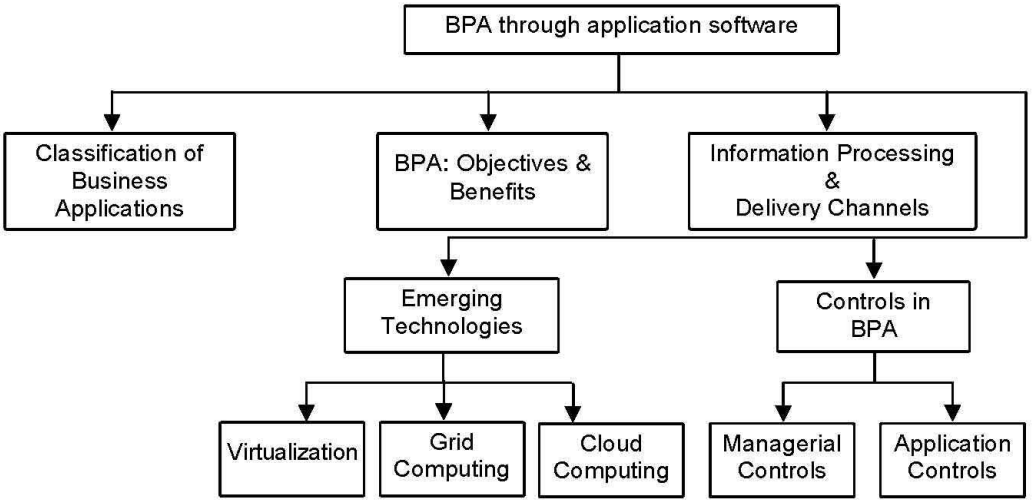
4. BUSINESS PROCESS AUTOMATION THROUGH APPLICATION SOFTWARE



TOPIC 1: CLASSIFICATION OF BUSINESS APPLICATIONS

Q.No.1. What are Business Applications and its types? (A)

1. Business is defined as a person's regular occupation or commercial activity, a person's concern.
2. Application is defined as a computer program to fulfill a particular purpose.
3. Business Application is a program used to fulfill a person's need for regular work or commercial activity. **(M17 - RTP, M15 MTP1 - 1M)**
4. *A business application is a program or a set of programs used by business people.*

Classification of Business Applications

Types	Nature of Processing	Source of Application	Nature of Business	Nature of applications
Type I	Batch Processing	Custom built	Small business	Accounting Application
Type II	Online Processing	Packaged software	Medium Business	Cash Management
Type III	Real-time Processing	Leased	Large business	Manufacturing Applications
More types	No	Yes	No	Yes

SIMILAR QUESTION:

1. **Explain different classifications in Business Applications?**

TOPIC 2: BUSINESS PROCESS AUTOMATION: OBJECTIVES & BENEFITS

Q.No.2. What is BPA? What are the Objectives of BPA? (A) (PM, N14-2M, N14 MTP2-2M)

a) Business Process Automation (BPA) can be defined as removing the human element from existing business processes by automating the repetitive or standardized process components.

b) BPA can make the business processes faster and more efficient, robust, and flexible.

Objectives of BPA:

1. **Confidentiality:** To ensure that data is only available to persons who have right to see the same;
2. **Integrity:** To ensure that no unauthorized amendments can be made in the data.
3. **Availability:** To ensure that data is available when asked for.
4. **Timeliness:** To ensure that data is made available in at the right time.

Q.No.3. Why Business Process Automation? (A) (PM, M15 RTP)

1. BPA is the basic component of an enterprise-wide automation and management scheme for both business and IT workflow.
2. BPA can optimize and streamline business processes by automating the process components.
3. BPA improves the performance, accuracy and efficiency of the key business processes.
4. **Benefits:**
   a) **Reducing the Impact of Human Error:** BPA removes human participation in the process, which is the source of many errors.
   b) **Transforming Data into Information:** BPA can collects and stores data also analyze data and make it available in a form that is useful for decision-making.
   c) **Improving performance and process effectiveness:** In many cases, tasks that must be done manually are the bottleneck in the process. Automating those manual tasks speeds up the effective throughput of the application.
   d) **Making users more efficient and effective:** People can focus their energies on the tasks they do best, allowing the computers to handle those that machines are best suited for.
   e) **Making the business more responsive:** Enterprises can easily automate new applications and processes as they are introduced that provide greater control over business and IT processes.
   f) **Improving Collaboration and Information Sharing:** Business processes designed through a collaborative interface mean IT can integrate its processes with the business-side logic that drives day-to-day operations.
   g) **Cost Saving:** Automation leads to saving in time and labor costs through higher efficiency and better management of the people involved;
   h) **To remain competitive:** To provide the level of products and services as offered by competition.
   i) **Fast service to customers:** Automation shortens cycle times in the execution of processes through improved and refined business workflows and help enterprises to serve their customers faster and better.

SIMILAR QUESTION

1. **What are the benefits of BPA?**

Q.No.4. Explain how to go about BPA? (A)
(N14 RTP, N16 RTP, M17-RTP, N15 MTP1 - 4M)

The steps to go about implementing business process automation

Step 1: Define why we plan to implement a BPA: The primary purpose for which an enterprise implements automation may vary from enterprise to enterprise.
A list of generic reasons for going for BPA may include:

a) Errors in manual processes leading to higher costs.

b) Paying for goods and services not received.

c) Unable to recruit and train new employees.

d) Lack of management understanding business processes.

e) Poor customer service.

Step 2: Understand the rules / regulation under which enterprise needs to comply with: One of the most important steps in automating any business process is to understand the rules of engagement, which include the rules, adhering to regulations and document retention requirements.

Step 3: Document the process, we wish to automate: At this step, all the documents that are currently being used need to be documented. The benefits are

a) It provides clarity on the process.

b) It helps to determine the sources of inefficiency, bottlenecks, and problems.

Step 4: Define the objectives/goals to be achieved by implementing BPA: Once the above steps have been completed, entity needs to determine the key objectives of the process improvement activities.

Step 5: Engage the business process consultant: To achieve BPA, decide which company/ consultant to partner with, depends upon Objectivity of consultant in understanding/evaluating entity situation.

Step 6: Calculate the RoI for project: The right stakeholders need to be engaged and involved to ensure that the benefits of BPA are clearly communicated and implementation becomes successful.

Step 7: Developing the BPA: Once the requirements have been documented, ROI has been computed and top management approval to go ahead has been received, the consultant develops the requisite BPA.

Step 8: Testing the BPA: Once developed, it is important to test the new process to determine how well it works and the process of testing is an iterative process, the objective being to remove all problems during this phase.

