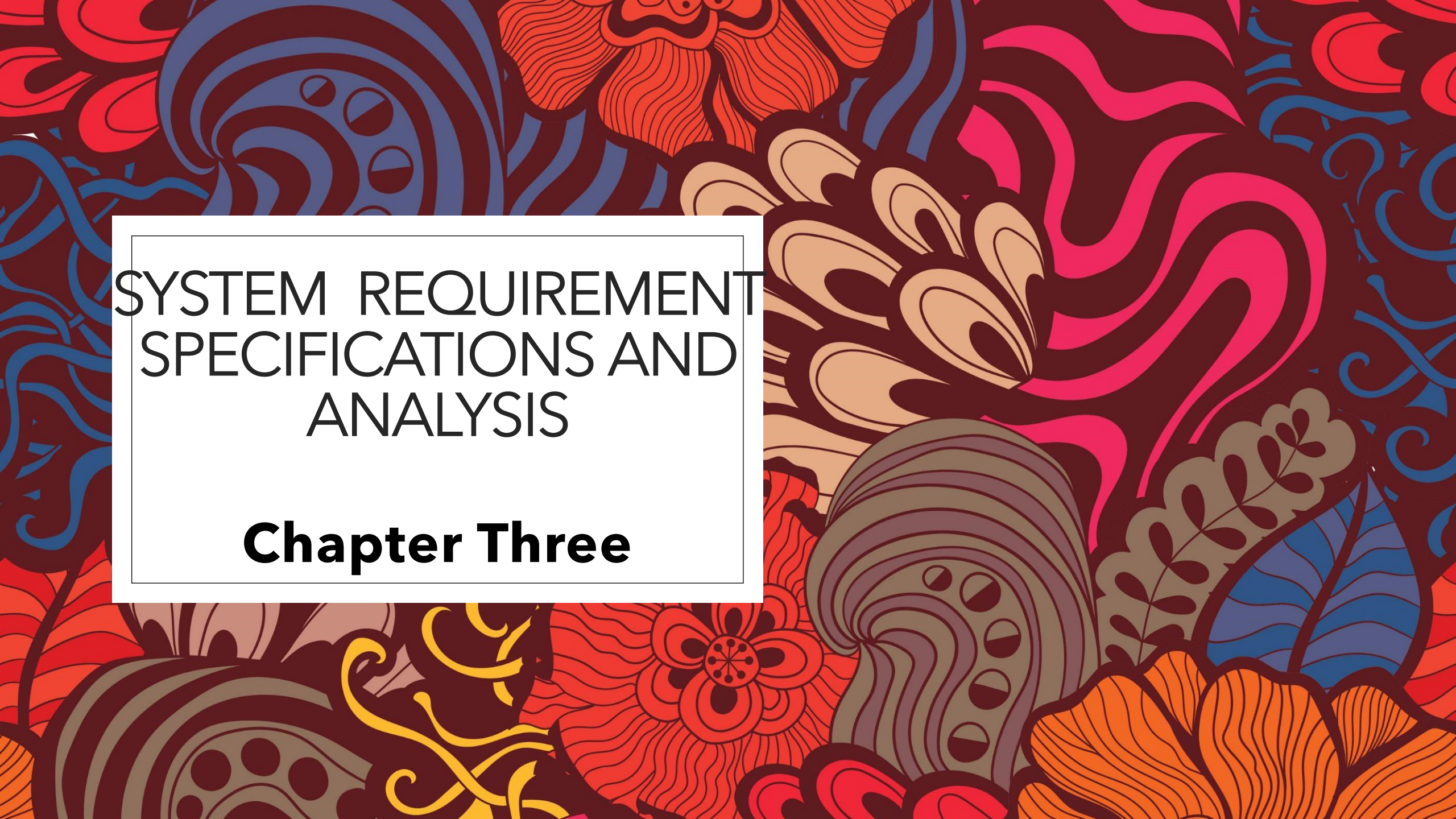

SYSTEM REQUIREMENT SPECIFICATIONS AND ANALYSIS
Chapter Three

Contents

- System Requirement and its Determination
- Requirement Finding Techniques
- Requirement Elicitation and Analysis
- Requirement Analysis vs. Object Oriented System Analysis

Software Requirement

- A requirement is a vital feature of a new system which may include
  - ✓ processing or capturing of data,
  - ✓ controlling the activities of business.
  - ✓ producing information, and
  - ✓ supporting the management.
- The software requirements are description of features and functionalities of the target system.
- Requirements convey the expectations of users from the software product.
- The requirements can be obvious or hidden, known or unknown, expected or unexpected from client's point of view.

