CHAPTER 3

Fundamentals of Information Systems

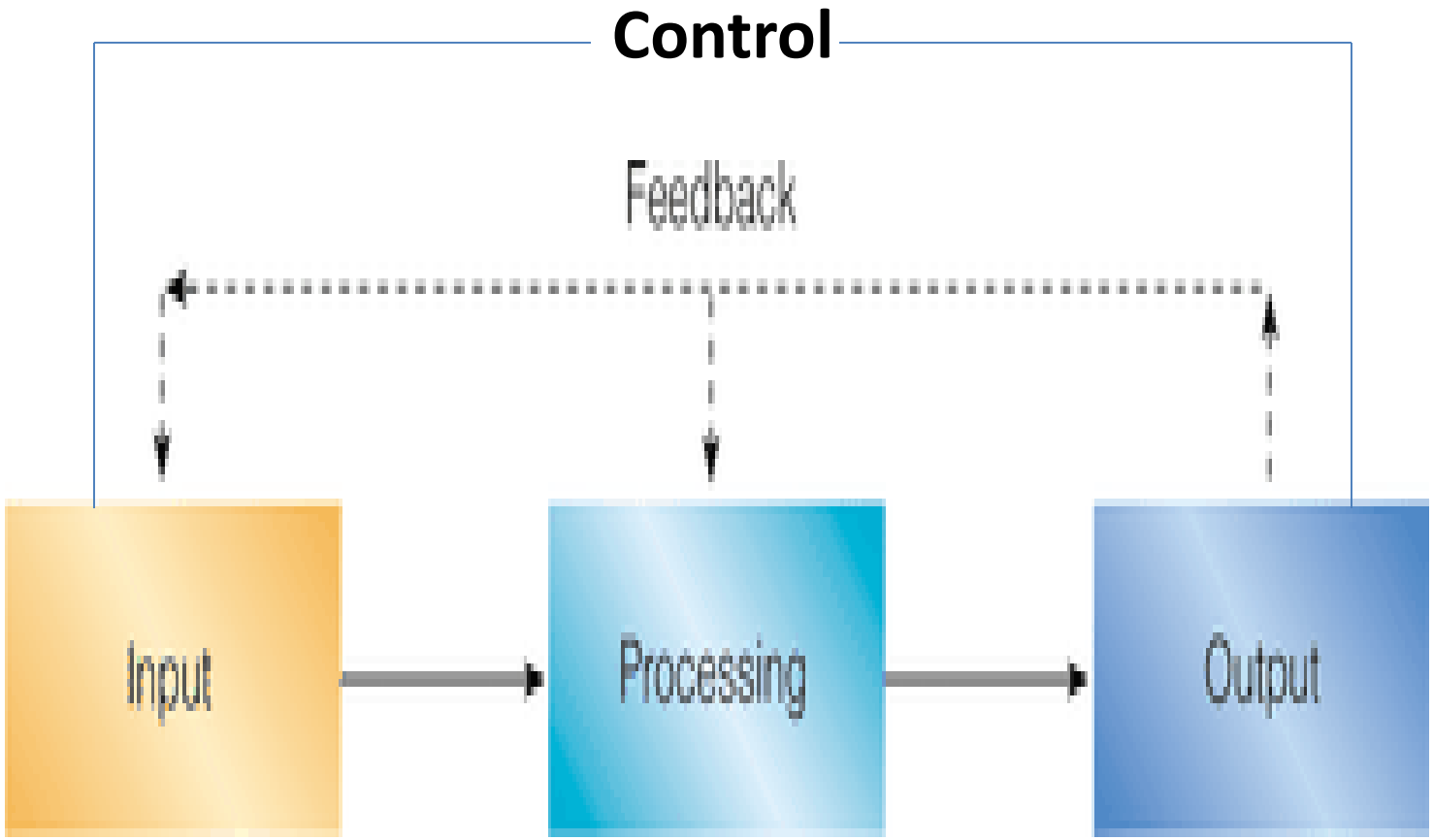
Learning Objectives:

- Identify the major features, characteristics and components of a system
- Distinguish data from information and describe the characteristics of the later
- Describe the building blocks of IS
- Identify the development phases of Information Systems
- Identify system development methodologies

System

- System
  - A set of elements or components that interact to accomplish goals
  - A combination of components working together
  - A system is an orderly grouping of interdependent components linked together according to a plan to achieve a specific objective.

