CSE 4513

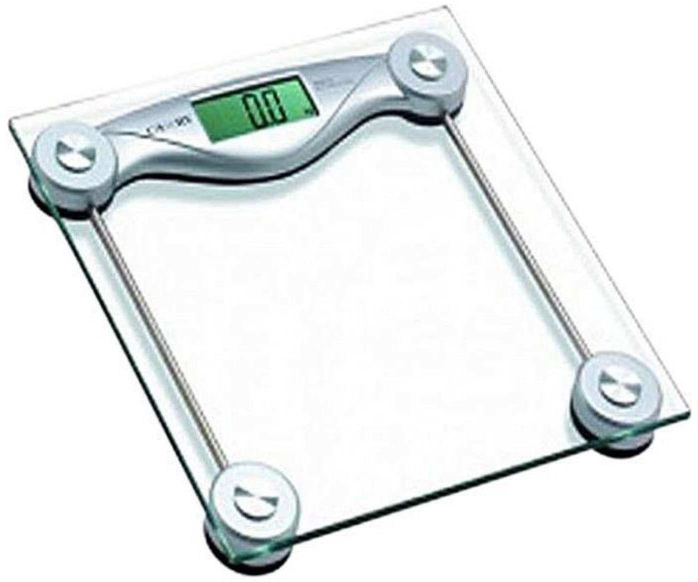
Lec – 4

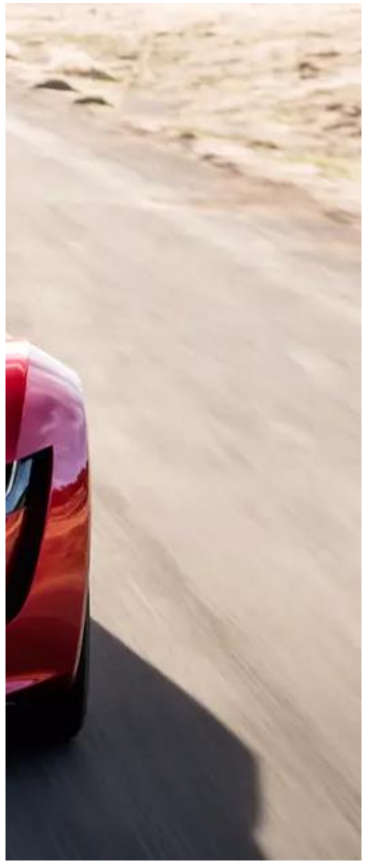
Requirements Analysis and Specification

Misleading Requirements

Father: What do you want from me on your birthday?

Son: Something that moves from 0 to 60 within 3 seconds.





Father Delivered to Son

Expectation of Son

Finally someone understood the reality 😂
20

BACKGROUND..

- ✓ What is a Requirement?
  - ➢ A condition or capability that must be possessed by a system (IEEE)
- ✓ The requirements task:
  - ➢ Input: User needs in minds of people (hopefully)
  - ➢ Output: precise statement of what the future system will do
- ✓ What is the output of the Req. phase ?
  - ➢ A software requirements specification (SRS) document
- ✓ What is an SRS ?
  - ➢ A complete specification of what the proposed system should do!

BACKGROUND..

- ✓ Requirements understanding is hard
  - ➢ Visualizing a future system is difficult
  - ➢ Capability of the future system not clear, hence needs not clear
  - ➢ Requirements change with time
  - ➢ …
- ✓ Essential to do a proper analysis and specification of requirements

Purpose of SRS document

- ✓ SRS establishes basis of agreement between the user and the supplier.
  - ➢ Users needs have to be satisfied, but user may not understand software
  - ➢ Developers will develop the system, but may not know about problem domain
- ✓ SRS is
  - ➢ the medium to bridge the communications gap, and
  - ➢ specifies user needs in a manner both can understand

Need for SRS...

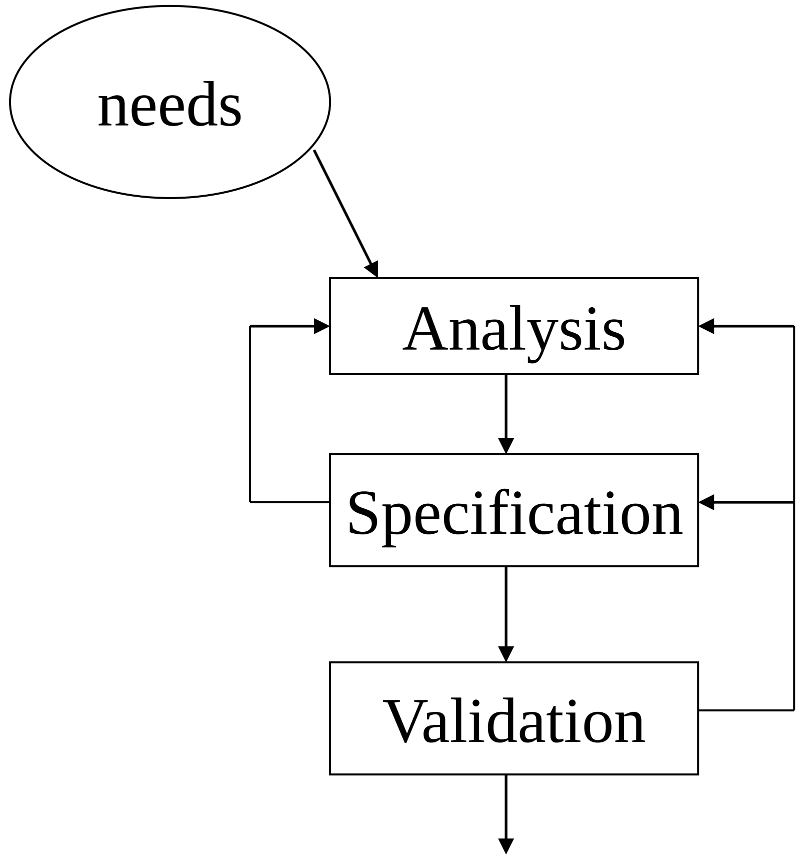
- ✓ Helps user understand his needs.
  - ➢ users do not always know their needs
  - ➢ must analyze and understand the potential
  - ➢ The requirement process helps clarify needs
- ✓ **SRS provides a reference for validation of the final product**
  - ➢ Clear understanding about what is expected.
  - ➢ Validation - " SW satisfies the SRS "

