Foundations of Software Development
Unit 3: Systems Analysis and Design

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Unit 3: Systems Analysis and Design

- The concept of a System, Basic Components

- Phases of the Classical Systems Development Life Cycle (SDLC) Method

- The Prototype methods

- The structured development approach using Functional Decomposition Diagram (FDD), Data Flow Diagram (DFD)

General Diagram of System

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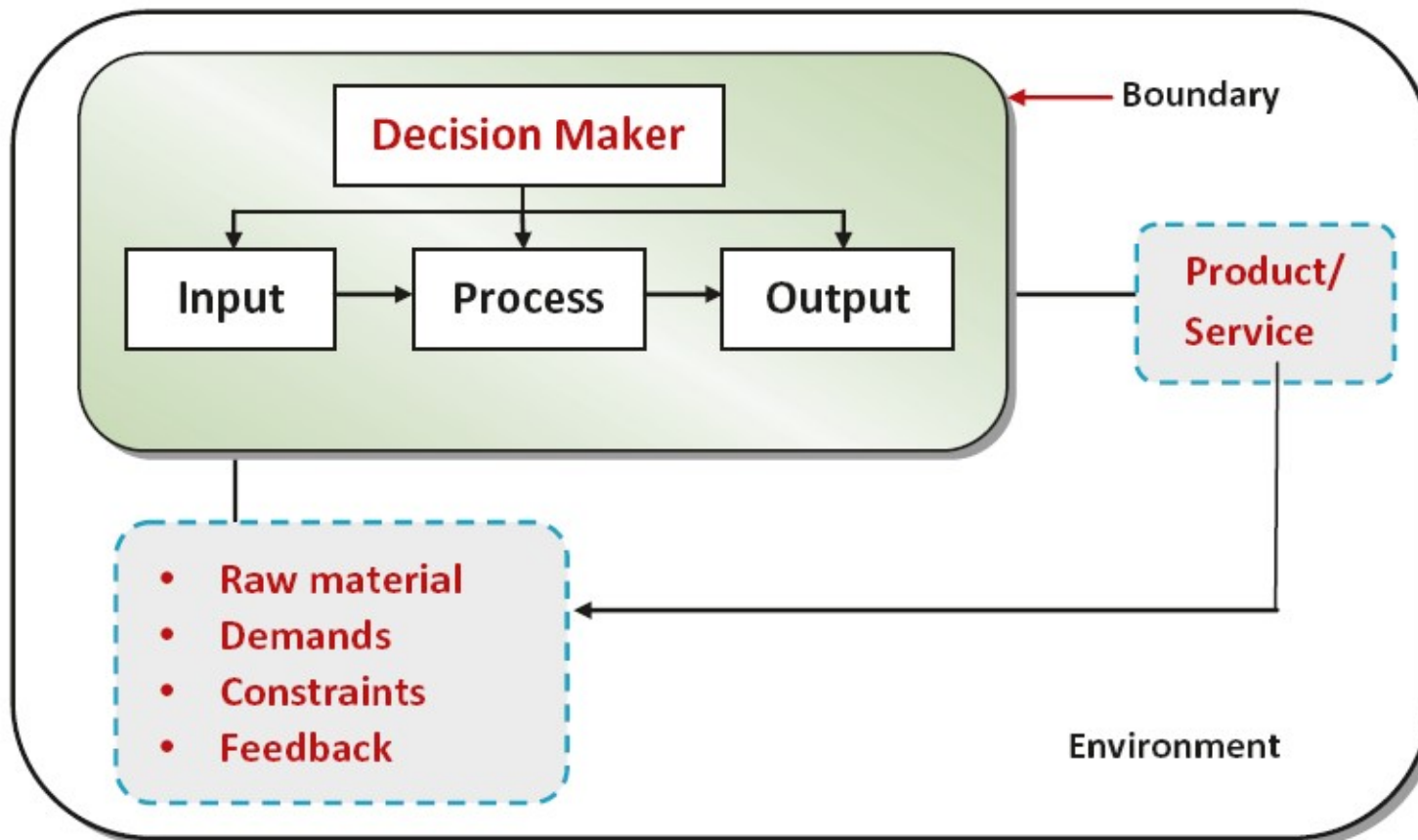
Structure of a system:

Input: Input includes those elements that enters into a system. Examples are raw materials, cost and resources

Processes: All the elements necessary to convert the input into output are included in the process. Examples are procedures, tools, decisions, activities etc.

Output: Outputs describes the finished products or the consequences of being in the system. (results). Examples are service, finished product or profit.

Feedback: Flow of information from output component to the decision maker concerning the system output or performance.

Environment: (No output, no input, no process) Elements outside the system. Examples are customers, Govt., Banks

Boundary: A system is separated from its environment by its boundary. It may be physical (e.g. building) or conceptual(e.g.. Time)

Systems Analysis and Design Overview:

- Improving business through better procedures and methods
  - Not for **profit** only
  - Not for **computerization**
  - Not to decide the **change** of info. Systems
  - **But for better quality of procedures**

- **Analysis:** Process of gathering & interpreting facts and diagnosing problems and using the information to recommend improvements to the system.

What

Systems Analyst Work:

- Systems Analysis only

- Systems Analysis and Design

- Systems Analysis, Design and Programming

Users:

- Hands on End User → clerk and operational staff

- Indirect End User → supervisor

- User Manager → manager

- Senior Manager → MD

Closed and Open Systems:

- An **open system** relay on its environment for input and/or feedback. It may exchange information, material or energy.

- A **Close** system rely on itself(independent) and do not interact with its environment.