Components of a system



Input

- Involves capturing and assembling elements that enter the system to be processed
- collecting and capturing data manually or via computer
- Input can be in various forms or media (e.g. phone calls, grade sheets, barcodes)
- Data can be input via keyboard or by an automated process, such as scanning

Processing

- Involves transformation processes that convert input into output
- Processing may involve calculations, comparisons, summarizing, or grouping
  - E.g.. calculating your grade involves weighting your scores on various tests or assignments, adding them together, and then converting the resulting percentage or point total to an A, B, C, etc.

Output

- Involves transferring elements that have been produced by a transformation process to their ultimate destination
- Output is the production of useful information.
- An output can be a report displayed on a monitor, a printed report, a paycheck, a verbal response, or an image

Output

- Output from one system might be the input for another.
  - E.g., a point of sale system might create a file of all items sold during a day. That file might be used as input to an inventory system to adjust stock levels to reflect the sales

Feedback

- Data about the performance of a system
- Feedback is a kind of output used to adjust the input or processing activities
- Feedback can be evaluated to determine whether a system is moving toward the achievement of its goals.
- necessary adjustments based on feedbacks are made to a system's input and processing components to ensure that it produces proper output

Control

- The control elements guide the system.
- It is the decision-making subsystem that controls the pattern of activities governing input, processing, and output.

Characteristics of a System

- ***Environment:*** A system does not exist in a vacuum, it exists and functions in an environment containing other systems
- ***Subsystem***: A system that is a component of a larger system
- ***Boundary***: A system separated from its environment
- ***Interface***: Several systems may share the same environment
- ***Open System***: Interacts with other systems
- ***Closed System***: Does not interact
- ***Adaptive System***: Modify themselves to meet the demands of a changing environment

Information System

- An **information system** (IS) is a set of interrelated components that collect, manipulate, store, and disseminate data and information and provide a feedback mechanism to meet an objective
- **Examples:** ATMs; airline reservation systems; course enrollment systems

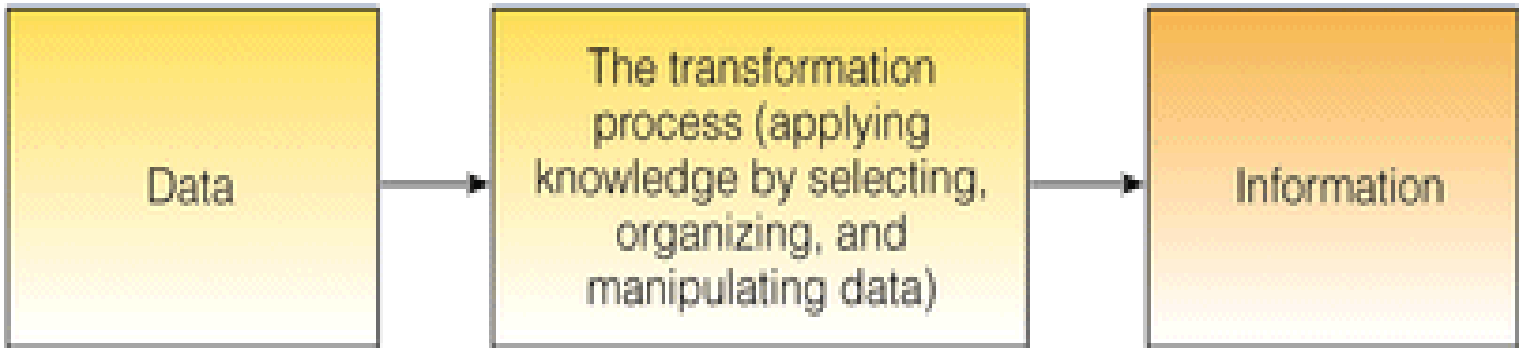
Data Vs Information

- The terms **data** and **information** are often used interchangeably
  - Data are raw facts or observations.
- ***Types of Data***

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

  - **Information** is processed data
    - A collection of facts organized in such a way that they have value beyond the facts themselves.