Need for SRS…

- ✓ High quality SRS essential for high Quality SW
  - ➢ Requirement errors get manifested in final sw
  - ➢ To satisfy the quality objective, must begin with high quality SRS
  - ➢ Requirements defects cause later problems
    - ▪ 25% of all defects in one study; 54% of all defects found after user testing
    - ▪ defects often found in previously approved SRS.
- ✓ Good SRS reduces the development cost
  - ➢ **SRS errors are expensive to fix later**
  - ➢ **Req. changes can cost a lot (up to 40%)**
  - ➢ Good SRS can minimize changes and errors

Requirement process

- ✓ Process is not linear, **<u>it is iterative and sometime parallel</u>**
- ✓ Overlap between phases - some parts may be analyzed and specified
- ✓ Specification itself may help analysis
- ✓ Validation can show gaps that can lead to further analysis and spec



REQUIREMENTS PROCESS...

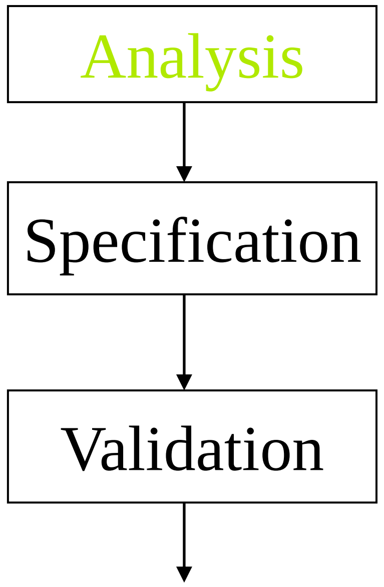
- ✓ Divide and conquer is the basic strategy
  - ➢ Decompose into small parts, understand each part and relation between parts

- ✓ Large volumes of information is generated
  - ➢ Organizing them is a key

- ✓ Techniques like data flow diagrams, object diagrams etc. used in the analysis

PROBLEM ANALYSIS

- ✓ Aim: to gain an understanding of the needs, requirements, and constraints on the software
- ✓ Analysis involves
  - ➢ Interviewing client and users
  - ➢ Reading manuals
  - ➢ Studying current systems
  - ➢ Helping client/users understand new possibilities
  - ➢ Like becoming a consultant
- ✓ Must understand the working of the organization , client, and users



PROBLEM ANALYSIS..

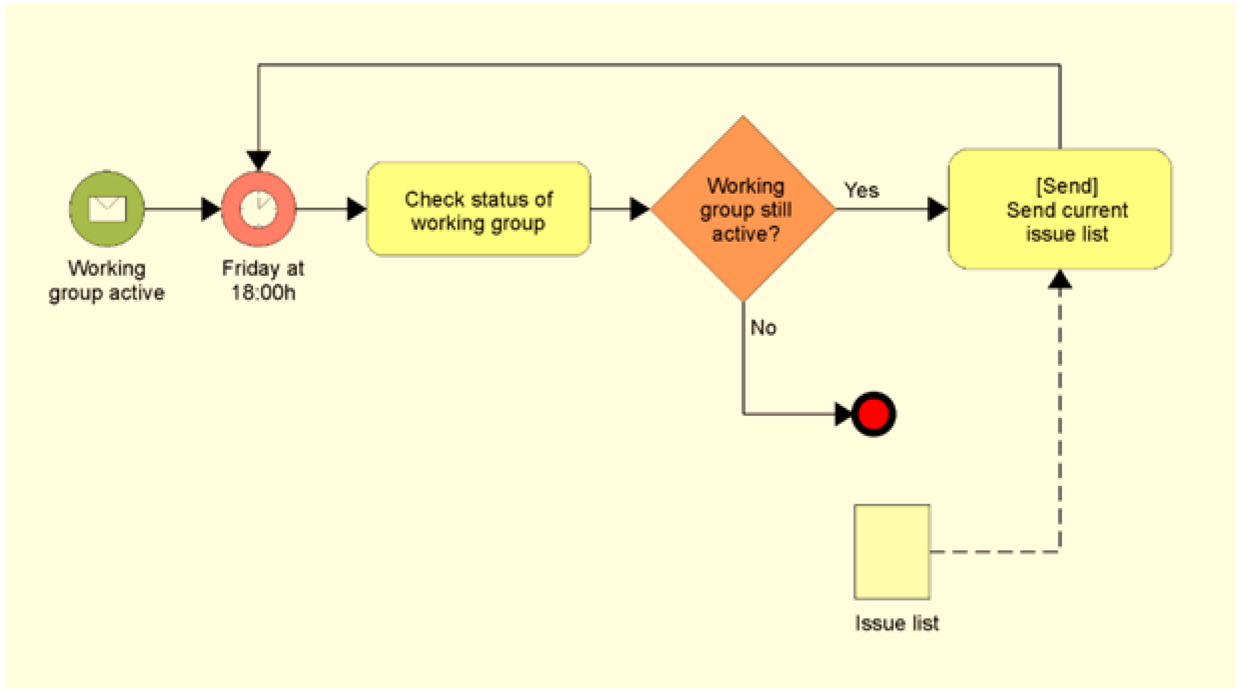
- ✓ Some issues
  - ➢ Obtaining the necessary information
  - ➢ Brainstorming: interacting with clients to establish desired properties
  - ➢ Information organization, as large amount of info. gets collected
  - ➢ Ensuring completeness
  - ➢ Ensuring consistency
  - ➢ Avoiding internal design
  - ➢ Basic principle: problem partition
  - ➢ Partition w.r.t what?
    - ▪ **Object - OO analysis**
    - ▪ **Function - structural analysis**
    - ▪ **Events in the system – event partitioning**

