



HIGHER EDUCATION
ACADEMY



HIGHER EDUCATION
INSTITUTE



Study Guide

Diploma Programme

Principles of Information Systems and Data Management

v2.0



Message to Student



"I encourage you to be an active learner, questioning and extending what you know in order to become a contributing participant in the modern global economy."

Dear Kaplan Student,

Thank you for choosing Kaplan Singapore and entrusting your educational investment with us.

It is Kaplan Singapore's and the School of Diploma Studies' mission as your 'private education institution of choice' to commit to providing a fulfilling student journey and learning experience for your development. The underlying goal of Kaplan Singapore is to ensure that our students are able to respond to the demands of the globalised economy set against a highly uncertain and complex environment.

In the 21st Century it is important that your educational experience provides you with the skills and competencies on HOW to think and not just WHAT to think.

As such, the Kaplan Diplomas, which have a long history of being recognised as equivalent to the first year or more of undergraduate studies in high-quality international universities, aim to prepare you for work, further study, and lifelong learning.

Your role as a Kaplan student is to participate, think deeply on a topic and work with other students and your Lecturers to broaden your knowledge. I encourage you to be an active learner, questioning and extending what you know in order to become a contributing participant in the modern global economy.

However, only you can embody these attributes. You are the major determinant of your own academic success and as adult learners you will receive both the freedom and responsibility this entails. With that, I wish you well in your learning and look forward to seeing you succeed.

Krishna Rajulu
Academic Dean, Kaplan Singapore

Kaplan Desired Graduate Attributes

Through the reading of this module, Kaplan Singapore intends to:

- Instill in students the value of lifelong and self-directed learning by stimulating intellectual curiosity, creative and critical thinking and an awareness of cultural diversity;
- Assist students in developing professional attributes, ethical values, social skills and strategies that will nurture success in both their professional and personal lives;
- Foster integrity, commitment, responsibility and a sense of service to the community;
- Prepare students to meet the ever-changing needs of their communities both now and in the future; and
- Promote innovative and effective teaching.

Culminating from these institutional values and educational goals, Kaplan Singapore's Desired Graduate Attributes are:

Inquiry and criticality: Graduates will be able to critically collect, evaluate and apply information and data in order to make decisions in a wide variety of professional situations. This attribute is demonstrated when students:

- Undertake, evaluate and apply appropriate research, theories, concepts and tools to investigate problems and find solutions;
- Exercise critical thinking and independent judgement to assess situations and determine solutions; and
- Have an informed respect for the principles, methods, values and boundaries of their profession and the capacity to question these.

Ethicality and discernment: Graduates will be able to assess situations and respond in an ethically, socially and professionally responsible manner. This attributed is demonstrated when students:

- Act responsibly, ethically and with integrity in their profession;
- Hold personal values and beliefs and participate in the broad discussion of these values and beliefs while respecting the views of others;
- Understand the broad local and global economic, political, social and environmental systems and their impact as appropriate to their discipline and profession; and
- Acknowledge personal responsibility for their own judgments and behaviour

Ability to communicate well: Graduates will recognise the importance and value of communication in the learning and professional environment. This attributed is demonstrated when students:

- Create and present knowledge, arguments and ideas confidently and effectively using a variety of methods and technologies;
- Recognise the wide range of possible audiences for information and respond with communication strategies appropriate to those audiences; and
- Work collaboratively with people from diverse backgrounds and be aware of the different roles of team members and to function within that team.

Independent and reflective practitioner

- Graduates will be able to work independently and be self-directed learners with the capacity and motivation for continued professional learning and development; and
- They will be able to critically reflect on their own practice and evaluate and understand current capacity and further development needs

Embedded within the desired graduate attributes are the following skills:

- Conduct research.
- Analyse, organise and present data and information.
- Think and read critically.
- Make an oral presentation.
- Intellectual curiosity and awareness of culture and diversity.
- Develop professional ethos and practice that will foster success in career and life.
- Meet the ever changing needs of communities now and in the future.

Table of Contents

Message to Student	i
Kaplan Desired Graduate Attributes	ii
Table of Contents	iii
About this module	iv
Introduction to Students	v
Scheme of Work	vi
Assessment Matters	viii
Topic 1	
Understanding Information	1
Topic 2	
Business Information Systems	8
Topic 3	
Hardware and Software	15
Topic 4	
Databases and Networks	23
Topic 5	
Acquiring and Developing BIS	31
Topic 6	
Project Initiation	35
Topic 7	
systems Analysis	40
Topic 8	
Systems Design	47
Topic 9	
Systems Testing and Implementation	54
Topic 10	
IS Security	61

About this module

This course aims to develop an understanding of the concept of information system and the activities in the systems development life cycle.

It highlights the role and contribution of information systems in the organisation and how data and information are organised and used in a company. All this has an impact on the rapidly changing role of today's IS professional.

Module Learning Outcomes

Upon successful completion of this module, the student should be able to:

- Explain the use of information systems in modern organisations;
- Demonstrate understanding for the variations of components used in modern information systems;
- Explain the system development life cycle from inception, development, testing and deployment to monitoring;
- Describe a list of requirements for basic application system and a conceptual model of a modern information system;
- Discuss the different ethical frameworks and how these apply to different information systems;
- Demonstrate understanding for modern information systems from an IT security perspective.

Overview of Learning Resources

Recommended reading:

Title: The Book of Informatics,
Authors : John Gammack, Valerie Hobbs and Diarmuid Pigott
Edition : 2011
Publisher : Cengage Learning

Title : Principles of Information Systems
Authors : Stair, Ralph M and Reynolds, George W
Edition : 11th edition (2012)
Publisher : Course Technology

Title : Introduction to Information Systems: Supporting and Transforming Business
Authors : R. Kelly Rainer, Brad Prince and Casey G. Cegielski
Edition : 5th edition (2013)
Publisher : Wiley

Other sources:

See Proquest and Newslink databases linked to your Elearn LMS homepage. The National Library Board on North Bridge Road (databases are for Singaporean/PR only)

Instructions to Students

How to use this study guide

This study guide consists of written notes that form the main treatise of the subject matter of this module. You are strongly advised to **study these notes carefully and thoroughly, as well as, examine the sources that have been cited.**

Written quiz and examination will not test beyond the scope of the contents found in the study guide. However, in order to fully address the assessment requirements of the assignment, you will need to research beyond the confines of the study guide. Nevertheless, the materials herein are still a sound basis from which to build the assignment.

Further supporting materials

The study guide is supplemented by the following:

- Reproduced PowerPoint slides used by the lecturers
- Activity sheets

PowerPoint Slides

The PowerPoint slides are meant for the lecturers to signpost the flow of the lesson and for you to have a visual focus when in class. Outside of class, they can also serve to help you recall the activities that took place during the respective lessons so that you might be reminded of key learning points.

However, the PowerPoint slides must **NOT replace the need for you to read the written notes** in the study guide. The slides alone are **INSUFFICIENT for you to gain the necessary understanding of the subject matter**. As such, they **will NOT prepare you adequately** for the various summative assessment components.

Activity Sheets

It is imperative that you sincerely attempt all the activities in class and document your responses faithfully. **These activity sheets are specially designed to scaffold your learning; working through the tasks is an integral part of developing the desired skills.**

Also, by making your thinking visible through the activity sheets, it is then possible for your lecturer to provide **you with growth producing feedback** so that you may improve your performance or have your doubts clarified.

Scheme of Work

LESSON	TOPICS
1	01 Understanding Information <ul style="list-style-type: none"> • Data and Information • Creating Information • The Business Environment • Managerial Decision Making • Focus on Knowledge Management
2	02 Business Information Systems <ul style="list-style-type: none"> • Introduction to Systems • Different Types of Systems • Business Information Systems (BIS) • Resources that Support BIS • Categories of BIS • BIS and Strategic Advantage
3	03 Hardware and Software <ul style="list-style-type: none"> • Components of Computer System • Major Categories of Computer • Types of Microcomputers • Input Devices • Output Devices • Focus on Printers • Storage Devices • Processors • Categories Software
4	04 Databases and Networks <ul style="list-style-type: none"> • Databases • Computer Networks • Network Components
5	05 Acquiring and Developing BIS <ul style="list-style-type: none"> • How and Why are Information Systems Acquired? • Software Acquisition and the System Development Lifecycle Revision Topics 1-5
6	06 Project Initiation <ul style="list-style-type: none"> • Introduction • Reasons for Project Initiation • The Feasibility Study
7	07 Systems Analysis <ul style="list-style-type: none"> • Introduction • Identifying the Requirements • Documenting the Findings • System Analysis - An Evaluation
8	08 Systems Design <ul style="list-style-type: none"> • Introduction • Aims of Systems Design • Constraints of Systems Design • Relationship between Analysis and Design • Elements of Design • Systems or Outline Design • Defining Structure of Program Modules • Security Design

9	09 System Testing and Implementation <ul style="list-style-type: none"> • Introduction • System Build and Implementation • Maintenance
10	Assignment Consultation
11	Software Tools used in IS
12	Case Study
13	10 IS Security <ul style="list-style-type: none"> • The Need for Controls • Control Strategies • Types of Control • Some Techniques for Controlling Information Systems • Focus on Malware • Threats Related to Internet Services
14	Revision Toipcs 6-10 Assignment Consultation Module Consolidation

Assessment Matters

Assessment Overview

Assessment 1: CA Quiz

Weightage: 20% (20 marks)
Date: To be confirmed
Duration: 10 minutes per quiz
Test Format: 5 MCQs per topic

Assessment 2: Individual Assignment

Weightage: 80% (100 marks)
Word Limit: 2000 words
Date: Lesson 14 (FT) / Lesson 7 (PT)
Citation Format: APA v.7
References: Module Specific

Important Policies

Penalties for Plagiarism

Plagiarism in any form is not tolerated by Kaplan Singapore. That said, direct quotations and general similarities of common terms and language mean the E-Learn LMS will often pick up every small similarity so the likelihood of a Turnitin Similarity report recording a result of 0% is unrealistic. After all, no technology is perfect and there is the need for some direct quotation (provided you reference using APA guidelines, of course) and to use commonly accepted terms and language.

By way of quality control, Kaplan Singapore has imposed an absolute cut-off of 25% in proprietary programmes (a zero grade for the assessment). In all cases, the lecturer is the true determinant of any result. To be certain you should always reference according to the APA style required by the institution.

TOP TIP:

The surest way to succeed is to ensure all work is correctly referenced. Keep a copy of the Kaplan Singapore Academic Works and APA Guide handy when you are typing your assignments and use it to guide you as to correct referencing, citation and other aspects of academic writing.

APA GUIDE: <http://bit.ly/igd-apa>

Penalties for late submissions

Kaplan Singapore prepares students for the realities of the workforce and further education by requiring students to meet deadlines and submit all work on time. As such, students are required to seek approval and penalties will be imposed on late assignment submissions in accordance with the table below and cited in the Programme Handbook:

No of days late	Penalty
1 – 5 days	10% deduction per day from the marks attained by students.
After 5 days	Assignments that are submitted more than 5 days after the due date will not be accepted and it will be deemed as "No Submission". Student will be required to re-module.

Source: Kaplan School of Diploma Studies Student Handbook (V4.5, 2017), Section 9

Assignment Submission: How to Use E-Learn LMS for Assignment Submission

1. You will be enrolled by the School of Diploma Studies Programme Management into the E-Learn LMS system only after your fee payment is confirmed.
2. You will be sent your USER NAME and PASSWORD via email.
3. Reset your password as prompted.
4. Enter the site at the following address: <https://elearn-diploma.kaplan.com.sg>
5. To submit assignment please refer to the LMS Manual

Please refer to your Student Handbook for more details on Penalties for Plagiarism, Misconduct, Examinations Rules and Regulations. Should you have any queries, please contact diploma.sg@kaplan.com

Assignments and Kaplan Learning Management System

Kaplan Singapore School of Diploma Studies requires you to submit Assignments through the Learning Management System (E-Learn LMS). When submitted, your assignment is checked for plagiarism by software called Turnitin linked to the E-Learn LMS. The software is intended to provide one more tool to improve the quality of academic writing and as such will be compulsory for use. It is important to note that this is merely one of many tools available to you and that final decisions about the quality of your work rest with your lecturer.

This page intentionally left blank

Study Guide

Topic 01: Understanding Information

Lesson Learning Outcomes

At the end of this chapter, the students will:

- Distinguish between Data, Information and Knowledge
- Explain why modern organizations rely heavily on information and communication technologies

Why Learn About Information Systems in Organizations?

Information systems are essential tools that help people accomplish their job goals.
Information systems are used by:

- Sales representatives
- Managers
- Financial advisors

Introduction:

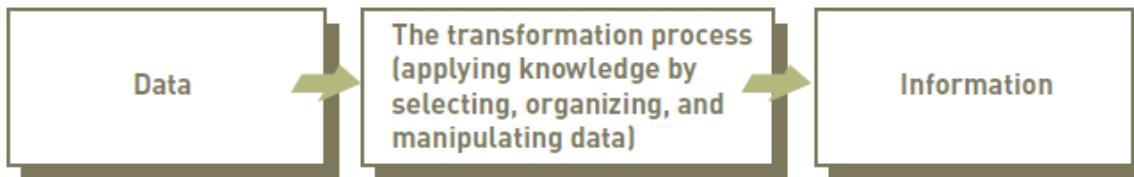
Information system (IS) are a group of interconnected components that gather, manipulate, and broadcast information and data and give feedback to meet an objective. Companies and businesses can utilize information systems to increase profits and decrease expenses. Information is an organization's most treasured possession, which is frequently confused with the term data.

Data, Information, and Knowledge:

- Data are raw facts
- Information is a group of facts arranged in such a way that they have value more than facts.
- Process are a group of logically connected tasks.
- Knowledge is the understanding of a group of information.
- **Types of data are as follows:**

Data	Represented by
Alphanumeric data	Numbers, letters, and other characters
Image data	Graphic images and pictures
Audio data	Sound, noise, or tones
Video data	Moving images or pictures

The procedure involved in transforming data into information:



The features of valuable information:

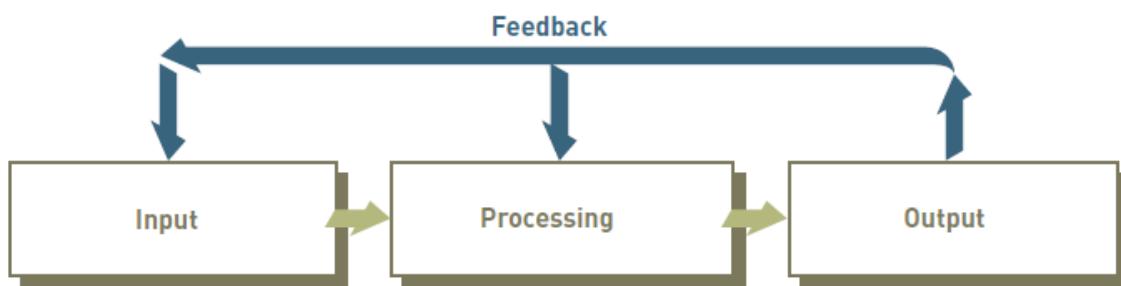
If a company's information is incorrect or is incomplete it leads to people making poor decisions, which in turn leads to huge losses. Depending on the type of data, an individual requires some characteristics become more relevant than others do.

What is an Information System?

Information system (IS) is a group of interconnected elements that:

- Collect (input)
- Manipulate (process)
- Store
- Broadcast (output) data and information
- Provide a feedback mechanism to meet a goal.

Components of an information system:



Input, Processing, Output, Feedback:

- Input is the process of assembling and gathering raw data.
- Processing is a process of translating data into valuable outputs.
- Output is a method that involves production of beneficial information, typically in the form of documents and reports.
- Feedback is a process of utilizing information from the system, which is later used to make changes to processing activities.

Manual and Computerized Information Systems:

- An information system can be either manual or computerized. Example an investment analyst prepares hand drawn charts and trend lines to support the company in taking investment related decisions. Computerized information systems survey the stock markets and recommends when large chunks of stocks should be bought or sold.

Computer-Based Information Systems:

- It is a single set of software, telecommunications, procedures, hardware databases and people which are all put together to collect, manipulate, store, and process data into information.
- Technology infrastructure comprises of all the databases, people, hardware, software, telecommunications and procedures put together to collect, manipulate, store, and process data into information.

Components of a computer-based information system:

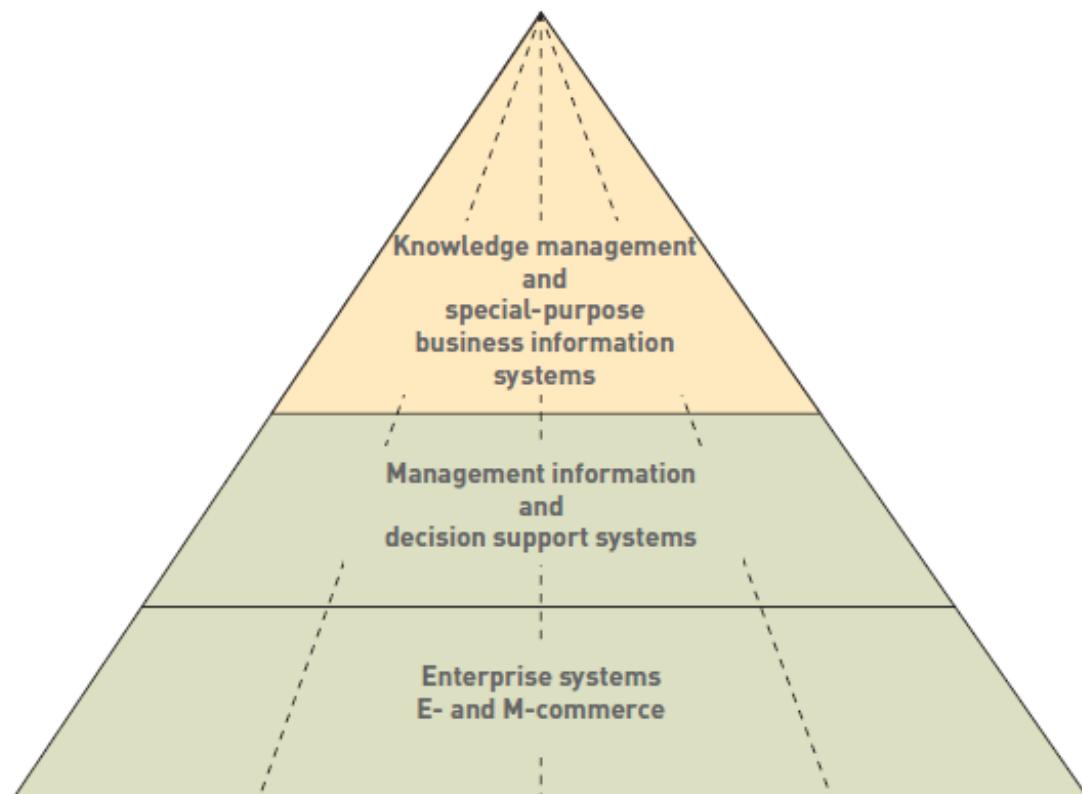
- **Hardware:**
Comprises of all the computer equipment used to accomplish input, processing, and output actions.
- **Software:**
Comprises of all the computer programs that control the procedures of the computer.
- **Database:**
Is a systematic collection of facts and information, usually consisting of two or more linked data files.
- **Telecommunications, networks, and the Internet:**
It is a process, which involves the electronic broadcasting of signals for communications.
- **Networks:**
Link computers and equipment that enables electronic communication.
- **Internet:**
A computer network, comprising of many interconnected networks, which are all involved in freely exchanging information.
- **Intranet:**
Internal network that allows individuals within an organization to exchange information.
- **Extranet:**
Network that allows only designated outsiders, such as business partners and customers, to access authorized information of a businesses' intranet.
- **People:**
The most important element are the individuals who run the computers.

- **Procedures:**

This comprises of plans, guidelines, procedures, and rules for utilizing the CBIS.

Business Information Systems:

- Most common kinds of information systems are those that are intended for supporting decision making, electronic and mobile business, transaction processing and management information.
- Some companies utilize certain special systems like virtual reality, which not every company uses.



Electronic and Mobile Commerce:

E-commerce is any business transaction performed electronically between:

- Business-to-business (B2B)
- Business-to-consumer (B2C)
- Consumer-to-consumer (C2C)
- Business and the public sector
- Consumers and the public sector

E-commerce can improve a company's stock prices and market value.

Mobile commerce (m-commerce) involves the use of mobile or wireless devices to conduct business.

Electronic business (e-business) utilizes information systems and the internet to conduct all business-related functions.

Enterprise Systems: Transaction Processing Systems and Enterprise Resource Planning:

- **Transaction:**
Involves any business-related exchange, such as payments, sales etc.
- **Transaction processing system (TPS):**
It is a systematic group of people, procedures, software, databases, and devices used to record finished business transactions.
- **Enterprise resource planning:**
A group of integrated programs accomplishes the important business operations for an entire global organization.

Information and Decision Support Systems:

- **Management information system (MIS):**
A systematic group of people, procedures, software, databases, and devices offers routine information to managers and decision makers.
- **Decision support system (DSS):**
It is a systematic collection of people, procedures, software, databases, and devices that support problem-specific decision-making.

This can include:

- A group of models which are used to support a decision maker or user (model base)
- A group of facts and information which support in decision making (database)
- Systems and procedures like user interface which help decision makers and other users communicate with the DSS.

Specialized Business Information Systems:

- **Knowledge management systems (KMSs):**
It is a systematic collection of people, procedures, software, databases, and devices to create, store, share, and use the company's knowledge and experience.
- **Artificial intelligence (AI):**
It is a computer system, which takes on features of the human intelligence.
- **Expert systems:**
It is a prearranged computer capability to make suggestions and function like an expert in a field.

- **Virtual reality:**
It is recreation of a real or imagined environment that can be experienced visually in three dimensions (3D).
- **Multimedia:**
It can include photos and images, audio, and special effects.

References

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.
- DIKW. (2013, April 6). LegoViews. <https://legoviews.com/2013/04/06/put-knowledge-into-action-and-enhance-organisational-wisdom-lsp-and-dikw/>

Image Reference:

<https://acculturated.com/wp-content/uploads/2015/12/8-redundant-info>
<http://2oqz471sa19h3vbwa53m33yj.wpengine.netdna-cdn.com/wp-content/uploads/2016/04/internet-minute-2016.png>

Topic 02: Business Information Systems

Lesson Learning Outcomes

At the end of this chapter, the students will:

- Explain how Business Information Systems (BIS) play a crucial part in gaining and sustaining a competitive edge over other organizations operating in the same industry
- Identify systems and their components
- Describe the behavior of systems
- Describe the basic strategies and methods used to gain competitive advantage using BIS

The Systems theory gives an effective means of examining and upgrading the different business processes. It can be used in a wide variety of areas and is essential to obtaining a good understanding of the managerial application of BIS. A system can be defined as a compilation of interconnected components that function together towards a shared goal. The function of a system is to receive inputs and transform them into outputs.

Characteristics of System

- The different components of a system work together to achieve a collective goal. This is called as the system's objective. The objective of a system is generally very precise and can usually be expressed in a single sentence.
- System objective: All the different components of a system should be interrelated to each other by a common objective.
- Systems do not function in complete isolation. They are included within a surrounding that have other systems and external agencies. The extent of a system is restricted by its boundary. Everything outside of the boundary is considered as part of the system's surrounding and everything within the boundary is considered as part of the system itself. The boundary also demarcates the interface between a system and its surrounding. The interface defines exchanges between a system and the surrounding.
- Environment- The surroundings of a system, outside its boundary.
- Boundary- The interface between a system and its surrounding.
- Interface- Controls the exchanges between a system and its surrounding, or other systems.
- Systems can be made up of other smaller systems and can be complicated. These are called as subsystems. Systems made up of many subsystems are sometimes called as suprasystems.
- The main function of a subsystem is to support the greater functions of the suprasystem. In an organization, marketing and finance are the subsystems and they are within the system's boundary, while the Customers, sales channel, suppliers, competitors, partners, legislation etc. lie outside the business environment.

- An organization will work together with all the elements that are beyond the system boundary in the environment, which is referred to as an open system. Most information systems will fall into this group because they will accept input and will respond to them. Totally closed systems that do not interact with their surroundings are uncommon.
- Subsystem- Large systems can be made up of smaller systems known as subsystems.
- Suprasystem- A larger system comprising of many smaller subsystems.
- Open system: Interaction happens with components outside the system boundary.
- Closed system: No interaction at all or limited interaction occurs with the surrounding.
- Subsystems in an information system work together by exchanging information. This is called as an interface between systems.

Portable Computers

Portable computers are computers that can be carried easily. Laptops, notebooks, subnotebooks, and tablet computers are all examples of portable computers. Desktop computers are comparatively small, low-cost single-user computer systems that are extremely versatile. They are small enough to fit on an office table, and they have adequate memory and storage for most business computing tasks. Workstations are computers that are highly powerful when compared to personal computers nevertheless they are still small enough to fit on a desk.

Servers

When we look at networking in general any device on the network that responds to requests from client applications is operating as a server. A server is a computer that contains information, which is meant to be shared with many client systems. Web pages, documents, databases, pictures, video, and audio files are all examples that can be stored on a server and can be delivered when a request is received from clients. In other instances, the print server delivers the client print requests to the specific printer. Various types of server applications may have different requests for client access like, some servers may require user authentication to access the requested data. Such servers depend on a centralized list of user accounts and the permissions granted to each user.

- For information systems and business systems, it is important for having clearly defined interfaces for it to be an efficient organization.
- For example, sales orders must be sent from the sales department to the finance department and then to the distribution subsystem. If this does not happen, orders may be lost or delayed.
- The connection or pairing between subsystems differs. The extent of coupling outlines how closely interlinked the different subsystems are. It is a basic principle of systems theory and BIS design that subsystems must be coupled loosely.
- Subsystems, which are extremely dependent on one another, are known as close-coupled systems. In such instances, the outputs of one system are the direct inputs of another system.

- Decoupled systems are not as much dependent on one another and so are more capable of dealing with unforeseen situations or events. Such systems have greater levels of autonomy. Even Though decoupled systems are extremely flexible and adaptive than their very flexibility increases the possibility that inadequacies may occur.
- Coupling explains how closely interlinked different subsystems are. When the modules pass only the minimum of information between them and do not share data and program code is called loose coupling. Close-coupled systems are extremely dependent on each other.
- Systems are hierarchical- Systems are made up of many subsystems, which in turn may be made up of other subsystems. One should understand that the different parts of a system are dependent on one another in some or the other way. This interdependence implies that any changes to one part of a system leads to changes in one or more parts.

Resources that support BIS

1. **People resources:**

This include the users and those who develop, maintain and operate the system.

2. **Hardware resources:**

This includes all types of machines and not just computer hardware.

3. **Software resources:**

This includes computer programs and the different media on which they are stored; the term can also be used to explain the procedures used by people.

4. **Communications resources:**

This includes the different resources that are required to allow different systems to transfer data.

5. **Data resources:**

This includes all the information that an organization has access to, irrespective of its form.

Advantages of computer processing

• **Speed:**

Computers can process billions of commands every second, permitting them to complete a given work in a very less time.

• **Accuracy:**

The results of a calculation done by a computer is possible for it to be entirely accurate. Apart from the errors that a human is more likely to make, such can be eliminated.

• **Reliability:**

In all the organizations, the computer-based information systems function round the clock and are only put offline for repairs or some routine maintenance.

- **Programmability:**
All computer-based information systems are designed to fulfil a function, the capability to alter the software that controls them gives them a high degree of flexibility. Even the easiest personal computer, can be used to create letters, produce cash flow projections, or control databases.
- **Repetitive tasks:**
Computer-based information systems are highly suitable to do repetitive jobs that might be boring and fatigue causing to people. The use of technology helps to cut down errors and free employees to do other tasks.

Limitations of computer-based processing

- **Judgement/experience:**
Regardless of the many advances in artificial intelligence methods, computer-based information systems are considered as incapable of resolving problems by using their own experience and judgement.
- **Improvisation/flexibility:**
Usually, computer-based information systems are incapable in reacting to unforeseen situations and events. Apart from this, most systems are designed to fulfil a particular function; hence, it can be difficult to modify them to meet new/ changed needs.
- **Innovation:**
Computers lack the creativity of a human brain. They have a restricted thinking capability hence it is difficult for them to discover new ways of improving processes or solving problems.
- **Intuition:**
Intuition plays an important role for people in certain social situations. BIS cannot use intuition therefore it is unsuitable for certain kinds of situations.
- **Qualitative information:**
Managers usually make decisions based on the suggestions of others. Their confidence in the person has a major influence on the decision itself. However, BIS cannot act upon qualitative information of this type.

E-business and e-commerce

- **Electronic business (e-business):**
All electronically facilitated information exchanges, both inside an organization and with outside stakeholders, assisting the range of business practices is called as an e-business.
- **Electronic commerce (e-commerce):**
All electronically facilitated information exchanges between an organization and all its external stakeholders.
 - **Buy-side e-commerce:** It is an E-commerce transaction, which takes place between a purchasing organization and its many vendors.

- **Sell-side e-commerce:** It is an E-commerce transaction, which takes place between the supplier organization and its many customers.

Enterprise systems

- Enterprise systems intend to support the business processes of an organization across any operational boundaries that are within that organization. Internet technology is used to integrate information within the business and as well as the external stakeholders like the customers, partners, and suppliers.
- The four main components of an enterprise system are as follows:
 - Enterprise resource planning (ERP) - this involves internal production, distribution, and financial processes.
 - Customer relationship management (CRM) - this involves marketing and sales processes.
 - Supply chain management (SCM) - this involves the flow of materials, customers, and information through the supply chain.
 - Supplier relationship management (SRM) - this involves sourcing, purchasing and the warehousing of goods and services.