- Special type of closed system are known as **black box**, where process is not well defined.
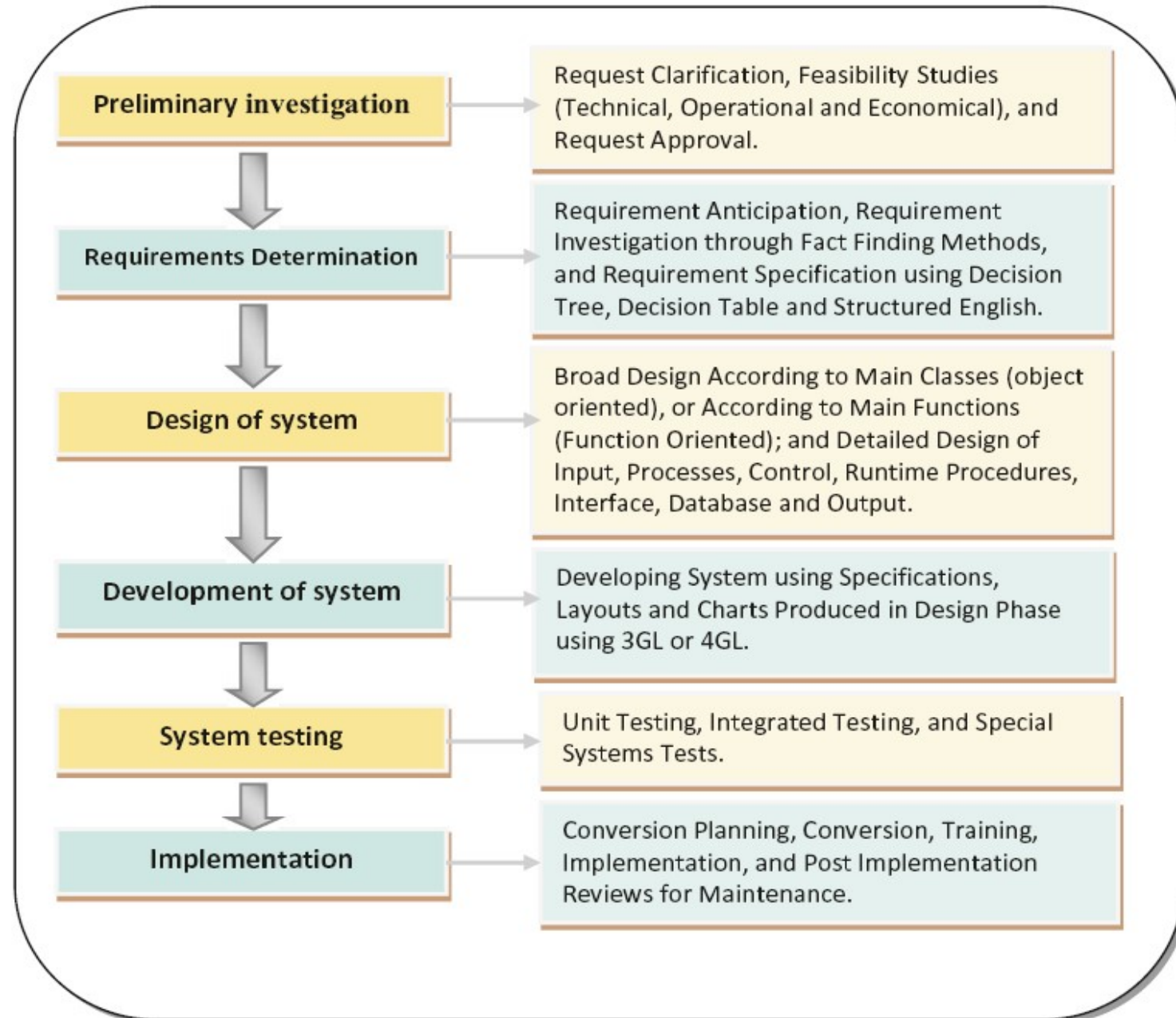
Closed Vs. Open Inventory System

- Cost and constant lead time

- Vendors and users are excluded from the analysis

- Weather and other environmental factors are ignored

- Variable demand

- Vendors and users are being considered

- Weather and other environmental factors are determining demand and lead time

Approaches:

-to develop computer information system:

- **Systems Development Life Cycle Method (Classical or Linear Approach)**

- **Structured Analysis Development Method**

- **Systems Prototype Method**

Systems Development Life Cycle Method

Preliminary investigation	→	Request Clarification, Feasibility Studies (Technical, Operational and Economical), and Request Approval.
Requirements Determination	→	Requirement Anticipation, Requirement Investigation through Fact Finding Methods, and Requirement Specification using Decision Tree, Decision Table and Structured English.
Design of system	→	Broad Design According to Main Classes (object oriented), or According to Main Functions (Function Oriented); and Detailed Design of Input, Processes, Control, Runtime Procedures, Interface, Database and Output.
Development of system	→	Developing System using Specifications, Layouts and Charts Produced in Design Phase using 3GL or 4GL.
System testing	→	Unit Testing, Integrated Testing, and Special Systems Tests.
Implementation	→	Conversion Planning, Conversion, Training, Implementation, and Post Implementation Reviews for Maintenance.

Preliminary investigation:

- Request Clarification
- Feasibility Study
  - Technical feasibility*(equipments, technology etc.)*

  - Economic feasibility*(costs, benefits etc.)*

  - Operational feasibility*(usage, implementation etc.)*

- Request Approval *(cost, priority and completion time is estimated now)*

Requirements Determination :

- **Requirements Anticipation**
  - Mixed Blessings

- **Requirements Investigations**
  - Interview (Structured and Unstructured)
  - Questionnaire (Open end and Close end)
  - Record Review
  - Observation
  - Prototype

- **Requirements Specifications**
  - Decision Tree
  - Decision Table
  - Structured English

Design of system:

Meeting the requirements

Logical Design and Physical Design

How?

Considering data to input, calculated or stored
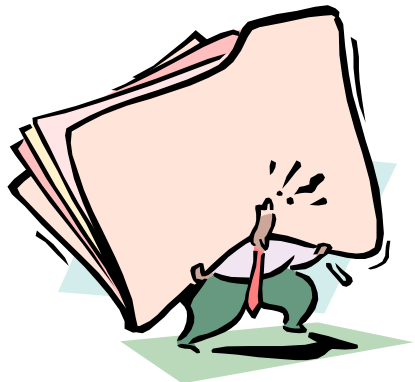
Results in design specifications using charts, tables and symbols

…Designers have to assist programmers also.

