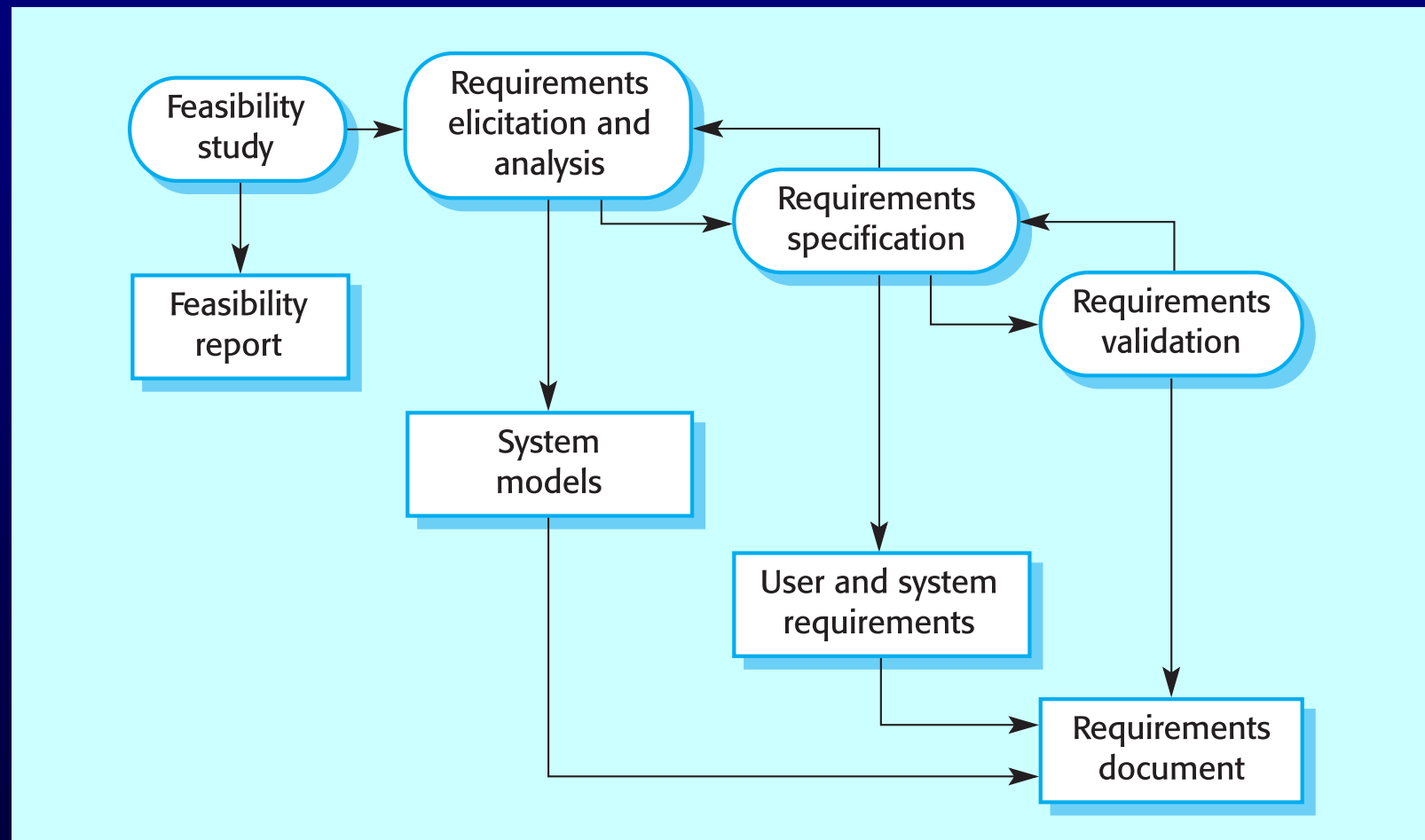

Requirements Engineering Processes

Topics covered

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

The requirements engineering process



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.

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 of requirements analysis

- 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.

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.

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 the perspectives of different stakeholders. Stakeholders may be classified under different viewpoints.
- This multi-perspective analysis is important as there is no single correct way to analyse system requirements.

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.

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 (1)

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 (2)

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.