SIMILAR QUESTION:

1. Discuss the steps involved in implementation of BPA?

Q.No.5. What are the Applications that help entity to achieve BPA? (A) (N15 MTP2 - 5M)

1. Many applications are available today that help enterprise to achieve business process automation.
2. Some of them are:
   - **a) TALLY:**
     - **i)** It is an accounting application that helps entity to automate processes relating to accounting of transactions.
     - **ii)** It also helps to achieve automation of few processes in inventory management.
     - **iii)** *It has features such as Remote Access Capabilities, Tax Audit and Statutory Compliance, Payroll, Excise for Manufacturers, Multilingual Support, VAT Composition Returns, TDS etc.*
   - **b) SAP R/3:**
     - **i)** SAP R/3 is ERP software, which allows an entity to integrate its business processes.
     - **ii)** ERP stands for Enterprise Resource Planning, which aims at better utilization of the resources and helps entity achieve better business performance.

iii) *It has the features such as time management, reporting and analysis, budget monitoring, workflow approval, sales management, team management, leave management, travel management, recruitment management and demand planning.*

c) **MS Office Applications:** **(N15 - 2M, M16 RTP, N14 MTP1-1M)**

i) These are various office automation systems made available by Microsoft Corporation which include MS Word, MS Excel, MS PowerPoint, MS Access, etc.

ii) *It has features such as customized ribbon, backstage view, built-in graphics toolset, enhanced security, excel spark lines, pivot for Excel, PowerPoint broadcast, Power Point compression, paste, preview and outlook conversation view.*

d) **Attendance Systems:**

i) The application helps entity to automate the process of attendance tracking and report generation.

ii) *It has features such as supervisor login access, holiday pay settings, labour distribution, employee scheduling and rounding, employee view time card, overtime settings, battery-backed employee database and optional door/gate access control etc.*

e) **Vehicle Tracking System:**

i) Applications allowing owner of goods to check the temperature of cold stored goods while in transit.

ii) *It has features such as GPS based location, GPRS connection based real-time online data-logging and reporting, route accuracy on the fly while device is moving, real-time vehicle tracking, SMS & e-mail notifications.*

f) **Travel Management Systems:** **(N16 RTP, M17-RTP, N16 MTP2 - 2M)**

i) Many business processes specific to this industry have been automated, including ticket booking for airplane, bus, train, hotel, etc.

ii) *It has features such as streamlined foreign travel approval process, 'safe return' process for people tracking, traveler portal for up to date information, secure traveler profile information, online retrieval of e-tickets, reservations.*

g) **Educational Institute Management Systems:**

i) ICAI, itself is a good example of this automation.

ii) A student based on his registration number can file many documents online including exam forms.

iii) *It has features such as student's registration, student's admission, fee collection, student's attendance, result management, result analysis, library management, HR management, staff attendance, payroll system, timetable management.*

h) **Automated Toll Collection Systems:**

i) Many toll booths allow users to buy pre-paid cards, where user need not stop in lane to pay toll charges, but just swipe / wave the card in front of a scanner.

ii) *It has features such as real-time toll plaza surveillance system, automatic vehicle identification system (based on in-road sensors), license plate recognition, zoom capability on captured images, laser based toll audit systems, automated vehicle classification.*

i) **Department Stores Systems:**

i) There has been huge development in the retail sector in India, which includes the billing processes and inventory management.

ii) *It has features such as point of sale, multi-channel operation, supplier database, products database, purchase ordering, management reporting, loyalty schemes, stock control and inventory management.*

j) **File Management System:**

i) These allow office records to be kept in soft copy and easy tracking of the same.

ii) *It has features such as web access, search, Microsoft office integration, records management software, electronic forms (e-forms), calendar, etc.*

SIMILAR QUESTION:

1. **Discuss some of the applications that help enterprise to achieve Business Process Automation.**

TOPIC 3: CONTROLS IN BPA

Q.No.6. Define the term Control? What are the major Control Objectives in Business Process Automation (BPA)? (A) (PM, N15 - 4M, N14 RTP, N16 RTP, N14 MTP1 - 4M)

1. Control is defined as policies, procedures, practices and organization structure that are designed to provide reasonable assurance that business objectives are achieved and undesired events are prevented or detected and corrected.
2. Controls can be divided into two types:
   a) **Managerial Controls:** The controls at this level provide a stable infrastructure in which IS can be built, operated, and maintained on a day-to-day basis.
   b) **Application Controls:** These controls cover all phases of data right from data origination to its final disposal. **(M15 MTP1 - 2M)**
3. Major control objectives are given as follows:
   a) **Authorization:** Ensures that all transactions are approved by responsible personnel in accordance with their specific or general authority before the transaction is recorded.
   b) **Completeness:** Ensures that no valid transactions have been omitted from the accounting records.
   c) **Accuracy:** Ensures that all valid transactions are accurate, consistent with the originating transaction data, and information is recorded in a timely manner.
   d) **Validity:** Ensures that all recorded transactions fairly represent the economic events that actually occurred, are lawful in nature, and have been executed in accordance with management's general authorization. **(N15 RTP)**
   e) **Physical Safeguards and Security:** Ensures that access to physical assets and information systems are controlled and properly restricted to authorized personnel.
   f) **Error Handling:** Ensures that errors detected at any stage of processing receive prompts corrective action and are reported to the appropriate level of management.
   g) **Segregation of Duties:** Ensures that duties are assigned to individuals in a manner that ensures that no individual can control both the recording function and the procedures relative to processing a transaction.
4. The controls are used to Prevent, Detect, or Correct unlawful events.
   a) **Preventive:** those which prevent occurrences of an error say security guard.
   b) **Detective:** those which capture an error say audit trail.
   c) **Corrective:** those which correct an error or reduce the loss due to errors/risk say insurance policy.

Q.No.7. Explain various Managerial Controls in detail? (B)

1. **Top Management and Information Systems Management Controls:** **(M16 - 4M)**
   a) The senior managers who take responsibility for IS function in an organization face many challenges.

b) The major functions that a senior manager must perform are as follows:

i) Planning – determining the goals of the information systems function and the means of achieving these goals;

ii) Organizing – gathering, allocating, and coordinating the resources needed to accomplish the goals;

iii) Leading – motivating, guiding, and communicating with personnel.

iv) Controlling – comparing actual performance with planned performance as a basis for taking any corrective actions that are needed.

c) Top management must prepare two types of information systems plans a Strategic plan and an Operational plan.

2. Systems Development Management Controls:

a) Systems Development Management has responsibility for the functions concerned with analyzing, designing, building, implementing, and maintaining information systems.

b) Three different types of audits may be conducted during system development process.

Concurrent Audit	Auditors are members of the system development team. They assist the team in improving the quality of systems development for the specific system they are building and implementing.
Post implementation Audit	Auditors might be evaluating whether the system needs to be scrapped, continued, or modified in some way.
General Audit	Auditors evaluate systems development controls overall. They seek to determine whether they can reduce the extent of substantive testing needed to form an audit opinion about management's assertions relating to the financial statements for systems effectiveness and efficiency.