Informal Approach to Requirement Analysis

- ✓ No defined methodology; info obtained through analysis, observation, interaction, discussions,…
- ✓ Requirement analysis techniques are mainly used to map the business workflow so that you can analyze, understand and make required changes to that workflow or process.
- ✓ various requirement analyzing techniques that can be used as per the software development process like
  - ➢ Business process modeling notation (BPMN)
  - ➢ UML (Unified Modeling Language)
  - ➢ Flow chart technique
  - ➢ Data flow diagram

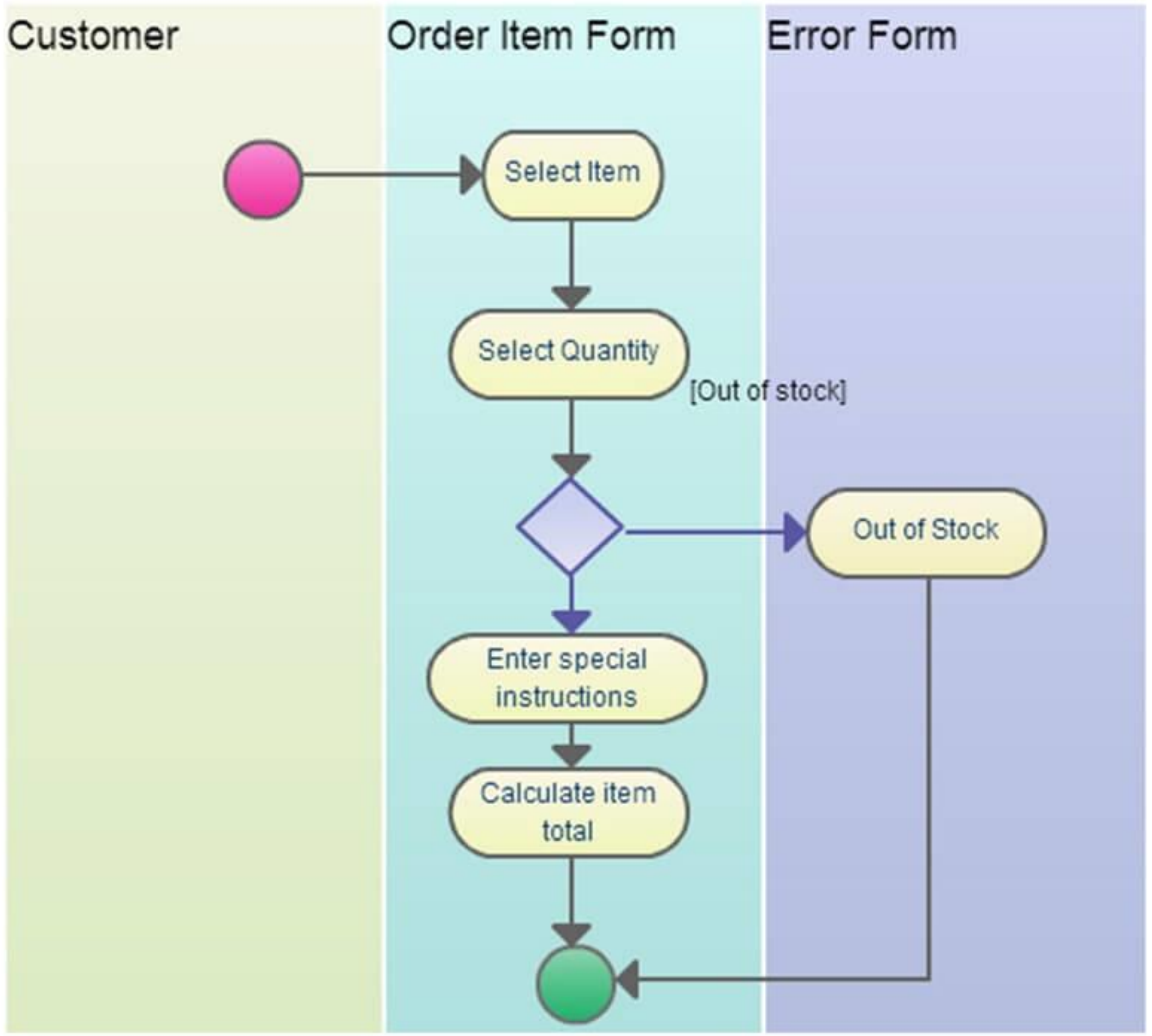
Requirement Analysis - BPMN

- ✓ is a graphical representation of business process using simple objects, which helps the organization to communicate in a standard manner. Various objects used in BPMN includes
  - ➢ Flow objects
  - ➢ Connecting objects
  - ➢ Swim lanes
  - ➢ Artifacts.
- ✓ should be able to give the detail about the activities carried out during the process like,
  - ➢ Who is performing these activities?
  - ➢ What data elements are required for these activities?


