

CHAPTER 1 – BUSINESS PROCESS MANAGEMENT & IT

1. WHAT IS A PROCESS?

From a business perspective, a process is a coordinated and standardized flow of activities performed by people or machines, which can traverse functional or departmental boundaries to achieve a business objective and creates value for internal or external customers.

2. BUSINESS PROCESS MANAGEMENT (BPM)

- ✓ BPM refers to the closed loop, iterative management of business processes over their complete lifecycle.
- ✓ BPM may be defined as: “The achievement of an organization’s objectives through the improvement, management and control of essential business processes”.
- ✓ Primary benefit of using technology for BPM:
 - automated coordination of activities
 - Distribution of tasks
 - Creation of basic operational value proposition

3. BPM PRINCIPLES AND PRACTICES

The primary objective of BPM is

- ✓ to improve products and services through
- ✓ structured approach to performance improvement that
- ✓ centers on systematic design and management of a company’s business processes.

Some of the key BMP principles

1. processes are assets
2. produces consistent value to customers
3. continuous improvement of processes.

Some of the key BMP practices

1. Appoint process owner.
2. Create process oriented structure
3. Put in place Information Technology

4. BPM IMPLEMENTATION

- ✓ develop a mindset
- ✓ BPM implementation is enormous
- ✓ easier with BPM tools
- ✓ BPM helps organizations optimize both work and revenues.

5. KEY FACTORS AND RELATED CONSIDERATION IN IMPLEMENTING BPM

- 1) **Scope** – A single process, A department , the entire company

- 2) **Goals** – Process understanding, improvement, re-engineering, and optimization.
- 3) **Skills required**-basic education, formal certification, consultants.
- 4) **Sponsorship Needed** - Executive Level, Department Level, Process Owner Level etc
- 5) **Methods to be used**: Six Sigma, BPM Life Cycle Method, TQM, Informal methods
- 6) **Tools to be used**: White-Boards, Sticky Notes, Software For Mapping etc.

6. BENEFITS OF BPM

- ✓ Managing large amounts of documents and data.
- ✓ The business can rearrange process steps and add in manual steps quickly.
- ✓ Reduced Process Costs due to increased quality / reduced no of errors.
- ✓ Reduced training time, expenses and internal support request.

7. NEED FOR A BPM IMPLEMENTATION

1. Create the long-term future positioning of the business and enhance its future capability
2. Introduce a knowledge of product and customer profitability
3. Re-engineer the business radically

8. CHALLENGES IN IMPLEMENTING BPA

- ☒ The number of interfaces with the customers is growing (e.g. phone, fax, email, sms, PDA, etc.)
- ☒ The product, service and price options have increased the complexity of the business.
- ☒ Budgets are being cut

9. BUSINESS PROCESS AUTOMATION (BPA): BENEFITS & RISKS

Benefits

1. Saving on costs:
2. Staying ahead in competition:
3. Fast service to customers:

Risks

1. Risk to jobs:
2. False sense of security:

10. ACCOUNTING SYSTEMS AUTOMATION

- ❖ AIS is defined as a system of collection, storage and processing of financial and accounting data that is used by decision makers.

Basic Functions of an Accounting Information System (AIS)

There are three basic functions of AIS and these are explained here.

- a. Collect and store data
- b. Record transaction
- c. Safeguarding organisational assets

11. PROCESSING CYCLES OF AN ACCOUNTS BPM

Financing Cycles: recognition of a major economic

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Revenue Cycle: It includes transactions relating to revenue and involves accounts like Sales, Accounts Receivable, Inventory

Expenditure Cycle: It includes transactions relating expenditures and involves accounts like Purchases, Accounts Payable, Cash Disbursements

Human Resource Cycle: Common Source Documents & Functions:

General Ledger & Reporting System:

Data Processing Cycle:

- If the process of updating of the data stored is periodic, it is referred to as batch processing and if involves immediate updating as each transaction occurs, it is referred to as on-line, real-time processing.
- 4 steps:
 1. *Data input*
 2. *Data storage*
 3. *Data processing*
 4. *Information output*

12. BENEFITS OF BPMS

- 1) **Automating repetitive business processes:**
- 2) **BPMS works by 'loosely coupling' with a company's existing applications:**
- 3) **Operational Savings:**
- 4) **Reduction in the administration involved in Compliance and ISO Activities:**
- 5) **Freeing-up of employee time:**

13. REASONS FOR FAILURE OF BPMS ARE

- ☒ Superficial or deficient executive involvement
- ☒ Failure to identify future business needs
- ☒ Resources not available when desirable
- ☒ Technological obsolescence.

14. INFORMATION AS A BUSINESS ASSET

- ❖ Information can be treated as a valuable commodity if it can be used effectively.
- ❖ To achieve operational efficiency, information technology must be tailored to an organisation's need for CRM, ERP etc.

15. MAPPING SYSTEMS:

Accountants/Auditors need not to learn complex programming languages but they must understand the documents that describes how processing take place.

This document includes flowcharts, narrative and other written communication that describe Input, Processing & Output.

Why Documentation is Important???

1. Depicting how the system works:
2. Training users:
3. Designing new systems:

4. Controlling system development and maintenance cost:

Various types of mapping systems are

1. Entity-Relationship Diagrams	2. Data flow diagrams
3. Flowcharts	4. Decision trees
5. Decision table, etc.	

16. ENTITY-RELATIONSHIP DIAGRAMS

An E-R diagram can express the overall logical structure of a database graphically. E-R diagrams are simple and clear-qualities that may well account in large part for the widespread use of three-R model.

- ✓ Boxes are commonly used to represent entities.
- ✓ Diamonds represent relationship sets.

Types of Relationship

- (a) One to One Relationship
- (b) One to Many
- (c) Many to One
- (d) Many to Many

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Advantages of using E-R Diagram

1. ER Modeling is simple and easily understandable
2. Intuitive and helps in Physical Database creation.
3. Can help in database design.
4. Can be generalized and specialized based on needs.

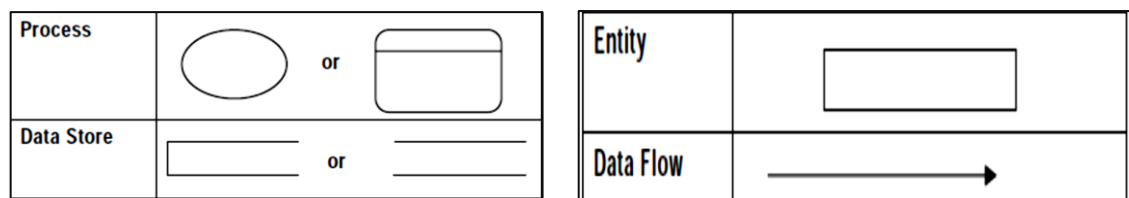
Limitations of using E-R Diagram

1. Physical design derived from E-R Model may have some amount of ambiguities or inconsistency.
2. Sometime diagrams may lead to misinterpretations.

Example 1: Refer book

17. DATA FLOW DIAGRAMS

- ✓ A data flow diagram (DFD) graphically describes the flow of data within an organization. It is used to document existing systems and to plan and design new ones. DFDs can also be used for the visualization of data processing (structured design).



The four major DFD component's symbols

1. **Entity:**
 - a. An entity is the source or destination of data.
 - b. Entities either provide data to the system or receive data from it.
2. **Process:**

- a. The process is the manipulation or work that transforms data, performing computations, making decisions (logic flow), or directing data flows based on business rules.
3. **Data Store:**
 - a. A data store is where a process stores data between processes for later retrieval by that same process or another one.
4. **Data Flow:**
 - a. Data flow is the movement of data between the entity, the process and the data store.

Advantages of using Data Flow Diagram

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1. It aids in describing the boundaries of the system.
2. It is beneficial for communicating existing system knowledge to the users.
3. DFDs can provide a detailed representation of system components.
4. DFDs are easier to understand by technical and nontechnical audiences

Limitations of using Data Flow Diagram

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1. It make the programmers little confusing concerning the system.
2. The biggest drawback of the DFD is that it simply takes a long time to create,
3. Physical considerations are left out.

Context Diagram

The Context Diagram is a high-level DFD that shows the entire system as a single process and shows the interaction between the system and external agents which act as data sources and data sinks, and gives no clues as to its internal organization.

18. FLOWCHARTS

- ✓ A flowchart is a type of diagram that represents an algorithm or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows.
- ✓ Flowcharting symbol (only relevant at our level has been taken here)

	<u>Terminator:</u> Used at the beginning and end of a program or subroutine.
	<u>Process:</u> Such as performing arithmetic.
	<u>Decision:</u>
	<u>Input/output operations.</u>
	<u>Connector:</u>
	When <u>Hardcopy output</u> is required or document to be printed.

Types of flowchart:-

1. **Document Flowchart** : traces the physical flow of documents
2. **System flow charts** → electronic flow of data and processing steps in an Information System.
3. **Program flowcharts**: detailed and is concerned with the logical/arithmetic operations on data within the CPU

BENEFITS OF FLOWCHARTS

1. *Quicker grasp of relationships –*
2. *Effective Analysis –*
3. *Communication –*
4. *Documentation –*

THE LIMITATIONS OF FLOWCHARTS ARE GIVEN BELOW:

- 1) *Complex logic –*
- 2) *Modification –*
- 3) *Link between conditions and actions –*
- 4) *Standardization –*

19. DIFFERENCE BETWEEN FLOWCHART AND DATA FLOW DIAGRAM

Flowchart	Data Flow Diagram
Flow chart presents steps to complete a process.	DFD presents the flow of data.
Flow chart does not have any input from or output to an external source.	DFD describes the path of data from an external source to internal source or vice versa.
Flow chart shows how to make a system function.	DFD define the functionality of a system.
Flow chart is used in designing a process.	DFD is used to describe the path of data that will complete that process.
Types of Flow charts – System, Data, Document and Program.	Types of DFD – Physical Data Flow and Logical Data Flow.

20. DECISION TREE

A decision tree is a way of representing combinations of decisions within a system as a diagram.

Advantages of using Decision Tree

- Are simple to understand and interpret.
- Possible scenarios can be added.
- Worst, best and expected values can be determined for different scenarios.

Limitations of using Decision Tree

- For data including categorical variables with different number of levels
- Calculations can get very complex particularly if many values are uncertain

21. DECISION TABLE

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A decision table is a table containing various conditions that are possible in a given state of problem and the actions that are to be followed in each course.

PARTS OF DECISION TABLE

Condition Stub	Condition Entries
Action Stub	Action Entries

Part	Meaning
Condition Statements	State the several conditions to consider in making a decision
Condition Entries	Entries that complete condition statements using Y, N, -, etc.
Action Statements	actions to be taken when a certain combination of conditions exist.
Action Entries	Entries that complete the action statements using X, blank etc.
Rules	Unique combinations of conditions and actions
Header	Title identifying in the table.
Rule Identifiers	Codes R1, R2, R3... uniquely identifying each rule.
Condition Identifiers	Codes uniquely identifying each condition statements/entry.
Action Identifiers	Codes A1, A2, A3... uniquely identifying each action statement/entry.

Advantages of using Decision Table

1. *Easy to Draw*
2. *Compact Documentation*
3. *Simplicity*
4. *Better Analysis*
5. *Non-technical*

Limitations of using Decision Table

1. All programmers may not be familiar with Decision Tables and therefore flow charts are more common
2. Flowcharts can better represent a simple logic of the system rather than a decision table.
3. Decision tables do not express total sequence of the events needed to solve the problem.

22. BUSINESS PROCESS RE-ENGINEERING (BPR):

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1. BPR is the fundamental rethinking, radical redesign of processes to achieve dramatic improvement, in critical measures of performance such as cost, quality, service & speed.
 - a. **Dramatic Achievement** means to achieve 80% or 90% reduction in delivery time etc.
 - b. **Radical redesign** means BPR is reinventing & not enhancing or improving.
 - c. **Fundamental rethinking** eliminating business processes altogether if it does not add any value to the customer.

BPR Success factors

1. Organization wide commitment:
2. BPR team composition:
3. Business needs analysis:
4. Adequate IT infrastructure:
5. Effective change management:
6. Ongoing continuous improvement:

23. SIX SIGMA:

Six Sigma is a set of strategies, techniques, and tools for process improvement. It follows a life-cycle having phases: Define, Measure, Analyze, Improve and Control (or DMAIC)

Define: Customers are identified and their requirements are gathered

Measure: Variances of output measures are graphed and process sigma are calculated.

Analyze: Using statistical methods causes of process output variations are identified.

Improve: Solution alternatives are generated to fix the root cause.

Control: Process is standardized and documented.

24. BPM LIFE CYCLE (BPM-L) –

Business Process Management-Life cycle establishes a sustainable process management capability that empowers organizations to embrace and manage process changes successfully.

