

## Chapter 4

# Information System and Systems Analysis and Design

# Learning Objectives

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- Explain the parts of an information system: people, procedures, software, hardware, data, and the Internet
- Explain the functional view of an organization and describe each function
- Describe the management levels and the informational needs for each level in an organization
- Discuss how information flows within an organization

# Learning Objectives

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- Discuss computer-based information systems.
- Distinguish among a transaction processing system, a management information system, a decision support system, and an executive support system.
- Distinguish between office automation systems and knowledge work systems.
- Explain the difference between data workers and knowledge workers.

# **Part 1: Information System**

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# Introduction

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- An information system is a collection of people, procedures, software, hardware, data, and the Internet
  - They all work together to provide information essential to running an organization
  - Computers are used in organizations to keep records of events
- Competent end users need to understand how the information flows as it moves through an organization



# 0 People

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- ❑ It is easy to overlook people as one of the parts of an information system
- ❑ Yet this is what personal computers are all about—**making people, and the end users like you, more productive**
- ❑ People are involved in information systems in just about every way
  - People **as a creator** of information systems
  - people **who develop** the information systems
  - people **as a support** for information systems
  - people **who use** information systems



# Procedures

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- ❑ The rules or guidelines for people to follow when using software, hardware, and data are **procedures**.
- ❑ These procedures are typically documented in manuals written by computer specialists.
  - Software and hardware manufacturers provide manuals with their products. These manuals are provided in either printed or electronic form.

## 3 Software

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- A **program** consists of step-by-step instructions that tell the computer how to do its work.
- The purpose of the software is to convert **data** (unprocessed facts) into **information** (processed facts).
  - For example, a payroll program would instruct the computer to take the number of hours you worked in a week (**data**) and multiply it by your pay rate (**data**) to determine how much you are paid for the week (**information**).

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# Hardware

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- The equipment that processes the data to create information is called **hardware**.
- It includes smartphones, tablets, keyboards, mice, displays, system units, and other devices.
- Hardware is controlled by software.

## (5) Data

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- The raw, unprocessed facts, including text, numbers, images, and sounds, are called data.
- Processed data yields information, and this Data must
  - Accurate
  - Timely
  - Specific
  - Organized for a purpose,

⑥

## Internet

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- Almost all information systems provide a way to connect to other people and computers, typically using the Internet.
- This **connectivity** greatly expands the capability and usefulness of information systems.

# Why are computers used in organizations?

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- To keep records of events.
- To help make decisions.

For example:

Point-of-sale terminals record sales as well as which salesperson made each sale. This information can be used for decision-making. For instance, it can help the sales manager decide which salespeople will get year-end bonuses for doing exceptional work.

# Organizational Information Flow

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- Do not just keep track of transactions and day-to-day business operations.
- Information flows vertically and horizontally throughout an organization
- **Information systems** support the natural flow of information within an organization's structure
  - 5 Functional Areas
  - Management Levels
  - Information Flow



# Five Functions of an Organization

- Accounting
- Marketing
- Human Resources
- Production
- Research



# Management Levels

Management is usually divided into three levels: **Top**, **Middle**, and **Supervisors**



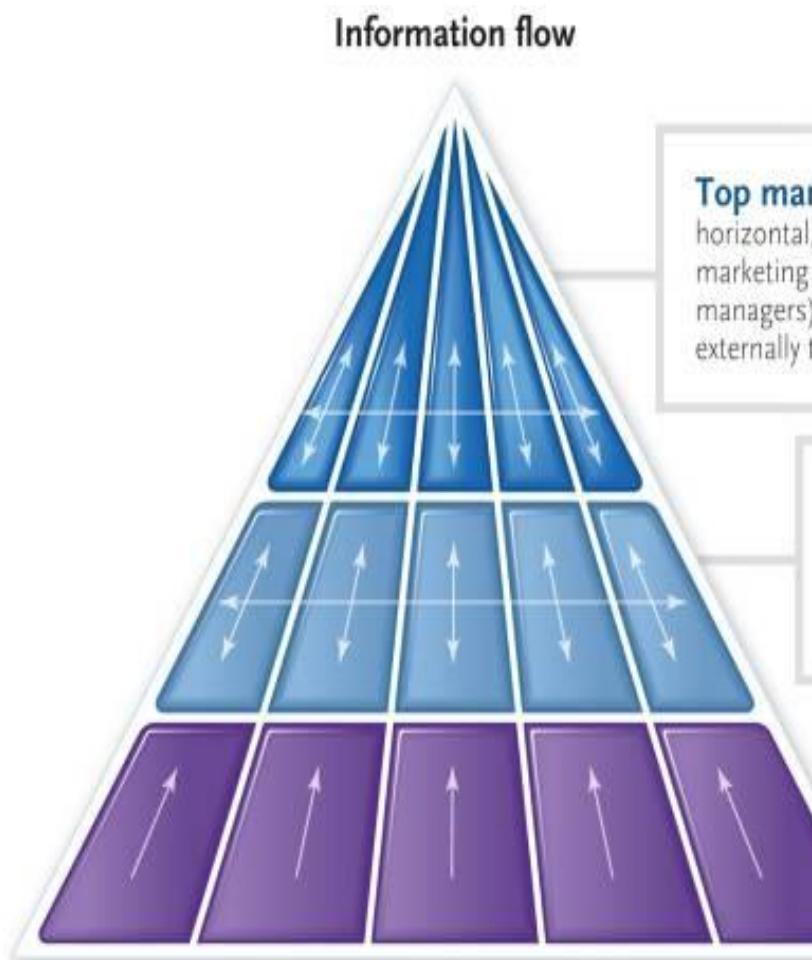
# Information Flow (Page 1 of 2)

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- Each level of management has different information needs
- The information flows to support these needs
  - Top management
    - Vertical, horizontal, and external
  - Middle management
    - Vertical and horizontal
  - Supervisor
    - Primarily vertical