…Software Requirement

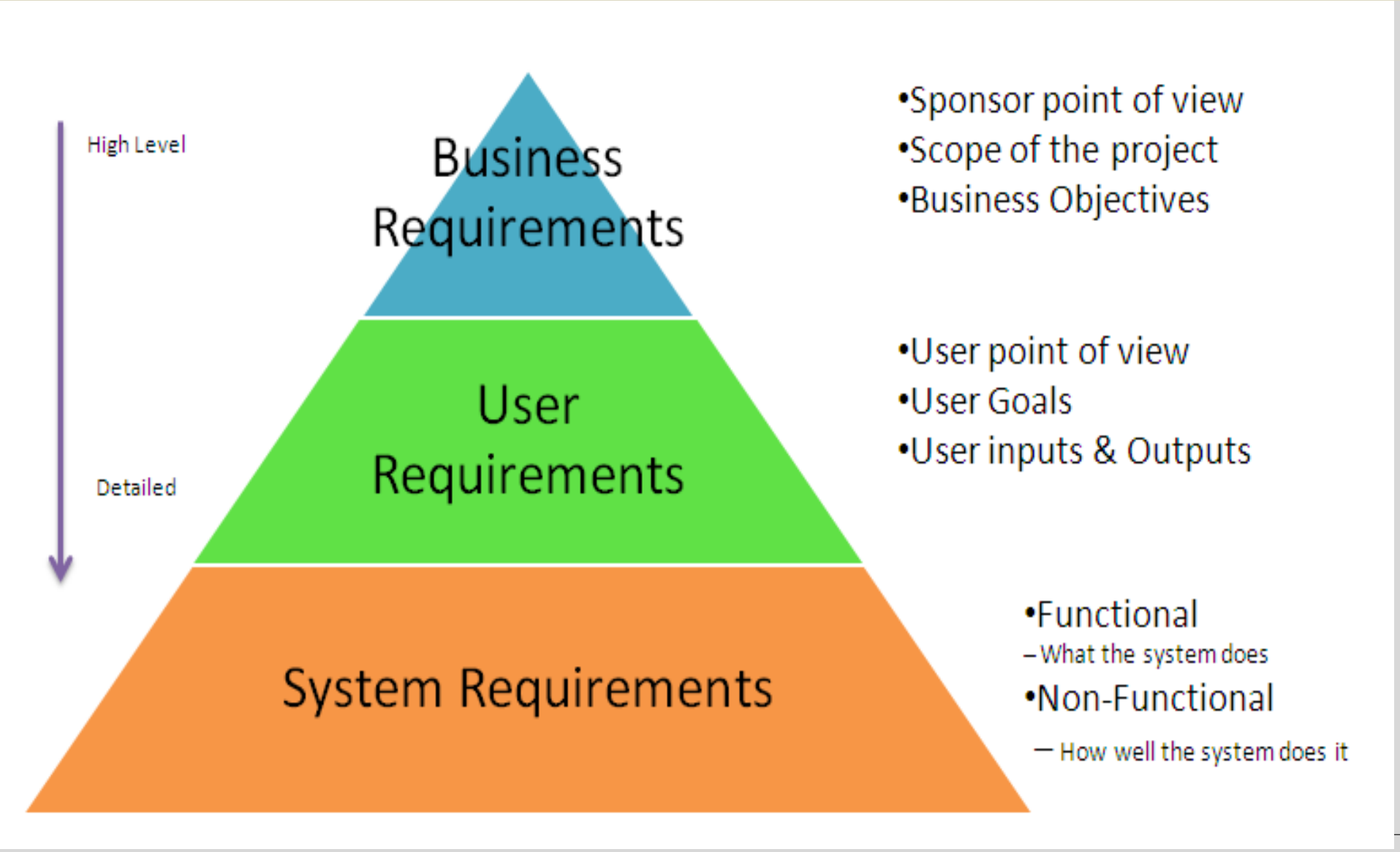
- **Requirements Classification:-**

1. Business requirements

2. User requirements

3. Software requirements

…Software Requirement



…Software Requirement

1. Business requirements

- Business analysts, leaders and other project sponsors create the **Business Requirement Document (BRD)** at the start of the project. This document defines the ***why*** behind the build.
- The BRD also serves as the basis for more detailed document preparation with clients.
- A BRD is composed of one or more statements. Write statements that match a project goal to a measurable stakeholder or business goal. The basic format of a BRD statement looks like:-

"The [project name] software will [meet a business goal] in order to [realize a business benefit]."

Example:- See the following detailed BRD statement:

"The laser marking software will allow the manufacturing floor to mark text and images on stainless steel components using a suitable laser beam in order to save money in chemical etching and disposal costs."

- The BRD should be a living document. Evaluate any future requirements, updates or change of the project against the BRD to ensure that the organization's goals are still met.

…Software Requirement

2. User requirements

- It reflect the specific needs or expectations of the software's customers.
- User requirements -- much like user stories -- highlight the ways in which customers interact with software.

