Requirements Engineering Process

Topics covered

Requirement Engineering Process

- Feasibility studies
- Requirements elicitation and analysis
- Requirements validation
- Requirements management

Requirements Engineering

"Requirement Engineering (RE)is the science and discipline concerned with analyzing and documenting requirements."

Requirements Engineering process

Goal of RE Process →to create and maintain a system requirement document

- Includes four high level **RE sub-processes**

- Assessing whether the system is useful to business(Feasibility Study)
- Discovering requirements(elicitation and analysis)
- Converting theses requirements into some standard form(specification)
- Checking that the requirements actually define the system that the customer wants(validation)

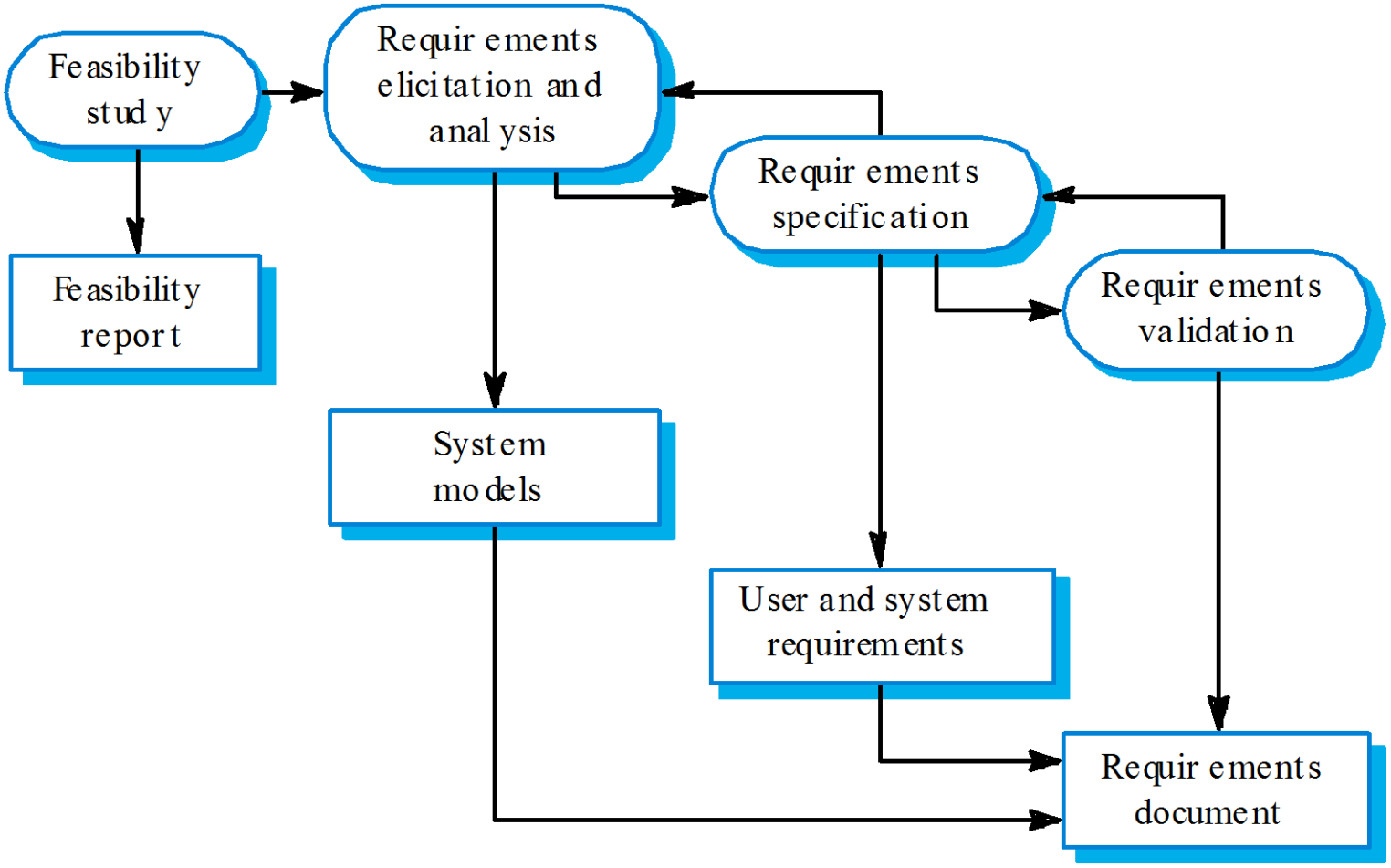
Requirements Engineering process

- The process used for RE vary widely depending on the **application domain**, the **people** involved and the **organisation** developing the requirements.