# Information Flow (Page 2 of 2)

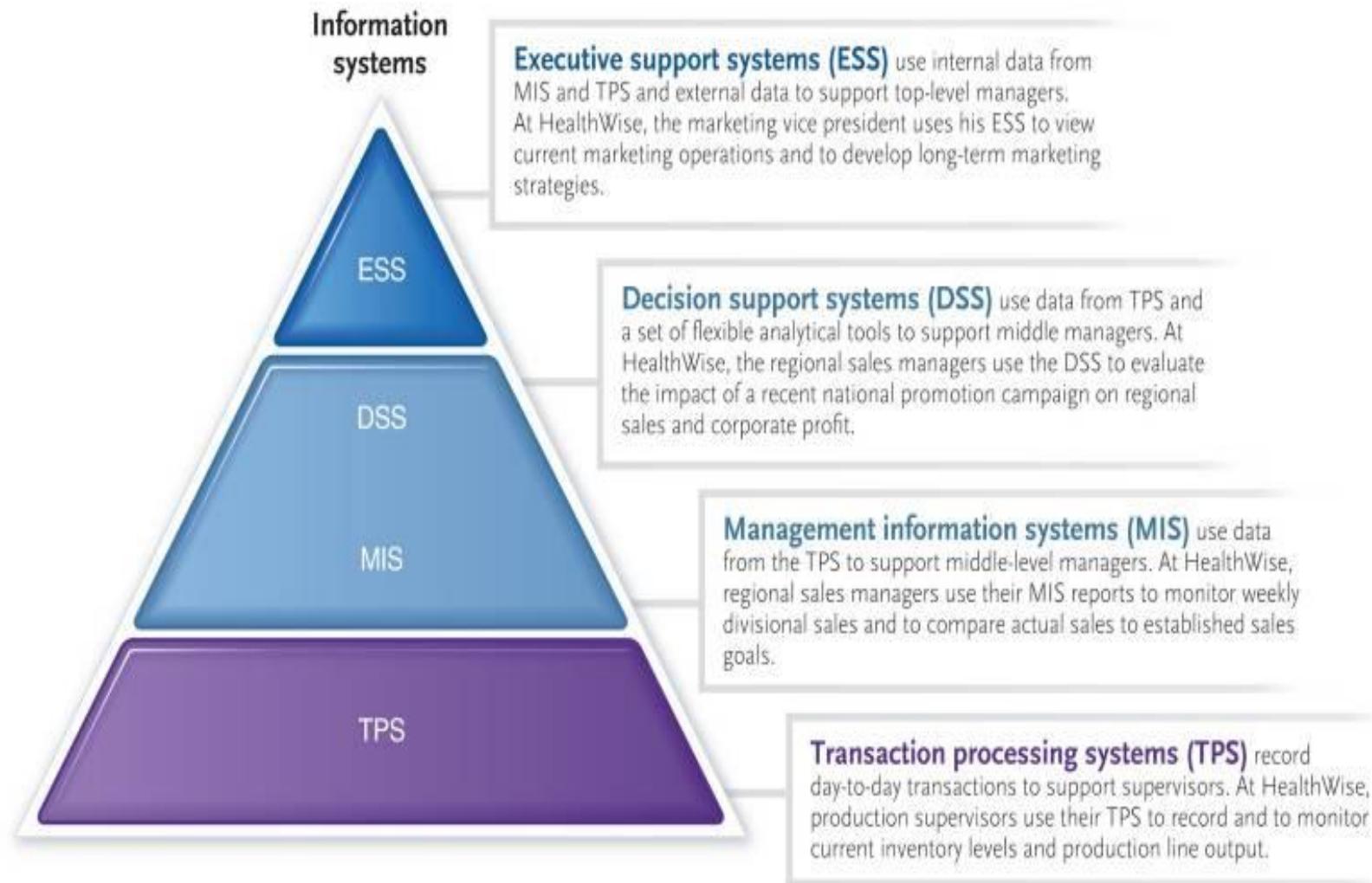


**Top managerial-level information flow** is vertical, horizontal, and external. At HealthWise, the vice president of marketing communicates vertically (with regional sales managers), horizontally (with other vice presidents), and externally to obtain data to forecast sales.

**Middle managerial-level information flow** is vertical and horizontal. At HealthWise, regional sales managers communicate vertically (with district sales managers and the vice president of marketing) and horizontally with other middle-level managers.

**Supervisory-level information flow** is primarily vertical. At HealthWise, production supervisors monitor worker activities to ensure smooth production. They provide daily status reports to middle-level production managers.

# Computer-Based Information Systems



# **Computer-Based Information Systems**

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## **Question to be answered**



- **What is a transaction processing system? How does it help supervisors?**
- **What is a management information system (MIS)?**
- **What is a decision support system (DSS)?**
- **How are MIS is different from DSS?**
- **What is an executive support system? Who uses it? What is it used for?**

1) TPS record day-to-day transaction in a database, aka data processing system.

It helps supervisors to track transaction trends, manage exception & irregularities.

2) MIS is the use of information technology, people and business process to record, store & process data.

It aims to produce information for decision-making.

3) → Flexible tool for data analysis for decision-making

→ Allow managers get ans to unexpected & generally non-recurring prob

↳ report don't have fixed format.

→ Parts of DSS : 1. User

2. System software

3. Data (internal & external)

4. Decision models : strategic models (Top management - long term plan)

Tactical model (middle management - Financial/promotion plan)

Operational model (lower-level manager to complete daily task)

4) MIS report have a fixed format while DSS don't

Aspect	Management Information System (MIS)	Decision Support System (DSS)
Purpose	Focuses on routine, structured decision-making.	Supports non-routine, semi-structured, or unstructured decisions.
Data Processing	Uses structured data from internal sources (e.g., TPS).	Combines structured, unstructured, and external data.
Analysis Tools	Provides static, pre-defined reports.	Uses models, simulations, and interactive tools.
User Level	Primarily used by middle managers.	Used by senior managers, analysts, or decision-makers.
Flexibility	Limited flexibility; relies on pre-programmed outputs.	Highly flexible; allows dynamic exploration of scenarios.

5) Executive support system(ESS)

→ Sophisticated software for presenting, summarizing & analyzing data

→ but 因为是给高层 so easy to-use

→ Provide immediate access to a company's KPI .

# Transaction Processing Systems (TPS)

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- Records day-to-day transactions in a database
- Also called **data processing systems (DPS)**
- Transaction processing systems generally go through a five-stage cycle of
  - Data entry activities
  - Transaction processing activities
  - File and database processing
  - Document and report generation
  - Inquiry processing activities.

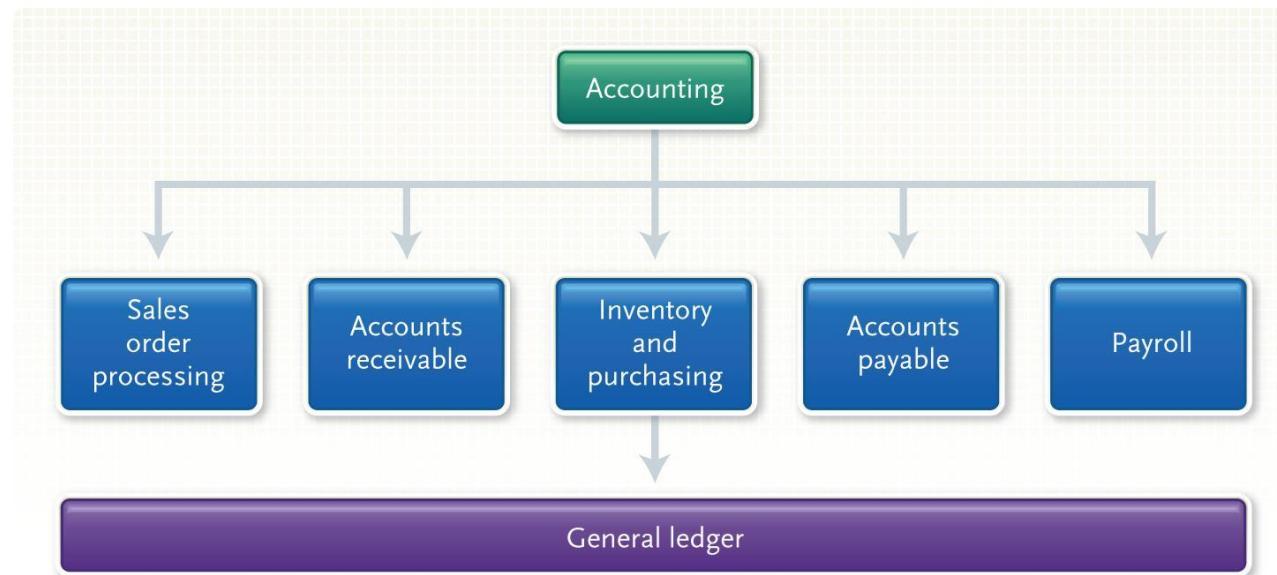
# Examples of TPS systems

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- Sales order entry
- Hotel reservation systems
- Payroll
- Employee record keeping
- Automated teller machines
- Credit card authorizations
- Online bill payments
- Self-checkout stations at grocery store
- The trading of stocks over the Internet
- Many other electronic commerce

# Example works of TPS for Accounting

- Sales order processing
- Accounts receivable
- Inventory and purchasing



# **Management Information Systems (MIS)**

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## **What is MIS?**

- **MIS** is the use of information technology, people, and business processes to record, store and process data to produce information that decision-makers can use to make day-to-day decisions.

# **Management Information Systems (MIS)**

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## **The need for MIS**

- MIS provides the information needed for decision-makers to make effective decisions.
- MIS systems provide a smooth way of communication within and outside the organization
- Record keeping – MIS records all an organization's business transactions and provides a reference point.