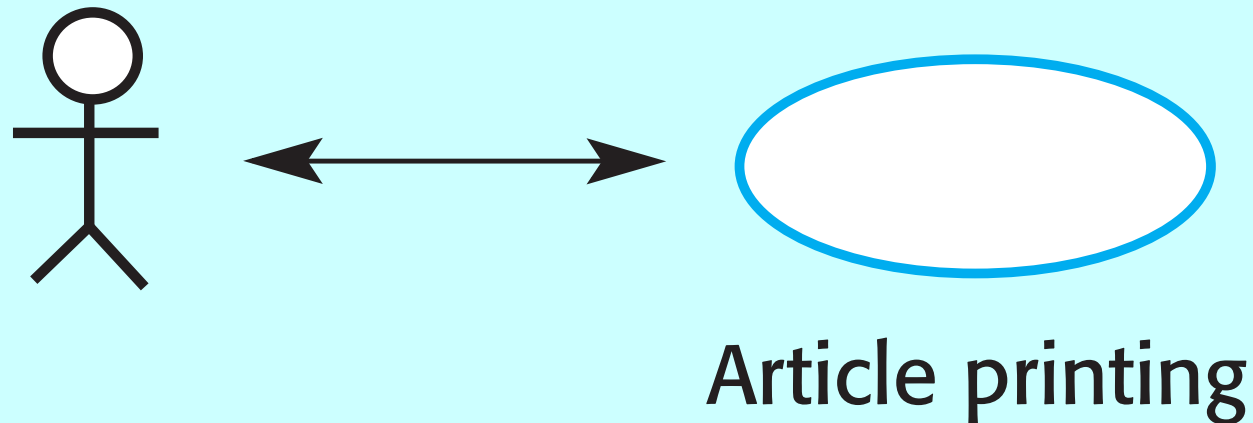
Other activities: Simultaneous downloads of other articles.

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.

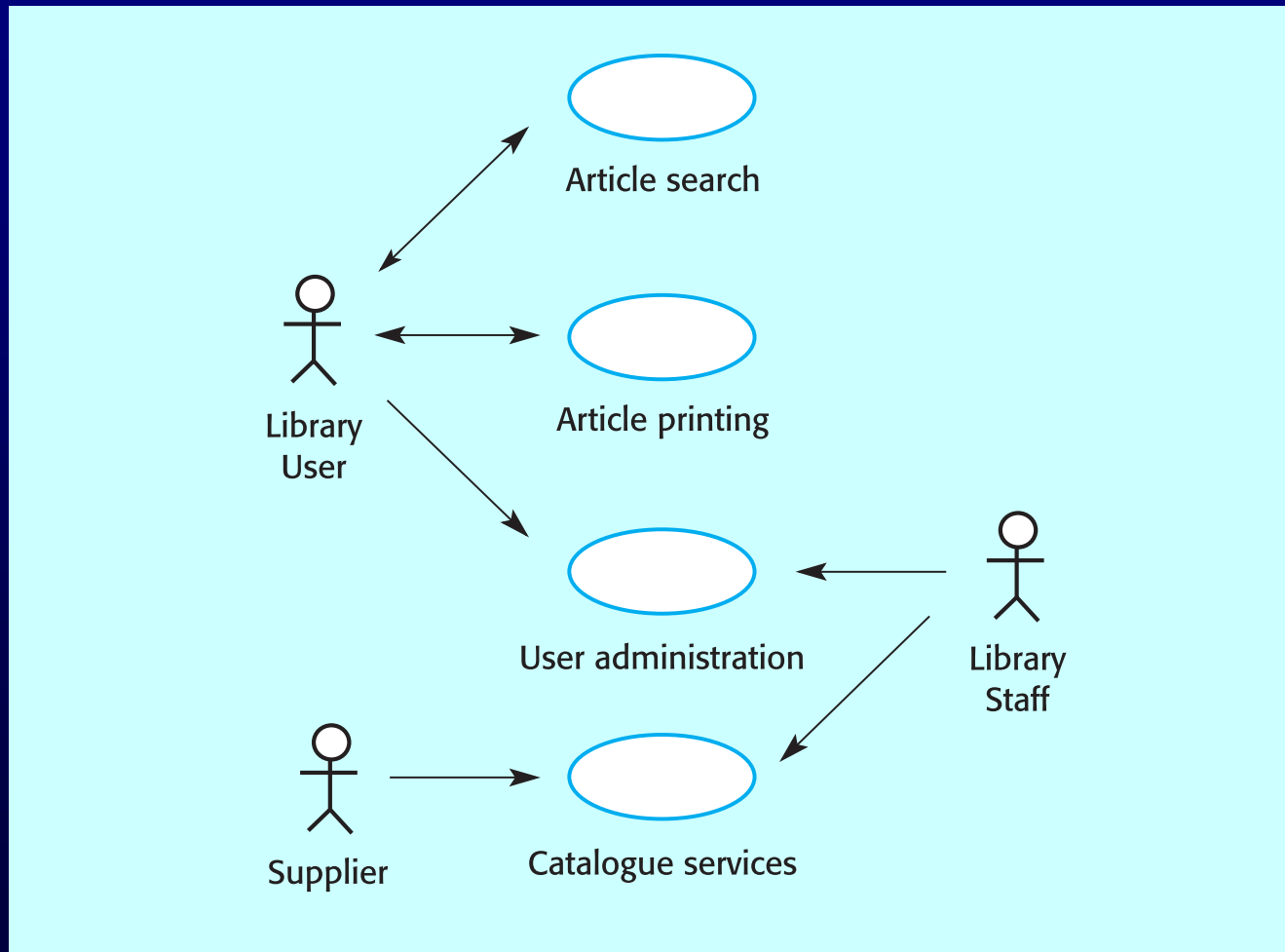
Use cases

- Use-cases are a scenario based technique 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.