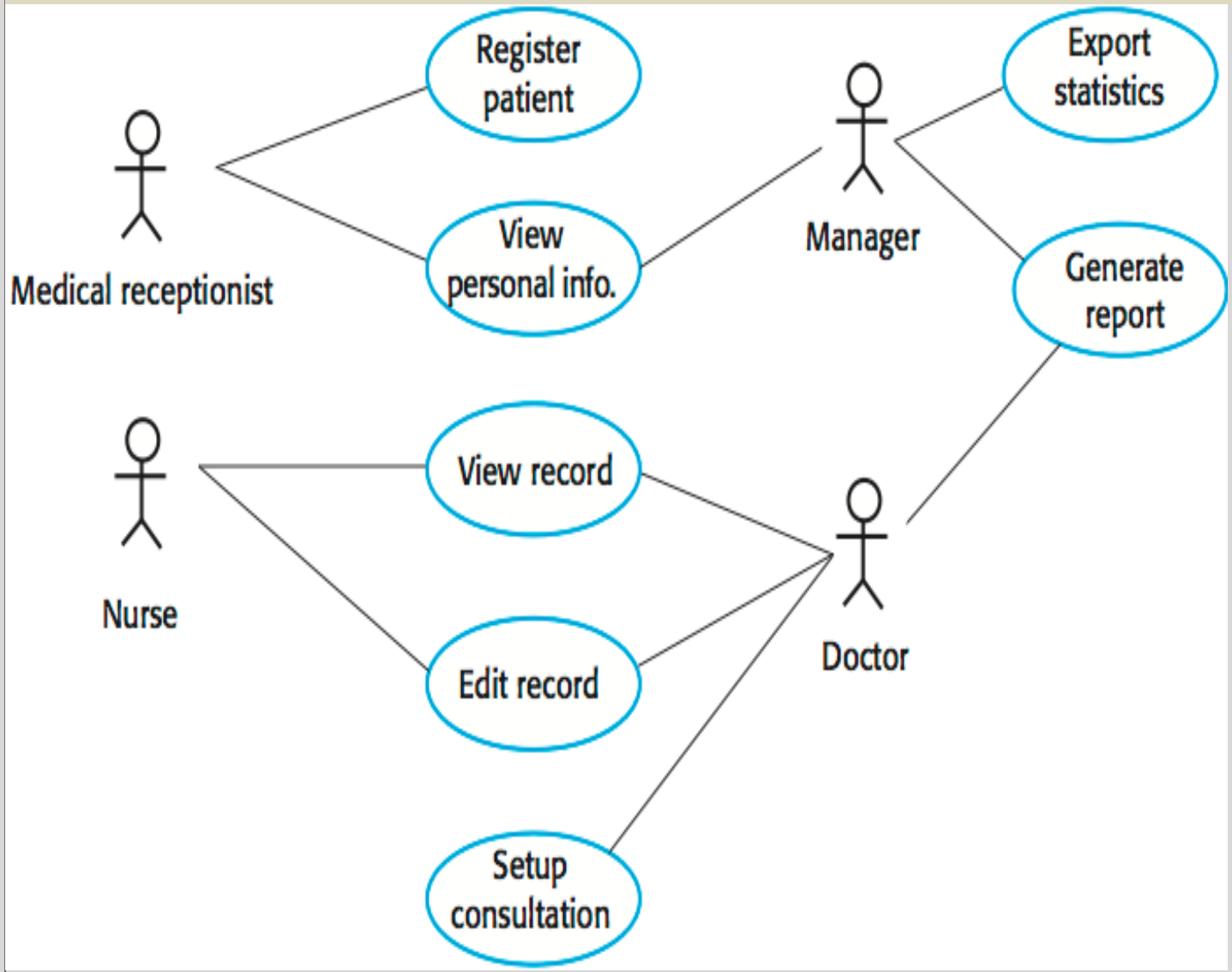
➢ There is no universally accepted standard for user requirements statements, but here's one common format:

"The [user type] shall [interact with the software] in order to [meet a business goal or achieve a result]."

Example : -A user requirement in that mold for the industrial ***laser marking software*** example looks like:

"The production floor manager shall be able to upload new marking files as needed in order to maintain a current and complete library of laser marking images for production use."

…Software Requirement



- **Example :-** A Sample use cases for a MHC which describe the user requirement and their interaction in the systems.

…Software Requirement

3. Software requirements

- After the BRD outlines the business goals and benefits of a project, the team should devise a software requirements specification (SRS) that identifies the specific features, functions, nonfunctional requirements and requisite use cases for the software.
- Essentially, the SRS details what the software will do, and it expands upon or translates the BRD into features and functions that developers understand.
- Software requirements typically break down into:
    - Functional requirements
    - Nonfunctional requirements
    - Domain requirements