Development of system:

- **Decision: Buy or make?**

- **Documentation**

  Documentation is essential in testing and continuing maintenance, if needed

- **Coding**

System testing:

- Unit test and test cases

- Integration testing

- Implementing and Testing directly

Implementation & Evaluation:

- Putting new tools into use…

- Parallel implementation with existing system if any

- Time bound implementation

Implementation & Evaluation:

- **Operational Evaluation:**
  - Systems functions, ease of use, response time, representation format and reliability

- **Organizational impact:**
  - Benefits, cost, revenue and profits, operational efficiency, impact on internal and external information flows.

- **User manager assessments:**
  - Attitudes of senior and user managers and end users.

- **Development performance:**
  - Overall development time and efforts, comparison with the standards and budgets.

Systems Prototype Method:
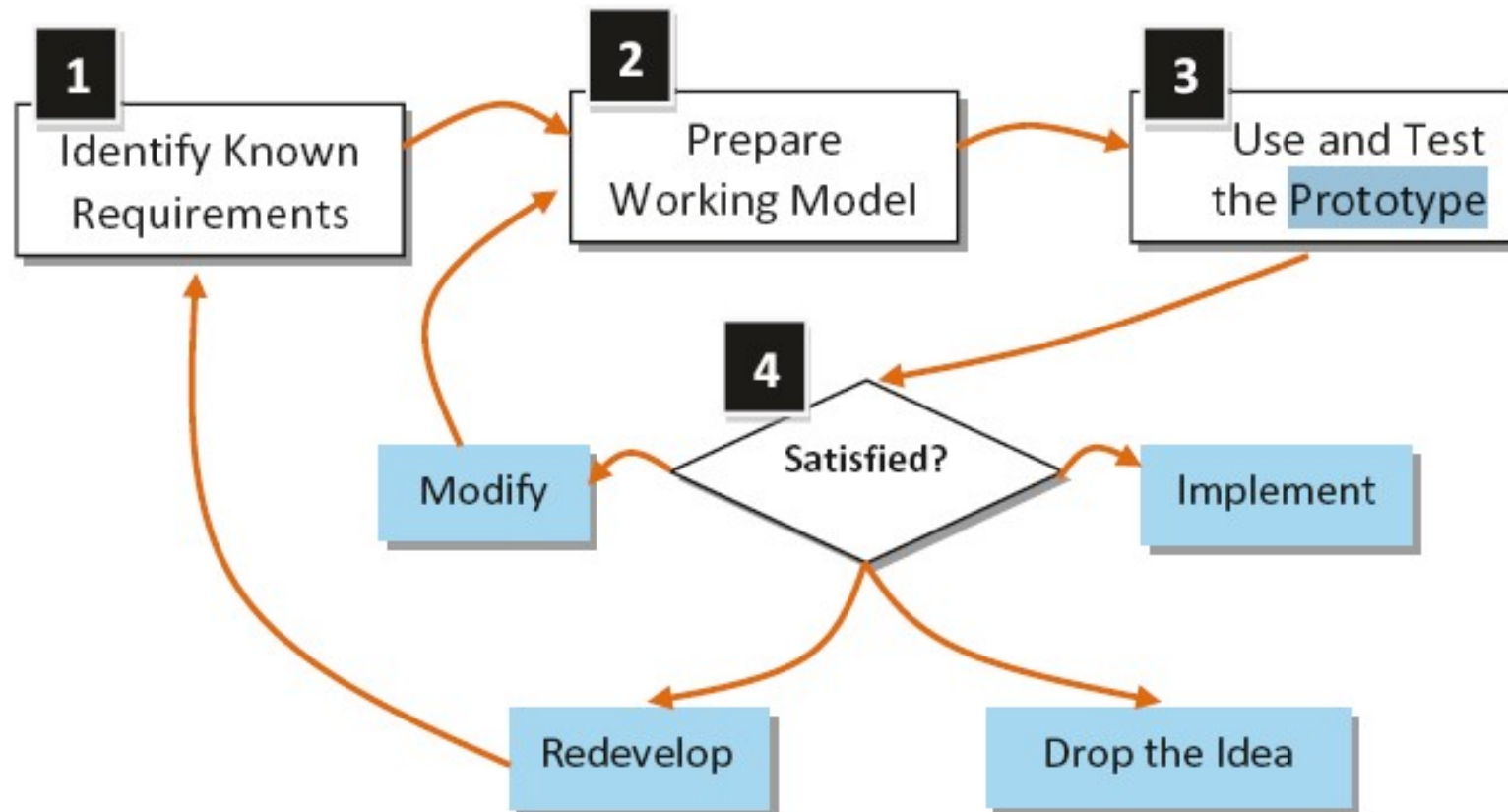
Systems Prototype Method:

- It is a working system/pilot or test model

- Used when high risk, high cost and requirements are not known

- It is an iterative as well as interactive process.

- After testing the model
  - Prototype is redeveloped
  - Implemented
  - Modified
  - Abandoned