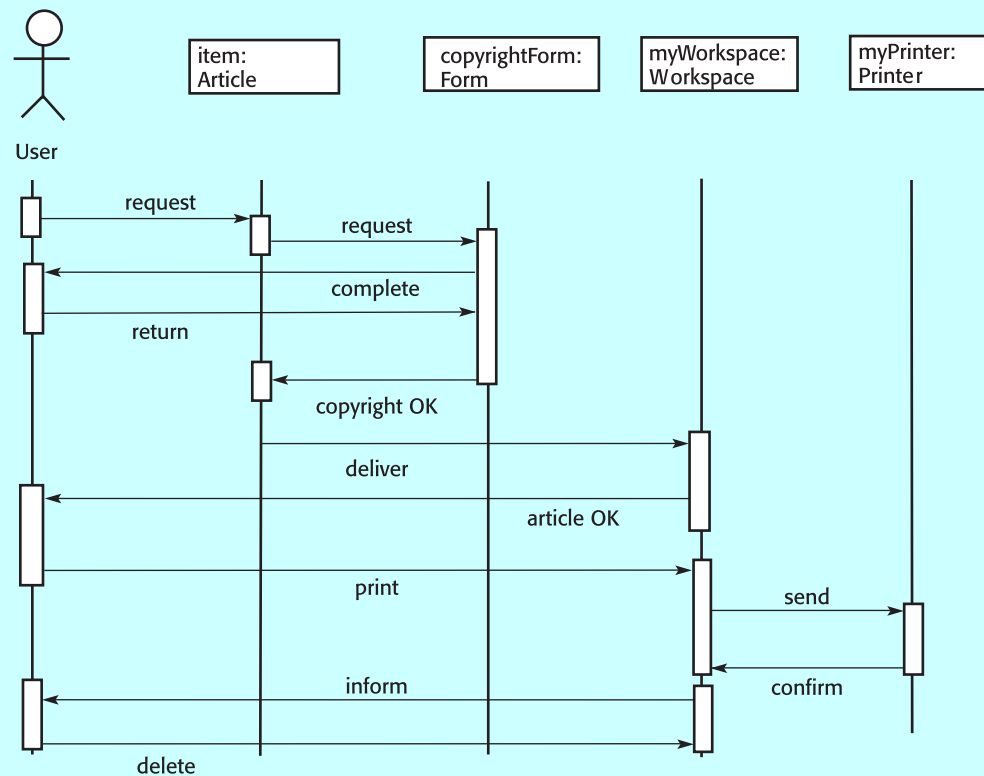
Article printing use-case



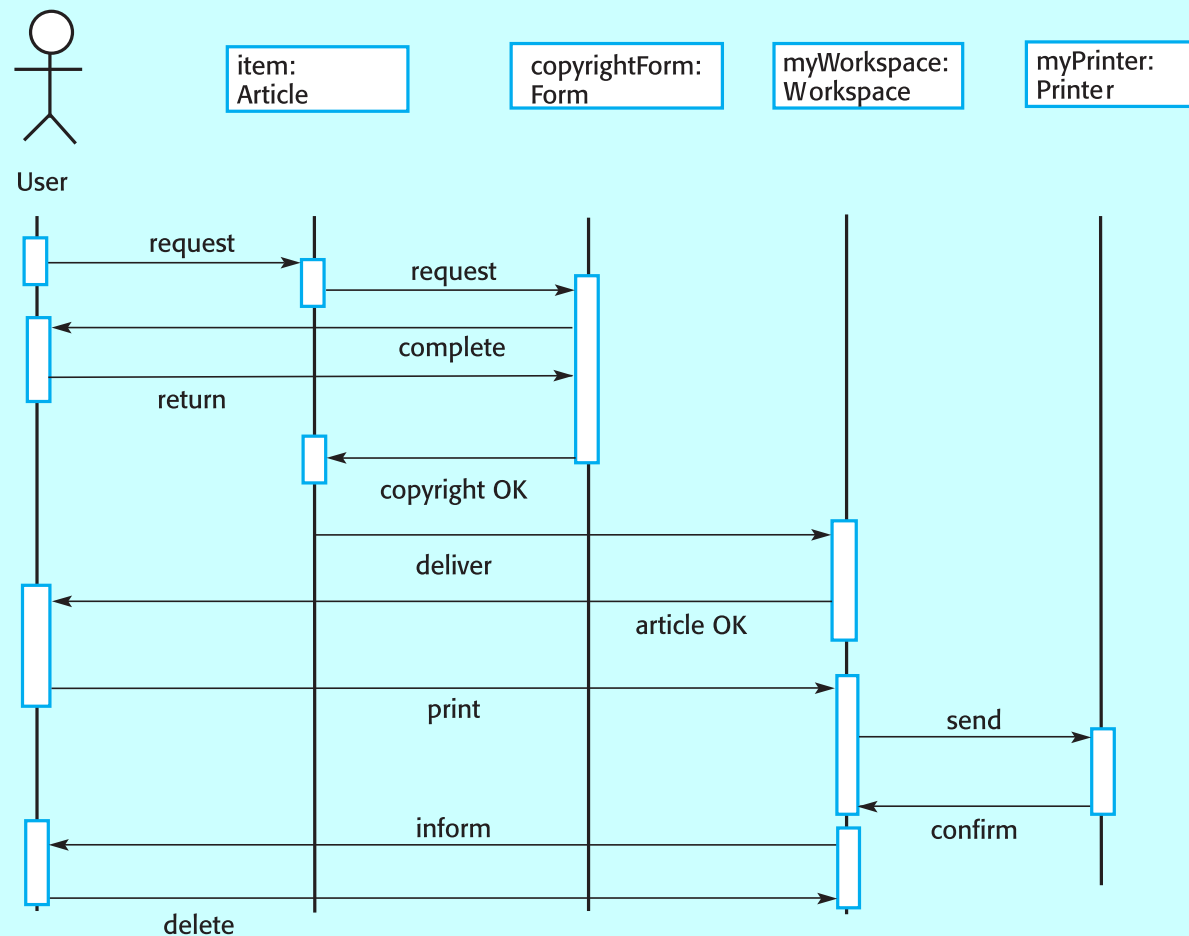
LIBSYS use cases



Article printing



Print article sequence



Ethnography

- A social scientists spends a considerable time observing and analysing how people actually work.
- People do not have to explain or articulate their work.
- Social and organisational factors of importance may be observed.
- Ethnographic studies have shown that work is usually richer and more complex than suggested by simple system models.

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.
- 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.

Review checks

- **Verifiability**. Is the requirement realistically testable?
- **Comprehensibility**. Is the requirement properly understood?
- **Traceability**. Is the origin of the requirement clearly stated?
- **Adaptability**. Can the requirement be changed without a large impact on other requirements?

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 classification

Requirement Type	Description
Mutable requirements	Requirements that change because of changes to the environment in which the organisation is operating. For example, in hospital systems, the funding of patient care may change and thus require different treatment information to be collected.