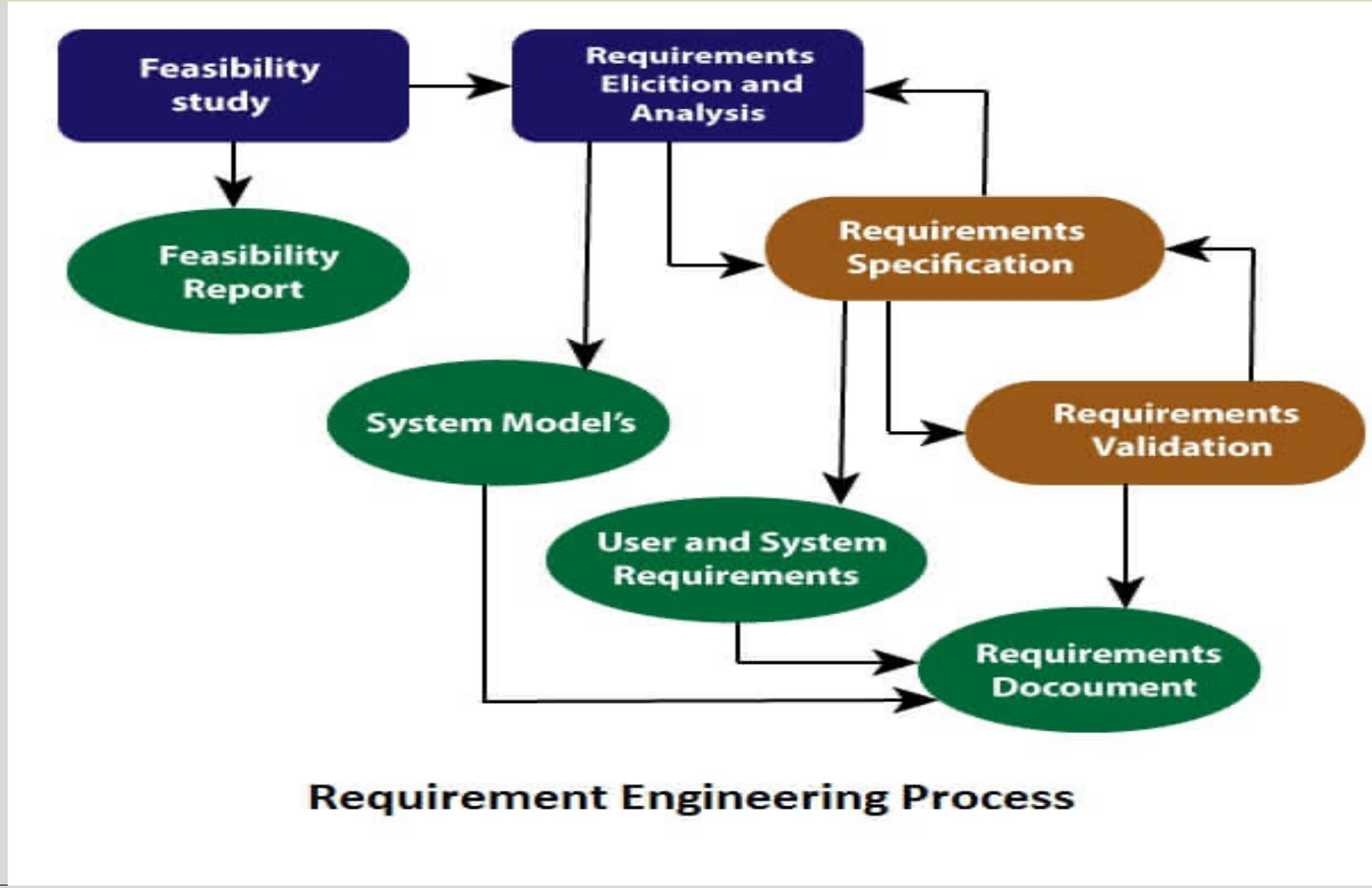
Requirement Engineering

- It provides the appropriate mechanism to understand what the customer desires, analyzing the need, and assessing feasibility, negotiating a reasonable solution, specifying the solution clearly, validating the specifications and managing the requirements as they are transformed into a working system.
- Thus, it is a process comprises an engineering design.
- The goal is to develop and maintain sophisticated and descriptive 'System Requirements Specification' document.

…..Requirement Engineering

- **Requirement Engineering Process (activities)**
  - Feasibility Study
  - Requirement Gathering (Requirement Elicitation and Analysis)
  - Requirement Specification
  - Requirement Validation

Requirement Engineering



Requirement Engineering Process

……Requirement Engineering

❑Feasibility Study

- The analysts does a detailed study about whether the desired system and its functionality are feasible to develop.
- This study analyzes whether the software product can be practically materialized in terms of implementation, contribution of project to organization, cost constraints and as per values and objectives of the organization.
- It should inform the decision of whether or not to go ahead with the project.

……Requirement Engineering

❑Requirement Gathering (Requirement Elicitation and Analysis)

- If the feasibility report is positive towards undertaking the project, next phase starts with gathering requirements from the user.
- **Elicitation** is the process of deriving the system requirements through ***observation of existing systems***, ***discussions with stakeholders***, etc. This may involve the development of one or more system models and prototypes that can help us understanding the system to be specified.
- Analysts and engineers communicate with the client and end-users to know their ideas on what the software should provide and which features they want the software to include.

…….Requirement Engineering

…..Requirement Gathering (Requirement Elicitation and Analysis)

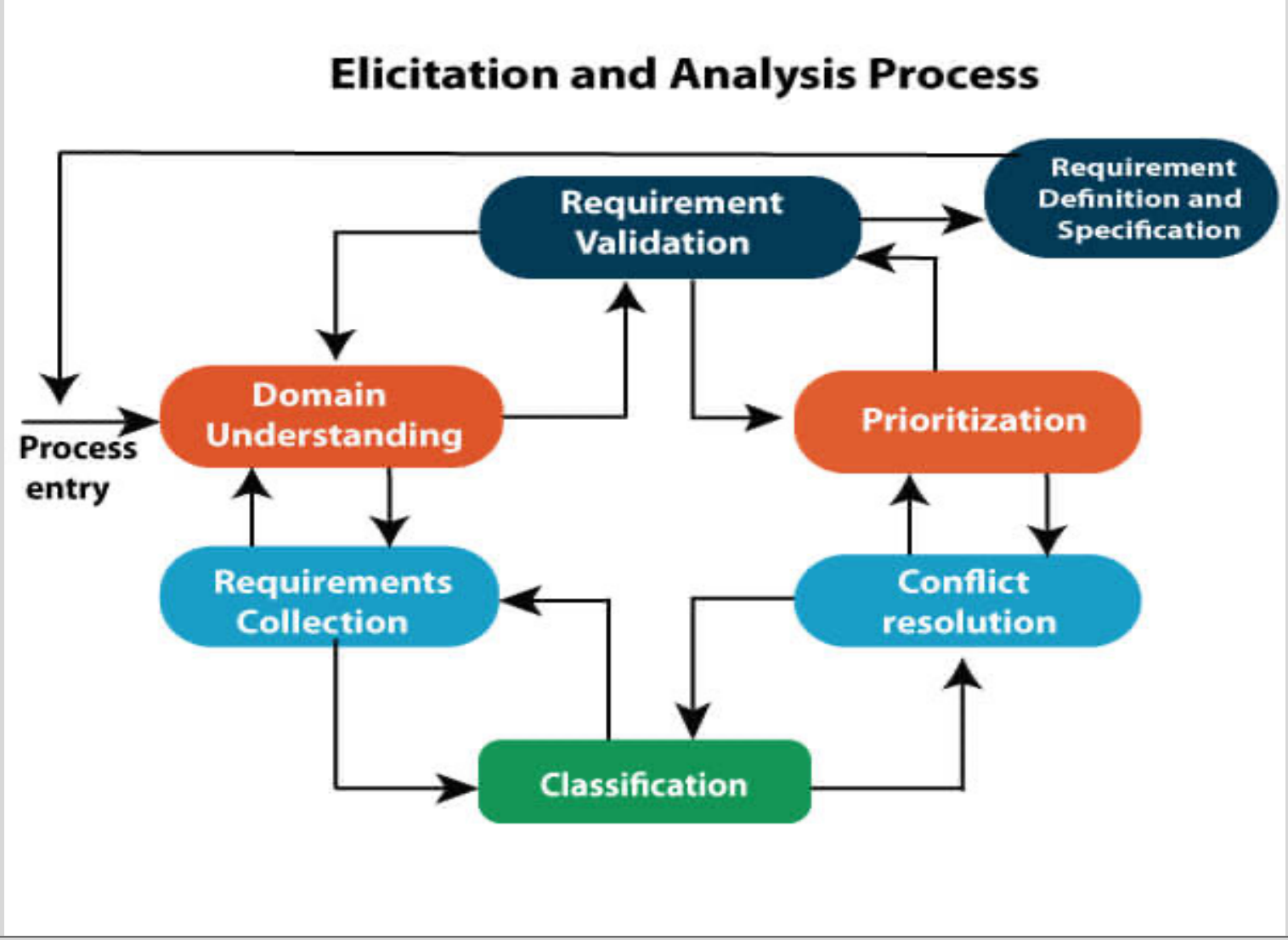
- **Requirement Analysis**
  - ways to accurately capture, interpret, and represent the voice of customers when specifying the requirements for a software product.
  - Requirements analysis is critical to the success or failure of a systems or software project.
  - The requirements should be documented, actionable, measurable, testable, traceable, related to identified business needs or opportunities, and defined to a level of detail sufficient for system design