- Speed is important with prototype

Structured Approach
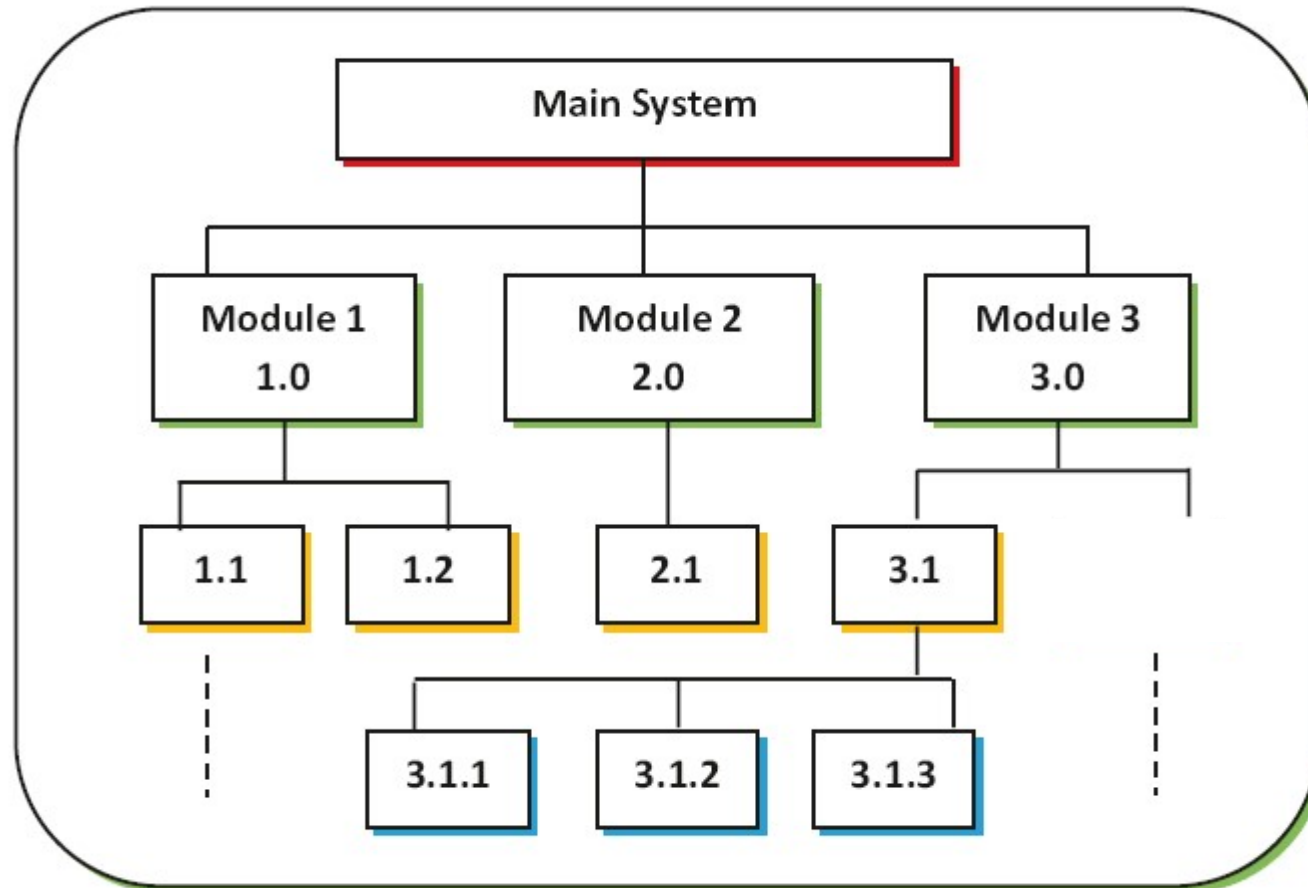
Function Decomposition Diagram
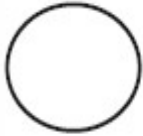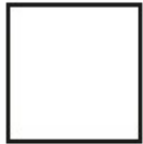
Function Decomposition Diagram
An Example
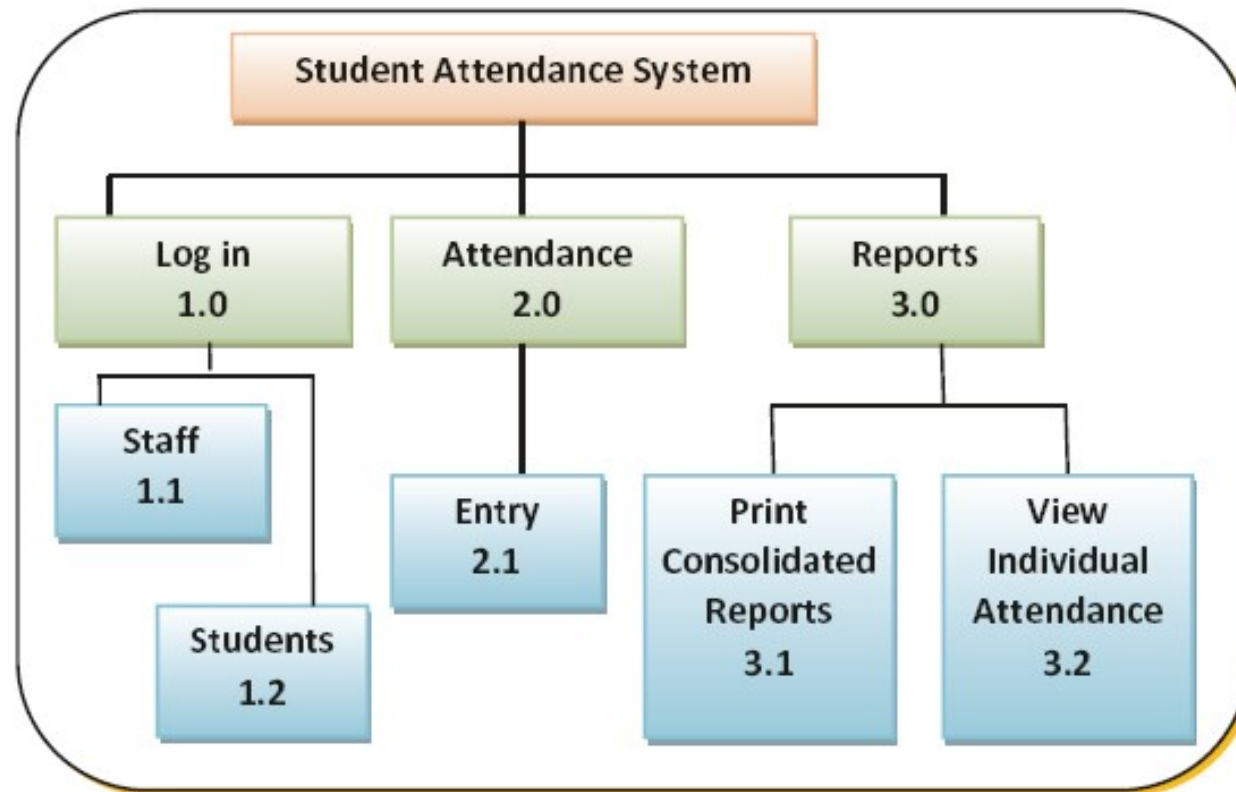
Function Decomposition Diagram
An Example