# Management Information Systems (MIS)

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- Produces standardized reports to support decision-making by middle managers
- Integrates data and summarizes details from databases in a structured form
- Produces predetermined reports
  - Periodic reports
  - Exception reports
  - Demand reports

HealthWise Group Regional Sales Report			
Region	Actual Sales	Target	Difference
Central	\$166,430	\$175,000	(\$8,570)
Northern	137,228	130,000	7,228
Southern	137,772	135,000	2,772
Eastern	152,289	155,000	(2,711)
Western	167,017	160,000	7,017

# Examples of MIS

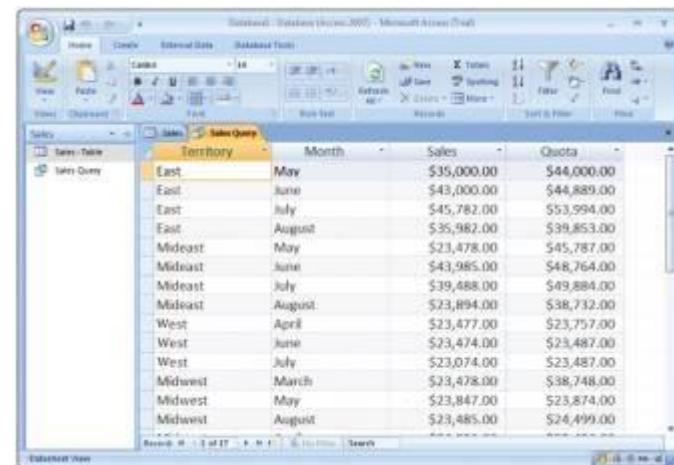
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- Some other examples of management information systems in an organisation
  - **process control,**
  - **office automation**
  - enterprise resource planning
  - finance systems
  - management reporting
  - and many more ...

# Decision Support Systems (DSS)

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- ❑ Flexible tool for analyzing data for decision-making purposes
- ❑ Enables managers to get answers to unexpected and generally non-recurring problems
  - Reports do not have a fixed format
- ❑ Microsoft Access is often used to provide an easy front-end interface for performing SQL decision support queries



The screenshot shows a Microsoft Access Database window titled "Sales - Microsoft Access 2007 - Microsoft Access [Blank]". The window displays a table named "Sales Query" with four columns: Territory, Month, Sales, and Quota. The data is sorted by Territory and Month. The table contains 18 rows of sales data across four territories (East, Midwest, West) over six months (May through October).

	Territory	Month	Sales	Quota
1	East	May	\$35,000.00	\$44,000.00
2	East	June	\$43,000.00	\$44,889.00
3	East	July	\$45,782.00	\$53,994.00
4	East	August	\$35,982.00	\$39,853.00
5	Midwest	May	\$23,478.00	\$45,787.00
6	Midwest	June	\$43,985.00	\$48,764.00
7	Midwest	July	\$39,488.00	\$49,884.00
8	Midwest	August	\$23,894.00	\$38,732.00
9	West	April	\$23,477.00	\$23,757.00
10	West	June	\$23,474.00	\$23,487.00
11	West	July	\$23,074.00	\$23,487.00
12	Midwest	March	\$23,478.00	\$38,748.00
13	Midwest	May	\$23,847.00	\$23,874.00
14	Midwest	August	\$23,485.00	\$24,499.00

# Parts of a DSS

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## User

- A decision-maker, like yourself

## System software

- Operating system
- Easy to learn and use

## Data

- Internal data
- External data

## Decision models



# DSS Decision Models

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## Strategic models

- Assists top level management in long-range planning

## Tactical models

- Assists middle-management control the work
- Financial and sales promotion planning

## Operational models

- Assists lower-level managers accomplish the daily activities and objectives

# Examples of DSS

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- ❑ **GPS:** A GPS analyzes route information and traffic data to plan the best path between places.
- ❑ **Crop planning:** Decision support systems help farmers know the best time to plant, fertilize and harvest crops.
- ❑ **Enterprise resource planning (ERP) dashboards:** Decision-makers use ERP dashboards to oversee performance indicators.
- ❑ **Clinical decision-making:** Medical professionals use clinical decision-support systems to help diagnose and plan treatment for patients.

# Executive Support Systems (ESS)

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- Designed for top management
- Sophisticated software for presenting, summarizing, and analyzing data, but specifically designed to be easy-to-use
- Provides immediate access to a company's key performance indicators



# Other Information Systems

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## ❑ Information workers

- Data workers
- Knowledge workers

## ❑ Office automation systems (OASs)

- Supports data workers
- Project management programs
- Videoconferencing systems

## ❑ Knowledge work systems (KWSs)

- Use specialized systems, such as  
CAD/CAM



# Enterprise Systems in Organizations

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- Business organizations have become very complex and their business needs can no longer be supported by one single information system.
- Information Systems are a critical component of a successful organization today.
- Management is generally categorized into three levels: Strategic, Mid-Management and Operational.
- Information Systems provide a high level of computer automation to support business functions such as:
  - Accounting
  - Human Resource Management
  - Marketing
  - Finance
  - Customer Service
  - Operations

# Careers In IT

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- Information systems managers oversee the work of programmers, computer specialist, systems analysts, and other computer professionals
- Employers look for individuals with strong technical backgrounds, with a Master's degree
- Strong leadership and communications skills
- Information systems managers can expect to earn from RM 49,200 to RM 73,600 annually



# A Look to the Future

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- Information overload
  - May have a negative effect
  - E-mail is one of the major sources of overload
- How to handle e-mail
  - Be selective
  - Remove
  - Protect
  - Be brief
  - Stop spam
  - Don't respond



# **Open-Ended Questions**

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- a) Name and discuss the five common functions of most organizations.
- b) Discuss the roles of the three kinds of management in a corporation.
- c) What are the four most common computer-based information systems?
- d) Describe the different reports and their roles in managerial decision making.
- e) What is the difference between an office automation system and a knowledge work system?

a) - Accounting, marketing , production, research, human resources-

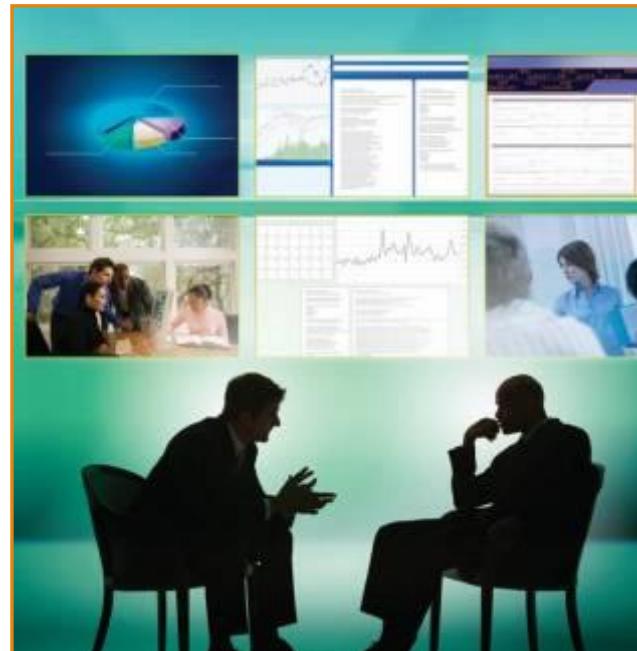
# Part 2: Systems Analysis and Design

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# Learning Objectives

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- Describe the six phases of the systems life cycle.
- Identify information needs and formulate possible solutions.
- Analyze existing information systems and evaluate the feasibility of alternative systems.



# Learning Objectives

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- Identify, acquire, and test new system software and hardware.
- Switch from an existing information system to a new one with minimal risk.
- Perform system audits and periodic evaluations.
- Describe prototyping and rapid applications development.

# Introduction

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- Most people in an organization are involved with an information system of some kind.
- For the organization to create and use the system requires thought and effort.
- In this chapter, you learn about history of software development methodology, six step process for performing systems analysis and design.