BIS and strategic advantage

BIS supports in the following ways:

- Cost leadership
- Product differentiation
- Innovation

A competitive advantage is a major and long-term value that an organization can enjoys over its other market competitors. Creating and retaining this advantage over the competitors is a complex process, but an organizations existence and prosperity depends on its success in achieving it. Several factors can lead to the achievement of competitive advantage and a prominent management theorist Michael Porter, has recommended the following widely accepted five forces model:

- Rivalry among existing competitors
- Threat of new market entrants
- Threat of substitute products and services
- Bargaining power of buyers
- Bargaining power of suppliers

For a company to be competitive it must be fast, economical, innovative, flexible, productive, and last but not the least customer oriented. The company should align its information system strategies with the general business objectives and strategies. Along with the five market forces, which was just discussed above, Porter, proposed the following three general strategies for the achieving a competitive advantage:

1. Altering industry structure
2. Creating new products and services
3. Improving existing product lines and services

However, the advantage a firm gain with a new information system that an organization enjoys is short lived, because competitors are fast in copying a good idea.

Productivity is roughly calculated by the measure of the output attained divided by the input needed. An information system can be utilized to observe and assess productivity over time to check if productivity has been increasing or not. If it has not been, increasing corrective measures can be taken to increase productivity. The measure of an Information System value that examines any additional profits that has been generated as a percentage of the investment in IS technology is called the Return on investment (ROI). One more measure of the IS value is the growth in profit, it brings. Market share is the proportion of sales that the organizations products/services have in terms of the total market. Market share can be utilized as a measure of IS value. Companies can also measure the accomplishments of their information systems based on customer satisfaction and awareness.

- When the outcome of any event is unknown, it is termed as a Risk. Organizations must be incredibly careful when designing systems or products as the outcome is unknown hence it poses a huge risk to the company. Poor planning or designing by the company can lead to high risk for the organization, which in turn will lead to huge losses. The field of information systems is wide and has numerous potential paths. The three main duties of an IS department are as follows:
- Operations (productivity of IS systems)
- Systems development (maintenance and review)
- Support (help desk and customer support)

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.

Topic 03: Hardware & Software

Lesson Learning Outcomes

At the end of this chapter, the students will:

- Describe the various components of the computer system
- Identify the type of computer system that a business uses
- Explain the purpose of software applications in different categories

To enhance their productivity, boost revenues, and cut costs organizations invest in a variety of hardware. They need to make wise choices while investing in hardware. Using obsolete equipment can lead the organization facing reduced productivity, which leads to losses.

The computer systems include the different input device, processing, output devices and storage devices. The Central Processing Unit (CPU) is considered as the brain of the computer. It comprises of three associated components.

- Arithmetic Logic Unit- The function of this unit is to perform mathematical calculations and logical comparisons.
- Control Unit- This unit monitors the devices and instructions. It functions as traffic controller providing instructions to various devices in the system and it coordinates with the various input device, the output devices, the memory and the processor.
- Registers: They are transitory high-speed storage spaces, which are used to store instructions, transitional results or calculations.

Fetch Execute Cycle of the CPU

The fetch execute cycle is the basic operation cycle of a computer. During the fetch, execute cycle the computer retrieves a program instruction from its memory. It then establishes and carries out the action that are needed for the instruction. The CPU continuously repeats the cycle of fetching, decoding and executing when the computer is on.

The components responsible for processing which are the CPU and memory are stored together in the same box, which is called the system unit. All other devices, like the monitor and keyboard, are connected either directly or indirectly to the system unit housing. Memory is found physically close to the CPU to reduce the access time. The CPU communicates with the memory for data and program instructions. The main feature of memory is to provide data and instructions rapidly to the CPU. The small unit of data is known as bit. A bit (b) can be either "0" or "1". A set of eight bits is called as a byte (B). Likewise, a set of 1024 bytes is called as Kilo Byte (KB), a set of 1024-Kilo bytes is a Mega Byte (MB), and a set of 1024 Megabytes is a Giga Byte (GB) and so on.

Primary Memory

Primary memory is a computer memory that is accessed directly by the CPU. Features of the primary memory are as follows:

- It is accessed directly by the processor
- It is the fastest memory that is available
- Each word is stored
- It is volatile i.e. its contents are lost when the power is turned off.

As primary memory is expensive, technologies have developed to optimize its use. Examples of primary memory are RAM, which may be of two types DRAM, and SRAM, ROM can be of these types PROM, EPROM.

Cache Memory

It is a small piece of high-speed volatile memory available to the processor for fast processing which is called the cache memory. The cache memory may be a reserved portion of the main memory, another chip on the CPU or an independent high-speed storage device. The process of keeping some data and instructions in cache memory for faster access is called caching. When a processor needs any piece of data or instruction it first checks the cache then it will check the main and secondary memories. Finding data or instruction on the cache is called a cache hit.

Secondary Storage

Secondary storage is alternatively referred to as external memory and auxiliary storage. A secondary storage device is non-volatile devise that holds data until it is deleted or overwritten. They are cheaper than primary memory. Example for secondary memory are:

- Hard drives
- USB thumb drives
- SD card
- CD
- DVD
- Floppy disks

Network- attached Storage (NAS)

It is a dedicated file storage that enables several users and heterogeneous client devices to retrieve data from a centralized disk capacity. Users on a local area network access the shared storage through the standard Ethernet connections. NAS devices are configured and managed with a browser-based utility. Each NAS resides on a LAN as an independent network node defined by its own unique IP address. The common features of NAS are it is easy to access, high capacity storage at low cost, it provides the infrastructure to consolidate storage in one place and to support tasks like archiving, back up and cloud tier. NAS and Storage Area Network (SANs) are the two-primary kind of networked storage. Unstructured data like audio, video, Microsoft Office documents and websites are managed by NAS. SANs are designed to for block storage inside database, which is called as structured data. NAS allows users to collaborate and share data more efficiently. NAS can connect to wireless routers, which makes it easy for work environments to access data from any location. NAS can be designed for large

organizations or small business and even for homes. Devises generally have at least two drive bays, single bay system are available for non-critical data. Enterprise NAS gear is mainly designed with high-end data features to enable storage and it come with at least four drive bays. Examples for NAS are Apple Corp., Dell EMC, IBM Spectrum, Huawei etc.

Input Devices

Input devises are peripheral equipment used to provide data and control signals to an information processing system. It enables input of raw data to the computer for processing. Input devices are important because they allow people to communicate with the computer and add new information. Examples are as follows:

- Keyboard
- Mouse
- Scanner
- Joy Stick
- Microphone
- Graphic Tablet
- Bar code reader
- Webcam
- Touch screen

Output Devices

Output devices are any piece of equipment which in involved in converting information into human understandable form. It usually receives data from a computer for display, projection and physical reproduction like printouts. They can be classified into visual, data and sound devices. An output devise functions by receiving a signal from the computer and utilizing that signal to perform a task to display the output. A computer can work without an output devises however, there would be no way to determine what the computer is doing; hence, we need output devises to see the results. Examples of output devises are as follows:

- Keyboard
- Monitor
- Speakers
- Printers
- Plotters
- Projectors
- Headphones

Multiprocessing and Parallel Processing

Multiprocessing involves the use of two or more central processing units (CPU) inside the same computer system. The main objective for using multiprocessor is to increase the system's execution speed. The two types of multiprocessors are shared memory multiprocessor and distributed memory processor. These types of systems are used when very high speed is required to process large amount of data. For example, they are used in satellite control, weather forecasting etc. This system is based on the symmetric multiprocessing model, in which each processor runs an identical copy of the OS and these copies communicate with each other. A processor is given a specific task. A master processor

controls the system. These systems can save money when compared to single processor systems because they can share peripherals power supplies etc.

Parallel processing involves running two or more processors to manage separate parts of the overall task. Dividing the task between multiple processors helps reduce the amount of time taken to run a program. Any system that has more than one CPU can perform parallel processing. This is commonly used to perform complex tasks and computations. The two commonly used parallel processor are SIMD and MIMD. In a typical parallel processing scenario a complex task will be divided into many parts with a software tool and each part will be assigned to a processor, then each processor will solve its part, and the data will be reassembled by a software tool to finally execute the task. For example, data scientists will commonly make use of parallel processing for computer and data-intensive work.

Software

Software is a set of programs that controls hardware functions. A lot of money and time is spent by organizations on software compared to hardware. Different hardware cannot function without a suitable software. Software aids companies to enhance their productivity and efficiency. Simultaneously, it can cut costs and automatize the different business processes. An instruction is a command to the system. A set of instruction, which are interrelated and are implemented sequentially is called a program. A software is nothing, but a collection of programs created to perform a specific task. A person who writes programs using different programming language is known as a programmer. There are many kinds of programming languages, which are used for multiple purposes. Every programming language contains a syntax, which is the grammar, and semantics, which is the meaning. There are two different types of software: systems software and application software. Systems software are a group of programs created to manage the activities and functions of the hardware and the many programs in the computer system. Examples are, OS, utility programs etc. Application software are programs that support people to solve specific computing problems. Both types of software can be used to meet the needs of an individual, a group, or an organization. Examples are Microsoft Office, Flash etc. Systems software regulates the function of the computer hardware. It also supports the application programs as well. Without systems software, there is no use for application programs. The various types of systems software are OS, middleware and utility programs.

Operating System

An Operating system functions as an interface between the user and the computer and it controls the hardware. An OS ties all the parts of OS together and control other programs. It plays the vital role in the operation of the entire computer system. There are many combinations of Operating Systems, which are as follows: 1. A single computer with a single user is meant to be used by only one person to do one job at a time. Examples- Android or Windows. 2. A single computer with many users: this is a big mainframe computer that can manage hundreds or even thousands of users who are all using the system simultaneously. Example- z/OS, UNIX 3. Multiple computers with many users are a group of computers like in office networks, which allows people to use any of the computers. Examples- Red Hat Linux, Windows Server, 4. Special function computers are used for specialized applications like space shuttles and military aircraft etc.

There are many functions of an operating system, such as:

- Handling the hardware and software of the system like the processor, memory etc.
- The OS gives a constant way for applications to communicate with hardware without the need for physical aspects of the hardware.
- The OS manages system assets such as memory and distribution of CPU time.
- OS make sure that every application gets the necessary resources it needs to increase the functioning of the system.
- The OS also manages the organization of folders and files.
- The file management system enables the user to do many tasks like creating files, creating folders, deleting files and folders, renaming etc.
- OS does many hardware functions as well like accepting input, producing output, retrieving data from storage devices, saving data.

There are two main types of interfaces in OS that are: command line and graphical user interface. Command line interface is for the command and graphical user interface is to do with menus, icons etc. An interface that permits applications to utilize the operating system is called as the Application program interface (API). Operating system regulates how memory is accessed, boosting the usage of existing resources and storage. Memory management done by the OS lets the computer to increase the speed at which instructions are processed. It is always vital to upgrade to new OS.

An Operating system can manage many tasks simultaneously. It can run multiple programs simultaneously. OS allows time-sharing due to which multiple people can use the computer simultaneously. One of the key functions that OS can provide is scalability. Networking capability of the OS allows computers to link together for the purpose of sending and receiving data. It is very simple to set up a network connection for the purpose of sharing resources and data. OS must give high levels of security to protect from illegal access to data. Generally, the OS provides a login process, which requires users to enter their valid username and a password for accessing data. File Management: OS handles all the files that are stored in the secondary storage and when some files are required, the OS can give access to the authorized users. A robust file management is needed to keep track where the files are stored, their size and other attributes. Which will help in easy location of files. There are many kinds of operating systems available in the market, like Windows, Mac, and Linux. Each of these operating systems have their own inherent strengths and weaknesses. Windows is the most popular OS followed by Apple OS. Linux is an open source OS and is considered as highly secure when compared to other operating systems. Google has expanded itself from search engine to multiple application areas like maps, browser, drive, mobile operating system and now into PC operating system, which is the Chrome OS. As there are various OS's, it is up to the user to choose which one is more appropriate for their needs.

Users are generally highly demanding hence technology should be able to support users in terms of data storage capacity, data processing speed. To enable it, they must have powerful and highly sophisticated OS for workgroups. Windows server: Can carry out tasks that are important for the websites and the web applications. This server is capable of blocking unauthorized access, provide improved administrative support and sophisticated security features. UNIX is a very sophisticated and powerful OS that can be used on multiple systems

and platforms. Red Hat Linux: It is open source and is based on Linux OS. This OS is very effective at serving web pages and can handle groups of up to eight servers. Mac OS X server: is the latest server from Apple and is based on Unix OS. It allows easy controlling of web services, network management, document sharing etc. and it supports a 64-bit processing. Enterprise OS: Mainframe computers give handling and storage capacity to meet vast data processing, security and scalability. Z/OS: IBM's first 64-bit enterprise OS it provides several new facilities to make it easier and cost effective for users to run huge mainframe computers. HP-UX and Linux: It is a Unix based OS created to manage various types of business-like online transactions and web applications. Red Hat Linux can also be utilized like an enterprise level OS.

Utility Programs

Utility programs take care of maintenance rectifying problems. Examples of utility programs such as compressing data, keeping tracks of tasks being run etc., Utility programs keeps track of the condition of all parts of the PC which includes hard disk, memory, printers etc., It also verifies if there are any troubles in the hard disk boot sector, file allocation tables etc. Virus and spyware can damage the data hence an antivirus program can be installed in the computer to check for unwanted program and eliminate them. File compression programs enables the reduction in the amount of disk space needed to store files. All OS allow compressing and decompressing the folders and files. Spam filtering tools can be installed in the computer to filter unwanted spam mails. Some of the spam emails can be hazardous for the computer system. There are a variety of software available in the market to supervise the hardware and network performance. They scan for problems in the network and trigger an alert when there is a problem. Extra utilities are available to boost the performance of servers and mainframes. Other utility programs are available in the market, which allow to easily transfer programs and data from one computer to another computer. There are highly specialized utility programs for visually impaired people. Key logging software permits managers to monitor employees.

Middleware

This software supports interoperability. The main benefit of middleware is to allow two different systems to exchange and communicate data. The key to unlocking the ability of any computer system is called application software. A company can either develop a unique program for a specific application or purchase and use an existing software program. Some companies opt to combine both the approaches and customize an off-the-shelf software.

Software Bug

A software bug is a flaw in the computer program that stops it from performing in the way it is intended perform. Some software bugs are noticeable and can cause the program to terminate without warning. Other software bugs are more subtle and allow errors to sneak into our work without our knowledge. Copyright and licensing: The law protects many software products and they use copyright licensing. These provisions can take several forms. In some instances, people are given unlimited access to the software on one or two computers. In other cases, it can depend on how much people pay to access the software.

Not all companies are profit driven hence many products are free for use. Freeware software is free for public. The main purpose to do this is to gain recognition or to donate to the society. Few example, AVG anti-virus, Adobe reader etc. Open source software is free. These type of

software permits to view the source code, modify and improve it. Many open source software is available in the open market. Software need to be updated regularly and software companies improve their programs and sell new programs regularly. One main problem that global companies face is that some software vendors do not provide adequate support in all locations. Supporting local operations is one of the greatest problems all IS teams face when setting standardized, company-wide systems.

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th Ed.). McGraw-Hill Higher Education.

Topic 04: Databases and Networks

Lesson Learning Outcomes

At the end of this chapter, the students will:

- Describe the use of database application software
- Explain the concept of a data warehouse
- Identify the benefits of the introduction of computer networks
- Describe the network components and terminology of networks

Data are just raw facts, which do not provide a clear meaning to the user. Data before processing is very hard to comprehend. A Database is a systematic compilation of data, which makes it easy for people to comprehend. Every value has a field name and a domain that allows us to comprehend them more effortlessly. A Database Management system is a software that facilitates designing, managing and maintaining a database. DBMS functions as an interface between the application program and the database. There are many popular DBMS products are Oracle, MS SQL server etc. An individual who manages the databases from is called as a database administrator. This person is responsible for all activities, which include designing to managing the database. It has become a popular practice for organizations to collect customer data. As the storage, costs are getting more cost-effective organizations are eager to store large amount of customer data. Once all the data has been collected organizations need organise it meaningfully otherwise all the information becomes less meaningful and more ambiguous.

Data is normally arranged in a hierarchy, which starts with a bit and continues through the hierarchy to a database. The order of data hierarchy is as follows:

- Bits
- Characters
- Fields
- Records
- Files
- Databases

A bit signifies a circuit that is either on or off. Bits can be arranged into units called bytes, and they are typically composed of 8 bits. Each byte signifies a character. A field is usually a name, number, or a combination of characters that defines a trait of a business object or a business activity. A record is a compilation of associated data fields. A file is a compilation of related records. A database is a compilation of integrated and related files.

An entity can be explained as a universal class of people, places, or objects for which data is collected, stored, and maintained. Examples for entities are student, employee, or customer etc. An attribute is a feature of an entity. For example, student number, last name, first name, mobile number, etc. The specific value of an attribute can be found in the fields of the record depicting an entity. Primary Key: There must be at least one attribute in the database table, which is considered as UNIQUE and NOT NULL. If an attribute is selected as a primary key, then its value must not be duplicated and simultaneously it should not be empty.

The traditional approach to data management is, maintaining separate files for each application. Data duplication is very common in this situation, which leads to businesses facing a range of data management problems. In a database approach, numerous application

programs share a group of related data, and each application utilizes a set of data that is either merged or related on the database. This approach gives many advantages, like reduced data dependency, updates and modification are easy, lowered redundancy, consistency of data access, and more economical program development. The different disadvantages are the expense involved in database management system, the requirement of a specialized computer system, and increased weakness. Use of the database approach has forced computer specialists to give specific care to content and access, the logical structure, and the physical organization of data. This results a well-designed and well-managed database, which is extremely valuable for business decision making.

A data model is a diagram of things and their relationships. It is one of the tools, which database designers utilize to demonstrate the logical relationships between data. Data modelling which is done at the level of the whole business is called as enterprise data modelling. An example of a data model is the entity-relationship (ER) diagram. To show the organization of and relationships between data an entity-relationship diagrams use basic graphical symbols. Normally, boxes are used in ER diagrams to show data items contained in data tables, and diamonds signify relationships between the data items and the entities. Relational models have become the most prevalent database types, and the describe data using the standard tabular format.

There are many kinds of database management systems, varying from small, economical software packages to highly sophisticated systems costing a lot. A flat file is an easy database program that has no relationship between its records. A flat file is often used to store and control a single table. Spreadsheet and word processing programs run on flat file capabilities. Databases for PCs are single-user DBMSs. Only one person can use these programs at a time. The popular examples for single-user DBMSs are Access and Quicken. Multiuser DBMSs allow many people to access the same database system simultaneously. These database systems are both powerful and costly. Oracle, Sybase, and IBM are popular vendors for multiuser database systems.

The latest generation of database management systems allows end users to build their own database applications. End users are using these tools to solve everyday problems, like how to manage information about employees, customers, inventory, sales etc. These database management systems are a vital tool along with word processing, spreadsheet, and graphics software. Microsoft's Access and Corel's Paradox are some of the more popular DBMSs for end users. IBM, Oracle, and Microsoft are popular options among the DBMSs used by professional programmers. PostgreSQL and MySQL are open-source database systems, which are available. A person who is responsible in designing, implementing, and maintaining the database system and the DBMS is called as a database administrator (DBA).

Database management systems can be used in combination along with other software packages or the Internet. A database management system can either function as a front-end application even a back-end application. A front-end application is the one that directly interacts with users. A back-end indirectly interacts with the users by interacting with the applications or programs. Data warehouse (DW): is an integrated group of data from several sources. DW saves historical data. Building a DW is a complex process for organizations because it involves a lot of time, money and involves quality issues. A DW is for an entire organization and to integrate all the departments is a complicated task. Data Mart is more for a specific department or function hence organizations can use it to integrate its different departments. Data mart is a subset of the data warehouse. Data mining is an analysis tool that is used to discover hidden patterns in huge databases.

The process of converting data into intelligence is called Business Intelligence (BI). BI is involved in giving the right information to the right people at the right time and in the right

format. BI helps organizations to take calculated decisions about which markets to target, how to manage customers etc.

Data loss prevention implies to the process organizations use to lock down data. This is to stop unauthorized users from trying to enter the system and steal data. Data loss prevention is very powerful tool, which is used in safeguarding the privacy of customer data. Data sources can be either internal or external. Internal data are the organization's systems such as human resources, finance etc., External data are from outside the organization like competitor's information etc. Both, internal and external data sources are required in designing a data warehouse.

When the data is accessible in the data warehouse, organizations tend to perform analysis. There is a wide range of analytical tools available for organizations such as Online Analytical processing, data mining etc. Insights about data can be gained through analysis hence it is important. It helps them find any hidden patterns of knowledge within the data stores. Once data is analysed it should to be presented in a format, which will be easy for decision makers to access to make quick decisions. Dashboard is a visual presentation of important information of an organization. Decision makers can have a glance at the dashboard make decisions instantly.

A logically interconnected compilation of shared data physically distributed over a computer network is called as a Distributed Database. Distributed DBMS is a Software system that allows the management to use distributed database and makes the process clear to the users. A single logical database is divided into several fragments, which are saved on one, or more linked computers. A copy of the frequently used data is called as a replicated database. Many industries are finding it essential to store huge amount data in the form of visual and audio signals in an orderly manner. For example, music companies should be able to store and manipulate sound from recording studios.

Networks

Telecommunication refers to the process of electronically transmitting signals for the purpose of communication by means of telephone, radio or television. The channel for communication between the sender and receiver is referred to as telecommunication. An important feature of telecommunications is the speed at which information is transmitted, that can be measured in bits per second (bps). Presently, the speeds are measured in Mega bits per second (Mbps) and Giga bits per second (Gbps). Protocols or rules are extremely important in networking. Protocol are set of rules used during communications. Communication between sender and receiver can be either synchronous or asynchronous. Examples for synchronous communication is voice and phone communication. Example for asynchronous is the e-mail. Simplex channel: Data transmission is only unidirectional. E.g. radio Half-duplex channel: Data transmission is bidirectional. E.g. Walkie-Talkie Full- duplex channel: Data transmission in both directions, which happens simultaneously. E.g. telephone.

Telecommunication media can be assessed on the expense incurred capacity and speed. An organization needs consider the various factors before they can choose the media type. The two different ways for communication are: Wired and Wireless. As the name suggests, wired means using cables and wireless mean without cables. There are various types of wired transmission, which are, Twisted pair in which two pairs of cables are used and it can be shielded or unshielded this type is very commonly used for telephone service. Disadvantage of these cables is the speed and distance of transmission. Coaxial cables use copper conductors to transfer signals; copper conductor is insulated hence less static interference; hence, it can provide faster data conduction than twisted pair however, they are expensive. Fiber optic cable is made up of thin fibers made from glass or plastic and it is insulated with

many layers. It uses light as the medium of transmission. It is much thinner when compared to other cables and it gives higher rates of data transmission. However, they are very expensive to obtain and install. Wireless transmission like the radio frequency range runs at low frequency, support mobile users, however, there will be more static interference in the signals. Microwave: They are considered to have high frequency range and are capable of high-speed transmission, but they should have a clear line between the sender and receiver. Infrared: Signal that are like microwave frequencies they are simple to install but must have clear line between sender and receiver.

Near field communication (NFC):

A set of short-range wireless communication protocols is used for communicating between two electronic devices, which are at a distance of 4cms, or less. It is used by smartphones, payment cards tablet etc. With NFC we can transfer information between devices quickly and with ease just by a single touch. NFC transmits data through electromagnetic radio fields to allow two devices to communicate with each other. To communication to take place both the devices should have NFC chips. Because the device that is receiving the data read it instantly, it greatly reduces the chance of errors.

Bluetooth-It is a high-speed low powered wireless technology link that has been designed to connect phones or other portable devices together. The Bluetooth devices are managed using the RF topology known as star topology. The range of Bluetooth communication is 10-30 feet. Ultra-wideband (UWB) is a radio technology that use very low energy level for short-range, high-bandwidth communications, it is used in non-cooperative radar imaging. Infrared transmission: It frequently used in remote controls, fire sensors etc., Infrared transmission allows handheld devices to send data to large computers within a vicinity and this type of transmission needs a clear line of sight for signals to be transmitted. Wi-Fi: It is a medium range wireless communication technology. When it is turned on, it scans for wireless networks within its range and connects to them. Wireless networks are very easy to set up and are economical.

3G is the third generation of wireless technologies. It comes with enhancements such as high-speed transmission, advanced multimedia access and global roaming. It is mostly used in mobile phones to connect to the internet or other IP networks to make voice or video calls, to download or upload data and to surf different websites. Communications enable wireless voice and broadband speed data communications. 4G is the fourth generation of mobile phone technology; it builds on what 3G offers but does everything at a much faster speed. The benefits of 4G are improved speeds, reduced latency and crystal-clear voice calls.

Bridges

A bridge is a network device that connects multiple LANs together to form a larger LAN. The process of aggregating networks is called network bridging. A bridge connects the different components so that they look like parts of a single network. They operate at the data link layer and hence are referred to as layer 2 switches. Some of the uses of bridges are, they connect two or more LANs with similar protocols this enables communication between them. They help in multiplying the network by joining many LANs together, they transmit data as a data frames, they protect the network from crashing, they are easy to install, they can switch any kind of packets, they can also connect virtual LANs and a wireless bridge is used to connect wireless networks.

Switches

They are networking devices operating at the layer 2. They connect devices in a network and use packet switching to send, receive or forward data frames over the internet. A switch has many parts to which computers are plugged in. When a data frame is received at the port, a switch scans the destination address, does the necessary checks, and transmits the frame to the right device. It supports unicast, multicast as well as broadcast forms of communications.

Routers

A router is an electronic device that is used to connect two or more computers. It can connect other electronic devices to one another. It usually connects to the Internet as well, through wires or through radio signals. This feature enables many computers to communicate with each other and simultaneously.

The Internet

The Internet is a worldwide system of computer networks. It is termed as the mother of all networks. A person can gain access to the Internet only if they have permission to access it because a username and password are required. Intranet is a private network, which is restricted to only the employees of a company. It needs a username and a password to access it. Extranet is also a private network generally used by suppliers, partners etc. It gives restricted access to resources. It needs a username and password to access it. The Internet plays a vital role for companies and people. It aids companies to market their products, interact with their clients etc. It is very common for organizations to rely very much on the internet for their everyday activities. Many companies have websites that give more information about themselves.

Web

The Web is one of the most valuable applications provided by Internet. It was developed by Tim Berners-Lee. Individuals use the web for their own personal activities like checking emails, playing games, paying bills, buying things online, chatting etc. Organizations use the web to market their products and services to customers. The Web is an ideal platform for people to communicate with each other, for the purpose of entertainment and for business activities.

Web documents are arranged using hyperlinks. To look at web pages a person needs a browser; there are many browsers in the open market and the most popular browsers are Google Chrome (GC) and Apple Safari (AS) followed by Internet Explorer (IE), Fire Fox (FF). Every web page is referred to as a web document and a set of these pages under a single domain is called as a Website. A specific language is needed to create a website. One of the prior languages to design the static web pages is the HTML. However, now organizations have many options to choose such as Dreamweaver, PHP, Dot Net etc. To ensure uniformity in web page design, the Cascading Style Sheets (CSS) are used. The new web or Web 2.0 enables a two-way communication, letting users to get and contribute information. Web 2.0 can be called as user-generated content.

There are many activities that can be done with Web, which are as follows:

- News
It is a latest trend and is called social journalism /citizen journalism. Common citizens are more involved in reporting the news nowadays. The online group is taking journalism into its hands and reporting different news from their own perspective using the different online tools.
- Education and Training
The web has contributed to education and training; in fact, it has revolutionized education. Advances in interactive Web technologies have further supported important educational relationships between teacher and student and how training is delivered.
- Business and Job Information
Promoting their company by offering news and information about a business and its products through the company's Web site and different online social media has assisted companies to gain more exposure, which can aid in boosting profits.
- Search engines
Search engines are Web sites within a site that allows users to locate information by matching keywords that the user provides to a list of documents containing those words or the closest matches.
- Wikis
Is an online encyclopaedia that allow a user add and edit information on a Web page.
- Video conferencing- Internet video conferencing is now available to anyone with a broadband Internet connection and a Web camera.
- Portal
Is a website that is more frequently visited. Vertical portal: Examples, ESPN.com, Blackvoices.com etc. Corporate portal: refers to organization's private portal.
- E-mail
This is the most extensively used application on the Internet, which allows users to send text messages and file attachments to another internet user.
- Instant messaging
This is a software program that allows people to type text which is displayed on a recipient's computer/phone almost immediately, making real-time communication between two people or groups of people feasible on the web.
- Blogs
Blogs are private Web pages that are designed by an individual/corporation to communicate their views and ideas with other readers across the globe.
- Podcasts
These are audio clips stored as an audio file and posted to the Web, so that people can be downloaded onto a computer or an iPod.
- E-Books and Audio Books
Apple's iPad revolutionized the eBook business by providing a form factor that is like but bigger than the Kindle. The iPad also has a colour backlit display.
- Online Games and Entertainment

Video games have become a huge industry. This generates many revenues.

There are many variants of e-tailers. Virtual merchants: no physical existence they operate entirely online. E.g. www.amazon.com Bricks and clicks: Work both online and offline. E.g. www.gap.com Catalogue merchants: provide a wide range of products. E.g. www.ikea.com Manufacturer-direct: removing middlemen and buying directly from the manufacturer. E.g. www.dell.com, Consumer to consumer (C2C). Ebay.com is a good example of C2C. Organizations are using internet to reach out to customers globally. It is quite evident with the rise in numbers of website domains that we presently have. Insurance services, travel services, job placement services are some of the prevalent domains.

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.

Topic 5: Acquiring and Developing BIS

Lesson Learning Outcomes

At the end of this chapter, the students will:

- Describe how organisation develop and acquire information systems and technologies to achieve goals.
- Describe the THREE main methods for acquiring information systems necessary to support a particular business need.
- Describe the Basic Systems Development Lifecycle (SDLC).