- However, there are a number of generic activities common to all processes

  - Requirements elicitation
  - Requirements analysis
  - Requirements validation
  - Requirements management

The requirements engineering process



Feasibility study

- A feasibility study decides whether or not the proposed system is worthwhile.

- A short focused study that checks

  - If the system contributes to organisational objectives
  - If the system can be engineered using **current technology and within budget**
  - If the system can be **integrated** with other systems that are used.

Feasibility study Implementation

Carrying out feasibility study involves

- Information assessment (what is required)
- Information collection
- Report writing

* Questions for people in the organisation

  - 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 study implementation

In a feasibility study you may consult information sources such as

- Managers of department where the system will be used
- Software engineers who are familiar with the type of proposed system
- Technology experts
- End user of system

Should complete a feasibility study in two or three weeks

- Once you have information → write feasibility report
- Make a recommendation → whether or not the system should continue
- In a report → you may propose changes to scope ,budget and schedule of the system.

Requirement Elicitation and Analysis

- Sometimes called requirement discovery.
- Involves technical staff (software engineers) working with customers to find out about the
  - application domain
  - the services that the system should provide and
  - the system's operational constraints.

May involve a variety of people in an organization

- End-users, managers, engineers involved in maintenance, domain experts etc. These are called *stakeholders*

Problems of Requirements analysis

Understanding stakeholder requirements is difficult for several reasons

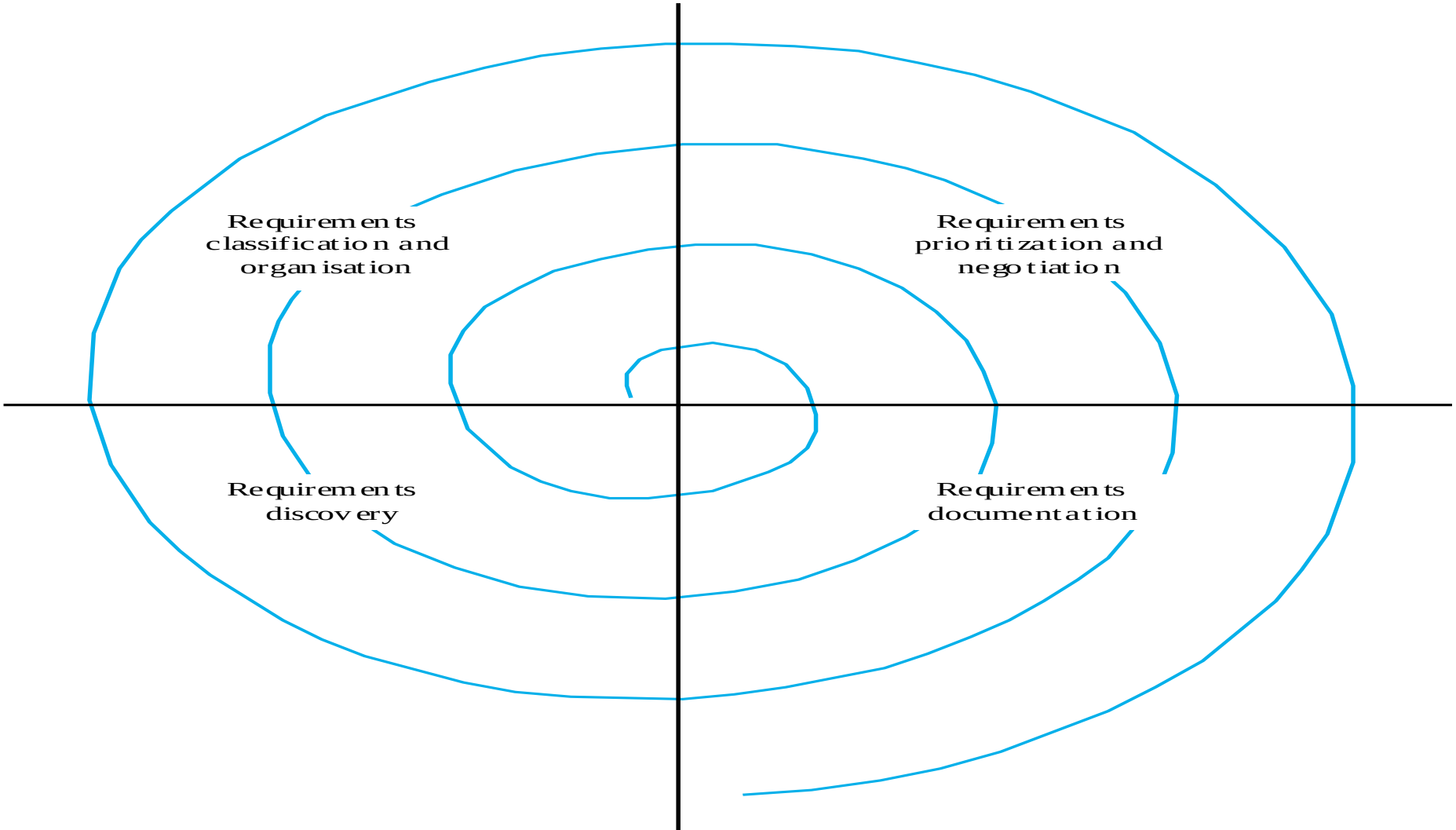
- Stakeholders don’t know what they really want.
- Stakeholders express requirements in their own terms.
- Different stakeholders may have conflicting requirements.
- Organisational and political factors may influence the system requirements.
- The requirements change during the analysis process. New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