# A Brief History of Software Development Methodologies



## STRUCTURED PROGRAMMING

IMPROVES:  
Development time  
CLARITY  
Quality

BY EXTENSIVE USE OF:  
Block Structures  
Subroutine  
FOR and WHILE loops

1950s



## WATERFALL



is a sequential (non-iterative) process which is seen as flowing steadily downwards through the phases



- PADI
1. Planning
  2. Analysis
  3. Design
  4. Implementation



## 迭代 ITERATIVE & INCREMENTAL

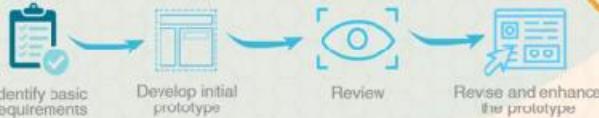
idea is to develop a system through repeated cycles (iterative) and in smaller portions at a time (incremental), allowing to gain knowledge during development of earlier versions

1970s



## PROTOTYPING

is the activity of creating prototypes of software applications, i.e., incomplete versions for users to evaluate the design

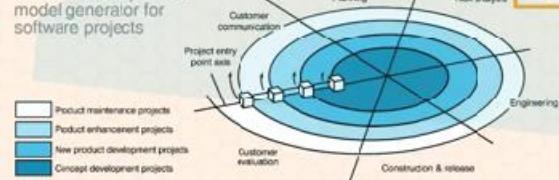


Deploy 部署



## SPIRAL

is a risk-driven process model generator for software projects



late 1980s

late 1980s

Waterfall era  
ENDs

PREDICTIVE

## V-MODEL

is an extension of the waterfall model.



The process steps are bent upwards after the coding phase, to form the typical V shape



## RAPID APPLICATION DEV

put less emphasis on planning and more emphasis on process, adaptability and the necessity of adjusting requirements

1990s

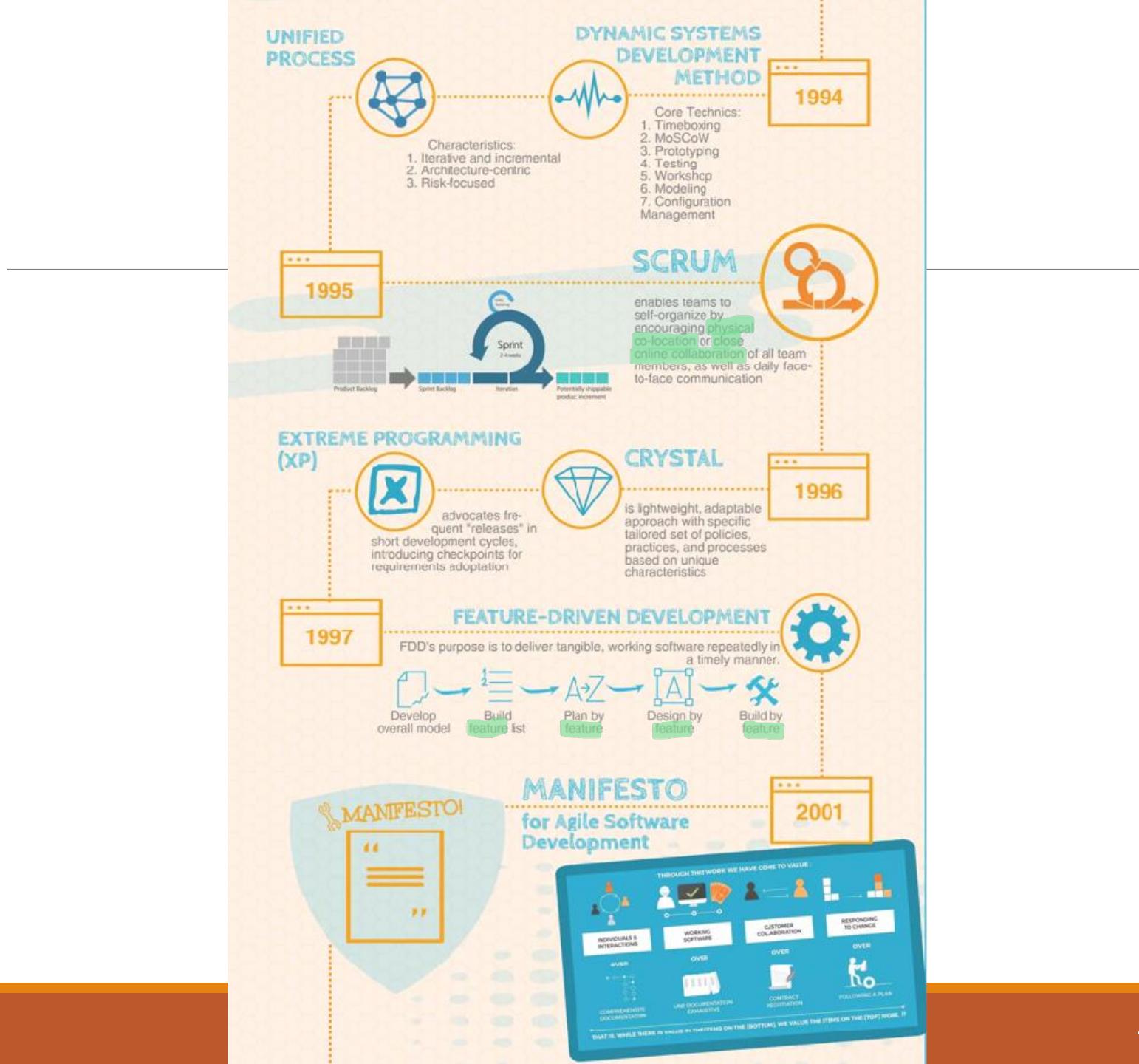


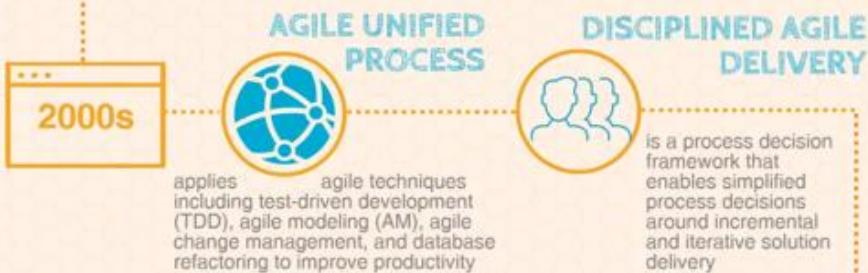
1990-  
2000s

## AGILE METHODS RISE

They implement adaptive planning, evolutionary development, early delivery, and continuous improvement, and it encourages rapid and flexible response to change







### SCALED AGILE FRAMEWORK (SAFe)



is a framework consisting of a knowledge-base of integrated patterns intended for enterprise-scale Lean-Agile development

### LARGE-SCALE SCRUM (LeSS)



is regular Scrum applied to large-scale development. For example, for one product group with 500 people

**2010s**



*Summarizing  
AGILE umbrella of  
methods*

- Scrum
- Lean software development
- Kanban (process + method)
- Extreme Programming (XP)
- Continuous Integration (CI)
- Continuous Delivery (CD)
- Feature Driven development (FDD)
- Test Driven Development (TDD)
- Crystal Clear
- ...
- Scrum-of-Scrums
- Scrum at Scale (Scrum@Scale)
- Large-scale Scrum (LeSS)
- Scaled Agile Framework (SAFe)
- Disciplined Agile Delivery (DAD)
- Dynamic Systems Development Method (DSDM)
- Agile Project Management (AgilePM)
- Agile Unified Process (AUP)
- Open Unified Process (OpenUP)
- ...