Function Decomposition Diagram
An Example

Function Decomposition Diagram (FDD)

Library Management System

| Log in 1.0 | Issue 2.0 | Return 3.0 | Reports 4.0 |
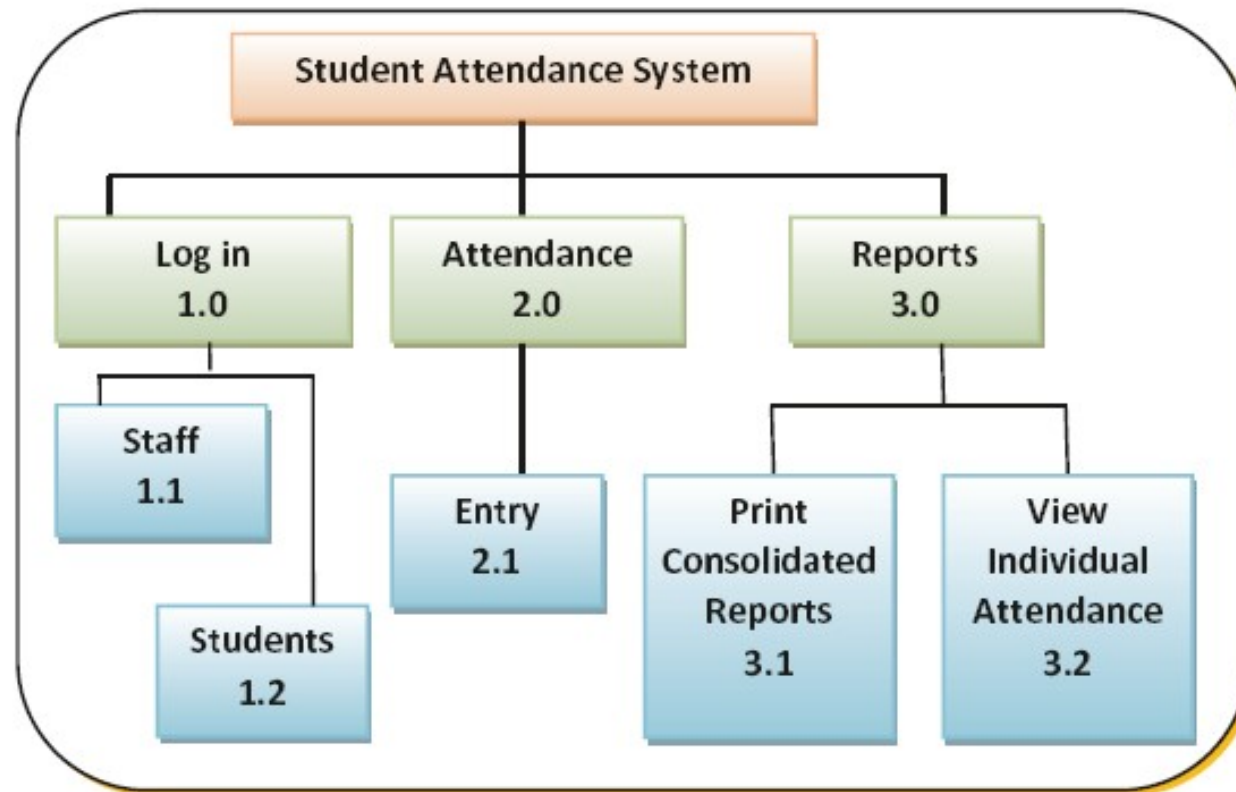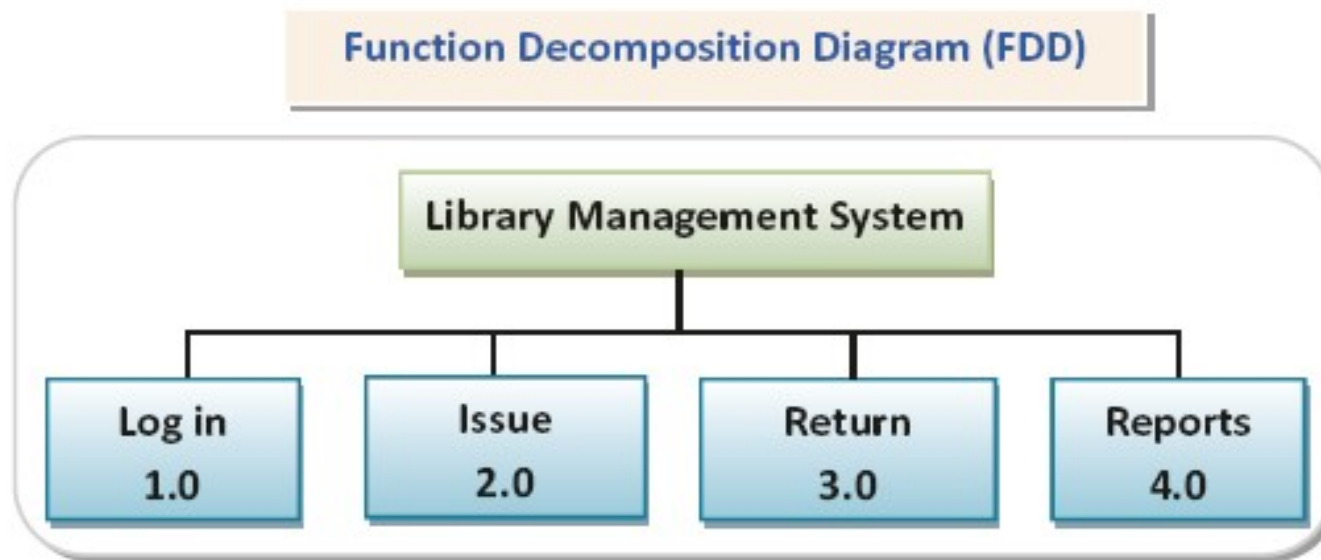
Data Flow Diagrams