Working group active
Friday at 18:00h
Check status of working group
Working group still active?
Yes
No
[Send] Send current issue list
Issue list

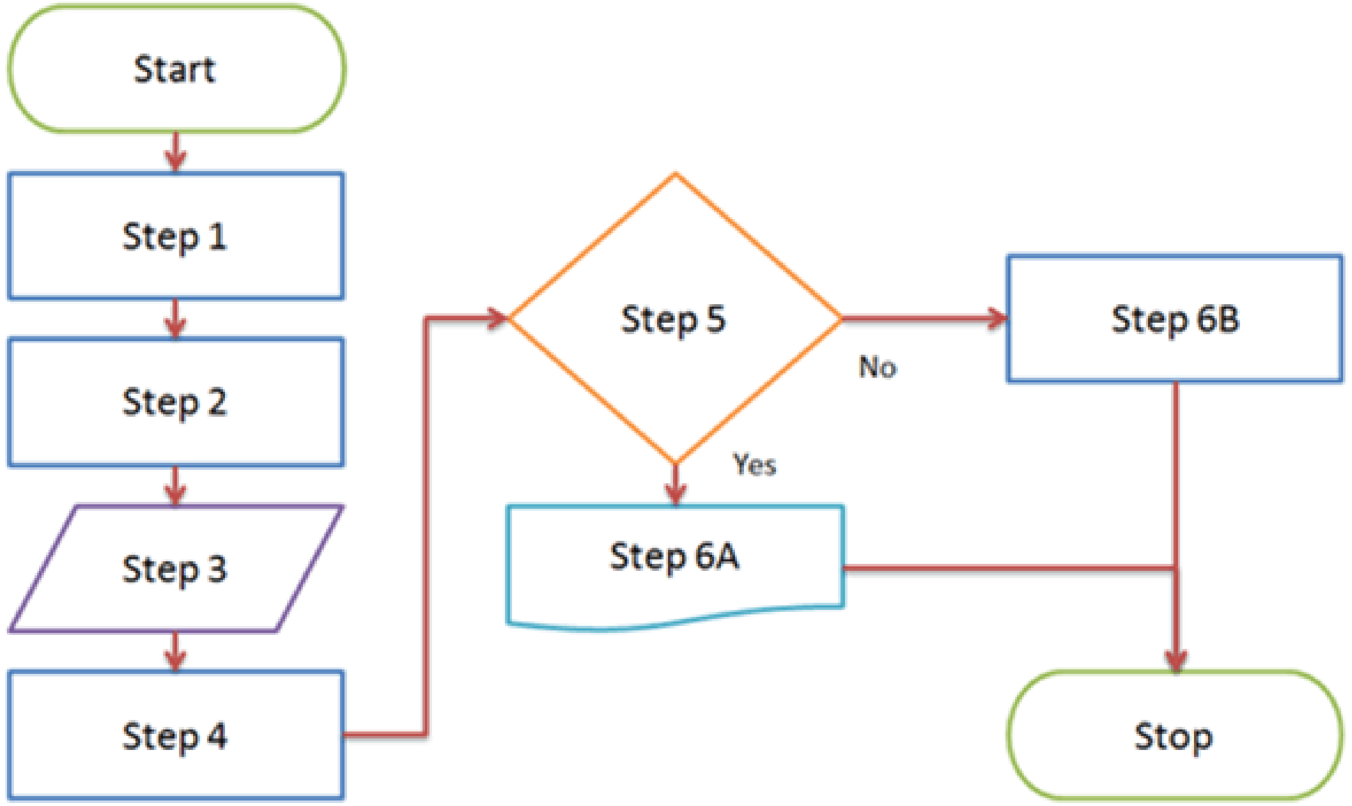
Requirement Analysis - UML

- ✓ is a modelling standard primarily used for specification, development, visualization and documenting of software system. To capture important business process and artifacts UML provides objects like
  - ➢ State
  - ➢ Object
  - ➢ Activity
  - ➢ Class diagram