Requirement Elicitation and Analysis

Process Activities

- Requirements discovery
  - Interacting with stakeholders to discover their requirements. Domain requirements are also discovered at this stage.
- Requirements classification and organisation
  - Groups related requirements and organises them into coherent clusters.
- Prioritisation and negotiation
  - Prioritising requirements and resolving requirements conflicts.
- Requirements documentation
  - Requirements are documented and input into the next round of the spiral.

The requirements elicitation and analysis process



Requirements discovery

- The process of gathering information about the proposed and existing systems
- Distilling the user and system requirements from this information.
- Sources of information include documentation, system stakeholders and the specifications of similar systems.

Techniques of Requirement Discovery

Interview:

- In formal or informal interviewing, the RE team puts questions to stakeholders about the system that they use and the system to be developed.
- There are two types of interview
  - Closed interviews where a pre-defined set of questions are answered.
  - Open interviews where there is no pre-defined agenda and a range of issues are explored with stakeholders.

Effective Interviewers

- Interviewers should be open-minded.
- Willing to listen to stakeholders and should not have pre-conceived ideas about the requirements.
- If the stake holders comes up with surprising requirements , willing to change their minds about the system
- They should prompt the interviewee with a question or a proposal and should not simply expect them to respond to a question such as ‘what do you want’.

Scenarios

- Scenarios are real-life examples of how a system can be used.

They should 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.

LIBSYS scenario

Initial assumption: The user has logged on to the LIBSYS system and has located the journal containing the copy of the article.

Normal: The user selects the article to be copied. He or she is then prompted by the system to either provide subscriber information for the journal or to indicate how they will pay for the article. Alternative payment methods are by credit card or by quoting an organisational account number.

The user is then asked to fill in a copyright form that maintains details of the transaction and they then submit this to the LIBSYS system.

The copyright form is checked and, if OK, the PDF version of the article is downloaded to the LIBSYS working area on the user's computer and the user is informed that it is available. The user is asked to select a printer and a copy of the article is printed. If the article has been flagged as 'print-only' it is deleted from the user's system once the user has confirmed that printing is complete.

LIBSYS scenario

What can go wrong: The user may fail to fill in the copyright form correctly. In this case, the form should be re-presented to the user for correction. If the resubmitted form is still incorrect then the user's request for the article is rejected.

The payment may be rejected by the system. The user's request for the article is rejected.

The article download may fail. Retry until successful or the user terminates the session.

It may not be possible to print the article. If the article is not flagged as 'print-only' then it is held in the LIBSYS workspace. Otherwise, the article is deleted and the user's account credited with the cost of the article.

