
Requirements Engineering Processes

이동아

Objectives

- To describe the principal requirements engineering activities and their relationships
- To introduce techniques for requirements elicitation and analysis
- To describe requirements validation and the role of requirements reviews
- To discuss the role of requirements management in support of other requirements engineering processes

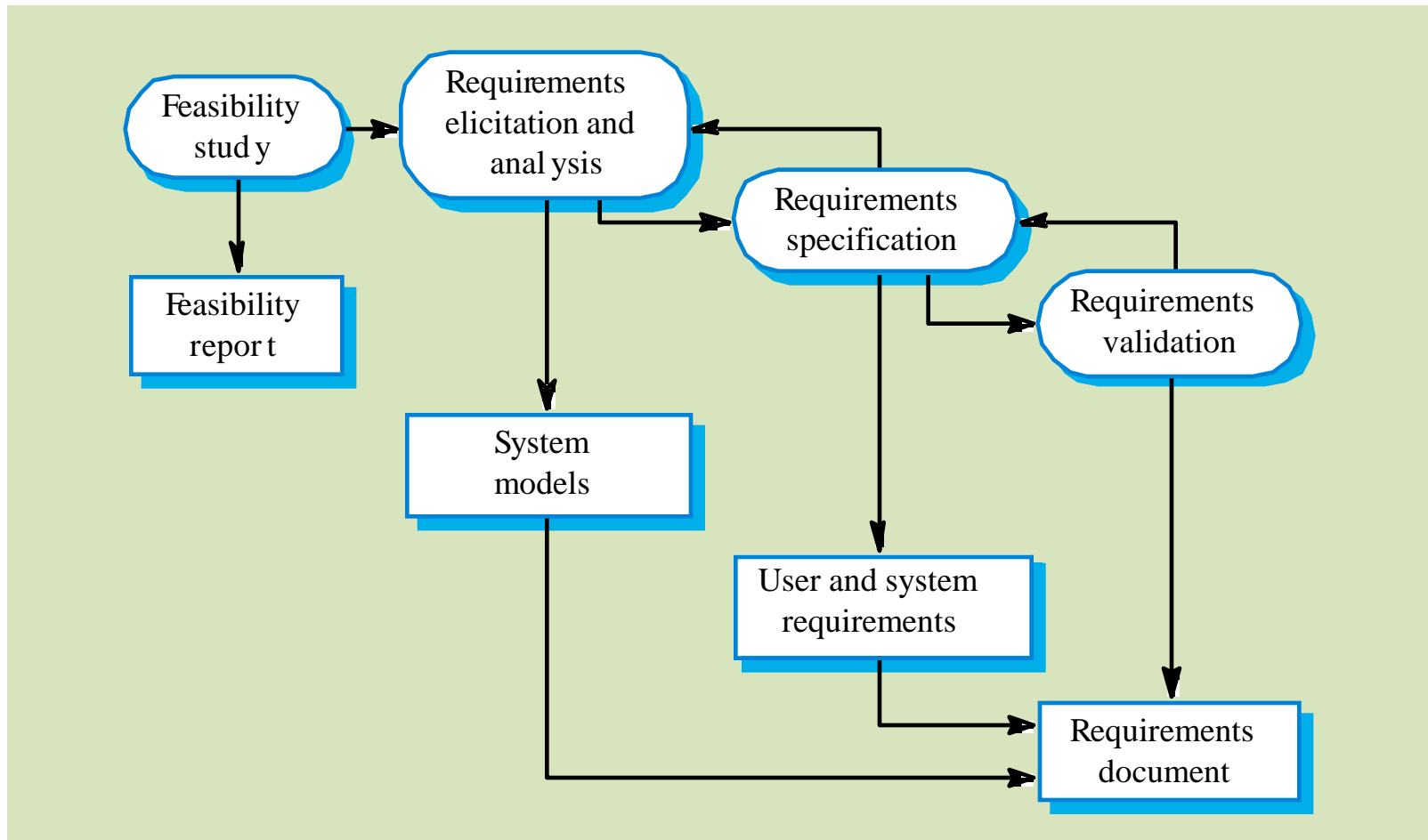
Topics covered

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

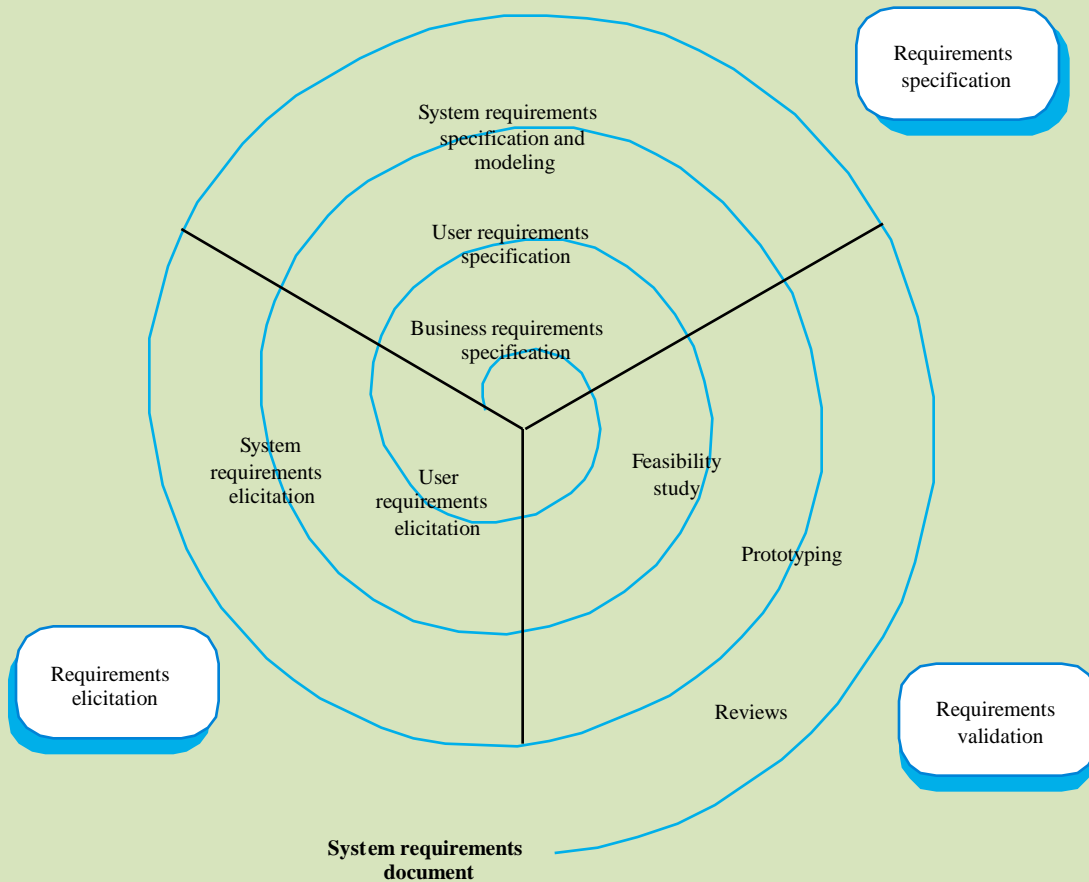
Requirements engineering processes

- The processes 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



Requirements engineering



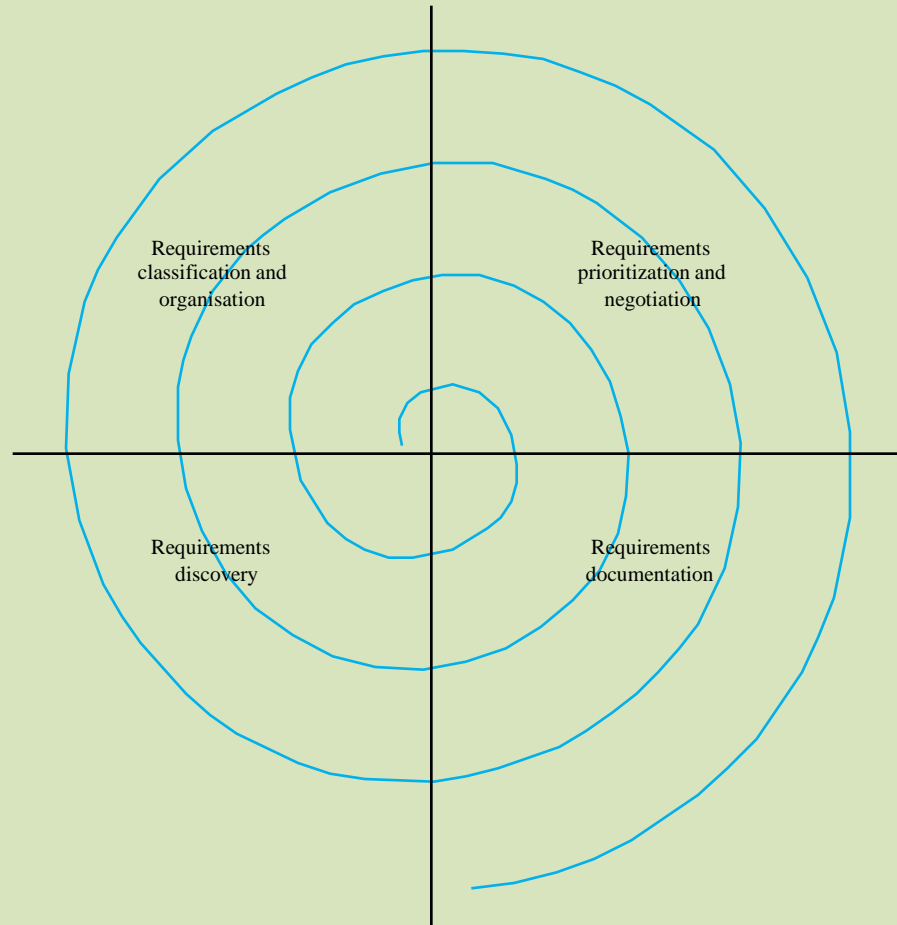
Feasibility studies

- 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.
- Questions for feasibility
 - 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?

Elicitation and analysis