- 1) **Analysis phase:**
- 2) **Design phase:**
- 3) **Implementation phase:**
- 4) **Run and Monitor phase:**
- 5) **Optimize:**

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25. TOTAL QUALITY MANAGEMENT (TQM)

TQM is a management mechanism **designed to improve a product or process** and aims at improving the quality of the products produced and the process utilized. TQM processes are divided into four sequential categories: Plan, Do, Check, and Act (the PDCA cycle)

Plan: define the problem to be addressed

Do: develop and implement a solution

Check: confirm the results through before-and-after data comparison;

Act: document results; recommendations for the problem to be addressed in the next PDCA cycle.

26. BPM TECHNOLOGY

BPM technology can complement existing (and future) investments in applications and give organizations the ability to implement a real – time process improvement without the extensive process conversion efforts.

Classify each of the following items as belonging in the revenue, expenditure, human resources/payroll, production, or financing cycle.

- | | | |
|--|---|-------------------------------|
| (a) Purchase raw materials | (b) Decide how many units to make next month | |
| (c) Pay for raw materials | (d) Disburse payroll checks to factory workers | |
| (e) Hire a new assistant controller | (f) Update the allowance for uncollectible accounts | |
| (g) Establish a 10,000 credit limit for customer XYZ Company | | |
| (a) Expenditure Cycle | (b) Production Cycle | (c) Expenditure Cycle |
| (d) Payroll Cycle | (e) Payroll Cycle | (f) Financial Reporting Cycle |
| (g) Revenue Cycle | | |

CHAPTER 2 - INFORMATION SYSTEMS AND IT FUNDAMENTALS

1. IMPORTANCE OF IT IN AUDITING

- ✓ Accountants and Auditors in their various roles ranging from accounting to auditing have to use technology to perform their jobs effectively and efficiently.
- ✓ **Auditors will have to provide assurance on the security, effectiveness, and reliability of information, applications, and new and effective business practices and processes.**

2. AUDITING IN IT ENVIRONMENT

- ❖ Evaluating and reporting the adequacy of system controls, efficiency, economy, effectiveness, and security practices
- ❖ To assure that assets and information resources are safeguarded,
- ❖ That data integrity is protected, and
- ❖ That the system complies with applicable policies, rules, laws and regulations.

3. IT RISKS AND ISSUES

- ✓ Regulations are making it mandatory for auditors to review the structure and systems of governance and risk management which is embedded in IT in most enterprises.
- ✓ The scope and objective of assurance do not change with technology but the way controls are reviewed is drastically changed.

4. NEED FOR CONTROLS IN INFORMATION SYSTEMS

A well designed information system should have controls built-in for all its sensitive or critical sections. It include:

1. Access to IT resources, including data and programs;
2. System development methodologies and change control;
3. Quality Assurance Procedures;
4. Physical Access Controls;
5. Business Continuity Planning (BCP) and Disaster Recovery Planning (DRP);
6. Network and Communication;

5. IMPACT OF IT ON RISKS AND CONTROLS

Risks:

1. **Ready access to terminals:**
2. **On-line processing of data and validation**
3. **Appropriate controls are not resident within the computer**
4. **The greatest exposure of all is a failure to recognize risks**

CONTROLS

The **four major areas** in which controls have been affected are:

1. Realignment of functions data entry
2. Changes in custody of files and documents.

3. Transfer of responsibilities
4. Decline of accountability

6. AUDITORS' CONCERN

1. Develop and apply new criteria in evaluating control weaknesses
2. Tailor testing techniques to the CIS under study; and
3. Use computers to perform some portions of audit examination.

7. BUSINESS PROCESS MANAGEMENT

Business Process Management (BPM) is the methodology used by enterprises to improve end-to-end business processes in various stages.

An Enterprise Resource Planning (ERP) application divides BPM into the following phases:

1. ***Analysis phase:***
2. ***Design phase:***
3. ***Implementation phase:***
4. ***Run and Monitor phase:***

8. BUSINESS PROCESS AUTOMATION

BPA application ties up the following activities [CRITICAL PILLERS]:

- a. **Integration**: pass and modify data between the **component applications**.
- b. **Orchestration**: ability to bring different business departments or branches under one umbrella.
- c. **Automation**: **Orchestration and integration unite with automation** enable a more effective, nimble and efficient business process.

Some benefits of pursuing such automation include:

- a. Reducing the Impact of Human Error:
- b. Transforming Data into Information
- c. Improving performance and process effectiveness
- d. Making users more efficient and effective
- e. Making the business more responsive
- f. Improving Collaboration and Information Sharing

9. IT PROCESSES INVOLVED IN A TYPICAL BUSINESS ENTERPRISE

1. ***Database access and changes***
2. ***File replication and data backup:***
3. ***Systems and event log monitoring:***
4. ***Job scheduling:***
5. ***Application integration:***
6. ***File transfers:***
7. ***Printing:***

10. COMPUTING TECHNOLOGIES

Server

A server is a computer (Hardware) or device on a network dedicated to run one or more services (as a host), to serve the needs of the users of other computers on a network.

Types of Servers:

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1. **File server:** computer and storage device dedicated to storing files.
2. **Print server:** This is a computer that manages one or more printers.
3. **Network server:** This is a computer that manages network traffic.
4. **Database server:** This is a computer system that processes database queries.
5. **Application Server:** handles all application operations
6. **Web Servers:** deliver (serves up) web pages. Any computer can be turned into a Web server by installing server software and connecting the machine to the Internet.
7. **Mail Server:** Mail servers move and store mail over corporate networks.

Popular Computing Architecture

- ✓ **Instruction Set Architecture (ISA):** Instruction Set Architecture (ISA) is related to how the computer understands what each element in its basic language.
 - ***Complex Instruction Set Computer (CISC):*** If the control unit contains a **number of micro-electronic circuitry** and each **micro-circuitry** is **activated** by a **micro-code**, this design approach is called CISC design. In this Variable length instructions are commonly used and less space is required.
 - ***Reduced Instruction Set Computer (RISC):*** When separate electronic circuitry produces all the necessary signals, this approach is called RISC design. In this Fixed length instructions are commonly used so job of fetching & decoding instructions is more efficient.
- ✓ **Micro architecture:** detailed description of the system. It can be seen as how the ISA does and what it does.
- ✓ **Multi-processing, virtualization,**
 - ***Multiprocessing*** is the use of two or more Central Processing Units (CPUs) within a single computer system to allocate tasks between them.
 - ***Hardware Virtualization*** refers to the creation of a virtual machine that acts like a real computer with an operating system.

11. CLOUD COMPUTING

Cloud Computing: 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."

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12. CLOUD COMPUTING ENVIRONMENT

The cloud computing environment can consist of multiple types of clouds which are as follows:

- a) **Public Clouds:**
 - a. This environment can be used by the general public. This includes individuals, corporations and other types of organizations.
 - b. Public clouds are administrated by third parties or vendors over the Internet
 - c. Services are offered on pay-per-use basis.
 - d. Moreover, one of the limitations is security assurance.
- b) **Private Clouds:**
 - a. This cloud computing environment resides within the boundaries of an organization and is used exclusively for the organization's benefits.
 - b. It enables an enterprise to manage the infrastructure and have more control.

- c. But main limitation is that IT teams may have to invest large amount in buying, building and managing clouds.
- c) **Community Cloud**: This is sharing of computing infrastructure between organisations of same community. Say government of India saving all data on a cloud to share information across different departments.
- d) **Hybrid Cloud**: It is maintained by both internal and external providers. It is a composition of two or more clouds (Private, Community or Public).

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13. CLOUD COMPUTING ARCHITECTURE

A cloud computing architecture consists of two parts - Front End and a Back End that connect to each other through a network, usually the Internet.

Front end:

- ✓ The front end of the cloud computing system comprises of the client's devices (and some applications are needed for accessing the cloud computing system).
- ✓ Web services like email programs use some existing web browsers such as Firefox.

Back end:

- ✓ The back end is cloud itself which include various computer machines, data storage systems and servers.
- ✓ Groups of these clouds make a whole cloud computing system.
- ✓ There are some set of rules, generally called as **Protocols** which are followed by this server.
- ✓ It uses a special type of software known termed as **Middleware** that allow computers that are connected on networks to communicate with each other.

14. SERVICE MODELS OF CLOUD COMPUTING

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1. **Infrastructure as a Service (IaaS)**:
 - a. It provides clients with access to server hardware, storage etc.
 - b. The service is typically paid for on a usage basis.
2. **Platform as a Service (PaaS)**:
 - a. Provide basic operating software and optional services to develop and use software applications.
 - b. For example, Google App Engine allows clients to run their web applications using web browser on Google's infrastructure.
 - c. The major drawback of is that it may lock us into the use of a particular development environment.
3. **Software as a Service (SaaS)**:
 - a. 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.
 - b. In this no need to install and run an application on a user's own computer.
4. **Network as a Service (NaaS)**:
 - a. It is a category of cloud services where the capability provided to the cloud service user is to use network/transport connecting services.
 - b. Some examples are: Virtual Private Network, Mobile Network Virtualization etc.
5. **Communication as a Service (CaaS)**:
 - a. CaaS has evolved in the same lines as SaaS.
 - b. Based on pay-as-you-go.

- c. Examples are: Voice over IP (VoIP), Instant Messaging (IM), etc.

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15. MOBILE COMPUTING

- ❖ Mobile Computing, is the use of portable computing devices to enable users to access the Internet and data on their home or work computers from anywhere in the world. It **involves**:
1. **Mobile Communication**: Infrastructure put in place to ensure that seamless and reliable communication goes on.
 2. **Mobile Hardware**: This would range from Portable laptops, Smart phones, etc.
 3. **Mobile Software**: Mobile Software is the actual program that runs on the mobile.

16. BUSINESS APPLICATIONS OF MOBILE COMPUTING

1. Some **examples of business applications** are:
 - a. There is increase in workforce productivity as mobile device enables employees to work from anywhere, anytime by accessing and updating information as required.
 - b. Customer service can be improved by responding to customer queries quickly.
 - c. Identify problem and resolve it online as no geographical barriers.
 - d. Business processes can be transformed by using mobile devices.

17. MOBILE COMPUTING CONCERNS

1. Dangers of misrepresentation
2. Portable power is not available then the portable systems must rely entirely on battery.
3. Potential health hazards.

18. APPLICATION SOFTWARE

- ✓ Software that guide a computer to perform useful tasks beyond the running of the computer itself.
- ✓ The **different types of application software** are:
- **Application Suite**: applications bundled together.
 - **Enterprise Infrastructure Software**: support enterprise software systems. E.g. email servers, Security software.
 - **Enterprise Software**: Addresses an enterprise's needs
 - **Information Worker Software**: Addresses individual needs required. E.g. Spreadsheets, CAAT (Computer Assisted Audit Tools), etc.
 - **Content Access Software**: Used to access contents E.g. Media Players
 - **Educational Software**: Holds contents adopted for use by students. E.g. Test CDs
 - **Media Development Software**: Addresses individual needs to generate and print electronic media for others to consume. E.g. Desktop Publishing, Video Editing etc.

Benefits of Application Software

1. **Addressing User needs**:
2. **Less threat from virus**:
3. **Regular updates**:

Disadvantages of such software as well and these are given as follows:

1. Development is costly.
2. Infection from Malware.

19. DATABASE MANAGEMENT SYSTEMS (DBMS)

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- ✓ DBMS as basically just a computerized record keeping. i.e., a collection of computerized data files.
- ✓ Even this simple system helps us do various operations on the files, such as:
 1. Adding new files to database,
 2. Deleting existing files from database,
 3. Inserting data in existing files,
 4. Modifying data in existing files,
 5. Deleting data in existing files, and
 6. Retrieving or querying data from existing files.
- ✓ DBMS provide the facility to create and maintain a well-organized database.

20. DATABASE MODEL

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Hierarchical Database Structure

1. Records are logically organized in a hierarchy of relationships.
2. Structure like an inverted tree.
3. The top record is known as root record and next all keep parent child relationship.
4. **Features** of Hierarchical Database Structure
 - a. Less flexible than other database structure.
 - b. It is very simple structure and easy to implement.
5. **Advantage:**
 - a. Logically simple structure.
 - b. Always a link between parent and child which enforce data integrity.
 - c. Top- down approach makes efficient data processing.
6. **Disadvantage:**
 - a. Difficult to implement.
 - b. Rigid database structure.
 - c. Not suited for handling many to many relationships.

Network database structure

1. Each node may have several parents.
2. Replace hierarchical tree with graph.
3. Ability to handle many to many relationship.
4. **Advantage:**
 - a. Higher level of flexibility than hierarchical model.
 - b. Support many to many relationships
5. **Disadvantage:**
 - a. Operation and maintenance becomes more complicated.
 - b. Difficult to program because of complex nature.
 - c. Relationships cannot be added to the existing data base easily.

Relational database structure

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1. Data are organized in two dimensional tables.
2. Easy to understand.
3. Each row in table is a record and each column represents one type of data element. Ex. Oracle
4. Advantage
 - a. Highly flexible to program and retrieve data.

- b. Can be efficiently used with a computer has limited memory.
- 5. Much easier to use
- 6. Limitation
 - a. Processing efficiency is comparatively low.
 - b. No processing can be done without establishing the data relationships.