Application software can be developed in two ways and this is usually referred to as the make-or-buy decision. A packaged software is an application software that is bought and is ready to use, this kind of software is also referred to as a commercial off-the-shelf (COTS) software.

A custom-developed software is to develop the software from the scratch and is 100% built according to the customer requirements. This kind of software can be outsourced to an external software company or it can be developed in-house.

Purchasing or leasing externally developed software has a number of advantages, which are as follows:

- It is cost effective
- It involves less risk regarding the features and performance of the software
- Easy to install

Developing software internally also has some advantages, which are as follows:

- It meets the unique business requirements, which a commercially available software package cannot provide.
- Installing a new software package usually requires changes in how a company function. Hence, it is better to develop the software in-house as it reduces the changes in the business procedures and policies.
- It provides a competitive advantage.
- It meets the constraints of existing systems. A company can develop its own software to make sure that the new system will interface seamlessly with the old system.

Companies choose in-house development for the following reasons:

- The development can be controlled by the owner or the company.
- The company has the ownership of the intellectual asset hence, confidentiality will be maintained and making changes is easy.

- It ensures customer trust and satisfaction because they will feel that the information will be safe because only trusted employees work on the project, which in turn ensure that the details of the software are a secret.

Companies may choose to outsource it to a vendor for custom development for the following reasons:

- The vendor may be an expert in that type of software
- The vendor may have a lot of experience therefore; he can develop the software in a short period of time.

System Development

Systems development is the process of converting organizational problems or opportunities into information technology enabled solutions.

The entire objective of systems development is to accomplish business goals by delivering the correct information to the correct person, in the right format and at the right time. The effect a particular system has on an organization's ability to meet its goals governs its true value.

The systems development process is also referred to as systems development life cycle (SDLC) because the events linked with it are an ongoing process. The life of the system continues because of maintenance and review.

The traditional systems development life cycle is as follows:

- Systems investigation
- Systems analysis
- Systems design
- Systems implementation
- Systems maintenance and review

If the system needs important changes beyond the regular maintenance, if it needs to be replaced due to new technology, or if the IS requirements of the company changes considerably all this leads to a new project to be initiated and the cycle will start all over again.

1. Students are sometimes confused when reading different books or taking different courses, which cover the SDLC and its phases.
2. A common question is 'Isn't the SDLC supposed to have 5 phases?' or something like that.
3. A basic way to understand these variations is that you can have a cake and decide to cut it into 4 slides, or 6 slides, or 8 slides. However, the contents of the cake remain the same. Perhaps we wish to have smaller slides so that we can share the cake with more people.
4. In the SDLC, the writer or professional may have his or her own reasons for having more or less phases. Knowing the exact details is not so important at this stage. What is important is that students feel comfortable knowing that the basic tasks and deliverables in the basic SDLC remain very similar or the same

1. Note that the term 'systems implementation' can cover more or less tasks and activities (depending on how it is explained).
2. Systems implementation (Option A) = Programming + Implementation (Option B) = Programming + Testing + Implementation (Option C).
3. Does this mean that Systems implementation (Option A) does not include programming? The answer is 'No'. The programming and testing are part of the implementation phase in Option A, but are shown separately in Option C.

Part of understanding the SDLC and subsequent subjects in the Diploma and Degree programs is to understand decomposition of the project into phases and into tasks.

Here is an example of a phase and some of its constituent tasks. Please note and learn the numbering. What is shown below is not complete.

User Requirements Definition (part of Analysis) Tasks

- Identify stakeholders
- Conduct data gathering
- Compile user requirements document. Sub-tasks for Task
- Review the Finance Department business process document
- Interview the Finance Manager
- Interview the Treasury Manager
- Interview the Accounts Supervisor What are the deliverables?

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.

Topic 06: Project Initiation

Lesson Learning Outcomes

At the end of this chapter, the students will:

- Explain how to create a simple information to solve a problem.
- List the reasons why an IS project is initiated.
- Describe the various parts of feasibility study.

Systems investigation is the first step in the traditional SDLC of a new or modified business information system.

The purpose of a systems investigation is to recognize potential problems and opportunities and examine them in light of the aims of the company. Usually, systems investigation tries to find answers to the following questions:

- What are the main problems will a new or enhanced system solve?
 - What business opportunities will a new or enhanced system provide?
1. Systems request form: submitted by someone who wants IS department to initiate systems investigation
 - ✓ Problems in or opportunities for system
 - ✓ Objectives of systems investigation
 - ✓ Overview of proposed system
 - ✓ Expected costs and benefits of proposed system
 2. Performance objectives
 - ✓ Output quality or usefulness
 - ✓ Output accuracy
 - ✓ Output format quality or usefulness
 - ✓ Speed at which output is produced
 - ✓ Scalability of resulting system
 - ✓ Risk of the system
 3. Cost objectives
 - ✓ Development costs
 - ✓ Costs of uniqueness of system application
 - ✓ Fixed investments in hardware and related equipment
 - ✓ Ongoing operating costs

Goal:

Goals can often be expressed in just a few words that describe a general aim. They are seldom directly measurable. They usually include a desirable quality.

Examples:

Increased customer satisfaction, improved cash flow.

Objective:

Each goal can have one or more associated objectives. Unlike Goals, Objectives are measurable and provide a direct indication that progress is being made towards the goal.

There are more than one way to explain the words represented by the acronym SMART. Please compare what is in the slide with what is stated below. If there is a difference, it is deliberate.

SMART stands for:

1. Specific
Be very clear, in what you want to achieve.
2. Measurable
The progress must be measurable and so there is a clear way to know that you have met your goal.
3. Achievable
This target must be something that you think can be done.
4. Relevant
The objective is relevant to the business goal; or the goal is relevant to the business strategy.
5. Time-bound
There is a clear deadline

The example of goal and objectives are meant to be examples and not a perfect 'model' answer and students are invited to explore how to improve the goal and objectives further.

The goal and objectives are based on an imaginary situation where a city core has bad traffic congestion and part of that business problem is seen as due to parking problems.

In this example, there is only one business goal, which is then linked, to more specific and multiple objectives.

Members of development team change from phase to phase

1. Systems investigation team
Upper- and middle-level managers, a project manager, IS personnel, users, and stakeholders
2. The objective of a feasibility study
Determine if an information system project can be done,
3. Key results of a feasibility study
 - Can the project be done?
 - What are the risks?
 - How can the risks be managed?
 - What are the alternatives?

Five aspects of Feasibility Study

1. Technical
To determine whether the company has the capability to do this project
2. Economic
To determine the benefits and savings that are expected from a candidate system
3. Legal
To determine whether the proposed system conflicts with legal requirements
4. Operational
To determine how well a proposed system solves the problems
5. Schedule
To determine how reasonable the project timetable is

TELOS – Feasibility Study Details

- **Technical Feasibility**
The purpose is to determine whether the company has the capability to do this project. The assessment is based on an outline design of system requirements in terms of Input, Processes, Output, Fields, Programs, and Procedures. Technological feasibility is carried out to determine whether the company has the capability, in terms of software, hardware, personnel and expertise, to handle the completion of the project.
- **Economic Feasibility**
The purpose is to determine the benefits and savings that are expected from a candidate system. Economic feasibility amounts to judging whether possible benefits of the project are worthwhile. As soon as a specific solution has been identified, the analyst can weigh the costs and benefits of each alternative.
- **Legal Feasibility**
The purpose is to determine whether the proposed system conflicts with legal requirements. Determines whether the proposed system conflicts with legal requirements, e.g. a data processing system must comply with the local privacy laws.
- **Operational Feasibility**
The purpose is to determine how well a proposed system solves the problems. This measures how well your company will be able to solve problems and take advantage of opportunities that are presented during the course of the project.
- **Schedule Feasibility**
The purpose is to estimate how long the system will take to develop, and if it can be completed in a given time period using some methods like payback period. Schedule feasibility is a measure of how reasonable the project timetable is.

The Systems Investigation Report

- Summarizes results of systems investigation
- Summarizes the process of feasibility analysis
- Recommends a course of action
- Continue on into systems analysis
- Modify the project in some manner
- Drop the project
- Reviewed by steering committee

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.

Topic 07: Systems Analysis

Lesson Learning Outcomes

- Describe Requirement Specification.
- Describe the various methods of collecting data.

Requirements Determination

The requirements determination stage is executed for the purpose of expanding the system request's high-level statement of business necessities into an accurate list. This comprehensive list of all the necessities will be used for other activities as an input in the analysis phase. It can be used for making use cases, creating process models, and it can be used for creating data models.

What is a Requirement?

In simple terms, a requirement is a statement, which explains how the system must perform or what features it should have. In the analysis stage, the necessities are stated based on the business person's viewpoint and it also focuses on what the system will do. They are called as business requirements/user requirements because it focuses on the user requirements. In the design stage, these user requirements will further develop into more technical forms and it explains how the implementation of the system will take place. During the design stage, the requirements are stated from the viewpoint of a developer and it is called as the system requirements. The terms system requirements and business requirements are not fixed terms and hence they can be used interchangeably. It is vital to keep in mind that a requirement statement provides us with information regarding what a system must do and these requirements will transform as the project shifts from analysis stage to the design stage and finally to the implementation stage. Requirements statements changes from a comprehensive statement of what a system must have (business capabilities) to a more comprehensive statement of all the technical methods in which these abilities will be executed in the new system. The nature of requirements can be either functional or non-functional.

A functional requirement contains the procedure the system has to execute or the information it has to have. Example for a process directed functional requirements that a system should have is the capability to search for available record. The functional requirements move into the next stage, which is the analysis phase, because they specify the characteristics that the system has to contain.

A non-functional requirement denotes the behavioural features the system should have, like usability and performance. For example, accessing the system through a web browser can be considered as a non-functional requirement. Non-functional requirements can indirectly influence the rest of the analysis process. In the design stage, non-functional requirements are used to make decisions regarding the hardware and software requirements, deciding on the user interface and the system's basic architecture.

Functional Requirements given below lists different kinds functional requirements such as the process-oriented and information-oriented and examples for each type.

Functional Requirement	Description	Examples
Process-oriented	A process the system must perform; a process the system must do	<ul style="list-style-type: none"> ■ The system must allow registered customers to review their own order history for the past three years. ■ The system must check incoming customer orders for inventory availability. ■ The system should allow students to view a course schedule while registering for classes.
Information-oriented	Information the system must contain	<ul style="list-style-type: none"> ■ The system must retain customer order history for three years. ■ The system must include real-time inventory levels at all warehouses. ■ The system must include budgeted and actual sales and expense amounts for current year and three previous years.

Non-Functional Requirements given below lists the different kinds of non-functional requirements. The non-functional requirements explain the different features pertaining to the system such as operational, performance security and political and cultural requirements. However, these features do not explain the business processes or information but they are very vital in understanding how the final system must be like. For example, the team working on the project need to know whether the system needs to be extremely secure or does it have to cater to a customer base, which is multilingual. The requirements will affect decisions taken during the design stage specifically those related to the design of the architecture. The main aim during this phase is to recognise any major problems.

Nonfunctional Requirement	Description	Examples
Operational	The physical and technical environments in which the system will operate	<ul style="list-style-type: none"> ■ The system can run on handheld devices. ■ The system should be able to integrate with the existing inventory system. ■ The system should be able to work on any Web browser.
Performance	The speed, capacity, and reliability of the system	<ul style="list-style-type: none"> ■ Any interaction between the user and the system should not exceed 2 seconds. ■ The system downloads new status parameters within 5 minutes of a change. ■ The system should be available for use 24 hours per day, 365 days per year. ■ The system supports 300 simultaneous users from 9–11 A.M.; 150 simultaneous users at all other times.
Security	Who has authorized access to the system under what circumstances	<ul style="list-style-type: none"> ■ Only direct managers can see personnel records of staff. ■ Customers can see their order history only during business hours. ■ The system includes all available safeguards from viruses, worms, Trojan horses, etc.
Cultural and Political	Cultural and political factors and legal requirements that affect the system	<ul style="list-style-type: none"> ■ The system should be able to distinguish between U.S. currency and currency from other nations. ■ Company policy is to buy computers only from Dell. ■ Country managers are permitted to authorize custom user interfaces within their units. ■ Personal information is protected in compliance with the Data Protection Act.

Source: The Atlantic Systems Guild, <http://www.systemsguild.com>

Requirements Definition

The requirements definition is a simple list of all the functional and non-functional requirements in an outline format. For example, in the table given below depicts the entire requirements sample for a recreational vehicle dealership. If you notice all the requirements are numbered

in an outline format to ensure that all the requirements are easily and clearly identifiable. First, all the requirements are classified into functional and non-functional requirements after which each of the headings are further classified by the type of requirement or by its function.

Functional Requirements

1. New Vehicle Management

- 1.1 The system will allow managers to view the current new vehicle inventory.
- 1.2 The system will allow the new vehicle manager to place orders for new vehicles.
- 1.3 The system will record the addition of new vehicles to inventory when they are received from the manufacturers.

2. Vehicle Sales Management

- 2.1 The system will enable salespersons to create a customer offer.
- 2.2 The system will allow salespeople to know whether an offer is pending on a specific vehicle.
- 2.3 The system will enable managers to record approval of a customer offer.
- 2.4 The system will prepare a sales contract.
- 2.5 The system will prepare a shop work order based on customer requested dealer options.
- 2.6 The system will record a customer deposit.
- 2.7 The system will record a customer payment.
- 2.8 The system will create a record of the customer's vehicle purchase.

3. Used Vehicle Management

- 3.1 The system will record information on a customer trade-in vehicle ... etc.

Nonfunctional Requirements

1. Operational

- 1.1 The system should run on tablet PCs to be used by salespeople.
- 1.2 The system should interface with the shop management system.
- 1.3 The system should connect to printers wirelessly.

2. Performance

- 2.1 The system should support a sales staff of 15 salespeople.
- 2.2 The system should be updated with pending offers on vehicles every 15 minutes.

3. Security

- 3.1 No salesperson can access any other salesperson's customer contacts.
- 3.2 Only the owner and sales manager may approve customer offers.
- 3.3 Use of each tablet PC should be restricted to the salesperson to whom it is assigned.

4. Cultural and Political

- 4.1 Company policy says that all computer equipment is purchased from Dell.
- 4.2 Customer personal information is protected in compliance with the Data Protection Act.
- 4.3 The system will conform to the state's "lemon law."

Occasionally, based on the requirements definition the business requirements are prioritised. They can be ranked as having "high," "medium," or "low" importance in the new system, they can either be ranked as high, medium or low or they can be categorised based on the version of the system, which will address the requirement for example, release 1, release 2, or release 3. This process is vital in the RAD method because it releases requirements in batches by creating step-by-step versions of the system.

The main purpose of the requirements definition is to give the needed information, which is required by other deliverables in the analysis stage, which involves use cases, process models, data models, and it supports the different activities taking place in the design stage. Defining the scope of the system is the most vital purpose of the requirements definition. The

document explains in detail to the analysts as to how the final system has to function. It also specifies the user expectations. If at all there are some inconsistencies or some misunderstandings crop up, the document will help in clarifying the problem.

Determining Requirements

To determine the requirements for the requirements definition both the business and information technology viewpoints are required. Systems analysts may sometimes fail to comprehend the actual needs of the clients. A study conducted by the Standish Group found that when the user does not involve in the process it becomes the main reason for the information technology project to fail. On the other hand, the business users can be unaware of the various benefits that the new technology can provide and may simply use the current, ineffective processes.

Let us consider an example of building a house or an apartment. If we are asked to design a house or an apartment, it would be a big challenge because do don't have the required technical skill requires to complete the task, however an architect is skilled to design a house or an apartment but an architect working on the project without any input from the end user can lead to unique requirements of the user being missed. Hence to overcome this hurdle it is best that the end user and the architect work together to determine the requirements.

Occasionally, it so happens that the users do not know what their requirements are. Hence, it is very vital that the analyst makes sure that the user requirements is focused and is not just a blown-up list of the different wishes of the users. A number of tools are available so that the analyst can help the users in understanding their actual needs. The tools that can be used by the analyst can be classified into three depending on the degree of change, which is expected from the new system. The three categories are Business process automation (BPA) which comprises of a small amount of changes; business process improvement (BPI) comprises of a moderate amount of changes, and business process reengineering (BPR) comprises of a significant amount of changes. The analyst can choose the technique, which will fit the project.

Creating the Requirements Definition

Making the requirements definition is considered to be an ongoing process through which the analyst collects the required information by using certain techniques such as interviews, document analysis etc. The analyst examines all the information that has been collected to recognize the correct business requirements for the system, and includes it into the requirements definition report. The requirements definition is always updated so that the project team and business users can refer to it to get an understanding of the new system. To make a requirement definition the team members involved in the project first list out the different functional and non-functional requirements for the new system, which become the main portion of the document. Next, the analyst uses various

These become the main sections of the document. Next, the analysts use various techniques like interviews and observation to collect the required information. Finally, the analysts along with the team and the end users verify, change, and complete the list so that the requirements a can recognised and can be prioritised.

The process involved in analysis has three steps:

- Understand the present situation (the as-is system).
- Recognize the required improvements.
- List the requirements needed for the new system (the to-be system).

The three requirements analysis techniques, which are the business process automation, the business process improvement, and the business process reengineering aids the analysts to help the users through the analysis, process so that the requirements of the system can be created.

Requirements Gathering Techniques

An analyst is like a detective he /she understands that a problem exists hence he/she must look for solutions. However, looking for solutions can be very tricky. The analyst uses many techniques to look for solutions. A good analyst always will collect requirements by using various methods to ensure that the existing business processes and the needs for the new system are properly understood. It is considered a good practice to fully understand all the requirements so that errors can be avoided because errors, which are found later on in the SDLC, can create many problems.

Reasons behind the Difficulty in Conducting Fact-finding Exercise

1. When the end users are unable to list out the exact requirements.
2. When the users fail to comprehend or are completely unaware of the benefits that can be got with the help of the new information system.
3. When the many users interpret the software requirements differently.
4. Existing biases among the users based on attitudes, the environment and the personality can hinder in listing out the actual business requirements.
5. Sometimes the requirements can overlap organizational limits.
6. Information requirements can be complex and can vary hence making it difficult to create a requirement list that can be examined.
7. Communication gaps and miscommunication that can exist between the different users makes it difficult to define the requirements.

Requirements Gathering in Practice

Interview: Structured interviews are used for gathering information regarding the existing system and the expectations of the users from the new system. The success of this method depends on careful planning, conducting the interview in the right way and recording vital information appropriately.

Questionnaire: A questionnaire is a list of set questions, which are used to elicit response from the end users to collect information regarding the user requirements or the existing system. They usually have open-ended questions and closed ended questions. However, they

are open to misinterpretation if they are not correctly designed. Questionnaires are very useful when used along with other methods to corroborate the various information received through different methods. It can also provide areas to investigate further.

Document Review: This method involves examining the existing systems documents, guides, requirements specifications etc. This method will help gathering information, which has been missed out during interviews of questionnaires.

Observation: The method is very useful in recognising inefficiencies in the existing method of working. It involves observing various aspects of the operations. It is a time-consuming process. If the person who is conducting the observation is not properly trained then there are chances of vital information being missed out.

Brainstorming: In this method, interaction within a group is initiated to generate new and creative ideas to find solutions for the existing problem. It is an unstructured method. If the users participate actively in this method then an accurate view of the existing business process can be achieved. However, if the person conducting the session is not trained appropriately it can lead to chaos because of poor planning and control and structure.

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.

Topic 08: Systems Design

Lesson Learning Outcomes

- Describe the difference between analysis and design stage
- List what defines a good-quality information system
- Describe the system architecture for a workflow processing system
- Explain why Client/Server model is popular

What are the various factors that are considered vital for the end-users to be satisfied with the new system and the factors that will enable a satisfactory return the business has invested in? The vital factors are listed below:

- The new system should be user friendly
- The new system should provide the appropriate functions for the end-users
- The new system should function at a rapid speed, retrieving the requested data and shifting between many screen views
- The new system should be reliable
- The new system should be secure
- The new system should function in an integrated manner with the other systems

Use Case

The requirements definition describes what the new system has to do. Let us further understand how these requirements are further fine tuned into a set of use cases that give more information regarding the different processes the system should fulfil and the data the new system has to capture and store. Usually, one or multiple system requirements are explained by each use case. When the use case is, ready the steps that follow will be to combine the requirements definition and the use cases to develop a more comprehensive explanation of all the processes and the data in the form of a process model and data model for the new system.

A formal way of signifying how the new system interacts with the environment is called as a use case. The use case describes the various activities that the user can perform on the new system. A use case modelling is an external or a functional view of the business process. It will illustrate how the users will view the process rather than the internal methods on which the process and supporting mechanisms function.

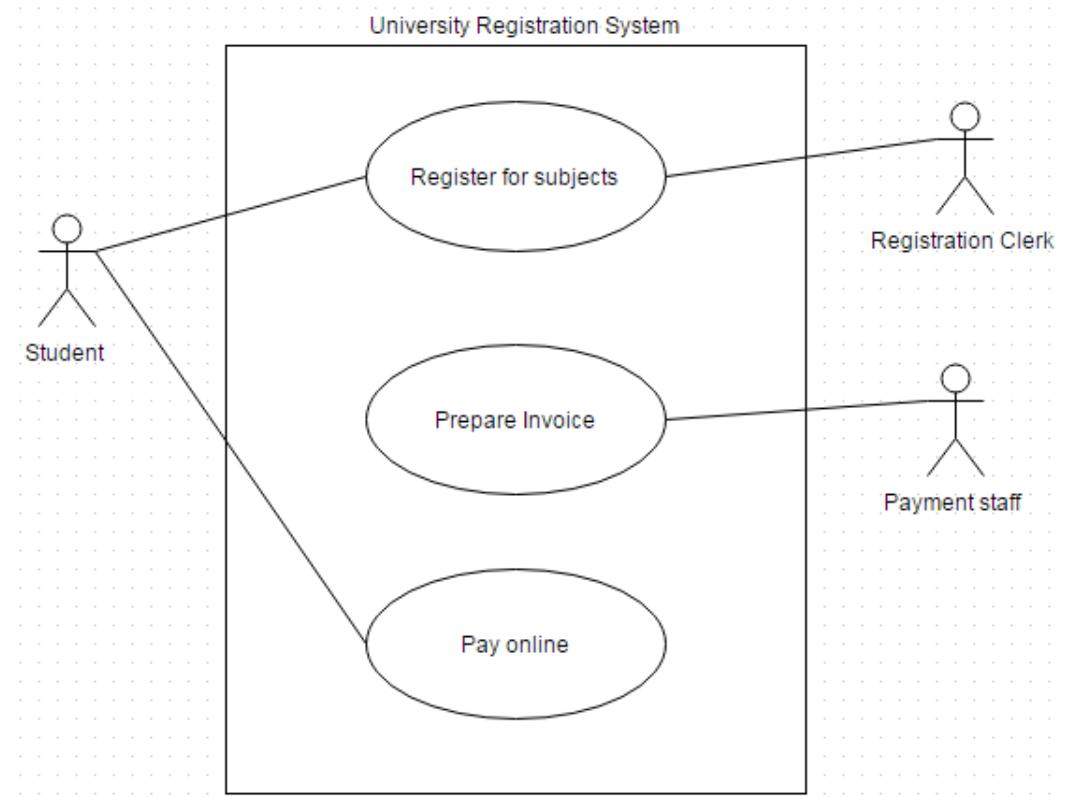
Elements of a Use Case

A use case comprises of a fairly comprehensive explanation of all the functions that take place as a response to a trigger event. The use case comprises of many bits of information, this information is arranged in three main parts, which are as follows:

- Basic information
- Input and output
- Details

Basic Information

Each use case will have a number and a name. The use case name has to be simple and descriptive. The number is just a sequential number that is used to refer to each use case for example, use case. The explanation of the use case provides a bit more details regarding the purpose of the use case.



Inputs and Outputs

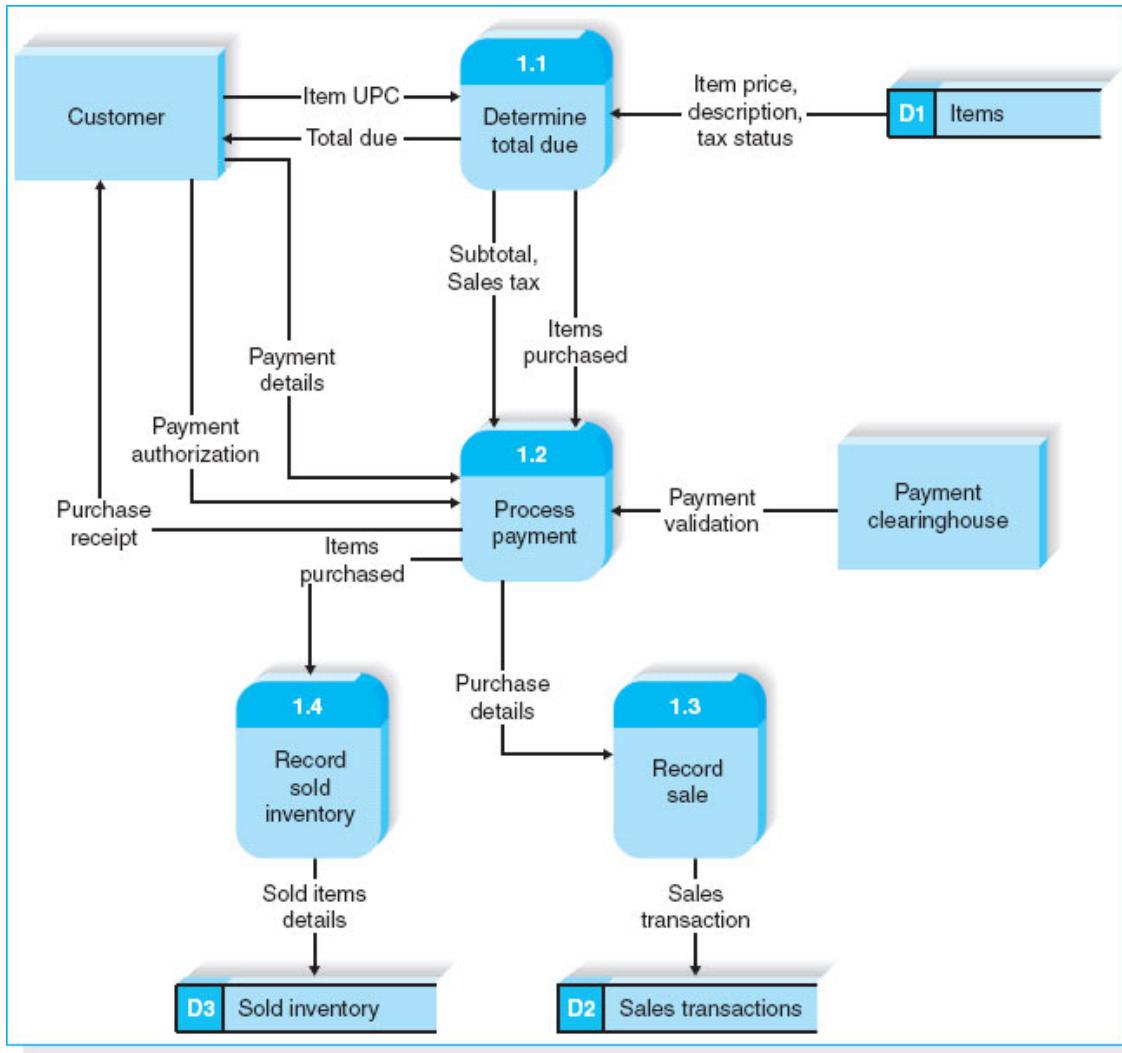
The inputs and the outputs are the second main part of a use case. Each input and output to the use case will contain a description combined with their source and destination. These comprise of all the possible inputs and outs and not just those that are usually a part of the use case. The aim here is to see that each one is included; however, it is very common to miss out few inputs and outputs when the users and analysts define them initially. However, this is not a very serious problem because the building of the use case process involves making changes and refining it gradually- as the analysts and the users work their way through the various parts of the use case, they can go back to the previous parts to make any corrections if required.

Process Modeling

A process model illustrates the business processes, which include all the activities that the users will do. Process models can be developed either for an already existing system or for an entirely new system. One of the most common process modelling method is the data flow diagramming (DFD).

Reading Data Flow Diagrams

DFD for the process of buying goods at the supermarket. An analyst can easily understand the process by which a business functions by studying the data flow diagramming. The example of the diagram given below shows the DFD process involved in purchasing products from a supermarket.

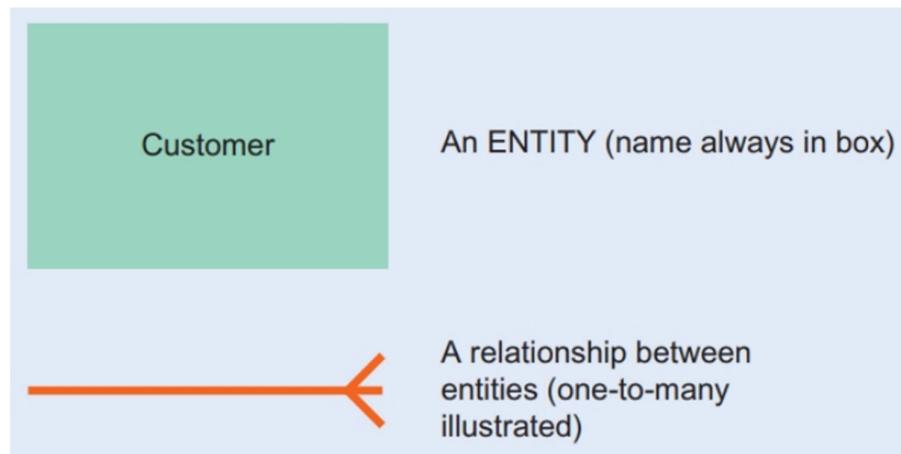


Data Modeling

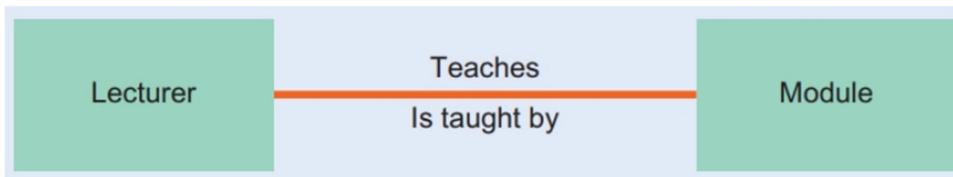
A data model illustrates as to how the data flows through the different business processes within an organization. During the analysis stage, the data model represents the logical arrangement of data, however it does not indicate as to how the data is stored, created or manipulated. This is done so that all the technical information does not distract the analyst and remain focused on the business. It is only during the design phase; will the data model be transformed so that it can exactly demonstrate how the data will be stored in the databases.