3. Programming Management Controls: **(N15 MTP2 - 3M)**

a) The program development life cycle comprises six major phases – Planning; Design; Control; Coding; Testing; and Operation and Maintenance with Control phase running in parallel for all other phases.

b) The purpose of the control phase during software development or acquisition is to monitor progress against plan and to ensure software released for production use is authentic, accurate, and complete.

Phases of Program Development Life Cycle

Phase	Controls
Planning	Techniques like Work Breakdown Structures (WBS), Gantt Charts and PERT (Program Evaluation and Review Technique) Charts can be used to monitor progress against plan.
Design	A systematic approach to program design, such as any of the structured design approaches or object-oriented design is adopted.
Coding	Programmers must choose a module implementation and integration strategy (like Top-down, bottom-up and Threads approach).
Testing	Three types of testing can be undertaken: • Unit Testing – which focuses on individual program modules; • Integration Testing – Which focuses in groups of program modules; and • Whole-of-Program Testing – which focuses on whole program. These tests are to ensure that a developed or acquired program achieves its specified requirements.

Operations & Maintenance	Three types of maintenance can be used. • Repair maintenance -- in which program errors are corrected; • Adaptive Maintenance -- in which the program is modified to meet changing user requirements; • Perfective Maintenance -- in which the program is tuned to decrease the resource consumption.

4. Data Resource Management Controls:

a) Data is a critical resource that must be managed properly. Accordingly, centralized planning and control must be implemented.

b) For data to be managed better users must be able to share data, data must be available to users when it is needed, in the location where it is needed, and in the form in which it is needed.

c) Careful control should be exercised over the roles by appointing senior, trustworthy persons, separating duties to the extent possible and maintaining and monitoring logs of the data administrator's and database administrator's activities.

5. Quality Assurance Management Controls: **(N15 RTP)**

a) Organizations are increasingly producing safety-critical systems and users are becoming more demanding in terms of the quality of the software they employ to undertake their work.

b) Organizations are undertaking more ambitious (determined) information systems projects that require more stringent quality requirements and are becoming more concerned about their liabilities if they produce and sell defective software.

6. Security Management Controls: **(N15 MTP1 - 2M)**

a) Information security administrators are responsible for ensuring that information systems assets are secure.

b) Some of the major threats and to the security of information systems and their controls are:

Major threats and their control measures

Threat	Control
Fire	Well-designed, reliable fire-protection systems must be implemented.
Water	Facilities must be designed and sited to mitigate losses from water damage
Energy Variations	Voltage regulators, circuit breakers, and uninterruptible power supplies can be used.
Structural Damage	Facilities must be designed to withstand structural damage.
Pollution	Regular cleaning of facilities and equipment should occur.
Unauthorized Intrusion	Physical access controls can be used.
Viruses and Worms	Controls to prevent use of virus-infected programs and to close security loopholes that allow worms to propagate.
Misuse of software, data and services	Code of conduct to govern the actions of information systems employees.
Hackers	Strong, logical access controls to mitigate losses from the activities of hackers.

7. Operations Management Controls:

a) Operations management typically performs controls over the functions like Computer Operations, Communications Network Control, Data Preparation and Entry, Production control, File Library; Documentation and Program Library; Help Desk/Technical support; Capacity Planning and Performance Monitoring and Outsourced Operations.

b) Operations management control must continuously monitor the performance of the hardware/software platform to ensure that systems are executing efficiently, an acceptable response time or turnaround time is being achieved.

Q.No.8. Discuss Boundary controls in detail? (A)

1. **Boundary control techniques:**

   a) **Cryptographic controls:** Cryptography achieves this goal by scrambling data into codes, that appear meaningless to anyone who does not have authentication to access the respective system resource or file. **(M16 - 2M, N14 MTP1 - 1M, M16 MTP1 - 1M)**

   b) **Passwords:** User identification by an authentication mechanism with personal characteristics like name, birth date, employee code, function, designation, etc. Or a combination of two or more of these can be used as a password boundary access control.

   c) **Personal Identification Numbers (PIN):** The personal identification number is similar to a password assigned to a user and encrypted using a cryptographic algorithm. *The application generates a random number stored in its database independent of user identification details or a customer selected number.* **(N15RTP)**

   d) **Plastic Cards:** **(N14RTP, M16 MTP2 - 1M)**

      i) Plastic / Identification cards store information required in an authentication process.

      ii) These cards are used to identify a user need to go through procedural controls like application for a card, preparation of the card, issue of the card, use of the card and return of the card or card termination phases.

   e) **Digital Signatures:** Digital Signatures establish the authenticity of persons and prevent the denial of messages or contracts when data is exchanged electronically. **(M16RTP)**

   f) **Access controls: (Refer 4th chapter Q.No: 31)** **(N14 MTP2 - 1M)**

Q.No.9. Discuss Input Controls in detail? (A) **(M15 RTP)**

1. Input Controls are responsible for ensuring the accuracy and completeness of data and instruction input into an application system.
2. Input controls are important since substantial time is spent on inputting data which involves human intervention and are therefore prone to errors and fraud.
3. Input control techniques are:

   a) **Source Document Control:**

      i) A well designed source document reduces the likelihood of data recording errors, increases the speed with which data be recorded and controls the work flow.

      ii) Source document controls facilitates the data entry into a computer system and subsequent reference checking.

   b) **Data Coding Controls:** These controls are put in place to reduce user error during data feeding.

   c) **Batch Controls:** **(N14 MTP1 - 2M)**

   These are put in place at locations where batch processing is being used. Batch processing is where there is a time gap between occurrence and recording of transactions, that is, transactions are not recorded at the time of occurrence but are accumulated and a set (based on number/ time) is processed.

d) Validation Controls: These validate the accuracy/correctness of input data. Input Validation Controls are intended to detect errors in transaction data before the data are processed.

Q.No.10. Discuss Process Controls in brief. (A) (M15 - 4M, M15 MTP2 - 1M)

1. Data processing controls perform validation checks to identify errors during processing of data.
2. They are required to ensure both the completeness and the accuracy of data being processed.

Some of them are:

1. **Run-to-run Totals:**
   - **a)** These help in verifying data that is subject to process data through different stages.
   - **b)** A specific record (probably the last record) can be used to maintain the control total.
2. **Reasonableness Verification:** Two or more fields can be compared and cross verified to ensure their correctness.
3. **Edit Checks:** Edit checks similar to the data validation controls can also be used at the processing stage to verify accuracy and completeness of data.
4. **Field Initialization:** Data overflow can occur, if records are constantly added to a table or if fields are added to a record without initializing it, i.e., setting all values to zero before inserting the field or record.
5. **Exception Reports:** Exception reports are generated to identify errors in data processed. *Such exception reports give the transaction code and why the particular transaction was not processed and what error in processing the transaction.*
6. **Existence/Recovery Controls:** The check-point/restart logs, facility is a short-term backup and recovery control that enables a system to be recovered if failure is temporary and localized.