Object Oriented Data Base Model:

An object oriented database (also referred to as object-oriented database management system or OODBMS) is a set of objects. In these databases, the data is modeled and created as objects.

- ❖ In this all the elements of database are considered as objects.
- ❖ Objects can be linked together to create database structure.
- ❖ Objects of similar attributes and behavior are grouped into classes.
- ❖ Objects using a concept known as inheritance and data hiding.
- ❖ The structure once created can be used anywhere.

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21. ADVANTAGES OF A DBMS

1. *Permitting data sharing:*
2. *Minimizing Data Redundancy:*
3. *Integrity can be maintained:*
4. *Program and file consistency:*
5. *User-friendly:*
6. *Improved security:*
7. *Achieving program/data independence:* In a DBMS data does not reside in applications but data bases program & data are independent of each other.
8. *Faster application development:*

22. DISADVANTAGES OF A DBMS

- ☒ *Cost:* Implementing a DBMS system can be expensive
- ☒ *Security:* If one gets access to database then it could be an all or nothing proposition.

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23. SYSTEM SOFTWARE

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Operating System (OS)

An Operating System (OS) is a set of computer programs that manages computer hardware resources and acts as an interface with computer applications programs.

Activities which are executed by Operating systems include:

1. *Performing hardware functions:*
2. *User Interfaces:*
3. *Hardware Independence:* Operating System provides Application Program Interfaces (API), which can be used by application developers to create application software, thus no need to recode for each type of configuration.
4. *Memory Management:*
5. *Task Management:*
6. *Networking Capability:*
7. *Logical access security:*
8. *File management:*

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24. HARDWARE

- ✓ **Processing devices** contain the Central Processing Unit and main memory. The Central Processing Unit (CPU or microprocessor) is the actual hardware that interprets and executes the program. CPU consists of three functional units:
 - ❖ **Control Unit (CU):**
 - ❖ **Arithmetic and Logical Unit (ALU):**
 - ❖ **Registers:**
 - **Accumulators:**
 - **Address Registers:**
 - **Storage Registers:**
 - **Miscellaneous:**
- ✓ **Data Storage** Devices refers to the memory where data and programs are stored.
 - **Internal memory:** Registers are internal memory within CPU, which are very fast and very small. This includes Processor Registers and Cache Memory.
 - **Cache Memory:** bridge speed difference between Registers and Primary Memory
 - **Processor Registers:** Registers are internal memory within CPU, which are very fast and very small.
 - **Primary Memory:** (1) Random Access Memory (RAM) (2) Read Only Memory (ROM)
 - Random Access Memory (RAM)
 - This is Read Write memory.
 - Volatile in nature means Information is lost as soon as power is turned off.
 - Information can be read as well as modified.
 - Read Only Memory (ROM)
 - Information can be read not modified.
 - This is non volatile in nature (contents remain even in absence of power).
 - Generally used by manufacturers to store data & programs like translators that is used repeatedly.
 - **Virtual Memory:** not a separate device but an imaginary memory area supported by operating systems. If a computer lacks the Random Access Memory (RAM) needed to run a program or operation, Windows uses virtual memory to compensate.
 - **Secondary Memory:** The secondary memories are available in bigger sizes, thus programs and data can be stored on secondary memories. Secondary storage does not lose the data when the device is powered down. Example: Hard Disk, CD, DVD etc.

25. NETWORK LINKS

- ✓ Networks could be of two types:
 - **Connection Oriented networks:** Wherein a connection is first established and then data is exchanged like it happens in case of telephone networks.
 - **Connectionless Networks:** Where no prior connection is made before data exchanges. Like SMS networks.

Issues addressed by Network Modeling

- ✓ **Routing:** It refers to the process of deciding on how to communicate the data
- ✓ **Bandwidth:** refers to amount of data which can be sent across a network in given time.

- ✓ **Resilience:** It refers to the ability of a network to recover from any kind of error
- ✓ **Contention:** It refers to the situation that arises when there is a conflict for some common resource.

Important Benefits of a Computer Network

1. **Distributed nature of information:**
2. **Resource Sharing:**
3. **Computational Power:**
4. **Reliability:**
5. **User communication:**

26. INFORMATION SYSTEM LIFE CYCLE [OR SDLC]

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SDLC is a methodology used to describe process of building Information Systems.

SDLC framework provides a sequence of activities for system designers and developers to follow.

Phase 1: System Investigation

This phase examines that 'What is the problem and is it worth solving'?

1. Technical feasibility:	2. Economic feasibility:
3. Legal feasibility:	4. Operational feasibility:
5. Schedule feasibility:	

Phase 2: System Analysis

'What must the Information System do to solve the problem'? involve:

✓ Interviewing staff:	✓ Examine current business:
✓ Sending out questionnaires:	✓ Observation of current procedures:

Phase 3: System Designing

'How will the Information System do what it must do to obtain the solution to the problem'?

1. **Hardware platform:**
2. **Software:**
3. **Outputs:**
4. **Inputs:**
5. **Modular design:** Of each program in the application;

Phase 4: System Implementation

'How will the Solution be put into effect'? This phase involves the following steps:

1. Coding and testing of the system;
2. Acquisition of hardware and software; and
3. Either installation of the new system or conversion of the old system to the new one.

In Installation, there are following major activities:

1. extensive re-cabling and changes in office layouts;
2. Training the users on the new system; and
3. Conversion of master files to the new system or creation of new master files.

In Conversion, there are following major activities:

1. **Direct Changeover:** User stops using the old system one particular day and starts using the new system from thereon, usually over a weekend or during a slack period.

2. **Parallel Conversion:** The old system continues alongside the new system for a few weeks or months.
3. **Phased Conversion:** Used with larger systems that can be broken down into individual modules which can be implemented separately at different times.
4. **Pilot Conversion:** New system will first be used by only a portion of the enterprise, for example at one branch or factory.

Phase 5: System Maintenance and Review

This phase evaluates results of solution and modifies the system to meet the changing needs.

Post implementation review would be done to address:

- ✓ Modification of Reports, and
- ✓ Request for new programs.

System maintenance could be with following different objectives:

1. **Perfective Maintenance:** This implies that while the system runs satisfactorily, there is still room for improvement.
2. **Adaptive Maintenance:** All systems will need to adapt to changing needs within a company.
3. **Corrective Maintenance:** Problems frequently surface after a system has been in use for a short time, however thoroughly it was tested. Any errors must be corrected.

27. RECENT TECHNOLOGIES/DEVICES

Bluetooth

1. Bluetooth is a wireless technology standard for exchanging data over short distances up to 50 meters creating personal Area Networks (PANs).
2. With use of a mobile phone with Bluetooth enabled; we can send pictures, videos, exchange business cards and also transfer files to our PC.

Wi-Fi:

1. Wi-Fi is a popular wireless networking technology that **uses radio waves** to provide wireless high-speed Internet and network connections.
2. Wi-Fi networks use radio technologies called 802.11 to provide secure, reliable, fast wireless connectivity.

Tablet: A Tablet computer or simply tablet is a one piece general-purpose computer contained in a single panel. Its distinguishing characteristic is the use of a touch screen as the input device. Some features of Tablets are as follows:

1. <i>Input Method:</i>	2. <i>Size:</i>
3. <i>Battery Life:</i>	4. <i>Storage Capacity:</i>
5. <i>Software:</i>	

SmartPhone: A SmartPhone is a mobile phone built on a mobile operating system with more advanced computing capability connectivity than a feature phone.

Touchpad: translate the motion and position of a user's fingers to a relative position on screen. Touchpad is a common feature of laptop computers.

Ultra-Mobile PC (UMPC): An Ultra-Mobile PC is a small form factor version of a pen computer, and are operated like tablet PCs using a touch screen or a stylus, and can also have a physical keyboard.

Android: Android is a Linux-based operating system designed primarily for touch screen mobile devices such as smart phones and tablet computers.

Groupware: Groupware also known as Team-ware, Collaboration Software is

Differences between Hierarchical Database Model and Network Database Model

Hierarchical Database Model	Network Database Model
The hierarchical model permits a record to be a member of only one set at one time.	Unlike the hierarchical mode, the network model permits a record to be a member of more than one set at one time.
The hierarchical data structure implements one-to-one and one-to-many relationships.	The network model allows us to represent one-to-one, one-to-many and many-to-many relationships.
Each parent record may have one or more child records, but no child record may have more than one parent record.	Each parent record may have one or more child records, and even a child record may have more than one parent record.
The hierarchical data structures require specific entrance points to find records in a hierarchy.	The network data structures can be entered and traversed more flexibly.

Differences between Random Access Memory (RAM) and Read Only Memory (ROM)

Random Access Memory (RAM)	Read Only Memory (ROM)
RAM is a volatile memory and when the computer is turned off, RAM loses its data. When the computer is turned on again, operating system and other files are once again loaded into RAM usually from the hard disk.	Unlike RAM, ROM is non-volatile. The contents of ROM remain even after the computer is switched off.
This is Read Write memory wherein information can be read as well as modified.	Originally, the ROM used to be read only; however, the new versions of ROM viz. EEPROM allow limited rewriting making it possible to upgrade firmware such as the BIOS by using installation software.

What is CPU? What are the three functional units of a Central Processing Unit (CPU)?

The Central Processing Unit is the actual hardware that interprets and executes the program (software) instructions and coordinates how all the other hardware devices work together.

It consists of three functional units:

1. Control Unit (CU):	2. Arithmetic and Logical Unit (ALU):
3. Registers:	

CHAPTER 3 - TELECOMMUNICATION AND NETWORKS

1. TRENDS IN TELECOMMUNICATION

Industry Trends

Telecommunications networks and services are available from numerous large and small telecommunications companies.

Technology Trends

Open systems with unrestricted connectivity, using Internet networking technologies as their technology platform, are becoming the primary telecommunications technology drivers.

Business Application Trends

The trend toward Internet technologies, open systems, and the rapid growth of the Internet, has dramatically increases the number of feasible telecommunications applications.

2. THE BUSINESS VALUE OF TELECOMMUNICATIONS

The strategic capabilities of telecommunications & other information technologies include:

1. *Overcome geographic barriers:*
2. *Overcome time barriers:*
3. *Overcome cost barriers:*
4. *Overcome structural barriers:*

3. NEED AND SCOPE OF TELECOMMUNICATION NETWORKS

- 1) *File Sharing -*
- 2) *Resource Sharing -*
- 3) *Remote Access -*
- 4) *Shared Databases*
- 5) *Fault Tolerance - defense against accidental data loss.*
- 6) *Internet Access and Security -*

4. TELECOMMUNICATION NETWORK MODEL

1. **Terminals: Any input or output device**
2. **Computers: perform their communication assignments.**
3. **Telecommunications Processors:** Telecommunications Processors support data transmission and reception between terminals and computers by providing a variety of control and support functions. Some examples are:
 - a. **Network Interface Card (NIC):** Network Interface Card (NIC) is a computer hardware component that connects a computer to a computer network. Each NIC has a unique address called MAC address.
 - b. **Modems:** A MODEM is a device that converts a digital computer signal into an analog telephone signal or vice versa. Modems are required to send computer data with ordinary telephone lines.

- c. **Multiplexers:** A multiplexer is a communications processor that allows a single communications channel to carry simultaneous data transmissions from many terminals. Typically, a multiplexer merges the transmissions of several terminals.
- d. **Internetwork Processors:** Telecommunications networks are interconnected by special-purpose communications processors called internetwork processors such as switches, routers, hubs, bridges, repeaters and gateways.

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- i. **Switch** - Switch is a communications processor that **makes connections between telecommunications circuits** in a network.
- ii. **Router** – Router is a communications processor that interconnects networks based on **different rules or protocols**, so that a telecommunications message can be routed to its destination.
- iii. **Hub** – Hub is a port-switching communications processor. This allows sharing of the network resources such as servers, printers, etc.
- iv. **Bridge** – Bridge is a communications processor that connects numerous Local Area Networks (LAN). It magnifies the data transmission signal while passing data from one LAN to another.
- v. **Repeater** – Repeater is a communications processor that boosts/amplifies the signal before passing it to the next section of cable in a network.
- vi. **Gateway** – Gateway is a communications processor that connects networks that use different communication architectures.

4. **Telecommunications Media/Channels:** It connects the message source with the message receiver. Data are transmitted and received over channels

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- a. **Guided Media/Bound Media:** uses a "cabling" system that guides the data signals along a specific path.
 - i. **Twisted-Pair Wire:**
 - ii. **Coaxial Cable:**
 - iii. **Fiber Optics:**

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- b. **Unguided Media/Unbound Media:** nothing to guide them along a specific path.
 - i. **Terrestrial Microwave:** line-of-sight path between relay stations spaced approximately 30 miles apart.
 - ii. **Radio Waves:** in the wireless Local Area Networks.
 - iii. **Micro Waves:** 300 MHz (0.3 GHz) and 300 GHz.
 - iv. **Infrared Waves:** is used in industrial, scientific, & medical Applications.
 - v. **Communication Satellites:** cost-effective method for moving large quantities of data over long distances.