The Process of Transforming Data into Information



The Process of Transforming Data into Information

Characteristics of Valuable Information

- Accurate: Information must not contain any errors. It must be accurate.
- Accessible: Authorized users should be able to access the information whenever required.
- Complete: Information must contain all important and related data.
- Economical: Information should be economical to produce both in terms of time and cost.
- Format: Information should be available in the desired format.
- Flexible: Information should be flexible enough to be used for different purposes.

Characteristics of Valuable Information

- Reliable: Information is dependable and is generated using correct data.
- Relevant: Information must be relevant so that it can be used by the organization.
- Secure: Unauthorized users should not be able to access the information. Access is allowed only to authorized individuals.
- Simple: Information must be easily understandable and usable. Complex information is difficult to use and may not serve its purpose.
- Timely: Information must be available when it is needed. Late or outdated information is of no use.
- Verifiable: There should be a means to cross check the available information.

Components of an Information System

- An information system uses the resources of *people*, *hardware*, and *software* to perform input, processing, output, storage, and control activities that convert data resources into information products

- An information system can be manual or computerized

Computer-based Information System (CBIS)

- **Computer-based information system (CBIS)** uses computer technology to perform input, processing & output activities
- **CBIS** consists of:
  - **Hardware**
  - **Software**
  - **Databases**
  - **Telecommunications & networks**
  - **People**
  - **Procedures** that are configured to collect and process data into information

