

UNDERSTANDING

Information Technology

A Self-study Module

[For CA-Intermediate (IPC) Course]

Third Edition

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Understanding Information Technology: A Self-study Module

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Preface

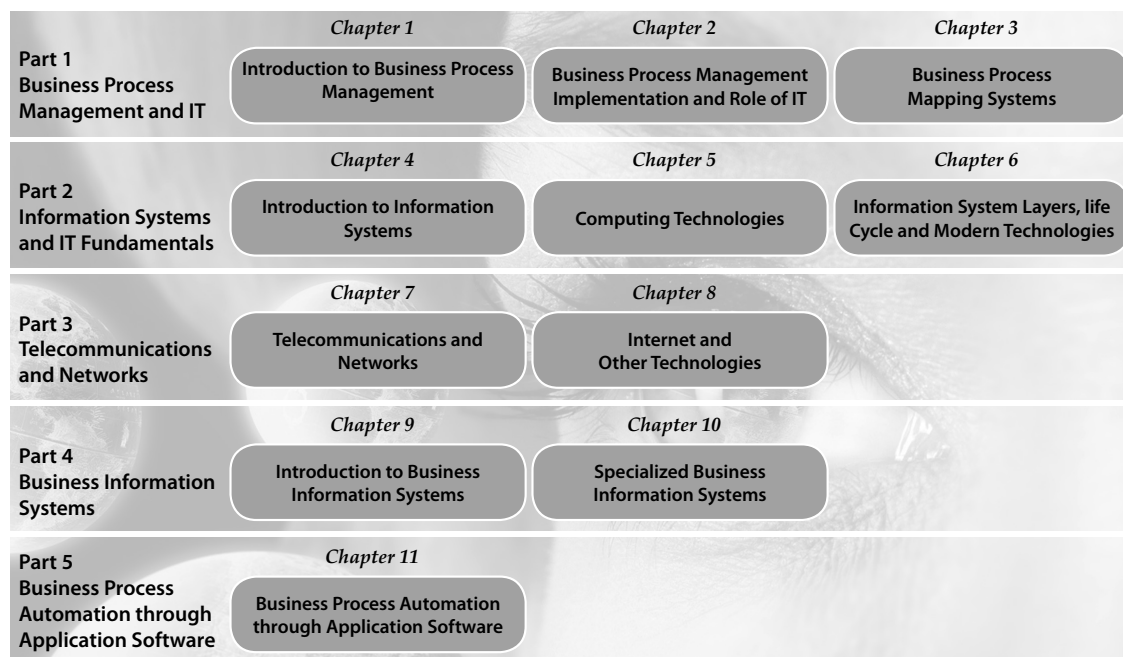
Welcome to the second edition of 'Understanding Information Technology: A Self-study Module'! As an author, I am sensitive to your learning needs. I believe that presentation is an effective tool that determines the success of an author. For this very reason, I have taken your point of view into consideration. In writing each chapter, I have taken every care to make the content informative as well as easy and interesting to read.

This new course can have a major impact on your career direction and future success. It provides the comprehensive knowledge of information technology that would help you to utilize your talent in the dynamic 21st century business world where information systems and emerging new technologies have taken centre stage in running businesses.

The aim of 'Understanding Information Technology: A Self-study Module' is to help CA Intermediate (IPC) students by clearly explaining, analysing, and evaluating important information technology concepts. My approach in writing this book was essentially twofold: to write an accessible textbook that students feel comfortable with but without compromising on the academic rigour.

The case-studies, herein, have been taken from contemporary world and leading brands around us. These help to bridge the gap between theories to practice; aiming not only at a comprehensive learning experience but also offering an interesting reading. To supplement this, I have tried to adopt a user-friendly writing style that gives clear and concise explanations to help students engage readily with the content and grasp complex IT concepts easily.

The book 'Understanding Information Technology: A Self-study Module' has been divided into five parts and seven chapters. The chapter organization provides a student-friendly approach to the study of Information Technology. Structure of this book has been shown in this diagram.



I would be happy to get your feedback, comments and queries. You can get in touch with me at om.trivedi@carvinowledge.in, www.facebook.com/strategyclasses or call me at 9953922272 (between 8 pm – 10 pm).

Good luck for a challenging and successful learning experience!

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Syllabi Mapping

Intermediate (IPC), Group-II Paper-7A: Information Technology (50 Marks)

Level of Knowledge: Working Knowledge

Objective: “To develop understanding of Information Technology as a key enabler and facilitator of implementing Information Systems in enterprises and their impact on business processes and controls”.

Parts	Syllabus	Chapters in the book
Part I	Business Process Management and IT	
	Introduction to various Business processes: Accounting, Finances, Sale and Purchase.	Chapter 1: Introduction to Business Process Management
	Business Process Automation– Benefits & Risks Accounting systems vs. Value chain automation, Information as a business asset Impact of IT on business processes, Business Risks of failure of IT Business Process Re-engineering	Chapter 2: Business Process Management Implementation and Role of IT
	Approach to mapping systems: Entity Diagrams, Data Flow Diagrams, Systems Flow diagrams, Decision trees/tables.	Chapter 3: Business Process Mapping Systems
Part II	Information Systems and IT Fundamentals	
	Understand importance of IT in business and relevance to Audit with case studies.	Chapter 4: Introduction to Information Systems
	Understand working of computers and networks in business process automation from business information perspective Concepts of Computing, Computing Technologies & Hardware –Servers, end points, popular computing architectures, emerging computing architectures & delivery models – example: SaaS, Cloud Computing, Mobile computing, etc. Example: Overview of latest devices/technologies –i5, Bluetooth, Tablet, Wi-Fi, Android, Touchpad, iPad, iPod, Laptop, Notebook, Smartphone, Ultra-Mobile PC etc.)	Chapter 5: Computing Technologies
	Overview of IS Layers–Applications, DBMS, systems software, hardware, networks & links and people Overview of Information Systems life cycle and key phases	Chapter 6: Information System Layers, life Cycle and Modern Technologies
Part III	Telecommunication and Networks	
	Fundamentals of telecommunication Components and functions of Telecommunication Systems Data networks –types of architecture, LAN, WAN, Wireless, private and public networks etc. Overview of computing architectures – centralised, de-centralised, mainframe, client- server, thin-thick client etc. Network Fundamentals–Components, Standards and protocols, Network risks & controls –VPN, Encryption, Secure protocols, Network administration and management– concepts and issues How information systems are facilitated through telecommunications.	Chapter 7: Telecommunications and Networks

	How Internet works, Internet architecture, key concepts, risks and controls E-Commerce and M-commerce technologies	Chapter 8: Internet and Other Technologies
Part IV	Business Information Systems	
	Information Systems and their role in businesses The relationship between organisations, information systems and business processes Accounting Information Systems and linkages to Operational systems Business Reporting, MIS & IT	Chapter 9: Introduction to Business Information Systems
	IT as a business enabler & driver –ERP, Core Banking System, CRM, SCM, HRMS, Payment Mechanisms Organisation Roles & responsibilities and table of authorities, importance of access controls, privilege controls Specialised systems -MIS, DSS, Business Intelligence, Expert Systems, Artificial Intelligence, Knowledge Management systems etc.	Chapter 10: Specialized Business Information Systems
Part V	Business process automation through Application software	
	Business Applications–overview and types Business Process Automation, relevant controls and information systems Information Processing & Delivery channels and their role in Information Systems Key types of Application Controls and their need Emerging concepts– Virtualisation, Grid Computing, Cloud delivery model	Chapter 11: Business Process Automation through Application Software

Amendments/Updations Applicable for May 2016 Exam onwards
(As per ICAI additions or updations introduced in new Study Material)

ICAI Chapters	Chapter name	Additions or Updations done by ICAI in New Study Material	Addition, Updation and Amendments in Our Book	
Chapter 1	Business Process Management and IT	Re-ordering of Chapter 1	Part – 1: Business Process Management and IT	Chapter 1: Introduction to Business Process Management
Chapter 2	Information Systems and IT Fundamentals	Re-ordering of Chapter 2	Part – 2: Information Systems and IT Fundamentals	Chapter 4: Introduction to Information Systems Chapter 5: Computing Technologies Chapter 6: Information System Layers, Life Cycle and Modern Technologies
Chapter 5	Business Process Automation through Application Software	5.6.4: Application Functions based Controls	Part – 2: Business Process Automation through Application Software	Chapter 11: Business Process Automation through Application Software
		Fig. 5.6.1: Types of Application Controls		
		5.7.1: Virtualization	Part – 2: Information Systems and IT Fundamentals	Chapter 5: Computing Technologies
		5.7.2: Grid Computing		

Special Note for Students

The topic of “**COMPUTING AND EMERGING TECHNOLOGIES**” have been discussed at **2 places in ICAI Study Module: In Chapter 2 and Chapter 5**. For the ease of study, revision and better understanding of the abovementioned concepts, I have compiled these concepts in one chapter, “**PART- II: Chapter 5**” in this book.

Visual Walkthrough

Part Learning Objectives and Planning

Every part contains a 'Learning Objectives' and a 'Chart' that provides an overview of each part with important learning objectives and chapters covered under it.

Chapter Outline

Every chapter contains a chapter outline that provides an overview of the chapter with important topics covered.

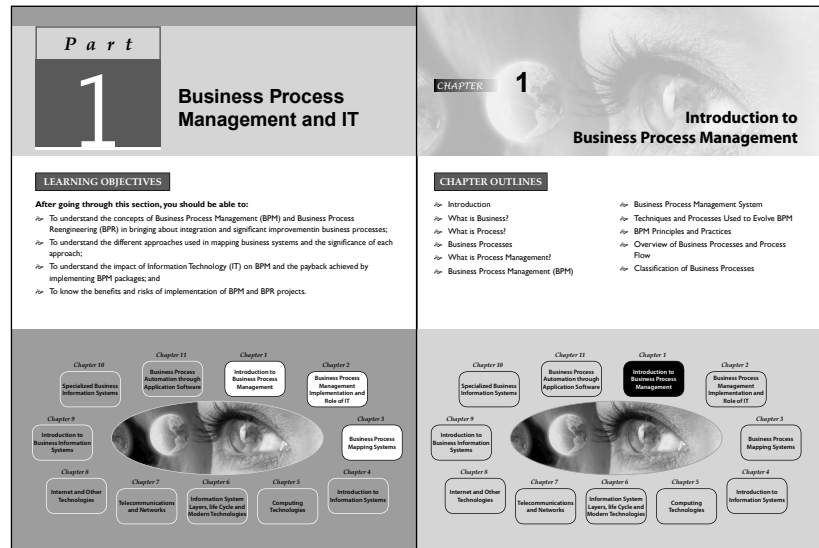
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	Fundamentals of telecommunication Components and functions of Telecommunication Systems Data networks: types of architecture, LAN, WAN, Wireless, private and public networks, etc.	Chapter 7: Telecommunications and Networks
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Syllabi Mapping

The text has been mapped with the new CA Intermediate (IPC) syllabus of 'Information Technology' issued by the ICAI.

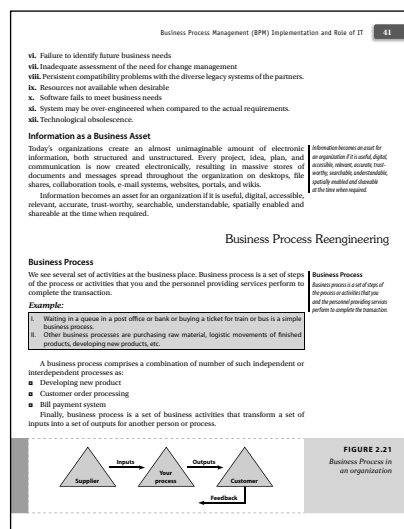
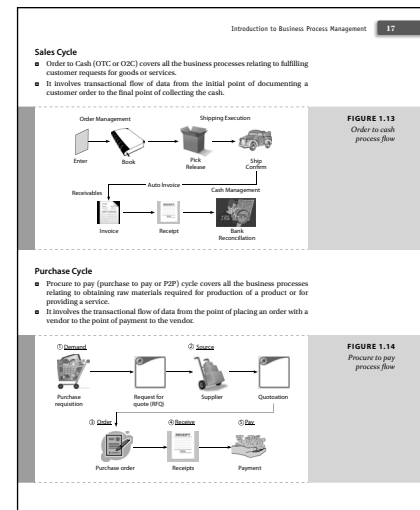
Annotation/Facts Boxes

These are the shortest way to explain the meaning of particular concept. Margin notes, along with the text provide material that is complementary to the matter contained in the text.



Flow Diagrams

Flow diagrams have been used at relevant places to depict the concept in simulated manner. The purpose is to provide visualization of the theoretical concept or some phenomenon.