5. **Tele-communications Control Software:**

- a. **Network Management:** functions **include:**
 - i. **Traffic management–**
 - ii. **Security–**
 - iii. **Network monitoring–**
 - iv. **Capacity planning–**

5. FACTORS CONTRIBUTING TOWARDS INCREASING USE OF LAN SOLUTIONS:

1. **Security** -
2. **Expanded PC usage through inexpensive workstation** -
3. **Distributed processing** -

4. **Data management benefits -**
5. **Software cost and up-gradation -**
6. **CLIENT- SERVER NETWORKING**

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Client: provides a presentation services and the appropriate computing
Client computers can be classified as Fat Client, Thin Client or Hybrid Client.

1. **Fat / Thick Client:** performs the bulk of any data processing operations itself.
2. **Thin Client:** Thin clients use the resources of the host computer.
3. **Hybrid Client:** A hybrid client is a mixture of the above two client models. Hybrid clients are well suited for video gaming.

Server:

A server is one or more multi-user processors with share memory providing computing, connectivity and the database services and the interfaces relevant to the business need.

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PROMINENT CHARACTERISTICS

1. **Service:**
2. **Shared Resources:** .
3. **Transparency of Location:** C/S software usually **masks the location**
4. **Mix-and-Match:**
5. **Scalability:**
6. **Integrity:**

Issues in Client/Server Network

- 1) When the server goes down or crashes, all the computers connected to it become unavailable to use.
- 2) Simultaneous access to data and services by the user takes little more time for server to process the task.

7. PEER-TO-PEER NETWORKING (P2P)

- ✓ Each of the system is called a peer and act as both server and client.
- ✓ There is no serve concept and it is simple in design and maintenance

Advantages

- 1) Peer-to-Peer Networks are easy and simple to set up
- 2) It is very simple and cost effective.
- 3) If one computer fails to work, all other computers connected to it continue to work.

Disadvantages

- 1) There can be problem in accessing files if computers are not connected properly.
- 2) It does not support connections with too many computers
- 3) The data security is very poor in this architecture.

8. MULTI-TIER ARCHITECTURE

Single Tier / One-Tier Architecture

1. A single computer that contains a database and a front-end (GUI) to access the database is known as Single Tier System.

2. **Advantages:**

- a. A single-tier system requires only one stand-alone computer.
- b. It also requires only one installation of proprietary software which makes it the most cost-effective system available.

3. **Disadvantages:**

- a. It can be used by only one user at a time.
- b. A single tier system is impractical for an organization which requires two or more users to interact with the organizational data stores at the same time.

Two Tier Systems/ Two Tier Architecture

1. A two-tier system consists of a client and a server.

2. A presentation layer or interface runs on a client, and a data layer or data structure gets stored on a server.

3. **Advantages :**

- a. The system performance is higher because business logic and database are physically close.
- b. Processing is shared between the client and server; more users could interact with system.

4. **Disadvantages:**

- a. Performance deteriorates if number of users is greater than 100.
- b. There is restricted flexibility

n-Tier Architecture

1. n-Tier Architecture is a client–server architecture in which presentation, application processing, and data management functions are logically separated.

2. For example, an application that uses middleware to service data requests between a user and a database employs multi-tier architecture. The most widespread use of multi-tier architecture is the Three-tier architecture.

3. Its three tiers are the presentation tier, application tier and data tier.

a. **Presentation Tier:**

b. **Application Tier:**

c. **Data Tier:**

4. **Advantages:**

- a. Clear separation of user-interface-control and data presentation from application-logic
- b. Dynamic load balancing: If bottlenecks in terms of performance occur, the server process can be moved to other servers at runtime.

5. **Disadvantages:**

- a. It creates an increased need for network traffic management
- b. More need of server load balancing and fault tolerance.
- c. Current tools are relatively immature and are more complex.

9. VIRTUAL PRIVATE NETWORKS (VPN)

1) Many organizations use Virtual Private Networks (VPNs) to establish secure intranets and extranets.

2) A VPN is a private network that uses a public network to connect remote sites or users together.

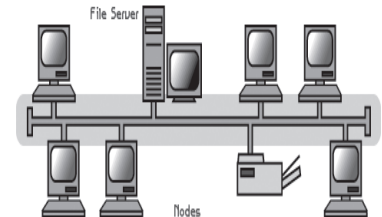
10. NETWORK COMPUTING

- 1) **Centralized Computing:** Centralized computing is computing done at a central location, using terminal that are attached to a central computer.
- 2) **Decentralized Computing:** Decentralized computing is the allocation of resources, workstation, or office location. In contrast, both hardware and software.

11. NETWORK TOPOLOGIES

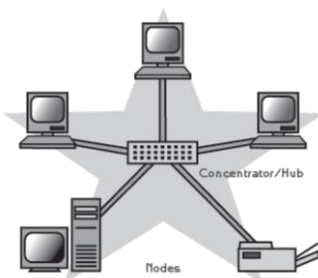
The geometrical arrangement of computers and devices in a network is known as network topology.

Bus or Linear Topology



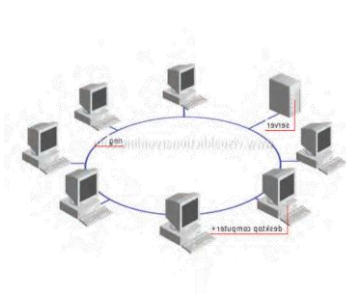
Advantages	Disadvantages
1. Short cable length needed	1. Difficult to locate fault
2. Simple wiring layout	2. Repeater needed
3. Easy to extend	3. Slow speed of network
4. Reliable in small network.	4. Dependence on a single cable

Star Topology



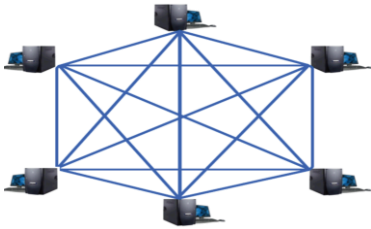
Advantages	Disadvantages
1. Easy to connect	1. Long cable length needed
2. Faster communication	2. Dependence on a central node or hub
3. Simple access protocols	3. One device per connection
4. No dependence on single cable/node.	
5. Easy to locate fault	

Ring Networks



Advantages	Disadvantages
1. Short cable length needed	1. Difficult to locate fault
2. Simple wiring layout	2. Relative expensive
3. Easy to extend	3. Slow speed of network
4. Two-way communication	4. Dependence on single cable
5. High performance for a small no. of workstations.	

Mesh Networks: In fully interconnected mesh, no need to routing.



Advantages	Disadvantages
1. Easy to locate fault 2. Fast speed of network 3. No need of repeater 4. Great amount of redundancy	1. Long cable length needed 2. Not a simple wiring layout 3. Not easy to extend 4. Set-up cost is high

12. **TRANSMISSION TECHNOLOGIES**

(communications channel)

SERIAL TRANSMISSION	PARALLEL TRANSMISSION
In this, the data bits are transmitted serially one after another.	In this, the data bits are transmitted simultaneously.
Data is transmitted over a single wire.	Data is transmitted over 8 different wires.
It is a cheaper mode of transferring data.	It is relatively expensive mode of transferring data.
It is useful for long distance data transmissions.	Not practical for long distance communications as it uses parallel path, so cross talk may occur.
It is relatively slower	It is relatively faster.
Example : RS-232 serial port	Example: LPT1 port for printer

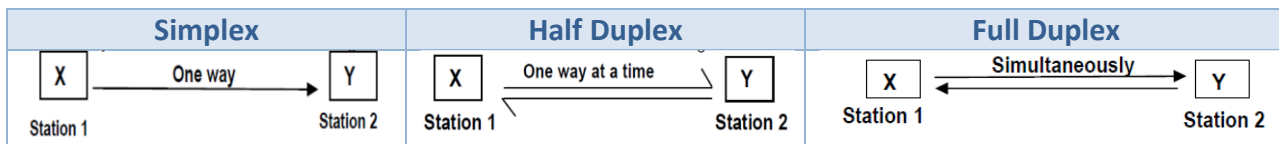
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ASYNCHRONOUS TRANSMISSION	SYNCHRONOUS TRANSMISSION
Used between devices of dissimilar speed	Used between devices of similar speed
Each data word is accompanied by start and stop bits.	Allows characters to be sent down the line without start-stop bits.
Extra Start and Stop bits slow down the transmission process relatively.	Transmission is faster as in absence of start and stop bits, many data words can be transmitted per second.
It is relatively cheaper.	The synchronous device is more expensive to build as it must be smart enough to differentiate between the actual data and the special synchronous characters.

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More reliable as the start and stop bits ensure that the sender and the receiver remain in step with one another.	Chances of data loss are relatively higher.
It is less efficient as extra bits are added with every byte	It is more efficient as no extra bit is to be added.

13. TRANSMISSION MODES



14. TRANSMISSION TECHNIQUES

Communication networks can be categorized into

- a) *Broadcast* → data transmitted by one node is received by many
- b) *Switched networks* → data transferred from source to destination is routed through the switch nodes. 3 types of **switching technique**:

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May 2011

- a. **Circuit switching** → a single circuit is formed between two devices and communication is allowed for a limited duration like call.
- b. **Message switching** → intermediate switch will store data received from sending device and forward it when network is available. This characteristic is often referred to as “store-and forward”. Ex. Electronic mail and voice mail.

- c. **Packet Switching** → In Packet Switching a message is broken into small parts (packets) and **routed individually** through the network depending on the availability.

In circuit a dedicated path is used whereas in Packet each packet is transmitted through different routes.

15. NETWORK ARCHITECTURES AND PROTOCOLS

Network Architecture: Network architecture refers to the layout of the network, consisting of the hardware, software, connectivity, communication protocols and mode of transmission.

Protocols: A protocol is the formal set of rules for communicating, including rules for timing of message exchanges, the type of electrical connection used by the communications devices, error detection techniques etc.

Network protocols which are essentially software are sets of rules for-

1. Communicating timings, sequencing, formatting, and error checking for data transmission.
2. Providing standards for data communication.

A protocol defines the following three aspects of digital communication:

Aspect	Description
Syntax	Syntax means the format of data being exchanged. It includes the character set used, type of encoding scheme, etc.
Semantics	Semantics means the type and order of messages used to ensure reliable and error-free information transfer.

Timing

Timings define the rate of data transmission or the speed and the correct timing for data transfer.

When transmission begins, Protocol at the sending computer:

1. Breaks the data into packets,
2. Adds destination address (of the other computer/server) to the packet,
3. Prepares and sends data for transmission through Network Interface Card (NIC).

After transmission from sending device, Protocol at the receiving computer–

1. Takes data packets off the cable or other medium,
2. Brings packets into computer through Network Interface Card (NIC),
3. Strips the packets off any transmitting information like address,
4. Copies data from packet to a buffer for reassembly,
5. Passes the reassembled data to the application program say Internet Explorer.

16. OSI OR OPEN SYSTEM INTERCONNECTION



1. Physical Layer → Electronic signals, cabling
2. Data Link Layer → physical protocol is assigned i.e. MAC
3. Network Layer → The way that the data will be sent to the recipient device is determined in this layer.
4. Transport Layer → maintains flow control of data and error checking and recovery.
5. Session Layer → establishes, maintains and ends communication.
6. Presentation Layer → takes data from application layer and converts it into a format that other layers understands.
7. Application Layer → actually interacts with the users through the operating system or application software

Nov 2009

17. INTERNET'S TCP/IP

The Internet's protocol suite is called Transmission Control Protocol/Internet Protocol and is known as TCP/IP.

Five levels of TCP/IP include as shown in the diagram are as follows:

- 1) Application or process layer
- 2) Host-to-Host Transport layer
- 3) Internet Protocol (IP)
- 4) Network Interface
- 5) Physical layer

18. NETWORK RISKS, CONTROLS AND SECURITY

The basic objective for providing network security is two-fold:

- ✓ to safeguard assets, and
- ✓ to ensure and maintain the data integrity.

There are two types of systems security. A physical security is implemented to protect the physical systems assets of an organization like the personnel, hardware etc. A logical security is intended to control malicious and non-malicious threats.

19. THREATS AND VULNERABILITIES

A threat is anything that can disrupt the operation, functioning, integrity, or availability of a network or system.

1. **Unstructured threats** → inexperienced individuals; using available tools; curiosity
2. **Structured threats** → technically competent; create hacking scripts; targets a specific destination; hired by organized crime or state-sponsored intelligence organizations, etc.
3. **External threats** → working outside an organization, which does not have authorized access to organization's computer systems
4. **Internal threats** → from individuals who have authorized access to the network. It has been seen that majority of security incidents originate from Internal threats

Vulnerabilities: Vulnerability is an inherent weakness in the design, configuration, or implementation of a network or system that renders it susceptible to a threat.

