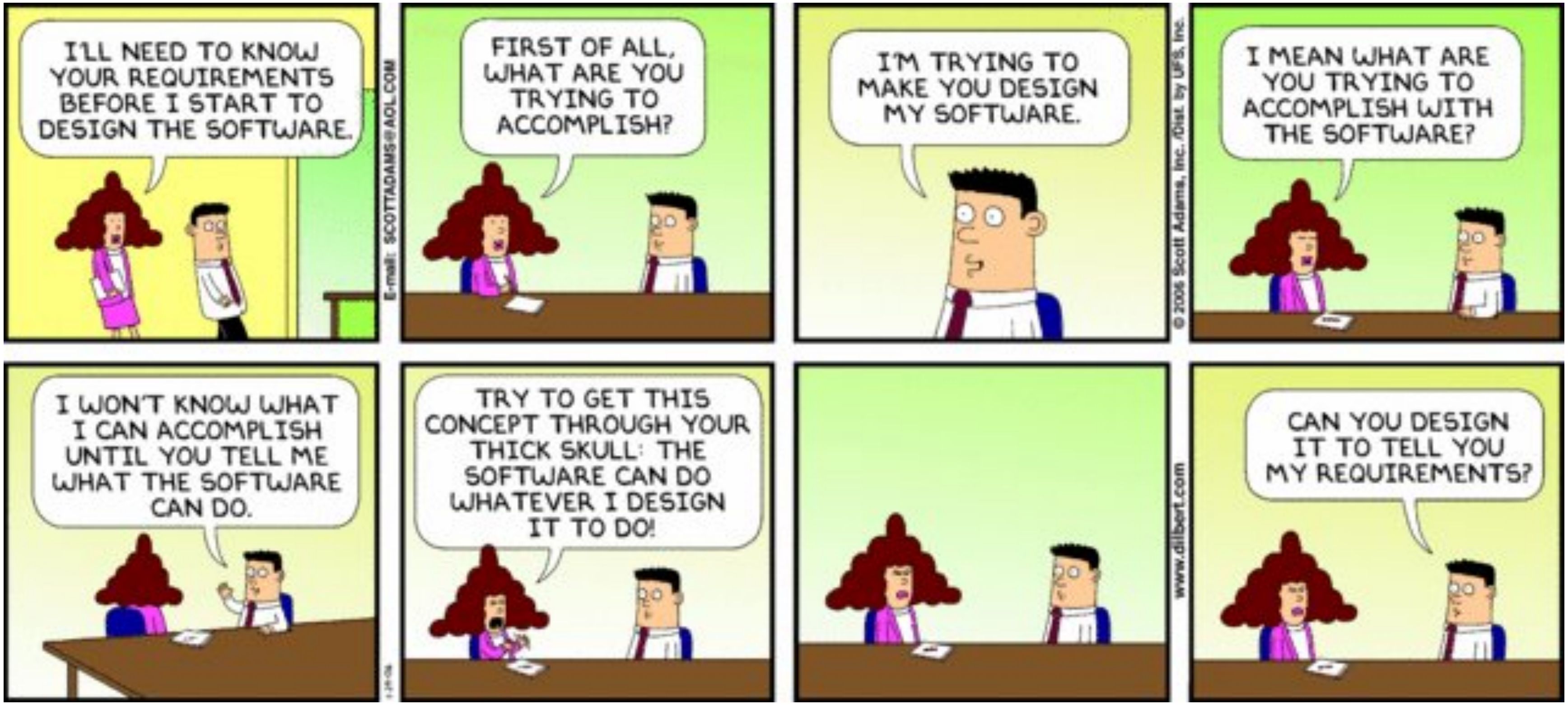
Requirements Engineering Processes

With materials adapted from Software Engineering, Ian Sommerville

Requirements Engineering


I'LL NEED TO KNOW YOUR REQUIREMENTS BEFORE I START TO DESIGN THE SOFTWARE.
E-mail: SCOTTADAMS@AOL.COM
FIRST OF ALL, WHAT ARE YOU TRYING TO ACCOMPLISH?
I'M TRYING TO MAKE YOU DESIGN MY SOFTWARE.
© 2006 Scott Adams, Inc./Dist. by UFS, Inc.
I MEAN WHAT ARE YOU TRYING TO ACCOMPLISH WITH THE SOFTWARE?
I WON'T KNOW WHAT I CAN ACCOMPLISH UNTIL YOU TELL ME WHAT THE SOFTWARE CAN DO.
TRY TO GET THIS CONCEPT THROUGH YOUR THICK SKULL: THE SOFTWARE CAN DO WHATEVER I DESIGN IT TO DO!
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CAN YOU DESIGN IT TO TELL YOU MY REQUIREMENTS?