Lightweight approaches

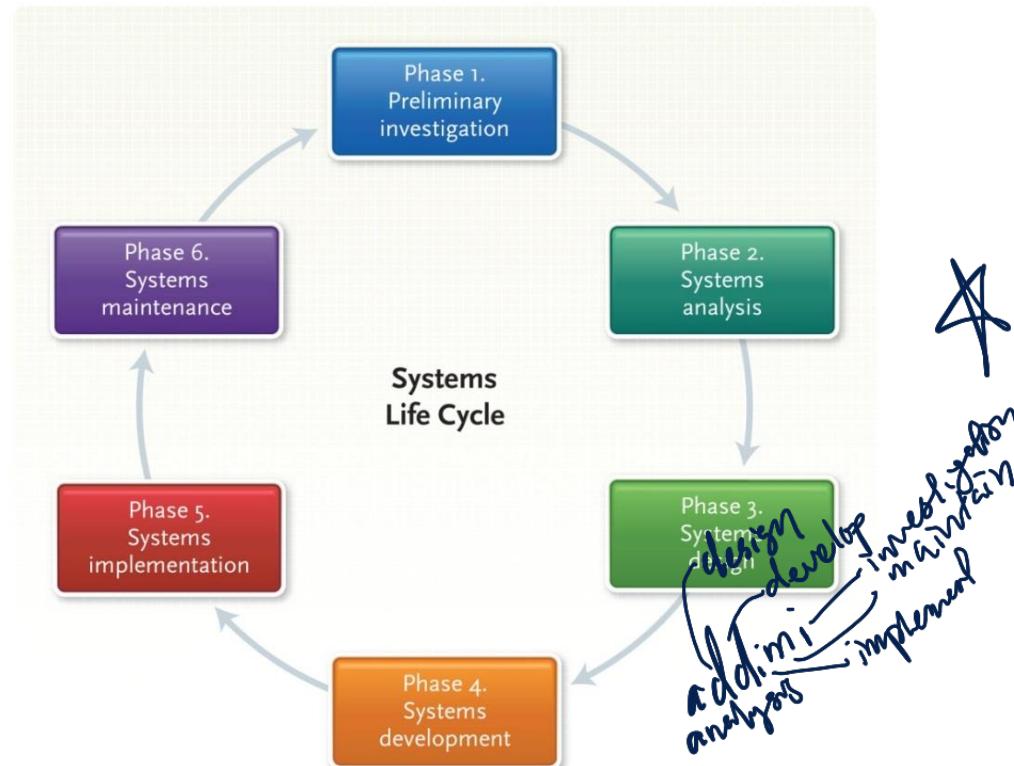
Fuller approaches (beyond 1 team)

**2020s**

*TO BE CONTINUED...*

# System Analysis and Design

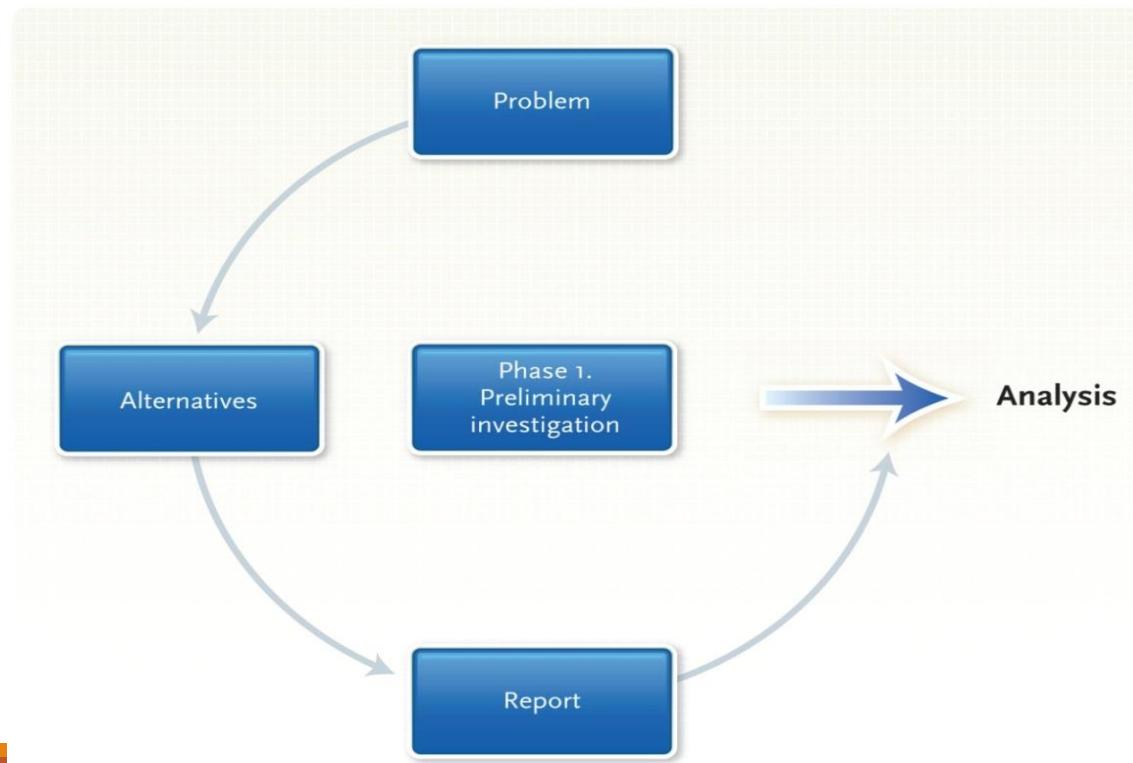
**Six-phase** problem-solving procedure for examining and improving an information system