- 1) **Software Bugs** → failure to handle exceptional conditions, access validation error etc.
- 2) **Timing Windows** → temporary file is exploited by an intruder to gain access.
- 3) **Insecure default configurations** → vendors use known default passwords.
- 4) **Trusting Untrustworthy information** → when address can't be identified bogus routers can gain access to systems and do damage.
- 5) **End users** → users of computer systems are not professionals and are not always security conscious. Like user may write down password or mostly are negligence towards security procedures like saving confidential files to places where they are not properly protected.

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20. LEVEL OF SECURITY (SECURITY PROGRAM)

- 1) *Preparing project plan for enforcing security:*
- 2) *Asset identification:*
- 3) *Asset valuation:*
- 4) *Threat identification:*
- 5) *Threats probability of occurrence assessment:*
- 6) *Exposure analysis:*
- 7) *Controls adjustment:*
- 8) *Report generation outlining the levels of security to be provided for individual systems, end user, etc.:*

21. NETWORK SECURITY PROTOCOLS

Network Security Protocols are **primarily designed to prevent any unauthorized user, application, service or device from accessing network data.**

Network security protocols generally **implement cryptography and encryption** techniques to secure data.

Network security **involves four aspects**: Privacy (Confidentiality), Message Authentication, Message Integrity and Non-repudiation.

Privacy: This means that the sender and the receiver expect confidentiality. This is achieved by cryptography and encryption techniques

Authentication: This means that the receiver is sure of the sender's identity and that an imposter has not sent the message.

Integrity: This means that the data must arrive at the receiver exactly as it was sent. There must not be any changes during the transmission – either accidental or malicious.

Non-Repudiation: This means that a receiver must be able to prove that a received message came from a specific sender and the sender must not be able to deny sending it.

RTP

Cryptography:

Cryptography is the practice and study of techniques for secure communication in the presence of third parties (called Adversaries). More generally, it is related to various aspects in information security such as data confidentiality, integrity, authentication, and non-repudiation.

PM

Encryption:

- 1) ***Plaintext*** - It is the message that is to be encrypted. It is transformed by a function that is parameterized by a key.
- 2) ***Ciphertext*** - It is the output of the encryption process that is transmitted often by a messenger or radio.
- 3) ***Encryption Model*** - The intruder may hear and accurately copies down the complete ciphertext but he does not know what the decryption key is and so cannot decrypt the ciphertext easily. Sometimes the intruder can not only listen to the communication channel but can also record messages and modify. The art of breaking ciphers, known as **Cryptanalysis**, and the art of devising them (cryptography) are collectively known as **Cryptology**.

There are two categories of encryption/decryption methods: the Secret Key Method and the Public Key Method.

- ✓ In **Secret key encryption/decryption** method, the **same key is used by both sender and the receiver**. In this, for **decryption the algorithm is used in inverse order of the algorithm** used for encryption.
- ✓ In **Public key encryption**, there are **two keys: a private key and a public key**. The private key is kept by the receiver and the public key is announced to the public.

There are **two basic approaches to encryption**:

- **Hardware encryption** devices are available at a reasonable cost,
- **Software encryption** is typically employed in conjunction with specific applications.

RTP

Some of the popular network security protocols include Secure Shell (SSH), Secure File Transfer Protocol (SFTP), Secure Hypertext Transfer Protocol (HTTPS) and Secure Socket Layer (SSL) etc.

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1) ***SSH*** –

- a. Secure Shell is a program to log into another computer over a network, to execute commands in a remote machine, and to move files from one machine to another.
- b. SSH protects a network from IP spoofing, IP source routing, and DNS spoofing.
- c. During SSH login, the entire login session, including transmission of password, is encrypted;

2) ***SFTP*** –

- a. The SSH File Transfer Protocol (also known as Secure FTP and SFTP) is a computing network protocol for accessing and managing files on remote file systems.

3) **HTTPS** –

- a. Hypertext Transfer Protocol Secure (HTTPS) is a communications protocol for secure communication over a computer network,

4) **SSL** –

- a. It is essentially a protocol that provides a secure channel between two machines operating over the Internet or an internal network.
- b. SSL protocol is typically used when a web browser needs to securely connect to a web server over the inherently insecure Internet.

22. **NETWORK SECURITY TECHNIQUES**

Firewall: Firewall is a device (combination of hardware and software) that forms a barrier between a secure and an open environment when the latter environment is usually considered hostile, for example the Internet

Site Blocking : site Blocking is a software-based approach that prohibits access to certain Web sites that are deemed inappropriate by management.

PM

IDS Technologies:

- a) Intrusion Detection is the system of detecting inappropriate, incorrect, or anomalous activity in a network. 4 types:
 - a. **Network Intrusion Detection (NID)** → intercepts and captures packets of data traveling along various communication mediums.
 - b. **Host-based Intrusion Detection (HID)** → monitor, detect, and respond to user and system activity and attacks on a given server. Best suited to combat internal threats because of its can monitor and respond to specific user actions
 - c. **Hybrid Intrusion Detection (HyID)** → combination of both NID and HID systems

May 2013

Network Access Control

Network Access Control (NAC) products **enforce security policy** by granting only security policy–compliant devices access to network assets.

Anti - Malware

Anti-malware network tools help administrators identify block and remove malware. Malware is always on the lookout for network vulnerabilities such as in operating systems, browsers, applications etc. that they can exploit.

23. **NETWORK ADMINISTRATION AND MANAGEMENT**

Network management refers to the activities, methods, procedures, and tools that pertain to the operation, administration, maintenance, and provisioning of networked systems.

A common way of characterizing network management functions is FCAPS—

- ✓ **Fault Management** → identifies and isolates network issues, proposes problem resolution, and subsequently logs the issues and associated resolutions.
- ✓ **Configuration Management** → Monitors network and system configuration information so that the impact on network operations can be tracked and managed.

- ✓ **Accounting Management** → tracking network utilization information etc. so business units can be appropriately billed. For non-billed networks, accounting refers to administer the set of authorized users
- ✓ **Performance Management** - Measures and makes network performance data available so that performance can be maintained and acceptable thresholds.
- ✓ **Security Management** - Controls access to network resources as established by organizational security guidelines. include managing network authentication, authorization, and auditing,

24. STRATEGIC CAPABILITIES OF INTERNET ALONG WITH THEIR BUSINESS APPLICATIONS

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Strategic Capabilities	e-Business Examples	Business Value
Overcome geographic barriers: Capture information about business transactions from remote locations	Use the Internet and extranets to transmit customer orders from travelling salespeople to a corporate data centre	Provides better customer service by reducing delay in filling orders
Overcome time barriers: Provide information to remote locations immediately	Credit authorization at the point of sale using online POS networks	Credit inquiries can be made and answered in seconds.
Overcome cost barriers: Reduce the cost of more traditional means of communication	Desktop videoconferencing between a company and its business partners using the Internet etc.	Reduces expensive business trips; allows employees to collaborate,
Overcome structural barriers: Support linkages for competitive advantage	Business-to-business electronic commerce websites for transactions with suppliers and customers	Fast, convenient services lock in customers and suppliers.

25. INTERNET ARCHITECTURE

- ✓ To join the Internet, the computer is connected to an **Internet Service Provider**, or simply ISP, from whom the user purchases Internet access or connectivity.
 - **DSL (Digital Subscriber Line)**
 - DSL (Digital Subscriber Line) reuses the telephone line
 - The computer is connected to a device called a DSL modem
 - At the other end, a device called a DSLAM (Digital Subscriber Line Access Multiplexer) converts between signals and packets.
 - **CMTS (Cable Modem Termination System)**
 - This is used to send signals over the cable TV system.
 - Like DSL, this is a way to reuse existing infrastructure.
 - The device at the home end is called a cable modem and the device at the cable head-end is called the CMTS (Cable Modem Termination System)
- ✓ ISPs connect their networks to exchange traffic at IXPs (**Internet eXchange Points**). An IXP is a room full of routers, at least one per ISP. A LAN in the room connects all the routers.

26. INTERNET APPLICATIONS

- 1) E-mail, browsing the sites on the World Wide Web
- 2) Electronic commerce transactions between businesses
- 3) The Internet provides electronic discussion forums and bulletin board systems
- 4) The Internet allows gathering information through online services using web browsers

27. BUSINESS USE OF THE INTERNET

- 1) Providing customer and vendor support
- 2) Collaboration among business partners
- 3) Buying and selling products and services
- 4) Marketing, sales, and customer service applications
- 5) Electronic commerce

28. INTRANET

An intranet is a network inside an organization that uses Internet technologies such as web browsers and servers, TCP/IP network protocols, HTML etc. to provide an Internet-like environment within the enterprise for information sharing, support of business processes etc.

Role of Intranet in Business Operations and Management

1. Applications like order processing, inventory control, sales management etc. can be implemented on intranets, extranets, and the Internet.
2. Employees or external business partners, can access and run applications using web browsers from anywhere on the network whenever needed.

29. EXTRANETS

Extranets are network links that use Internet technologies to interconnect the intranet of a business with the intranets of its customers, suppliers, or other business partners.

30. FIVE RULES OF THE EXTRANET

- 1) *Be as flexible as the business:*
- 2) *Deploy in "Internet time":*
- 3) *Protect the interests of the data owner:*
- 4) *Serve the partner as a customer:*
- 5) *Drive information to the decision-maker:*

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31. ELECTRONIC COMMERCE

Electronic Commerce is the automation of the business process between buyers and sellers. It involves the automation of a variety of transactions through reliable and secure connections. In simple words it is the process of doing business online.

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32. BENEFITS OF E-COMMERCE

- 1) Reduction in costs to buyers from increased competition in procurement
- 2) Reduction in errors, time, and overhead costs in information processing
- 3) Reduction in time to complete business transactions, from delivery to payment.
- 4) Creation of new markets as it enables to easily and cheaply reach potential customers.

- 5) Reduction in advertising costs.
- 6) Reduction in overhead costs through automation, and large-scale inter

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33. RISKS INVOLVED IN E-COMMERCE

- 1) **Repudiation of contract:**
- 2) **Lack of authenticity of transactions:**
- 3) **Problem of piracy:** Intellectual property
- 4) **Non-recognition of electronic transactions:**
- 5) **Lack of audit trails:**
- 6) **Data Loss or theft or duplication:**
- 7) **Denial of Service:**
- 8) **Problem of anonymity:**

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34. TYPES OF E-COMMERCE

1. **Business-to-Business (B2B):**
2. **Business-to-Consumer (B2C):** advantages
 - a. Shopping can be faster and more convenient.
 - b. Offerings and prices can change instantaneously.
 - c. Call centers can be integrated with the website.
3. **Consumer-to-Business (C2B):**
4. **Consumer-to-Consumer (C2C):**
5. **Business-to-Government (B2G):**
6. **Business-to-Employee (B2E):**

35. ASPECTS TO BE CONSIDERED IN IMPLEMENTING E-COMMERCE

1. Implementing appropriate policies, standards and guidelines.
2. Performing cost benefit analysis and risk assessment to ensure value delivery.
3. Implementing the right level of security across all layers and processes.
4. Establishing and implementing the right level of baseline (best practice) controls.

36. MOBILE COMMERCE

M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices using Wireless Application Protocol (WAP).

Industries affected by M-Commerce

- 1) Financial services, which includes mobile banking
- 2) Stock Markets

37. ELECTRONIC FUND TRANSFER (EFT)

Nov 2011

a) Automated Teller Machines (ATMs)	b) Point-of-sale (POS) Transactions
c) Pre-authorised Transfers or electronic mandate	d) Telephone Transfers

38. INFORMATION SYSTEMS AND TELECOMMUNICATION

- ✓ It give opportunity to move data at distant location & to collaborate between employees etc.
- ✓ Telecommunications helps in
 - An increase in the efficiency of operations;

- Improvements in the effectiveness of management; and
 - Innovations in the marketplace.
- ✓ Telecommunications may provide these values through the following impacts:
- Time compression
 - Overcoming geographical dispersion
 - Restructuring business relationships

CHAPTER 4 - BUSINESS INFORMATION SYSTEMS

1. WHAT IS INFORMATION SYSTEMS

Information

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Distinguish between Data and Information

Data is a raw fact and can take the form of a number or statement such as a date or a measurement. It is necessary for businesses to put in place procedures to ensure data have been processed so that they are meaningful. This is done through some processing.

Information System: Information System (IS) is a combination of people, hardware, software, communication devices, network and data resources that processes (can be storing, retrieving,

2. COMPONENTS OF INFORMATION SYSTEM

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- 1) People, hardware, software, and data are four basic resources of information systems;
- 2) Human resources consist of end users and IT specialists;
- 3) A process is used to convert data into information for end users;
- 4) Information processes consist of input, processing, output, storage, and control processes.

All components of Information Systems are mutually connected and cannot exist individually. The relationship between separated components is defined for best process efficiency.