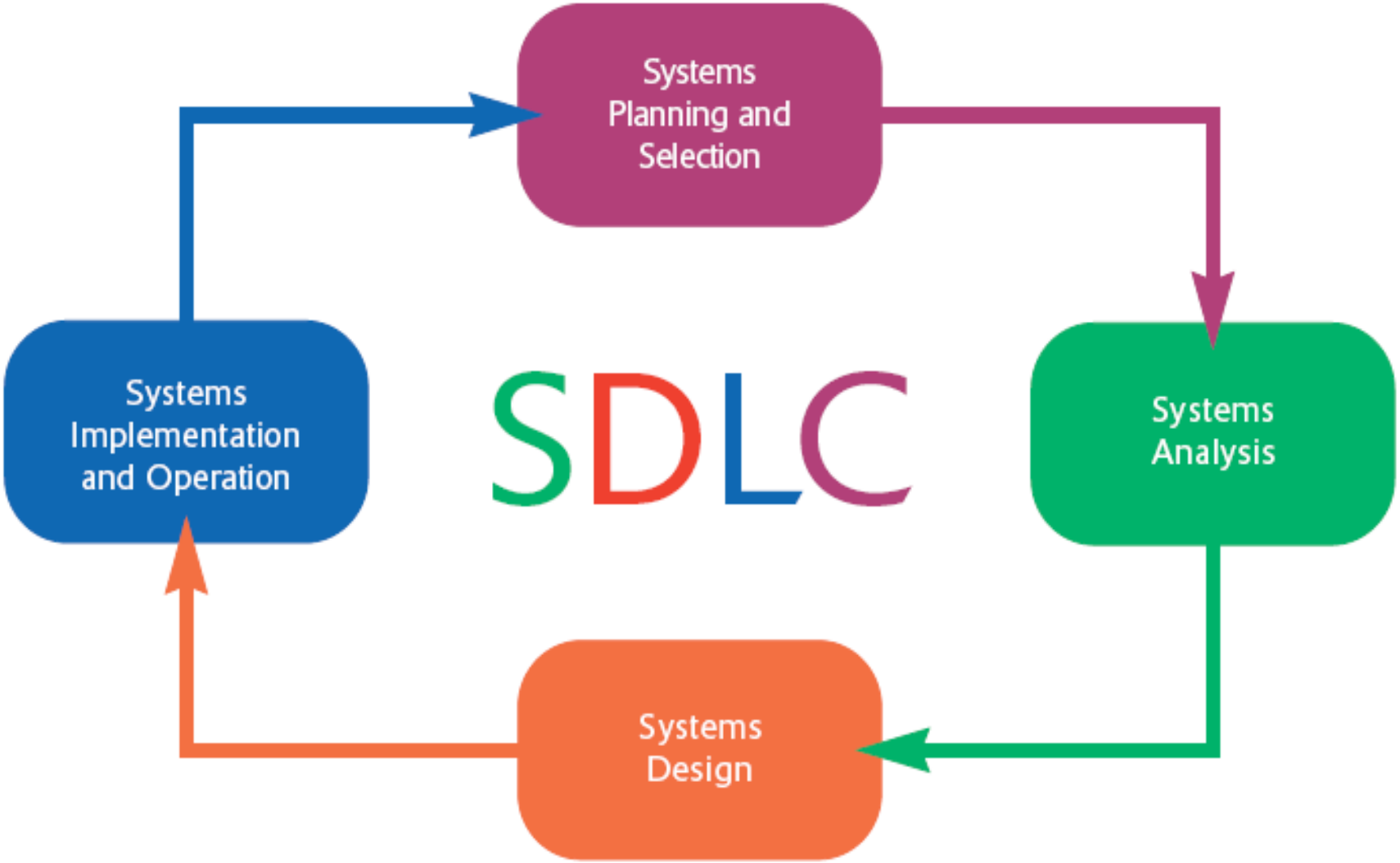
Components of a CBIS

- **Hardware** - computer equipment used to perform input, processing, and output activities.
- **Software** - computer programs that govern the operation of the computer.
- **Database** - an organized collection of facts and information, typically consisting of two or more related data files.
- **People** - the most important element in most computer-based information systems. – IS Professionals, End Users
- **Procedures -** include the strategies, policies, methods, and rules for using the CBIS.

Telecommunications, Network, and the Internet

- **Telecommunications** - the electronic transmission of signals for communications.
- **Networks** - used to connect computers and computer equipment in a building, around the country, or around the world to enable electronic communications.
- **Internet** - the world's largest computer network, actually consisting of thousands of interconnected networks

System Development Phases



System Development Phases

The **systems development life cycle** (SDLC), also referred to as the application development life-cycle, is a term used in systems engineering, information systems and software engineering to describe a process for planning, creating, testing, and deploying an information system

Phase 1: Systems Planning and Selection

- The primary activities of this phase are:
  - Identifying the need for a new or enhanced system and
  - Selection of projects that are perceived to meet the objectives of an organization
- Information system needs of an organization may result from:
  - Requests to deal with problems in current procedures
  - The desire to perform additional tasks
  - The realization that information technology could be used to capitalize on an existing opportunity

Phase 1: Systems Planning and Selection

- Once a project is selected, a plan is designed that layout important issues such as:
    - *Feasibility study*
    - *Scope*
    - *Schedule*
- The plan is finally presented to the management to proceed to the next phase.

Phase 2: Systems Analysis

- During this phase, the organization's current procedures and the information systems used to perform different tasks are studied.
- The activities generally included in the analysis phase are:
  - determining the requirements of the system
  - Requirement structuring and elimination of redundancies
  - generating alternative initial designs to match the requirements
- The output of the analysis phase is a description of the alternative solution recommended by the analysis team

Phase 3: Systems Design

- During systems design, the description of the recommended alternative solution is converted into logical and then physical system specifications.
- Logical design is not tied to any specific hardware and systems software platform.
- During physical design decision is made regarding:
  - programming language
  - database systems
  - hardware platform
  - operating system, and
  - network environment the system will run under.
- The final product of the design phase is the physical system specifications

Phase 4: Systems Implementation and Operation

- During systems implementation and operation, the system specifications are turned into a working system that is tested and then put into use.
- Implementation includes coding, testing, and installation.
- During operation, programmers make the changes that users ask for and modify the system to reflect changing business conditions.