Symbols of data flow diagrams (DFD)

| Symbol description	Yourdon and Constantine method	Gane and Sarson method
Dataflow: shows flow of data from one entity to another entity. It must be labeled	⟶	⟶
Process: describes how data are used and processed	◯	▢
Source or sink: is the external resources that initiate request/query and get the results	▢	▢
Data stores: stores data in predefined form by a process. It can be in an electronic form or not	▭	▭

Example of FDD and DFD: Inventory
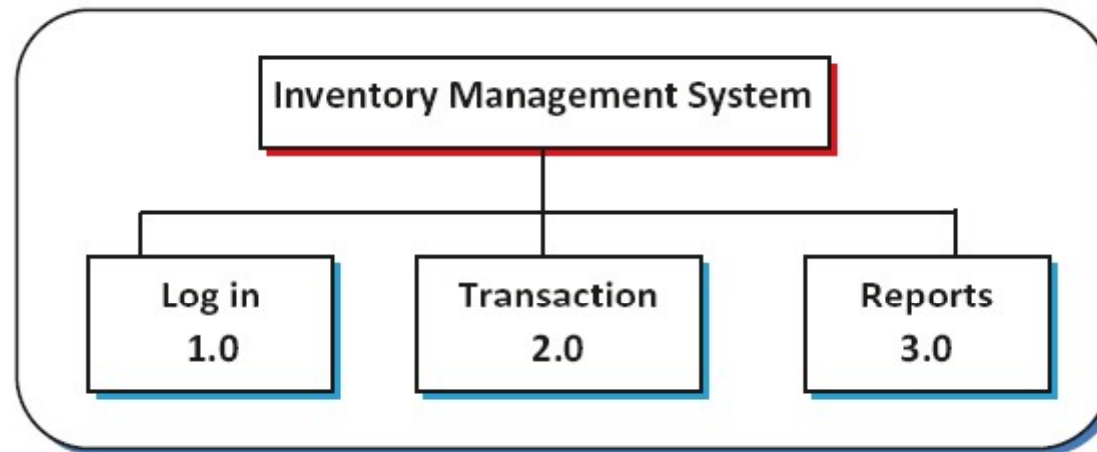
Function Decomposition Diagrams

Example of Data Flow Diagrams
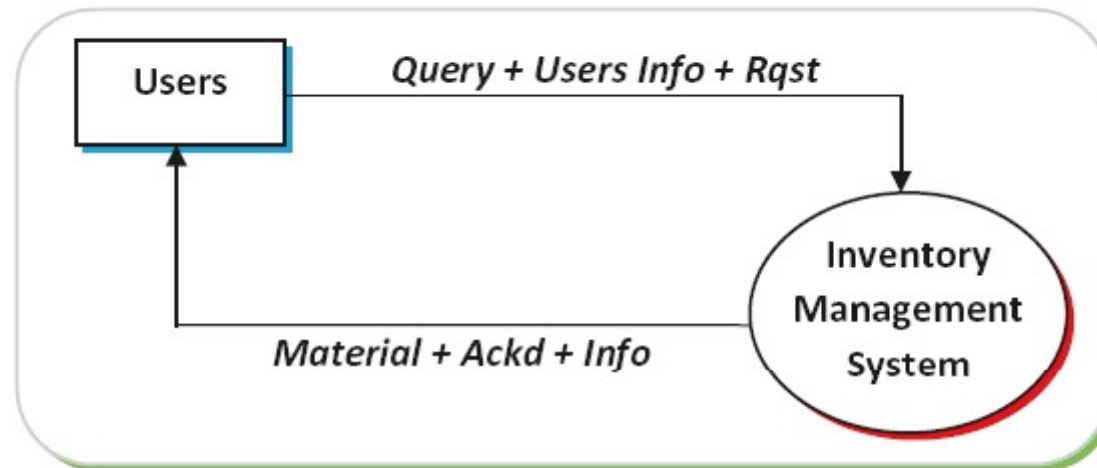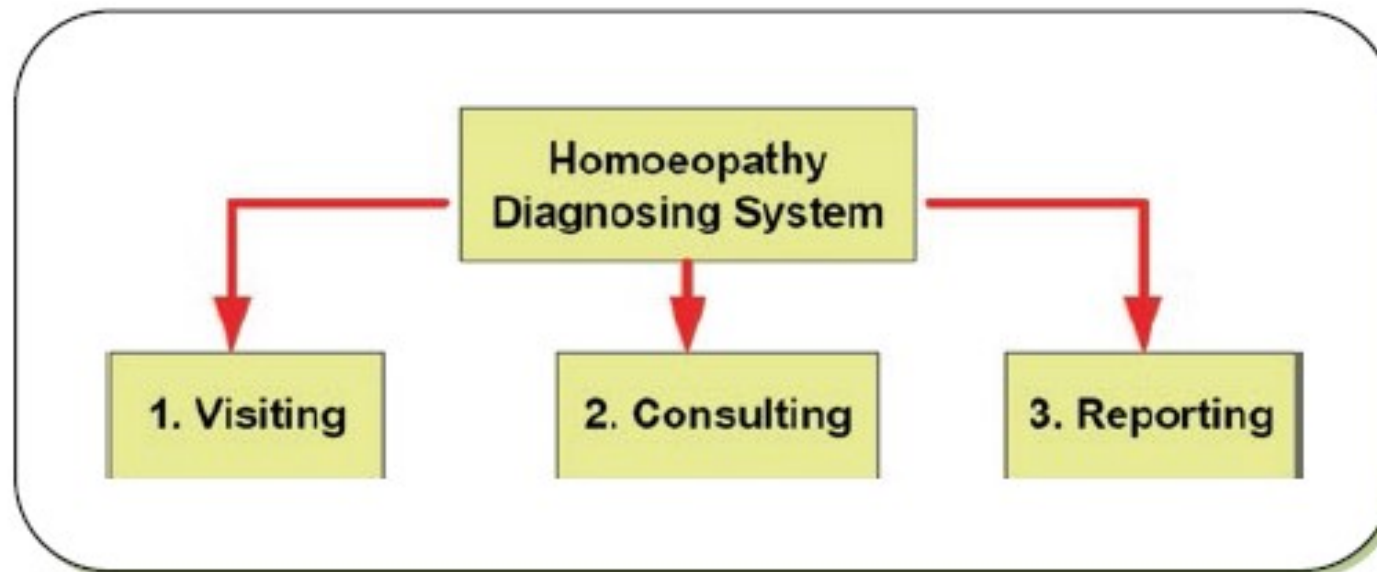