Topics covered

- Requirement engineering processes
- Feasibility studies
- Requirements elicitation and analysis
- Requirements validation
- Requirements management

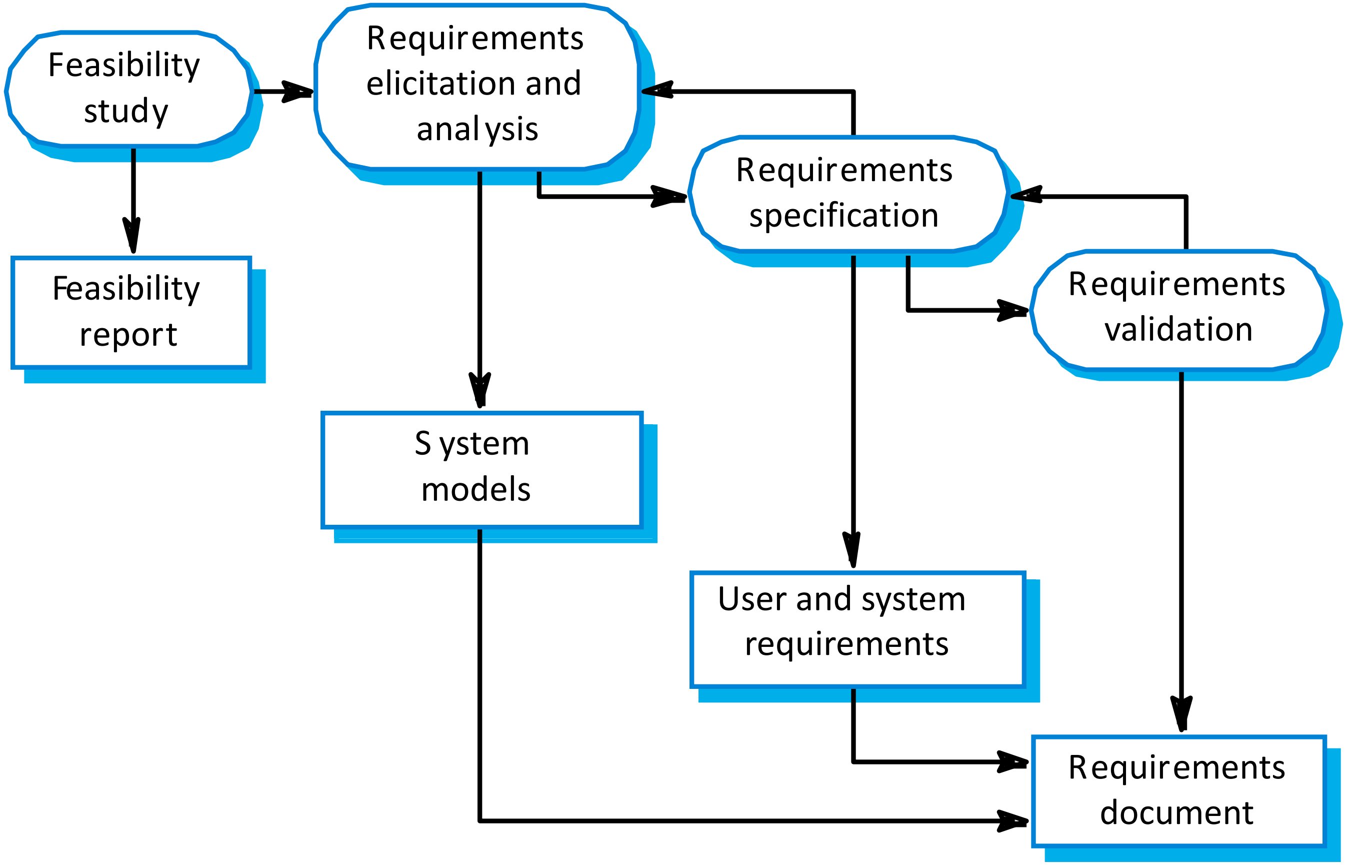
Requirements engineering (RE) processes

- RE process is a set of activities performed to create software requirements
- Processes used for RE vary widely
  - Dependent on organizations, domains, process methodologies
- Common activities
  - Requirements elicitation
  - Requirements analysis
  - Requirements validation
  - Requirements management