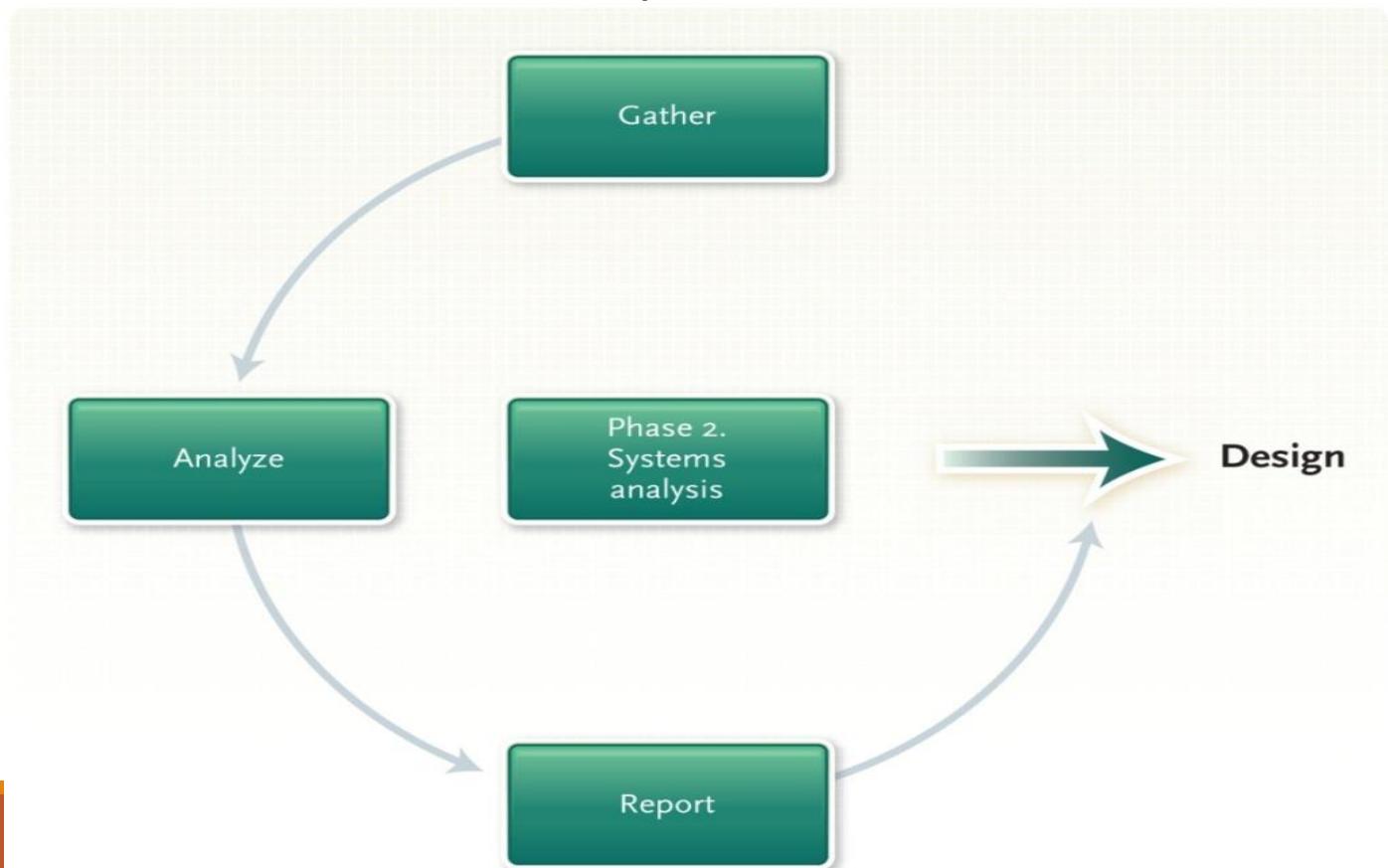
# Phase 1: Preliminary Investigation

The preliminary investigation determines the need for a new information system



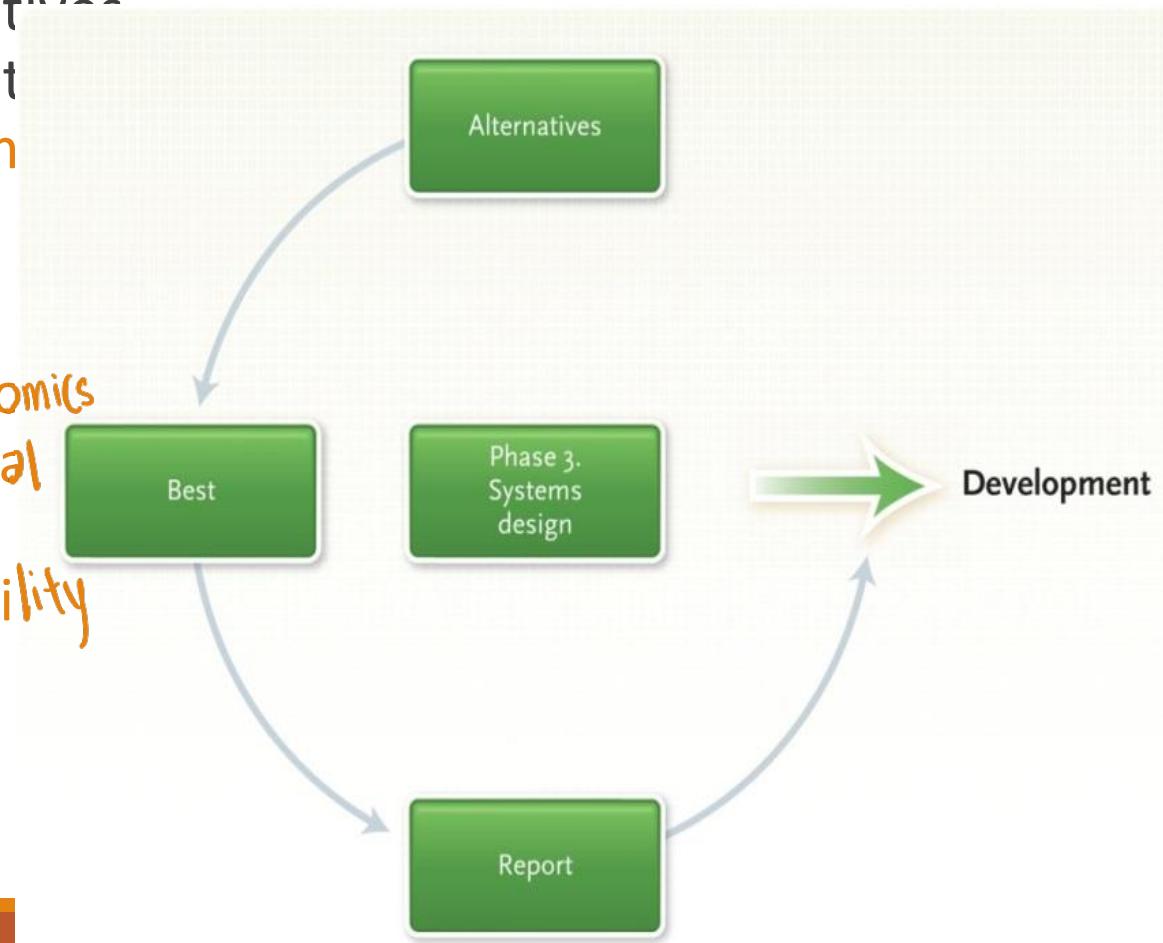
## Phase 2: Systems Analysis

Data is collected about the present system and then  
analyzed to determine the new requirements



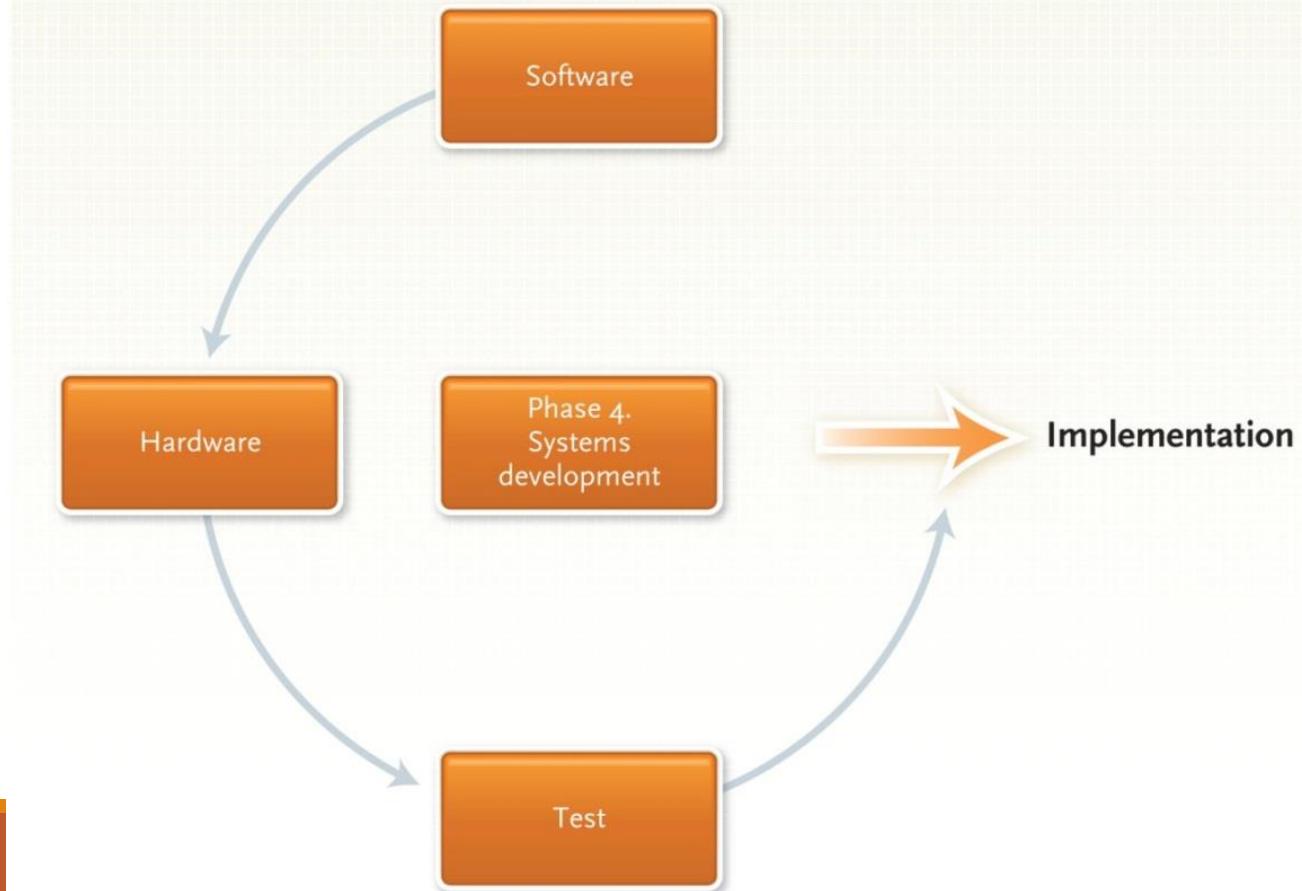
# Phase 3: Systems Design

- Define the alternatives → select the best system and write a system design report
- Evaluate systems according to **economics feasibility, technical feasibility, and operational feasibility**