Emergent requirements	Requirements that emerge as the customer's understanding of the system develops during the system development. The design process may reveal new emergent requirements.
Consequential requirements	Requirements that result from the introduction of the computer system. Introducing the computer system may change the organisations processes and open up new ways of working which generate new system requirements
Compatibility requirements	Requirements that depend on the particular systems or business processes within an organisation. As these change, the compatibility requirements on the commissioned or delivered system may also have to evolve.

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;

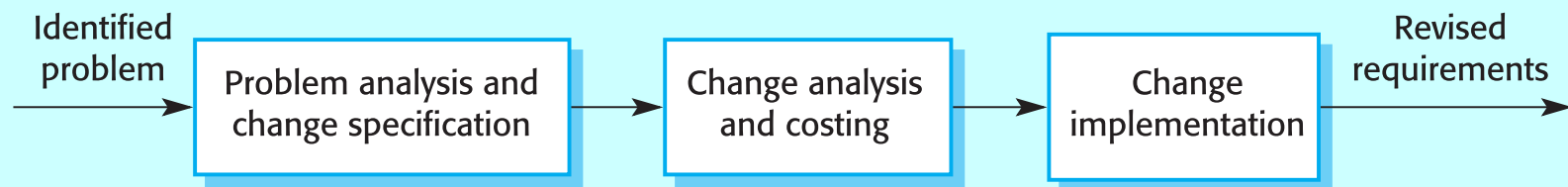
A traceability matrix

Req. id	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2
1.1		D	R					
1.2			D			D		D
1.3	R			R				
2.1			R		D			D
2.2								D
2.3		R		D				
3.1								R
3.2							R	

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.

Change management



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.
- Business changes inevitably lead to changing requirements.
- Requirements management includes planning and change management.