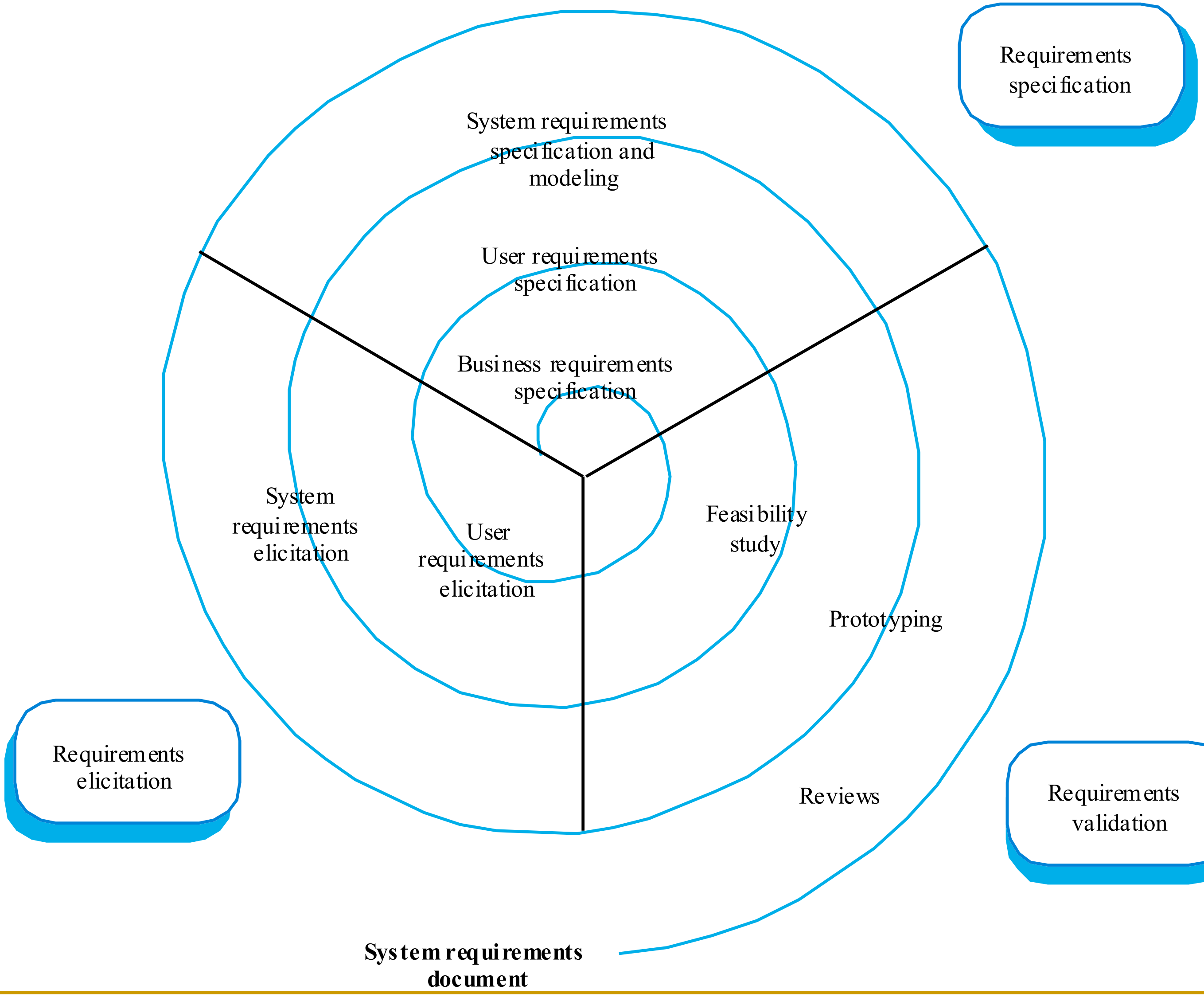
RE process

trả lời được những câu hỏi:
- nghiên cứu thị trường người dùng
- thời gian, chi phí, chất lượng, công nghệ có đáp ứng được nhu cầu hiện tại hay không
- đủ khả năng về năng lực lãnh đạo

có thể thực thi được hay không



Requirements engineering


Requirements specification
System requirements specification and modeling
User requirements specification
Business requirements specification
System requirements elicitation
User requirements elicitation
Feasibility study
Prototyping
Reviews
Requirements elicitation
Requirements validation
System requirements document

Topics covered

- Requirement engineering processes
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Feasibility studies

- Feasibility studies decide whether or not the proposed system is worthwhile

- A short focused study checks
  - if the system contributes to organizational objectives
  - if the system can be developed using current technology
  - if the system can be integrated with other systems that are used
  - if the system can be developed within budget and schedule
  - if the system can compete with other similar systems

Feasibility study implementation

- Based on information assessment (what is required), information collection and report writing

- Questions for people in the organization
  - What if the system wasn't implemented?
  - What are current process problems?
  - How will the proposed system help?
  - What will be the integration problems?
  - Is new technology needed? What skills?
  - What facilities must be supported by the proposed system?