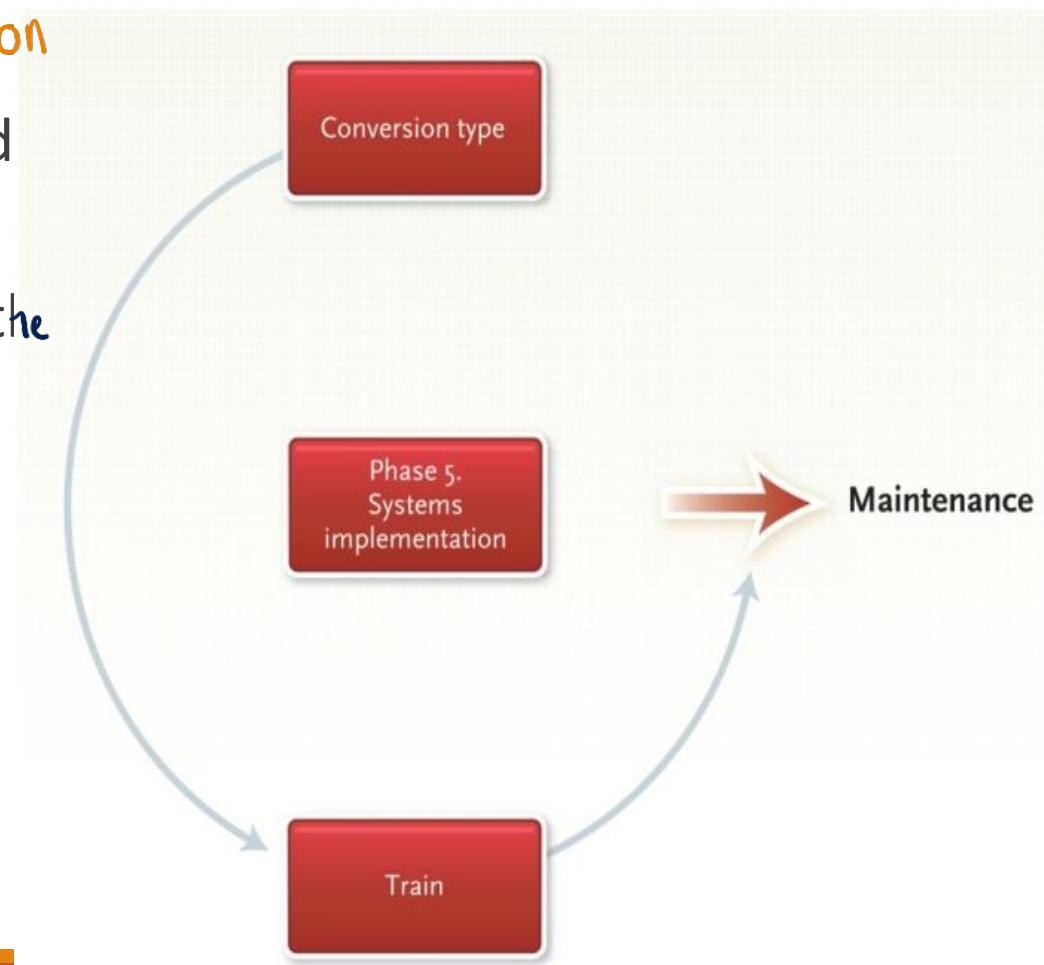
# Phase 4: Systems Development

In the development phase, you acquire the software and hardware, and ~~test~~.



# Phase 5: Systems Implementation

- ❑ Also known as **conversion**
  - ❑ Converting from the old system to the new one
  - ❑ Training people to use the new system
  - ❑ Types of conversion approaches include:
    - Direct
    - Parallel
    - Pilot
    - Phased
- ? {*



Here's a breakdown of the four main \*\*types of conversion approaches\*\* used in system implementation:

### 1. \*\*Direct Conversion\*\*

- Also known as "cold turkey," this approach involves completely stopping the old system and immediately starting the new system on a specific date.
- \*\*Pros:\*\* Quick and inexpensive; no duplicate effort needed.
- \*\*Cons:\*\* High risk, as any issues with the new system can halt operations.

### 2. \*\*Parallel Conversion\*\*

- In this approach, both the old and new systems operate simultaneously for a period. Users can verify the new system's results against the old one, ensuring accuracy and reliability.
- \*\*Pros:\*\* Safer, as there's a fallback if the new system fails; results can be cross-verified.
- \*\*Cons:\*\* High cost and resource-intensive, as it requires maintaining two systems.

### 3. \*\*Pilot Conversion\*\*

- The new system is implemented in a small part of the organization (such as one department) before rolling out across the entire organization.
  - **Pros:** Limits risk to a small group, allowing issues to be resolved before wider implementation.
  - **Cons:** May delay full implementation if problems arise in the pilot.

#### 4. **Phased Conversion**

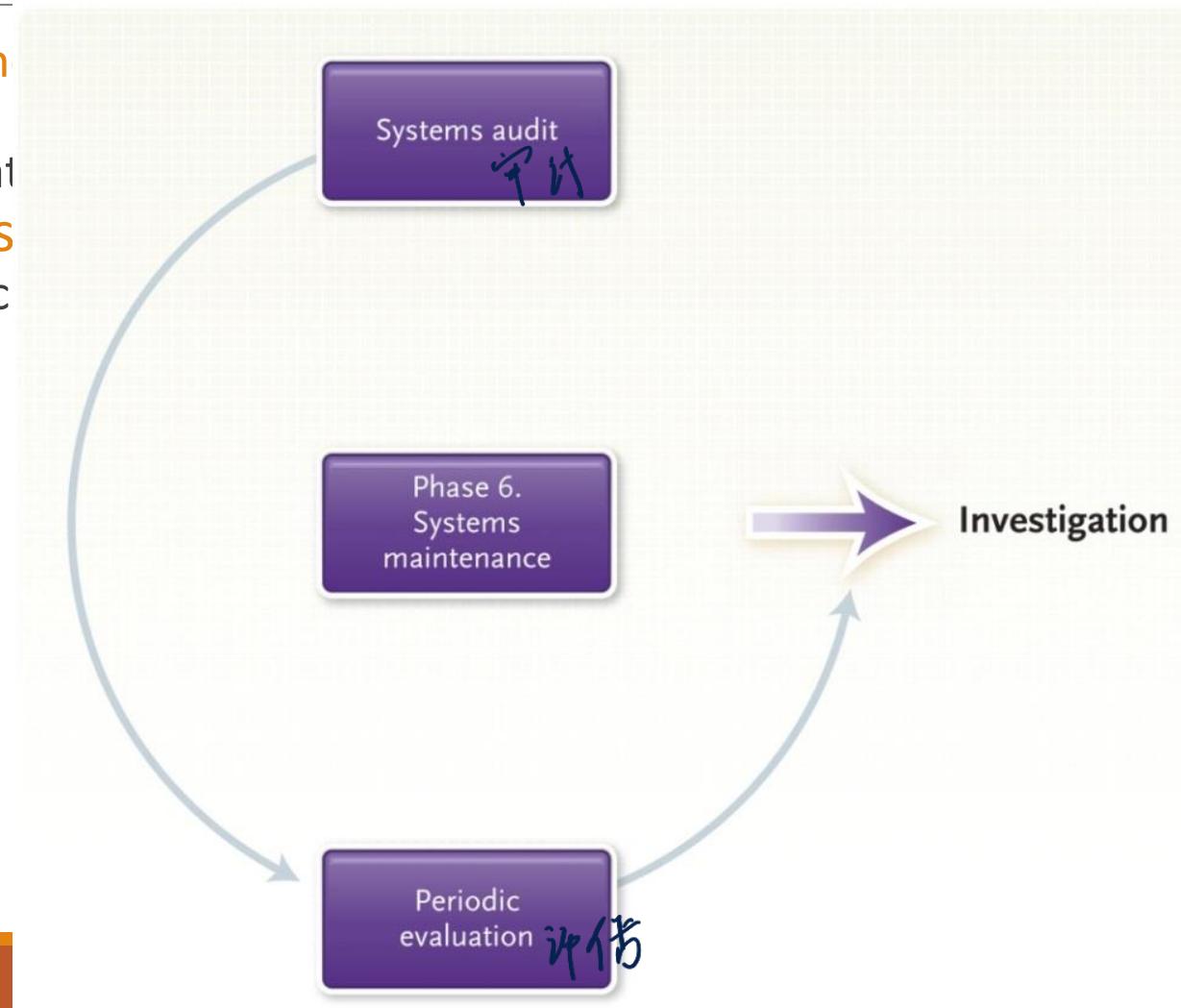
- The system is implemented in stages or modules, where different components of the new system are gradually integrated with the old system.
  - **Pros:** Lower risk and allows for adjustments along the way; reduces the load on resources.
  - **Cons:** Takes longer to complete the entire system transition and may cause temporary disruptions as each phase is implemented.