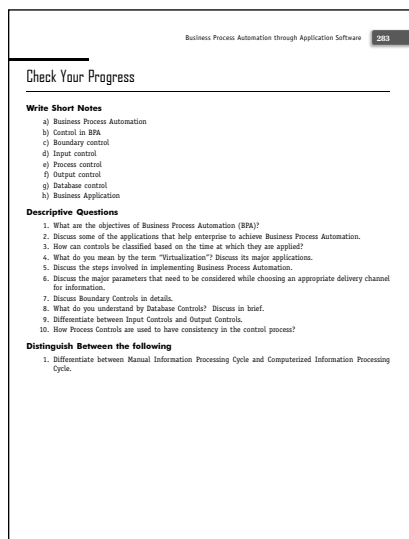
Examples

Each chapter includes examples illustrating the concepts you need to know and the techniques you need to learn.

Visual Walkthrough

IT Focus Box

Here, we tried to introduce some industry and real life aspects of information technology. This box has also been created keeping in mind CA IPC questions, to be asked in the examinations.

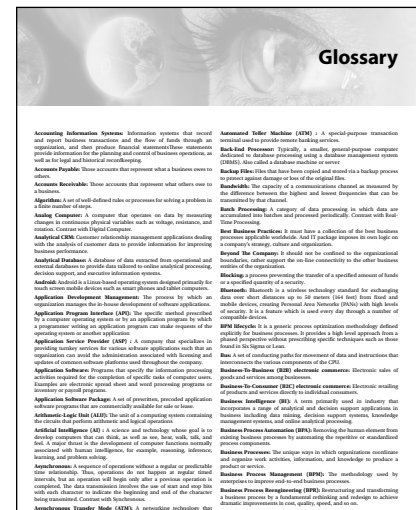
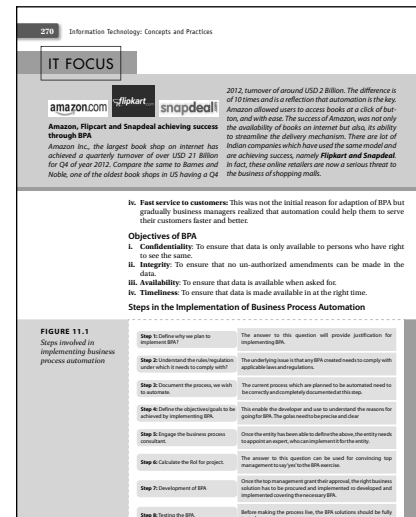


Chapter-end Questions

It has been given in the form of 'Check Your Progress'. This will help the CA Intermediate (IPC) students in learning the recalling progress and serves as ready reference to the previous years' examination questions.

Glossary

A complete glossary of information technology concepts has been provided in the book for quick recap of the important topics discussed throughout.



Instructor's Resources

'Understanding Information Technology: A Self-study Module' includes teaching tools to support instructors in the classroom. The supplements that accompany the textbook include an Instructor's Manual, Test Bank and Power Point Presentations. Please contact your Carvinowledge Press sales representative to request the CD-ROM containing teaching tools or mail us at info@carvinowledge.in.

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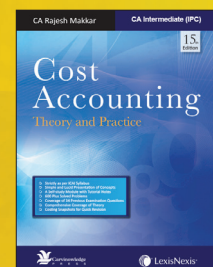
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Understanding Information Technology *A Self-study Module*

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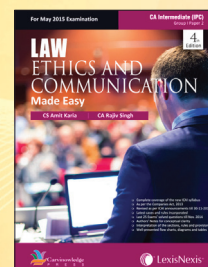
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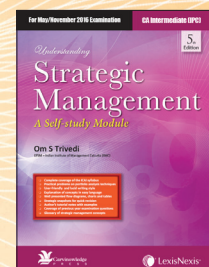
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Understanding Strategic Management
A Self-study Module
Author: Om S Trivedi



Om S Trivedi has authored books like Strategic Management, Information Technology, Ethics and Communication and Generic Skills for CA students and professionals. He is Indian Institute of Management-Calcutta (IIM-C) alumnus and qualified the Executive Programme for Sales and Marketing (EPSM) in 2009. With an experience of more than 8 years in teaching CA students and an experience of more than a decade in the publishing industry, he has huge exposure to academics and the dynamics of various organizations. He has done researches and projects in areas like competition studies, value creation and competitive advantages. Making apt use of his knowledge and experience, he has been interacting with CA, CS, CMA and MBA students. During the years, his students have benefitted immensely from his live examples and real-life case studies related to the subject and secured good results in Strategic Management, Information Technology and General Management. He has also acted in the capacity of a consultant and business advisor to several Indian and multinational companies.



₹ 360/-

3rd
Edition

For May/November 2016 Examination

CA Intermediate (IPC)

3rd
Edition

Understanding

Information Technology

A Self-study Module

Om S Trivedi

EPSM – Indian Institute of Management Calcutta (IIMC)

- Comprehensive coverage of ICAI syllabus
- Full coverage of past year question papers
- User-friendly and lucid writing style
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- Case studies, examples and caselets
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Understanding Information Technology
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IT Summary

(Summary for Quick Revision)

Part 1—Business Process Management and IT

Chapter 1 – Introduction to Business Process Management

Important aspects of business process management from a business management point of view are increasing customer satisfaction, reducing cost of doing business (cost reduction), and establishing new products and services at low cost (value creation).

What is Business?

The term business refers to all economic activities pursued mainly to satisfy the material needs of the society, with the purpose of earning profits.

What is Process?

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.

Business Processes

Business process is a set of steps of the process or activities that you and the personnel providing services perform to complete the transaction.

A business process comprises a combination of number of such independent or interdependent processes as:

- Developing new product
- Customer order processing
- Bill payment system

Overview of Business Processes and Process Flow

Business Process Flow

- A business process flow is a prescribed sequence of work steps.
- It is performed in order to produce a desired result for the organization.

Business Process Life Cycle

The business process consists of phases that are related to each other. The phases are organized in a cyclical structure.

Phases of Business Process Management-Life cycle

- i. Analysis phase:
- ii. Design phase:
- iii. Implementation phase:
- iv. Run and Monitor phase:
- v. Optimize:

Accounting Cycle

- Accounting covers the business processes involved in recording and processing accounting events of a company.
- It begins when a transaction occurs and ends with its inclusion in the financial statements.

Sales Cycle

- Order to Cash (OTC or O2C) covers all the business processes relating to fulfilling customer requests for goods or services.
- It involves transactional flow of data from the initial point of documenting a customer order to the final point of collecting the cash.

Purchase Cycle

- Procure to pay (purchase to pay or P2P) cycle covers all the business processes relating to obtaining raw materials required for production of a product or for providing a service.
- It involves the transactional flow of data from the point of placing an order with a vendor to the point of payment to the vendor.

Classification of Business Processes

Business processes

Organizational Business processes: These are the high-level processes that are typically specified in textual form by their inputs, their outputs,

their expected results and their dependencies on other organizational business processes.

Operational Business processes: These are the basis for developing implemented business processes that contain information on the execution of the process activities and the technical and organizational environment in which they will be executed.

What is Process Management?

Process management involves concerted efforts to map, improve, and adhere to organizational processes.

Steps to manage a process:

- i. To **define** the steps (tasks) in the process.
- ii. To **map** the tasks to the roles involved in the process.
- iii. To **implement** the steps (tasks) in the process.
- iv. To **establish** performance measures to improve the process.
- v. To **set up the organizational**

Business Process Management (BPM)

What is BPM? BPM is a set of functions in a certain sequence that, at the end, delivers value for an internal or external customer.

BPM is a methodology used by the enterprises to improve end-to-end business processes.

ICAI Definition of BPM:

“The achievement of an organization’s objectives through the improvement, management and control of essential business processes”.

Objectives of BPM

- To evaluate the efficacy and usefulness of business processes
- To constantly analyze
- To assess the usefulness of these processes

Benefits of using Techniques for BPM

- i. Effectiveness gains for enterprises:
- ii. Creation of basic operational value proposition:
- iii. Revenue growth:

Benefits of Using Techniques for BPM

- i. Effectiveness gains for enterprises
- ii. Creation of basic operational value proposition
- iii. Revenue growth
- iv. Process improvements
- v. Goal fulfillment

BPM Principles

- i. Processes are assets
- ii. Processes produce consistent value to customers
- iii. Continuous improvement of processes
- iv. Role of IT

BPM Practices

- i. Strive for process-oriented organizational structure.
- ii. Appoint process owners.
- iii. Senior management needs to commit and drive BPM.
- iv. Execution of BPM process improvements should take a bottom-up approach.
- v. Put in place information technology systems to monitor, control, analyze, and improve processes.
- vi. Work collaboratively with business partners on cross-organizational business processes.
- vii. Continuously train the workforce and continuously improve business processes.
- viii. Align employee bonuses and rewards to business process performance.
- ix. Utilize both incremental (e.g., Six Sigma) and more radical (e.g., BPR) methodologies to implement process improvement.

Theories of Process Management

Six Sigma

Six Sigma is a highly disciplined process that helps us focus on developing and delivering near-perfect products and services.

Six Sigma has its base in the concept of probability and normal distribution in statistics. Six Sigma strives that 99.99966% of products manufactured are defect free.

It also follows a life-cycle having phases: Define, Measure, Analyze, Improve and Control (or DMAIC)

Total Quality Management (TQM)

Total Quality Management (TQM) is a people-focused management system that aims at continual increase in customer satisfaction at continually lower real cost.

Business Process Reengineering

A business process comprises a combination of number of such independent or interdependent processes as:

- Developing new product
- Customer order processing
- Bill payment system

Reengineering: The complete rethinking, reinventing and redesigning of how a business or set of activities operate.

BPR: Business Process Reengineering (BPR) involves fundamental rethinking and radical redesigning of a business process so that a company can create best value for the customer by eliminating barriers that create distance between employees and customers.

Key words in this BPR definition are:

- i. Fundamental:
- ii. Radical:
- iii. Spectacular:
- iv. Processes:

BPR Success Factors

- i. Organization wide commitment
- i. Organization wide commitment
- ii. BPR team composition
- iii. Business needs analysis
- iv. Adequate IT infrastructure
- v. Effective change management
- vi. Ongoing continuous improvement

Chapter 2 – Business Process Management (BPM) Implementation and Role of IT

In modern business world, the organizations should develop a mindset that implementing BPM technology can contribute towards an organization becoming process-centric.

BPMs represents a breakthrough in the use and implementation of information systems.

BPM Implementation Methodology

Phase 1- Commit phase	Phase 4- Design phase
Phase 2- Research phase	Phase 5- Implement phase
Phase 3- Analyze phase	Phase 6- Support phase

Need for a BPM Implementation

- a. To create the long-term future positioning of the business and enhance its future capability.
- b. To create short-term cost effectiveness and improvement to current customer service.
- c. To initiate continuous improvement from the base of the current, but improved, processes.
- d. To introduce a knowledge of product and customer profitability.
 - e. To re-engineer the business radically and provide clear future competitive differentiation.
- f. To address the cultural barriers that prevent effective cross-functional and hierarchical working.
- g. To introduce leadership and a role for managers and empowered staff.

How does BPM lead to success?

The volume of work and the complexity of the business process demand that organizations look for possible IT applications to support and automate their processes.

- a. Enterprise Content Management (ECM) system:
- b. Customer Relation Management (CRM) system:
- c. Enterprise Resource Planning (ERP) system:
 - Active Design + Optimal Add Value +Integrated Networking = Success

What is Business Process Automation (BPA)?

“A business process is a set of activities or strategies to automate business processes so as to bring benefit to enterprise in terms of cost, time and effort.”

Business Process Automation (BPA): Removing the human element from existing business processes by automating the repetitive or standardized process components.

The Key Benefits of Business Process Automation

- i. Improved Efficiency:
- ii. Better Process Control:
- iii. Improved customer service:
- iv. Flexibility:
- v. Business process improvement:
- vi. Improved procedures:
- vii. Improved assignments:

Automation of the Functional Units

Functional areas: in an organization are based on the functional capabilities, viz; sales, marketing, Supply chain, customer service, finance, production, research and development and human resource.

Automation of functional units: means the automation of all the functional areas involved in day to day business transactions or business processes.

Enterprise Business Systems: End-to-end Customer Processes

There are numerous internal processes that form an internal supply chain, which relate to the end-to-end process of the organization.

- Sales – please treat me as one single client
- Marketing – what product or service do you have to offer?
- Delivery – please provide the product or service as quickly as possible.

BPM automation is also about a new way of working, monitoring and managing the organization, which could result in a new organizational structure. Refer to figure 2.4 for a better understanding of the end-to-end customer processes adopted by an organization.