REQUIREMENT ANALYSIS - FLOWCHART

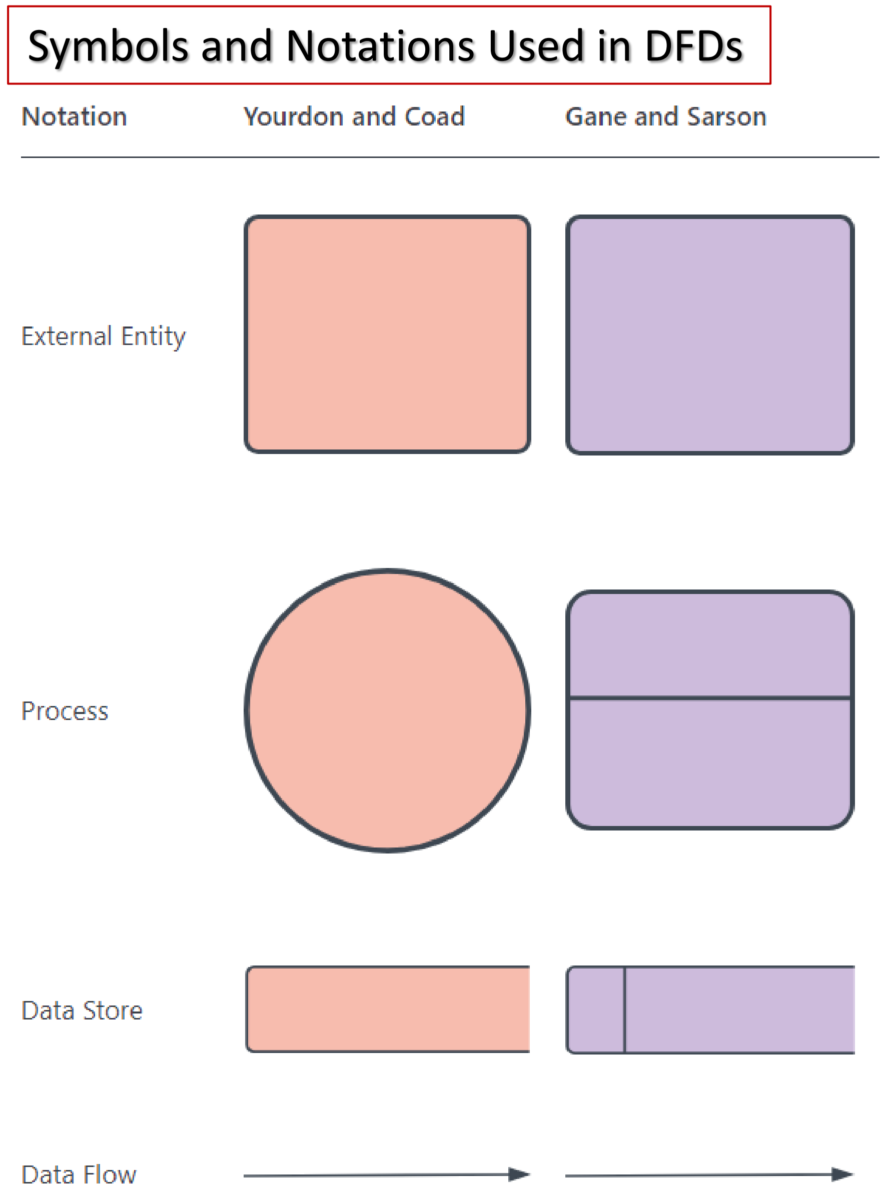
- ✓ A flowchart is a visual representation of the sequential flow and control logic of a set of related activities or actions.
- ✓ A flow chart can be used for different activities like representing data flows, system interactions, etc.



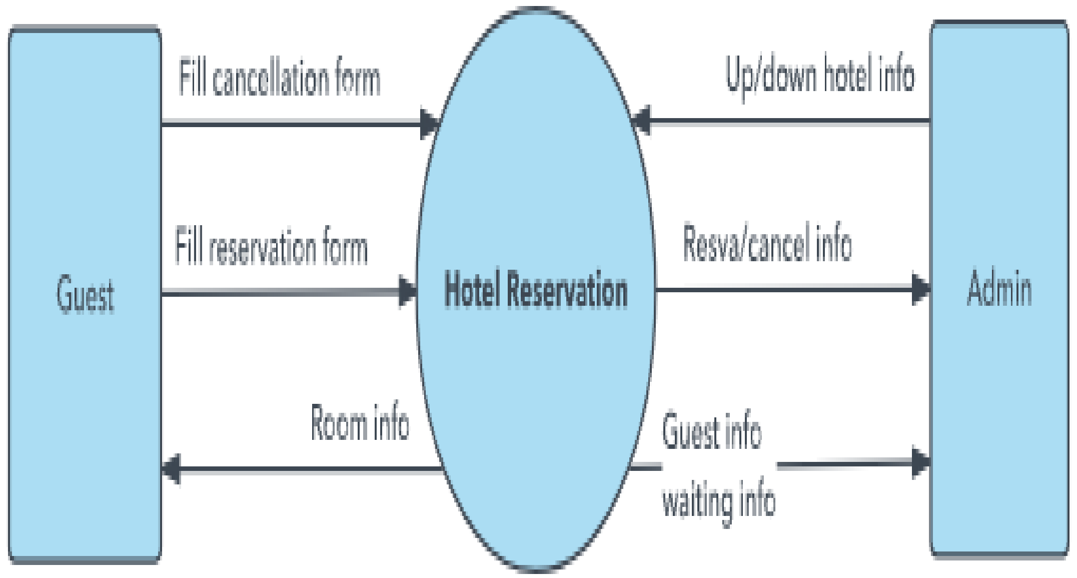
Requirement Analysis - Data flow diagrams