Q.No.11. Discuss Output Controls in detail? (B) (N16 - 4M)

1. Output controls ensure that the data delivered to users will be presented, formatted and delivered in a consistent and secured manner.
2. Output can be in any form, it can either be a printed data report or a database file in a removable media such as a flash drive or CD-ROM or it can be a Word document on the computer's hard disk.
3. Whatever the type of output, it should be ensured that the confidentiality and integrity of the output is maintained and that the output is consistent.
4. **Storage and Logging of Sensitive and Critical Forms:**
   - **a)** Pre-printed stationery should be stored securely to prevent unauthorized destruction or removal and usage.
   - **b)** *Only authorized persons should be allowed access to stationery supplies such as security forms, negotiable instruments etc.*
5. **Logging of Output Program Executions:** When programs, used for output of data, are executed, they should be logged and monitored.
6. **Controls over Printing:** It should be ensured that unauthorized disclosure of information printed is prevented.
7. **Report Distribution and Collection Controls:**
   - **a)** Distribution of reports should be made in a secure way to avoid unauthorized disclosure of data.
   - **b)** A log should be maintained as to what reports were printed and which of them where collected. Uncollected reports should be stored securely.

8. **Retention Controls:**
   a) Retention controls consider the duration for which outputs should be retained before being destroyed.
   b) Consideration should be given to the type of medium on which the output is stored.
9. **Existence/Recovery Controls:** These controls are needed to recover output in the event that it is lost or destroyed. If the output is written to a spool of files or report files and has been kept, then recovery is easy and straight-forward.

Q.No.12. What do you understand by Database Controls? Discuss in brief? (B)
(M15 MTP2 - 2M)

1. Database controls protect the integrity of a database when application software acts as an interface to interact between the user and the database.
2. **Sequence Check Transaction and Master Files:**
   a) Synchronization and the correct sequence of processing between the master file and transaction file is critical to maintain the integrity of updation, insertion or deletion of records in the master file with respect to the transaction records.
   b) *If errors in this stage are overlooked, it leads to corruption of the critical data.*
3. **Ensure all records on files are processed:** While processing the transaction file records mapped to the respective master file the end-of-file of the transaction file with respect to the end-of-file of the master file is to be ensured.
4. **Process multiple transactions for a single record in the correct order:** Multiple transactions can occur based on a single master record. For example, dispatch of a product to different distribution centers. The order in which transactions are processed against the product master record must be done based on a sorted transaction codes.

Q.No.13. Discuss Communication Controls in detail? (B) (PM, M16 MTP1 - 4M, N16 MTP1 - 2M)

Communication Controls: Components in the communication subsystem are responsible for transporting data among all the other subsystems within a system and for transporting data to or receiving data from another system.

1. **Physical Component Controls:** These controls involve Transmission Media - Bounded (Guided) Media or Unbounded (Unguided) Media; Communication Lines – Private (Leased) or Public; Modems; Port Protection Devices; Multiplexors and Concentrators.
2. **Line Error Controls:** Whenever data is transmitted over a communication line, it can be received in error because of attenuation, distortion, or noise that occurs on the line. Error Detection (using Parity Checking, Cyclic Redundancy Checks (CRC) and Loop Check) and Error Correction (using forward Error Correcting Codes and Backward Error Correction) are major approaches under Line Error Controls.
3. **Flow Controls**: These are needed because two nodes in a network can differ in terms of the rate at which they can send receive and process data. The simplest form of flow control is "Stop-and-Wait Flow Control" in which the sender transmits a frame of data only when the receiver is ready to accept the frame.
4. **Link Controls:** This involves two common protocols – HDLC (Higher Level Data Control) and SDLC (Synchronous Data Link Control);
5. **Topological Controls:** A communication network topology specifies the location of nodes within a network, the ways in which these nodes will be linked, and the data transmission capabilities of the links between the nodes. Some of the four basic topologies include Bus, Ring, Star and Tree Topology. **(N16 RTP)**

6. **Channel Access Controls**: These techniques fall into two classes – Polling methods and Contention methods. Polling techniques establish an order in which a node can gain access to channel capacity; whereas in Contention methods, nodes in a network must compete with each other to gain access to a channel.

7. **Internetworking Controls:** Internetworking is the process of connecting two or more communication networks together to allow the users of one network to communicate with the users of other networks. Three types of devices are used to connect sub-networks in an Internet: Bridge, Router and Gateway.

SIMILAR QUESTION:

1. Explain different types of communication controls?

TOPIC 4: EMERGING TECHNOLOGIES

Q.No.14. What do you mean by the term Virtualization? Explain Major applications of Virtualization? (A) (M15 - 2M, N16 - 4M, N15RTP, M15 MTP1 - 5M)

1. It is the process of creating logical computing resources from available physical resources.

2. In computing, virtualization means to create a virtual version of a device or resource, such as a server, storage device, network or even an operating system where the framework divides the resource into one or more execution environments.

3. The core concept of Virtualization lies in Partitioning, which divides a single physical server into multiple logical servers. Once the physical server is divided, each logical server can run an operating system and applications independently.

Major applications:

a) **Server Consolidation:** Virtual machines (=servers created by virtualization software) are used to consolidate many physical servers into fewer servers, which in turn host virtual machines. This is also known as "Physical-to-Virtual" or 'P2V' transformation.

b) **Disaster Recovery:** Virtual machines can be used as "hot standby" environments for physical production servers. This changes the classical "backup-and-restore" philosophy, by providing backup images that can "boot" into live virtual machines, capable of taking over workload for a production server experiencing an outage.

c) **Testing and Training:** Hardware virtualization can give root access to a virtual machine. This can be very useful such as in kernel development or operating system environment.

d) **Portable Applications:** Portable applications are needed when running an application from a removable drive, without installing it on the system's main disk drive.

e) **Portable Workspaces:** Recent technologies have used virtualization to create portable workspaces on devices like iPods and USB memory sticks.

Q.No.15. Explain some common types of Virtualization? (A) (PM, M16 MTP2 - 4M)

Hardware Virtualization:

a) Hardware Virtualization or Platform Virtualization refers to the creation of a virtual machine that acts like a real computer with an operating system.

b) The basic idea of Hardware virtualization is to consolidate many small physical servers into one large physical server so that the processor can be used more effectively.

c) The software that creates a virtual machine on the host hardware is called a hypervisor or Virtual Machine Manager.

d) The hypervisor controls the processor, memory and other components by allowing several different operating systems to run on the same machine without the need for a source code.

e) The operating system running on the machine will appear to have its own processor, memory and other components.