IS Development Methodologies

- A **system development methodology** refers to the framework that is used to structure, plan, and control the process of developing an information system.
- A wide variety of such frameworks have evolved over the years, each with its own recognized strengths and weaknesses.

IS Development Methodologies

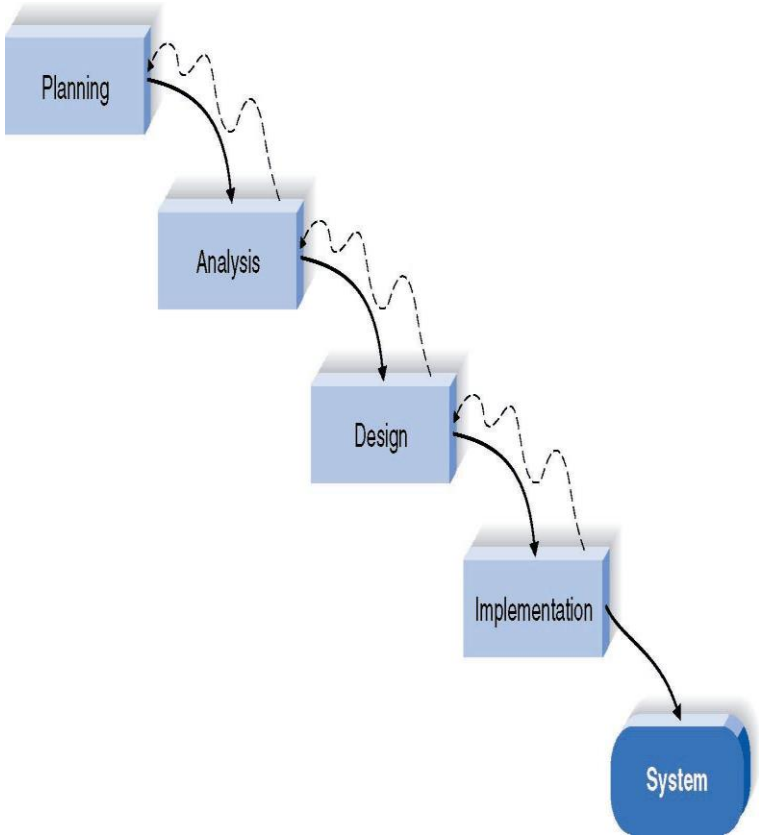
The methodologies can be categorized as:

- ***Structured design***
  - Waterfall Development Method
  - Parallel development
- ***Rapid Application Development (RAD)***
  - Phased Development
  - Prototyping
  - Throw-Away Prototyping
- ***Agile development***
  - XP streamline SDLC