Challenges in Implementing BPA

- i. The number of interfaces with the customers is growing (e.g. phone, fax, email, SMS, PDA, etc.)
- ii. The product, service and price options have increased the complexity of the business
- iii. Most organizations have a whole suite of ‘build and buy’ systems and applications, often each with its own data format
- iv. Budgets are being cut.

BPM Technology

BPM works as a bridge between the IT and business.

BPM provides an independent process layer, linking the various independent applications needed to execute a single end-to-end business process.

BPM = process and organization (including people) as well as technology

Components of BPM suit • Process engine • Business analytics • Content management • Collaboration tools

Value Chain Automation

What is Value Chain?

Value Chain: Viewing a firm as a series, chain, or network of basic activities that adds value to its products and services and thus adds a margin of value to the firm.

Value chain of an organization consist of: • Primary activity and • Support activity

Primary Activities

Primary activities: Primary activities are those business activities that are directly related to the manufacture of products or the delivery of services to the customer.

- a. Inbound logistics
- b. Operations
- c. Outbound logistics
- d. Marketing and sales
- e. Service

Support Activities

Support activities are those business activities that help support the day-to-day operation of the business and that indirectly contribute to the products or services of the organization.

- a. Procurement
- b. Human Resource Management
- c. Technology Development
- d. Firm Infrastructure

Business Process Automation (BPA): Benefits and Risks

Benefits of BPA • Saving on costs • Staying ahead in competition • Fast service to customers

Risks of BPA • Risk of jobs • False sense of security

- An accounting system is used to identify, analyze, measure, record, summarize, and communicate relevant economic information to interested parties.
- Accounting and information systems comprise the functional area of business responsible for providing information to the other areas to enable them to do their jobs and for reporting the results to interested parties.

What is Information System?

(i) A set of people, procedures, and resources that collects, transforms, and disseminates information in an organization. (ii) A system that accepts data resources as input and processes them into information products as output.

Accounting Information System

Information systems that record and report business transactions and the flow of funds through an organization, and then produce financial statements. These statements provide information for the planning and control of business operations, as well as for legal and historical recordkeeping.

Users of accounting information

Internal: Owners, managers, employees

External: Customers, creditors, government

Processing Cycles of an Accounts BPM

- i. **Financing Cycle** – It provides a clear view of firm's processing framework and involves activities of obtaining necessary funds to run the organization, repay creditors, and distribute profits to investors.
- ii. **Revenue Cycle** – It involves activities of selling goods or services and collecting payment for sales.
- iii. **Expenditure Cycle** – It involves activities of buying and paying for goods or services used by the organization.
- iv. **Human Resource Cycle/Payroll Cycle** – It involves activities of hiring and paying employees.
- v. **Production Cycle** – It involves the recurring set of business activities and related data processing operations associated with the manufacturers of products including activities like converting raw materials and labour into finished goods.
- vi. **General Ledger and Reporting System:** This involves the information processing operations involved in updating the general ledger and preparing reports that summarize the results of an organization's activities.
- vii. **Data Processing Cycle:** The Data Processing Cycle consists of following basic steps with alerts, controls and feedback at each step:
 - Data input –
 - Data processing –
 - Data storage –
 - Information output –

Impact of IT on BPM

Use of IT in the business process implementation can save lot of time, money and energy of any organization. It creates real value for any organization and its stakeholders and makes business processes very simple. BPM helps organizations optimize both work and revenues.

Organizations that utilize BPM systems to accomplish IT enabled business process change, gain from the following capabilities:

- Closer business involvement in designing IT enabled business processes,
- Ability to integrate people and systems that participate in business processes,
- Ability to simulate business processes to design the most optimal processes for implementation,
- Ability to monitor, control, and improve business processes in real time, and
- Ability to effect change on existing business processes in real time without an elaborate process conversion effort.

Benefits of BPMS

- Automating repetitive business processes.
- BPMS works by 'loosely coupling' with a company's existing applications.
- Operational savings.
- Reduction in the administration involved in compliance and ISO Activities.
- Freeing-up of employee time.
- Greater company agility.
- Higher customer satisfaction levels.

Business Risks of failure of IT

Superficial or deficient executive involvement; deficient project management; breakdown in gap analysis; limited options for customization of the BPM software; too complicated to be customized; failure to identify future business needs; inadequate assessment of the need for change management etc.

Some of the other reasons for failure of BPMS include:

- i. Superficial or deficient executive involvement
- ii. Deficient project management
- iii. Breakdown in gap analysis
- iv. Limited options for customization of the BPM software is required
- v. Not flexible enough or too complicated to be customized to meet the precise workflow and business process.
- vi. Failure to identify future business needs
- vii. Inadequate assessment of the need for change management
- viii. Persistent compatibility problems with the diverse legacy systems of the partners.
- ix. Resources not available when desirable
- x. Software fails to meet business needs
- xi. System may be over-engineered when compared to the actual requirements.
- xii. Technological obsolescence.

Information as a Business Asset

Information becomes an asset for an organization if it is useful, digital, accessible, relevant, accurate, trust-worthy, searchable, understandable, spatially enabled and shareable at the time when required.

Chapter 3 – Business Process Mapping Systems

Business process mapping takes a specific objective and helps to measure and compare that objective alongside the entire organization's objectives to make sure that all processes are aligned with the company's values and capabilities. techniques for mapping business processes are:

- A. Entity Relationship Diagrams
- B. Data Flow Diagrams
- C. Systems Flow diagrams
- D. System outline charts
- E. Decision Trees/Tables

Entity Relationship Diagrams

An **entity-relationship** (ER) diagram is a graphical representation of **entities** and their **relationships** to each other. It is typically used in

computing in regard to the organization of data within databases or information systems.

Entity:

- Rectangular Boxes are commonly used to represent entities.
- An entity is a piece of data—an object or concept about which data is stored.
- An entity may be a 'physical object' such as a house or a car, an 'event' such as a house sale or a car service, or 'concept' such as a customer transaction or order.

Relationship:

- A relationship is how the data is shared between entities.
- It specifies the relations among entities from two or more entities.
- Example: Instructor teaches Class or Student attends Class. Most relationships can also be stated inversely as 'Class is taught by Instructor'.

Attributes:

- Diamonds are normally used to represent relationships.
- Ovals are used to represent attributes.
- Attributes are common properties of the entities in any entity set.

One-to-One

One instance of an entity (A) is associated with one other instance of another entity (B).

One-to-Many

One instance of an entity (A) is associated with zero, one or many instances of another entity (B), but for one instance of entity B there is only one instance of entity A.

Many-to-Many

One instance of an entity (A) is associated with one, zero or many instances of another entity (B), and one instance of entity B is associated with one, zero or many instances of entity A.

Flowchart

A **flowchart** is a graphical representation of an algorithm.

Advantages of Using Flowcharts

1. Communication:
2. Effective Analysis:
3. Efficient Coding:
4. Efficient Program Maintenance:
5. Quicker grasp of relationships:
6. Documentation:

Limitations of Using Flowcharts

1. Complex Logic:
2. Alterations and Modifications:
3. Reproduction:
4. Link between conditions and actions:
5. Standardization:

Types of Flow Charts

- a. **System Outline Chart:** System Outline Charts merely list the inputs, file processed and the outputs without considering their sequence.
- b. **System Flow Chart:**
System Flow Charts are designed to present an overview of data flow through all parts of a computer
- c. **Run Flow Charts:**
Run Flow Charts are prepared from the Systems Flowchart and show the reference of computer operations to be performed.
- d. **Program Flow Chart:**
Program Flowcharts are diagrammatic representation of the data processing steps to be performed within a computer program.

Decision Trees/Tables

Decision Tree

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

Decision Tables

A decision tree is a way of representing combinations of decisions within a system as a diagram. A decision table is one which represents

all possible conditions and actions. Each column represents a unique combination. Decision tables are a precise yet compact way to model complicated logic. A decision table is typically divided into four quadrants:

- | | |
|--------------------------|------------------|
| ■ Conditions | ■ Actions |
| ■ Condition alternatives | ■ Action entries |

Types of Decision Table

Limited Entry Tables

Part-2 Information Systems and IT Fundamentals

Chapter 4 – Introduction to Information Systems

Imagine if there is no television, no cell phone, no facebook, no WhatsApp, no twitter, no fax, the collapse of the banking system. Most of our lives would be affected dramatically.

What is an Information System?

Information System: A set of people, procedures, and resources that collects, transforms, and disseminates information in an organization. A system that accepts data resources as input and processes them into information products as output.

Need for Information Technology

- IT is referred to as a computer-based tool that people use to work with information and support the information-processing needs of an enterprise.
- IT allows enterprises to work more efficiently and to maximize productivity.
- IT provides faster communication, electronic storage and the protection of records to any enterprise.
- IT enables business enterprises to differentiate their products and services from that of their competitors.

Reasons to Use of IT for Business

- i. **Communication Capabilities**
- ii. **Data and Information Management**
- iii. **Automated Processes**

Importance of IT in Auditing

Importance of IT in Auditing

- Information Technology encompasses all aspects of functioning of enterprises from strategy to operations, conception to completion and from ideation to value creation.
- The location of digital data could be traced to computers and servers either at identified offices of clients or vendors.
- The increasing digitization of data leads to an increasing impact and exerts continuing pressure on Accountants and Auditors to expand their skills beyond traditional roles of using IT for office automation to providing innovative services harnessing the power of technology.
- Auditors provide solutions to complex issues by integrating specialized technology with their extensive experience to create new strategic business processes.

Auditing in IT Environment

- Auditing in a computerized environment would depend on the scope and objective of audit.
- Audit broadly involves the process of evaluating and reporting the adequacy of system controls, efficiency, economy, effectiveness, and security practices
- It assures that assets and information resources are safeguarded, that data integrity is protected, and that the system complies with applicable policies, procedures, standards, rules, laws and regulations.

The Audit Objectives

- | | |
|------------------|------------------------|
| ■ Existence: | ■ Compliance: |
| ■ Authorization: | ■ Operational: |
| ■ Valuation: | ■ Assisting management |
| ■ Cut-off: | ■ Participating |

Differences in Audit Procedures in IT Environment

- a. Study Technical Aspects:
- b. Use Unique Techniques:
- c. Audit Software Usage:

Need for Controls in Information Systems

Types of Information System Control procedures:

- Strategy and direction.
- General Organization and Management.
- Access to IT resources, including data and programs.
- System development methodologies and change control.
- Operation procedures.
- System Programming and technical support functions.
- Quality Assurance Procedures.
- Physical Access Controls.
- Business Continuity Planning (BCP) and Disaster Resource Planning (DRP).
- Network and Communication.
- Database Administration.
- Protective and detective mechanisms against internal and external attacks.

Special Features of Auditing in an IT Environment

- To know the Methodology of Audit so to ensure that the standards,
- To understand the steps and techniques necessary to plan, perform and complete the Audit.

Impact of IT on Risks and Controls**Impact of IT on Risks**

- a. leads to ease in perpetration of computer related crimes thereby increasing temptation for abuse.
- b. On-line processing of data and validation checks would help the prospective perpetrator in guessing passwords and aid in circumventing controls in inputs to computer.
- c. Appropriate controls are not resident within the computer systems to detect or to prevent the accidents.
- d. a failure to recognize risks or potential impacts of those risks.

Impact of IT on Controls

- a. Realignment of functions data entry and source of transactions may be centralized.
- b. Changes in custody of files and documents:
- c. Transfer of responsibilities Single
- d. Decline of accountability

Auditors' Concern

The key concerns of auditor are as follows:

- a. Develop and apply new criteria in evaluating control weaknesses in Computerized Information Systems (CIS);
- b. Tailor testing techniques to the CIS under study; and
- c. Use computers to perform some portions of audit examination.

Business Process Automation

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

Steps involved in BPA

Step 1: Define why we plan to implement BPA?

Step 2: Understand the rules/ regulation under which it needs to comply with?

Step 3: Document the process, we wish to automate.

Step 4: Define the objectives/ goals to be achieved by implementing BPA.

Step 5: Engage the business process consultant.

Step 6: Calculate the ROI for project.

Step 7: Development of BPA.

Step 8: Testing the BPA.

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:

Phase I- Analysis phase:

Phase II- Design phase:

Phase III- Implementation phase:

Phase IV- Run and Monitor phase:

Activities under BPA application

Integration
Orchestration
Automation

Benefits of Pursuing Business Process Automation

- i. Reducing the Impact of Human Error:
- ii. Transforming Data into Information:
- iii. Improving performance and process effectiveness:
- iv. Making users more efficient and effective:
- v. Making the business more responsive:
- vi. Improving Collaboration and Information Sharing:

IT Processes Usually Involved in a Business Enterprise

- i. Database access and changes:
- ii. File replication and data backup:
- iii. Systems and event log monitoring:
- iv. Job scheduling:
- v. Application integration: vi. File transfers:
- vii. Printing:

Chapter 5 – Computing Technologies**What is Computing?**

Computing is the process of utilizing computer technology to complete a task. It involves computer hardware, software and a computer system.