- Sometimes called requirements elicitation or requirements discovery.
- Involves technical staff 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 end-users, managers, engineers involved in maintenance, domain experts, trade unions, etc. These are called stakeholders.
- Problems
 - 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.

The requirements spiral



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.

Requirements discovery

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

System	Stakeholder
Automated teller machine	Bank customers Representatives of other banks Bank managers Counter staff Database administrators Security managers Marketing department Hardware and software maintenance engineers Banking regulators

Interviewing

- 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.
- Normally a mix of closed and open-ended interviewing.
 - Pros: Interviews are good for getting an overall understanding of what stakeholders do and how they might interact with the system.
 - Cons: Interviews are not good for understanding domain requirements
 - Requirements engineers cannot understand specific domain terminology;
 - Some domain knowledge is so familiar that people find it hard to articulate or think that it isn't worth articulating.

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.
- An example
 - LIBSYS scenario

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

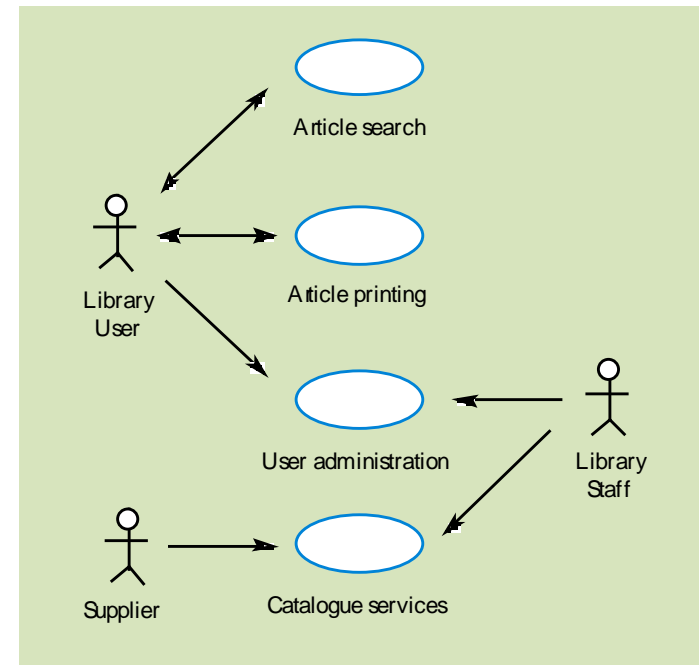
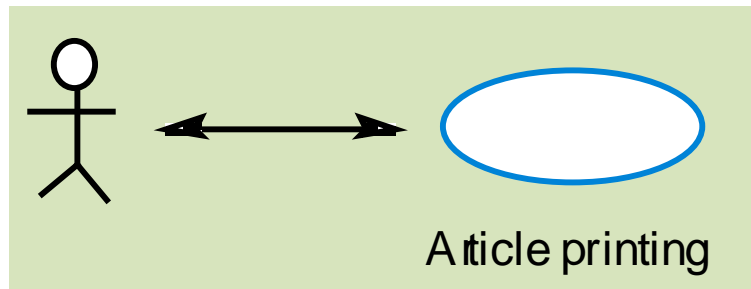
Normal: The user selects the article to be copied. He or she is then prompted by the system to either provide subscriber information for the journal or to indicate how they will pay for the article. Alternative payment methods are by credit card or by quoting an organisational account number.

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.