Network Virtualization: **(M15 – 2M, M17-2M, M15 RTP, N15 RTP, M15 MTP1 - 5M)**

a) Network virtualization is a method of combining the available resources in a network by splitting up the available bandwidth into channels, each of which is independent from the others, and each of which can be assigned (or reassigned) to a particular server or device in real time.

b) This allows a large physical network to be provisioned into multiple smaller logical networks and conversely allows multiple physical LANs to be combined into a larger logical network.

c) This behavior allows administrators to improve network traffic control, enterprise and security. Network virtualization involves platform virtualization, often combined with resource virtualization.

Storage Virtualization: **(M16 - 2M)**

a) Storage virtualization is the apparent pooling of data from multiple storage devices, even different types of storage devices, into what appears to be a single device that is managed from a central console.

b) Storage virtualization helps the storage administrator perform the tasks of backup, archiving, and recovery more easily -- and in less time -- by disguising the actual complexity of a Storage Area Network (SAN).

c) Administrators can implement virtualization with software applications or by using hardware and software hybrid appliances.

d) The servers connected to the storage system aren't aware of where the data really is.

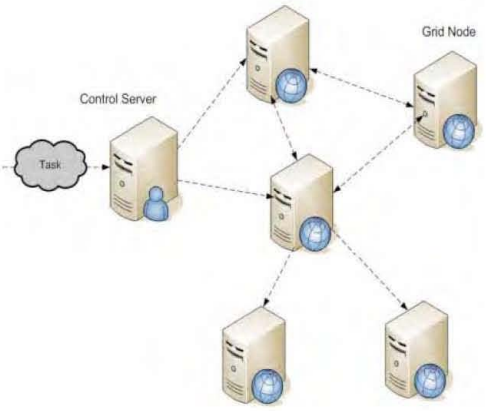
e) Storage virtualization is sometimes described as "abstracting" the logical storage from the physical storage.

SIMILAR QUESTION:

1. **Differentiate Hardware virtualization and Storage virtualization?** **(M17 MTP - 4M)**

Q.No.16. What is Grid Computing? Explain various application areas of Grid Computing? (A) (N14 – 4M, N14 RTP, M17-RTP,N14 MTP1 - 4M, M15 MTP1 - 3M)

1. Grid Computing is a computer network in which each computer's resources are shared with every other computer in a communication system.
2. Processing power, memory and data storage are allocated to authorized users then resources are accessed by users to perform specific tasks.
3. Grid computing is a form of distributed computing where a virtual computing system is created by using many loosely connected computing devices to perform a large computing task.
4. In distributed computing, different computers within the same network share one or more resources.
5. In the ideal grid computing system, every resource is shared, turning a computer network into a powerful supercomputer performance.



Application Areas of Grid Computing:

1. Civil engineers work together to design, execute, & analyze shake table experiments.
2. An insurance company mines data from partner hospitals for fraud detection.

3. An application service provider offloads excess load to a compute cycle provider.
4. An enterprise configures internal & external resources to support e-Business.
5. Large-scale science and engineering are done through the interaction of people, heterogeneous computing resources, information systems and instruments, all of which are geographically and organizationally distributed.

Q.No.17. What are the reasons of using Grid Computing? (B)
(N16 RTP, M15 MTP1 - 3M, M16 MTP2 - 4M, N16 MTP2 - 4M)

a) **Making use of Underutilized Resources:** Grid computing provides a framework for exploiting these underutilized resources and thus has the possibility of substantially increasing the efficiency of resource usage.

b) **Resource Balancing:** This feature of grid computing handles occasional peak loads of activity in parts of a larger organization. An unexpected peak can be routed to relatively idle machines in the grid; **(N16 RTP)**

c) **Parallel CPU Capacity:** A CPU-intensive grid application can be thought of as many smaller sub-jobs, each executing on a different machine in the grid.

d) **Virtual resources and virtual organizations for collaboration:** The users of the grid can be organized dynamically into a number of virtual organizations, each with different policy requirements. These virtual organizations can share their resources, collectively as a larger grid.

e) **Access to additional resources:** In addition to CPU and storage resources, a grid can provide access to other resources such as bandwidth to perform a complex task.

f) **Reliability:** The machines also use duplicate processors in such a way that when they fail, one can be replaced without turning the other off. Power supplies and cooling systems are also duplicated.

g) **Management:** The grid offers management of priorities among different projects. When maintenance is required, grid work can be rerouted to other machines without crippling (disabling) the projects involved.

SIMILAR QUESTION:

1. **Briefly explain grid computing benefits?**

Q.No.18. Discuss the constraints that need to be taken into consideration while developing a secured Grid Architecture? (B) (PM, M16 - 4M, M16 MTP1 - 2M,M17 MTP - 4M)

To develop secured grid architecture, following constraints are taken from the characteristics of grid environment and application.

a) **Single Sign-on:** A user should authenticate once and they should be able to acquire resources, use them, and release them and to communicate internally without any further authentication.

b) **Protection of Credentials:** User passwords, private keys, etc. should be protected.

c) **Interoperability with local security solutions:** Access to local resources should have local security policy at a local level. Despite of modifying every local resource there is an inter-domain security server for providing security to local resource.

d) **Exportability:** The code should be exportable i.e. they cannot use a large amount of encryption at a time. There should be a minimum communication at a time.

e) **Support for secure group communication:** In a communication there are number of processes which coordinate their activities. This coordination must be secure and for this there is no such security policy.

f) **Support for multiple implementations:** There should be a security policy which should provide security to multiple sources based on public and private key cryptography.

SIMILAR QUESTION:

1. **What are the rules and restrictions we should consider while developing secured Grid Architecture?**

Q.No.19. Which type of resources are shared among a group of users in Grid computing? Discuss in detail? (C)

Some resources may be used by all users of the grid, while others may have specific restrictions.

1. **Computation:** The most common resource is Computing Cycles provided by the processors of the machines on the grid where processors can vary in speed, architecture, software platform, and other associated factors such as memory, storage, and connectivity.
2. **Storage:** A grid providing an integrated view of data storage is sometimes called a Data Grid. Each machine on the grid usually provides some quantity of storage for grid use, even if temporary. Storage can be memory attached to the processor or it can be secondary storage, using hard disk drives or other permanent storage media.
3. **Communications:** Communications within the grid are important for sending jobs and their required data to points within the grid. The bandwidth & redundant communication paths are needed to better handle potential network failures.
4. **Software and Licenses:** The grid may have software installed that may be too expensive to install on every grid machine. License management software keeps track of how many concurrent copies of the software are being used and prevents more than that number from executing at any given time.
5. **Special equipment, capacities, architectures, and policies:** Platforms on the grid will often have different architectures, operating systems, devices, capacities, and equipment. Each of these items represents a different kind of resource that the grid can use as criteria for assigning jobs to machines.