……Requirement Engineering

Significant of Requirement Analysis

- It helps organizations to determine the actual needs of stakeholders.
- It enables the development team to communicate with stakeholders in a language they understand (like charts, models, flow-charts,) instead of pages of text.
- Once the requirements are gathered, we document the requirements in a **Software Requirements Specification (SRS)** document, use cases or as User Stories, which are shared with the stakeholders for approval
- This document is **easy to understand** for both **normal users** and **developers**.
- Any changes in the requirements are also documented and go through a change control procedure and finalized on approval.

.....Requirement Engineering



……Requirement Engineering

Elicitation and Analysis Process

a) Requirement Discovery :

- Interact with stockholders to discover requirements Domain requirements are also discovered at this stage.

b) Requirement classification and organization :

- Group related requirements and organized them into coherent cluster

……Requirement Engineering

c) Requirement Prioritization and negotiation

- Prioritizing requirements and resolving requirement conflicts
- The best negotiations strive for a "**win-win**" result.

d) Requirement Specification

- All formal & informal, functional and non-functional requirements are documented and made available for next phase processing.

……Requirement Engineering

- **Problems of Elicitation and Analysis**
  - Getting all, and only, the right people involved.
  - Stakeholders often don't know what they want
  - Stakeholders express requirements in their terms.
  - Stakeholders may have conflicting requirements.
  - Requirement change during the analysis process.
  - Organizational and political factors may influence system requirements.
  - New stakeholders may emerge and the business environment may change.

……Requirement Engineering

❑Requirement Specification (SRS)

- SRS is a document created by system analyst after the requirements are collected from various stakeholders. Two types of requirements may be included in this document; **user and system requirements.**
- SRS defines how the intended software will interact with hardware, external interfaces, speed of operation, response time of system, portability of software across various platforms, maintainability, speed of recovery after crashing, Security, Quality, Limitations etc.

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……Requirement Engineering

……Requirement Specification (SRS)

- **SRS should come up with following features:**
  - User Requirements are expressed in natural language.
  - Technical requirements are expressed in structured language.
  - Design description should be written in Pseudo code.
  - Format of Forms and GUI screen prints.
  - Conditional and mathematical notations for DFDs etc.

…..Requirement Engineering

❑Software Requirement Validation

- After requirement specifications are developed, the requirements mentioned in this document are validated in terms of realism, consistency and completeness.
  - User might ask for illegal, impractical solution or experts may interpret the requirements incorrectly.
- **Goal:-** to discover errors in the requirements document. When errors are found, it must be modified to correct these problems.

…..Requirement Engineering

- **…….Software Requirement Validation**
- Requirements can be checked against following conditions -
  - If they can be practically implemented
  - If they are valid and as per functionality and domain of software
  - If there are any ambiguities
  - If they are complete
  - If they can be demonstrated