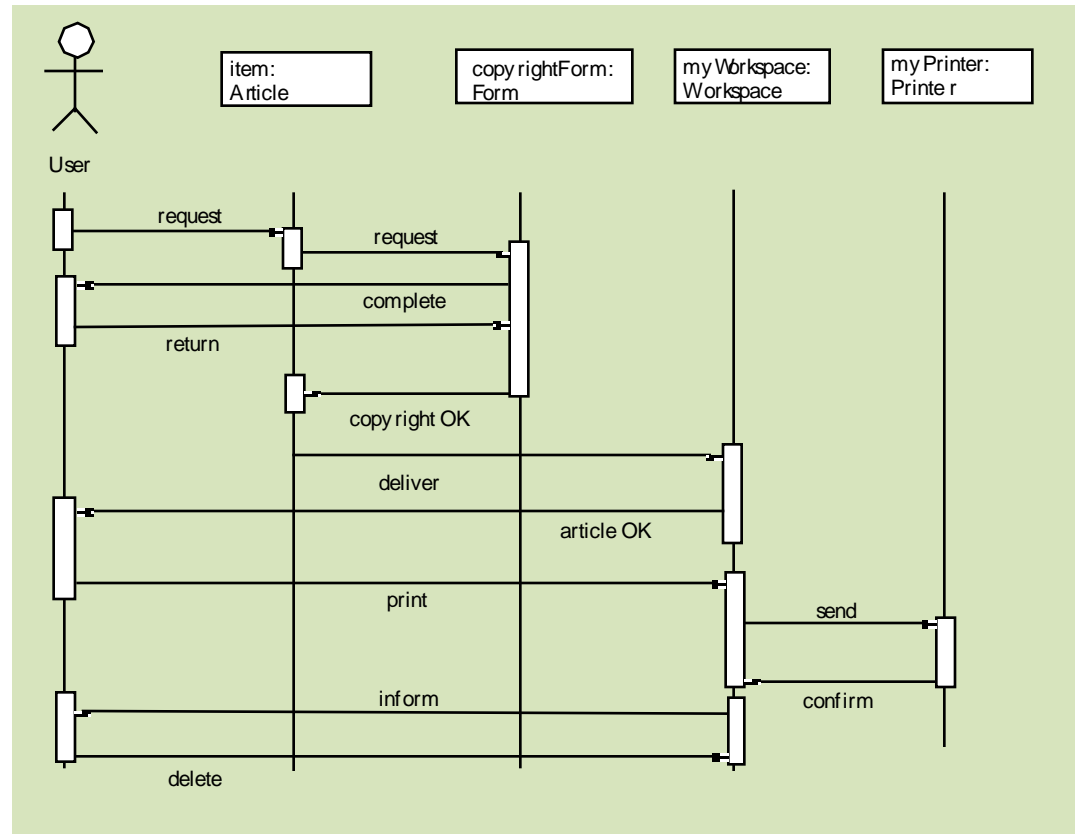
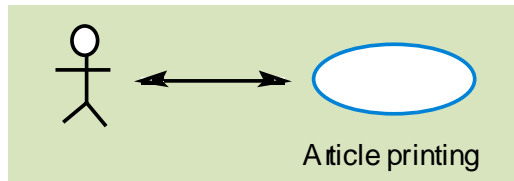
The copyright form is checked and, if OK, the PDF version of the article is downloaded to the LIBSYS working area on the user's computer and the user is informed that it is available. The user is asked to select a printer and a copy of the article is printed. If the article has been flagged as 'print-only'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

Use cases

- Use-cases are a scenario based technique in the UML 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.



Article printing



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
 - 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
 - Verifiability. Can the requirements be checked?