- Feasibility report can be included in vision document

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Requirements elicitation and analysis

- Also called requirements elicitation or requirements discovery

- Involves technical staff working with customers to find out
  - the application domain
  - the services that the system should provide
  - the system's operational constraints

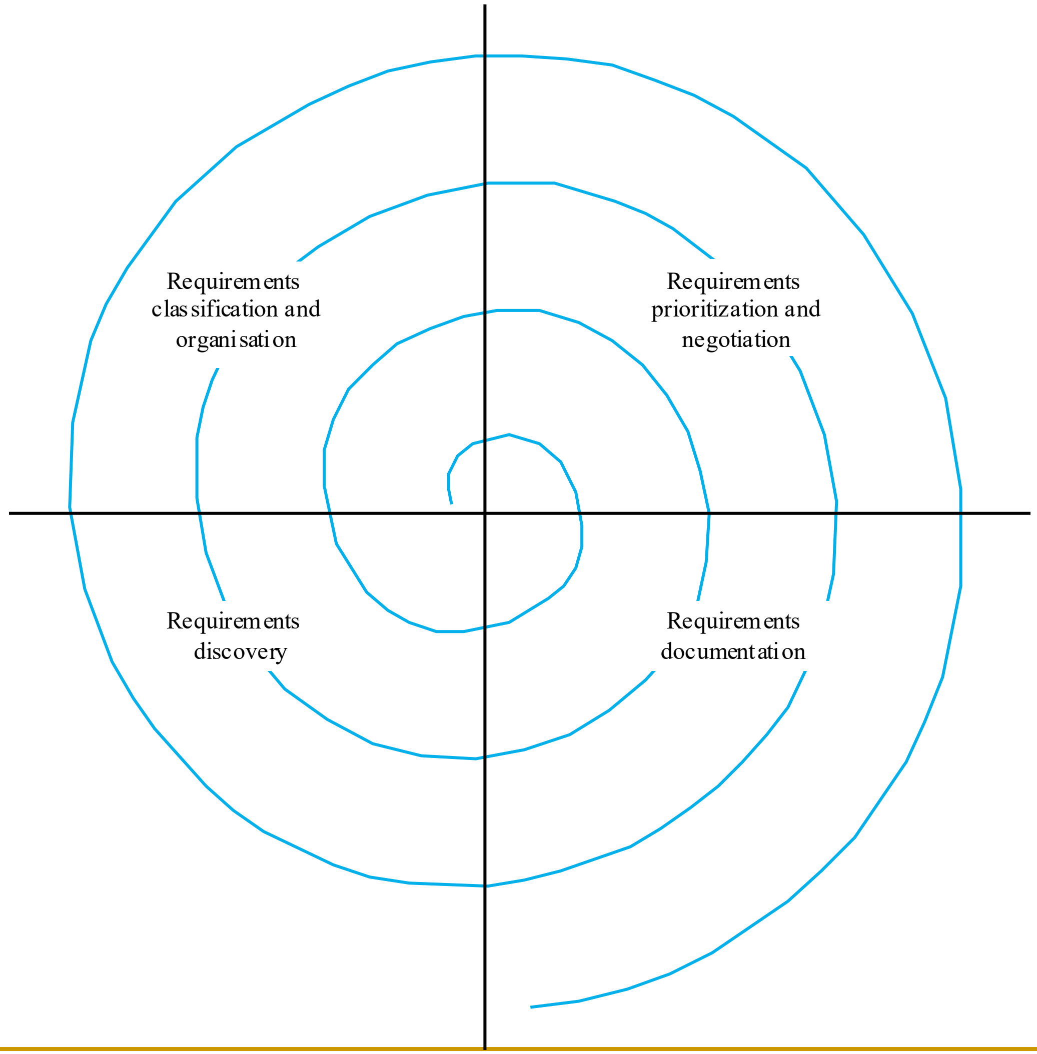
- May involve end-users, customers, managers, engineers, domain experts, maintainers, operators, etc.
  - also called *stakeholders*

người dùng cuối

Problems of requirements analysis

- Stakeholders don’t know what they really want
- Stakeholders express requirements in their own terms
- Different stakeholders may have conflicting requirements
- Organizational and political factors may influence the system requirements
- Requirements change during the analysis process
  - New stakeholders may emerge and the business environment change