Entity Relationship Diagram (ERD)

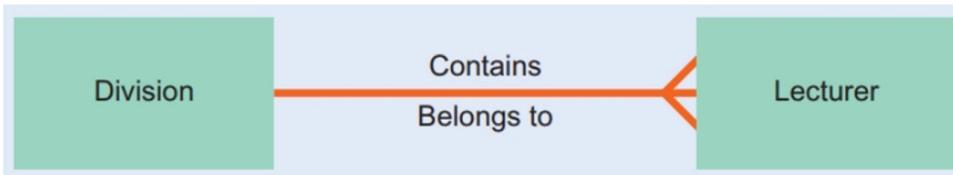
An entity relationship diagram (ERD) is a diagram, which illustrates the relationship of the entity sets that has been stored in a database. It demonstrates the information that is created, stored, and used by a business system. An analyst can examine the ERD to understand how the various individual bits of information have been arranged and how they relate to each other in a system. In an ERD, all the information, which are similar, are listed together and kept in boxes called entities. To represent the relationships among the data lines are drawn between them. Special symbols are added to the diagram to illustrate the high-level business rules that has to be supported by the system. The ERD does not indicate any order; however, the various entities that are similar and that are related will be placed close together.



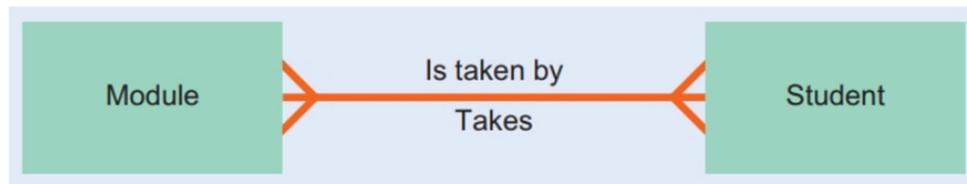
One-to-one relationship



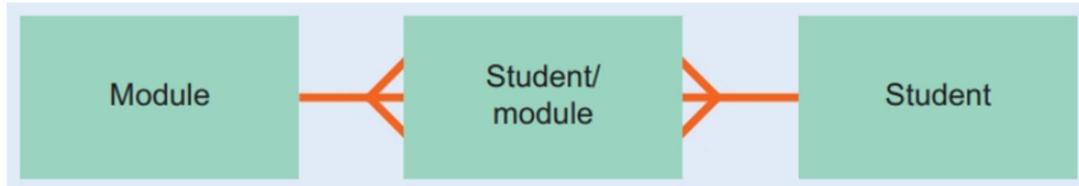
One-to-many relationship



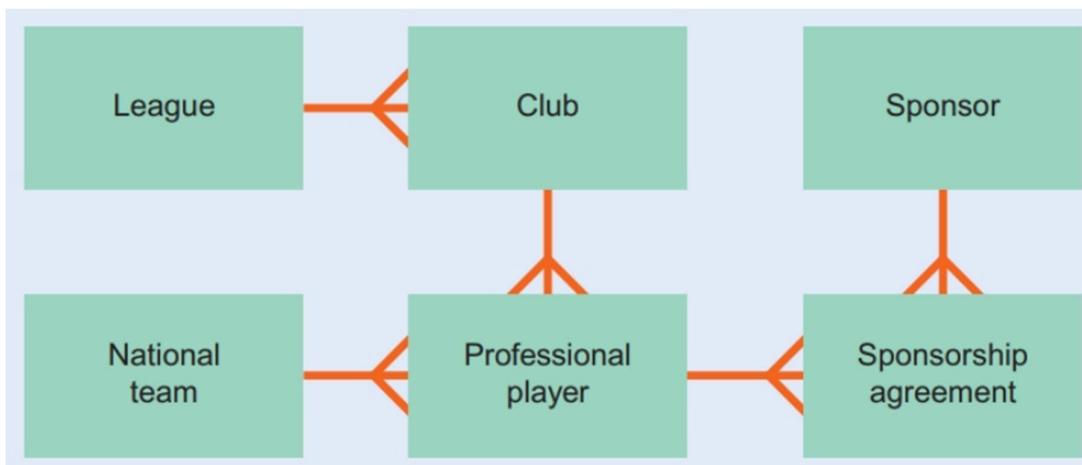
Many-to-many relationship



Many-to-many relationship decomposed into two one-to-many relationship



Entity Relationship Diagram



Client/Server Architecture

When a designer has to design an information system for a client or a server architecture, he/she has to determine as to how the tasks have to be divided between the client and the server.

The four tasks when designing an IS are as follows:

- Data storage
- Query processing
- Display
- Application logic including the business rules

Structured English

Structured English is a method used for creating the different design requirements for programmers. This specifies how the various individual modules or groups of modules have to be implemented. This technique is more precise and specific when compared to flowcharts. This method uses key words to explain the structure of the program. 'Pseudocode' and 'program design language' are the two other terms which are used for Structured English.

This example moves through each record of a database table totalling all employees' salaries. (Note that this could be accomplished more quickly using an SQL statement.)

```
DO WHILE NOT end of table
  IF hoursrworked> basicrhours
    SET pay = (hours*basicrrate) + (overtimehours*overtimerrate)
  ELSE
    SET pay = (hours*basicrrate)
  END if
  SET totalrpay = totalrpay + pay
  move to next record
ENDDO
```

Data Security

Data security is one of the most vital design issues, more precisely when the new information system being built comprises of a lot of sensitive and confidential information about the company, which can be, accessed using the WAN or the Internet.

The four key features of security that has to be achieved through design are as follows:

1. Authentication
2. Authorization
3. Privacy
4. Data Integrity

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.

Topic 09: Systems Testing and Implementation

Lesson Learning Outcomes

At the end of this chapter, the students will:

- Describe what systems development is.
- State the purpose of the build phase and its difference from changeover to implementation.
- Identify the appropriate testing method required for a system.

In terms of time and cost, developing a system's software is considered as the main part of any systems development project. This component is the best comprehended and faces less problems when compared to all the other aspects of the SDLC. The systems analyst will not do the actual programming hence these notes will only look at managing the programming process.

There are various tools meant for systems development that are available to programmers and business users that aid in writing software.

The different software development tools are as follows:

- Microsoft Visual Studio
- Visual Basic
- Visual C++

The software programmers change program requirements into working program codes.

The system analysts will create various tests that will be executed on the new system.

When the software programmes are done then the system analyst can conduct various tests on the new system to check whether the system is performing for what it has been designed for.

Testing is considered as the main component of the implementation stage. Some companies hire specialized testers to perform testing.

In the stage of implementation, it is the responsibility of the analyst to prepare the final system documentation and create a user document.

Assigning Programming Tasks

During the process of project planning the project manager first, recognises the number of people that are required and the level of skill that is needed for building the new system. Next, the project manager has to allocate the different program modules to his chosen team members who will be involved in building the new system. The project manager should ensure that each programming module has to be unique and distinct from the other modules. All the related modules are grouped together and then allocated by the project manager to all the team members depending on their skill levels and experience. Team members who are highly experienced will be allocated complex modules and on the other hand, members with less experience will be allocated tasks that are less complex. Occasionally there can be a disparity between the programming skills of the team members and the skills required to successfully

complete the task. In such situations, the project manager should take measures to bridge the gap by ensuring the team members receive the required additional training or arrange for mentoring sessions by highly experienced programmers. If in case, the skill, which is required, is not available readily then the project manager has to identify and allocate extra time within the project schedule.

To speed up the programming processes it is quite a tempting idea to hire more team members but ironically in system development more the number of team members the longer it takes for the project to be completed. The reason for this being big teams require a lot of coordination, which leads to time wastage. The ideal team is a small team for system development. However, if the project is hand is very complex and it needs a large team then it is good to break the project into many parts so that each group can focus on their assigned part and function as independently as possible.

Testing

Programming is always considered as a fun and creative task. Less experience programmers usually are carried away in developing and testing of the programs by themselves and often do not tend to focus on testing and documenting the work. This is the case because documentation is a very tedious processes and not an exciting task hence these tasks receive very less attention than programming.

Let us look at an analogy; programming and testing are comparable to writing and editing. An amateur writer like a university student will usually stop after completing his/her first draft. However, the hallmark of good writing is rereading, editing, and revising the first draft. In the same way, a comprehensive and robust testing process is the hallmark of an experienced software developer. Many organizations spend considerable amount of time and money on testing and retesting the new system than on writing programs.

Test Planning

The process of testing begins with the testing group developing a 'test plan', which explains all the tests, which will be executed. A test plan is a document with roughly twenty to thirty pages, with separate pages dedicated for each individual test, which will be conducted. Each individual test will have a specific aim, a set of specific test cases that need to be examined, and it describes the results that are expected and finally it will have the actual results received. The purpose of the test is taken either from the program specification or from the program source code. For example, if a program requirement specified that the order quantity should be between 10 and 100 cases then the tester will develop a set of test cases to make sure that the quantity is authenticated before the system accepts it.

Stages in Testing

1. Unit Testing

Unit testing involves focusing on only one unit, an individual program or an individual program module, which execute specific tasks, which can be tested. The main aim of this type is to make sure that the unit, program or the module performs according to the specifications of the program. This testing is done after the programmer has developed and tested the code for errors and finds it error free. This test is entirely based on the specification of the program and this will help to find errors that have happened due to the programmers misunderstanding of the requirements. This testing is usually done by the analyst or occasional by the programmer who developed it.

The two methods of unit testing are as follows:

- **Black box testing-** The person who is doing the testing focuses mainly on finding out whether the program is functioning according to the requirements.
- **White-box testing-** Used for highly complex situations when the tester wants to check the actual program code.

2. Integration Testing

This testing involves assessing whether groups of modules or programs that are supposed to function together are they functioning as expected and to check if they have any errors. This testing checks if the interface and the links between various parts are functioning appropriately. Integration testing focuses on data exchanges taking place and on the flow of control between the modules. The test is usually done by an analyst or a programmer and it follows the same process involved in unit testing.

The four methods of integration testing are as follows:

- User interface testing
- Use scenario testing
- Data flow testing
- System interface testing

3. System Testing

A systems analyst to check whether all the modules and programs are working together as expected without any errors conducts this test. This testing is quite similar to integration testing however; it has a much larger scope. System testing checks whether the new system meets all the requirements of the business. It also checks the systems security, usability and performance. System's documentation is also tested.

4. Acceptance Testing

The end users usually conduct acceptance tests with assistance from the team members involved in the project. The aim of the acceptance test is to confirm whether the new system meets the user requirements and functions properly without any glitches. Acceptance testing takes place in two phases which are: alpha testing, this involves testing the system using made-up data, and beta testing, involves the user using the system with real data and as the testing progresses monitoring the systems for error.

PRINCIPLES OF INFORMATION SYSTEMS & DATA MANAGEMENT



Stage	Types of Tests	Test Plan Source	When to Use	Notes
Unit Testing	Black-box testing: treats program as black box.	Program specifications	For normal unit testing	The tester focuses on whether the unit meets the requirements stated in the program specifications.
	White-box testing: looks inside the program to test its major elements.	Program source code	When complexity is high	By looking inside the unit to review the code itself, the tester may discover errors or assumptions not immediately obvious to someone treating the unit as a black box.
Integration Testing	User interface testing: The tester tests each interface function.	Interface design	For normal integration testing	Testing is done by moving through each and every menu item in the interface either in a top-down or bottom-up manner.
	Use scenario testing: The tester tests each use scenario.	Use scenario	When the user interface is important	Testing is done by moving through each use scenario to ensure that it works correctly. Use scenario testing is usually combined with user interface testing because it does not test all interfaces.
	Data flow testing: Tests each process in a step-by-step fashion.	Physical DFDs	When the system performs data processing	The entire system begins as a set of stubs. Each unit is added in turn, and the results of the unit are compared with the correct result from the test data; when a unit passes, the next unit is added and the test is rerun.
System Testing	System interface testing: tests the exchange of data with other systems.	Physical DFDs	When the system exchanges data	Because data transfers between systems are often automated and not monitored directly by the users, it is critical to design tests to ensure that they are being done correctly.
	Requirements testing: tests whether original business requirements are met.	System design, unit tests, and integration tests	For normal system testing	This test ensures that changes made as a result of integration testing did not create new errors. Testers often pretend to be uninformed users and perform improper actions to ensure that the system is immune to invalid actions (e.g., adding blank records).
	Usability testing: tests how convenient the system is to use.	Interface design and use scenarios	When user interface is important	This test is often done by analysts with experience in how users think and in good interface design. This test sometimes uses the formal usability testing procedures discussed in Chapter 9.
Acceptance Testing	Security testing: tests disaster recovery and unauthorized access.	Infrastructure design	When the system is important	Security testing is a complex task, usually done by an infrastructure analyst assigned to the project. In extreme cases, a professional firm may be hired.
	Performance testing: examines the ability to perform under high loads.	System proposal and infrastructure design	When the system is important	High volumes of transactions are generated and given to the system. This test is often done by the use of special-purpose testing software.
	Documentation testing: tests the accuracy of the documentation.	Help system, procedures, tutorials	For normal system testing	Analysts spot-check or check every item on every page in all documentation to ensure that the documentation items and examples work properly.
Acceptance Testing	Alpha testing: conducted by users to ensure that they accept the system.	System tests	For normal acceptance testing	Alpha tests often repeat previous tests, but are conducted by users themselves to ensure that they accept the system.
	Beta testing: uses real data, not test data.	No plan	When the system is important	Users closely monitor the system for errors or useful improvements.

DFD = data flow diagram.

System Build and Implementation

The steps that are involved in system build and implementation are as follows:

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications
- Quality Assurance Documents

System Maintenance

The process of upgrading and improving the system to ensure the system continues to meet the requirements of the organization is called as system maintenance. A considerable amount of money is invested by organizations to system maintenance because a system continues to evolve as it is continuously being used. Most of the time novice system analysts and programmers start working in system maintenance until they have gained considerable experience that will allow them to develop new projects by themselves.

Making the Transition to the New System

Using a computer system in many ways is very much like driving on a mud road. As time progresses, the mud road starts developing potholes in the most used parts of the road. Even though these potholes show where it is safe to drive to avoid the potholes, changing them is difficult. In the same way as people start using the computer system or different work processes those system and processes become habits and people become comfortable with it. These habits, which people have become comfortable with, start to limit people's activities, which leads to resisting change because they see their jobs in terms of these processes rather than in terms of the final goal of serving the customers.

The Migration Plan

The various business, technical and people problems have to be addressed to ensure that the old business processes and computer programs transition smoothly and successfully to the new business processes and computer programs. The migration plan contains the plans and procedures that will govern and guide the smooth transition. The plan also describes who will perform which activities, and when the transition will be made from the old system to the new.

Method	Main advantages	Main disadvantages
Immediate cutover	Rapid, lowest cost	High risk if serious errors in system
Parallel running	Lower risk than immediate cutover	Slower and higher-cost than immediate cutover
Phased implementation	Good compromise between immediate cutover and parallel running	Difficult to achieve technically due to interdependencies between modules
Pilot system	Essential for multinational or national rollouts	Has to be used in combination with the other methods

Preparing a Business Contingency Plan

It is extremely tempting to believe that by performing careful and comprehensive work in the analysis and design phase and by managing the project appropriately will lead to a smooth and successful implementation of the new system. It is not uncommon for the project team members to be optimistic about their success. However, it is best to expect the worst from a new system. Business contingency planning involves the process of limiting minor glitches in technology turning into full fledge disaster. Contingency planning aids organisations to endure small problems in the new system without facing major disruptions in the organisation.

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.

Topic 10: IS Security

Lesson Learning Outcomes

At the end of this chapter, the students will:

- Describe the categories of threats faced by organizational information systems.
- Describe the major approaches that can be adopted to ensure the integrity of an information system.
- Describe the major categories of controls that can be applied to information systems.
- Describe the type of threats related to Internet Services.

Information is considered as a very vital and valuable business asset and this concept has always been emphasized. The task of make sure that the organizational information stays secure is a very important task and should not be taken lightly.

The two fundamental principles on which the controls of information systems are based on are as follows:

1. To ensure that the data that the organization holds is accurate.
2. To ensure that the data is protected from damage or loss.

Personal Data in the Information Age

When Kim Kardashian was in Paris, she tweeted her location by accident, which led to her being robbed at gunpoint.

How did the robbers find out her location just form a tweet?

The robbers were able to find her location because each time a person sends a tweet it is by default geo tagged. This means that all our phones it can be either an iPhone or an Android automatically embeds into our tweets our geographical location. We might think that this is a very harmless but it can sometimes be very dangerous because our tweets can be tracked always, which means we can be exposing ourselves to various threats.

In the information age, it is not only the individual people who are being targeted but also organizational data is under serious threat constantly. An example for organizational data breech is, the Singapore's Ministry of Defence was breached in the year 2017 and sensitive data such as NRIC, date of birth, mobile numbers of eight hundred and fifty servicemen were stolen.

A few famous cases of data breaches in the last decade include:

- The WikiLeaks diplomatic cables leak, which released 251,000 diplomatic cables sent from the US Foreign Services to other countries from 1973 to 2010.
- In 2014 the Sony Hack led to a data breach and all the personal details and emails of the employees were leaked.
- The Mossack Foneseca leak, also known as the Panama Papers, was a leak from an insider working in the law firm. It released the details of tax havens.

Consequences of Data Breaches

- Customers trust will be lost
- Vital data will be lost
- Data breaches leads to identity theft which inadvertently leads to identity frauds
- It causes a lot of financial losses
- When an organization's data is breached and there is data loss, this leads to the organization losing its credibility with their customers because they will be hesitant to trust them anymore. Due to this loss of credibility the organizations have to spend a lot to rebuild their reputation. This means the organization has to spend valuable time on this rather than on developing the organization.
- Usually in an organization, the low or mid-level workers are the weak links who are the end users of the digital infrastructure.

Threats

A threat is defined as a potential risk of an asset's loss of value (Mattord and Whitman, 2016).

- Common types of threats:
 - a. Natural threats
 - b. Threats from others
 - c. Threats from yourself

Natural threats

- Data can be completely destroyed or damaged due to natural threats like accidents and natural disasters. For example, earthquakes and fire accidents.
- Natural threats can destroy and wipe out large amounts of data.
- Floods and fires can destroy many important personal data and damage memory cards, which leads to huge loss to the owner of the data.

Threats from yourself

- Threats can arise from our own carelessness by not being alert and not taking security precautions.
- Hackers can easily get information from people by using social engineering method. In this method, people are manipulated using social skills to give out their important information. For example, in the 'white hat' video the hacker asks for help from the information technology helpdesk by asking them to click on a link, when the link is clicked it will allow the hacker to gain access into the organization's network, which lead to data theft.

- Leaving our belongings unattended makes it easy for people to rob information.

Threats from others

- Some people can create elaborate plans to con other unsuspecting individuals.
- Hackers are capable of placing very innocent looking advertisements, which contain malicious hyperlinks to lure people into clicking them. When the unsuspecting individual clicks on the link, viruses, malware and Trojans will be introduced into the computer, which can crash the system.
- Hence, it is very vital for users to be updated regarding these techniques and people have to take precautions to keep themselves safe from attacks.
- People should be careful regarding what they throw into the trashcan, because the contents can be searched and important data can be used for the purpose of theft. This is known as dumpster diving.
- When people are unaware, people with bad intentions can look over the computer screen/ mobile screens and steal information. This is called as shoulder surfing.

Elements of Data Security

- Being free from damage or harm is defined as security.
- Security, from the technological viewpoint, comprises of securing all vital data and the entire infrastructure, which house the vital data from unauthorised access and misuse.
- The main aim of security in technology involves protecting all the laptops, computers, computer networks, other devices linked to the network and the data stored on the network.
- Security is a very important issue for anyone who chooses to accesses the internet and it should not be taken lightly.
- Maintaining data confidentiality is very important and this can be achieved by allowing only authorised people from accessing the data.
- Maintaining data integrity is very important; this means the data should be accurate and complete.
- Maintaining data authenticity is very important; this means the data should not be tampered with in any way.
- Data has to be always available to authorized users.

Data Security Attacks

Data security is extremely important for organizations and business, which rely on technology for their day-to-day functioning and various transactions.

Data breaches can result in the following issues:

- Monetary loss
- Loss of customer trust
- Loss of important data
- Computer resources can be misused
- Identity theft which leads to identity fraud

Implementing Data Security

- The most effective method to limit data breaches is by implementing robust security practices for devices.
- Steps to secure devices are as follows:
 1. By taking appropriate precautionary measures to secure the devices.
 2. By ensuring regular maintenance of the infrastructure
 3. By taking appropriate measure when the data has been breached

Precautionary measures are as follows:

1. Installation and maintenance of antivirus
2. Installation and maintenance of a firewall
3. User accounts can be secured by ensuring the passwords are strong
4. Ensuring that any downloading that happens should be from a trusted source.
5. Devices should be scanned regularly for viruses.
6. Regularly updating the devices

System maintenance measures are as follows:

1. Vital data should always have backup copies
2. Making sure that the applications have enough free space and memory so that they can function smoothly.
3. Making sure that the CPU and other parts of the computer do not overheat up.
4. The application memory caches have to be cleared regularly.

Reacting to a data breach are as follows:

1. Anticipating and having a plan ready as a counter measure
2. The computers power supply should be turned off
3. Ensuring that the computer has been immediately disconnected from the network
4. By ensuring the reinstallation of the system applications

Access control is the selective method by which systems specify who may use a particular resource and how they may use it (Mattord & Whitman, 2016).

Occasionally one computer can be used by many people, which increases the security risks. In such instances security can be ensured by access control, in this method the administrators can allow users to have the following kinds for access control to reduce the possibility of a data breach:

- Control over the system can be unrestricted
- Control over the system can be limited
- Control over the system can be minimal

Reference

- Stair, R., & Reynolds, G. (2016). Principles of information systems. Cengage Learning.
- Marakas, G., & O'Brien, J. (2012). Introduction to information systems - Loose leaf (16th ed.). McGraw-Hill Higher Education.

Principles of Information Systems and Data Management

Liew You Jie

CT0357623

Department of Information Technology, Kaplan

FTDip2106_IT71

Dr. Satish.kumar

Assignment Due Date 10 Dec 2021

Introduction to the organization

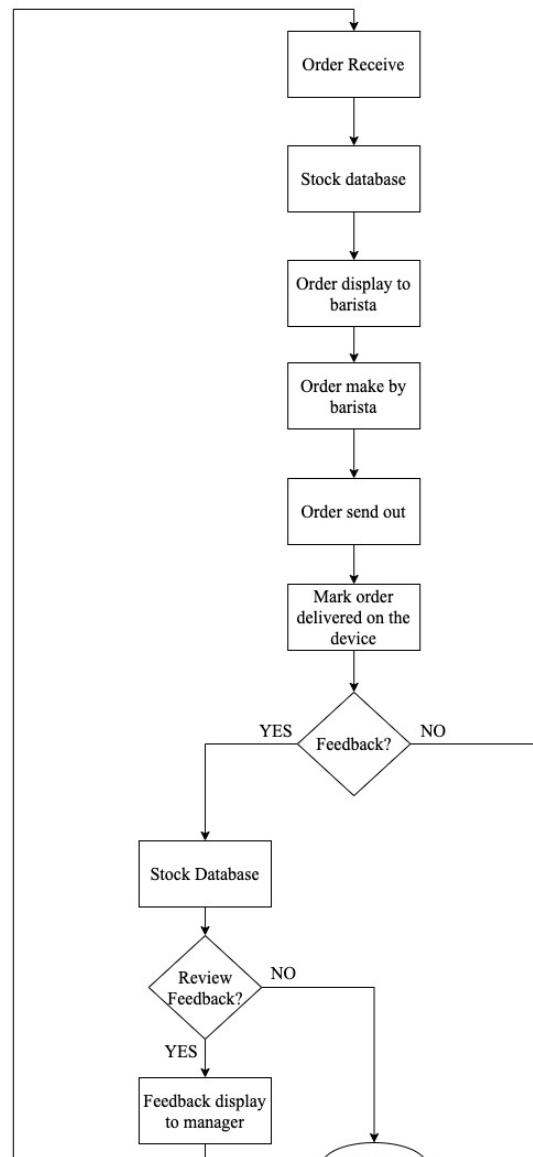
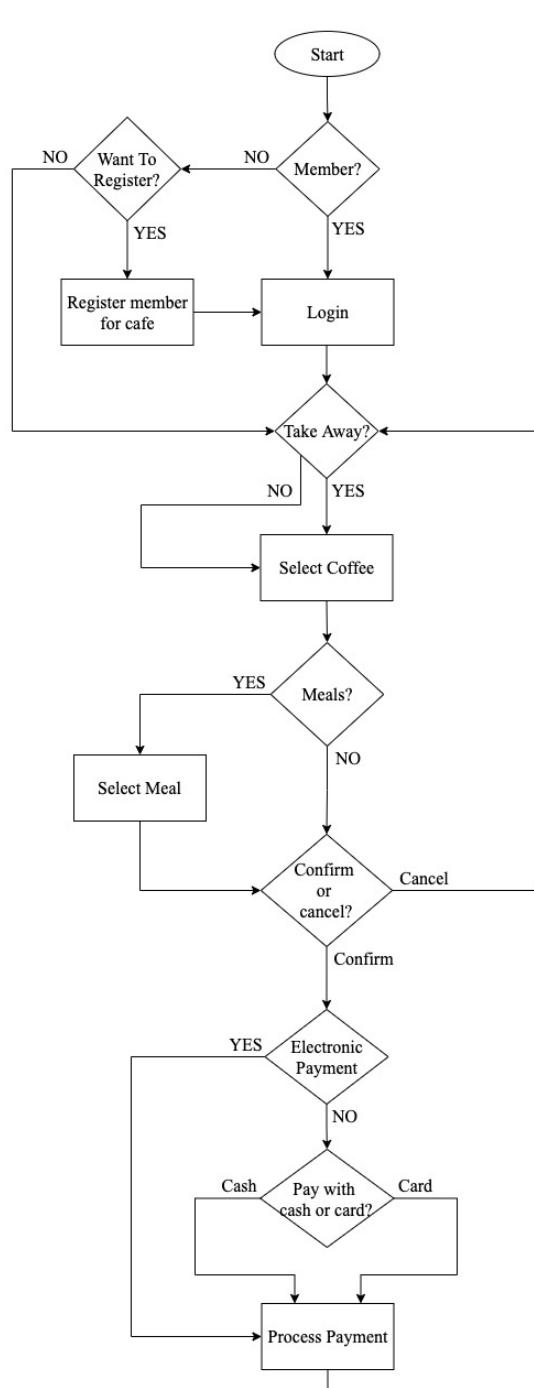
Jenny's Café was established in 2021 and is located in the business district of Sentosa, Singapore. It was founded by two good friends who love to travel. The café aims to provide its customers with an aromatic cup of coffee as well as some light snacks. The café selects the best quality coffee beans for brewing, which are imported from Indonesia to ensure their quality. The café's busiest hours are during weekday mornings and after work. The café has a staff of eight, including a manager, two cashiers, two waiters and three baristas. Most of the customers are office workers and tourists who come to the café just to have a cup of coffee to refresh and relax. The main core problem is that some customers are very busy and need to order and consume quickly so that they can start working again. The current process is well organised, but the manager feels that the system could be improved to maximise efficiency. In the current process, customers patronise the café and sit down, the waiter takes the order from the customer, records it on paper and then gives the barista a list of what is needed to prepare the meal.

Business Goal of the new IS

Café managers, in order to increase efficiency, will use a Food Ordering System (FOS) which can be passed directly from the customer to the barista, thus eliminating the part where the waiter is responsible for ordering and greatly increased the efficiency of the café. (Patel and Chirag, 2018) The FOS will help baristas avoid mistakes. When customers arrive, they can select their preferred coffee or meal from a tabletop ordering device (iPad, Samsung tab) and submit their order, with the barista's computer system displaying the request. This is to avoid confusion, especially during peak times, and customers can provide feedback on their meal via the electronic menu to improve the café's service. Customer feedback is stored in the back

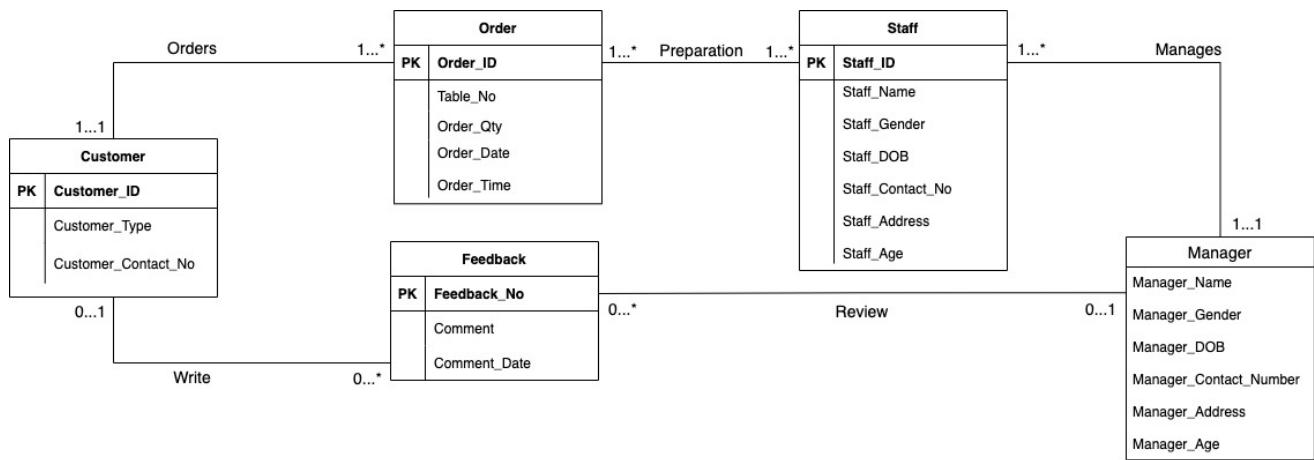
office of the system and the manager checks the comments and then makes the first changes for the café. Over time, this helps to build the brand of the café and attract more customers to patronise and taste unique types of coffee.