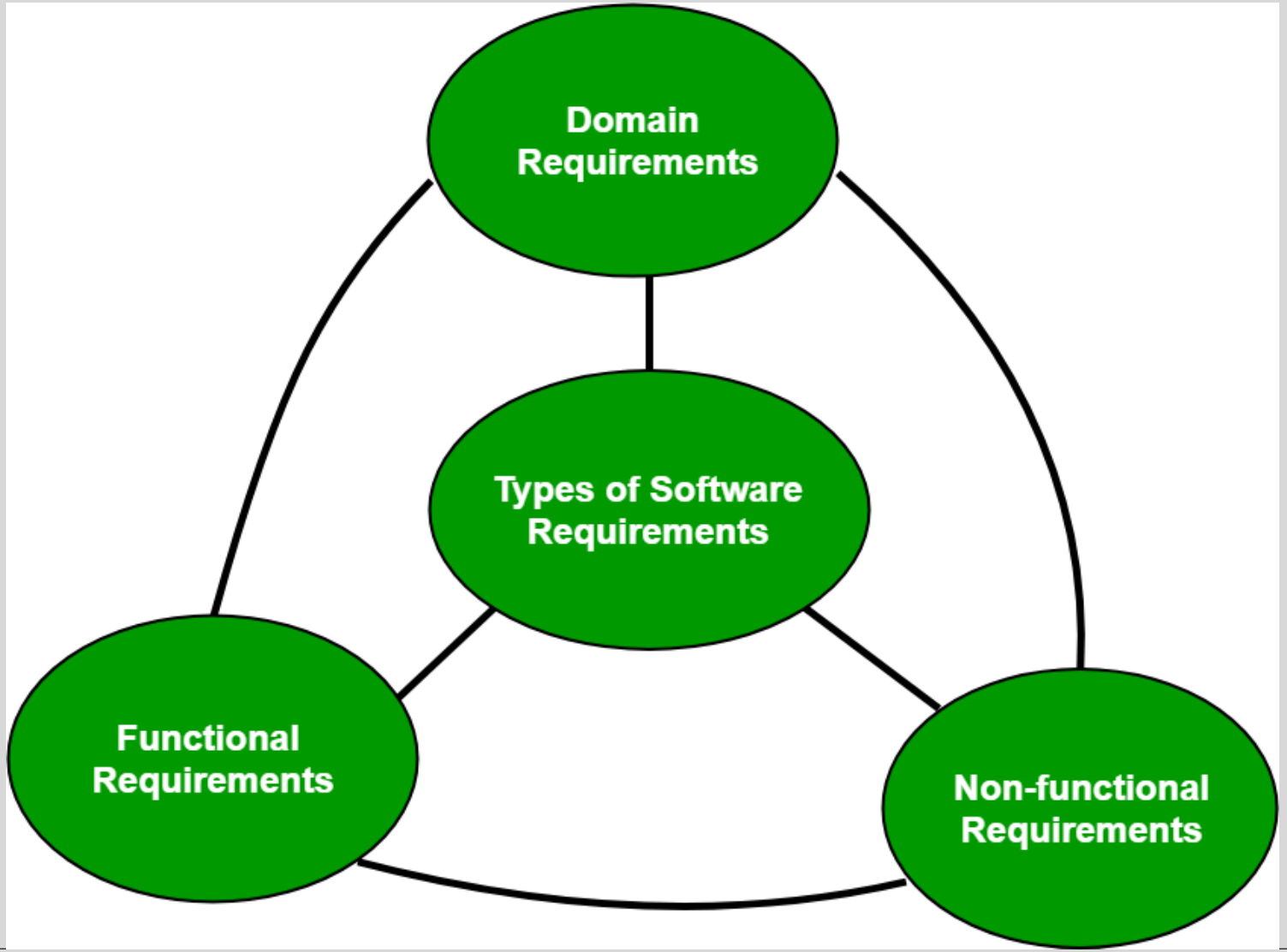
…..Requirement Engineering

➢ **Requirement Quality attributes**

…..Software Requirement Validation

- **Clear**: unambiguous functional meaning.
- **User-centric**: focusses on what the user needs to achieve.
- **Complete**: all functional steps within each requirement and all CRUD events across a set of requirements
- **Consistent**: user and object names are consistent throughout.
- **Concise**: contains no extraneous and unnecessary content.
- **Measurable**: can be sized in COSMIC function points (unit of measure of software functional size).
- **Testable**: If it is measurable, it is usually testable too.
- **Valuable** : is necessary for delivering essential user capabilities.
- **Design-free**: excludes “how” it should be implemented.
- **Unique**: no duplicated functionality across the set of requirements

Types of Software requirements



….Types of Software requirements

❑Functional Requirements

- These are the requirements that the end user specifically demands as basic facilities that the system should offer.
- All these functionalities need to be necessarily incorporated into the system as a part of the contract.
- These are represented or stated in the *form of input to be given to the system, the operation performed and the output expected*.

…..Types of Software requirement

- **……Functional Requirements**
  - **Example:-** in a hospital management system, a doctor should be able to retrieve the information of his patients.
  - Each high-level functional requirement may involve several interactions or dialogues between the system and the outside world.
  - In order to accurately describe the functional requirements, all scenarios must be enumerated.

…Types of Software requirement

❑Non-functional requirements

- These are basically the **quality constraints** that the system must satisfy according to the project contract.
- The priority or extent to which these factors are implemented varies from one project to other.
- They basically deal with issues like:
  - Portability, Security, Maintainability, Reliability, Scalability, Performance, Reusability, Flexibility
- A system can meet its functional requirements and fail to meet its nonfunctional requirements.

…Types of Software requirement

❑…….Non-functional requirements

➢Non-functional Requirements are classified into following types:

- Interface constraints?
- Performance constraints: response time, security, storage space, etc.
- Operating constraints?
- Life cycle constraints: maintainability, portability, etc.
- Economic constraints: Financial benefits for the organization

◦ The process of specifying non-functional requirements requires the knowledge of the functionality of the system, as well as the knowledge of the context within which the system will operate.

Exercises

Answer the type of requirements for the given scenarios

- The system shall be available in English, Spanish and Amharic.

Non- Functional Requirement

Exercises

- The system shall allow the user to search for books by author and title.

Functional Requirement

Exercises

- The system shall provide a list of all previously ordered books to the user.

Functional Requirement

Exercises

- The system shall support minimum 1000 transactions per hour.

Non- Functional Requirement

Exercises

- The system shall be available to all users 24/7.

Non- Functional Requirement

Exercises

- The system shall allow the user to remove books from the shopping cart at any moment.