The requirements spiral



Process activities

- Requirements discovery
  - Interacting with stakeholders to discover their requirements
- Requirements classification and organization
  - Groups related requirements and organizes them into coherent clusters
- Prioritization and negotiation
  - Prioritizing requirements and resolving requirements conflicts
- Requirements documentation
  - Requirements are documented

Requirements discovery

- Gathering information about the proposed and existing systems
  - extracting user and system requirements from this information

- Sources of information
  - documentation and specifications of similar systems
  - observations
  - existing procedures, processes, and reports
  - other materials

ATM stakeholders

- Bank customers
- Representatives of other banks
- Bank managers
- Counter staff
- Database administrators
- Security managers
- Marketing department
- Hardware and software maintenance engineers
- Banking regulators

Viewpoints

- Viewpoints are a way of structuring the requirements to represent perspectives of different stakeholders

- This multi-perspective analysis is important
  - there is no single correct way to analyze system requirements

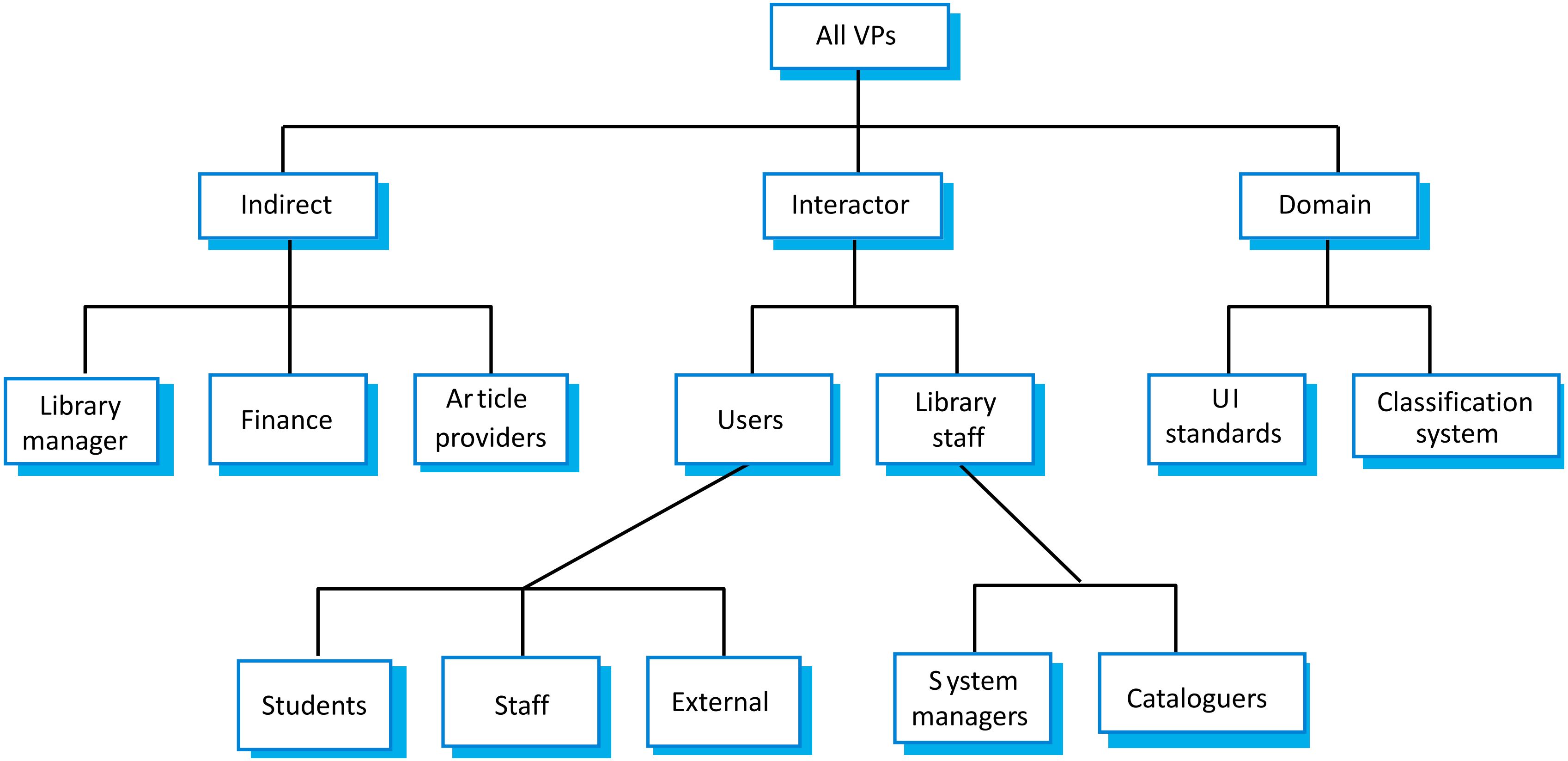
Types of viewpoint

- Interactor viewpoints
  - People or other systems that interact directly with the system
    - In an ATM, the customer’s and the account database are interactor view points
- Indirect viewpoints
  - Stakeholders who do not use the system themselves but who influence the requirements
    - E.g., management and security staff are indirect viewpoints
- Domain viewpoints
  - Domain characteristics and constraints that influence the requirements
    - E.g., standards for inter-bank communications