Structured design

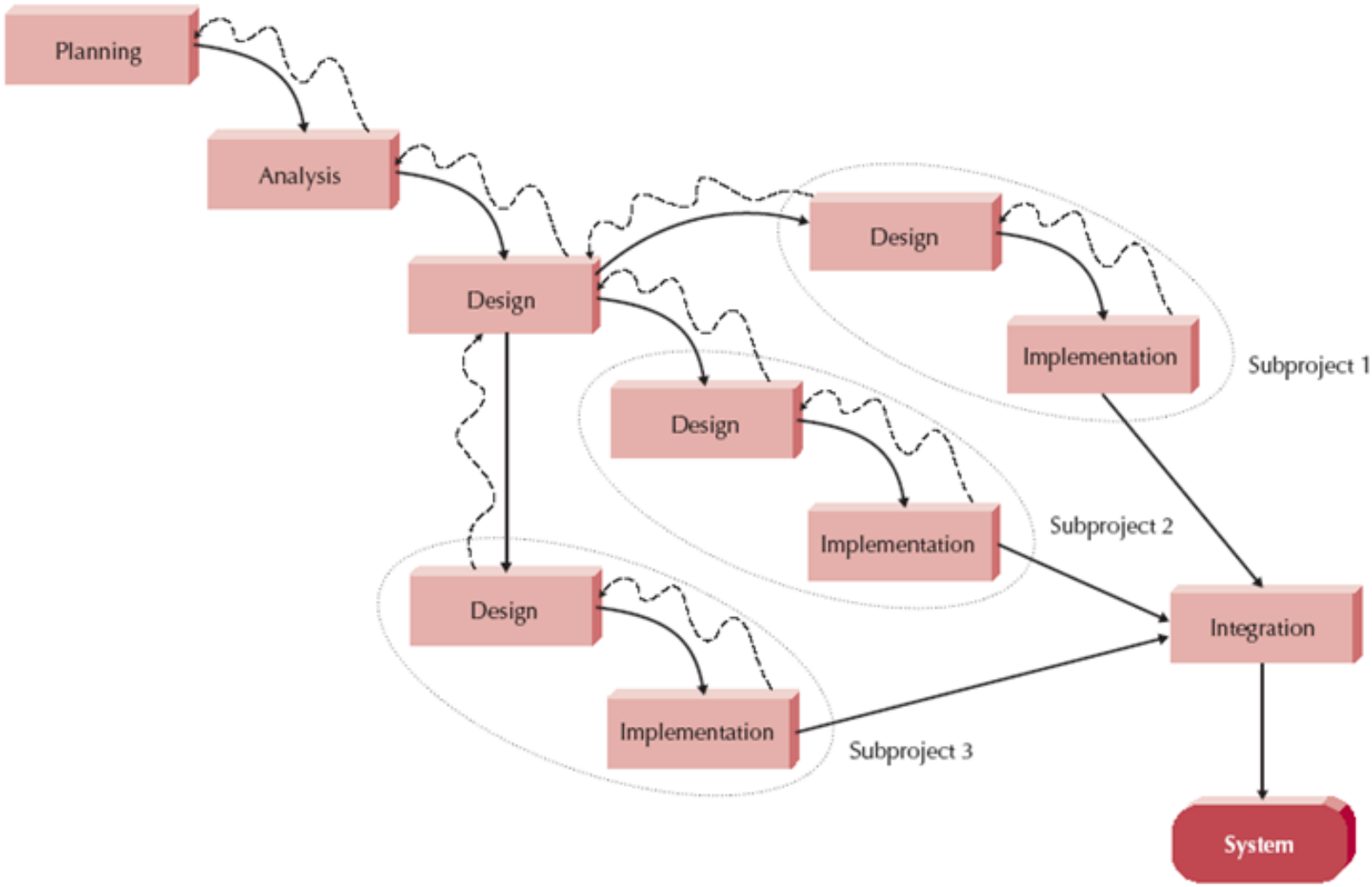
- **Waterfall Development Method**

Pros	Cons
Identifies systems requirements long before programming begins	Design must be specified on paper before programming begins
	Long time between system proposal and delivery of new system
	Rework is very hard



Structured design

- **Parallel development**



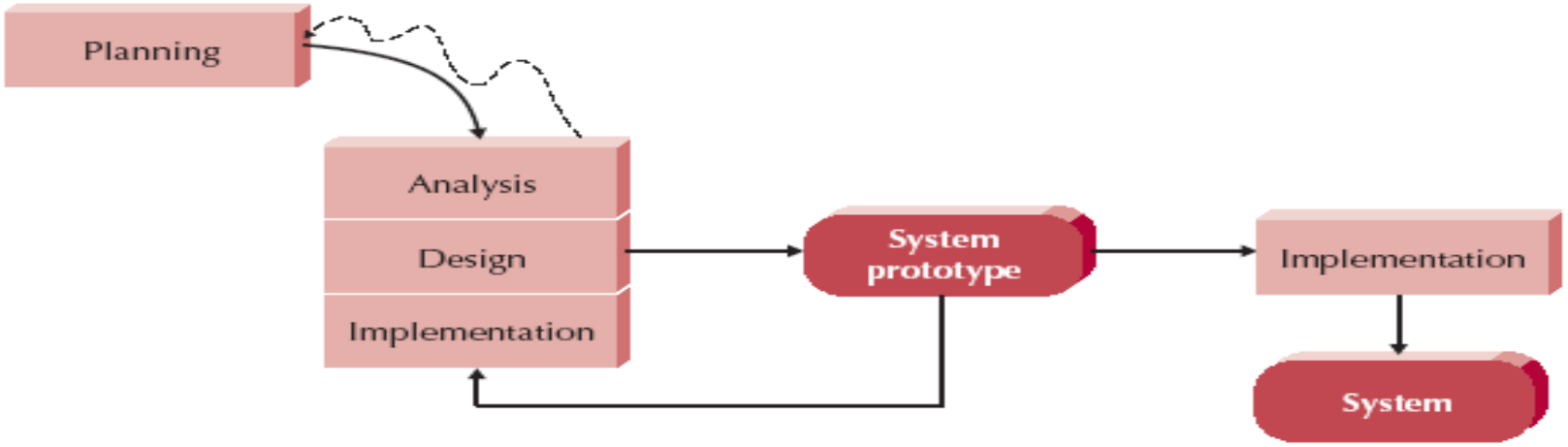
Rapid Application Development (RAD)

