than a single axis direction. Therefore, angular cuts on the work piece would not be possible. An NC machine capable of straight-cut movements is also capable of PTP movement



1

Continuous Path (Contouring) Positioning Control: -A continuous path machine has the ability to move its drive motors at varying rates of speed while positioning the machine which facilitates cutting of arc segments and angles. The most common type of continuous path operations are milling and lathe operations. In continuous path machine, the tool is cutting while the axes of motion are moving, as for example, in a milling machine. All axes of motion might move simultaneously, each at a different velocity. When a non-linear path is required, the axial velocity changes, even within the segment. For example, cutting a circular contour requires a sine rate change in one axis, while the velocity of the other axis is changed at a cosine rate. In contouring machines, the position of the cutting tool at the end of each segment together with the ratio between the axial velocities determines the desired contour of the part and at the same time the resultant feed also affects the surface finish.

2



1

G00- point to point movement (rapid traverse) between previous point and end point defined in current block. Block must include x-y-z coordinate of end position

2

b

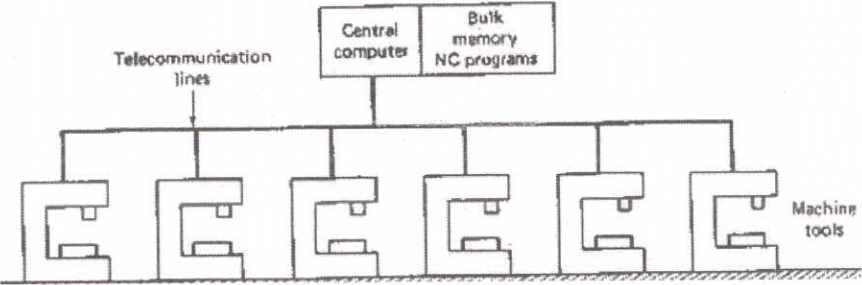
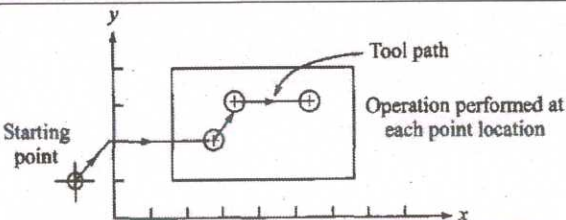
G01- linear interpolation movement. Feed rate must be specified. Block must include x-y-z coordinate of end position

2

7

G02- clock wised circular interpolation movement. Block must include either arc radius or arc center; coordinates of end position must be specified

2

		3		
b	<ul style="list-style-type: none"> • NC machines can be used continuously 24×7 throughout the year and only need to be switched off for occasional maintenance. • CNC machines are programmed with a design which can then be manufactured hundreds or even thousands of times. Each manufactured product will be exactly the same. • Less skilled/trained people can operate CNC machines unlike manual lathes / milling machines etc. which need skilled engineers. • CNC machines can be updated by improving the software used to drive the machines • Modern design software allows the designer to simulate the manufacture of his/her idea. There is no need to make a prototype or a model. This saves time and money. • One person can supervise many CNC machines as once they are programmed, they can usually be left to work by themselves. Only the cutting tools need replacement occasionally. • Ease of program input. • Multiple program storage. • Online part programming and editing. • Use of advanced interpolation. • Automatic tool compensation. • Auto generation of part program for existing components. • Change in system of units 	Any 7*1	7	
IX	<p>Point-to-point Positioning Control: - Point-to-point machines move only in straight lines. They are limited to drilling, reaming, boring, etc. and straight milling cuts parallel to a machine axis. When making an axis move, all affected drive motors run at the same speed. When one axis motor has moved the instructed amount, it stops while the other motor continues until its axis has reached its programmed location.</p>  <p>Straight-cut Positioning Control: -Straight-cut control systems are capable of moving the cutting tool parallel to one of the major axes at a controlled rate suitable for machining. It is, therefore, appropriate for performing milling</p>	2 1 1	8	15

		G41- cutter offset compensation, left of part surface	1		
X	a.	N1 G90; N2 G28 G54 M03 S1000; N3 G17;	2.5	15	15
		N4 G00 X15 Y15; N5 G18; N6 G00 Z5; N7 G01 Z-5 F15; N8 G00 Z5; N9 G17; N10 G00 X75; N11 G18; N12 G01 Z-5 F15; N13 G00 Z5; N14 G17; N15 G00 X45 Y35; N16 G18; N17 G01 Z-5 F15; N18 G00 Z5; N19 G17; N20 G00 X15 Y55; N21 G18; N22 G01 Z-5 F15; N23 G00 Z5; N24 G17; N25 G00 X75 Y55; N26 G18; N27 G01 Z-5 F15;	10		
		N28 G17; N29 G00 X0Y0; N30 M30;	2.5		