Viewpoint identification

- Identify viewpoints using
  - Providers and receivers of system services
  - Systems that interact directly with the system being specified
  - Regulations and standards
  - Sources of business and non-functional requirements
  - Engineers who have to develop and maintain the system
  - Marketing and other business viewpoints

LIBSYS viewpoint (VP) hierarchy



Interviewing

- RE team questions stakeholders about the existing system and the system to be developed

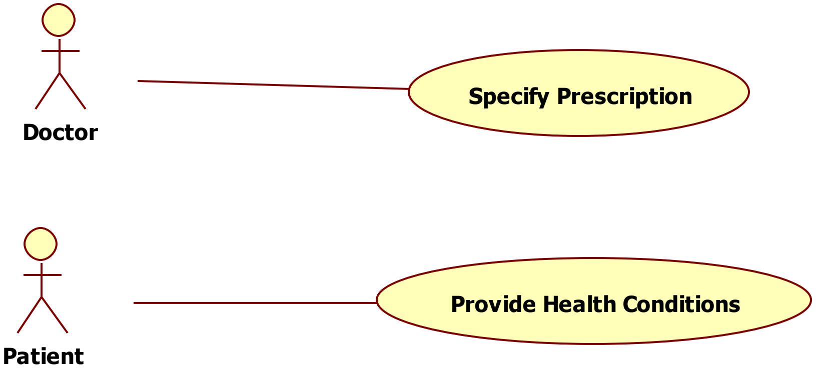
- Types of interview
  - Closed or structured interviews: prepared questions are answered
  - Open or unstructured interviews: no pre-defined agenda and a range of issues to explored with stakeholders
  - Mixed: some prepared and follow-up questions

Interviews in practice

- Normally a mix of closed and open-ended interviewing
- Interviews are good for getting an overall understanding of
  - what stakeholders do
  - how they might interact with the system
- Effective interviews
  - Open-minded, willing to listen to stakeholders
  - No pre-conceived ideas about the requirements
  - Prompt interviewees with questions or proposals
  - Avoid asking ‘what do you want’

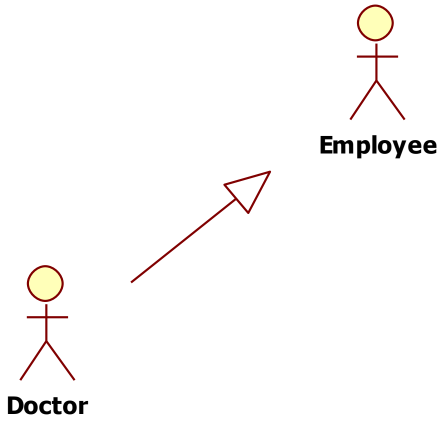
Use Case Diagrams

- Use case diagrams are used to model the use case view of a system as seen by end users, analysts, and testers
- Use case diagrams are usually a part of requirement specifications
  - Accompanying use case specifications
- Main elements
  - Actors
  - Use cases
  - Relationships



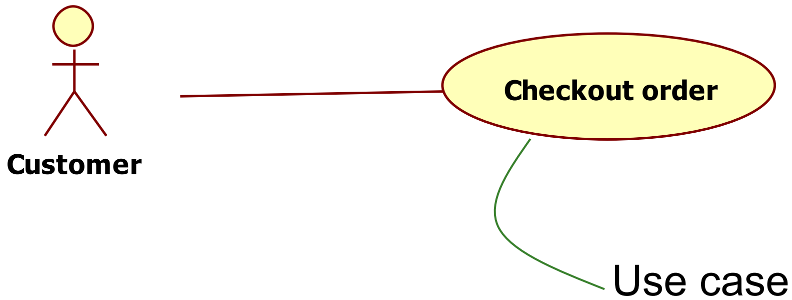
Actors

- An actor represents an external person, process, or **anything** that interacts with the system
- It represents a role that a person, process, or thing plays with the system
  - One physical user can play multiple roles. Thus, multiple actors can be bound to one physical user
  - Multiple users have the same role, hence, represented by one actor
- Between actors may have a generalization