Flowchart



First, ask the customer for membership and log in. For non-members, enquire whether they want to register as one or skip the process. Ask whether for take-away or dine-in before going through the next procedure which the customer choose the coffee and/or meal, before proceeding where the customers make confirmation, if cancel, they have to make a new selection. Then, process the payment by cards or cash. The order will be stored in the database and sent to the barista for preparation. Once ready, it will be delivered and marked by the waiter. The customers will be asked for a review. The process will ends if they refuse or if they choose to answer the feedback will be send to the database for the manager to review.

Class Diagram



Class	Description
Customer	People who patronize the café and make purchases
Order	The list of items required
Staff	The employees who prepare the order
Manager	The person in charge of daily operation
Feedback	Comments/reviews from customers

Attribute	Description
Customer_ID	Special number for the customer
Customer_Type	To know customer membership status
Customer_Contact_No	Customer personal phone number

Order_ID	Indicates the number of order
Table_No	The place the customer waits
Order_Qty	Total request of meal / coffee
Order_Date	Display date order was placed
Order_Time	Display time order was placed
Staff_ID	The employees staff number
Staff_Name	Name
Staff_Gender	Staff is Male / Female
Staff_DOB	Birth Day
Staff_Contact_No	Phone number
Staff_Address	Place of stay
Staff_Age	Age
Manager_Name	Name
Manager_Gender	Manager is Male / Female
Manager_DOB	Birth Day
Manager_Contact_No	Phone number
Manager_Address	Place of stay
Manager_Age	Age
Feedback_No	Unique number to identify feedback
Comment	Write comment by customer
Comment_Date	Display date comment was placed

Systems Acquisition

The café can use SWOT to carry out an internal evaluation and study in order to select the most suitable system software. For the café, a fast start-up system was needed so that customers could order and enjoy their choice of coffee or food in a smooth manner. The café will use off-the-shelf software. (Ralph M. Stair and George W. Reynolds, 2017)

In terms of advantages, it would be cost effective and time saving strategy for the café to purchase off-the-shelf software as opposed to customized software. Not only that, but the café must carefully consider whether the off-the-shelf software can address current and future needs and must be functionally appropriate. Most off-the-shelf software can be tested, and it is possible to choose the most appropriate so as not to make mistake of buying the one that will not help. Software providers have more mature technology and experience, avoiding the problem of bugs in the software that could affect the reporting of errors in orders.

In terms of disadvantages, off-the-shelf software may not meet all the functions and it may be necessary to purchase off-the-shelf software produced by other companies to use it, but it is difficult to integrate with existing systems. In addition, the supplier of the existing software may abandon it and the owner has no control over improvements to the software and over new versions. (R.Kelly Rainer, 2010)

Objectives (SMART)

To develop on a food ordering system (FOS) which focuses by using modern technology to help customers in ordering and send it to the barista's screen. This allows customers to enjoy their meals quickly and minimises the problem of customer congestion, giving the café a new competitive edge.

The system will provide the café with a new level of creativity. The feedback system will allow customers' comments and/or dissatisfaction to be reviewed through the system, so that the manager and barista can coordinate to create new and unique drinks or food items that will make the café more attractive.

The café hopes to implement the system within 2 months in order to improve the café's performance and expand its branches. This will enable the café to increase its competitive interest in the marketplace with its peers. The budget for this system is S\$7,000. (O'Brien. J, Marakas. G, 2010)

Feasibility

Technical Feasibility:

The information system of the cafe will be developed by an external company using off-the-shelf software. Using the technology on the table (iPad, Samsung Tab), customers will be able to place orders using their tablets. The market is gradually adopting it, so there is high level of maturity and reduced error rate.

Economic Feasibility:

It is reasonable to purchase the system for SGD 7,000. The revenue is estimated around S\$3,500 per month (e.g. one cup costs SGD10 and 350 cups are sold in one month) so the system will only cost about two months of revenue. Besides, it will help the barista's accuracy and efficiency, which will have a good improvement on the café.

Legal Feasibility:

The café's system database follows Singapore's laws for storage. Customer, staff and manager data will be stored in accordance with the PDPA laws to prevent personal privacy and data leakage. Access to the database will be granted to the manager, thus avoiding the problem of data being accessed by multiple people and easily stolen. In the event of forced access to the system, an alarm will be raised to inform the manager.

Operational Feasibility:

In the 21st century, using technological products, almost everyone uses a smartphone but there are exceptions. To have an information systems that are user-friendly and easy to understand when the customer is given a tablet and proceeds with the order process. If the information system is difficult to use, it will be an extreme failure as the staff need to be trained and teach the customer to use it. Such an action would cost the company's time so a simple system is a clear way to use it. Thus, it can reduce the needs to hire more staff and the

existing ones can be made aware of the operation to advise the customers who have difficulties.

Schedule Feasibility:

The café is estimated to implement the information system within two months, with all operations in the meantime being unaffected. The risks associated with the system are judged to be minimal, so the café can use the system to grow its business.

System requirements statements

Information systems should meet the conditions and needs as to be more profitable for the stakeholders. Research and analysis are carried out to understand the suitability of the system. Through these, the functionality of the system will reach the requirements. (Dennis, Wixom and Roth, 2012)

Functional Requirements

The first function of the information system is to accept and read the data or information entered by the user for the order process via the tablet. If there is no input, the system cannot process any information or data.

The system can be used to show the user on the coffee and food selection page complete with pictures for the user's reference of which help them to choose their choices of meals. The illustration helps the customers to know what they have keyed in and what to expect.

A synchronised information system enables customers and baristas to confirm and coordinate their work in a timely manner. Tagging and updating of the database on the tablet allows the barista's order history to be updated in time for analysis for the café.

The feedback function lets the user to leave comments on the coffee / meals or services, and acts as a bridge between the manager and the customer from which to get input. Therefore,

the manager will be informed directly on the feedbacks, without going through the barista or the waiter, to take any appropriate actions. (Charles S. Wasson, 2005)

Non-Functional Requirements (NFR)

Security:

The database has restricted user permissions, indicating that the information in the database can only be viewed by those with qualified permissions. Further protection of the privacy and data of the database followers.

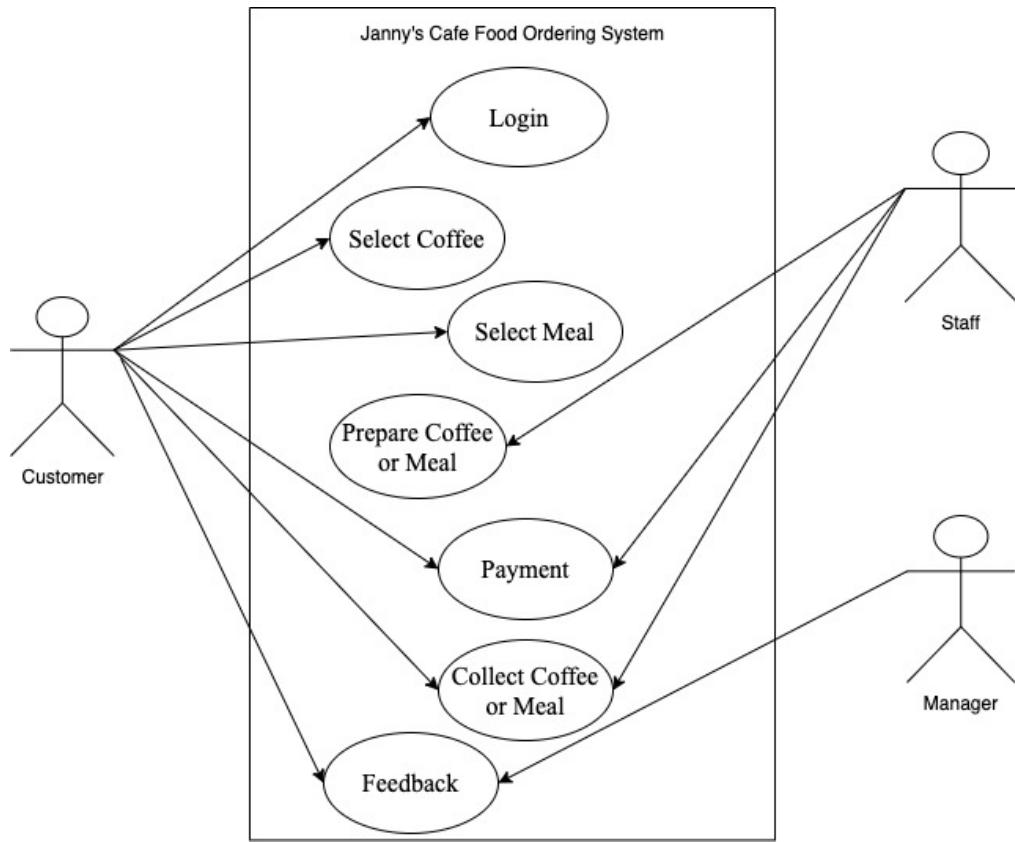
Performance:

The device must support system installation and compatibility, however high memory is also an important factor. The device must have an efficient response time to display the screen to the customer without any delays.

Usability:

The system is designed more user friendly to use the system for customers. The manager can edit and modify information in the database. The manager can delete incorrect orders through the database.

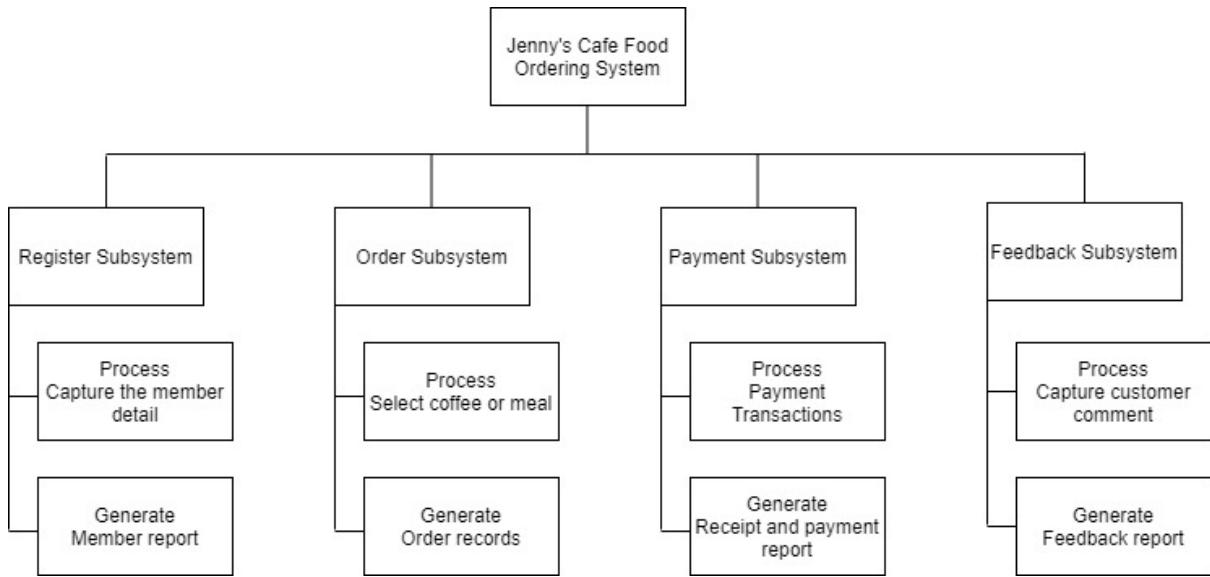
Use case diagram



The food ordering system of Jenny's Café has three actors outside the box ~ Customer, the staff and manager and interacts with the system (represented using lines).

Inside the box, there are seven use case ~ Processes of "Login", "Select Coffee" and "Select Meal" by customer, who can login if a member and select coffee and meal. The "Prepare coffee or meal" process by staff to prepare the ingredients needed for the order. The "Payment" process involves customer and staff, as the payer and the recipient. "Collect coffee or meal" by staff is to collect the completed order to the customer's desk. The "Feedback" process where the customer writes the comment and the manager to review.

Conceptual Model



The food ordering system at Jenny's Café has 4 sub-systems namely register, order, payment and feedback.

When a customer needs to sign up as a member, the register subsystem will collect their information to generate a membership report. The order subsystem is used for the customer's choice of coffee or meal and generates them into an order record. When a customer enters payment information, the payment subsystem will generate a receipt and payment report. The feedback subsystem is used for customers to comments on things in the cafe and generate a feedback report.

Storyboard



When a customer wants to join the café as a member, he needs to register to create an account. The customer also has the option of logging in as a guest. On the register page, the customer needs to fill in their first name, last name, NRIC and email address. If the customer clicks confirm, the member id will be sent to the customer's email address. The customer then needs to order any coffee or meal, view the image through the order page to select any order they want and click add. All added coffees or meal items will be displayed on your order page and customers can view them via the buttons on the order page. In case the customer needs to adjust the quantity of the order simply increase or decrease it, in addition if the customer confirms the order they can click on pay. Once payment has been made, a receipt with payment information is issued with the member id, order id, date, time, amount and

payment type. Then, you can choose to print it out or click on feedback for improvements to the café.

Hardware, Software and Network Components (list)

- Tablet Computer
- Router
- Database System
- Computer
- Monitor
- Ethernet Cables
- Firewall
- POS Machine
- Receipt Printer
- Cash Drawer

Conclusion

In conclusion, the food ordering system helps Jenny's Café sales to rise further by analysing, researching and planning the needs and objectives of Jenny's Café and making a greater profit at a lower price.

References List

Patel and Chirag (2018). Online Food Ordering System. Retrieved Nov 11, 2021, from
<https://www.abebooks.com/servlet/BookDetailsPL?bi=30729694832>

Ralph M. Stair and George W. Reynolds (2017) Principles Of Information Systems. Retrieved Nov 19, 2021, from https://vk.com/wall-80984752_10481

R.Kelly Rainer (2010). Introduction To Information System – Third Edition. Retrieved Nov 21, 2021, from <https://fahad913.files.wordpress.com/2017/06/introduction-to-information-systems-supporting-and-transforming-business.pdf>

O'Brien. J and Marakas. G (2010). Introduction To Information System – Fifteenth Edition. Retrieved Nov 22, 2021, from
https://www.academia.edu/31669892/O'Brien_Introduction_to_Information_Systems_2010

Alan Dennis, Barbara Wixom, and Roberta Roth (2012) System Analysis & Design – Fifth Edition. Retrieved Nov 26, 2021, from
https://www.saigontech.edu.vn/faculty/huynq/SAD/Systems_Analysis_Design_UML_5th%20ed.pdf

Charles S. Wasson (2005) System Analysis, Design, and Development. Retrieved Nov 26, 2021, from
https://www.zu.edu.jo/UploadFile/Library/E_Books/Files/LibraryFile_12159_26.pdf



Principles Of Information Systems and Data Management

Topic 01
Understanding Information

Learning Objectives

Upon successful completion of this topic, students should be able to:

- Distinguish between Data, Information and Knowledge.
- Explain why modern organisations rely heavily on information and communication technologies.

What is Data?

What is Information?

What is Knowledge ?

3



DATA, INFORMATION & KNOWLEDGE

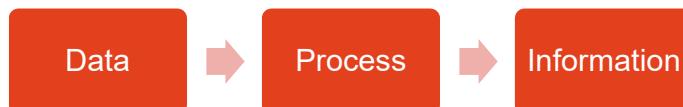
- Data are raw facts
- Information is a collection of facts organized in such a way that they have value beyond the facts themselves.
- Process are a set of logically related tasks.
- Knowledge is an awareness and understanding of a set of information.

4



INFORMATION SYSTEM – DEFINITION

- Information + System
 - is a set of connected components to collect, create, store, retrieve, manage data.
 - Information Systems (IS) takes inputs (data), transforms into useful outputs (information).



5

KAPLAN

DATA

- 10
- 23
- 31
- 45
- 88
- 11

What does the above numbers represent?

Raw Facts...

6

KAPLAN

INFORMATION

Month	Transport Expenses
Jan	\$10
Feb	\$23
Mar	\$31
Apr	\$45
May	\$88
June	\$11

Raw facts transformed into more useful and meaningful - Information

7



KNOWLEDGE

- Have you heard of the word “Knowledge”?
- Degree and Master Programs in Knowledge Management
- New terms and titles: Knowledge Base, Knowledge Engineer, CKO (not CEO/CIO/CTO)
- Knowledge is the awareness and understanding of information which helps us in making useful decisions.

8



What is the value of the information?

9



IMPORTANCE OF INFORMATION

- Information must be available to the right people at the right time in the right format.
- Individuals or organizations can make poor decisions if the information is not accurate.
- Information that is delayed or insecure or unreliable can cost the organization. (thousands to millions of dollars)

Let us look into some of the key characteristics of information.

10



CHARACTERISTICS OF INFORMATION

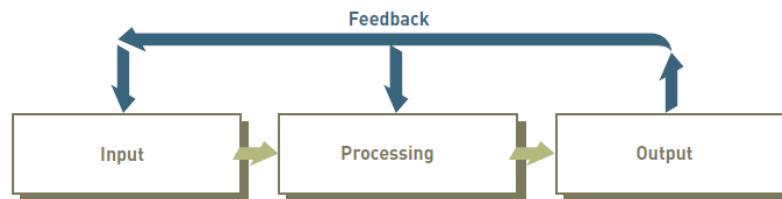
- Accurate
- Reliable
- Verifiable
- Secure
- Complete
- Flexible
- Simple
- Timely

11

KAPLAN

SYSTEMS COMPONENTS

- Components of a System:
 - Inputs
 - Processing
 - Outputs
 - Feedback Channel



12

KAPLAN

MANUAL & COMPUTERISED INFORMATION SYSTEMS

An information system can be manual or computerized.

Example:

An investment analyst manually draws charts and trend lines to assist the company in making investment decisions.

Computerized information systems follows the stock indexes and markets and suggest when large blocks of stocks should be purchased or sold.

13



COMPUTER-BASED INFORMATION SYSTEMS

- Single set of hardware, software, databases, telecommunications, people, and procedures:
 - That are configured to collect, manipulate, store, and process data into information.
- Increasingly, companies are incorporating CBIS into their products and services.

14



BUSINESS INFORMATION SYSTEMS

- Most common types of information systems:
 - Those designed for electronic and mobile commerce, transaction processing, management information, and decision support.
- Some organizations employ:
 - Special-purpose systems, such as virtual reality, that not every organization uses.

15

KAPLAN

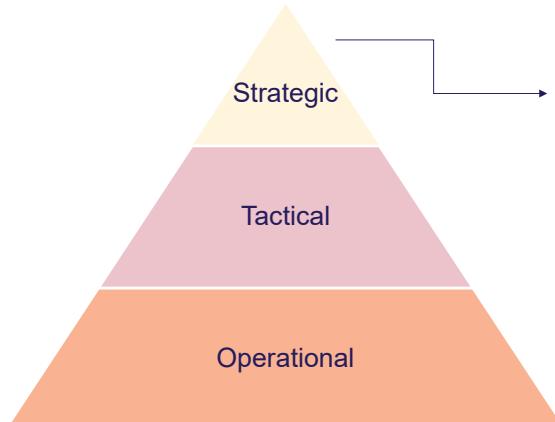
LEVELS OF MANAGERIAL DECISION MAKING



16

KAPLAN

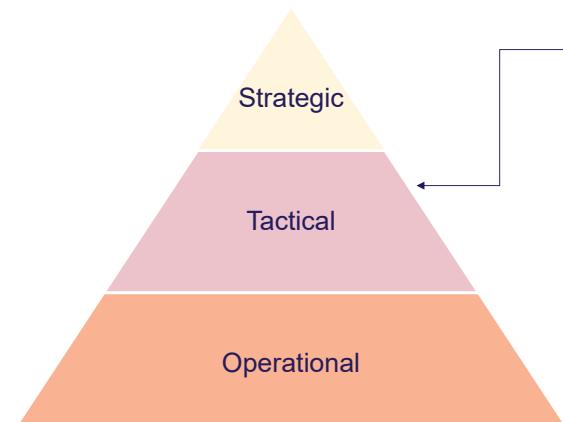
LEVELS OF MANAGERIAL DECISION MAKING



- For **long-term organisational planning**. Decisions tend to be unstructured and are made infrequently.
- However, the decisions made at this level are likely to have a large impact on the organisation as a whole and cannot be reversed easily.
- An example of a decision taken at the strategic level might be a choice of new markets to move into.

17

LEVELS OF MANAGERIAL DECISION MAKING



- For **medium-term planning**. Managers monitor the performance of the organisation, control budgets, allocate resources and set policies.
- Decisions taken at this level are used to set medium-term goals that form stages leading to the accomplishment of the organisation's strategic objectives.
- An example of a decision taken at the tactical level might be setting a departmental budget

18

LEVELS OF MANAGERIAL DECISION MAKING



- For short-term planning and the day-to-day control of the organisation's activities. The decisions taken at this level direct the organisation's efforts towards meeting the medium-term goals, abiding by the budgets, policies and procedures set at the tactical level.
- Operational decisions tend to be highly structured and have little impact on the organisation as a whole.
- An example of a decision taken at the operational level might be setting a daily or weekly production schedule.

19

KAPLAN

BUSINESS INFORMATION SYSTEMS

Most common types of information systems are those that are designed for electronic and mobile commerce, transaction processing, management information, and decision support.

20

KAPLAN

INFORAMTION SYSTEMS – ISSUES

- Computer-related mistakes and waste are a concern.
- Ethical issues concern what is generally considered right or wrong.
- Individual privacy an important social issue.
 - Personal information can be inadvertently disclosed, lost or stolen
 - Many Internet sites collect personal and financial information
- Social networks can cause problems in the workplace.



Principles of Information Systems and Data Management

Topic 02
Business Information Systems

Learning Objectives

Upon successful completion of this topic, students should be able to:

- Explain how BIS play a crucial part in gaining and sustaining a competitive edge over other organisations operating in the same industry.
- Identify systems and their components.
- Describe the behavior of systems.
- Describe the basic strategies and methods used to gain competitive advantage through the use of BIS.

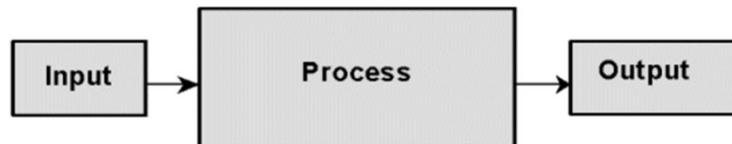
SYSTEMS THEORY

- The Systems theory gives an effective means of examining and upgrading the different business processes. It can be used in a wide variety of areas and is essential to obtaining a good understanding of the managerial application of BIS.
- A system can be defined as a compilation of interconnected components that function together towards a shared goal. The function of a system is to receive inputs and transform them into outputs.

3

KAPLAN

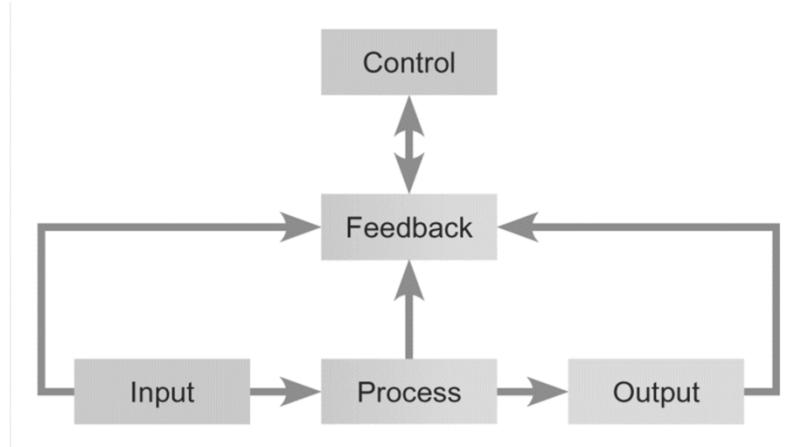
BASIC MODEL OF TRANSFORMATION PROCESS



4

KAPLAN

GENERIC MODEL OF A SYSTEM



5

KAPLAN

CHARACTERISTICS OF SYSTEM

- The different components of a system work together to achieve a collective goal.
 - This is called as the system's objective.
 - The objective of a system is generally very precise and can usually be expressed in a single sentence.
- **System objective:** All the different components of a system should be interrelated to each other by a common objective.

6

KAPLAN

SYSTEMS

1. Subsystem:

Large systems can be made up of smaller systems known as subsystems.

2. Suprasystem:

A larger system comprising of many smaller subsystems.

3. Open system:

Interaction happens with components outside the system boundary.

4. Closed system:

No interaction at all or limited interaction occurs with the surrounding.

7



PORTABLE SINGLE-USER COMPUTERS

- Handheld computers:

- Single-user computers that provide ease of portability because of their small size.

- Smartphone:

- Combines functionality of mobile phone, camera, Web browser, e-mail tool, MP3 player, and other devices into a single device.

8



PORTABLE SINGLE-USER COMPUTERS

- Laptop computer:
 - Designed for use by mobile users
- Notebook computer:
 - Weighs less than 5 pounds
- Netbook computer:
 - Small, light, inexpensive
- Tablet computers:
 - Portable, lightweight computers with no keyboard

9



NON-PORTABLE SINGLE-USER COMPUTERS

- Thin client:
 - Low-cost, centrally managed computer with no extra drives
- Desktop computers:
 - Single-user computer systems that are highly versatile

10



MULTIPLE-USER COMPUTER SYSTEMS

- Server:
 - Used by many users to perform a specific task, such as running network or Internet applications
- Blade server:
 - Houses many computer motherboards
- Mainframe computer:
 - Large, powerful computer shared by dozens or even hundreds of concurrent users connected to the machine over a network
- Supercomputers:
 - The most powerful computers with the fastest processing speed and highest performance

11



SOFTWARE

- Organizations spend more on Software than Hardware.
- Software can help improve the organizations to improve productivity.
- Have you ever wondered about the deductions done using your EZ-link card? Calculating bills at any supermarket etc.,
- Software is indispensable for any system and people using it.

12



RESOURCES THAT SUPPORT BIS

- 1. People resources**
- 2. Hardware resources**
- 3. Software resources**
- 4. Communications resources**
- 5. Data resources**

13



RESOURCES THAT SUPPORT BIS

People resources:

This include the users and those who develop, maintain and operate the system.

Hardware resources:

This includes all types of machines and not just computer hardware.

Software resources:

This includes computer programs and the different media on which they are stored, the term can also be used to explain the procedures used by people.

Communications resources:

This includes the different resources that are required to allow different systems to transfer data.

Data resources:

This includes all the information that an organization has access to, irrespective of its form.

14



ADVANTAGES OF COMPUTER PROCESSING

- **Speed:**

Computers can process billions of commands every second, permitting them to complete a given work in a very less time.

- **Accuracy:**

The end results of a calculation done by a computer is possible for it to be entirely accurate. Apart from this errors that a human is more likely to make such can be eliminated entirely.

- **Reliability:**

In all the organizations, the computer-based information systems function round the clock and are only put offline for repairs or some routine maintenance.

15



ADVANTAGES OF COMPUTER PROCESSING

- **Programmability:**

All computer-based information systems are designed to fulfil a function, the capability to alter the software that controls them gives them a high degree of flexibility. Even the easiest personal computer, can be used to create letters, produce cash flow projections or control databases.

- **Repetitive tasks:**

Computer-based information systems are highly suitable to do repetitive jobs that might be boring and fatigue causing to people. The use of technology helps to cut down errors and free employees to do other tasks

16



LIMITATIONS OF COMPUTER-BASED PROCESSING

- **Judgement/experience:**

Regardless of the many advances in artificial intelligence methods, computer-based information systems are considered as incapable of resolving problems by using their own experience and judgement.

- **Improvisation/flexibility:**

Usually, computer-based information systems are incapable in reacting to unforeseen situations and events. Apart from this, most systems are designed to fulfil a particular function, hence it can be difficult to modify them to meet new/ changed needs.

17



LIMITATIONS OF COMPUTER-BASED PROCESSING

- **Innovation:**

Computers lack the creativity of a human brain. They have a restricted thinking capability hence it is difficult for them to discover new ways of improving processes or solving problems.

- **Intuition:**

Intuition plays an important role for people in certain social situations. BIS cannot use intuition therefore it is unsuitable for certain kinds of situations.

- **Qualitative information:**

Managers usually make decisions based on the suggestions of others. Their confidence in the person has a major influence on the decision itself. However, BIS cannot act upon qualitative information of this type.

18



E-BUSINESS AND E-COMMERCE

- **Electronic business (e-business):** All electronically facilitated information exchanges, both inside an organization and with outside stakeholders, assisting the range of business practices is called as an e-business.
- **Electronic commerce (e-commerce):** All electronically facilitated information exchanges between an organization and all its external stakeholders.
 - **Buy-side e-commerce:** It is an E-commerce transaction which takes place between a purchasing organization and its many vendors.
 - **Sell-side e-commerce:** It is an E-commerce transaction which takes place between the supplier organization and its many customers.

19



ENTERPRISE SYSTEMS

- Enterprise systems intend to support the business processes of an organization across any operational boundaries that are within that organization. Internet technology is used to integrate information within the business and as well as the external stakeholders like the customers, partners and suppliers.