Each approach has its own benefits and challenges, and the choice depends on factors like organizational risk tolerance, resource availability, and the complexity of the new system.



# Phase 6: Systems Maintenance

Systems maintenance is a very important, ongoing activity that includes a **systems audit** and a periodic evaluation.

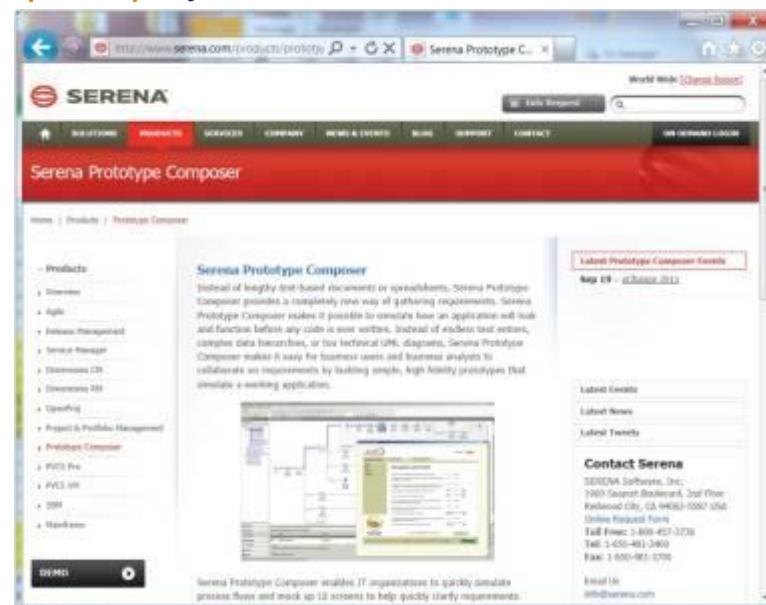


# Prototyping and Rapid Applications Development

investigatory  
analysis  
design  
develop  
implement  
Maintenance

Alternatives to the **systems life cycle** may be used if the system is not feasible 可行的

- Prototyping is building a model
- Rapid applications development (RAD) ?



broken down into smaller, manageable parts. It is used to analyze the system in a structured manner, starting with the big picture and then detailing each component. This helps ensure no part is overlooked and that each component fits into the overall system design.

### c) \*\*What is system maintenance? When does it occur?\*\*

\*\*System maintenance\*\* is the process of monitoring and updating a system after it has been implemented to ensure it continues to function effectively. This phase includes bug fixes, software updates, and enhancements based on evolving business requirements or technology changes.

Maintenance occurs after the implementation phase and continues throughout the system's lifespan, making it an ongoing process to keep the system operational and relevant.

### d) \*\*Explain prototyping and RAD. When might they be used by corporations?\*\*

\*\*Prototyping\*\* is the development of an early, simplified version of a system to help users visualize and interact with

the system, gather feedback, and refine requirements before the full-scale system is developed. It is often used when requirements are unclear or likely to change.

**Rapid Application Development (RAD)** is a methodology that emphasizes quick development and iteration. It involves breaking the project into smaller components that can be quickly developed, tested, and integrated. RAD allows developers to adjust the system based on user feedback quickly.

Corporations might use prototyping and RAD when they need to develop systems rapidly, require significant user involvement, or are dealing with evolving requirements. Both methods enable more flexibility and faster turnaround times compared to traditional development models.

# Careers in IT

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- A **systems analyst** plans and designs new systems, following the **systems life cycle**
- Requires a Bachelor's degree in Computer Science or Information Systems and technical experience
- Can expect to earn an annual salary of RM 48,306 to RM 72,600

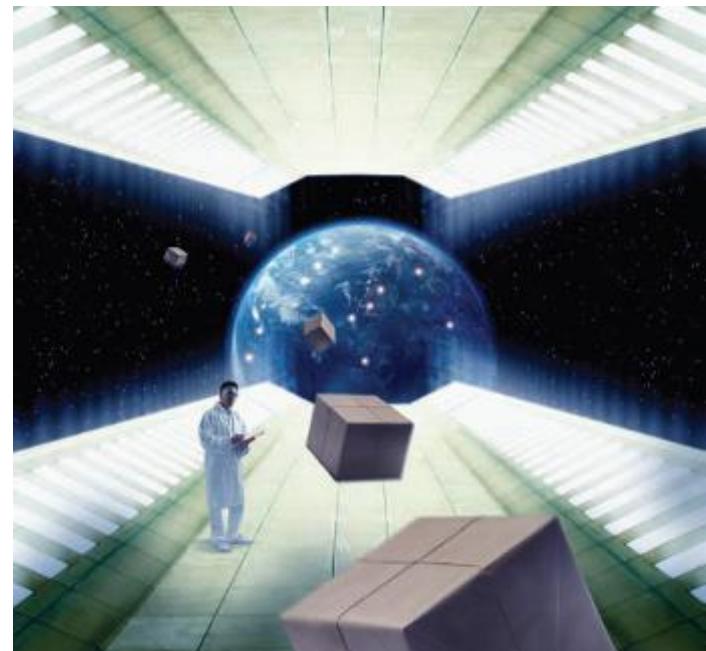


# A Look to the Future

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## The Challenge of Keeping Pace

- To stay competitive with today's fast business pace, new technologies must be incorporated
- Increased use of RAD and prototyping
- Increased use of outside consulting



# Open-Ended Questions

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- a) What is a system? What are the six phases of the systems life cycle? Why do corporations undergo this process?
- b) What are the tools used in the analysis phase? What is top-down analysis? How is it used?
- c) What is system maintenance? When does it occur?
- d) Explain prototyping and RAD. When might they be used by corporations?



### a) \*\*What is a system? What are the six phases of the systems life cycle? Why do corporations undergo this process?\*\*

A \*\*system\*\* is a set of related components that work together to achieve a specific objective. In information systems, this refers to a collection of hardware, software, data, people, and procedures that work together to provide

meaningful information to an organization.

The \*\*six phases of the systems life cycle\*\* are:

1. \*\*Preliminary Investigation\*\* – Understand the problem, define the system's goals, and evaluate feasibility.
2. \*\*Analysis\*\* – Collect requirements, analyze needs, and understand how the system should function.
3. \*\*Design\*\* – Develop a blueprint or design of the system that meets user requirements.
4. \*\*Development\*\* – Code and build the system based on the design specifications.
5. \*\*Implementation\*\* – Deploy the system to the user environment, including training and support.
6. \*\*Maintenance\*\* – Monitor, update, and maintain the system to ensure it continues to meet business needs.

Corporations undergo this process to ensure their information systems are robust, effective, and aligned with business objectives. It helps mitigate risks, reduces potential downtime, and ensures the system can adapt to changing business needs.

### b) \*\*What are the tools used in the analysis phase? What is top-down analysis? How is it used?\*\*

In the \*\*analysis phase\*\*, some common tools include:

- \*\*Data flow diagrams (DFDs)\*\* – to visualize how data moves through the system.
- \*\*Interviews, questionnaires, and observation\*\* – to gather user requirements.

- **Flowcharts** – to map out processes and understand workflows.
- **Use case diagrams** – to define interactions between users and the system.

**Top-down analysis** is an approach where the overall system is viewed as a high-level structure that is then