Sub-fields of Computing

- i. Computer Science
- ii. Computer Engineering
- iii. Information Systems
- iv. Information Technology
- v. Software Engineering

Computing Technologies**Server Computing (Client-Server Architecture)**

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.

Client/server model is a concept for describing communications between computing processes that are classified as service consumers (clients) and service providers (servers).

Client-server Computing

Client-server computing is a distributed computing model in which client applications request services from server processes. Clients and servers typically run on different computers interconnected by a computer network. Any use of the Internet, such as information retrieval from the World Wide Web, is an example of client-server computing.

A **client application** is a process or program that sends messages to a server via the network.

The **server process** or program listens for client requests that are transmitted via the network.

Components of a client server technology

Server A versions of software for installation on network servers designed to control and support applications on client microcomputers in client/server networks. Examples: Multiuser network operating systems and specialized software for running Internet, intranet, and extranet Web applications, such as electronic commerce and enterprise collaboration.

Client: Generally clients are the personal computers. They are the “users” of the services offered by the servers. Basically, there are 3 types of clients.

- a. Non-Graphical User Interface (GUI)
- b. GUI-Clients:
- c. Object-Oriented User

Server:

Servers and Types of Server

A **server** is a software program that provides a service to a client computer.

Types of Server

Database Servers

A **database server** is a server computer that runs database software, such as Microsoft's SQL Server 2000.

File Servers

The most common task of a file server is to store shared files and programs.

Print Servers

A **Print Server** is a computer that manages one or more printers

Internet Servers

There are various types of server applications that provide a service over the Internet like web servers, mail servers, FTP servers, multimedia servers and real-time communication servers

Web Servers

A **Web server** is a server computer that runs softwares that enables the computer to host an Internet Web site.

Mail Servers

A **Mail server** is a server that handles the network's e-mail needs.

Multimedia Servers

Multimedia Servers are software applications designed to stream audio and visual files over the Internet.

Real Time Communication Servers

Real Time Communication servers include chat servers, IRC servers, instant messaging servers and video messaging servers.

FTP Servers

FTP Servers are used to transfer files from one computer to another over the Internet.

Application Server

An **application server** is a software framework dedicated to the efficient execution of procedures (programs, routines, scripts) for supporting the construction of applications.

Transaction Servers

A transaction server is a software component that is used in implementing transactions.

Proxy Server

A **Proxy Server** is designed to restrict access to information on the Internet.

Popular Computing Architecture

A computer system is sometimes subdivided into two functional entities:

- Hardware
- Software

Computer architecture is the art that specifies the relations and parts of a computer system.

Types of computer architecture

Instruction Set Architecture (ISA)

Micro architecture

System Design

Complex Instruction Set Computer (CISC)

Reduced Instruction Set Computer (RISC)

Instruction Set Architecture (ISA)

The **instruction set**, also called **instruction set architecture (ISA)**, is a part of the computer that pertains to programming, which is basically machine language.

Instruction Set Architecture (ISA) is related to the programming of a computer – that is, how the computer understands what each element in its basic language means, what instructions are to be carried out and in what order, etc.

Examples of instruction set

ADD - Add two numbers together.

IN - Input information from a device, e.g. keyboard.

LOAD - Load information from RAM to the CPU.

Complex Instruction Set Computer (CISC)

If the control unit contains a number of micro-electronic circuitry to generate a set of control signals and each micro-circuitry is activated by a micro-code, this design approach is called CISC design.

Examples of CISC processors: Intel 386, 486, Pentium, Pentium Pro, Pentium II, Pentium III processors etc.

Reduced Instruction Set Computer (RISC)

To execute each instruction, if there is separate electronic circuitry in the control unit, which produces all the necessary signals, this approach of the design of the control section of the processor is called RISC design. It is also called hard-wired approach.

Examples of RISC processors: IBM RS6000, MC88100 processors etc.

Micro Architecture

Micro Architecture is also known as Computer Organization. It is concerned with the way the hardware components operate and the way they are connected together to form the computer system.

Micro architecture is the term used to describe the resources and methods used to achieve architecture specification.

System Design

Systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements.

It includes all of the other hardware components within a computing system such as:

- i. System interconnects-Computer buses and switches:
- ii. Memory controllers and hierarchies:
- iii. CPU off-load mechanisms-Direct Memory Access (DMA):
- iv. Issues-multi-processing, virtualization, software features etc.

Emerging Computing Models

Cloud Computing

A method of computing in which an individual or an organization makes use of another organizations excess computing power or data storage capacity.

What is Cloud Computing?

Cloud Computing: A type of computing, comparable to grid computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications, involves delivering hosted services over the Internet.

Example:

Online file storage, social networking sites, webmail, and online business applications.

Characteristics of Cloud Computing

- i. Elasticity and Scalability:
- ii. Pay-per-Use:
- iii. On-demand:
- iv. Resiliency:
- v. Multi Tenancy:
- vi. Workload Movement:

Service Models of Cloud Computing

Cloud Computing Service Models: Software as a Service (SaaS) Platform as a Service (PaaS) Infrastructure as a Service (IaaS) Network as a Service (NaaS) Communication as a Service (CaaS)

Cloud Computing = Software as a Service + Platform as a Service + Infrastructure as a Service + Network as a Service + Communication as a Service

a) Software as a Service (SaaS)

- Users can access a software application hosted by the cloud vendor on pay per-use basis.
- A SaaS provider gives subscribers access to both resources and applications.
- SaaS makes it unnecessary for you to have a physical copy of software to install on your devices.

b) Platform as a Service (PaaS):

- A PaaS system goes a level above the Software as a Service setup.
- A PaaS provider gives subscribers access to the components that they require to develop and operate applications over the internet.

c) Infrastructure as a Service (IaaS):

- It is the foundation of cloud services.
- It provides basic infrastructure services to customers.
- It provides clients with access to server hardware, storage, bandwidth and other fundamental computing resources.

d) Network as a Service (NaaS)

- NaaS is a category of cloud services where the capability provided to the cloud service user is to use network/transport connecting services.
- NaaS involves optimization of resource allocation by considering network and computing resources as a whole.

e) Communication as a Service (CaaS)

- CaaS has evolved in the same lines as SaaS.
- CaaS is an outsourced enterprise communication solution that can be leased from a single vendor.
- The CaaS vendor is responsible for all hardware and software management and offers guaranteed Quality of Service (QoS).

Cloud Computing Environment

i. Public cloud:

A cloud is called a “**public cloud**” when the services are rendered over a network that is open for public use. Public cloud services may be free or offered on a pay-per-usage model.

ii. Private cloud:

Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party, and hosted either internally or externally.

iii. Community cloud:

Community cloud shares infrastructure between several organizations from a specific community with common concerns (security, compliance, jurisdiction, etc.), whether managed internally or by a third-party, and either hosted internally or externally.

iv. Hybrid cloud:

Hybrid cloud is a composition of two or more clouds (private, community or public) that remain distinct entities but are bound together, offering the benefits of multiple deployment models.

Cloud Computing Architectural Considerations

Parts of Cloud Computing Architecture – Front end (Fat client, thin client mobile devices, etc.) – Back end (Server, storage, etc.)

Advantages of Cloud Computing

- i. Cost Efficient:
- ii. Almost Unlimited Storage:
- iii. Backup and Recovery:
- iv. Automatic Software Integration:
- v. Easy Access to Information:
- vi. Quick Deployment:

Disadvantages of Cloud Computing

- i. Technical Issues
- ii. Security in the Cloud
- iii. Prone to Attack

Mobile Computing

What is the mobile?

Mobile Computing, is the use of portable computing devices (such as laptop and handheld computers) in conjunction with mobile communications technologies to enable users to access the Internet and data on their home or work computers from anywhere in the world.

Mobile is someone/something that can move or be moved easily and quickly from place to place.

What is mobile computing?

Mobile computing involves:

- i. Mobile Communication
- ii. Mobile Hardware
- iii. Mobile Software

Business Applications of Mobile Computing

- i. Increase in workforce productivity:
- ii. Improvement in customer service:
- iii. Improvement in incident management:
- iv. Transformation in business processes:
- v. Dynamic and efficient business offerings:
- vi. Availability of data at multiple locations:

Mobile Computing Concerns

- Security of data:
- Dangers of misrepresentation:
- Power consumption:
- Potential health hazards.

Grid Computing

Grid Computing is a computer network in which each computer's resources are shared with every other computer in the system.

Grid computing in general is a special type of parallel computing that –

- relies on complete computers (with onboard CPU, storage, power supply, network interface, and so forth)
- connected to a network (private, public, or the Internet) by a conventional network interface.

Grid computing is a special kind of Distributed Computing

Why Need Grid Computing?

- Civil engineers collaborate to design, execute, and analyse shake table experiments.
- An insurance company mines data from partner hospitals for fraud detection.
- An application service provider offloads excess load to a compute cycle provider.
- An enterprise configures internal & external resources to support e-Business workload.
- Large-scale science and engineering are done through the interaction of people, heterogeneous computing resources, information systems and instruments, all

Benefits of Grid Computing

- Making use of Underutilized Resources
- Resource Balancing
- Parallel CPU Capacity
- Virtual resources and virtual organizations for collaboration
- Access to additional resources
- Reliability
- Management

Types of Resources

- Computation
- Storage
- Communication
- Software and licenses
- Special equipment, capabilities, architecture and policies

Using a Grid: User's Perspective

- Enrolling and installing Grid Software
- Logging onto the grid
- Queries and submitting jobs
- Data configuration
- Monitoring progress and recovery
- Reserving resources

Using a Grid: An Administrative Perspective

- Planning
 - Security
 - Organization
- Installation
- Managing enrollment of donors and users
- Certificate Authority
- Resource Management
- Data sharing

Grid Computing Security

- To provide authentication to verify the users, process which have user's computation and resources used by the processes to authenticate
- To allow local access control mechanisms to be used without change.
- To develop security architecture, following constraints are taken from the characteristics of grid environment and application.
- Single Sign-on
- Protection of Credentials
- Interoperability with local security solutions
- Exportability
- Support for secure group communication
- Support for multiple implementations

Network Virtualization

What is Virtualization?

- Virtualization is the process of creating logical computing resources from available physical resources.

What is Network Virtualization?

Network virtualization is the process of combining hardware and software network resources and network functionality into a single, software-based administrative entity, a virtual network.

- External virtualization, combining many networks or parts of networks into a virtual unit,
- Internal virtualization, providing network-like functionality to software containers on a single network server

Major Applications of the Concepts of the Virtualization

- Server Consolidation:
- Disaster Recovery:
- Testing and Training:
- Portable Applications:
- Portable Workspaces:

Types of Virtualization

- Hardware Virtualization
- Network Virtualization
- Storage Virtualization

Chapter 6 – Information System Layers, Life Cycle and Modern Technologies

The layers of an information system encompass the hardware and software used to deliver the solution to the final consumer of services.

- Step 1: (Application Program).
- Step 2: (Hardware).
- Step 3: (Operating System - System Software)
- Step 4: (Networks).
- Step 5: (Database Management System (DBMS))
- Step 6: (User/People)

Step i: Applications Software

Step ii: DBMS

Step iii: System Software

Step iv: Hardware

Step v: Network Links

Step vi: People

Application Software

Application Software: Programs that specify the information processing activities required for the completion of specific tasks of computer users. Examples are electronic spreadsheet and word processing programs or inventory or payroll programs

Application-Specific Programs: Application software packages that support specific applications of end users in business, science and engineering, and other areas.

Types of Application Software

- Application Suite:
- Enterprise Software:
- Enterprise Infrastructure Software:
- Information Worker Software:
- Content Access Software:
- Educational Software:
- Media Development Software:

Benefits and of Disadvantages Application Software

Benefits of Application Software

- Addressing User needs:
- Less threat from virus:
- Regular updates:

Disadvantages of Application Software

- Development is costly:
- Infection from Malware:

Database Management Systems (DBMS)

What is a Database System?

A **database system** is basically a computer based record keeping system.

Database: An integrated collection of logically related data elements. A database consolidates many records previously stored in separate files so that a common pool of data serves many applications.

What is a Database Management System (DBMS)?

- DBMS are software that aid in organizing, controlling and using the data needed by the application programme.

Database Management System (DBMS): A set of computer programs that controls the creation, maintenance, and utilization of the databases of an organization.

Objectives of DBMS

- To know its information needs;
- To acquiring that information;
- To organize that information in a meaningful way;
- To assure information quality; and
- To provide software tools so that users in the enterprise can access information they require.