20



FOUR MAIN COMPONENTS OF ENTERPRISE SYSTEM

1. Enterprise resource planning (ERP)- this involves internal production, distribution and financial processes.
2. Customer relationship management (CRM)- this involves marketing and sales processes.
3. Supply chain management (SCM)- this involves the flow of materials, customers and information through the supply chain.
4. Supplier relationship management (SRM)- this involves sourcing, purchasing and the warehousing of goods and services.

21



COMPETITIVE ADVANTAGE

- Significant and (ideally) long-term benefit to a company over its competition
- Can result in higher-quality products, better customer service, and lower costs
- Organizations often use their information systems to help gain a competitive advantage

22



FACTORS FIRMS SEEK COMPETITIVE ADVANTAGE

- Rivalry among existing competitors:
 - Industries with stronger rivalries tend to have more firms seeking competitive advantage
- Threat of new entrants:
 - Threat appears when:
 - Entry and exit costs to an industry are low
 - Technology needed to start and maintain a business is commonly available

23



FACTORS FIRMS SEEK COMPETITIVE ADVANTAGE

- Threat of substitute products and services:
 - The more consumers can obtain similar products and services that satisfy their needs, the more likely firms are to try to establish competitive advantage
- Bargaining power of customers and suppliers:
 - When customers have a lot of bargaining power, companies increase their competitive advantage to retain their customers

24



STRATEGIC PLANNING FOR COMPETITIVE ADVANTAGE

- Strategies:
 - Cost leadership
 - Differentiation
 - Niche strategy
 - Altering the industry structure
 - Creating new products and services
 - Improving existing product lines and service

25



STRATEGIC PLANNING FOR COMPETITIVE ADVANTAGE

- Other strategies:
 - Growth in sales
 - First to market
 - Customizing products and services
 - Hiring the best people
 - Innovation

26



PRODUCTIVITY

- A measure of output achieved divided by input required. Higher level of output for a given level of input means greater productivity.
- Lower level of output for a given level of input means lower productivity.
- Productivity = $(\text{Output} / \text{Input}) \times 100\%$
- Can be based on factors such as the amount of raw materials used, resulting quality, or time to produce the goods or service.

27



RETURN ON INVESTMENT & VALUE OF INFORMATION SYSTEMS

- Return on investment (ROI):
 - One measure of IS value
 - Investigates the additional profits or benefits that are generated as a percentage of the investment in IS technology
- Earnings growth
 - The increase in profit that the system brings

28



RISK

- Managers must consider the risks of designing, developing, and implementing systems.
- Information systems can sometimes be costly failures.

29



TYPICAL IS TITLES AND FUNCTIONS

- Chief information officer (CIO)
 - Employs the IS department's equipment and personnel to help the organization attain its goals
- Senior IS Managers
 - Vice president of information systems, manager of information systems, and chief technology officer (CTO)
- LAN administrators
 - Set up and manage the network hardware, software, and security processes

30





Principles of Information Systems and Data Management

Topic 03
Hardware and Software

Learning Objectives

Upon successful completion of this topic, students should be able to:

- Describe the various components of the computer system.
- Identify the type of computer system that a business uses.
- Explain the purpose of software applications in different categories.

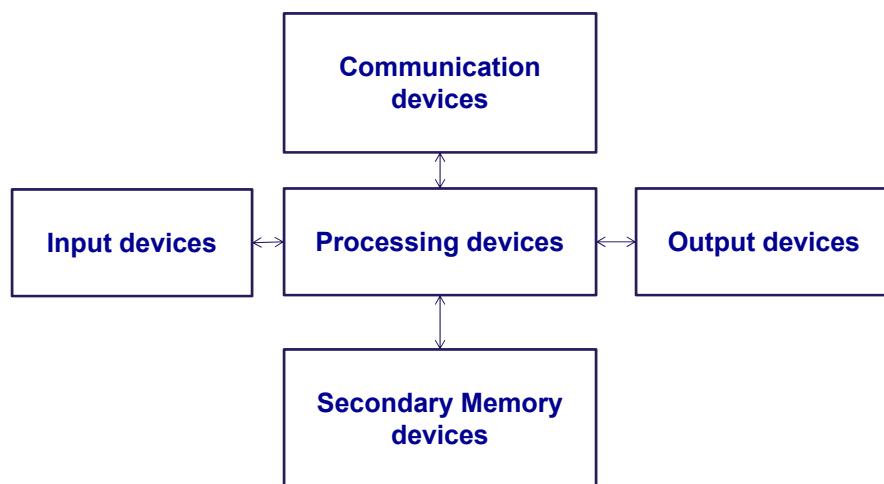
IMPORTANCE OF HARDWARE

- Focus on hardware is increasing in organizations, forms can:
 - Improve productivity
 - Increase revenue, reduce costs
 - Provide better service to customers
- Essential for managers to learn or have basic knowledge in IT.

3

KAPLAN

COMPUTER SYSTEMS



4

KAPLAN

HARDWARE COMPONENTS

- Central Processing Unit (CPU)
 - Arithmetic Logic Unit (ALU)
 - Control Unit (CU)
 - Registers

5



FETCH – EXECUTE CYCLE

- Step 1: Fetch instruction
- Step 2: Decode instruction
- Step 3: Execute instruction
- Step 4: Store results

6



CENTRAL PROCESSING UNIT

- System unit:
 - Houses the components responsible for processing (the CPU and memory)
- All other computer system devices are:
 - Linked either directly or indirectly into the system unit housing

7



MEMORY CHARACTERISTICS & FUNCTIONS

- Main memory
 - Provides the CPU with a working storage area for programs and data
 - Rapidly provides data and instructions to the CPU
- Storage capacity
 - Eight bits together form a byte (B)

8



MEMORY CHARACTERISTICS

Name	Abbreviation	Size
Bit	b	0 or 1
Byte	B	8 bits
Kilo Byte	KB	1024 B
Mega Byte	MB	1024 KB
Giga Byte	GB	1024 MB
Tera Byte	TB	1024 GB
Peta Byte	PB	1024 TB

9



MEMORY – TYPES

- Primary Memory
 - Volatile
 - Temporary
 - RAM
- Secondary Memory
 - Non Volatile
 - Permanent
 - ROM

10



SECONDARY STORAGE

- Secondary storage offers the advantages of non-volatility, greater capacity, and greater economy.
- Less expensive than primary memory.
- Secondary storage are slower in terms of access as compared to primary memory.

11



SECONDARY STORAGE DEVICES

- Magnetic tapes:
 - Primarily for storing backups of critical organizational data
- Magnetic disks:
 - Direct-access storage device
- Redundant array of independent/inexpensive disks (RAID):
 - Method of storing data that generates extra bits of data from existing data

12



SECONDARY STORAGE DEVICES

- Virtual tape:
 - Used for less frequently needed data
- Optical secondary storage devices:
 - Compact disc read-only memory (CD-ROM):
 - Storage capacity is 740 MB
 - Digital video disc (DVD):
 - 6 x capacity of CD
 - Blue-ray high-definition video disk:
 - 3 x capacity of DVD

13



ENTERPRISE STORAGE OPTIONS

- Network-attached storage (NAS):
 - Hard disk storage that is set up with its own network address rather than being attached to a single computer
- Storage area network (SAN):
 - Special-purpose, high-speed network that provides direct connections among data-storage devices and computers

14



ACCESS METHODS

- Sequential access:
 - Need to retrieve data in a specific sequence.
 - Devices used called sequential access storage devices (SASDs)
 - Magnetic Tapes
- Direct access:
 - No specific sequence; can be any order.
 - Devices used are called direct access storage devices (DASDs)
 - CDs

15



INPUT AND OUTPUT DEVICES

- Input and output devices:
 - Gateways to the computer system
 - Part of a computer's user interface
- Data can be human- or machine-readable
- Data entry converts human-readable data into machine-readable form
- Data input transfers machine-readable data into system

16



INPUT DEVICES

- Devices used to input general types of data:
 - Personal computer input devices
 - Speech recognition technology
 - Digital cameras
 - Scanning devices
 - Optical data readers
 - Magnetic ink character recognition (MICR) devices
 - Magnetic stripe card

17



INPUT DEVICES

- Devices used to input general types of data (continued):
 - Chip-and-PIN cards and contactless cards
 - Point-of-sale devices
 - Automated teller machine (ATM) devices
 - Pen input devices
 - Touch-sensitive screens
 - Bar-code scanners
 - Radio frequency identification chips

18



OUTPUT DEVICES

- Display monitors used to display output from computer
- Plasma display:
 - Uses thousands of smart cells (pixels) consisting of electrodes and neon and xenon gases that are electrically turned into plasma to emit light
- LCD displays:
 - Flat displays that use liquid crystals
 - Brighter, flicker-free, and do not emit radiation

19



OUTPUT DEVICES

- OLED displays
 - Uses layer of organic material sandwiched between two conductors
 - Provide sharper and brighter colors than LCDs and CRTs
- Power usage
 - Plasma (most), LCD, OLED (least)
- Digital audio player:
 - Can store, organize, and play digital music files

20



OUTPUT DEVICES

- Printers and plotters:
 - Laser printers and inkjet printers
 - Plotters used for general design work
- Digital Audio Players
 - MP3 players compress sound sequence into small file while preserving original level of sound quality
- E-books:
 - Digital media equivalent of a conventional printed book

21



MULTIPROCESSING

- Multiprocessing:
 - Simultaneous execution of two or more instructions at the same time
- Coprocessor:
 - Executes specific types of instructions
 - Speeds processing
- Multicore microprocessor:
 - Combines two or more independent processors into a single computer

22



SOFTWARE

- Organizations spend more on Software than Hardware
- Software can help improve the organizations to improve productivity
- Have you ever wondered about the deductions done using your EZ-link card? Calculating bills at any supermarket etc.,
- Software is indispensable for any system and people using it.

23



SOFTWARE – DEFINITION

- Program: set of instructions which are interrelated and executed sequentially.
- Programmer: A person who writes program.
- Programming Language: A language used to write computer programs.
E.g. C, C++, Java etc.,
- Software: is a collection of programs designed for a specific purpose.

24



SOFTWARE – TYPES

There are two different types of Software:

- **Systems Software**

- Set of programs that coordinates the activities and functions of hardware and other programs
- Mandatory

- **Application Software**

- Software designed for a specific purpose.
- Helps users solve particular problems
- Optional

25



SYSTEMS SOFTWARE

- Controls the operations of computer hardware
- Supports the application programs' problem-solving capabilities
- Types of systems software:
 - Operating systems
 - Utility programs
 - Middleware

26



OPERATING SYSTEMS

- Controls hardware
- Acts as interface between the user and computer
- Kernel:
 - The heart of the operating system
 - Ties all components of the OS together and regulates other programs

27



OPERATING SYSTEMS

- Combinations of OSs, computers, and users includes:
 - Single computer with a single user
 - Single computer with multiple simultaneous users
 - Multiple computers with multiple users
 - Special-purpose computers

28



OPERATING SYSTEMS

Activities performed by the operating system:

- Perform common computer hardware functions
- Provide a user interface and input/output management
- Provide a degree of hardware independence
- Manage system memory
- Manage processing tasks
- Provide networking capability
- Control access to system resources
- Manage files

29



OPERATING SYSTEMS

- Common hardware functions:
 - Get input from keyboard or another input device
 - Retrieve data from disks
 - Store data on disks
 - Display information on a monitor or printer

30



OPERATING SYSTEMS

User interface and input/output management

- User interface:
 - Allows individuals to access and command the computer system
- Command-based user interface:
 - Requires that text commands be given to the computer to perform basic activities
- Graphical user interface (GUI):
 - Uses icons and menus displayed on screen to send commands to the computer system
- Natural user interface
 - Allow people to use touch screens

31



OPERATING SYSTEMS

- Hardware independence:
 - Application program interface (API):
 - Allows applications to make use of the operating system
 - Enables software developers to build applications software without needing to understand the inner workings of the operating system and hardware
- Memory management:
 - Allows computer to execute program instructions effectively and to speed processing

32



OPERATING SYSTEMS

- Processing tasks:
 - Multitasking:
 - More than one program can run at the same time
 - Time-sharing:
 - Allows more than one person to use a computer system at the same time
 - Scalability:
 - Ability of the computer to handle an increasing number of concurrent users smoothly

33



OPERATING SYSTEMS

- Networking capability:
 - Send and receive data
- Access to system resources and security:
 - Protection against unauthorized access
 - OS establishes a logon procedure
- File management:
 - Availability of files
 - Denying unauthorized access to files

34



CURRENT OPERATING SYSTEMS

- Microsoft PC operating systems:
 - Windows XP
 - Windows Vista
 - Windows 7
 - Windows 8, 10
- Apple Computer Operating Systems:
 - Mountain Lion
 - Mac users can dual boot to run either Windows or Mac OS
- Linux:
 - Red Hat Linux
 - OpenSUSE
 - Caldera OpenLinux

35



CURRENT OPERATING SYSTEMS

- Google Chrome OS:
 - Linux-based operating system designed for netbooks and nettops
 - Designed to run on inexpensive low-power computers
 - Chromium OS:
 - Open-source version of Chrome OS
- Android
 - Operating system for mobile devices

36



WORKGROUP OPERATING SYSTEMS

- Windows Server:
 - Can be used to prevent unauthorized disclosure of information
- UNIX:
 - Can be used on many computer system types and platforms
- Red Hat Linux:
 - Can manage a cluster of up to eight servers
- Mac OS X Server:
 - Includes support for 64-bit processing

37



ENTERPRISE OPERATING SYSTEMS

- z/OS:
 - IBM's first 64-bit enterprise OS
- HP-UX and Linux:
 - HP-UX:
 - Robust UNIX-based OS from Hewlett-Packard
 - Supports Internet, database, and business applications on server and mainframe enterprise systems

38



UTILITY PROGRAMS

- Help perform variety of tasks
- Common types of utilities:
 - Hardware utilities
 - Security utilities
 - File-compression utilities
 - Spam-filtering utilities
 - Network and Internet utilities
 - Server and mainframe utilities

39



UTILITY PROGRAMS

- Other utilities:
 - Key logging software allows a manager to see every keystroke a worker makes on a computer system
 - Monitoring software can catalog the Internet sites that employees visit
 - Keyboard shortcut utilities allow users to map common tasks to defined keyboard combinations

40



MIDDLEWARE

- Software that allows different systems to communicate and exchange data
- Can also be used as an interface between the Internet and older legacy systems
- Service-oriented architecture (SOA):
 - Uses modular application services to allow users to interact with systems, and systems to interact with each other

41



APPLICATION SOFTWARE

- Application programs:
 - Interact with systems software
 - Help you perform common tasks, such as:
 - Creating and formatting text documents
 - Performing calculations
 - Managing information

42



OVERVIEW OF APPLICATION SOFTWARE

- Proprietary software:
 - One-of-a-kind program for a specific application, usually developed and owned by a single company
- Off-the-shelf software:
 - Existing software program that is purchased
- Application service provider (ASP):
 - Company that can provide software, support, and computer hardware on which to run the software from the user's facilities over a network

43



APPLICATION SOFTWARE

- Personal Application software
 - Software Suites and Integrated Software Packages
 - Collection of single programs packaged together in a bundle
 - Word processor, spreadsheet, database management, graphics, communications tool, organizers
- Workgroup Application software
 - Support teamwork, whether people are in the same location or dispersed around the world
- Enterprise Application Software
 - Software that benefits an entire organization
 - Helps managers and workers stay connected

44



SOFTWARE ISSUES AND TRENDS

- Software bug:
 - Defect in a program that keeps it from performing as it should
- Some tips for reducing impact of software bugs:
 - Register all software
 - Check read-me files for work-around
 - Access support area of the manufacturer's Web site for patches
 - Install latest software updates

45



COPYRIGHTS AND LICENSES

- Most software products are protected by law using copyright or licensing provisions:
 - In some cases, you are given unlimited use of software on one or two computers
 - In other cases, you pay for your usage; if you use the software more, you pay more
- Some software now requires that you register or activate it before it can be fully used

46



FREWARE AND OPEN-SOURCE SOFTWARE

- Freeware:
 - Software that is made available to the public for free
- Open-source software:
 - Distributed, typically for free, with the source code

Software	Category
Linux	Operating System
Open Office	Application Software
Firefox	Browser
MySQL	Database
OpenProj	Project Management

47



SOFTWARE UPGRADES

- Software companies revise their programs and sell new versions periodically
- Most software upgrades:
 - Offer new features and capabilities
- Some users do not always get the most current software upgrades or versions:
 - Unless it includes significant improvements or capabilities

48





Principles of Information Systems and Data Management

Topic 04
Database and Network

Learning Objectives

Upon successful completion of this topic, students should be able to:

- Describe the use of database application software.
- Explain the concept of a data warehouse.
- Identify the benefits of the introduction of computer networks.
- Describe the network components and terminology of networks.

DATABASES – TERMINOLOGY

- Data:
 - raw facts
- Database:
 - Organized collection of data
- Database management system (DBMS):
 - Software that helps to create, design, manage a database
 - Acts as interface between the application program and database
- Database administrator (DBA):
 - Administers or manages the database

3



DATA MANAGEMENT

- Organizations tend to collect lot of data about customers.
- It is important for them to organize the data before they can process for useful information.
- Without proper data management it is difficult for organizations to complete business activities.

4



HIERARCHY OF DATA

- Bit (a binary digit):
 - Circuit that is either on or off
- Byte:
 - Typically made up of eight bits
- Character:
 - Basic building block of information
- Field:
 - Name, number, or combination of characters that describes an aspect of a business object or activity

5



HIERARCHY OF DATA

- Record:
 - Collection of related data fields
- File:
 - Collection of related records
- Database:
 - Collection of integrated and related files
- Hierarchy of data:
 - Bits, characters, fields, records, files, and databases

6



DATA ENTITIES, ATTRIBUTES & KEYS

- Entity:
 - A person, place, or thing for which data is collected, stored, and maintained
- Attribute:
 - Characteristic of an entity
- Data item:
 - Specific value of an attribute

7



DATA ENTITIES, ATTRIBUTES & KEYS

- Key:
 - Field or set of fields in a record that is used to identify the record
- Primary key:
 - Field or set of fields that uniquely identifies the record

8



EXAMPLE

Student ID	Name	Address	Mobile
12123	John	Orchard	88776655
12124	Michelle	Somerset	87654321
12125	Jack	Serangoon	81726354

The above example has three records and four attributes.

Primary Key: Student ID

9



DATABASE APPROACH

- The database approach:
 - Traditional approach to data management:
 - Each distinct operational system used data files dedicated to that system
 - Database approach to data management:
 - Pool of related data is shared by multiple application programs

10



DATA MODELING

- Data model:
 - Diagram of data entities and their relationships
- Enterprise data modeling:
 - Understanding or investigating the organization needs.
- Entity-relationship (ER) diagrams:
 - Uses graphical symbols to show relationships between entities

11



RELATIONAL DATABASE MODEL

- Relational model:
 - Describes data using a standard tabular format
 - Each row of a table represents a data entity (record)
 - Columns of the table represent attributes (fields)
 - The domain is the range of allowable values for data attributes

12



RELATIONAL MODEL

Student ID	Name	Course	Major
101	Joseph	Degree	Marketing
102	Michelle	Masters	Finance
103	Mark	Degree	Accounting

Attributes: 4
Records: 3

13



OVERVIEW OF DATABASE TYPES

- Single user
 - Only one person can use the database at a time
 - Examples: Access, FileMaker Pro, and InfoPath
- Multiple users
 - Allow dozens or hundreds of people to access the same database system at the same time
 - Examples: Oracle, Microsoft, Sybase, and IBM

14



POPULAR DATABASE MANAGEMENT SYSTEMS

- Popular DBMSs for end users:
 - Microsoft's Access and FileMaker Pro
 - Number of open source DBMS including PostgreSQL, MySQL, and CouchDB

15



DATABASE ADMINISTRATION

- DBA:
 - Works with users to decide the content of the database
 - Works with programmers as they build applications to ensure that their programs comply with database management system standards and conventions
- Data administrator:
 - Responsible for defining and implementing consistent principles for a variety of data issues

16



USING DATABASES WITH OTHER SOFTWARE

- DBMSs can act as front-end or back-end applications:
 - Front-end applications interact directly with people
 - Back-end applications interact with other programs or applications

17



DATA WAREHOUSES, DATA MARTS & DATA MINING

- Data warehouse
 - Database that holds business information from many sources in the enterprise
- Data mart
 - Subset of a data warehouse
- Data mining
 - Information-analysis tool that involves the automated discovery of patterns and relationships in a data warehouse

18



BUSINESS INTELLIGENCE

- Involves gathering enough of the right information:
 - In a timely manner and usable form and analyzing it to have a positive impact on business strategy, tactics, or operations
- Competitive intelligence:
 - Limited to information about competitors and the ways that knowledge affects strategy, tactics, and operations

19



BUSINESS INTELLIGENCE

- Counterintelligence:
 - Steps organization takes to protect information sought by “hostile” intelligence gatherers
- Online analytical processing (OLAP) allows users to explore data from a number of perspectives
 - Provides top-down, query-driven data analysis

20



BUSINESS INTELLIGENCE

- Data loss prevention (DLP):
 - Refers to systems designed to lock down data within an organization
 - Powerful tool for counterintelligence
 - A necessity in complying with government regulations that require companies to safeguard private customer data

21



DATA

Data exist in organisations

- Data is a record of something that has happened
 - Receipt
 - Enrolment
 - Email
- It comes from many sources
 - Human Resources
 - Finance
 - ...etc
- For BI, the data from these sources will often be consolidated in a data warehouse

22



ANALYSIS

Having the data available is only the start

- It needs to be analyzed
- There are many methods of analysis, e.g.,
 - Queries
 - Analytics
 - Data, text, web mining

23



PRESENTATION

There needs to be ways of making sure the “right” people have access to the “right” information

- It can be presented using
 - Reports
 - Pivot tables
 - Charts
 - Dashboards

24



DISTRIBUTED DATABASES

- Distributed database:
 - Database in which the data may be spread across several smaller databases connected via telecommunications devices
 - Gives corporations more flexibility in how databases are organized and used
- Replicated database:
 - Holds a duplicate set of frequently used data

25



VISUAL, AUDIO & OTHER DATABASE SYSTEMS

- Visual databases:
 - Used to store images of charge slips, X-rays, vital records
 - Can be stored in some object-relational databases or special-purpose database systems
- Spatial data technology:
 - Using database to store and access data according to the locations it describes

26



TELECOMMUNICATIONS

- Telecommunications is the electronic transmission of signals for communications
- Telecommunications medium – is the channel for communication between sender and receiver
- Synchronous communications:
 - Receiver gets message instantaneously
- Asynchronous communications:
 - Receiver gets message after some delay

Examples for them??

27



BASIC TELECOMMUNICATIONS CHANNEL CHARACTERISTICS

- Simplex channel:
 - Transmission of data in one direction
- Half-duplex channel:
 - Data transmission in both directions, but one at a time.
- Full-duplex channel:
 - Data transmission in both directions, but at the same time.

Examples??

Which of them is more efficient?

28



BASIC TELECOMMUNICATIONS CHANNEL CHARACTERISTICS

- Guided transmission media types:
 - Available in many types
- Twisted-pair wire:
 - Two pairs of thin cables twisted to each other.
- Coaxial cable:
 - Offers cleaner and crisper data transmission (less noise) than twisted-pair wire
- Fiber-optic cable:
 - Transmits signals with light beams

29



BASIC TELECOMMUNICATIONS CHANNEL CHARACTERISTICS

- Wireless communications options:
 - Transmission of signals without cables.
 - Radio, microwave, or infrared frequencies
 - Wireless communication is regulated
 - To avoid signal interception

30



SHORT RANGE WIRELESS OPTIONS

- Near field communication (NFC)
 - Short-range wireless connectivity technology designed for cell phones and credit cards
- Bluetooth
 - You should know them. Mobile – Mobile??
- Ultra wideband (UWB)
 - Short-range communications that employs extremely short electromagnetic pulses lasting 50 to 100 picoseconds over a range of 10 to 50 meters
- Infrared transmission
 - Sends signals at a frequency of 300 GHz and above
 - Used to transmit data captured by sensors to data recorder

Examples?

31

KAPLAN

MEDIUM-RANGE WIRELESS OPTIONS

- Wi-Fi (Wireless Fidelity):
 - Wireless telecommunications technology brand owned by the Wi-Fi Alliance
 - Employs wireless access point that consists of a transmitter with an antenna that receives the signal and decodes it
 - Wi-Fi access points have maximum range of about 300 feet outdoors and 100 feet within a dry-walled building

32

KAPLAN

WIDE AREA WIRELESS NETWORK OPTIONS

- 3G wireless communications:
 - Support wireless voice and broadband speed data communications in a mobile environment
- 4G wireless communications:
 - Provides increased data transmission rates in the 5–40 Mbps range
- Long Term Evolution (LTE)
 - Standard for wireless communications for mobile phones based on packet switching

33



NETWORKS AND DISTRIBUTED PROCESSING

- Computer network:
 - Connection of two or more devices
 - Can transmit and receive information to improve organizational effectiveness and efficiency
- Local area networks
 - Network connection in a limited geographical location. (e.g., office or home)
- Wide area networks:
 - No geographical limitations.

34



CLIENT/SERVER SYSTEMS

- Client/server architecture:
 - Multiple computer platforms are dedicated to special functions
- Client:
 - Any computer requesting for a service from the server.
- Server:
 - Granting the request to clients.

35



TELECOMMUNICATIONS HARDWARE

- Smartphones
 - Don't you know them? iPhone – Samsung.
 - Have their own software operating systems
- Modems
 - Modulation/demodulation devices
- Multiplexers
 - Combine data from multiple data sources into a single output signal that carries multiple channels

36



TELECOMMUNICATIONS HARDWARE

- Switches, bridges, routers, and gateways
 - Switch: uses the physical device address in each incoming message on the network
 - Bridge: connects two LANs together using the same telecommunications protocol
 - Router: forwards data packets across two or more distinct networks toward their destinations
 - Gateway: serves as an entrance to another network

37



TELECOMMUTING AND VIRTUAL WORKERS & WORKGROUPS

- Telecommuting:
 - Work from home. Is it good?
- Telecommuters:
 - Highly disciplined, independent, flexibility
- Jobs unsuitable for telecommuting:
 - What jobs are suitable/unsuitable?

38



INTERNET, INTRANET & EXTRANET

- Internet
 - Public network; no restrictions
- Intranet
 - Private network; requires username and password
- Extranet
 - Private network between two organizations. Limited access

39



COMMUNICATION AND COLLABORATION

- E-mail:
 - Internet communication
 - Most common form of online communication
- Instant messaging:
 - Online, real-time communication
- Microblogging, status updates, and news feeds:
 - Facebook and Twitter.
- Web log or blogs:
 - Online diary
- Podcast:
 - Audio broadcast over the Internet

40



ONLINE MEDIA & ENTERTAINMENT

- Content streaming:
 - No need to wait for download; Watch as you download
- Music:
 - Loads of music files on Internet
 - Radio online
 - Piracy issues.
- Online games:
 - Video games generate over \$20 billion annually
 - Most of them are available online.

41



E-BOOKS AND AUDIO BOOKS

- An e-book is a book stored digitally
- Apple's iPad changed the eBook industry by providing a form factor that is similar to but larger than the Kindle
- Dozens of eBook formats, some proprietary
- Audio books – getting more popularity

42



SHOPPING ONLINE

- E-tail stores:
 - Online versions of retail stores
 - Provide access to many products that may be unavailable in local stores
- Online clearinghouses, Web auctions, and marketplaces:
 - Provide a platform for businesses and individuals to sell their products and belongings
- www.eBay.com
 - The most popular online auction or marketplace

43



TRAVEL, GEOLOCATION AND NAVIGATION

- Businesses that have a strong online presence:
 - Travel agencies
 - Resorts, airlines, cruise lines
 - All businesses associated with travel
- Google Maps:
 - Provides extensive location-specific business information, satellite imagery, up-to-the-minute traffic reports, and Street View

44





Principles of Information Systems and Data Management

Topic 05

Acquiring and Developing BIS

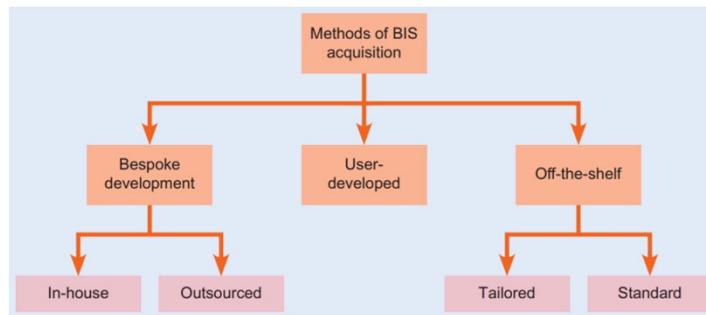
Learning Objectives

Upon successful completion of this topic, students should be able to:

- Describe how organisations develop and acquire information systems and technologies to achieve goals.
- Describe the THREE main methods for acquiring information systems necessary to support a particular business need.
- Describe the Basic Systems Development Lifecycle (SDLC).

METHODS FOR ACQUIRING INFORMATION SYSTEMS

Bespoke Development | User-developed Software | 'off-the-shelf' Software



3

KAPLAN

METHODS FOR ACQUIRING INFORMATION SYSTEMS

Bespoke Development | User-developed Software | 'off-the-shelf' Software

- Developed 'from scratch' by one or more IS professionals to meet the business requirements of the application.
- Has the benefit of producing software tailored to the precise requirements of the business. There is also the benefit that the creation of bespoke information systems may confer specific competitive advantage since competitor organisations do not have the same software solutions.
- Downside: Expense, Time, Quality

4

KAPLAN

METHODS FOR ACQUIRING INFORMATION SYSTEMS

Bespoke Development | User-developed Software | 'off-the-shelf' Software

- Enterprise resource planning or institutional applications are those that affect general corporate activities, cut across more than one department or functional area, or are systems that involve organisational data held in corporate databases.
- End-user applications are more limited in scope. Applications may be departmental or personal in nature and are usually output-or report-oriented rather than input-driven. These applications may be written either by IT professionals or by the end-users themselves.
- Main benefit: Not subject to mistranslation or the provision of over-sophisticated solutions.