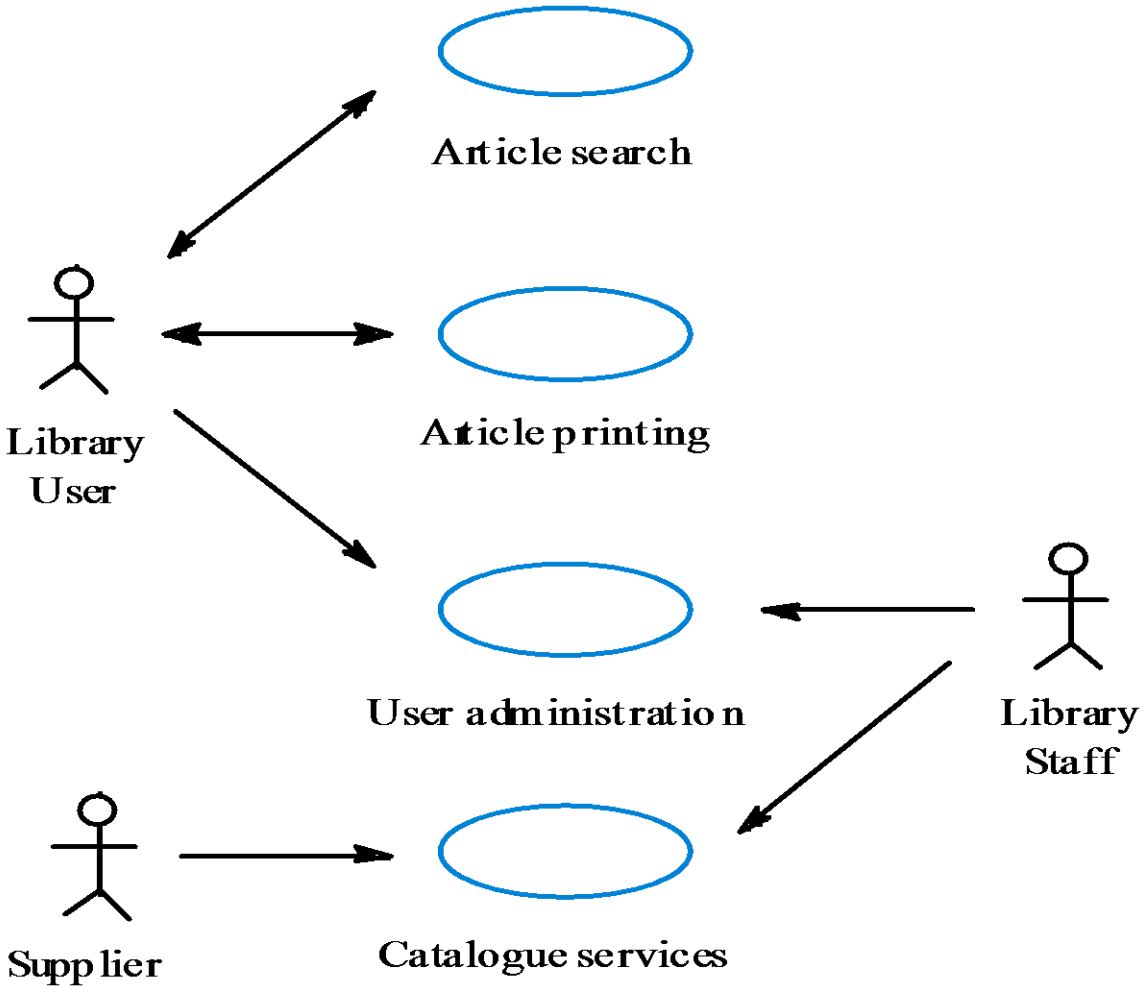
Other activities: Simultaneous downloads of other articles.

System state on completion: User is logged on. The downloaded article has been deleted from LIBSYS workspace if it has been flagged as print-only.

Use cases

- Use-cases are a scenario based technique for requirement elicitation
- which identify the actors in an interaction and which describe the interaction itself.
- A set of use cases should describe all possible interactions with the system.
- Sequence diagrams may be used to add detail to use-cases by showing the sequence of event processing in the system.

LIBSYS use cases



Social and Organisational factors

- Software systems do not exist in isolation – they are used in a social and organisational context.
- This can influence or even dominate the system requirements.
- Good analysts must be sensitive to these factors.

Ethnography

- Ethnography is an observational technique that can be used to understand social and organisational requirements.
- An analyst immerses him or herself in the working environment(where the system will be used)
- Help analyst to discover implicit system requirements

Requirements validation

- Concerned with demonstrating that the requirements define the system that the customer really wants.
- Requirements error costs are high so validation is very important
  - Fixing a requirements error after delivery may cost up to 100 times the cost of fixing an implementation error.

Requirements checking

Checks include

- **Validity.** Does the system provide the functions which best support the customer's needs?
- **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