- **Phased Development**
  - Break overall system into a series of versions
  - Each version has Analysis, Design, and Implementation
  - Output from one version is the input to the next
  - Incorporate ideas, issues, lessons learned in one version into the next version

Pros	Cons
Gets useful system to users quickly Most important functions tested most	Initial system is intentionally incomplete System requirements expand as users see versions

Rapid Application Development (RAD)

- **Prototyping**
  - Analysis, Design, Implementation are performed concurrently
  - Start with a "quick-and-dirty" prototype
  - Provides minimal functionality
  - Repeat process, refining the prototype each time
  - Stop when prototype is a working system



Rapid Application Development (RAD)

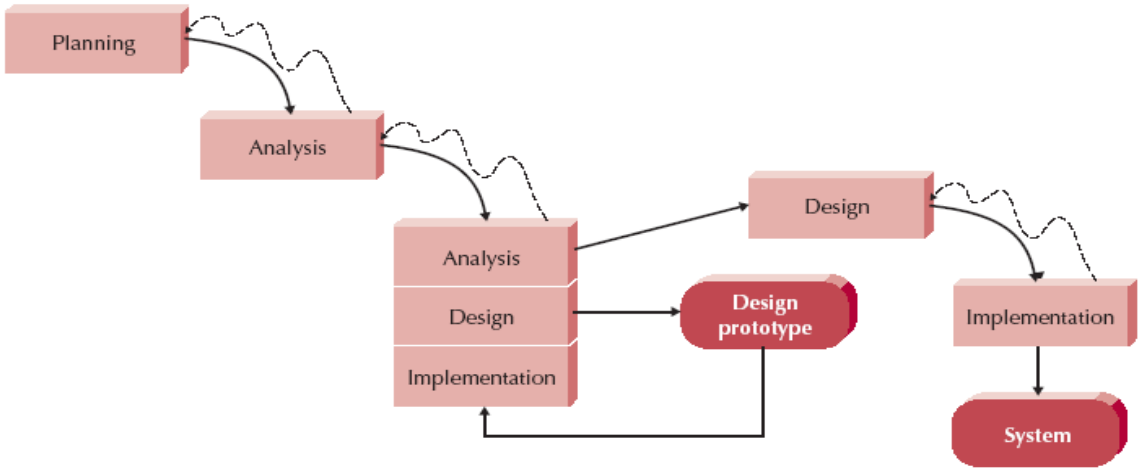
- **Prototyping**

Pros	Cons
Gets working system to users quickly	Fast paced. Hard to conduct careful, methodical analysis
Reassures users that the project is progressing	Initial design decisions have long term staying power
Quickly refines true requirements	Problems may come to light late in design, requiring re-design

Rapid Application Development (RAD)

- **Throw-Away Prototyping**
  - Use prototypes only to understand requirements

    Example: use html to show User Interface (UI)
  - Prototype is not a working design
  - Once requirements are understood, the prototypes are thrown away
  - The system is then built using SDLC



Rapid Application Development (RAD)