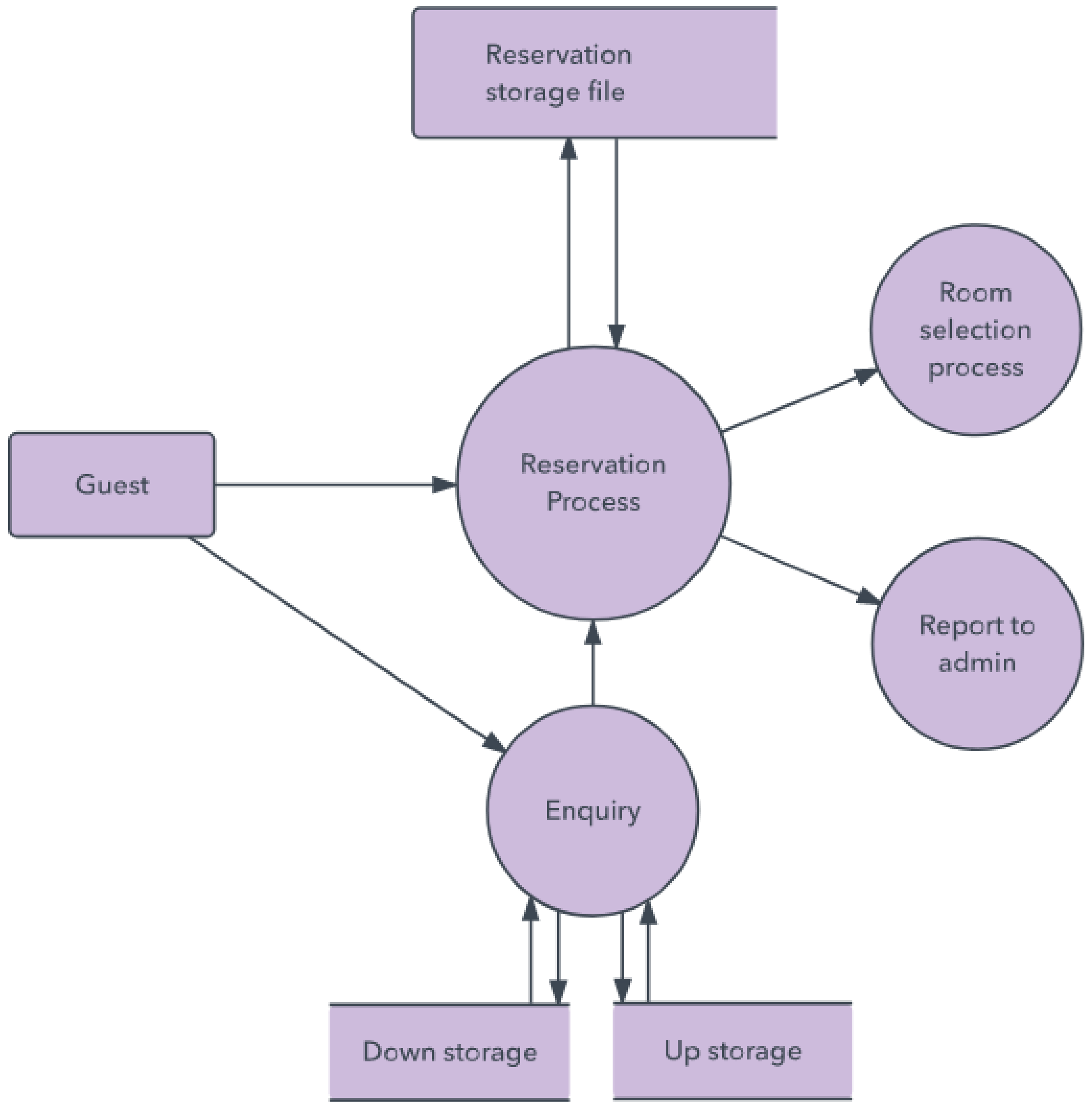
- ✓ Data flow diagrams show how data is processed by a system in terms of inputs and outputs.

  Components of data flow diagram includes
  - ➢ Process
  - ➢ Flow
  - ➢ Store
  - ➢ External Entity
- ✓ A DFD shows flow of data through the system
  - ➢ Views system as transforming inputs to outputs
  - ➢ Transformation done through transforms
  - ➢ DFD captures how transformation occurs from input to output as data moves through the transforms
  - ➢ Not limited to software



DFD Example


Guest
Fill cancellation form
Fill reservation form
Room info
Hotel Reservation
Up/down hotel info
Resva/cancel info
Guest info
waiting info
Admin


Reservation storage file
Room selection process
Guest
Reservation Process
Report to admin
Enquiry
Down storage
Up storage

DFD RULES AND TIPS

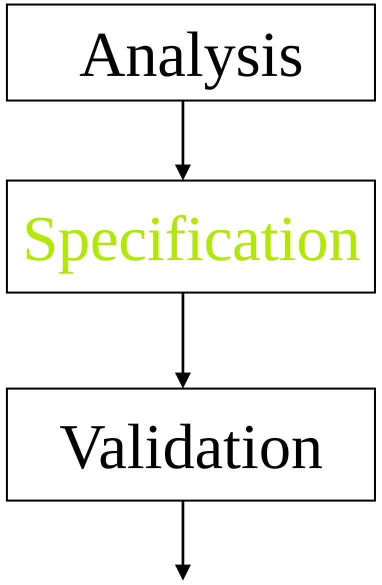
- ✓ Each process should have **at least one input and an output**.
- ✓ Each data store should have **at least one data flow in and one data flow out**.
- ✓ **Data stored in a system must go through a process**.
- ✓ All processes in a **DFD go to another process or a data store**.