Use Cases

- A use case describes a set of sequences of actions performed by an actor to produce observable results value to the actor



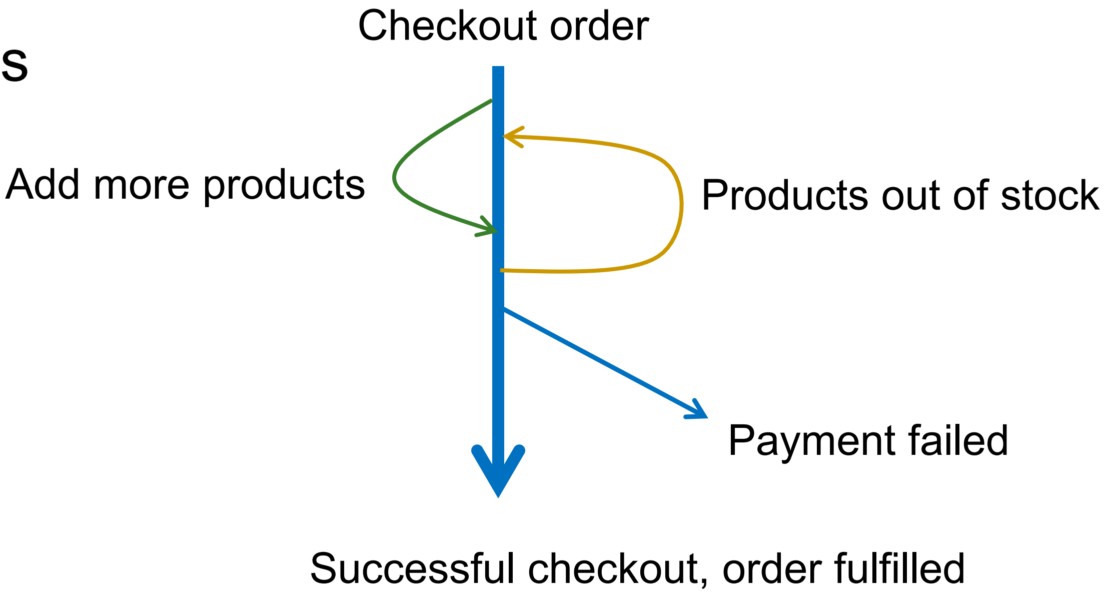
Use case. The customer gets an order confirmation after actions performed successfully

Use Cases (cont'd)

- At the system level, use cases represent external behavior of a system that is visible to outside users
- A use case specifies WHAT the system does, but not HOW it does
- A use case hides internal structure and operations of a system. It usually represents system-level functions of a system

Description of Use Cases

- The behavior of a use case is described by a flow of events
- A use case has one main flow (basic flow) and alternative flows
  - Regular variants
  - Odd cases
  - Exceptions



Scenarios

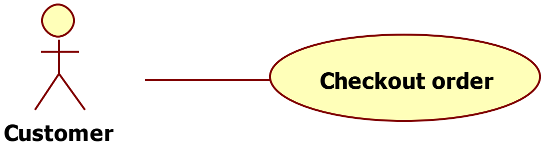
- A use case describes a set of sequences which each sequence in the set represents a possible flow in the use case
- A scenario is a specific sequence of events happening
- A scenario is viewed as an instance of a use case
- Scenarios are real-life examples of how a system can be used

Scenarios (cont’d)

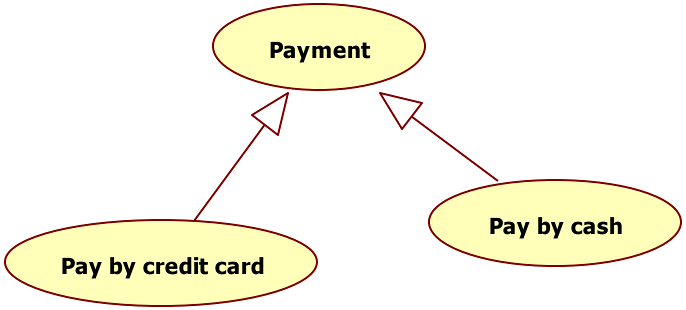
- Scenarios may include
  - A description of the starting situation
  - A description of the normal flow of events
  - A description of what can go wrong
  - Information about other concurrent activities
  - A description of the state when the scenario finishes

Types of Use Case Relationships

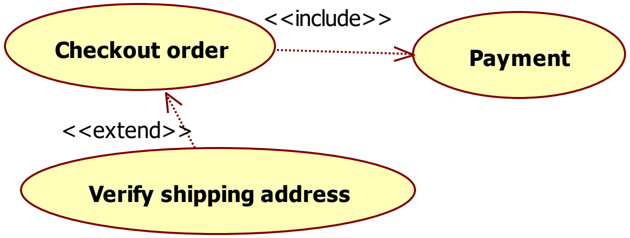
- Association
  - Between actors and use cases



- Generalization
  - Between general use cases and more specific ones



- Include
  - Between use cases
- Extend
  - Between use cases



Difference?