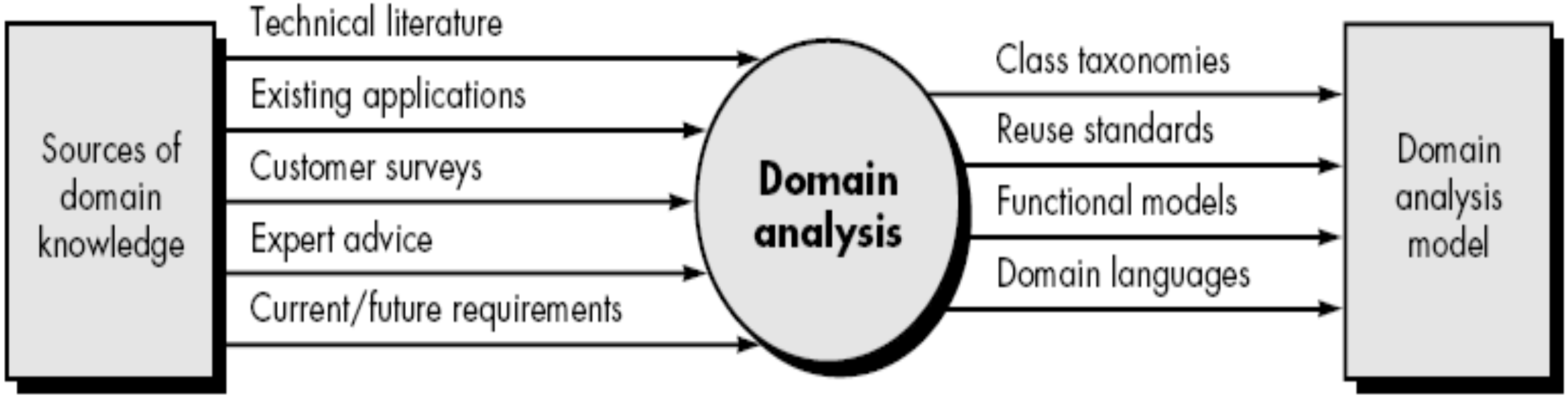
Functional Requirement

….Types of System requirements

- **Domain requirements**
  - Requirements which are characteristic of a particular category or domain of projects.
  - The basic functions that a system of a specific domain must necessarily exhibit come under this category.
  - **E.g.** in an academic software that maintains records of a school or college, the functionality of being able to access the list of faculty and list of students of each grade is a domain requirement.
    - These requirements are therefore identified from that domain model and are not user specific.

….Types of System requirements

- Software domain analysis is the identification, analysis, and specification of common requirements from a specific application domain, typically for reuse on multiple projects within that application domain. The Figure illustrates key inputs and outputs for the domain analysis process.



Class Taxonomies **:-** Classify them in different categories to study further and identify

Domain language**:** **a computer language specialized to a particular application domain**.

Summery:- Activities in requirement Determination

❑Requirements Anticipation

- It predicts the characteristics of system based on previous experience which include certain problems or features and requirements for a new system.

➢Requirements Investigation

- It is studying the current system and documenting its features for further analysis.

➢Requirements Specifications

- It includes the analysis of data which determine the requirement specification, description of features for new system, and specifying what information requirements will be provided.

Requirement Finding Techniques

Requirement finding techniques

- The main aim of fact finding techniques is to determine the information requirements of an organization used by analysts to prepare a precise SRS understood by user.

❑Interviewing

- Systems analyst collects information from individuals or groups by interviewing.
- The analyst can be formal, legalistic, play politics, or be informal; as the success of an interview depends on the skill of analyst as interviewer.

- **Unstructured Interview** − Unstructured Interview refers to an interview in which the questions to be asked to the respondents are not set in advance.
- **Structured Interview** − Structured Interview is one in which a particular set of predetermined questions are prepared by the interviewer in advance.

…..Requirement finding techniques

- The **structured interview** uses preset questions, which are asked to all the candidates. On the other extreme, in an **unstructured interview**, the questions which are asked are not determined in advance, rather they are spontaneous.
- **Unstructured Interview** is one, that does not use any fixed format, however, the interviewer may have a few planned questions prepared beforehand.
- It is a qualitative research method, in which the questions are prepared during the interview. As the interview is unplanned, it has an informal approach where a friendly conversation takes place between the interviewer and interviewee.

……Requirement finding techniques

❖**Advantages of Interviewing**

- This method is frequently the best source of gathering qualitative information.
- It is useful for them, who do not communicate effectively in writing or who may not have the time to complete questionnaire.
- Information can easily be validated and cross checked immediately.
- It can handle the complex subjects.
- It is easy to discover key problem by seeking opinions.
- It bridges the gaps in the areas of misunderstandings and minimizes future problems.

….Requirement finding techniques

❑Questionnaires

- This method is used by analyst to gather information about various issues of system from large number of persons.
- There are two types of questionnaires −
- **Open-ended Questionnaires** − It consists of questions that can be easily and correctly interpreted. They can explore a problem and lead to a specific direction of answer.
- **Closed-ended Questionnaires** − question types that ask respondents to choose from a distinct set of pre-defined responses, such as "**yes/no**" or among set multiple choice questions. Used to gather quantitative data from respondents.

…..Requirement finding techniques

❖Advantages of Questionnaires

- It is very effective in surveying interests, attitudes, feelings, and beliefs of users which are not co-located (to be in the same place).
- It is useful in situation to know what proportion of a given group approves or disapproves of a particular feature of the proposed system.
- It is useful to determine the overall opinion before giving any specific direction to the system project.
- It is more reliable and provides high confidentiality of honest responses.
- It is appropriate for electing factual information and for statistical data collection which can be emailed and sent by post.

……Requirement finding techniques

❑Review of Records, Procedures, and Forms

- Review of existing records, procedures, and forms helps to seek insight into a system which describes the current system capabilities, its operations, or activities.

❖Advantages

- It helps user to gain some knowledge about the organization or operations by themselves before they impose upon others.
- It helps in documenting current operations within short span of time as the procedure manuals and forms describe the format and functions of present system.
- It can provide a clear understanding about the transactions that are handled in the organization, identifying input for processing, and evaluating performance.
- It can help an analyst to understand the system in terms of the operations that must be supported.
- It describes the problem, its affected parts, and the proposed solution.