People Resources	Specialists - systems analysts, software developers End Users—anyone else who uses information systems
Hardware Resources	Machines - computers, monitors, disk drives, printers, optical scanners. Media - floppy disks, magnetic tape, optical disks, plastic cards, paper forms.
Software Resources	Programs - operating system programs, spreadsheet programs etc. Procedures - data entry procedures, paycheck distribution procedures.
Data Resources	Product descriptions, customer records, employee files, inventory databases.
Network Resources	Communications media, communications processors, network access, control software.
Information Products	Management reports and business documents using text and graphics displays, audio responses, and paper forms.

3. TRANSACTION PROCESSING SYSTEM (TPS)

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- ✓ Transaction Processing System (TPS) may be defined as a type of information system that collects, stores, modifies and retrieves the day-to-day data transactions of an enterprise.
- ✓ Example: Airline Reservation Systems, Railway reservation by IRCT, Banking system etc.
- ✓ transactions virtually instantly

Attributes of TPS:

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- 1) ***Access Control:***
- 2) ***Equivalence:***
- 3) ***High Volume Rapid Processing:***

4) *Trustworthiness*:

Transactions Processing Qualifiers

In order to qualify as a TPS, transactions made by the system must pass the **ACID Test** which is explained as below:

Prerequisite	Explanation
Atomicity	✓ This means that a transaction is <u>either completed in full or not at all</u> .
Consistency	TPS systems exist within a set of <u>operating rules</u>
Isolation {seclusion = अकेलापन)	Transactions must appear to take place in seclusion . For example, when a fund transfer is made between two accounts the debiting of one and the crediting of another <u>must</u> appear to take place <u>simultaneously</u> .
Durability	Once transactions are completed they <u>cannot be undone</u> .

These four conditions ensure that TPS systems carry out their transactions in a methodical, standardized and reliable manner.

Typical Transaction Processing Cycle

1. **Data Entry**: capture of business data. Data has to be quickly and correctly captured for its proper processing.
2. **Transaction Processing**: (i) batch processing, and (ii) real-time processing (also called online processing).
3. **Database Maintenance**: databases must be updated by its transaction processing systems.
4. **Document and Report Generation**: TPS produce a variety of documents and reports like sales receipts etc.

4. OFFICE AUTOMATION SYSTEMS (OAS)

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- ✓ The Office Automation Systems (OAS) is amalgamation of hardware, software, and other resources used to smooth the progress of communications and augment (बढ़ाना) efficiency.
- ✓ Office automation refers to the use of computer and software to digitally generate, collect, store, manipulate, and relay office information needed for accomplishing basic tasks and goals.
- ✓ **Examples** of Office Automation Applications
 - **Word Processing** → Use of a computer to prepare typed or printed documents.
 - **Electronic mail** →
 - **Electronic Calendaring** → Use of a networked computer to store and retrieve a manager's appointment calendar.
 - **Video Conferencing** → to link geographically dispersed conference participants.
 - **FAX** →
 - **Desktop Publishing** → Uses a computer to prepare output that is very close in quality to that produced by a typesetter.

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5. KNOWLEDGE MANAGEMENT SYSTEM (KMS)

- ✓ **Knowledge Management Systems (KMS) refer to any kind of IT system that stores and retrieves knowledge, improves collaboration, locates knowledge sources, mines repositories, captures and uses knowledge, or in some other way enhances the KM process.**
- ✓ There are two broad types of knowledge—Explicit [recorded] and Tacit [personal know-how]
 - ***Explicit knowledge***: Explicit knowledge is that which can be formalized easily and also easily available. This type of knowledge is codified, easy to document, transfer and reproduce. For example – Online tutorials, Policy etc.
 - ***Tacit knowledge***: Tacit knowledge, resides in a few, mostly in just one person and hasn't been captured by the organization or made available to others. It is difficult to document and communicate the tacit knowledge. For example – hand-on skills, special know-how, employee experiences.

KNOWLEDGE BASE is a special kind of database for knowledge management. It is an information repository that provides a means for information to be collected, organized, shared, searched and utilized.

Link between Information and Knowledge

- ✓ **Knowledge is derived from information.** Knowledge represents information with a potential use retained for reference in future decision situations
- ✓ For example, 3450/- is data, my bank account has a balance of 3450/- is information and if balance falls below 2500/- I shall have to pay minimum balance charge, is knowledge.

Knowledge Discovery and Data Mining (KDD) fundamentally deals with ways and means of capturing and making obtainable knowledge of the experts to others, in electronic form.

6. MANAGEMENT INFORMATION SYSTEM (MIS)

- ✓ **Management Information System' (MIS) refers to the data, equipment and computer programs that are used to develop information for managerial use.**
- ✓ Management Information System is an integrated, user-machine system provides accurate, timely and meaningful data to support operation, management and decision-making functions in an organization.

Developing MIS – Dos and Don'ts

Do

- ✓ Have simpler and manageable system.
- ✓ Develop common understanding between consultant and the organization.
- ✓ Involve programmer in needs assessment.
- ✓ Have simple software for users to handle.

Don't

- ☒ Don't Be ambitious
- ☒ Don't Be unrealistic in developing action plan
- ☒ Don't Depend heavily on the Consultant
- ☒ Don't Invest heavily in in-house application development

Some Examples of MIS

- ✓ Airline reservations (seat booking, payment, schedules, boarding list, special needs, etc.)
- ✓ Integration of department with the help of contemporary software's like ERP

7. DECISION SUPPORT SYSTEMS (DSS)

- ✓ DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, and business models to identify and solve problems and make decisions.
- ✓ DSS has four basic components:
 - 1) **The user**:
 - 2) **One or more databases**:
 - 3) **Planning languages**: Planning languages can either be general-purpose or special purpose allowing users to perform routine tasks and specific tasks respectively.
 - 4) **Model Base**: Model base is the brain of the DSS as it performs data manipulations
- ✓ Framework of Decision Support System consists of four phases:
 - 1) **Intelligence** - Searching for conditions that call for decision.
 - 2) **Design** - Inventing, developing and analyzing possible alternative actions of the solution.
 - 3) **Choice** - Selecting a course of action among those.
 - 4) **Implementation** - Adopting the selected course of action in decision situations.

A DSS helps users to:

- ✓ Engender {originate/develop} data models and “what if” scenarios
- ✓ manipulate data directly
- ✓ premeditated (सोचा-समझा) to make non-routine decisions
- ✓ slot in data from external sources

8. EXECUTIVE INFORMATION SYSTEM (EIS)

RTP

- ➔ An Executive Information System (EIS) is used by executives to access and administer the data that enable them to make **business decisions**.
- ➔ EIS is different from a Decision Support System (DSS) as EIS is targeted at executives and DSS is targeted at managers.
- ➔ EIS is also known as **Enterprise** Information Systems or Executive Support Systems (ESS)

Components of an EIS

- 1) **Hardware** Includes Input data-entry devices, CPU, Data Storage files and Output Devices.
- 2) **Software** Includes Text base software, Database, and Graphic types
- 3) **User Interface** questions/answers, menu driven, command language, natural language etc.
- 4) **Telecommunication** Involves transmitting data from one place to another

Specialized Systems

Specialized Systems provide **comprehensive end to end IT solutions and services** like systems
Specialized Systems also offer comprehensive solutions to various sectors to confront challenges.

9. ENTERPRISE RESOURCE PLANNING (ERP)

- ✓ Enterprise Resource planning system (ERPs) integrate (Or attempt to integrate) all data and Processes of an organization into a single unified system.
- ✓ A key ingredient of most ERP system is the use of a single, Unified database to store data for the various system modules.
- ✓ ERP allows a company to track sales orders from the order desk, to production planning, purchasing, production, warehousing, shipping and accounts receivable.
- ✓ Popular ERP packages are SAP R/3, JD Edwards, Baan, Oracle 9i

10. CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

- ✓ Customer Relationship Management (CRM) may be defined as a business process in which client relationships; customer loyalty and brand value are built through marketing strategies and activities.
- ✓ **Benefits** of CRM
 - CRM establishes the benefits of generating customer loyalty, raising a market intelligence enterprise, and an integrated relationship.
 - CRM Preserve existing customers by providing enhanced services and gain customer loyalty.

11. SUPPLY CHAIN MANAGEMENT (SCM)

- ✓ Supply Chain Management may be defined as the process of planning, implementing and controlling the operations of the supply chain with the purpose of satisfying the customer's requirement as efficiently as possible.
- ✓ **Components** of SCM:
 - 1) **Procurement/Purchasing** –
 - i) right items are delivered in the exact quantities at the correct location on the specified time
 - 2) **Operations** – transform them and produce the products
 - 3) **Distribution** –
 - 4) **Integration** -

12. HUMAN RESOURCE MANAGEMENT SYSTEMS (HRMS)

A Human Resources Management System (HRMS) is a software application that coalesce [unite] many human resources functions, together with benefits administration, payroll, recruiting and training, and performance analysis and assessment into one.

Key Integration Points or Key Modules of HRMS

- 1) **Workforce Management**: Workforce Management provides powerful tools to effectively manage labour rules, ensure compliance, and control labour costs and expenses.
- 2) **Time and Attendance Management**: The time and attendance module gathers standardized time and work related efforts. Cost analysis and efficiency metrics are the primary functions.
- 3) **Payroll Management**: This module of the system is designed to automate payroll functions and facilitate salary, deductions, calculations etc. and eliminates errors.
- 4) **Training Management**: Training programs can be entered with future dates which allow managers to track progress of employees
- 5) **Compensation Management**:

- 6) **Recruitment Management:**
- 7) **Employee Self Service (ESS):**

13. CORE BANKING SYSTEM (CBS)

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- ✓ Banks use core banking applications to process their operations where CORE stands for "**Centralized Online Real-time Environment**".
- ✓ Core Banking System may be defined as the set of basic software components that manage the services provided by a bank to its customers through its branches (branch network).
- ✓ CBS is developed to perform **core operations** of banking like recording of transactions, passbook maintenance, and interest calculations on loans and deposits, customer records, balance of payments and withdrawal.
- ✓ These systems are running 24x7 to support Internet banking, global operations, and real time transactions via ATM, Internet, phone, and debit card.
- ✓ The **various elements** of core banking include making and servicing loans; opening new accounts; processing cash deposits and withdrawals; processing payments and cheques; calculating interest; Customer Relationship Management (CRM) activities etc.
- ✓ Examples of major core banking products include Infosys' Finacle, Nucleus FinnOne and Oracle's Flexcube application.

Infosys' Finacle

Finacle core banking solution is a comprehensive, componentized yet integrated business solution, addressing all the core needs of banks, in easy-to-configure modules.

The key modules of Finacle are as below:

1. **Enterprise customer information:**
2. **Consumer banking:**
3. **Corporate banking:**
4. **Payments:**

Nucleus FinnOne: The Nucleus FinnOne is a web-based global banking product designed to support banks and financial solution companies in dealing with assets, liabilities, core financial accounting and customer service. Retail & Corporate Banking, Cash Management, Credit Risk & Appraisal, Basel II etc. are covered.

Oracle's FLEXCUBE

- ✓ Oracle FLEXCUBE can take advantage of the high fidelity [reliability] reports provided by the system for better management and operational controls
- ✓ Oracle **FLEXCUBE empowers** universal banks with:
 - ❖ Superior Web experience through self-service and assisted channels
 - ❖ Improved bank staff productivity with intuitive, role-based dashboards
 - ❖ Comprehensive transaction banking capabilities & Straight-Through-Processing (STP)
 - ❖ Improved risk management and reporting

14. ACCOUNTING INFORMATION SYSTEM (AIS)

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- ✓ Accounting Information System is defined as a system of collection, storage and processing of financial and accounting data that is used by decision makers.
- ✓ The different sub components in AIS include Budgeting and Planning, Expenses and Revenue Management, Cash and Treasury Management, Accounting software.

- ✓ The accounting information system focuses strongly on different accounting transactions and other important aspects such as payroll, sales, purchases, invoicing, taxation, inventory management etc.

The key elements that **compose** the **typical Accounting Information System** are as follows:

- 1) ***People:***
- 2) ***Procedure and Instructions:***
- 3) ***Data***
- 4) ***Software:***
- 5) ***Information Technology Infrastructure:***
- 6) ***Internal Controls:***

15. **ARTIFICIAL INTELLIGENCE**

- ✓ Artificial Intelligence (AI) is the area of computer science focusing on creating machines that can fit in place of behaviors that humans regard as intelligent.
- ✓ The objective of AI is to make a computer that can discover, sketch, and crack problems.
- ✓ Expert systems, Pattern Recognition, Natural language processing, and many others are some of the various purposes on which AI may be applied

16. **EXPERT SYSTEM**

- ✓ An Expert System (ES) is a computerized information system that allows non-experts to make decisions comparable to those of an expert.
- ✓ The aim of the expert system is to have a team of seasoned specialists holding industry-wide experience who further spread across implementations like in Defense, Government, Finance, Telecom, and Engineering sectors.
- ✓ Some of the commercial applications of AI are as follows
 - ***Decision Support*** → Intelligent human–computer interface (HCI) systems that can understand spoken language and gestures, and facilitate problem solving by supporting organization wide collaborations to solve particular problems.
 - ***Information Retrieval*** → Natural language technology to retrieve any sort of online information, from text to pictures, videos, maps, and audio clips, in response to English questions.
 - ***Virtual Reality*** → X-ray–like vision enabled by enhanced-reality visualization that allows brain surgeons to “see through” intervening tissue to operate.
 - ***Robotics*** → Machine-vision inspections systems for gauging, guiding, identifying, and inspecting products and providing competitive advantage in manufacturing.