5



METHODS FOR ACQUIRING INFORMATION SYSTEMS

Bespoke Development | User-developed Software | 'off-the-shelf' Software

- Direct purchase of a pre-written application used by more than one company.
- Offer a broad functionality that will suit a wide range of different businesses.
- Major benefit: Low cost, Less likely to suffer from the bugs
- Downside: Offer too many features, May require businesses to process information in a particular way that is at odds with the way they normally do business.

6



What are the factors affecting software acquisition in a company?

7



CRITICAL FACTORS AFFECTING SOFTWARE ACQUISITION

1. Time
2. Cost
3. Quality

Acquisition Option	Delivery Time	Cost	Quality: Bugs	Quality: Fits business needs
Bespoke in-house	Poor	Poor	Poor	Good
Bespoke software house	Good	Very poor	Medium	Medium
End-user dev	Poor	Medium	Poor	Good
Tailored off-the-shelf	Good	Good	Good	Medium
Standard off-the-shelf	Very good	Very good	Very good	Poor

8



GROUP ACTIVITY

- Discuss a situation where you need to make a decision to make or buy a product or service ?
- What are the factors to consider ?
- How much weightage would be given to each factor?
- How will you make the final decision

9



Group Activity

- Discuss a situation where you need to make a decision to make or buy a product or service ?
 - E.g. **New Business systems**
 - Not available in the market ; Unique, Competitive advantage,
- What are the factors to consider ?
 - (1) Confidentiality , (2) Skills and Knowhow , (3) Time and effort (4) Costs
- How much weightage would be given to each factor?
 - (1) 60% ; (2) 20% ; (3) 10%, (4) 10%
- How will you make the final decision
 - Is the product likely to be completed as designed?
 - Can it be completed on time within costs ?
 - Any risks ?

10



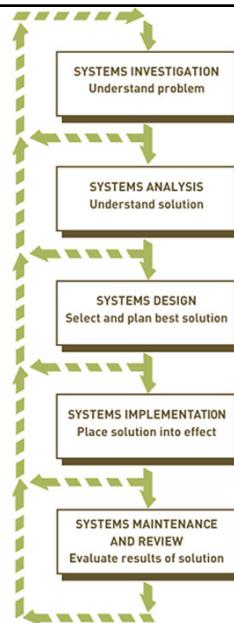
Group Activity

- Discuss a situation where you need to make a decision to make or buy a product or service ?
 - E.g. Library systems
 - Available in the market ? ; Any Unique or Competitive advantage Requirements?
 - Common process and standard systems
- What are the factors to consider ?
 - (1) Skills and Knowhow , (3) Time and effort (4) Costs
- How much weightage would be given to each factor?
 - (1) 30% ; (2) 20% ; (3) 50%
- How will you make the final decision
 - Is the product likely to be completed as designed?
 - Can it be completed on time within costs ?
 - Any risks ?

11

KAPLAN

BASIC SYSTEMS DEVELOPMENT CYCLE



KAPLAN

SYSTEMS DEVELOPMENT

- It is important to transform planning to execution.
- Every employee (at all levels) work together and use systems.
- Helps to understand how project can be planned, aligned with corporate goals and developed rapidly.

13



PARTICIPANTS IN SYSTEMS DEVELOPMENT

- Development team:
 - Determines objectives of the information system
 - Delivers system that meets objectives
- Project:
 - Planned collection of activities that achieves a goal
- Stakeholders:
 - People who ultimately benefit from project

14



PARTICIPANTS IN SYSTEMS DEVELOPMENT

- Users:
 - People who will interact with the system regularly
- Systems analyst:
 - Professional who specializes in analyzing and designing business systems
- Programmer:
 - Responsible for modifying or developing programs to satisfy user requirements

15



PLANNING → EXECUTION

- Information systems planning:
 - organizational goals → systems development initiatives
- Aligning organizational goals and IS goals:
 - Critical for successful systems development effort
- Planning is done by a lot of organizations and even individuals but it is very important to execute them.

16



SYSTEMS DEVELOPMENT LIFE CYCLE

- Systems investigation:
 - Identifies problems and opportunities
- Systems analysis:
 - SWOT
- Systems design:
 - Looking at the solution
- Systems implementation:
 - Creating the system. (or modifying the existing system)
- Systems maintenance and review:
 - Does the new system meets the expectations

17



PROTOTYPING AND RAD

- Prototyping
 - An iterative approach
 - Less risky
- Rapid application development (RAD):
 - Employs tools, techniques, and methodologies designed to speed application development

18



OUTSOURCING & ON-DEMAND COMPUTING

- Reasons for using outsourcing and on-demand computing approaches:
 - To reduce costs
 - To obtain state-of-the-art technology
 - To eliminate staffing and personnel problems
 - Increases technological flexibility

19



IMPORTANCE OF PLANNING

- The bigger the project:
 - The more likely that poor planning will lead to significant problems
- Important factor for systems development success:
 - Organizational experience with the systems development process
- Need to involve users and stakeholders
- Need to meet user needs within the budget and given time frame

20



PROJECT MANAGEMENT TOOLS

- Project schedule:
 - Detailed description of what is to be done
- Project milestone:
 - Completion dates of various parts in a project
- Project deadline:
 - Completion of the entire project
- Critical path:
 - Activities that cannot be delayed.
- Gantt chart
 - Graphical tool used for planning and monitoring.

21



SYSTEMS INVESTIGATION

- What primary problems might a new or enhanced system solve?
- What opportunities might a new or enhanced system provide?
- What new hardware, software, databases, telecommunications, personnel, or procedures will improve an existing system or are required in a new system?
- What are the potential costs (variable and fixed)?
- What are the associated risks?

22



FEASIBILITY ANALYSIS

- Technical feasibility
- Economic feasibility
- Legal feasibility
- Operational feasibility
- Schedule feasibility

23



SYSTEMS INVESTIGATION REPORT

- Summarizes results of systems investigation
- Summarizes the process of feasibility analysis
- Recommends a course of action:
 - Continue on into systems analysis
 - Modify the project in some manner
 - Drop the project
- Reviewed by steering committee

24



SYSTEMS ANALYSIS

- Overall emphasis of analysis:
 - Data Collection
 - Requirements Analysis
 - Considering alternatives
 - Investigating feasibility of solutions
- Primary outcome of systems analysis:
 - Prioritized list of systems requirements

25



SYSTEMS ANALYSIS REPORT

- Elements:
 - Strengths and weaknesses of existing system from a stakeholder's perspective
 - User/stakeholder requirements for new system
 - Organizational requirements for new system
 - Description of what new information system should do to solve the problem

26



SYSTEMS DESIGN

- Answers the question:
 - How will the information system solve a problem?
- Results in a technical design that:
 - Details system outputs, inputs, and user interfaces
 - Specifies hardware, software, databases, telecommunications, personnel, and procedures
 - Shows how these components are related

27



LOGICAL AND PHYSICAL DESIGN

- Logical design:
 - Functional requirements of the system
 - User interface
- Physical design:
 - Underlying structure of the system.
 - Users not really interested about the physical design aspects

28



SYSTEMS DESIGN

- Request for proposal (RFP):
 - Document that specifies required resources such as hardware and software in detail
- Evaluating and selecting a systems design:
 - Preliminary evaluation
 - Final evaluation
- Systems design report will form a base for Systems implementation

29



SYSTEMS IMPLEMENTATION

- Includes:
 - Hardware acquisition
 - Rent or buy or lease?
 - Software acquisition
 - Buy or build?
 - User preparation
 - Preparing all relevant people
 - Hiring and training of personnel
 - Recruitment of new staff
 - Site and data preparation
 - Installation, testing, start-up, and user acceptance

30



TESTING

- Forms of testing:
 - Unit testing
 - System testing
 - Volume testing
 - Integration testing
 - Acceptance testing

31



START UP

- Begins with the final tested information system
- Approaches:
 - Direct conversion (plunge, direct cutover)
 - Phase-in approach (piecemeal)
 - Pilot start-up
 - Parallel start-up

32



USER ACCEPTANCE

- Formal agreement signed by user that states that a phase of installation or the complete system is approved
- Legal document that removes or reduces IS vendor's liability

33



MAINTENANCE AND REVIEW

- Systems maintenance:
 - Check, manage and modify to meet user needs
- Final step of systems development
- Analyzes systems to make sure that they are operating as intended
- Can be performed during systems development

34





Principles of Information Systems and Data Management

Topic 06
Project Initiation

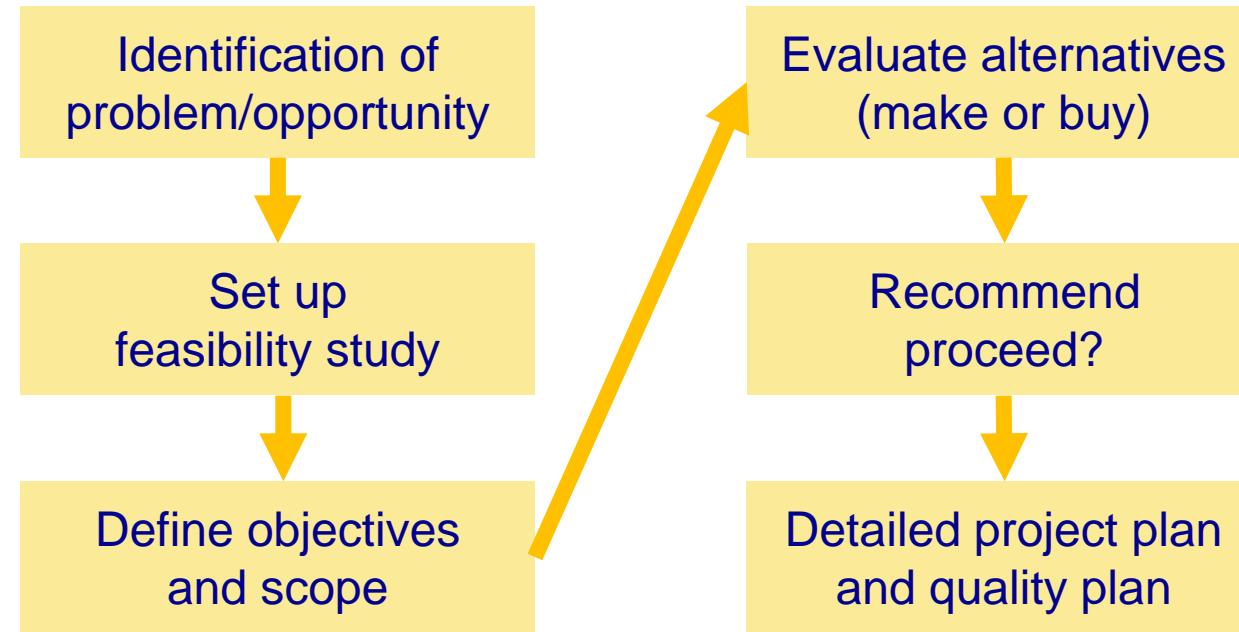
Learning Objectives

Upon successful completion of this topic, students should be able to:

- Explain how to create a simple information to solve a problem.
- List the reasons why an IS project is initiated.
- Describe the various parts of feasibility study.

Failure to achieve success in information systems development often occurs if the very first initiation phase of the project is poorly managed.

SEQUENCE OF MAIN ACTIVITIES INVOLVED WITH PROJECT INITIATION



What are the 10 reasons why an IS project might be initiated?

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. Improved internal information flows
4. Improved external information flows
5. Improved customer service
6. Legislation changes
7. Responsiveness
8. Reach
9. Control
10. Competitive advantage

REASONS WHY IS PROJECT IS INITIATED

1. Capability



2. Cost savings

3. Improved internal information flows

4. Improved external information flows

5. Improved customer service

6. Legislation changes

7. Responsiveness

8. Reach

9. Control

10. Competitive advantage

A new system can provide a new capability to achieve something that has not previously been possible

OR

can also be enhanced to improve an existing capability where capacity has become limited.

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. **Cost savings** 
3. Improved internal information flows
4. Improved external information flows
5. Improved customer service
6. Legislation changes
7. Responsiveness
8. Reach
9. Control
10. Competitive advantage

Cost reduction is often the key driver for the introduction of new systems.

Different aspects of quantifying cost are given in the section on cost–benefit analysis.

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. **Improved internal information flows** →
4. Improved external information flows
5. Improved customer service
6. Legislation changes
7. Responsiveness
8. Reach
9. Control
10. Competitive advantage

Well-established organisations with a long history of using computer-based information systems may have developed their software portfolio in a piecemeal manner over many years.

As a result, the installed legacy systems may not have the linkages necessary to facilitate efficient and effective communication within and between different functional areas of the organisation.

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. Improved internal information flows
4. **Improved external information flows**
5. Improved customer service
6. Legislation changes
7. Responsiveness
8. Reach
9. Control
10. Competitive advantage



In addition to an organisation's internal value chain, there is also the external value chain to consider and, in particular, the relationship between the organisation and its customers, suppliers and channel partners.

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. Improved internal information flows
4. Improved external information flows
5. **Improved customer service** 
6. Legislation changes
7. Responsiveness
8. Reach
9. Control
10. Competitive advantage

Customers are also more likely to respond favourably to an organisation when they have confidence in the accuracy of the information held about them and their business transactions.

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. Improved internal information flows
4. Improved external information flows
5. Improved customer service
6. **Legislation changes**
7. Responsiveness
8. Reach
9. Control
10. Competitive advantage



These are a fact of life for all organisations and provide one of those 'must-do' situations where legislative requirements must be complied with.

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. Improved internal information flows
4. Improved external information flows
5. Improved customer service
6. Legislation changes
7. **Responsiveness**
8. Reach
9. Control
10. Competitive advantage



Organisations are increasingly competing on the basis of the speed for responding to the changing internal and external business environment. This means that an organisation's portfolio of information systems also enjoy a sufficiently flexible hardware and software infrastructure so that enhancements and improvements can easily be incorporated into the organisation's IS portfolio.

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. Improved internal information flows
4. Improved external information flows
5. Improved customer service
6. Legislation changes
7. Responsiveness
8. **Reach** —————→
9. Control
10. Competitive advantage

This factor recognises that potential customers and suppliers can exist anywhere in the world. Therefore, by using Internet and extranet technologies, it is possible to extend an organisation's value chain such that it can broaden its range of possible suppliers (thus potentially reducing costs) and also its customer base (thus increasing revenues).

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. Improved internal information flows
4. Improved external information flows
5. Improved customer service
6. Legislation changes
7. Responsiveness
8. Reach
9. **Control** —————→
10. Competitive advantage

Control can be improved through better information delivery for managers.

REASONS WHY IS PROJECT IS INITIATED

1. Capability
2. Cost savings
3. Improved internal information flows
4. Improved external information flows
5. Improved customer service
6. Legislation changes
7. Responsiveness
8. Reach
9. Control
10. Competitive advantage

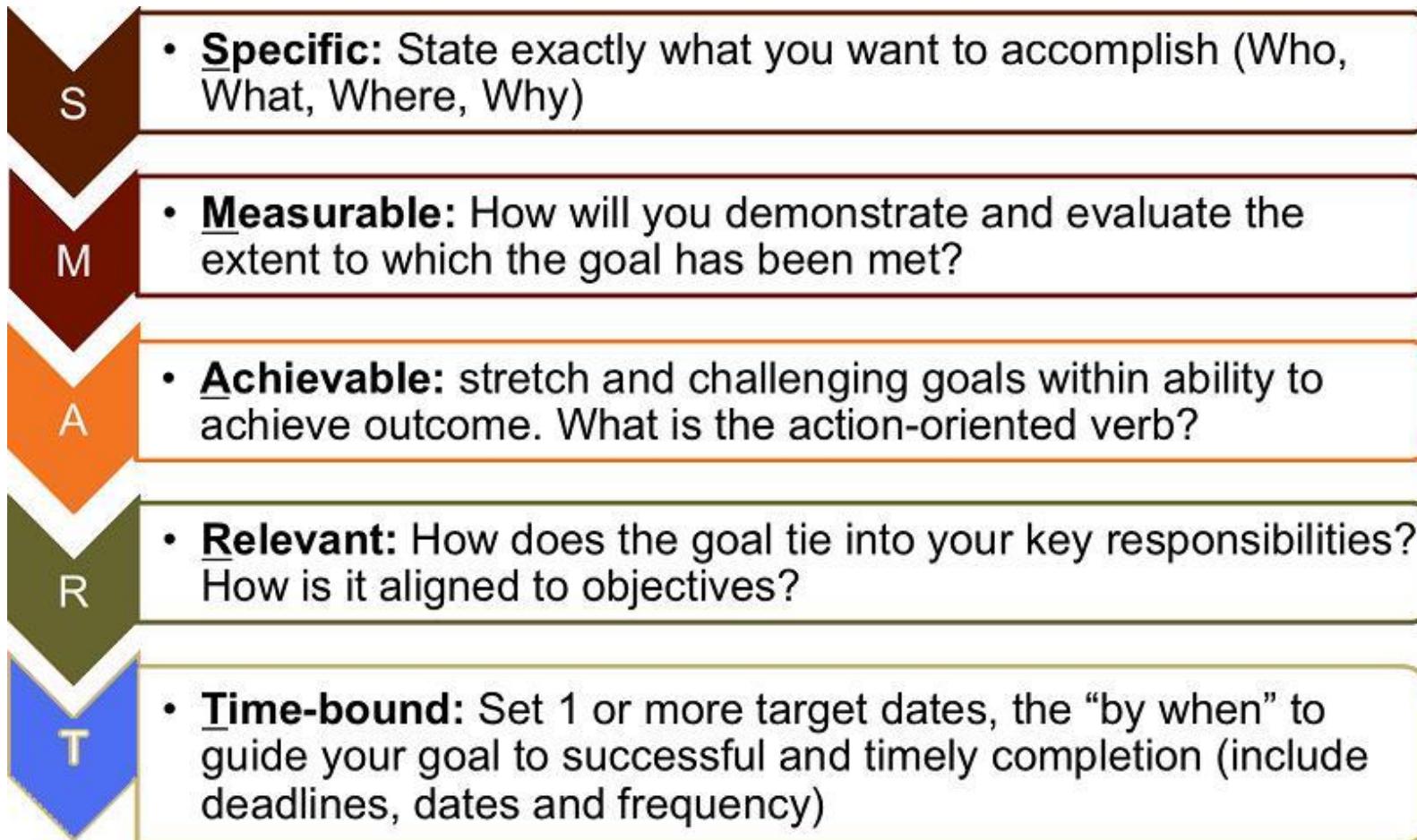
If information systems can give a company an edge over its rivals through the benefits above, a competitive advantage may be achieved.

What are the different parts of a feasibility study used to review each of the possible solutions that have been proposed?

CATEGORIES OF FEASIBILITY STUDY

Feasibility Type	Scope	Question Answered	Technique used to Control
Organisational	Alignment of the system with organisational needs. Impact of system on organisational practice	Will the system meet the business's needs and help improve its performance?	Critical success factors and key performance indicators Change management
Economic	Evaluation of the relative costs and benefits of the new system	Will the costs outweigh the benefits?	Cost–benefit analysis Return-on-investment and payback calculations
Technical	Evaluation of possible technical problems and their solutions	Will the system work efficiently?	Risk analysis Capacity planning Performance and availability modelling
Operational	Evaluation of likely response to system by its users and management	Will the system be accepted by end-users into their day-to-day work?	Risk analysis Change management Usability analysis

ESTABLISHING OBJECTIVES FOR SYSTEMS DEVELOPMENT



SMART EXAMPLES

Broad Goal: I want to become a well-known expert.

- Specific: I will become a well-known expert on the topic of small business accounting.
- Measurable: I will be successful if I am asked to speak publicly on the topic at least once a month, receive interview requests every week and write one article per month for a top industry publication.
- Attainable: I will accomplish this by acquiring the services of a PR/publicity firm and launching a publicity campaign.
- Relevant: Establishing myself as a small business accounting expert will reinforce my 20+ years of experience in the field and allow me to reach more small business owners who need accounting advice.
- Time-Based: I want to be considered a small business accounting expert in two years.

SMART Examples

Broad Goal: I want to start a business.

- Specific: I will sell handmade cards through Etsy.com.
- Measurable: I will be ready to take my first Etsy order within four weeks, and I will aim to sell a minimum of five cards per week.
- Attainable: I will get set up on Etsy first. Then, I will build an inventory of 30 handmade cards to sell. Finally, I will promote my business and build customer relationships through word of mouth, referrals and local networking.
- Relevant: Selling handmade cards will allow me to benefit financially from my favorite hobby.
- Time-Based: My Etsy store will be up and running within four weeks, and I will have an inventory of 30 cards to sell within six weeks.

ACTIVITY QUESTION

Use the SMART way to write objectives for implementing a systems to prevent **virus infection into networks**

- S – What you want to accomplish Goal?
- M – How will you be able to measure this?
- A – What action is required to achieve this?
- R – How does this goal align to the main objective?
- T – Set target date to achieve this



Principles of Information Systems and Data Management

Topic 07
Systems Analysis

Learning Objectives

Upon successful completion of this topic, students should be able to:

- Describe the various methods of collecting data.
- Describe Requirement Specification.

**What is involved in the
process of Systems Analysis?**

3



**Fact finding + Documentation
= System Analysis**

4



Fact finding + Documentation = System Analysis

Systems analysis involves the investigation of the business and user requirements of an information system.

5



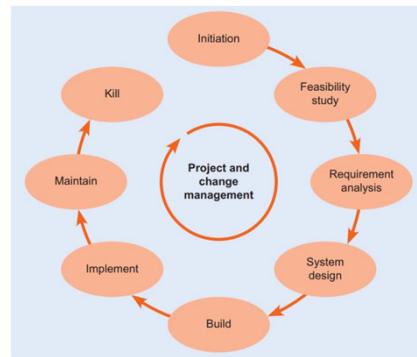
FACTORS INFLUENCING USE OF FACT-FINDING TECHNIQUES & DOCUMENTATION TOOLS

- The result of the 'make-or-buy decision'
- Application complexity
- User versus Corporate development

6



Any errors in systems development that occur during the analysis phase will cost far more to correct than errors that occur in subsequent stages. It is therefore essential that maximum thought and effort be put into the analysis process if unanticipated costs are not to arise in the later stages of development.



7

KAPLAN

IDENTIFYING BUSINESS/USER REQUIREMENTS

- The requirements determination stage is executed for the purpose of expanding the system request's high-level statement of business necessities into an accurate list.
- This comprehensive list of all the necessities will be used for other activities as an input in the analysis phase.
- It can be used for making use cases, creating process models, and it can be also used for creating data models

8

KAPLAN

WHAT IS A REQUIREMENT?

In simple terms, a requirement is a statement which explains how the system must perform or what features it should have.

9



FUNCTIONAL REQUIREMENT

A functional requirement contains the procedure the system has to execute or the information it has to have.

Example for a process directed functional requirements that a system should have is the capability to search for available record.

The functional requirements move into the next stage which is the analysis phase, because they specify the characteristics that the system has to contain.

10



FUNCTIONAL REQUIREMENT

Functional Requirement	Description	Examples
Process-oriented	A process the system must perform; a process the system must do	<ul style="list-style-type: none"> ■ The system must allow registered customers to review their own order history for the past three years. ■ The system must check incoming customer orders for inventory availability. ■ The system should allow students to view a course schedule while registering for classes.
Information-oriented	Information the system must contain	<ul style="list-style-type: none"> ■ The system must retain customer order history for three years. ■ The system must include real-time inventory levels at all warehouses. ■ The system must include budgeted and actual sales and expense amounts for current year and three previous years.

11



NON-FUNCTIONAL REQUIREMENT

- A non-functional requirement denotes the behavioural features the system should have, like usability and performance.
- For example, accessing the system through a web browser can be considered as a non-functional requirement.
- Non-functional requirements can indirectly influence the rest of the analysis process.
- In the design stage non-functional requirements are used to make decisions regarding the hardware and software requirements, deciding on the user interface and the system's basic architecture.

12



NON-FUNCTIONAL REQUIREMENT

Nonfunctional Requirement	Description	Examples
Operational	The physical and technical environments in which the system will operate	<ul style="list-style-type: none"> ■ The system can run on handheld devices. ■ The system should be able to integrate with the existing inventory system. ■ The system should be able to work on any Web browser.
Performance	The speed, capacity, and reliability of the system	<ul style="list-style-type: none"> ■ Any interaction between the user and the system should not exceed 2 seconds. ■ The system downloads new status parameters within 5 minutes of a change. ■ The system should be available for use 24 hours per day, 365 days per year. ■ The system supports 300 simultaneous users from 9-11 A.M., 150 simultaneous users at all other times. ■ Only direct managers can see personnel records of staff. ■ Customers can see their order history only during business hours. ■ The system includes all available safeguards from viruses, worms, Trojan horses, etc.
Security	Who has authorized access to the system under what circumstances	<ul style="list-style-type: none"> ■ The system should be able to distinguish between U.S. currency and currency from other nations. ■ Company policy is to buy computers only from Dell. ■ Country managers are permitted to authorize custom user interfaces within their units. ■ Personal information is protected in compliance with the Data Protection Act.
Cultural and Political	Cultural and political factors and legal requirements that affect the system	

Source: The Atlantic Systems Guild, <http://www.systemsguild.com>

13



REQUIREMENTS DEFINITION

- The requirements definition is a simple list of all the functional and non-functional requirements in an outline format.
- For example, (next slide) depicts all the requirements sample for a recreational vehicle dealership.
- If you notice all the requirements are numbered in an outline format to ensure that all the requirements are easily and clearly identifiable.

14



REQUIREMENTS DEFINITION

Functional Requirements

1. New Vehicle Management

- 1.1 The system will allow managers to view the current new vehicle inventory.
- 1.2 The system will allow the new vehicle manager to place orders for new vehicles.
- 1.3 The system will record the addition of new vehicles to inventory when they are received from the manufacturers.

2. Vehicle Sales Management

- 2.1 The system will enable salespersons to create a customer offer.
- 2.2 The system will allow salespeople to know whether an offer is pending on a specific vehicle.
- 2.3 The system will enable managers to record approval of a customer offer.
- 2.4 The system will prepare a sales contract.
- 2.5 The system will prepare a shop work order based on customer requested dealer options.
- 2.6 The system will record a customer deposit.
- 2.7 The system will record a customer payment.
- 2.8 The system will create a record of the customer's vehicle purchase.

3. Used Vehicle Management

- 3.1 The system will record information on a customer trade-in vehicle ... etc.

15



REQUIREMENTS DEFINITION

Nonfunctional Requirements

1. Operational

- 1.1 The system should run on tablet PCs to be used by salespeople.
- 1.2 The system should interface with the shop management system.
- 1.3 The system should connect to printers wirelessly.

2. Performance

- 2.1 The system should support a sales staff of 15 salespeople.
- 2.2 The system should be updated with pending offers on vehicles every 15 minutes.

3. Security

- 3.1 No salesperson can access any other salesperson's customer contacts.
- 3.2 Only the owner and sales manager may approve customer offers.
- 3.3 Use of each tablet PC should be restricted to the salesperson to whom it is assigned.

4. Cultural and Political

- 4.1 Company policy says that all computer equipment is purchased from Dell.
- 4.2 Customer personal information is protected in compliance with the Data Protection Act.
- 4.3 The system will conform to the state's "lemon law."

16



DETERMINING REQUIREMENTS

- To determine the requirements for the requirements definition both the business and information technology viewpoints are required.
- Systems analysts may sometimes fail to comprehend the actual needs of the clients.
- A study conducted by the Standish Group found that when the user does not involve in the process it becomes the main reason for the information technology project to fail.
- On the other hand, the business users can be unaware of the various benefits that the new technology can provide and may simply use the current, ineffective processes.

17



CREATING THE REQUIREMENTS DEFINITION

Making the requirements definition is considered to be an ongoing process through which the analyst collects the required information by using certain techniques such as interviews, document analysis etc.

18



3-STEP PROCESS INVOLVED IN ANALYSIS

- Understand the present situation (the as-is system).
- Recognize the required improvements.
- List the requirements needed for the new system (the to-be system).

19



REQUIREMENTS – GATHERING TECHNIQUES

- An analyst is like a detective he /she understands that a problem exists hence he/she must look for solutions. However, looking for solutions can be very tricky. The analyst uses many techniques to look for solutions.
- A good analyst always will collect requirements by using various methods to ensure that the existing business processes and the needs for the new system are properly understood.
- It is considered a good practice to fully understand all the requirements so that errors can be avoided because errors which are found later on in the SDLC can create a lot of problems.

20



CHALLENGES IN CONDUCTING FACT-FINDING EXERCISE

1. When the end users are unable to list out the exact requirements.
2. When the users fail to comprehend or are completely unaware of the benefits that can be got with the help of the new information system.
3. When the many users interpret the software requirements differently.
4. Existing biases among the users based on attitudes, the environment and the personality can hinder in listing out the actual business requirements.
5. Sometimes the requirements can overlap organizational limits.
6. Information requirements can be complex and can vary hence making it difficult to create a requirement list that can be examined.
7. Communication gaps and miscommunication that can exist between the different users makes it difficult to define the requirements.

21



REQUIREMENTS GATHERING: FACT-FINDING METHODS

- Interview
- Questionaries
- Document Review
- Observation
- Brainstorming

22



INTERVIEW

Structured interviews are used for gathering information regarding the existing system and the expectations of the users from the new system.