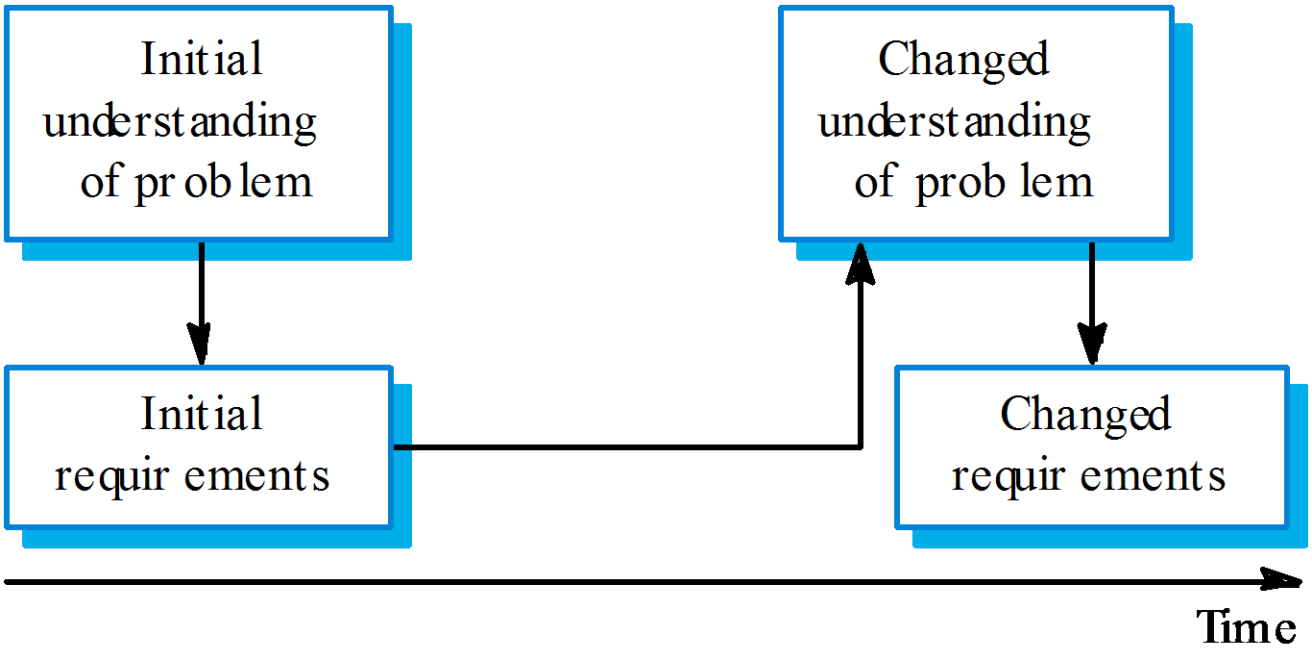
Requirements validation techniques

- Requirements reviews
  - Systematic manual analysis of the requirements(by a team of reviewers)
- Prototyping
  - Using an executable model of the system to check requirements.
- Test-case generation
  - Developing tests for requirements to check testability.

Requirements management

- Requirements management is the process of **managing changing requirements** during the requirements engineering process and system development.
  - New requirements emerge during the process as business needs change and a better understanding of the system is developed

Requirements evolution



Enduring and volatile requirements

From an evolution perspective

- **Enduring requirements.** Stable requirements derived from the core activity of the customer organisation. E.g. a hospital will always have doctors, nurses, etc. May be derived from domain models

- **Volatile requirements.** Requirements which change during development or when the system is in use.

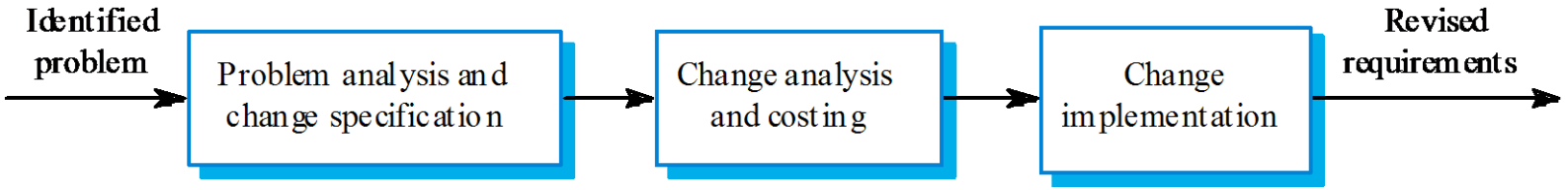
Requirements Change Management

Should apply to all proposed changes to the requirements.

Principal stages

- Problem analysis. Discuss requirements problem and propose change
- Change analysis and costing. Assess effects of change on other requirements;
- Change implementation. Modify requirements document and other documents to reflect change.

Change management



Traceability

- Traceability is concerned with the relationships between requirements, their sources and the system design

- **Source traceability**
  - Links from requirements to stakeholders who proposed these requirements
- **Requirements traceability**
  - Links between dependent requirements
- **Design traceability**
  - Links from the requirements to the design

Key points

- The requirements engineering process includes a 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 organisation factors influence system requirements.
- Requirements validation is concerned with checks for validity, consistency, completeness, realism and verifiability.
- Requirements management includes planning and change management.

Reading Assignment

- Different tools and techniques used for requirement discovery.

- Risks from Inadequate Requirement Process.