DBMS Operations on the Files

- Adding new files to database,
- Deleting existing files from database,
- Inserting data in existing files,
- Modifying data in existing files,
- Deleting data in existing files, and
- Retrieving or querying data from existing files

Database Models

A conceptual framework that defines the logical relationships among the data elements needed to support a basic business or other process.

Database Models

- Hierarchical Database Model
- Network Database Model
- Relational Database Model
- Object Oriented Database Model
- Hierarchical Database Structure Model

In a **hierarchical database structure**, records are logically organized into a hierarchy of relationships.

- All records in the hierarchy are called nodes.
- Each node is related to the others in a parent-child relationship.
- hierarchical data structure implements one-to-one and one-to-many relationships.

Hierarchically structured databases are less flexible than other database structures because the hierarchy of records must be determined and implemented before a search can be conducted.

Network Database Structure Model

Network Database Structure: A logical data structure that allows many-to-many relationships among data records. It allows entry into a database at multiple points, because any data element or record can be related to many other data elements.

Thus network model allows us to represent one-to-one, one-to-many and many-to-many relationships.

Relational Database Model

A **relational database** is structured into a series of two-dimensional tables.

Relational Data Structure: A logical data structure in which all data elements within the database are viewed as being stored in the form of simple tables. DBMS packages based on the relational model can link data elements from various tables as long as the tables share common data elements.

Object Oriented Database Model

Object oriented databases provide a unique object identifier (OID) for each object.

An Object Oriented database can extend the existence of objects so that they are stored permanently, and hence the objects persist beyond program termination and can be retrieved later and shared by other programs.

Advantages of a DBMS

- i. Permitting data sharing:
- ii. Minimizing Data Redundancy:
- iii. Integrity can be maintained:
- iv. Program and file consistency:
- v. User-friendly:
- vi. Improved security:
- vii. Achieving program/data independence:
- viii. Faster application development:

Disadvantages of a DBMS

- i. Cost:
- ii. Security:

System Software

System Software: Programs that control and support operations of a computer system. System software includes a variety of programs, such as operating systems, database management systems, communications control programs, service and utility programs, and programming language translators.

Functions of Operating System

1. Memory Management:
2. Processing Management:
3. Hardware (devices) and Software (applications) Management:
4. File Management:
5. Security Management:
6. Job scheduling and Accounting:
7. Interaction with Users (User Interface):
8. Interrupt Management:

Hardware

Hardware is the collection of physical elements that constitutes a computer system.

Components of a Computer Hardware System

Magnetic Disc and Tape Unit, Optical Disk, etc

Secondary Storage/Memory

Main Memory ALU Control Unit

CPU

Input

• Keyboard • Mouse • Optical Scanner • Light Pen • Voice Input, etc.

Output Unit

• Visual Display Unit • Printer • Audio Response Unit, etc.

Network Links

Computer Network is a collection of computers and other hardware interconnected by communication channels that allow sharing of resources and information.

Types of Networks

- i. Connection Oriented networks:
- ii. Connectionless Networks:

Important Benefits of a Computer Network

- i. File Sharing:
- ii. Print Sharing:
- iii. Fax Sharing:
- iv. Remote Access:
- v. Shared Databases:
- vi. Fault Tolerance:
- vii. Internet Access and Security:
- viii. Communication and Collaboration:
- ix. Better Organisation:
- x. Reduced Cost and improved efficiency:
- xi. Reduction in errors:

People: Users

- ▣ People are the most important element in most computer-based information systems.
- ▣ The people involved include users of the system and information systems personnel, including all the people who manage, run, program, and maintain the system.

Information System Life Cycle or Software/System Development Life Cycle (SDLC)**What is system Development?**

System Development: System development is a simple process to writing programs to solve the needs of the user

Systems Development Life Cycle (SDLC): Conceiving, designing, and implementing a system. Developing information systems by a process of investigation, analysis, design, implementation, and maintenance.

Various Phases for Developing an Information System*Systems investigation Feasibility Study*

- i. Determine how to address business opportunities and priorities.
- ii. Conduct a feasibility study to determine whether a new or improved business system is a feasible solution.
- iii. Develop a project management plan and obtain management approval.

Systems Analysis Functional Requirements

- i. Analyze the information needs of employees, customers, and other business stakeholders.
- ii. Develop the functional requirements of a system that can meet business priorities and the needs of all stakeholders.
- iii. Develop logical models of current system.

Systems Design System Specifications

- i. Develop specifications for the hardware, software, people, network, and data resources, and the information products that will satisfy the functional requirements of the proposed business information system.
- ii. Develop logical models of new system.

Systems Implementation Operational System

- i. Acquire (or develop) hardware and software.
- ii. Test the system, and train people to operate and use it.
- iii. Convert to the new business system.
- iv. Manage the effects of system changes on end users.

Systems Maintenance Improved System

Use a post implementation review process to monitor, evaluate, and modify the business system as needed.

Recent Technologies/Devices**Bluetooth**

It is designed to be an inexpensive, wireless networking system for all classes of portable devices, such as laptops, PDAs (Personal Digital Assistants), and mobile phones.

Bluetooth Networking

The **Bluetooth** technology provides both a point-to-point connection and a point-to-multipoint connection.

Wi-Fi

Wi-Fi works with no physical wired connection between sender and receiver.

Notebook Computer

Notebook computers typically weigh less than 6 pounds and are small enough to fit easily in a briefcase.

Notebook computers come with battery packs that enable you to run them without plugging them in.

Laptop Computer

A **small, portable computer** – small enough that it can sit on your lap.

Tablet Computer or Tablet

A tablet computer, or simply tablet is a one piece general-purpose computer contained in a single panel.

Features of Tablet Computer or Tablet

- i. Input Method:
- ii. Size:
- iii. Battery Life:
- iv. Storage Capacity:
- v. Performance:
- vi. Software:
- vii. Wireless:

Smart Phone

A **smartphone**, or **smart phone**, is a mobile phone with more advanced computing capability and connectivity than basic feature phones.

Touchpad: A touchpad is an input device. This is also known as a glide pad, glide point, pressure sensitive tablet, or track pad. It is found on the majority of portable computers, and now also available with some external keyboards, that allow you to move the mouse cursor without the need of an external mouse.

iPad

The iPad runs a version of iOS. iOS is designed for finger based use and has none of the tiny features which required a stylus on earlier tablets. Apple introduced responsive multi touch gestures, like moving two fingers apart to zoom in.

iPod

The iPod is a line of portable media players designed and marketed by Apple Inc. The first line was released on October 23, 2001, about 8½ months after iTunes (Macintosh version) was released.

Ultra-Mobile PC (UMPC)

An Ultra-Mobile PC is a small form factor version of a pen computer, a class of laptop whose specifications were launched by Microsoft and Intel in spring 2006.

Android

Android is an operating system based on the Linux kernel with a user interface based on direct manipulation, designed primarily for touchscreen mobile devices such as smartphones and tablet computers, using touch inputs, that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard.

Part-3 Telecommunications and Networks**Chapter 7 – Telecommunications and Networks**

Telecommunication systems enable the transmission of data over public or private networks.

A **network** is a communications, data exchange, and resource-sharing system created by linking two or more computers and establishing standards, or protocols, so that they can work together.

Networking an Enterprise

- The primary information technology infrastructure for many enterprises is Intranet and Extranet.
- The Internet and Internet-like networks inside the enterprise are called **Intranets**, between an enterprise and its trading partners are called **Extranets**.

Trends in Telecommunication

Industry trends: Toward more competitive vendors, carriers, alliances, and network services, accelerated by deregulation and the growth of the Internet and the World Wide Web.

Technology trends: Toward extensive use of Internet, digital fiber-optic, and wireless technologies to create high-speed local and global internetworks for voice, data, images, audio, and video communications.

Application trends: Toward the pervasive use of the Internet, enterprise intranets, and inter organizational extranets to support electronic business and commerce, enterprise collaboration, and strategic advantage in local and global markets.

The Business Value of Telecommunications

Use of the Internet, intranets, extranets, and other telecommunications networks can dramatically cut costs, shorten business lead times and response times, support e-commerce, improve the collaboration of workgroups, develop online operational processes, share resources, lock in customers and suppliers, and develop new products and services.

Strategic Capabilities

- a) Overcome geographic barriers:
- b) Overcome time barriers:
- c) Overcome cost barriers:
- d) Overcome structural barriers:

Telecommunication Network

A **telecommunications network** is a collection of terminal nodes, links and any intermediate nodes which are connected so as to enable telecommunication between the terminals.

Advantages of a Computer Network in an Organization

- a. File Sharing:
- b. Resource Sharing:
- c. Remote Access:
- d. Shared Databases:
- e. Fault Tolerance:
- f. Internet Access and Security:

Telecommunication Network Model

The five basic components in a telecommunications network: (1) terminals, (2) telecommunications processors, (3) telecommunications channels, (4) computers, and (5) telecommunications software.

Terminals

Any input or output device that is used to transmit or receive data can be classified as a terminal component.

Telecommunications Processors

Network Interface Card (NIC) is a computer hardware component that connects a computer to a computer network. It has additional memory for buffering incoming and outgoing data packets, thus improving the network throughput.

Network Interface Card (NIC)**Modems**

A device that converts signals the computer understands into signals that can be accurately transmitted over the phone to another modem, which converts the signals back into their original form.

Multiplexers

Multiplexer is a device that combines large number of low speed transmission lines into high speed line.

Internetwork Processors**Switch**

Each **switch** contains a certain number of ports, typically 8 or 16.

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. **Routing** is the process of deciding on how to communicate the data from source to destination, in a network.

Hub

Hub is a port-switching communications processor. This allows for the sharing of the network resources such as servers, LAN workstations, printers, etc.

Bridge

Bridge is a communication processor that connects number of Local Area Networks (LAN). It magnifies the data transmission signal while passing data from one LAN to another.

Repeaters

Repeater is a communications processor that boosts or amplifies the signal before passing it to the next section of cable in a network.

Gateway

Gateway is a device that connects dissimilar networks.

Telecommunications Media/Channels

Telecommunication medium may be:

- i. guided media: via Network Cables
- ii. unguided media: Wireless

Guided Media

In the guided transmission medium, the waves are propagated along a solid medium, such as copper twisted pair cable, co-axial cable, and optical Fiber.

The most common types of media are: • Twisted Pair Copper Cable • Coaxial Copper Cable • Fibre Optic Cable

Twisted Pair Cable**Unguided Media**

Unguided Transmission Media is a means of free data transmission that flow through the air. This kind of transmission is not guided or bounded to a channel to follow.

- Terrestrial Microwave • Radio Waves • Micro Waves • Infrared Waves
- Communication Satellites

What is Network Management?

Telecommunications software packages provide a variety of communication support services.

Examples of major network management functions include:

Traffic management–

- ▣ Security–
- ▣ Network monitoring–
- ▣ Capacity planning–

Types of Telecommunications Networks

Area Coverage Based Classification

Local Area Network (LAN)

A **Local Area Network (LAN)** is a group of computers and network devices connected together, usually within the same building, campus or spanned over limited distance. It provides high speed data transfer and is relatively inexpensive.

Wide Area Networks (WAN)

A **Wide Area Network (WAN)** is not restricted to a geographical location, although it might be confined within the bounds of a state or country. The Internet is an example of a world-wide public WAN.

Metropolitan Area Networks (MAN)

A metropolitan area network or MAN is a network that is smaller than a typical WAN but larger than a LAN (roughly 40 km in length).

Functional Based Classification

Client-Server Networking

A network that relies on dedicated servers is sometimes called a **client/server network**. Ex: Banks, Railway, internet etc.

Client-Server Networking: Client/server networks have become the predominant information architecture of enterprise wide computing.

- ▣ This is a computing environment where end user workstations (clients) are connected to micro or mini LAN (servers) or possibly to a mainframe (super server).
- ▣ Local area networks (LANs) are also interconnected to other LANs and wide area networks (WANs) of client workstations and servers.

Clients

In a client/server network, end-user PC or NC workstations are the clients.

Client computers can be classified as

- ▣ Fat Client
- ▣ Hybrid Client.
- ▣ Thin Client

Server

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

Characteristics and Issues of Client Server (C/S) Architecture

Some of the prominent characteristics of C/S architecture are as follows:

- ▣ Service:
- ▣ Mix-and-Match:
- ▣ Shared Resources:
- ▣ Scalability:
- ▣ Transparency of Location:
- ▣ Integrity:

Issues in Client/Server Network

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

Peer to Peer model

Other networks take an alternative approach, enabling any computer on the network to function as both a client and a server. Thus, any computer can share its printers and hard drives with other computers on the network. And while a computer is working as a server, you can still use that same computer for other functions such as word processing. This type of network is called a **peer-to-peer network**

Multi-Tier Architecture

Single Tier Systems

Generally, this type of system is used in small businesses.