The success of this method depends on careful planning, conducting the interview in the right way and recording vital information appropriately

23



QUESTIONNAIRE

- A questionnaire is a list of set questions which are used to elicit response from the end users to collect information regarding the user requirements or the existing system.
- They usually have open-ended questions and closed ended questions. However, they are open to misinterpretation if they are not correctly designed.
- Questionnaires are very useful when used along with other methods to corroborate the various information received through different methods. It can also provide areas to investigate further.

24



DOCUMENT REVIEW

This method involves examining the existing systems documents, guides, requirements specifications etc.

This method will help gathering information which has been missed out during interviews or questionnaires.

25



OBSERVATION

- The method is very useful in recognising inefficiencies in the existing method of working.
- It involves observing various aspects of the operations.
- It is a time-consuming process.
- If the person who is conducting the observation is not properly trained then there are chances of vital information being missed out.

26



BRAINSTORMING

In this method interaction within a group is initiated to generate new and creative ideas to find solutions for the existing problem. It is an unstructured method.

If the users participate actively in this method then an accurate view of the existing business process can be achieved.

However, if the person conducting the session is not trained appropriately it can lead to chaos because of poor planning and control and structure.



Principles of Information Systems and Data Management

Topic 08
Systems Design

Learning Objectives

Upon successful completion of this topic, students should be able to:

- Describe the difference between analysis and design stage.
- List what defines a good-quality information system.
- Describe the system architecture for a workflow processing system.
- Explain why Client/Server model is popular.

The design phase of information systems development involves producing a specification or ‘blueprint’ of how the system will work.

This forms the input specification for the final stage of building the system by programmers and database administrators.

The design phase is also closely linked to the previous analysis phase, since the users' requirements directly determine the characteristics of the system to be designed.

3



SYSTEMS DESIGN

The systems design is given in a design specification defining the best structure for the application and the best methods of data input, output and user interaction via the user interface.

The design specification is based on the requirements collected at the analysis stage.

4



What are the various factors that are considered vital for the end-users to be satisfied with the new system?

5



VITAL FACTORS FOR END-USERS TO BE SATISFIED WITH NEW SYSTEM

- The new system should be user friendly.
- The new system should provide the appropriate functions for the end-users.
- The new system should function at a rapid speed, retrieving the requested data and shifting between many screen views.
- The new system should be reliable.
- The new system should be secure.
- The new system should be function in an integrated manner with the other systems.

6



USE CASE

- A formal way of signifying how the new system interacts with the environment is called as a use case.
- The use case describes the various activities that the user can perform on the new system.
- A use case modelling is an external or a functional view of the business process. It will illustrate how the users will view the process rather than the internal methods on which the process and supporting mechanisms function.

7



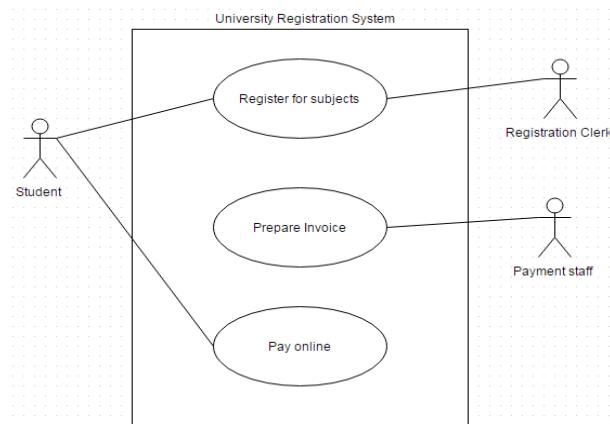
ELEMENTS OF A USE CASE

- Basic information
- Input and output
- Details

8



EXAMPLE OF USE CASE DIAGRAM



9

KAPLAN

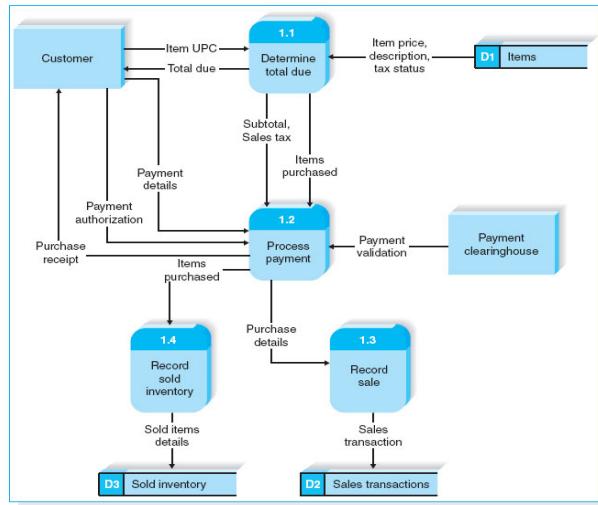
PROCESS MODELING

- A process model illustrates the business processes which include all the activities that the users will do.
- Process models can be developed either for an already existing system or for an entirely new system. One of the most common process modelling method is the data flow diagramming (DFD).

10

KAPLAN

DATA FLOW DIAGRAM: EXAMPLE



11

KAPLAN

ENTITY RELATIONSHIP DIAGRAM (ERD)

An entity relationship diagram (ERD) is a diagram which illustrates the relationship of the entity sets that has been stored in a database.

It demonstrates the information that is created, stored, and used by a business system.

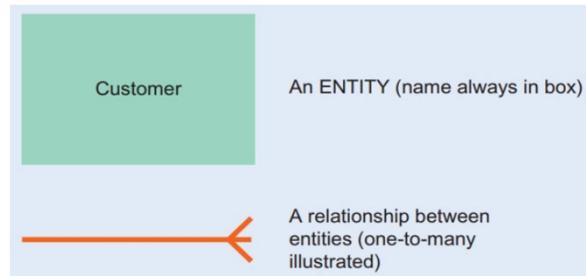
An analyst can examine the ERD to understand how the various individual bits of information have been arranged and how they relate to each other in a system.

12

KAPLAN

ENTITY RELATIONSHIP DIAGRAM (ERD)

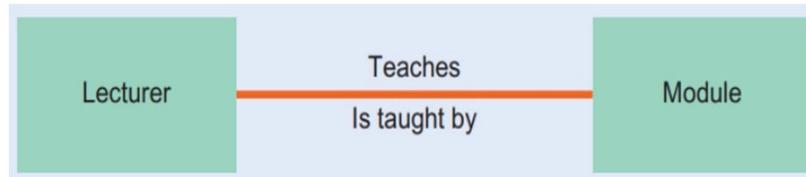
In an ERD all the information which are similar are listed together and kept in boxes called entities.



13

KAPLAN

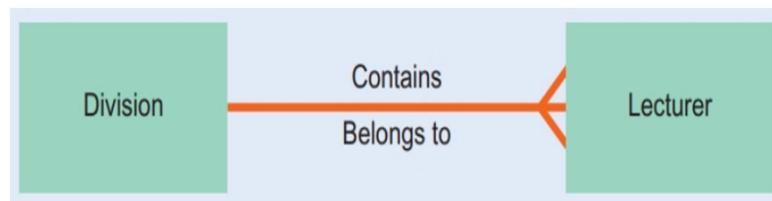
ONE-TO-ONE RELATIONSHIP



14

KAPLAN

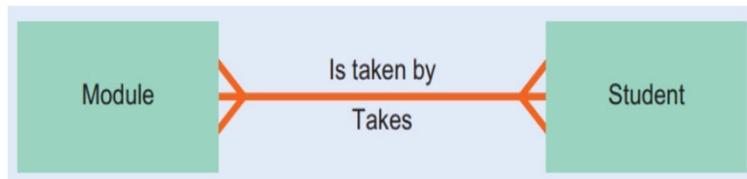
ONE-TO-MANY RELATIONSHIP



15

KAPLAN

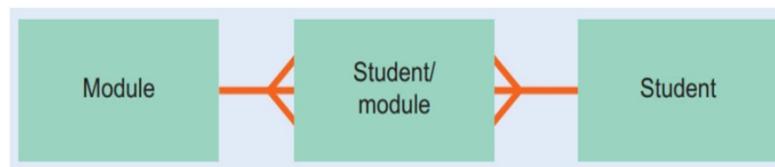
MANY-TO-MANY RELATIONSHIP



16

KAPLAN

MANY-TO-MANY RELATIONSHIP DECOMPOSED INTO 2 ONE-TO-MANY RELATIONSHIP



17

KAPLAN

SYSTEMS OR OUTLINE DESIGN

Client/Server Model of Computing

When designing an information system for the client/server architecture, the designer has to decide how to divide tasks between the server and the client.

- Data storage
- Query processing
- Display
- Application logic including the business rules

18

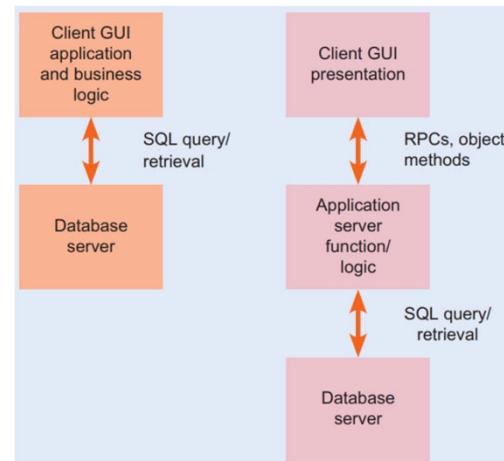
KAPLAN

SYSTEMS OR OUTLINE DESIGN

Client/Server Model of Computing

Client/server design generally follows just two main approaches

- Two-tier
- Three-tier



What is Structured English?

STRUCTURED ENGLISH

- Structured English is a method used for creating the different design requirements for programmers.
- This specifies how the various individual modules or groups of modules have to be implemented.
- This technique is more precise and specific when compared to flowcharts. This method uses key words to explain the structure of the program. ‘Pseudocode and ‘program design language’ are the two other terms which are used for Structured English.

21



STRUCTURED ENGLISH

This example moves through each record of a database table totalling all employees' salaries. (Note that this could be accomplished more quickly using an SQL statement.)

```

DO WHILE NOT end of table
  IF hoursworked> basicrhours
    SET pay = (hours*basicrrate) + (overtimehours*overtimerrate)
  ELSE
    SET pay = (hours*basicrrate)
  END if
  SET totalrpay = totalrpay + pay
  move to next record
ENDDO

```

22



SECURITY DESIGN

Data security is a key design issue, particularly for information systems that contain confidential company information which is accessed across a wide-area network or the Internet.

There are four main attributes of security which must be achieved through design:

1. Authentication
2. Authorisation
3. Privacy
4. Data Integrity

23



SECURITY DESIGN

Data security is a key design issue, particularly for information systems that contain confidential company information which is accessed across a wide-area network or the Internet.

There are four main attributes of security which must be achieved through design:

1. Authentication
2. Authorisation
3. Privacy
4. Data Integrity

Ensures that the sender of the message, or the person trying to access the system, is who they claim to be.

Passwords are one way of providing authentication but are open to abuse – users often tend to swap them. Digital certificates and digital signatures offer a higher level of security

24



SECURITY DESIGN

Data security is a key design issue, particularly for information systems that contain confidential company information which is accessed across a wide-area network or the Internet.

There are four main attributes of security which must be achieved through design:

1. Authentication
2. Authorisation
3. Privacy
4. Data Integrity

Checks that users have the right permissions to access the information that they are seeking.

This ensures that only senior personnel managers can access salary figures, for example.

25

KAPLAN

SECURITY DESIGN

Data security is a key design issue, particularly for information systems that contain confidential company information which is accessed across a wide-area network or the Internet.

There are four main attributes of security which must be achieved through design:

1. Authentication
2. Authorisation
3. Privacy
4. Data Integrity

Scrambling or encryption of messages so that they cannot easily be decrypted if they are intercepted during transmission.

Credit card numbers sent over the Internet are encrypted in this way.

26

KAPLAN

SECURITY DESIGN

Data security is a key design issue, particularly for information systems that contain confidential company information which is accessed across a wide-area network or the Internet.

There are four main attributes of security which must be achieved through design:

1. Authentication
2. Authorisation
3. Privacy
4. Data Integrity



Ensure that the message sent is the same as the one received and that corruption has not occurred.

A security system can use a checksum digit to ensure that this is the case and the data packet has not been modified.



Principles of Information Systems and Data Management

Topic 09

Systems Testing and Implementation

Learning Objectives

Upon successful completion of this topic, students should be able to:

- Describe what systems development is.
- State the purpose of the build phase and its difference from changeover to implementation.
- Identify the appropriate testing method required for a system.

**System build occurs after the system
has been designed.**

**System implementation follows the
build stage.**

3



SYSTEM BUILD & IMPLEMENTATION

- In terms of time and cost, developing a system's software is considered as the main part of any systems development project.
- This component is the best comprehended and also faces less problems when compared to all the other aspects of the SDLC.
- The systems analyst will not do the actual programming hence these notes will only look at managing the programming process.

4



SYSTEM BUILD & IMPLEMENTATION

- There are various tools meant for systems development that are available to programmers and business users that aid in writing software
 - Microsoft Visual Studio
 - Visual Basic
 - Visual C++

5



ASSIGNING PROGRAMMING TASKS

- During the process of project planning the project manager first, recognises the number of people that are required and the level of skill that is needed for building the new system.
- Next, the project manager has to allocate the different program modules to his chosen team members who will be involved in building the new system
- The project manager should ensure that each programming module has to be unique and distinct from the other modules
- All the related modules are grouped together and then allocated by the project manager to all the team members depending on their skill levels and experience.

6



SOFTWARE TESTING

Programming is always considered as a fun and creative task. Less experience programmers usually get carried away in developing and testing of the programs by themselves and often do not tend to focus on testing and documenting the work.

This is the case because documentation is a very tedious processes and not an exciting task hence these tasks receive very less attention than programming.

7



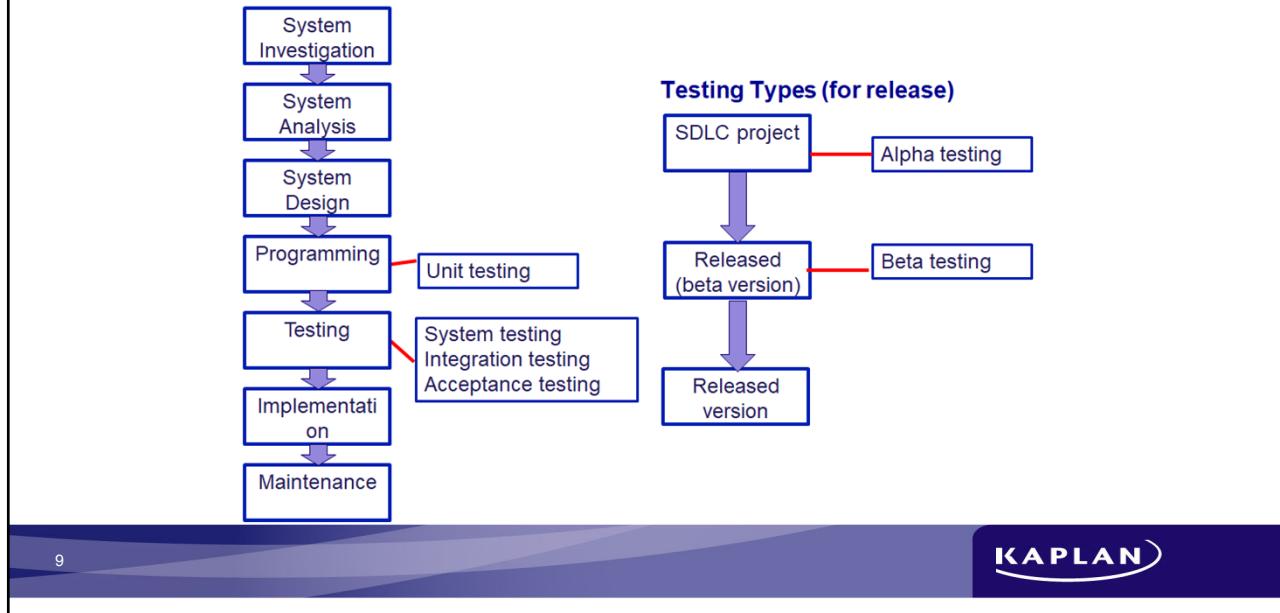
TEST PLANNING

- The process of testing begins with the testing group developing a 'test plan' which explains all the testes which will be executed.

8



TESTING LEVELS IN SDLC PROJECT



STAGES IN TESTING

- Unit Testing
- Integration Testing
- System Testing
- Acceptance Testing

10

KAPLAN

UNIT TESTING

Unit testing involves focusing on only one unit, an individual program or an individual program module which execute specific tasks which can be tested.

The main aim of this type is to make sure that the unit, program or the module performs according to the specifications of the program.

11



INTEGRATION TESTING

This testing involves assessing whether a group of modules or programs that are supposed to function together are they functioning as expected and to check if they have any errors.

This testing checks if the interface and the links between various parts are functioning appropriately. Integration testing focuses on data exchanges taking place and on the flow of control between the modules

12



SYSTEM TESTING

This test is conducted by a systems analyst to check whether all the modules and programs are working together as expected without any errors.

This testing is quite similar to integration testing however it has a much larger scope.

System testing checks whether the new system meets all the requirements of the business.

It also checks the systems security, usability and performance. System's documentation is also tested.

13



ACCEPTANCE TESTING

- Acceptance tests are usually conducted by the end users with assistance from the team members involved in the project.
- The aim of the acceptance test is to confirm whether the new system meets the user requirements and functions properly without any glitches.

14



SOFTWARE TEST PLAN

Software test plan: A document describing the scope, approach, resources and schedule of intended test activities for a particular software.

Some contents of the test plan:

- Test Items
- Features To Be Tested
- Features Not To Be Tested
- Approach
- Pass / Fail Criteria
- Test Deliverables

15



TEST CASES

Name	TC-47 Verify that lowercase data entry results in lowercase insert
Requirement	FR-4 (Case sensitivity in search-and-replace), bullet 2
Precondition	The test document TESTDOC.DOC is loaded (base state BS-12)
Steps	<ol style="list-style-type: none"> 1. Click on the "Search and Replace" button. 2. Click in the "Search Term" field 3. Enter This is the Search Term. 4. Click in the "Replacement Text" field. 5. Enter This is THE Replacement TeRm. 6. Verify that the "Case Sensitivity" checkbox is unchecked. 7. Click the OK button.
Expected Results	<ol style="list-style-type: none"> 1. The search-and-replace window is dismissed. 2. Verify that in line 38 of the document, the text This is the Search Term has replaced by This is THE Replacement TeRm. 3. Return to base state BS-12.
Pass / Fail	

16



SYSTEM BUILD AND IMPLEMENTATION

Documentation

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications
- Quality Assurance Documents

17

KAPLAN

SYSTEM BUILD AND IMPLEMENTATION

Documentation

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications
- Quality Assurance Documents

Used in the **user acceptance test** to check that the correct features have been implemented

18

KAPLAN

SYSTEM BUILD AND IMPLEMENTATION

Documentation

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications
- Quality Assurance Documents

Used during testing and operational use of the system by business users

19

KAPLAN

SYSTEM BUILD AND IMPLEMENTATION

Documentation

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications
- Quality Assurance Documents

Used during system testing and during maintenance by developers

20

KAPLAN

SYSTEM BUILD AND IMPLEMENTATION

Documentation

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications
- Quality Assurance Documents

Used in module testing
and during
maintenance

21

KAPLAN

SYSTEM BUILD AND IMPLEMENTATION

Documentation

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications
- Quality Assurance Documents

Used in testing and
maintenance by
database
administrators and
developers

22

KAPLAN

SYSTEM BUILD AND IMPLEMENTATION

Documentation

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications →
- Quality Assurance Documents

Used as part of
developer and user
testing

23

KAPLAN

SYSTEM BUILD AND IMPLEMENTATION

Documentation

- Requirement Specification
- User Manual
- Design Specification
- Detailed Design
- Data Dictionary or Database Design
- Detailed Test Plans and Test Specifications
- Quality Assurance Documents →

E.g. software change
request forms

Used to manage the
change during the build
and implementation
phases

24

KAPLAN

The writing of documentation is often neglected, since it tends to be less interesting than developing the software.

To ensure that it is produced, strong project management is necessary and the presence of a software quality plan will make sure that time is spent on documentation.

25



MAINTENANCE

The process of upgrading and improving the system to ensure the system continues to meet the requirements of the organization is called as system maintenance.

A considerable amount of money is invested by organizations to system maintenance because a system continues to evolve as it is continuously being used.

Most of the time novice system analysts and programmers start working in system maintenance until they have gained considerable experience that will allow them to develop new projects by themselves

26



MAINTENANCE

Post-Implementation Review

A post-implementation review occurs several months after the system has gone live. Its purpose is to assess the success of the new system and decide on any necessary corrective action.

- faults and suggested enhancements with agreement on which need to be implemented in a future release;
- success of system in meeting its budget and timescale targets;
- success of system in meeting its business requirements – has it delivered the anticipated benefits described in the feasibility study?
- development practices that worked well and poorly during the project.

27



CONFIGURATION MANAGEMENT

During the build phase, updated software versions will become more suitable for release as new functions are incorporated and the number of bugs is reduced.

Alpha | Beta | Gold

28



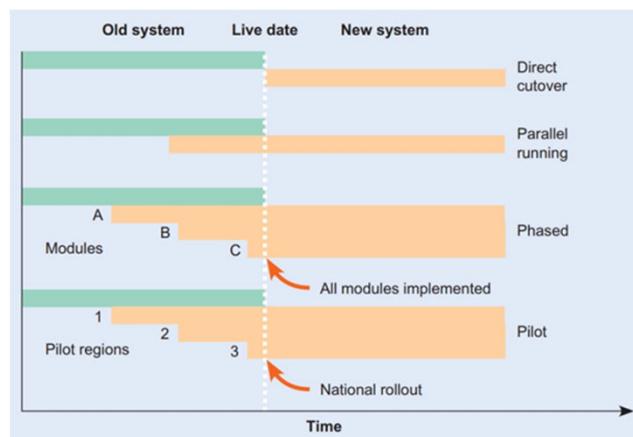
Alpha | Beta | Gold

- Alpha releases are preliminary versions of the software released early in the build phase (consist of majority of the functionality of the complete system, but may suffer from extensive bugs).
- Alpha testing is usually conducted by staff inside the organization developing the software or by favoured customers.
- Beta releases occur after alpha testing and have almost complete functionality and relatively few bugs.
- Beta testing will be conducted by a range of customers who are interested in evaluating the new software. The aim of beta testing is to identify bugs in the software before it is shipped to all customers.
- Gold releases is the final release of the software which will be shipped to all customers.

29

KAPLAN

ALTERNATIVE CHANGEOVER METHODS FOR SYSTEM IMPLEMENTATION



30

KAPLAN

ALTERNATIVE CHANGEOVER METHODS FOR SYSTEM IMPLEMENTATION

Method	Main advantages	Main disadvantages
Immediate cutover	Rapid, lowest cost	High risk if serious errors in system
Parallel running	Lower risk than immediate cutover	Slower and higher-cost than immediate cutover
Phased implementation	Good compromise between immediate cutover and parallel running	Difficult to achieve technically due to interdependencies between modules
Pilot system	Essential for multinational or national rollouts	Has to be used in combination with the other methods

31



MAKING THE TRANSITION TO THE NEW SYSTEM

- Using a computer system in many ways is very much like driving on a mud road. As time progresses the mud road starts developing pot holes in the most used parts of the road.
- Even though these pot holes show where it is safe to drive to avoid the pot holes, changing them is difficult.
- In the same way as people start using the computer system or different work processes those systems and processes become habits and people become comfortable with it.
- These habits which people have become comfortable with start to limit people's activities which leads to resisting change because they see their jobs in terms of these processes rather than in terms of the final goal of serving the customers.

32



THE MIGRATION PLAN

The various business, technical and people problems have to be addressed to ensure that the old business processes and computer programs transitions smoothly and successfully to the new business processes and computer programs.

The migration plan contains the plans and procedures that will govern and guide the smooth transition.

The plan also describes which activities will be performed, by whom and when the transition will be made from the old system to the new.

33



PREPARING A BUSINESS CONTINGENCY PLAN

- It is extremely tempting to believe that by performing careful and comprehensive work in the analysis and design phase and by managing the project appropriately will lead to a smooth and successful implementation of the new system.
- It is not uncommon for the project team members to be optimistic about their success.
- However, it is best to expect the worst from a new system. Business contingency planning involves the process of limiting minor glitches in technology turning into full fledged disaster.
- Contingency planning aids organisations to endure small problems in the new system without facing major disruptions in the organisation.

34





Principles of Information Systems and Data Management

Topic 10
IS Security

Learning Objectives

Upon successful completion of this topic, students should be able to:

- Describe the categories of threats faced by organisational information systems.
- Describe the major approaches that can be adopted to ensure the integrity of an information system.
- Describe the major categories of controls that can be applied to information systems.
- Describe the type of threats related to Internet Services.

IS SECURITY

- Information is considered as a very vital and valuable business asset and this concept has always been emphasized.
- The task of make sure that the organizational information stays secure is a very important task and should not be taken lightly.

3



TWO FUNDAMENTAL PRINCIPLES ON CONTROLS OF INFORMATION SYSTEMS

- To ensure that the data that the organization holds is accurate.
- To ensure that the data is protected from damage or loss.

4



PERSONAL DATA IN THE INFORMATION AGE

- In the information age, it's not only the individual people who are being targeted but also organizational data is under serious threat constantly.
- An example for organizational data breach is, the Singapore's Ministry of Defence was breached in the year 2017 and sensitive data such as NRIC, date of birth, mobile numbers of eight hundred and fifty servicemen were stolen.

5



CONSEQUENCES OF DATA BREACHES

- Customers trust will be lost
- Vital data will be lost
- Data breaches leads to identity theft which inadvertently leads to identity frauds
- It causes a lot of financial losses

6



THREATS

A threat is defined as a potential risk of an asset's loss of value (Mattord and Whitman, 2016).

Common types of threats:

- Natural threats
- Threats from others
- Threats from yourself

7



NATURAL THREATS

- Data can be completely destroyed or damaged due to natural threats like accidents and natural disasters. For example, earthquakes and fire accidents.
- Natural threats can destroy and wipe out large amounts of data.
- Floods and fires can destroy a lot of important personal data and damage memory cards which leads to huge loss to the owner of the data.

8



THREATS FROM YOURSELF

- Threats can arise from our own carelessness by not being alert and not taking security precautions.
- Hackers can easily get information from people by using social engineering method. In this method people are manipulated using social skills to give out their important information.
- For example, in the ‘white hat’ video the hacker asks for help from the information technology helpdesk by asking them to click on a link, when the link is clicked it will allow the hacker to gain access into the organization’s network which lead to data theft.
- Leaving our belongings unattended makes it easy for people to rob information

9



THREATS FROM OTHERS

- Some people can create elaborate plans to con other unsuspecting individuals.
- Hackers are capable of placing very innocent looking advertisements which contain malicious hyperlinks to lure people into clicking them.
- When the unsuspecting individual clicks on the link, viruses, malware and Trojans will be introduced into the computer which can crash the system.

10



ELEMENTS OF DATA SECURITY

- Being free from damage or harm is defined as security.
- Security, from the technological view point, comprises of securing all vital data and all the infrastructure which house the vital data from unauthorised access and misuse.
- The main aim of security in technology involves protecting all the laptops, computers, computer networks, other devices linked to the network and the data stored on the network.
- Security is a very important issue for anyone who chooses to accesses the internet and it should not be taken lightly.

11



CONFIDENTIALITY

- Maintaining data confidentiality is very important and this can be achieved by allowing only authorised people from accessing the data.

12



DATA INTEGRITY

- Maintaining data integrity is very important, this means the data should be accurate and complete.

13



AUTHENTICITY

Maintaining data authenticity is very important, this means the data should not be tampered with in any way.

14



AVAILABILITY

Data must be available to authorized users. This means that if the user is authorized, he or she must have full access to the data.

15



NON-REPUDIATION

Non-repudiation is the assurance that both parties involved in a digital transaction cannot deny that they did not make that transaction.

16



DATA SECURITY ATTACKS

Data security is extremely important for organizations and business which rely on technology for their day-to-day functioning and various transactions.

17



DATA BREACHES AND ISSUES

- Monetary loss
- Loss of customer trust
- Loss of important data
- Computer resources can be misused
- Identity theft which leads to identity fraud

18



IMPLEMENTING DATA SECURITY

The most effective method to limit data breaches is by implementing robust security practices for devices.

Steps to secure devices are as follows:

- By taking appropriate precautionary measures to secure the devices.
- By ensuring regular maintenance of the infrastructure.
- By taking appropriate measure when the data has been breached.

19



PRECAUTIONARY MEASURES

- Installation and maintenance of antivirus
- Installation and maintenance of a firewall
- User accounts can be secured by ensuring the passwords are strong
- Ensuring that any downloading that happens should be from a trusted source
- Devices should be scanned regularly for viruses.
- Regularly updating the devices

20



SYSTEM MAINTENANCE MEASURES

- Vital data should always have backup copies
- Making sure that the applications have enough free space and memory so that they can function smoothly
- Making sure that the CPU and other parts of the computer do not overheat up
- The application memory caches have to be cleared regularly

21



REACTING TO DATA BREACH

- Anticipating and having a plan ready as a counter measure
- The computers power supply should be turned off
- Ensuring that the computer has been immediately disconnected from the network
- By ensuring the reinstallation of the system applications

22



NEED FOR CONTROLS

Access control is the selective method by which systems specify who may use a particular resource and how they may use it (Mattord & Whitman, 2016).

23



NEED FOR CONTROLS

- Occasionally one computer can be used by many people which increases the security risks.
- In such instances security can be ensured by access control, in this method the administrators can allow users to have the following kinds for access control to reduce the possibility of a data breach:
 - Control over the system can be unrestricted
 - Control over the system can be limited
 - Control over the system can be minimal

24



MANAGING THREATS TO INTERNET SERVICES

Specialised software applications to maintain systems security include:

- Firewalls
- Intrusion detection software
- AI software