…..Requirement finding techniques

❑Observation

- This is a method of gathering information by noticing and observing the people, events, and objects. The analyst visits the organization to observe the working of current system and understands the requirements of the system.

❖Advantages

- It is a direct method for collecting information.
- It is useful in situation where authenticity of data collected is in question or when complexity of certain aspects of system prevents clear explanation by end-users.
- It produces more accurate and reliable data.
- It produces all the aspect of documentation that are incomplete and outdated.

….Requirement finding techniques

❑Joint Application Development (JAD)

- It is a new technique developed by IBM which brings owners, users, analysts, designers, and builders to define and design the system using organized and intensive workshops. JAD trained analyst act as facilitator for workshop who has some specialized skills.
- The JAD process enhances user participation, accelerating development, and hence improving the quality of specifications. This includes approaches for refining the quality of specification through successive collaborative workshops of JAD sessions.
- As the client is involved throughout the development process, it drives faster development and greater client satisfaction.

….Requirement finding techniques

Joint Application Development (JAD) Scenario

….Requirement finding techniques

❑….Joint Application Development (JAD)

❖Advantages of JAD

- It saves time and cost by replacing months of traditional interviews and follow-up meetings.
- It is useful in organizational culture which supports joint problem solving.
- Fosters formal relationships among multiple levels of employees.
- It can lead to development of design creatively.
- It Allows rapid development and improves ownership of information system.

….. Requirement finding techniques

- **Secondary Research or Background Reading**
  - This method is widely used for information gathering by accessing the collected information. It includes any previously gathered information used by the marketer from any internal or external source. **Example:-**
  - textbooks
  - news articles
  - university-published studies
  - encyclopaedias
  - published market research
  - academic journals, etc.

….. Requirement finding techniques

❑….Secondary Research or Background Reading

❖Advantages

- It is more openly accessed with the availability of internet.
- It provides valuable information with low cost and time.
- It act as indication to primary research and aligns the focus of primary research.
- It is used by the researcher to conclude if the research is worth it as it is available with procedures used and issues in collecting them.

Structured analysis vs Object oriented analysis

- Analysts use various tools to understand and describe the information system.

❑**Structured Analysis**

- It is a development method that allows the analyst to understand the system and its activities in a logical way.
- It is a systematic approach, which uses graphical tools that analyze and refine the objectives of an existing system and develop a new system specification which can be easily understandable by user.

➢**It has following attributes**

- It is graphic which specifies the presentation of application.
- It divides the processes so that it gives a clear picture of system flow.
- It is logical rather than physical i.e., the elements of system do not depend on vendor or hardware.
- It is an approach that works from high-level overviews to lower-level details.

….Structured analysis vs Object oriented analysis

Key Differences Between Structured and Object-Oriented Analysis and Design

Phase	Structured	Object-Oriented

Analysis	**Structuring Requirements**
	• DFDs
	• Structured English
	• Decision Table / Tree
	• ER Analysis
		Requirement Engineering
		• **Use Case Model** (find Uses Cases, Flow of Events, Activity Diagram)
		• **Object Model**
		  • Find Classes & class relations
		  • Object Interaction: Sequence & collaboration Diagram, State Machine Diagram,
		  • Object to ER Mapping

Design	• **DB design**
	  • (DB normalization)
	• **GUI Design**
	  • (forms & reports)
		• **Physical DB design**
		• **Design elements**
		  • **Design system Architecture**
		  • **Design classes:** Checking The Model, Combine Classes, Splitting Classes, Eliminate Classes
		  • **Design components**
		• GUI design

…..Structured analysis vs Object oriented analysis

❑Structured Analysis Tools

- During Structured Analysis, various tools and techniques are used for system development. They are −
  - Data Flow Diagrams
  - Data Dictionary
  - Decision Trees
  - Decision Tables
  - Structured English
  - Pseudocode

❑Object oriented analysis

- In the object-oriented approach, the focus is on capturing the structure and behavior of information systems into small modules that combines both data and process.
- The main aim of Object Oriented Design (OOD) is to improve the quality and productivity of system analysis and design by making it more usable.

Difference Between Structured and Object-oriented analysis :

Structured Analysis	Object-Oriented Analysis
The main focus is on the process and procedures of the system.	The main focus is on data structure and real-world objects that are important.
It uses System Development Life Cycle (SDLC) methodology for different purposes like planning, analyzing, designing, implementing, and supporting an information system.	It uses Incremental or Iterative methodology to refine and extend our design.
It is suitable for well-defined projects with stable user requirements.	It is suitable for large projects with changing user requirements.
Risk while using this analysis technique is high and reusability is also low.	Risk while using this analysis technique is low and reusability is also high.
Structuring requirements include DFDs (Data Flow Diagram), Structured Analysis, ER (Entity Relationship) diagram, CFD (Control Flow Diagram), Data Dictionary, Decision table/tree, and the State transition diagram.	Requirement engineering includes the Use case model (find Use cases, Flow of events, Activity Diagram), the Object model (find Classes and class relations, Object interaction, Object to ER mapping), Statechart Diagram, and deployment diagram.
This technique is old and is not preferred usually.	This technique is new and is mostly preferred.

….Structured analysis vs Object oriented analysis

❑Object oriented analysis

- The OO model is beneficial in the following ways −
  - It facilitates changes in the system at low cost.
  - It promotes the reuse of components.
  - It simplifies the problem of integrating components to configure large system.
  - It simplifies the design of distributed systems.

End Of Chapter