Q.No.20. What is meant by Cloud Computing? (A) (N14 – 4M, M16 - 2M, M14RTP, N15RTP)

1. A cloud is a collection of servers, applications, databases, documents, agreements, spreadsheets, storage capacity etc which allows organizations to share these resources from anywhere.
2. Cloud Computing is the use of various services, such as software development platforms, servers, storage, and software, over the Internet, often referred to as the "cloud."
3. The best example of cloud computing is Google Apps where any application can be accessed using a browser and it can be deployed on thousands of computer through the Internet.
4. The common cloud computing service models are software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a service (IaaS).

Q.No.21. Explain different service models of cloud computing? (A) (PM, N14 MTP1 - 4M)

1. There are five Cloud Computing Service based models.
   a) **Software as a Service (SaaS):** **(N14 – 2M)**
      i) It includes a complete software offering on the cloud. Users can access a software application hosted by the cloud vendor on pay- per-use basis.
      ii) SaaS is a model of software deployment where an application is hosted as a service provided to customers across the Internet.

iii) By removing the need to install and run an application on a user's own computer.

iv) It is seen as a way for businesses to get the same benefits as commercial software with smaller cost outlay (expense).

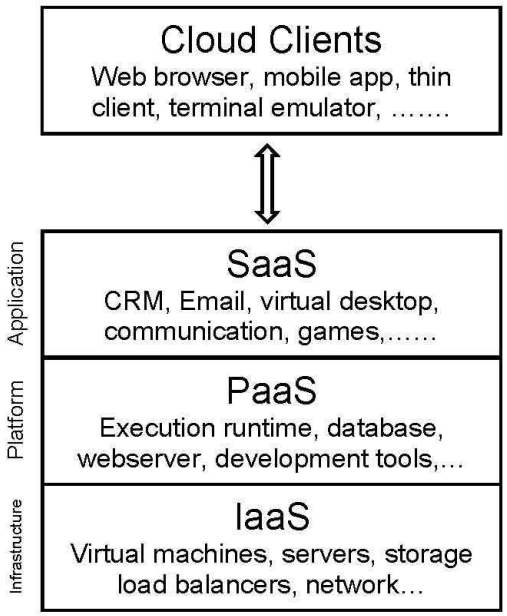
v) *SaaS can reduce the burden of software maintenance.*

b) Infrastructure as a Service (IaaS): **(N16 - 2M)**

i) It is the foundation of cloud services. It provides clients with access to server hardware, storage, bandwidth and other fundamental computing resources.

ii) The service is typically paid for on a usage basis.

iii) The service may also include dynamic scaling so that if the customer needs more resources than expected, they can get them on the fly (probably to a given limit). It provides access to shared resources on need basis, without revealing details like location and hardware to clients.



c) Platform as a Service (PaaS): **(M15 - 2M, N15 MTP2 - 2M)**

i) It provides clients with access to the basic operating software and optional services to develop and use software applications (e.g. database access and payment service) without the need to buy and manage the underlying computing infrastructure.

ii) It has evolved from Software as a Service (SaaS) and Infrastructure as a service (IaaS).

iii) *For example, Google App Engine allows clients to run their web applications (i.e. software that can be accessed using a web browser such as Internet Explorer over the internet) on Google's infrastructure.*

iv) The major drawback of Platform as a Service is that it may lock us into the use of a particular development environment and stack of software components.

d) Network as a Service (NaaS): **(M15-2M, N16 MTP1 - 2M)**

i) It is a category of cloud services where the capability provided to the cloud service user is to use network/transport connecting services.

ii) NaaS involves optimization of resource allocation by considering network and computing resources as a whole. Some of the examples are: Virtual Private Network, Mobile Network Virtualization etc.

e) Communication as a Service (CaaS): **(N16 MTP2 - 2M)**

i) CaaS has evolved in the same lines as SaaS.

ii) CaaS is an outsourced enterprise communication solution that can be leased from a single vendor.

iii) The CaaS vendor is responsible for all hardware and software management and offers guaranteed Quality of Service (QoS).

iv) It allows businesses to selectively deploy communication devices and modes on a pay-as-you-go, as- needed basis.

v) This approach eliminates the large capital investments. Examples are: Voice over IP (VoIP), Instant Messaging (IM).

Q.No.22. Explain the parts of cloud computing architecture? (B)
(PM, M16 - 2M, N15RTP, M15 MTP1 - 5M, M16 MTP2 - 4M)

1. A cloud computing architecture consists of two parts - Front End and Back End that connects to each other through a network, usually Internet.
2. Cloud computing architecture refers to the components and subcomponents.
3. Those are
   a) **Front end:** The front end of the cloud computing system comprises of the client's devices (or it may be a computer network) and some applications are needed for accessing the cloud computing system. All the cloud computing systems do not give the same interface to users.
   b) **Back end:** Back end refers to some physical peripherals. In cloud computing, the back end is cloud itself which may encompass various computer machines, data storage systems and servers.
   c) **Protocols:** There are some set of rules, generally called as Protocols which are followed by this server.
   d) **Middleware:** Middleware that allow computers that are connected on networks to communicate with each other.

SIMILAR QUESTION:

1. **Discuss Cloud Computing architecture?**

Q.No.23. What are the Characteristics of Cloud Computing? (B) (PM, M15 - 4M, M17-4M)

1. **Elasticity and Scalability:**
   a) Cloud computing gives us the ability to expand and reduce resources according to the specific service requirement.
   b) *For example, we may need a large number of server resources for the duration of a specific task. We can then release these server resources after we complete our task.*
2. **Pay-per-Use:** We pay for cloud services only when we use them, either for the short term or for a longer duration.
3. **On-demand:** Because we invoke cloud services only when we need them, they are not permanent parts of the IT infrastructure, this is a significant advantage for cloud use as opposed to internal IT services.
4. **Resiliency:** The resiliency of a cloud service offering can completely isolate the failure of server and storage resources from cloud users. Work is migrated to a different physical resource in the cloud with or without user awareness and intervention.
5. **Multi Tenancy:** Public cloud service providers often can host the cloud services for multiple users within the same infrastructure.
6. **Workload Movement:**
   a) This characteristic is related to resiliency and cost considerations.
   b) Cloud-computing provider migrates workload across servers both inside the data center and across data centers.

SIMILAR QUESTION:

1. **What are the features of cloud computing?**

Q.No.24. Discuss the Advantages and Disadvantages of Cloud Computing? (A)
(PM, M15 RTP, N15 MTP2 - 2M)

Advantages: **(N15 - 4M, M15 MTP2 - 5M, N16 MTP1 - 2M)**

1. **Cost Efficient:** Cloud computing is a cost efficient method to use, maintain and upgrade.
2. **Easy Access to Information:** It provides easy to access information from anywhere through an Internet connection.
3. **Almost Unlimited Storage:** Storing information in the cloud provides almost unlimited storage capacity.
4. **Backup and Recovery:** Since all the data is stored in the cloud, backing up and restoring is relatively much easier than storing the same on a physical device.
5. **Automatic Software Integration:** In the cloud, software integration is usually something that occurs automatically.
6. **Quick Deployment:** The entire system can be fully functional in a matter of a few minutes.