A **single computer** that contains a database and a front end to access the database is known as single-tier.

Two-Tier Architecture

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

In **two-tier system** database is stored on the server and this is accessed on the client.

3-tier and n tier Architecture

The **three-tier** architecture emerged in 1990s to overcome the limitations of the two-tier architecture.

The **third tier architecture (middle tier server)** is between the user interface (client) and the data management (server) components.

Why 3-tier?

3-tier architecture

- Client-tier is responsible for the presentation of data, receiving user events and controlling the user interface
- Application-server-tier protects the data from direct access by the clients.

Data-server-tier:

- Data-server-tier is responsible for data storage.

The Advantages of 3-tier Architecture

- Scalability:
- Improved Data Integrity:
- Dynamic load balancing:
- Improved Security:
- Hidden Database Structure:
- Change Management:

Ownership Based Classification

Public Data Network

A public data network is defined as a network shared and accessed by users not belonging to a single organization. It is a network established and operated by a telecommunications administration, or a recognized private operating agency.

Private Data Network

Private data networks provide businesses, government agencies and organizations of all sizes a dedicated network to continuously receive and transmit data critical to both the daily operations and mission critical needs of the organization.

Virtual Private Network

A virtual private network (VPN) emulates a private network over public or shared and therefore insecure infrastructures. It consists of two or more internal networks (or intranets) which can communicate securely as if all internal hosts from different intranets belonged to the same virtual network.

Types of VPN

Following are the 2 most common types of VPN.

i. Remote-access:

This is a user-to-LAN connection used by a company that needs to connect to the private network from various remote locations.

It is also called as Virtual Private Dial-Up Network (VPDN).

- Site-to-Site VPN:** Through the use of dedicated equipment and large-scale encryption, a company can connect multiple fixed sites over a public network such as Internet. Site-to-site VPNs can be one of the following two types:

- Intranet based:
- Extranet based:

Network Computing

This **network computing** or network centric concept views networks as the central computing resource of any computing environment.

Centralized Computing: Centralized computing is computing done at a central location, using terminals that are attached to a central computer.

Decentralized Computing: Decentralized computing is the allocation of resources, both hardware and software, to each individual workstation, or office location which are capable of running independently of each other.

Network Topology

The term network topology refers to the arrangement in which the computers and other network components are connected to each other. There are two important terms related with network topologies:

- **Node:** A node is a device that is connected to the network.
- **Packet:** A packet is a message that is sent over the network from one node to another node.

Bus Topology

Bus topology is commonly used for LANs.

In a bus topology, every node on the network can see every packet that is sent on the cable. Each node looks at each packet to determine whether the packet is intended for it.

Star Topology

In a star topology, each network node is connected to a central device called a hub or a switch, as shown in **Figure 7.21**. Star topologies are also commonly used with LANs.

Ring Topology

In a ring topology, packets are sent around the circle from computer to computer. Each computer looks at each packet to decide whether the packet was intended for it.

Mesh Topology

Mesh, has multiple connections between each of the nodes on the network,

Mesh networks are not very practical in a LAN setting.

However, mesh networks are common for metropolitan or wide area networks.

Transmission Technologies

Serial Transmission: In serial transmission, the bits of each byte are sent along a single path one after another

Asynchronous Transmission: In this, each character is sent at irregular intervals in time as in the case of characters entered at the keyboard in real time.

Synchronous Transmission: In this, the transmitter and receiver are paced by the same clock. The receiver continuously receives (even when no bits are transmitted) the information at the same rate the transmitter sends it.

Transmission Modes

a) Simplex Mode

In this data is communicated in one direction only from sender to receiver.

e.g. TV, Radio Communication,

b) Half Duplex

In this mode data can be communicated in both the direction but one at a time.

Example: Walky – Talky

c) Full Duplex

In this mode data is communicated in both the direction simultaneously.

Example: Voice communication over the telephone.

(i) Circuit Switching

a. In this transmission technique a permanent path is established between sender and receiver for the duration of data communication.

b. Circuit switching is the oldest technique

(ii) Packet Switching

a. Packet switching is the latest technique of data communication.

b. In this technique the data is communicated in the form of packets between sender and receiver.

(iii) Message Switching

a. Message switching is an extension of packet switching.

b. In this technique many packets of common destinations are combined together in the form of a message for communication to a common destination.

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, such as wired or wireless.

Protocols

A **protocol** is a set of rules that enables effective communications to occur.

A protocol defines the following three aspects of digital communication:

- a. Syntax:
- b. Semantics:
- c. Timing:

The OSI Model

The first three layers are sometimes called the lower layers.

Open Systems Interconnection Reference Model, affectionately known as the OSI model breaks the various aspects of a computer network into seven distinct layers.

The OSI model specifies what aspects of a network's operation can be addressed by various network standards.

The Seven Layers of the OSI Model

Physical

Governs the layout of cables and devices such as repeaters and hubs

Data Link

Provides MAC addresses to uniquely identify network nodes and a means for data to be sent over the Physical layer in the form of packets. Bridges and switches are layer 2 devices.

Network

Handles routing of data across network segments.

Transport

Provides for reliable delivery of packets.

Session

Establishes sessions between network applications.

Presentation

Converts data so that systems that use different data formats can exchange information.

Application

Allows applications to request network services.

Network Risks, Controls and Security

There are two types of systems security.

- a. A **physical security** is implemented to protect the physical systems assets of an organization like the personnel, hardware, facilities, supplies and documentation.
- b. A **logical security** is intended to control
 - i. malicious and non-malicious threats to physical security and
 - ii. malicious threats to logical security itself.

Importance of Network Security

- To protect company assets:
- To gain a competitive advantage
- To comply with regulatory requirements and judicial responsibilities:
- To keep your job:

Threats and Vulnerabilities

Threats

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

Types of Network Security threats:

- i. **Unstructured Threats:** These threats originate mostly from inexperienced individuals using easily available hacking tools from the Internet.
- ii. **Structured Threats:** These threats originate from individuals who are highly motivated and technically competent and usually understand network systems design and the vulnerabilities of those systems.
- iii. **External Threats:** These threats originate from individuals or organizations working outside an organization, which does not have authorized access to organization's computer systems or network.

- iv. **Internal Threats:** These threats originate from individuals who have authorized access to the network.

Vulnerabilities

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

Facts responsible for vulnerabilities in the software:

- i. Software **Bugs** -
- ii. Timing **Windows** -
- iii. Insecure **default configurations** -
- iv. Bad **Protocols** -
- v. Trusting **Untrustworthy information** -
- vi. End **users** -

Level of Security

Step 1: Preparing project plan for enforcing security

Step 2: Assets identification

Step 3: Assets valuation

Step 4: Threats Identification

Step 5: Assessment of probability of occurrence of threats

Step 6: Exposure analysis

Step 7: Controls adjustment

Step 8: Report generation

Network Security Protocols

Cryptography

Cryptography is the study of techniques related to all aspects of data security.

Within the context of any application-to-application communication, there are some specific security requirements, including:

- Authentication:
- Privacy/confidentiality:
- Integrity:
- Non-repudiation:

Encryption

Encryption is the process of transforming information (referred to as plaintext) to make it unreadable to anyone except those possessing special knowledge, usually referred to as a key. Simply,

Decryption: The reverse procedure of encryption is called decryption that is shown in Figure 7.37 when Cipher text is applied to decryption algo than original plaintext is generated. Keys are used to either encrypt or decrypt a message. These keys contain secret values consisting of complex mathematical formulae (algorithms).

There are two basic approaches to encryption:

- i. **Hardware encryption**
- ii. **Software encryption**

Network Security Protocols

Secure Shell (SSH)

- 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.

Secure File Transfer Protocol (SFTP)

- 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.

Secure Hypertext Transfer Protocol (HTTPS)

- Hypertext Transfer Protocol Secure (HTTPS) is a communications protocol for secure communication over a computer network, with especially wide deployment on the Internet.

Secure Socket Layer (SSL)

- It is essentially a protocol that provides a secure channel between two machines operating over the Internet or an internal network.

Network Security Techniques

Firewalls

Firewalls are systems which control the flow of traffic between the Internet and the Firm's internal LANs and systems.

A Firewall is a proven and effective means of protecting the Firm's internal resources from unauthorized and unwanted intrusion.

Message Authentication: It makes sure that a message is really from whom it purports to be and that it has not been tampered with. Regardless

Site Blocking

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

Intrusion Detection System (IDS)

Meaning: The goal of intrusion detection system is to monitor the network assets, to detect anomalous behavior and misuse.

Components of IDS

- i. **Network Intrusion Detection (NID):** Network intrusion detection deals with information passing in the wire between hosts. Typically referred to as "packet-sniffers," Network intrusion detection devices intercept packets traveling in different communication channels.
- ii. **Host-based Intrusion Detection (HID):** Host-based intrusion detection systems are designed to monitor, detect and respond to user and system activity and attacks on a given host.
- iii. **Hybrid Intrusion Detection (HID):** Hybrid intrusion detection systems offer management of and alert notification from both network and host-based intrusion detection devices.
- iv. **Network-Node Intrusion Detection (NNID):** Network-node intrusion detection was developed to work around the inherent flaws in traditional NID. Network-node pulls the packet-intercepting technology from the wire and puts it on the host.

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.

- Administration deals with keeping track of resources in the network and how they are assigned. It includes all the "housekeeping" that is necessary to keep the network under control.
- Maintenance is concerned with performing repairs and upgrades

Chapter 8 – Internet and Other Technologies

The Internet has become the largest and most important network of networks today and has evolved into a global information superhighway.

Features of the Internet

- The Net does not have a central computer system or telecommunications center.
- Instead, each message sent on the Internet has a unique address code so any Internet server in the network can forward it to its destination.
- The Net does not have a headquarters or governing body.
- The Internet is growing rapidly.

Networks and the Internet

Computer network: A computer network is a group of computers that are interconnected by electronic circuits or wireless transmissions of various designs and technologies for the purpose of exchanging data or communicating information between them or their users.

Internet Applications

- E-mail, browsing the sites on the World Wide Web, and participating in special interest newsgroups are the most popular Internet applications.
- Electronic commerce transactions between businesses and their suppliers and customers can also be performed with online web applications.

General Use of the Internet

- i. **Surf:**
- ii. **e-Mail:**
- iii. **Discuss:**
- iv. **Publish:**
- v. **Buy and Sell:**
- vi. **Download:**
- vii. **Compute:**
- viii. **Connect:**

Business Use of the Internet

- Strategic business alliances
- Providing customer and vendor support
- Collaboration among business partners
- Buying and selling products and services
- Marketing, sales, and customer service applications
- Growth of cross-functional business applications
- Emergence of applications in engineering, manufacturing, human resources and accounting.
- Enterprise communications and collaboration
- Attracting new customers with innovative marketing and products.
- Retaining present customers with improved customer service and support.
- Developing new web-based markets and distribution channels for existing products.
- Developing new information-based products

Intranets and Extranets**Intranet**

An **intranet** is an internal corporate network built using Internet and World Wide Web standards and products.

Benefits of Intranet

- **Workforce productivity:**
- **Time:**
- **Communication:**
- **Business operations and management:**
- **Cost-effective:**
- **Cross-platform capability:**

Extranet

An **extranet** extends selected resources of an intranet out to a group of its customers, suppliers, or other business partners.

Advantages of Extranet

- Exchange large volumes of data using Electronic Data Interchange (EDI).
- Share product catalogs exclusively with trade partners.
- Collaborate with other companies on joint development efforts.
- Jointly develop and use training programs with other companies
- Provide or access services provided by one company to a group of other

What is e-commerce?

Electronic commerce refers to a wide range of online business activities for products and services.

“E-commerce is the use of electronic communications and digital information processing technology in business transactions to create, transform, and redefine relationships for value creation between or among organizations, and between organizations and individuals.”

Types of E-commerce**B2B (Business-to-Business E-commerce)**

B2B e-commerce is simply defined as e-commerce between companies. B2B stands for Business-to-Business. It consists of largest form of E-commerce. This model defines that Buyer and seller are two different entities.

B2C (Business-to-Consumer E-commerce)

Business-to-consumer e-commerce, or commerce between companies and consumers, involves customers gathering information; purchasing physical goods or information goods and, for information goods, receiving products over an electronic network. The basic concept of this model is to sell the product online to the consumers.

C2C (Consumer to Consumer E-commerce)

Consumer-to-consumer e-commerce or C2C is simply e-commerce between private individuals or consumers. It perhaps has the greatest potential for developing new markets.