Exercise – Interview Stakeholders

- One member of your project plays a role as **customer**
- Everyone else will interview the **customer** and form a use case model
  - The customer will answer questions based on his/her knowledge about his/her current project
- You have 15 minutes for interviewing, 5 minutes for reporting (two teams to report)

Topics covered

- Requirement engineering processes
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Requirements validation

- Validate that the requirements reflect what the customer wants
- Errors in requirements result problems in design, code, and test

- Requirements error costs are high
  - Fixing errors caused by incorrect requirements after delivery is much higher than in early stages

Requirements checking

- Validity
  - Does the system provide the functions which best support the customer’s needs?
- Verifiability
  - Can the requirements be checked?
- Consistency
  - Are there any requirements conflicts?
- Completeness
  - Are all functions required by the customer included?
- Realism
  - Can the requirements be implemented given available budget and technology

Requirements validation techniques

- Requirements reviews
  - Systematic manual analysis of the requirements
  - Most common approach
- Prototyping
  - Using an executable model of the system to check requirements
- Test-case generation
  - Developing tests for requirements to check testability

Requirements reviews

- Regular reviews should be held while requirements are defined
- Requirements analysts, designers, developers, testers should be involved in reviews
- Reviews may be formal or informal
- Good communications help resolve problems at an early stage

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Requirements management

- Requirements management
  - process of managing changing requirements during the project

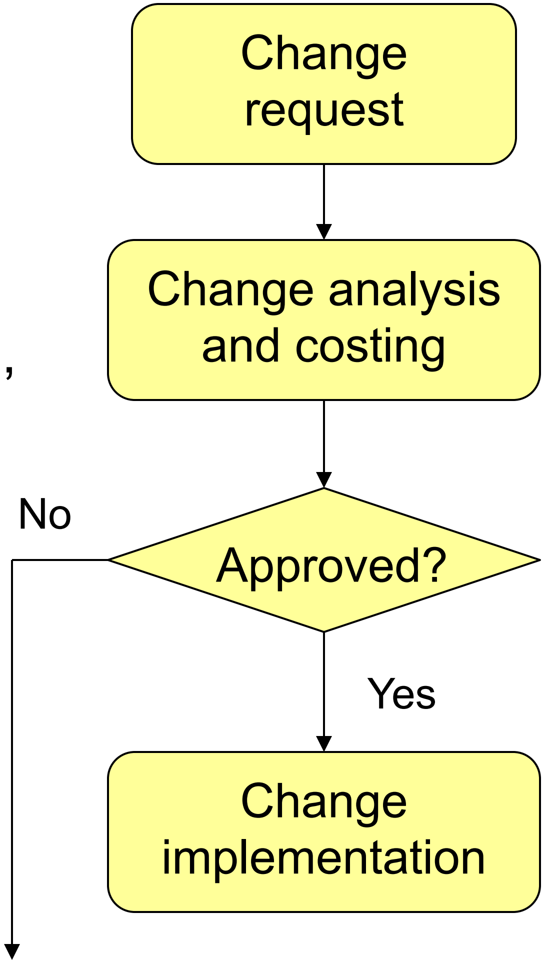
- Requirements are inevitably incomplete and inconsistent
  - New requirements emerge
    - business needs change
    - better understanding of the system

Requirements change

- New and changed business needs
- Better understanding of the system
- Priority of requirements from different viewpoints changes
- Business and technical environments change during project

Requirements change management

- Performed throughout the project
- Main steps
  - Change request
    - Request changes from customers, users, team
  - Change analysis and costing
    - Assess effects of change on other requirements
  - Change implementation
    - Modify requirements and affected docs
    - Change design, code, and test



Key points

- Requirements engineering process includes
  - feasibility study, requirements elicitation and analysis, requirements specification and requirements management
- Requirements elicitation and analysis is iterative involving
  - domain understanding, requirements collection, classification, structuring, prioritisation and validation.
- Systems have multiple stakeholders with different requirements

Key points

- Social and organization factors influence system requirements
- Requirements validation is concerned with checks for validity, consistency, completeness, realism and verifiability
- Business changes inevitably lead to changing requirements
- Requirements management includes planning and change management