Disadvantages: **(M17 MTP - 2M)**

1. **Technical Issues:**
   a) This technology is always prone to outages and other technical issues.
   b) *Even the best cloud service providers run into this kind of trouble, in spite of keeping up high standards of maintenance. We will invariably be stuck in case of network and connectivity problems.*
2. **Security in the Cloud:** Surrendering all the company's sensitive information to a third-party cloud service provider could potentially put the company to great risk.
3. **Prone to Attack:**
   a) Storing information in the cloud could make the company vulnerable to external hack attacks and threats
   b) *Nothing on the Internet is completely secure and hence, there is always the possibility of losing sensitive data.*

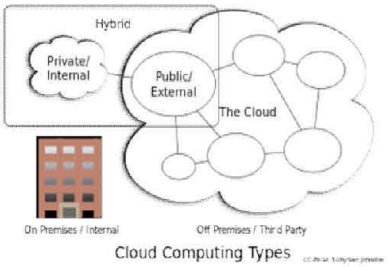
SIMILAR QUESTION:

1. **What are the benefits and risks of using cloud computing?**

Q.No.25. Explain various deployment models? (A)
(PM, N14 – 4M, N14RTP, N14 MTP2 - 4M, M16 MTP1 - 4M, M17 MTP-4M)

The cloud computing environment can consist of multiple types of clouds based on their deployment and usage.

1. **Public Clouds:**
   a) The public cloud is made available to the general public or a large industry group. They are administrated by third parties or vendors over the Internet, and services are offered on pay-per-use basis.
   b) Public clouds are also known as external clouds.
   c) The key benefits are:
      i) It is widely used in the development, deployment and management of enterprise applications, at affordable costs;
      ii) It allows organizations to deliver highly scalable and reliable applications rapidly and at more affordable costs.



2. **Private Clouds:**
   a) This cloud computing environment resides within the boundaries of an organization and is used exclusively for the organization's benefits.
   b) These are also called internal clouds.
   c) The benefit is that it enables an enterprise to manage the infrastructure and have more control. It provides high security and scalability but is expensive.
3. **Community Clouds:**
   a) This is the sharing of computing infrastructure in between organizations of the same community.
   b) For example, all Government organizations within India may share computing infrastructure on the cloud to manage data.
   c) The risk is that data may be stored with the data of competitors.
4. **Hybrid Clouds:**
   a) It is maintained by both internal and external providers.
   b) It is a composition of two or more clouds (Private, Community or Public).
   c) They have to maintain their unique identity, but are bound together by standardized data and application portability.

SIMILAR QUESTION:

1. **Describe different types of clouds in cloud computing environment.**

QUESTIONS FOR ACADEMIC INTEREST – FOR STUDENT SELF STUDY

Q.No.26. What are the applications based on nature of processing? (B)

1. **Batch Processing:** **(N16 RTP)**
   a) It is defined as a processing of large set of data automatically, without any need of any user intervention.
   b) The data is first collected, and then batch-processed, so all the collected data is processed in one step.
   c) Batched jobs can take a long time to process.
   d) Batch processing is used in producing bills, stock control, producing monthly credit card statements, etc
2. **Online / Interactive Processing:**
   a) Data is processed immediately while it is entered, the user usually has to wait a short time for a response. (Example: games, word processing, booking systems).
   b) It enables the user to input data and get the results of the processing of that data immediately. **(N15 - 1M)**
3. **Real-time Processing:** **(N15 - 1M, N15 MTP1 - 2M, N16 MTP2 - 2M)**
   a) Real time processing is a subset of interactive or online processing. Input is continuously, automatically acquired from sensors, which is processed immediately in order to respond to the input in as little time as possible.
   b) After the system finishes responding, it reads the next set of input data immediately to process that.

c) This system doesn't need a user to control it, it works automatically.

d) EX: warning systems on aircraft, alarm systems in hazardous zones, burglar alarms etc.

Q.No.27. What are the applications based on Source of Application? (C)
(M16 RTP, M17 MTP-2M)

1. **Custom-built Application:**
   a) These applications can be configured to meet a particular company's requirements.
   b) Customization involves additional coding/ programming while configuration is based on settings which are inputted by the user.
   c) Example – Billing, Inventory, Attendance etc.
2. **Packaged Software:**
   a) These are the standard applications which are not free but are licensed. Customization to suit business requirements may or may not be allowed.
   b) It is less expensive than customized application.
   c) For Example -Tally, Oracle 9i, etc.
3. **Leased Application:** **(N15 RTP)**
   a) Leased applications, where user pays fixed rent for using the application for agreed terms.
   b) Many specialized vendors provide users with option to get their job done by paying monthly rent; this is referred to as outsourcing.

Q.No.28. What are Applications based on Size and Complexity of Business (C)

1. **Small and Medium Enterprise (SME) business:**
   a) The best software for small and medium businesses is software designed to help them to run their operations better, cut costs and replace paper processes.
   b) The most popular software packages include accounts, office productivity, email and communications.
2. **Large Business:**

   Business applications that are designed for large business includes:
   a) CRM, for recording customer information and finding out trends in buying habits
   b) Sales force automation,
   c) human resources software
   d) Business intelligence and dashboard tools
   e) Database management systems
   f) Enterprise resource planning
   g) Supply chain management tools.

Q.No.29. Explain the Business applications based on nature of application? (A)
(M17-RTP)

1. A business application may also be classified based on business function it covers. Some of them are
   a) **Accounting Applications:** Accounting applications range from application software such as TALLY and wings to high-end applications such as SAP and Oracle Financials. *These are used by business entities for generating financial information such as balance sheet, profit and loss account and cash flow statements.*

b) **Office Management Software:** These applications help entities to manage their office requirements like word processors (MS Word), electronic spreadsheets (MS Excel), presentation software (PowerPoint), file sharing systems, etc. *The purpose is to automate the day-to-day office work and administration.*

c) **Compliance Applications:** Enterprises need to comply with applicable laws and regulations.

d) **Customer Relationship Management Software:** These are specialized applications *support* companies *to interact with their customers and respond to them. The response may be in the form of service support or may lead to product innovation.*

(N14 MTP2-1M, M16 MTP1-1M)

e) **Management Support Software:** These are applications catering to decision-making needs of the management. EX: DSS, EIS. **(M16 MTP2-1M)**

f) **ERP Software:** These applications called as Enterprise Resource planning software, which are used by entities to manage resources optimally and to maximize the three Es i.e. Economy, Efficiency and Effectiveness of business operations.

g) **Product Lifecycle Management Software:** These business applications are used by enterprises that launch new products and are involved in development of new products.

h) **Logistics Management Software:** For large logistics managing companies, these are key business applications. These companies need to keep track of products and people across the globe to check whether there are any discrepancies that need action.

i) **Legal Management Software:** In India, a lot of effort is being put to digitize the legal system. Government of India is keen to reduce the pendency in courts. *As this process goes on legal profession in India shall need such systems.*

j) **Industry Specific Applications:** These are industry specific applications focused on a specific industry sector. For example, software designed especially for banking applications, billing systems for malls, Cinema ticketing software, Travel industry related software, etc.