Other Approaches to RA

- ✓ Prototyping
- ✓ Object Oriented
  - ➢ Classes, attributes, methods
  - ➢ Association between classes
  - ➢ Class hierarchies

Requirements Specification

- ✓ Final output of requirements task is the SRS
- ✓ Why are DFDs, OO models, etc not SRS ?
  - ➢ SRS focuses **on external behavior**, while modeling focuses **on problem structure**
  - ➢ UI etc. not modeled, but have to be in SRS
  - ➢ Error handling, constraints etc. also needed in SRS
- ✓ Transition from **analysis to specification is not straight forward**
- ✓ **Knowledge about the system acquired in analysis used in specification**



Requirement Specification

"requirement" ≠ "specification"

- ✓ Requirement – understanding between customer and supplier
- ✓ Specification – what the software must do
- ✓ Requirements that are not in the SRS
  - ➢ Costs
  - ➢ Delivery dates
  - ➢ Acceptance procedures
  - ➢ etc

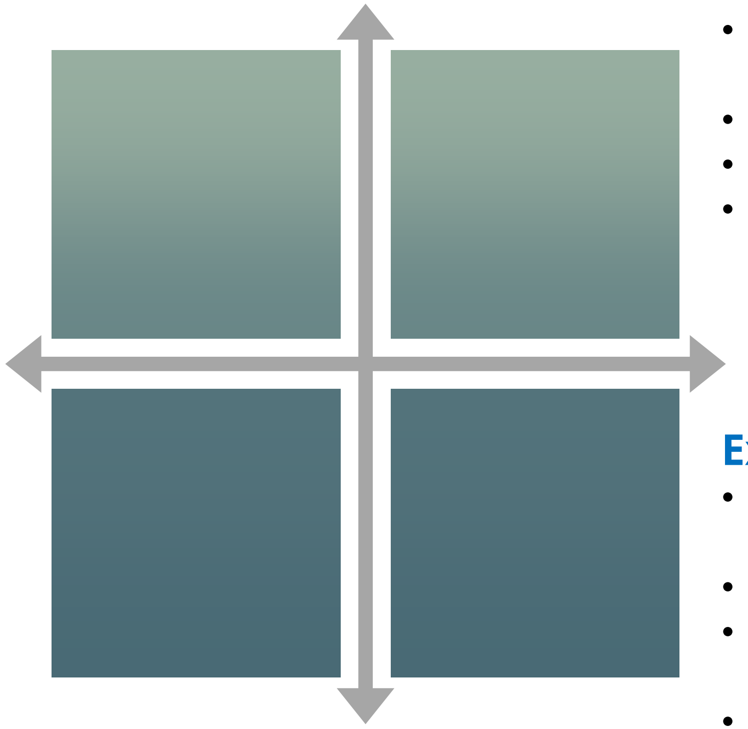
Components of an SRS

- ✓ What should an SRS contain ?
  - ➢ Clarifying this will help ensure completeness

- ✓ An SRS must specify following types of requirements:
  - ➢ Functional
  - ➢ Performance (sometime mentioned as non-functional requirement)
  - ➢ Design constraints
  - ➢ External interfaces

COMPONENTS OF AN SRS

Types of Requirements



Functional

- Specifies all the functionality that the system should support
- Outputs for the given inputs and the relationship between them
- All operations the system is to do
- Must specify behavior for invalid inputs too

Non-functional

- All the performance constraints on the software system
- Generally on response time , throughput etc
- Capacity requirements
- Must be in measurable terms

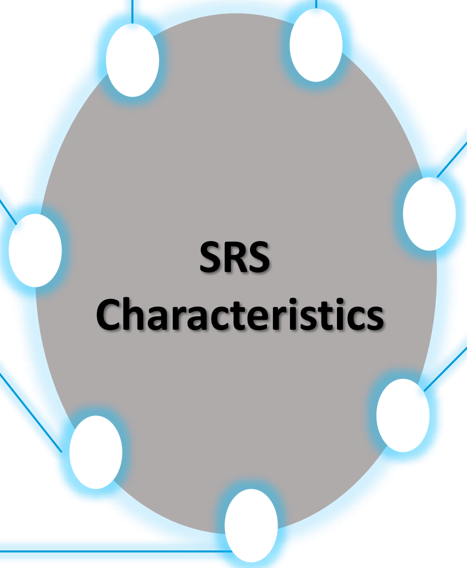
Design Constraints

- Factors in the client environment that restrict the choices
- Some such restrictions
  - Standard compliance and compatibility with other systems
  - Hardware Limitations
  - Reliability, fault tolerance, backup req.
  - Security

External Interface

- All interactions of the software with people, hardware, and sw
- User interface most important
- General requirements of “friendliness” should be avoided
- These should also be verifiable

CHARACTERISTICS OF SRS



Correctness
- Each requirement accurately represents some desired feature in the final system

Completeness
- All desired features or characteristics are specified
- Completeness and correctness strongly related

Unambiguous
- Each req has exactly one meaning
- Without this errors will creep in
- Important as natural languages often used