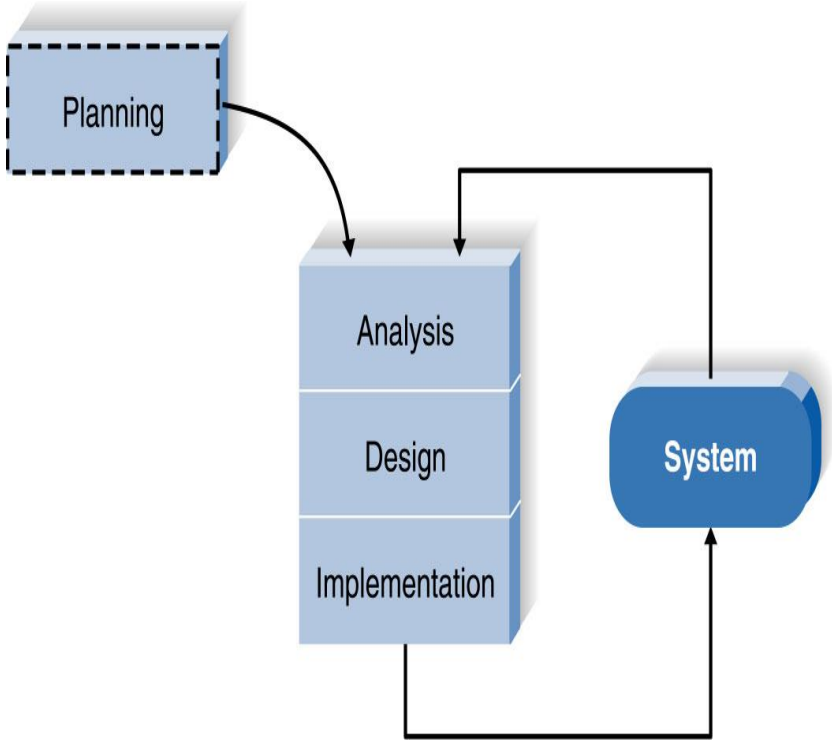
- **Throw-Away Prototyping**

Pros	Cons
Risks are Minimized	May Take Longer Than Prototyping
Important Issues are Understood Before the Real System is Built	

Agile development

- **XP streamline SDLC**
  - Eliminate much of the modeling and documentation
  - Emphasize simple, iterative application development

Pros	Cons
Fast Delivery of Results	Requires Discipline
Works Well in Projects With Undefined or Changing Requirements	Works Best in Small Projects
	Requires Much User Input



How to Select the Appropriate Methodology?

- ✓ Clarity of User Requirements
- ✓ Familiarity with Technology
- ✓ System Complexity
- ✓ System Reliability
- ✓ Short Time Schedules
- ✓ Schedule Visibility

Criteria for Selecting a Methodology

Ability to Develop Systems	Structured Methodologies			RAD Methodologies		Agile Methodologies
	Waterfall	Parallel	Phased	Prototyping	Throwaway Prototyping	XP
with Unclear User Requirements	Poor	Poor	Good	Excellent	Excellent	Excellent
with Unfamiliar Technology	Poor	Poor	Good	Poor	Excellent	Poor
that are Complex	Good	Good	Good	Poor	Excellent	Poor
that are Reliable	Good	Good	Good	Poor	Excellent	Good
with a Short Time Schedule	Poor	Good	Excellent	Excellent	Good	Excellent

Roles, Functions, and Careers in IS

- Primary responsibilities in information systems:
  - Operations:
    - System operators primarily run and maintain IS equipment
  - Systems development:
    - Focuses on specific development projects and ongoing maintenance and review

Roles, Functions, and Careers in IS

- Support:
  - Provides user assistance in hardware and software acquisition and use, data administration, user training and assistance, and Web administration
- Information service units:
  - A miniature IS department attached and directly reporting to a functional area in a large organization

Typical IS Titles and Functions

- Chief information officer (CIO):
  - Employs the IS department's equipment and personnel to help the organization attain its goals
- Network administrators:
  - Set up and manage the network hardware, software, and security processes