Q.No.30. Discuss Grid Computing w.r.t user perspective in detail? (B)

Grid w.r.t user perspective:

a) **Enrolling and installing Grid software:** The user positively establishes his identity with a Certificate Authority. Once the user and/or machine are authenticated, the grid software is provided to the user for installing on his machine for the purposes of using the grid as well as donating to the grid.

b) **Logging onto the grid:** Most grid systems require the user to log on to a system using an ID that is enrolled in the grid. Once logged on, the user can query the grid and submit jobs.

c) **Queries and submitting jobs:** Grid systems usually provide command-line tools as well as graphical user interfaces (GUIs) for queries. Job submission usually consists of three parts.

   i) First, some input data and possibly the executable program or execution script file are sent to the machine to execute the job.

   ii) Second, the job is executed on the grid machine. The grid software running on the donating machine executes the program in a process on the user's behalf.

   iii) Third, the results of the job are sent back to the submitter.

d) **Data configuration:** The data accessed by the grid jobs may simply be staged in and out by the grid system. However, depending on its size and the number of jobs, this can potentially add up to a large amount of data traffic. This type is necessary for large jobs to better utilize the grid and not create unnecessary bottlenecks.

e) **Monitoring progress and recovery:** The user can query the grid system to see how his application and its sub-jobs are progressing. A grid system, in conjunction with its job scheduler, often provides some degree of recovery for sub-jobs that fail. A job may fail due to a Programming error, Hardware or power failure, Communications interruption, and Excessive slowness due to infinite loop or some other form of contention.

f) **Reserving resources:** To improve the quality of a service, the user may arrange to reserve a set of resources in advance for his high priority use.

Q.No.31. Discuss Grid Computing w.r.t An Administrative perspective in detail? (B)

Grid w.r.t An Administrative perspective:

a) **Planning:** The administrator should understand the organization's requirements for the grid to better choose the grid technologies that satisfy grid's requirements. One of the first considerations is the hardware available and how it is connected via a LAN or WAN. Next, an organization may want to add additional hardware to supplement the capabilities of the grid.

b) **Security:** Security is a much more important factor in planning and maintaining a grid where data sharing comprises the bulk of the activity. It is important to understand the issues involved in authenticating users and providing proper authorization for specific operations.

c) **Organization:** It is important to understand how the departments in an organization interact, operate, and contribute to the whole.

d) **Installation:** First, the selected grid system must be installed on an appropriately configured set of machines. These machines should be connected using networks with sufficient bandwidth to other machines on the grid.

e) **Managing enrollment of donors and users:** The administrator is responsible for controlling the rights of the users in the grid. The rights of these grid user IDs must be properly set so that grid jobs do not allow access to parts of the donor machine to which the users are not entitled.

f) **Certificate Authority:** An organization may choose to use an external Certificate Authority or operate one itself. **(M16 MTP2 - 2M)**

The primary responsibilities of a Certificate Authority are:

i) Positively identifying entities requesting certificates;

ii) Issuing, removing, and archiving certificates;

iii) Protecting the Certificate Authority server;

iv) Maintaining a namespace of unique names for certificate owners;

v) Serving signed certificates to those needing to authenticate entities; and

vi) Logging activity.

g) **Resource Management:** Setting permissions for grid users to use the resources as well as tracking resource usage.

h) **Data sharing:** As a grid grows and the users become dependent on any of the data storage repositories, the administrator should consider procedures to maintain backup copies or replicas to improve performance.

Q.No.32. Differentiate manual information processing cycle and computerized information processing cycle? (B) (PM, M16 MTP1 - 4M) ***(For Student Self-study)***

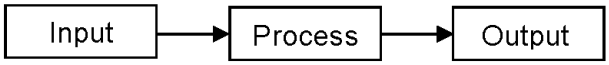
1. **Information Processing:**
   a) Information may be defined as processed data, which is of value to the user.
   b) Information is necessary for making right decisions at the right time on the basis of the right information available.
   c) The effort to create information from raw data is known as Information Processing.
2. **Manual Information Processing Cycle:**
   a) Systems where the levels of manual intervention is very high. For example - evaluation of examination papers, teaching and operations in operation theaters.

b) Components of manual information processing cycle include:

i) Input : Put details in register.

ii) Process : Summarize the information.

iii) Output : Present information to management in the form of reports.



3. Computerized Information Processing Cycle: **(M15 - 2M,M17 - 2M)**

a) These are systems where computers are used at every stage of transaction processing and human intervention is minimal.

b) The components of a computerized information processing cycle include:

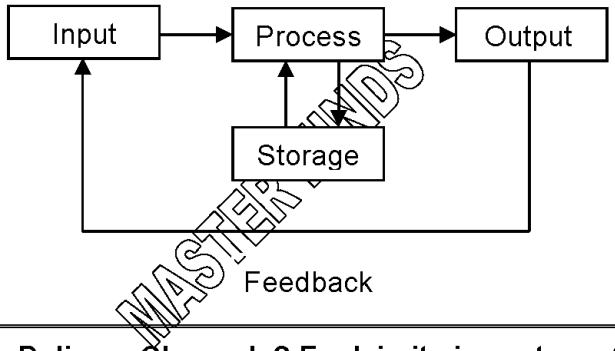
i) Input: Entering data into the computer;

ii) Processing: Performing operations on the data;

iii) Storage: Saving data, programs, or output for future use

iv) Output: Presenting the results.

v) Feedback: for control purpose



Q.No.33. Write short notes on Delivery Channels? Explain its importance? (C) (N14 - 4M)

1. Delivery channels refer to the mode through which information or products are delivered to users. For example,

2. Delivery channels for information:

a) Intranet: Network within the company/enterprise

b) E-mail: The most widely used delivery channel for information today

c) Internal newsletters and magazines

d) Staff briefings, meetings and other face-to-face communications methods

e) Notice boards in communal areas;

f) Manuals, guides and other printed resources

g) Hand-held devices (PDAs, etc)

h) Social networking sites, like Facebook, Whatsapp, etc.

3. Delivery channels for products :

a) Traditional models, brick and mortar type

b) Buying from a shop

c) Home delivery of products

d) Buying online, getting home delivery and making cash payment on delivery.

4. ***Importance:*** *It is important to have proper and accurate delivery channels for information or product distribution and to consider each of these channels while planning an overall information management and communications* strategy.

SIMILAR QUESTION:

1. **List out the types of delivery channels through which information is delivered to the user.**

THE END