Components of an Expert System are as follows

- Knowledge base*** -- equivalent of knowledge and insight of an expert.
- Inference engine*** -- contains the logic and reasoning mechanisms. Form its conclusions, and recommend a course of action.
- User interface*** -- allows to communicate with the other components.
- Explanation facility*** – provides explanation of the logic.
- Database of Facts*** – store input data.

Types of Expert System problem domains

- ✓ Expert systems are designed to deal with imprecise data or problems that have more than one solution.
- ✓ Using a technique called **fuzzy logic**; an expert system can deal with imprecise data by asking for a level of confidence.
- ✓ **Expert Systems can be Example-based, Rule-based or Frame-based.**
 - In **Example-based system**, developers enter the case facts and results. This system is used to match the case at hand with those previously entered in the knowledge base.
 - **Rule-based systems** are created by **storing data and decision rules as if-then** rules. The system asks the user questions and applied the if-then rules to the answers to draw conclusions and make recommendations.
 - **Frame based systems** organize all the information about a topic into logical units called frames, which are similar to linked records in data files. Rules are then established about how to assemble or inter-relate the frames to meet the user's needs.

17. BUSINESS INTELLIGENCE

- ❖ BI in simple words refers to the process of collecting and refining information from many sources, analysing and presenting the information in useful ways so that users can make better business decisions.

Business Intelligence Tools

Some of the key Business Intelligence tools are given as follows

- 1) **Simple Reporting and Querying:**
 - a. This involves using the data warehouse to get response to the query: "Tell me what happened."
- 2) **Business Analysis:**
 - a. This involves using the data to get response to the query: "Tell me what happened and why."
- 3) **Dashboards:**
 - a. The objective of Dashboard is to get response to the query: "Tell me a lot of things, but without too much effort".
 - b. Dashboards are **flexible tools** that can be bent into many different shapes.
- 4) **Scorecards:**
 - a. Scorecards offer a rich, visual gauge to display the performance of specific initiatives, business units, or the enterprise as a whole.
- 5) **Data Mining or Statistical Analysis:**
 - a. This involves using statistical, artificial intelligence, and related techniques to mine through large volumes of data and providing knowledge without users even having to ask specific questions.
 - b. **OLAP (Online Analytical Processing) is a multi-dimensional analytical tool typically used in data mining, that gathers and process vast amounts of information into useful packets.**

18. BUSINESS REPORTING THROUGH MIS AND IT

Benefits for micro-businesses and small to medium enterprises

- 1) **Paperless lodgement** (जमा करना) -

- 2) **Electronic record keeping** – stores the reports securely in the accounting or bookkeeping system;
- 3) **Pre-filled forms** - reports are automatically pre-filled with information existing in the accounting or from information held by government, saving valuable time;
- 4) **Ease of sharing** - between client, accountant, tax agent or bookkeeper for checking;
- 5) **Secure AUSkey authentication** - AUSkey is a common authentication solution for business-to-government online services.
- 6) **Same-time validation** - receive a fast response that any lodgement has been received.

Benefits for large business

- 1) **A single reporting language to report to government: eXtensible Business Reporting Language (XBRL) - an international standards-based business reporting language developed by accountants for financial reporting;**
- 2) **Reduce costs** - reduction in the cost of assembling, analyzing, and providing data.
- 3) **Streamline the process of aggregating data -**
- 4) **Increased access to comparable performance information –**
- 5) **Secure AUSkey authentication -**

19. ACCESS AND PRIVILEGE CONTROLS

- ❖ In order to safeguard software systems, procedures are developed and implemented for protecting them from unauthorized modification, disclosure or destruction to ensure that information remains accurate, confidential, and is available when required.
- ❖ **The administration of users' access to the software applies the principles of least privilege and "need to know" basis.**
- ❖ Access controls help us to restrict whom and what accesses our information resources, and they possess **four general functions**:
 - **Identity Management**: Identity management consists of one or more processes to verify the identity of user. However, it does not provide 100 percent assurance rather; it provides a level of probability of assurance. The level of probability depends on the identity verification processes in place
 - **Authentication**: Authentication is the process of verifying a subject's identity at the point of object access.
 - **Authorization**: Once a resource or network verifies a subject's identity, the process of determining what objects that subject can access begins. Related processes also enforce least privilege, need-to-know, and separation of duties.
 - **Accountability**: Each step from identity presentation through authentication and authorization is logged. The logs are stored for audits, sent to a log management solution, etc. They provide insight into how well the access control process is working.

Approaches to Access Control – 2 main approaches

- 1) **Role-based Access Control (RBAC)**: RBAC largely eliminates discretion when providing access to objects. Instead, administrators or automated systems place subjects/user into roles. Subjects receive only the rights and permissions assigned to those roles.
- 2) **Rules-based Access Control (RAC)**: RAC differs from RBAC methods because it is largely context-based. RBAC, for example, enforces static constraints based on a user's role. A manager, for example, has the ability to approve his/her employees' hours worked.

However, when s/he attempts to approve his/her own hours, system temporarily removes approval privilege. Note that this is dynamic and occurs at the time a transaction is attempted. This also sometimes called dynamic RBAC.

Principle of Least Privilege: This is a fundamental principle of information security, which refers to give only those privileges to a user account, which are essential to that user's work. For example, auditor can only view transaction not modify.

20. **PAYMENT MECHANISMS- MAJOR TYPES**

Credit Cards:

- ➔ The consumer presents his credit card number to the merchant.
- ➔ The merchant can verify this with the bank, and create a purchase slip for the consumer to endorse.
- ➔ The merchant then uses this purchase slip to collect funds from the bank, and, on the next billing cycle, the consumer receives a statement from the bank with a record of the transaction.
- ➔ In a credit card transaction, the steps involved are authorization, batching, clearing and funding.

How a credit card is processed?

- 1) **Acquirer**: A bank that processes & settles a merchant's credit card transactions.
 - 2) **Cardholder**: The owner of a card that is used to make credit card purchases.
 - 3) **Card network**: Visa, MasterCard or other networks that act as an intermediary
 - 4) **Discount fee**: A processing fee paid by merchants to acquirers
 - 5) **Interchange fee**: A charge paid by merchants to a credit card issuer and a card network
 - 6) **Issuer**: A financial institution, bank or company that issues or helps issue cards to cardholders.
-
- 1) **Step 1: Authorization** – This is the first step in processing a credit card. After a merchant swipes the card, the data is submitted to merchant's bank, called an acquirer, to request authorization for the sale. The acquirer then routes the request to the card issuing bank, where it is authorized or denied, and the merchant is allowed to process the sale.
 - 2) **Step 2: Batching** – This is the second step in processing a credit card. At the end of a day, the merchant reviews all the day's sales to ensure they were authorized and signed by the cardholder. It then transmits all the sales at once, called a batch, to the acquirer to receive payment.
 - 3) **Step 3: Clearing** – After the acquirer receives the batch, it sends it through the card network, where each sale is routed to the appropriate issuing bank. The issuing bank then subtracts its interchange fees, which are shared with the card network, and transfers the remaining amount through the network back to the acquirer.
 - 4) **Step 4: Funding** – This is the fourth and final step in processing a credit card. After receiving payment from the issuer, minus interchange fees, the acquirer subtracts its discount fee and sends the remainder to the merchant. The merchant is now paid for the transaction, and the cardholder is billed.

Using a credit card to make a purchase over the Internet requires additional steps to provide for secure transactions and authentication of both buyer and seller. To address these security concerns

Visa and MasterCard, develop a common standard to process card transactions, called the **Secure Electronic Transaction (SET)** standard.

Electronic Cheques →

- ✓ ***By the Financial Services Technology Corporation (FSTC)***: The FSTC is a consortium of banks and clearing houses that has designed an electronic cheque. This new cheque is initiated electronically, and uses a digital signature for signing and endorsing.
- ✓ ***By CyberCash***: An electronic cheque has all the same features as a paper cheque. The electronic cheque is superior to the paper cheque as sender can protect himself against fraud by encoding our account number with the bank's public key.

Smart Card → Electronic cards that contain information about how much money you have and deduct purchases from that total. These are commonly provided by almost all banks today.

Three types of smart cards have established themselves.

- ✓ ***Contact Cards*** –
- ✓ ***Contactless Cards*** –
- ✓ ***Combi Cards*** –

Electronic Purses → Electronic is yet another way to make payments over the net. It is very similar to a pre-paid card. For E.g.: Bank issues a stored value cards to its customers, the customer can then transfer value from their accounts to the cards at an ATM or PC.

CHAPTER 5 - BUSINESS PROCESS AUTOMATION THROUGH APPLICATION SOFTWARE

21. BUSINESS APPLICATIONS AND THEIR TYPES

Business applications are software or set of software used by business people. Its types are

Types	Nature of processing	Source of application	Size and Complexity of business	Nature of Application
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

22. APPLICATIONS BASED ON NATURE OF PROCESSING

- 1) **Batch Processing:** Data is first collected and then batch-processed.
- 2) **Online Processing:** Data is processed immediately while it is entered, the user usually only has to wait a short time for a response.
- 3) **Real-time Processing:** Real time processing is a subset of interactive or online processing. Input is continuously, automatically acquired from sensors.

23. APPLICATIONS BASED ON SOURCE OF APPLICATION

- 1) **Custom-built Application:** Customization involves additional coding as per business requirements and style. Example – Billing, Inventory etc.
- 2) **Packaged Software:** These are the standard applications which are not free but are licensed. For Example -Tally, Oracle 9i, etc.
- 3) **Leased application:** where user pays fixed rent for using the application for agreed terms.

24. APPLICATIONS BASED ON SIZE AND COMPLEXITY OF BUSINESS

- 1) **Small and Medium Enterprise (SME) business**
- 2) **Large Business**

25. BUSINESS APPLICATIONS BASED ON NATURE OF APPLICATION (TYPE)

- 1) **Accounting Applications:** day-to-day transactions of accounting and generating financial information
- 2) **Office Management Software:** manage office requirements like word processors
- 3) **ERP Software:** These are used by entities to manage resources optimally
- 4) **Industry Specific Applications:** banking applications, billing systems for malls .

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

26. BUSINESS PROCESS AUTOMATION

Business Process Automation (BPA) is a strategy to automate business processes so as to bring benefit to enterprise in terms of cost, time and effort.

Why BPA?

- ✓ **Reducing the Impact of Human Error:** BPA removes human participation in the process, which is the source of many errors.
- ✓ **Transforming Data into Information:** BPA analyze data and make it available in a form that is useful for decision making.
- ✓ **Improving performance and process effectiveness:** Automating manual tasks speeds up the effective throughput of the application.
- ✓ **Cost Saving:** Automation leads to saving in time and labor costs through higher efficiency and better management.
- ✓ **To remain competitive:** To provide the level of products and services as offered by competition.
- ✓ **Fast service to customers:** Automation shortens cycle times in the execution of processes and help enterprises to serve their customers faster and better.

27. OBJECTIVES OF BPA

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The success of any business process automation shall only be achieved when BPA ensures:

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

To ensure that all the above parameters are met, BPA needs to have appropriate internal controls put in place.

28. STEPS IN IMPLEMENTING BUSINESS PROCESS AUTOMATION

- a. Step 1: Define why we plan to implement BPA?
 - ✓ The answer to this question will provide justification for implementing BPA.
- b. Step 2: Understand rules/regulation under which it needs to comply with?
 - ✓ The underlying issue is that any BPA needs to comply with applicable laws & regulations say Companies Act, 2013 for accounting.
- c. Step 3: Document the process, we wish to automate.
 - ✓ The current process which are planned to be automated need to be correctly and completely documented at this step.
- d. Step 4: Define the objectives/goals to be achieved by implementing BPA.
 - ✓ This enables the developer and user to understand the reason for implementing BPA.
- e. Step 5: Engage the business process consultant.
 - ✓ Entity needs to appoint an expert, who can implement BPA.
- f. Step 6: Calculate the ROI for project.
 - ✓ This can be used for convincing top management to approve BPA project.
- g. Step 7: Development of BPA.

- ✓ After approval from top management, the right business solutions has to be 'procured & implemented' or 'developed & implemented'.
- h. Step 8: Testing the BPA.
 - ✓ Before making the process live, the BPA solution needs to be fully tested.

29. APPLICATIONS THAT HELP ENTITY TO ACHIEVE BPA

1. **TALLY:**

- a. It is an accounting application that helps entity to automate processes relating to accounting of transactions.
- b. It also helps to achieve automation of few processes in inventory management and tax compliances also.