Requirements validation techniques

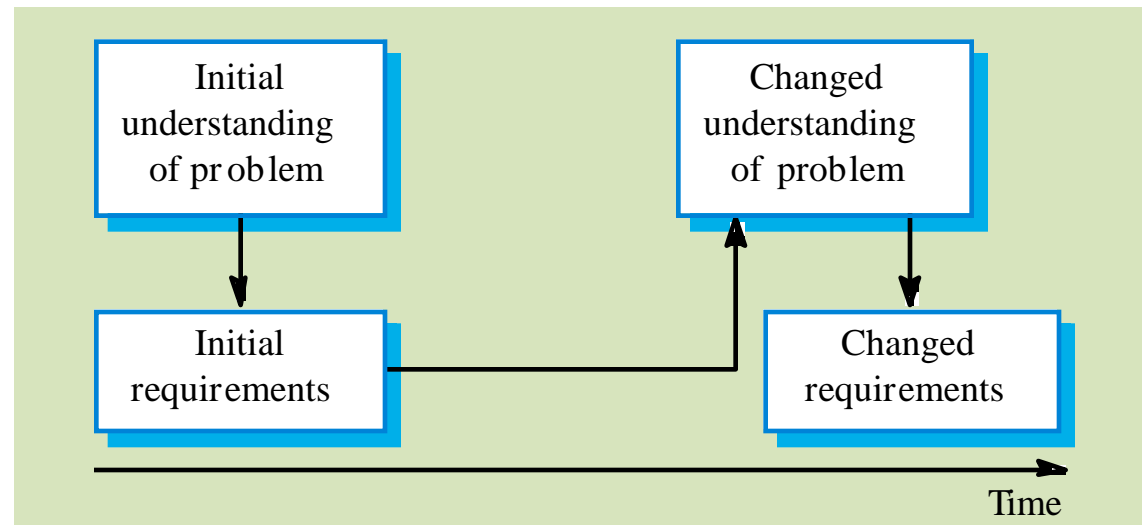
- Requirements reviews
 - Systematic manual analysis of the requirements.
 - Good communications between developers, customers and users can resolve problems at an early stage.
 - Review checks
 - Verifiability. Comprehensibility. Traceability. Adaptability.
- Prototyping
 - Using an executable model of the system to check requirements. Covered in Chapter 17.
- 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.
- Requirements are inevitably incomplete and inconsistent
 - New requirements emerge during the process as business needs change and a better understanding of the system is developed;
 - Different viewpoints have different requirements and these are often contradictory.

Requirements change

- The priority of requirements from different viewpoints changes during the development process.
- System customers may specify requirements from a business perspective that conflict with end-user requirements.
- The business and technical environment of the system changes during its development.



Requirements management planning

- During the requirements engineering process, you have to plan:
 - Requirements identification
 - How requirements are individually identified;
 - A change management process
 - The process followed when analysing a requirements change;
 - Traceability policies
 - The amount of information about requirements relationships that is maintained;
 - CASE tool support
 - The tool support required to help manage requirements change;

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;

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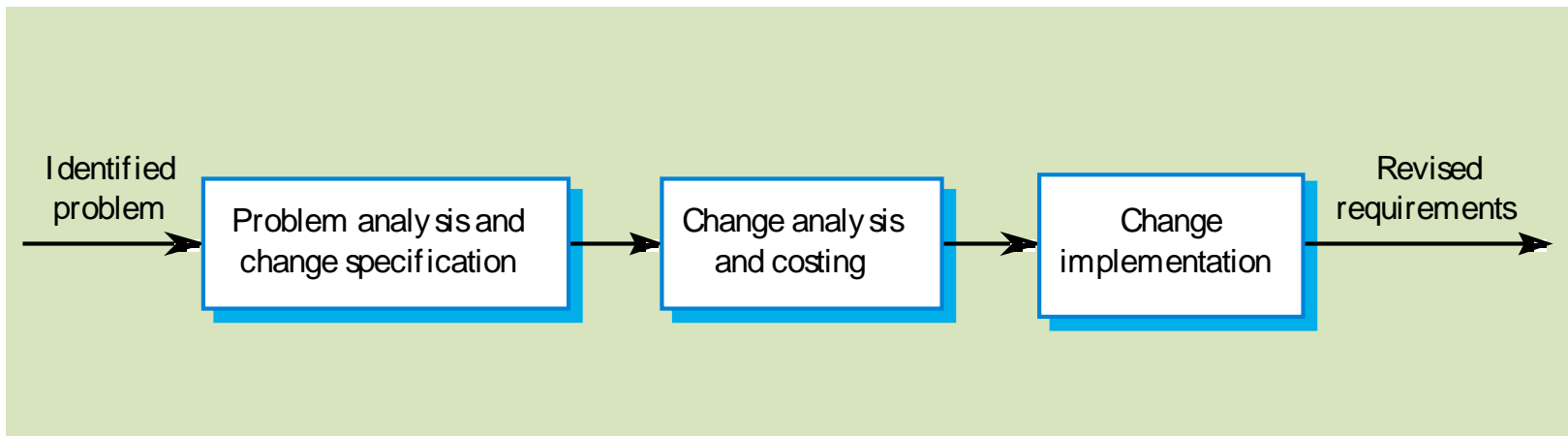
A traceability matrix

CASE tool support

- Requirements storage
 - Requirements should be managed in a secure, managed data store.
- Change management
 - The process of change management is a workflow process whose stages can be defined and information flow between these stages partially automated.
- Traceability management
 - Automated retrieval of the links between requirements.

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.



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.
- 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.