C2B (Consumer-to-Business E-commerce)

A consumer posts his project with a set budget online and within hours companies review the consumer's requirements and bid on the project. The consumer reviews the bids and selects the company that will complete the project. Freelancer.com (Figure 8.7) empowers consumers around the world by providing the meeting ground and platform for such transactions.

E-Commerce General Concerns

- **Loss of audit trail:**
- **Business Continuity:**
- **Exposure of data:**
- **Legal Risks:**
- **Record retention and retrievability:**
- **Segregation of duties:**

Additional Concerns**Reliability****Scalability****Ease of use****Payment Methods****Benefits of e-Commerce Application and Implementation**

- i. Reduction in costs to buyers
- ii. Reduction in errors,
- iii. Reduction in costs to suppliers
- iv. Reduction in time to complete business transactions,
- v. Creation of new markets
- vi. Easier entry into new markets,
- vii. Better quality of goods as
- viii. Faster time to market as
- ix. Optimization of resource selection
- x. Reduction in inventories
- xi. Reduction in overhead costs
- xii. Reduction in use of ecologically damaging materials
- xiii. Reduction in advertising costs.

Risks involved in e-Commerce

- i. **Problem of anonymity:**
- ii. **Repudiation of contract:**
- iii. **Lack of authenticity of transactions:**
- iv. **Data Loss or theft or duplication:**
- v. **Attack from hackers:**
- vi. **Denial of Service:**
- vii. **Non-recognition of electronic transactions:**
- viii. **Lack of audit trails:**
- ix. **Problem of piracy:**

Mobile Commerce

Mobile commerce (or m-commerce) is e-commerce where customers access the network using a mobile device such as a mobile phone, a communicator (a personal digital assistant integrated or attached to a mobile phone), or a smart phone

The advantages of m-commerce are:

- Providing wider reach.
- Reducing transaction costs.
- Competitive pricing
- Quick ordering facilities

The disadvantages of m-commerce are:

- Small screens of most devices still limit types of file and data transfer (i.e. streaming videos, etc.)
- WAP and SMS limited to small number of characters and text.
- Use of graphics limited
- Cost of establishing mobile and wireless broadband infrastructure

Electronic Fund Transfer

system in general denotes any kind of network (e.g., Internet) service that includes the exchange of money for goods or services.

Electronic money has been used between banks in the form of funds transfer since 1960.

EFT Systems in Operation

Automated Teller Machines (ATMs): Consumers can do their banking without the assistance of a teller, or to make deposits, pay bills, or transfer funds from one account to another electronically.

- **Point-of-Sale (PoS) Transactions:**
- **Pre-authorized Transfers:**
- **Telephone Transfers:**

Part-4 Business Information Systems

Chapter 9 – Introduction to Business Information Systems

Information System Concepts

Data: Data is a collection of facts usually collected as the result of experience, observation or experiment, or processes within a computer system, or a set of premises.

Information: Information is data that has been processed so that they are meaningful. It is organized data that has been arranged for better comprehension, understanding and/or retrieval.

Process: Process or procedure explains the activities carried out by users, managers and staff.

System: The system can be defined as “a group of mutually related, cooperating elements working on reaching a common goal by taking inputs and producing outputs in organized transformation processes.”

Information System:

Information System is • A set of people, procedures, and resources that collects, transforms, and disseminates information in an organization. • A system that accepts data resources as input and processes them into information products as output.

Components of Information System

- People resources include end users and IS specialists.
- hardware resources consist of machines and media.
- software resources include both programs and procedures.
- data resources can include data and knowledge bases.
- network resources include communications media and networks.

Business Information System

Business Information Systems (BIS) are systems integrating information technology, people and business. BIS bring business functions and information modules together for establishing effective communication channels which are useful for making timely and accurate decisions

Organisations, Information Systems and Business Processes

Business Process Model

In brief, it can be said that a business process:

- i. Has a Goal
- ii. Has specific inputs
- iii. Has specific outputs
- iv. Uses resources
- v. Has a number of activities that are performed in some order
- vi. May affect more than one organizational unit. Horizontal organizational impact.
- vii. Creates value of some kind for the customer.

Information Systems and their Role in Businesses

- Support of business processes and operations
- Support of decision making by employees and managers
- Support of strategies for competitive advantage

Components of an information system in business: • People • Information Technology • Business Processes

Types of Information Systems

Transaction Processing System (TPS)

An information system that processes data arising from the occurrence of business transactions

Airline Reservation Systems, Railway reservation by IRCT, Banking Systems, or the Accounting System of roughly any outsized company.

Features of Transaction Processing Systems

- i. Access Control:
- ii. Equivalence: TPS:
- iii. High Volume Rapid Processing:
- iv. Trustworthiness:

Pre-requisites or ACID TEST for any TPS

- i. Atomicity:
- ii. Consistency:
- iii. Isolation:
- iv. Durability:

Office Automation Systems (OAS)

The use of computer-based information systems that collect, process, store, and transmit electronic messages, documents, and other forms of office communications among individuals, workgroups, and organizations.

- The Office Automation Systems (OAS) is amalgamation of hardware, software, and other resources used to smooth the progress of communications and augment efficiency.

Example:

A word processing document may include a graph developed using a spreadsheet program, which is dynamically updated when the data in the spreadsheet is changed. OAS Activities

- i. Exchange of information
- ii. Management of administrative documents
- iii. Handling of numerical data
- iv. Meeting planning and management of work schedules

Knowledge Management System (KMS)

What is knowledge?

- Knowledge is a much broader concept than information.
- Knowledge consists of many pieces of related information, and has a structure or organisation whereby each piece of information is linked to others.

What is wisdom?

Wisdom adds yet another dimension by combining knowledge with experience, critical reflection and judgement, such as when assessing the moral and ethical implications of a decision.

What is Knowledge Management System (KMS)?

Knowledge management systems are knowledge-based information systems that support the creation, organization, and dissemination of business knowledge to employees and managers throughout a company.

Finally, it can be said that:

- Knowledge Management Systems (KMS) refer to any kind of IT system that stores and retrieves knowledge, improves collaboration, locates knowledge sources, mines repositories for hidden knowledge, captures and uses knowledge, or in some other way enhances the KM process.

Types of Knowledge

- a. Explicit knowledge
Explicit knowledge is articulated and represented in the form of spoken words, written material and compiled data.
- b. Tacit knowledge
Tacit knowledge is unarticulated and represented as intuition, perspective, beliefs, and values that individuals form based on their experiences.

Why knowledge has gained so much momentum in recent times?

- i. Altering Business surroundings:
- ii. Burgeon Connections:
- iii. Globalization:
- iv. Modification in Organizational composition:

Knowledge Discovery and Data Mining (KDD)

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

What is Data Mining?

Data mining is a major use of data warehouse databases and the static data they contain. In data mining, the data in a data warehouse are analyzed to reveal hidden patterns and trends in historical business activity.

Using special-purpose software to analyse data from a data warehouse to find hidden patterns and trends

Management Information System (MIS)

Management Information System (MIS) A management support system that produces pre-specified reports, displays, and responses on a **periodic, exception, demand, or pushreporting basis**.

A Management Information System aims at meeting the information needs of managers, particularly with regard to the current and past operations of the enterprise.

Examples:

- i. Airline reservations (seat, booking, payment, schedules, boarding list, special needs, etc.)

Decision Support Systems (DSS)

Decision Support System (DSS): An information system that utilizes decision models, a database, and a decision maker's own insights in an ad hoc, interactive analytical modelling process to reach a specific decision by a specific decision maker.

Components of DSS

- a. The user:
- b. One or more databases:
- c. Planning languages:
- d. Model Base:

Framework of Decision Support System

- i. Intelligence:
- ii. Design:
- iii. Choice:
- iv. Implementation:

Executive Information Systems (EIS)

Executive information systems (EIS) are information systems that combine many of the features of management information systems and decision support systems.

Executive Information System (EIS): An information system that provides strategic information tailored to the needs of executives and other decision makers.

Executive Support System (ESS): An executive information system with additional capabilities, including data analysis, decision support, electronic mail, and personal productivity tools

Components of EIS

- Hardware:**
Software:
User Interface:
Telecommunication:

Chapter 10 – Specialized Business Information Systems

Specialized Systems provide comprehensive end to end IT solutions and services to various corporations in India and other part of a world. These end to end IT solutions and services include:

- Systems integration
- Implementation
- Engineering services
- Software application
- Customization
- Maintenance

Enterprise Resource Planning (ERP)

Enterprise Resource Planning (ERP): Integrated cross-functional software that reengineers manufacturing, distribution, finance, human resources, and other basic business processes of a company to improve its efficiency, agility, and profitability.

“Enterprise Resource Planning (ERP) is essentially a software which integrates all the departments and their functions within a company through a single IT system.”

Various Stages of ERP

- ERP STAGE 1: Inventory Control
 ERP STAGE 2: ABC Analysis
 ERP STAGE 3: Economic Order Quantity
 ERP STAGE 4: Just In Time (JIT)
 ERP STAGE 5: Material Requirement Planning (MRP- I)
 ERP STAGE 6: Material Requirement Planning (MRP- II)
 ERP STAGE 7: Distribution Resource Planning (DRP)
 ERP STAGE 8: Enterprise Resource Planning
 ERP STAGE 9: Money Resource Planning (MRP III) or ERP-II
 ERP STAGE 10: Web-enabled EIS

Customer Relationship Management (CRM)

Customer Relationship Management Systems Information systems that track all the ways in which a company interacts with its customers

and analyses these interactions to optimize revenue, profitability, customer satisfaction, and customer retention.

- Customer relationship management (CRM) is about transforming an organization to become customer-centric and customer-facing in all that it does.
- A CRM may be defined as a business process in which client relationships; customer loyalty and brand value are built through marketing strategies and activities.

Analytical CRM

Analytical CRM: Customer relationship management applications dealing with the analysis of customer data to provide information for improving business performance.

- Analytical approach:
- Customer Relationship Management = Customer Understanding + Relationship Management
- Customer Understanding:
- Relationship Management:

Collaborative CRM

- It enables easy collaboration with customers, suppliers, and partners

CRM Interpretation

1. **Customer:**
Customer is a ‘Human Being’.
2. **Relationship:**
Relationship is the ‘Feeling’.
3. **Management:**
Management is ‘Management Tact’

Benefits of CRM

- i. Provides a single point of access to information
- ii. Supports better-informed business decisions
- iii. Enables real-time interactions
- iv. Integrates and personalizes the delivery of customer services.
- v. Improves the customer experience
- vi. Influences the Internet as a self-service delivery channel.

Supply Chain Management (SCM)**What is a Supply Chain?**

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers.

Supply Chain Management: Integrating management practices and information technology to optimize information and product flows among the processes and business partners within a supply chain.

What is Supply Chain Management?

It is the management of the flow of goods.

Components of SCM

Purchasing • Supplier selection • Strategic alliances
Operations • Lean • Inventory control • Quality
Integration • Coordination • Measurement • Control
Distribution • Transportation • CRM • Logistics parties

Human Resource Management Systems (HRMS)

Human Resource Information Systems (HRIS): Information systems that support human resource management activities such as recruitment, selection and hiring, job placement and performance appraisals, and training and development.

Human Resource Information Systems (HRIS) are designed to support:

- i. Planning to meet the personnel needs of the business.
- ii. Development of employees to their full potential.
- iii. Control of all personnel policies and programs.

Key Integration Points

- i. Compensation Management
- ii. Recruiting and Hiring
- iii. Succession Planning
- iv. Workforce Management
- v. Payroll and Benefits

Benefits of Human Resource Management Systems (HRMS)

- i. Bringing industry best practices to the HR functions.

- ii. HRMS lets you assess and utilize the human resource potential completely.
- iii. The solution increases the operational efficiency and productivity of the HR department.
- iv. Reduces HR administrative costs.
- v. Increases employee engagement and satisfaction.
- vi. Ensures seamless flow of information between employees, supervisors, managers and administrators.
- vii. Improves leadership development and succession.
- viii. Enhances data integrity within the enterprise.
- ix. Enables to meet compliance and audit requirements.

Core Banking System (CBS)

Core means “Centralized Online Real-time Environment”.

The word Core Banking is used to describe the various services being offered by the banking system to its customers and this is done by the whole banking core branches.

CBS Facilities

- Automatic teller machine or ATM
- Electronic fund Transfers or EFT
- Tele-banking
- Internet banking
- Branch clearing facility for banking branch offices

Platform where communication technology and information technology are merged to suit core needs of banking is known as **Core Banking Solutions (CBS)**.

Major Core Banking Products

- i. Infosys' Finacle
- ii. Nucleus FinOne
- iii. Oracle's Flexcube

Accounting Information System (AIS)

Accounting Information Systems: Information systems that record and report business transactions and the flow of funds through an organization, and then produce financial statements. These statements provide information for the planning and control of business operations, as well as for legal and historical recordkeeping.