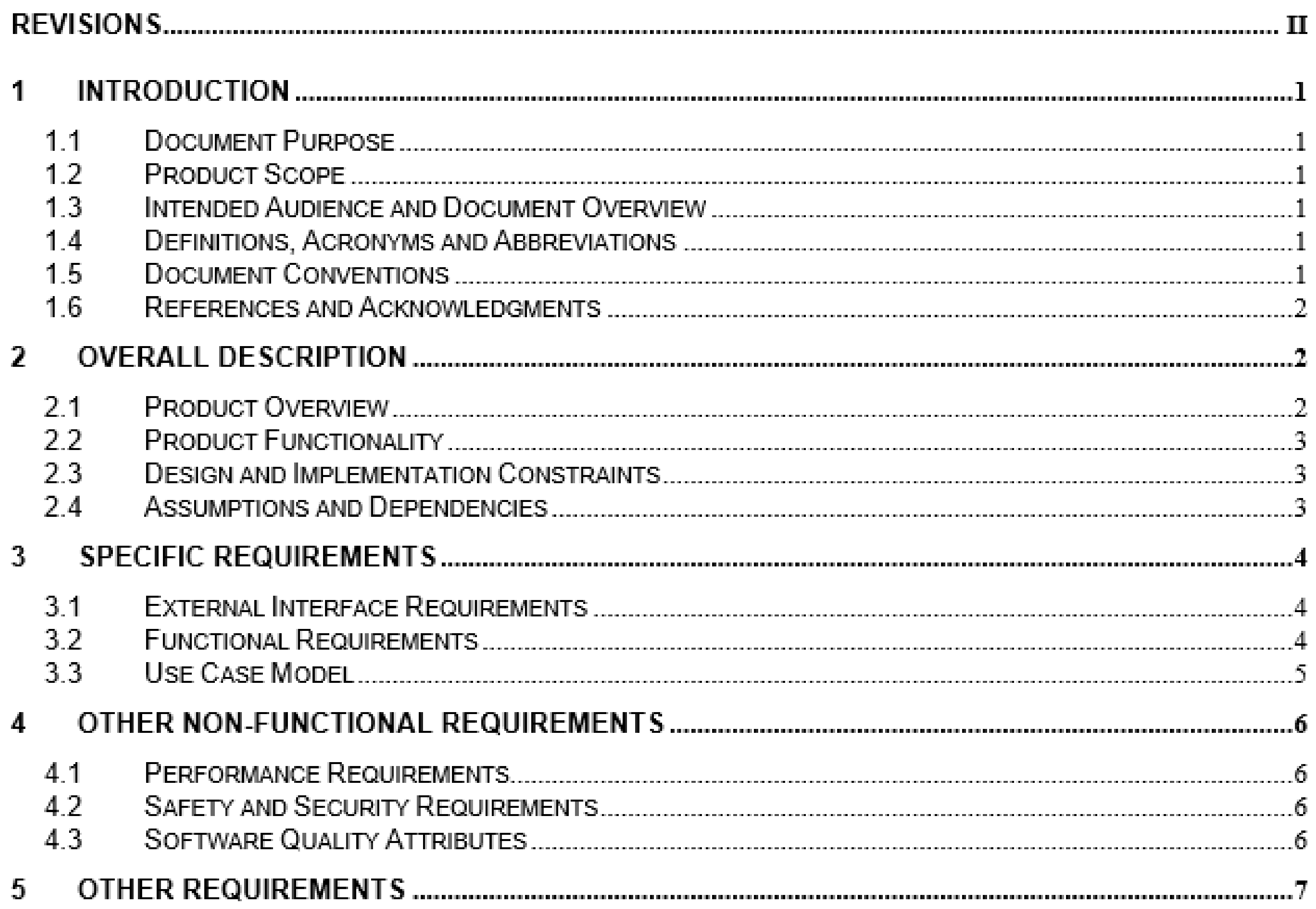
Verifiability
- There must exist a cost effective way of checking if sw satisfies requirements

Consistent
two requirements don't contradict each other

Ranked for importance/stability
Needed for prioritizing in construction
To reduce risks due to changing requirements

Traceable
The origin of the req, and how the req relates to software elements can be determined

SRS CONTENTS

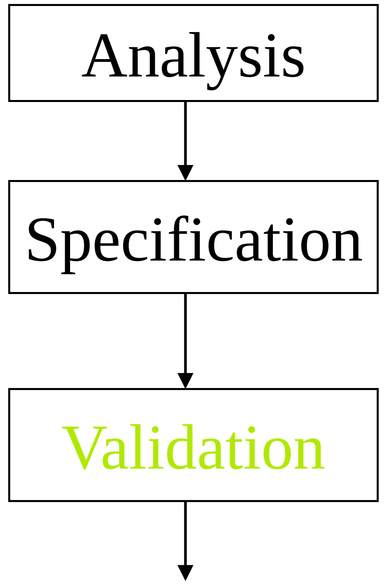


Microsoft Word
7 - 2003 Documen

Requirements Validation

- ✓ Lot of room for misunderstanding
- ✓ Errors possible
- ✓ Expensive to fix req defects later
- ✓ Must try to remove most errors in SRS
- ✓ Most common errors

➢ Omission	- 30%
➢ Inconsistency	- 10-30%
➢ Incorrect fact	- 10-30%
➢ Ambiguity	- 5 -20%



Requirements Review

- ✓ SRS reviewed by a group of people
- ✓ Group: author, client, user, dev team rep.
- ✓ Must include client and a user
- ✓ Process – standard inspection process
- ✓ Effectiveness - can catch 40-80% of req. errors

Next Class

User interface Design