2. **SAP R/3:**

- a. It is ERP software, which allows an entity to integrate its business processes
- b. It has the features such as reporting and analytics, budget monitoring, workflow approval, sales management etc.

3. **MS Office Applications:**

- a. These are various office automation systems by Microsoft Corporation which include MS Word, MS Excel, MS PowerPoint, MS Access, etc.
- b. It has features such as customized ribbon, built-in graphics toolset, enhanced security, excel spark lines, pivot for Excel, PowerPoint broadcast etc.

4. **Vehicle Tracking System:**

- a. Applications have been developed that allow tracking goods while in transit.
- b. It has features such as GPS based location, GPRS connection based real-time online data-logging and reporting, SMS & e-mail notifications, on-board memory to store location inputs during times when GPRS is not available or cellular coverage is absent.

5. **Automated Toll Collection Systems:**

6. **Department Stores Systems:**

30. INFORMATION PROCESSING

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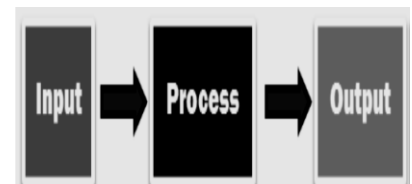
The effort to create information from raw data is known as Information Processing.

Classification of information is based on level of human/computer intervention, which is given as follows:

Manual Information Processing Cycle

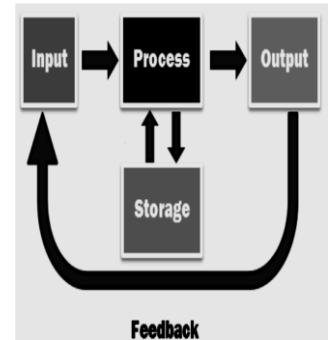
- ✓ These are the systems where the level of manual intervention is **very high**.
- ✓ Example: ticket checking by railway staff in trains, people maintaining books manually, etc.
- ✓ **Components** of manual information processing cycle include:

- **Input:** Put details in register.
- **Process:** Summarize the information.
- **Output:** Present information to management in the form of reports.



Computerized Information Processing Cycle

- ✓ These are systems where computers are used at every stage of transaction processing.
- ✓ The **components** of a computerized information processing cycle include:
 - ***Input***: Entering data into the computer;
 - ***Processing***: Performing operations on the data;
 - ***Storage***: Saving data, programs, or output for future use; and
 - ***Output***: Presenting the results.



31. DELIVERY CHANNELS & HOW TO CHOOSE INFORMATION DELIVERY CHANNEL

When choosing appropriate delivery channels, consider the following suggestions:

- ✓ *More than just the intranet:*
- ✓ *Understand staff needs & environment:*
- ✓ *Traditional Channel need to be formalized:*

32. CONTROLS IN BPA

- ✓ We need to ensure that all information that is generated from system is accurate, complete and reliable for decision making, hence the requirement for proper controls.
- ✓ ***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.***

33. CONTROL OBJECTIVES

- 1) ***Authorization*** -
- 2) ***Completeness*** -
- 3) ***Accuracy*** -
- 4) ***Validity*** - ensures that all recorded transactions fairly represent the economic events
- 5) ***Physical Safeguards and Security***
- 6) ***Error Handling*** - ensures that errors detected
- 7) ***Segregation of Duties*** - no one individual can control both recording & processing



Based on the time at which controls are applied, they may be categorized as follows:

- ➔ ***Preventive***: Those, which prevent occurrence of an error/fraud, say security guards.
- ➔ ***Detective***: Those, which capture an error, say audit trail.
- ➔ ***Corrective***: Those which correct an error or reduce the loss due to error/risk.

34. INFORMATION SYSTEMS' CONTROLS

Controls divided into 2 categories i.e. Managerial Controls & Application Controls.

- ✓ Auditors cannot examine and evaluate all the data processing carried out within an organization & need guidelines to find material losses or account misstatements
- ✓ Controls reduce expected losses from unlawful events by -
 - Decreasing the probability of the event occurring in the first place, or
 - Limiting the losses that arise if the event occurs.

35. MANAGERIAL CONTROLS

These are controls over the managerial functions that must be performed to ensure the development, implementation, operation and maintenance of information systems in a planned and controlled manner.

Types of Management Subsystem

- 1) *Top Management* →
- 2) *Information Systems Management* →
- 3) *Systems Development Management* →
- 4) *Programming Management* →
- 5) *Data Administration* →
- 6) *Security Administration* →
- 7) *Quality Assurance Management* →
- 8) *Operations Management* →

Managerial Functions Based Controls

- 1) *Top Management and Information Systems Management Controls*: Planning, Organizing, Leading, Controlling.
- 2) *Systems Development Management Controls*: Three different types of audits may be conducted during system development process as discussed below:
 - a. **Concurrent Audit**:
 - b. **Post-implementation Audit** :
 - c. **General Audit**:
- 3) *Programming Management Controls*: The primary objectives of this phase are to produce or acquire and to implement high-quality programs.

Phase	Controls
Planning	Techniques like Gantt charts and PERT Charts can be used to monitor progress against plan
Design	A systematic approach to program design
Coding	Programmers must choose a module implementation and integration strategy.
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.
Operation And 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; and

	Perfective Maintenance - in which the program is tuned to decrease the resource consumption.
Control	Monitor progress against plan and to ensure software released for production use is authentic, accurate, and complete.

4) **Data Resource Management Controls:**

5) **Quality Assurance Management Controls:**

6) **Security Management Controls:** Major threats and their control measures are as follows:

a. Fire:	b. Water:
c. Structural Damage:	d. Unauthorized Intrusion:
e. Viruses and Worms:	f.

7) **Operations Management Controls:** Operations management is responsible for the daily running of hardware and software facilities. Operations management typically performs controls over the functions like Computer Operations, Communications Network Control etc. Operations management control must continuously monitor the performance of the hardware/software platform to ensure that systems are executing efficiently.

36. APPLICATION CONTROLS AND THEIR TYPES

Boundary Controls:

- The major controls of the boundary system are the **access control mechanisms**.
- Access controls are implemented with an access control mechanism and links the authentic users to the authorized resources they are permitted to access.

Boundary control techniques include:

- 1) **Cryptography:**
- 2) **Access Controls:** restrict use of computer system resources to authorized users, ensure that users obtain only authentic computer system resources. An access control mechanism processes users' requests for resources in three steps:
 - a) Identification
 - b) Authentication
 - c) Authorization
- 3) **Personal Identification Numbers (PIN):** similar to a password assigned to a user by an institution based on the user characteristics
- 4) **Plastic Cards:**
- 5) **Digital Signatures:**

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Input Controls:

These are responsible for ensuring the accuracy and completeness of data that are input into an application system.

Type of Input Controls:

- 1) **Source Document Control:** In systems that use physical source documents to initiate transactions, careful control must be exercised over these instruments.
- 2) **Data Coding Controls:** Data Coding Controls are put in place to reduce user error during data feeding.

- 3) **Batch Controls:** These controls are put in place at locations where batch processing is being used. The objective is to ensure accuracy and completeness of the content and that they are not lost during transportation.
- 4) **Validation Controls:** These controls validate the accuracy/correctness of input data. Input Validation Controls are intended to detect errors in transaction data before the data are processed.

Process Controls:

- ✓ Data processing controls perform validation checks to **identify errors during processing** of data.
- 1) **Run-to-run Totals:**
- 2) **Reasonableness Verification:**
- 3) **Edit Checks:**
- 4) **Field Initialization:**
- 5) **Exception Reports:**
- 6) **Existence/Recovery Controls:**

Communication Controls:

Communication subsystem are responsible for transporting data within a system and for transporting data to or receiving data from another system.

Type of Communication Controls:

Physical Component Controls: Choose a physical component that has characteristics that make them reliable and that incorporate features or provide controls that mitigate the possible effects of exposures.

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.

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. For example in “Stop-and-Wait Flow Control” in which the sender transmits a frame of data only when the receiver is ready to accept the frame.

Link Controls: This involves two common protocols – HDLC (Higher Level Data Control) and SDLC (Synchronous Data Link Control).

Topological Controls: Network topology specifies the location of nodes within a network, the ways in which these nodes will be linked. Some of the four basic topologies include Bus, Ring, Star and Tree Topology.

Channel Access Controls: Two different nodes in a network can compete to use a communication channel. Whenever the possibility of contention for the channel exists, some type of channel access control technique must be used such as

Polling:

- ✓ **Polling (non contention)** techniques establish an order in which a node can gain access to channel capacity.
- ✓ **Contention Methods:** Using contention methods, nodes in a network must compete with each other to gain access to a channel. Whether the node can use the channel successfully, however, depends on the actions of other nodes connected to the channel.

Internetworking Controls: Internetworking is the process of connecting two or more communication net-works together to allow the users of one network to communicate with the users of other networks.

Output Controls

Output controls ensure that the data delivered to users will be presented, formatted and delivered in a consistent and secured manner.

- 1) **Storage and Logging of Sensitive and Critical Forms:**
- 2) **Logging of Output Program Executions:**
- 3) **Report Distribution and Collection Controls:**
- 4) **Retention Controls:**
- 5) Controls over Printing
- 6) Existence/Recovery Controls

Database Controls:

Protecting the integrity of a database when application software acts as an interface to interact between the user and the database are called the update controls.

- 1) **Sequence Check Transaction and Master Files:**
- 2) **Ensure all records on files are processed:**
- 3) **Process multiple transactions for a single record in the correct order:**

37. NETWORK VIRTUALIZATION

- ✓ In IT, Virtualization is the process of creating logical computing resources from physical resources.
- ✓ The core concept of Virtualization lies in Partitioning, which divides a single physical server into multiple logical servers
- ✓ **Major applications of the concepts of the virtualization are given as follows:**
 - **Server Consolidation:**
 - **Disaster Recovery:**
 - **Testing and Training:**
 - **Portable Applications:**
 - **Portable Workspaces:**

Some common types of Virtualization

Hardware Virtualization:

- ✓ Hardware Virtualization or Platform Virtualization refers to the creation of a virtual machine that acts like a real computer with an operating system.
- ✓ For example, a computer that is running Microsoft Windows may host a virtual machine that looks like a computer with the Linux operating system.

Network Virtualization:

- ✓ 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.
- ✓ 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.

Storage Virtualization:

- ✓ 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.
- ✓ Storage virtualization is sometimes described as “abstracting the logical storage from the physical storage

38. GRID COMPUTING

- ✓ A grid computing system can be as simple as a collection of similar computers running on the same operating system or as complex as inter-networked systems comprised of different computer platform.

Benefits of Grid Computing

1) Making use of Underutilized Resources	2) Resource Balancing
3) Parallel CPU Capacity	4) Virtual resources and virtual organizations for collaboration
5) Access to additional resources	6) Reliability
7) Management	

Types of Resources

A grid is a collection of machines, sometimes referred to as nodes, resources, members, donors, clients, hosts and many other such terms.

- ✓ Computation → processors of the machines on the grid
- ✓ Storage
- ✓ Communications
- ✓ Software and Licenses
- ✓ Special equipment, capacities, architectures, and policies

Using a Grid: User's Perspective (what user has to do)

- 1) Enrolling and installing Grid Software
- 2) Logging onto the grid
- 3) Queries and submitting jobs
- 4) Data configuration
- 5) Monitoring progress and recovery
- 6) Reserving resources

Using a Grid: An Administrative Perspective

- ✓ Planning → Security & Organization

- ✓ Installation
- ✓ Managing enrollment of donors and users
- ✓ Certificate Authority → to ensure the highest levels of security in a grid because the grid is designed to execute code and not just share data
- ✓ Resource Management
- ✓ Data sharing

39. APPLICATION AREAS OF GRID COMPUTING

- ✓ An insurance company mines data from partner hospitals for fraud detection.
- ✓ Civil engineers collaborate to design, execute, & analyze shake table experiments.
- ✓ An enterprise configures internal & external resources to support e-Business workload.
- ✓ An application service provider offloads excess load to a compute cycle provider.

40. GRID COMPUTING SECURITY

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

- 1) Single Sign-on:
- 2) Protection of Credentials
- 3) Interoperability with local security solutions
- 4) Exportability
- 5) Support for secure group communication
- 6) Support for multiple implementations

41. CLOUD COMPUTING

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*the capacity to recover quickly

Characteristics of Cloud Computing

- 1) *Elasticity and Scalability:*
- 2) *Pay-per-Use:*
- 3) *On-demand:*
- 4) *Resiliency*:*
- 5) *Multi Tenancy:*
- 6) *Workload Movement:*

Advantages of Cloud Computing

- 1) *Cost Efficient:*
- 2) *Almost Unlimited Storage:*
- 3) *Backup and Recovery:*
- 4) *Automatic Software Integration:*
- 5) *Easy Access to Information:*
- 6) *Quick Deployment:*

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Disadvantages of Cloud Computing

- 1) *Technical Issues:*
- 2) *Security in the Cloud:*
- 3) *Prone to Attack:*

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