Key Components of Accounting Information System

- i. People:
- ii. Procedure and Instructions:
- iii. Data:
- iv. Software:
- v. Information Technology Infrastructure:
- vi. Internal Controls:

Artificial Intelligence

Artificial intelligence (AI) is a field of science and technology based on disciplines such as computer science, biology, psychology, linguistics, mathematics, and engineering.

Artificial Intelligence (AI): The effort to develop computer-based systems that can behave like humans, with the ability to learn languages, accomplish physical tasks, use a perceptual apparatus, and emulate human expertise and decision making.

Discipline and Application areas of AI

Expert System

An expert system (ES) is a knowledge-based information system that uses its knowledge about a specific, complex application area to act as an expert consultant to end users.

Expert system is a computer based information system which provides advice or solutions for given problems, just like the human experts.

Component of Expert System

- 1. User interface:
- 2. Inference engine:
- 3. Explanation facility:
- 4. Knowledge base:
- 5. Knowledge Acquisition facility:

Characteristics of Expert System

- provides advice like human experts.
- can be example based, rule based and frame based
- Expert Systems provide various level of expertise like

Assistant Level:

Coleuege Level:

True Expert:

Limitation of Expert Systems

- Costly and complex system
- It is difficult to obtain the knowledge of experts

Types of Expert Systems

- i. **Example-based:** In Example-based system, developers enter the case facts and results. Through induction the ES converts tee examples to a decision tree that is used to match the case at hand with those previously entered in the knowledge base.
- ii. **Rule-based:** 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. Rule-based systems are appropriate when a history of cases is unavailable or when a body of knowledge can be structured within a set of general rules.
- iii. **Frame-based:** Frame based systems organize all the information (data, description, rules etc.) 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.

Business Intelligence

Business Intelligence (BI): A term primarily used in industry that incorporates a range of analytical and decision support applications in business including data mining, decision support systems, knowledge management systems, and online analytical processing.

Business Intelligence (BI) refers to all applications and technologies in the organization that are focused on the gathering and analysis of data and information that can be used to drive strategic business decisions.

Definitions

- Business Intelligence (BI) is the delivery of accurate, useful information to the appropriate decision makers within the necessary time frame to support effective decision making for business processes.

Business Intelligence Tools

- software
- standalone tools or suites of tools
- software programs and features

Key Business Intelligence tools

Simple Reporting and Querying

Business Analysis

Dashboards

Scorecards

Data Mining or Statistical Analysis

Business Reporting through MIS and IT

Business reports are routinely assigned to facilitate the following:

- i. Accomplish conclusions about a trouble or issue.
- ii. Demonstrate short and apparent communication skills.
- iii. Endow with recommendations for upcoming accomplishing.
- iv. Exhibit our analytical, reasoning, and evaluation skills
- v. Pertain business and management theory to a practical situation.
- vi. Scrutinize obtainable and potential solutions to a problem, situation, or question.

Benefits for Micro-Businesses and Small to Medium Enterprises

- i. Paperless lodgement-
- ii. Electronic record keeping -
- iii. Pre-filled forms -
- iv. Ease of sharing -
- v. Secure AUS key authentication -
- vi. Same-time validation -

Benefits for Large Business

- i. A single reporting language to report to government:
- ii. Reduce costs -
- iii. Streamline the process of aggregating data -

- iv. Increased access to comparable performance information –
- v. Secure AUS key authentication –
- vi. Same-time validation –

Importance of Access and Privilege Controls

It ensures that information remains accurate, confidential, and is available when required.

Functions of Access Control

- i. Identity Management:
- ii. Authentication:
- iii. Authorization:
- iv. Accountability:

Approaches to Access Control

Role-based Access Control (RBAC)

- RBAC largely eliminates discretion when providing access to objects.
- Subjects receive only the rights and permissions assigned to those roles.

Rules-based Access Control (RAC)

- RBAC, for example, enforces static constraints based on a user's role. RAC, however, also takes into account the data affected, the identity attempting to perform a task, and other triggers governed by business rules.

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, a backup user does not need to install software; hence, the backup user has rights only to run backup and backup-related applications. Any other privileges, such as installing new software, should be blocked.
- Least User Access or Least-privileged User Account (LUA) are also used,

Electronic Funds Transfer

Electronic Funds Transfer (EFT): The development of banking and payment systems that transfer funds electronically instead of using cash or paper documents such as checks.

Payment Mechanisms

- With the increase in online shopping and e-commerce industry, it has now become a requirement that the web stores are integrated with a payment gateway.

What is a payment gateway?

Payment gateway is fundamentally a service used to process credit card transactions when orders are accepted online from clients. In a way, it represents a physical POS (Point-of-sale) terminal, which is set in every retail outlet these days.

Major Types of Electronic Payments

Credit Cards

A **credit card** is a payment card issued to users as a system of payment.

How a credit card is processed?

- i. Authorization:
- ii. Batching:
- iii. Clearing:
- iv. Funding:

Electronic Cheques

- Electronic Cheque is a form of payment made via the internet that is designed to perform the same function as a conventional paper Cheque.

Following two systems have been developed to let consumers use electronic cheques to pay Web merchants directly:

- a. By the Financial Services Technology Corporation (FSTC):
- b. By Cyber Cash:

Smart Cards

Smart cards have an embedded microchip that contains all the information a magnetic strip contains but offers the possibility of manipulating the data and executing applications on the card.

- Contact Cards –
- Contactless Cards –
- Combi/Hybrid Cards –

Electronic Purses

- It is very similar to a pre-paid card.

- The electronic purse card can be used as an ATM card as well as a credit card.
- No credit check or signature is needed.

A Typical On-line Transaction

A typical online e-commerce transaction is composed of three main functions: **sales, payment and delivery.**

Part-5 Business Process Automation through Application Software

Chapter 11 – Business Process Automation through Application Software

Introduction

Through automation, business processes can now be easily extended outside of an organization to encompass suppliers and business partners.

Some of the examples of automation from our real life

- a. **Newspaper:** The delivery boy has used Google maps to chart his/her path to our house.
- b. **Petrol Pump:** Automated machines which fill car's tank and generate computerized bills.
- c. **The milkman:** Mother Dairy uses high degree of technology to ensure that we get the freshest milk.
- d. **School:** The kids going to school find that their test scores are being emailed or sent by SMS to their parents.

Business Applications

Business Application = Business + Application

A is an enterprise that provides products or services desired by customers.

Application is defined as a computer program to fulfill a particular purpose.

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

Applications based on Nature of Processing.

- Batch Processing
- Online Processing
- Real-time Processing

Applications based on Source of Application

- Custom-built Application
- Packaged Software
- Leased application

Applications based on Size and Complexity of Business

- Small and Medium Enterprise (SME) business
- Large Business

Types of Business Applications

Business Applications Based on Nature of Application

Accounting Applications

Office Management Software

Compliance Applications

Customer Relationship Management Software

Management Support Software

ERP Software

Product Lifecycle Management Software

Logistics Management Software

Legal Management Software

Industry Specific Applications

Basis of Business Applications

- i. Nature of processing
- ii. Source of application
- iii. Nature of business
- iv. Functions covered

Business Process Automation

“Business Process Automation (BPA) is a set of activities or strategies to automate business processes so as to bring benefit to enterprise in terms of cost, time and effort.”

- BPA increases productivity by automating key business processes through computing technology.

Why BPA is needed in Organizations?

- Cost Saving:**
- To create value:**
- To remain competitive:**
- Fast service to customers:**

Objectives of BPA

- Confidentiality:**
- Integrity:**
- Availability:**
- Timeliness:**

Step 1: Define why we plan to implement a BPA?

Step 2: Understand the rules / regulation under which enterprise needs to comply with?

Step 3: Document the process, we wish to automate.
The benefit of the above process for user and entity being:

Step 4: Define the objectives/goals to be achieved by implementing BPA.

Step 5: Engage the business process consultant.

Step 6: Calculate the RoI for project.

Step 7: Developing the BPA

Step 8: Testing the BPA

Applications that help entity to achieve BPA

- TALLY
- SAP R/3
- MS Office Applications
- Attendance Systems
- Vehicle Tracking System
- Automated Toll Collection Systems
- Department Stores Systems
- Travel Management Systems
- Educational Institute Management Systems
- File Management System

Information Processing

Information Processing: Efforts to create information from the raw data is called as Information Processing.

Manual Information Processing Cycle

Input: Puts details in register.

Process: Summarizes the information.

Output: Presents information in the form of Report.

Input: Entering data into the computer.

Processing: Performing operations on the data.

Storage: saving data, programs and outputs for future use.

Output: Presents information in the form of Report.

Delivery Channels

Delivery channel refers to the mode through which information or products are delivered to users.

Importance of Delivery Channels

- To be aware of 'what information is required for effective delivery of products or services.'
- To plan an overall information management and communications strategy.

Information Delivery Channel: How to choose one?

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

Controls in BPA

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.

Objectives of Control

- Authorization –
- Completeness –
- Accuracy –
- Validity –
- Physical **Safeguards and Security** –
- Error **Handling** –
- Segregation of **Duties** –

Types of Control

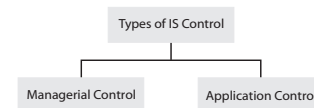
Application Controls

- Application controls are the controls on the sequence of processing events.
- These controls cover all phases of data right from data origination to its final disposal.

Internal Controls

The plan of enterprise and all the methods and procedures adopted by the management of an entity to assist in achieving management's objective of ensuring, as far as practicable, the orderly and efficient conduct of its business, including adherence to management policies, the safeguarding of assets, prevention and detection of fraud and error, the accuracy and completeness of the accounting records, and the timely preparation of reliable financial information.

Types of Application Control



Managerial Functions Based Controls

- Top Management and Information Systems Management Controls
- Systems Development Management Controls
- Programming Management Controls
- Data Resource Management Controls
- Quality Assurance Management Controls
- Security Management Controls
- Operations Management Controls

Boundary Controls

Controls in the boundary subsystem have three purposes –

- to establish the identity and authenticity of would-be-users of a computer system;
- to establish the identity and authenticity of computer-system resources that users wish to employ; and
- to restrict the actions undertaken by users who obtain computer resources to a set of authorized actions.

Major types of controls exercised in the boundary subsystem:

- Cryptographic Controls
- Access Controls

An access control mechanism processes users' requests for resources in three steps:

- Identification
- Authentication
- Authorization

- Personal Identification Numbers (PIN)

- Digital Signatures
- Plastic Cards

Input Controls

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

Input controls are important since substantial time is spent on inputting data which involves human intervention and are therefore prone to errors and fraud.

Types of Input Control Techniques

- Source Document Control
- Data Coding Controls
- Batch Controls
- Validation Controls

Communication Controls

Components in the communication subsystem are responsible for transporting data among all the other subsystems within a system and for transporting data to or receiving data from another system. Three types of exposure arise in the communication subsystem.

- a. As data is transported across a communication subsystem, it can be impaired through attenuation, delay distortion, and noise.
- b. The hardware and software components in a communication subsystem can fail.
- c. The communication subsystem can be subjected to passive or active subversive attacks.
 - Physical Component Controls
 - Line Error Controls

- Flow Controls
- Link Controls
- Topological Controls
- Channel Access Controls
- Internetworking Controls

Process Controls: Data processing controls perform validation checks to identify errors during processing of data.

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

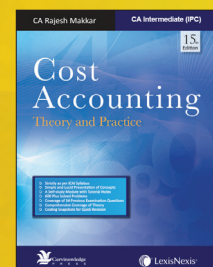
Database Controls: Protecting the integrity of a database when application software acts as an interface to interact between the user and the database are called the update controls.

Understanding Information Technology *A Self-study Module*

'Understanding Information Technology: A Self-study Module' aims to help CA Intermediate (IPC) students by clearly explaining, analyzing, and evaluating important information technology concepts. My approach in writing this book was essentially two-fold: to write an accessible textbook that students feel comfortable with but without compromising on the academic rigor. This book has been divided into five parts comprising eleven chapters. The organization of chapters provides a student-friendly approach to the study of Information Technology.

This new course on 'Information Technology' can have a major impact on your career path and future success by providing comprehensive knowledge of information technology. It would help you to utilize your talent in the dynamic 21st century business world where information systems and emerging new technologies have taken centre stage in running businesses.

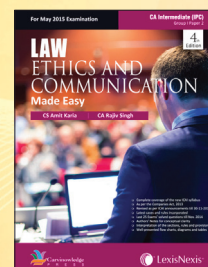
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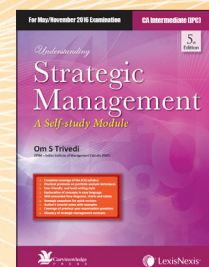
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