Context-level DFD of the inventory example

Next-level DFD of the inventory example
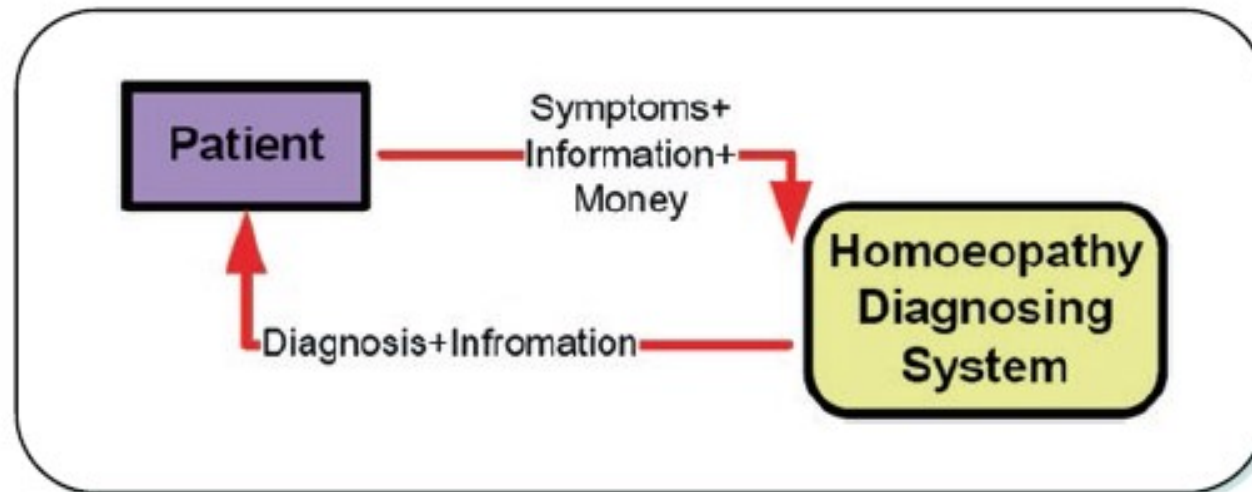
Case
Homoeopathy Patient Management System

Function Decomposition Diagram (FDD)

Homoeopathy Diagnosing System
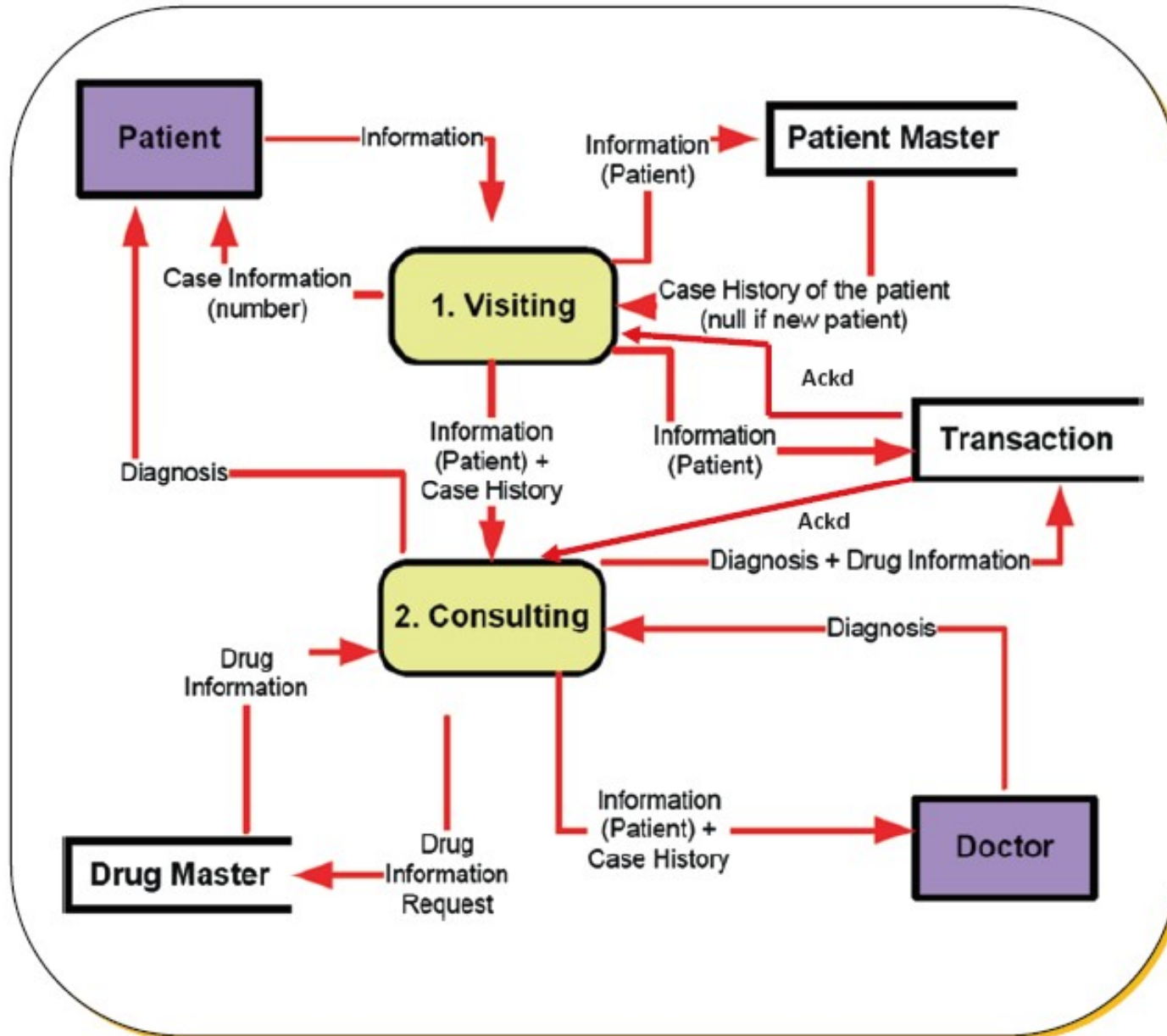- 1. Visiting
- 2. Consulting
- 3. Reporting

Case
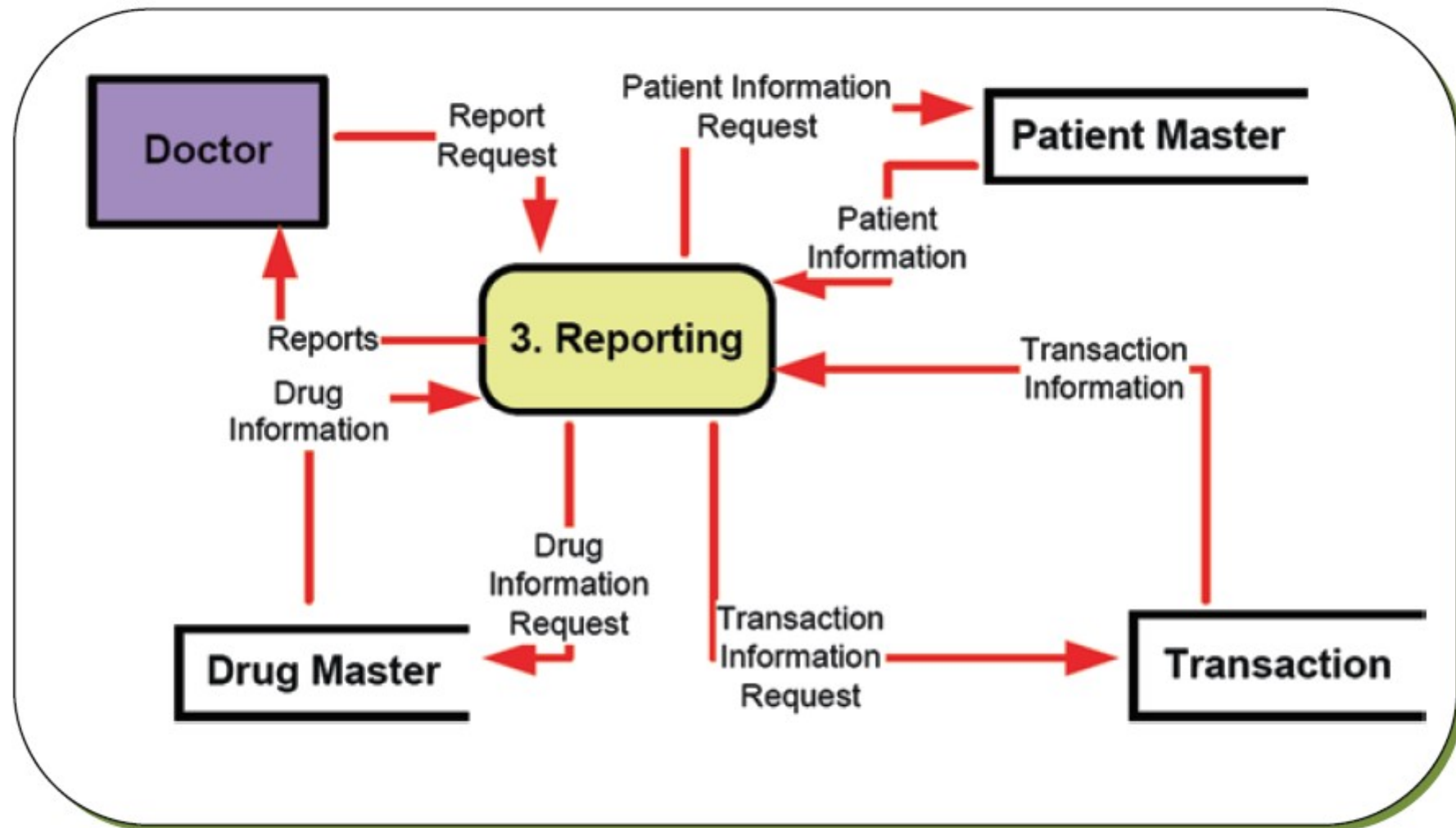# Homoeopathy Patient Management System

Context Level Data Flow Diagram (DFD)

Homoeopathy Patient Management System

Homoeopathy Patient Management System

Physical and Logical DFDs

Logical DFDs	Physical DFDs
Logical DFD is an implantation-independent view of the current system	Physical DFD is the implementation-dependent view of the current system
Logical DFD focuses on the flow of data between processes and focuses on conceptual working of the system instead of giving importance to the physical entities related to the system	It contains physical information about the system such as people, tasks, location information, names of documents, departments, equipment, devices, and related procedures
Logical DFD is more abstract in nature (in comparison with the physical DFDs)	Physical DFDs are comparatively more specific

Data Dictionary

- A data dictionary is a repository of elements in a system in an organized form.

- It contains systematic information regarding external entities, data stores, data flows, and processes.

- Often the data dictionary is compiled by Systems Analyst manually or by Computer-Aided Systems Engineering (CASE) tool automatically in parallel to the systems development.

Data Dictionary Uses

- DD is used to

- Manages details

- • Documents information about systems components

- • Facilitates analysis and other systems development activities

- • Serves as a platform for testing and cross verification by locating errors and

- omissions

- • Communicates with the developers and users

Data Dictionary

DD contains

- Data names
- Data descriptions
- Aliases
- Length, type and permissible values
- Data structures
  - Sequential (first name, middle name…)
  - Iterative (marks)
  - Optional (PAN no.)

References

- Sajja, P.S. "Essence of Systems Analysis and Design: A Workbook Approach", Springer International Publishing, Singapore, 2017

- Amazinganimations.com

- Presentermedia.com