

Requirements Engineering Processes

- 1 Processes used to discover, analyse and validate system requirements

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Requirements Engineering Processes Topics

- 1 Overview of the activities involved
- 1 Feasibility studies
- 1 Requirements elicitation and analysis
- 1 Requirements validation
- 1 Requirements management

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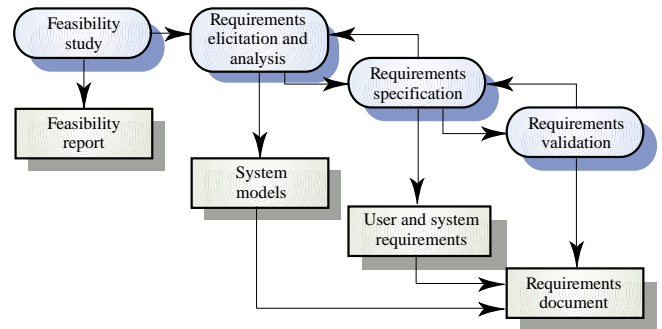
Requirements engineering processes

- 1 The processes used for requirements engineering vary widely depending on the application domain, the people involved and the organisation developing the requirements
- 1 However, there are a number of generic activities common to all processes
 - Requirements elicitation
 - Requirements analysis
 - Requirements validation
 - Requirements management

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The requirements engineering process



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Feasibility studies

- 1 A feasibility study decides whether or not the proposed system is worthwhile
- 1 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

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Feasibility study implementation

- 1 Based on information assessment (what is required), information collection and report writing
- 1 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?

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Elicitation and analysis

- 1 Sometimes called requirements elicitation or requirements discovery
- 1 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
- 1 May involve end-users, managers, engineers involved in maintenance, domain experts, trade unions, etc. These are called *stakeholders*

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Problems of requirements analysis

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

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The requirements analysis process includes these activities:

- 1 Domain understanding
- 1 Requirements collection
- 1 Classification
- 1 Conflict resolution
- 1 Prioritisation
- 1 Requirements checking

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Viewpoint-oriented elicitation

- 1 Stakeholders represent different ways of looking at a problem or problem viewpoints
- 1 Each stakeholder who will interact with the system will have a different point of view, or viewpoint, of what the system should do.
- 1 This multi-perspective analysis is important as there is no single correct way to analyse system requirements
- 1 Viewpoints and services may be used to structure non-functional requirements

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Question

- 1 6.1 Who are the stakeholders in a university student records system? Why it is almost inevitable that the requirements of different stakeholders will conflict in some way?

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Question

- 1 6.1 Who are the stakeholders in a university student records system? Why it is almost inevitable that the requirements of different stakeholders will conflict in some way?
 - University central administration including those responsible for registration, payment of fees, examinations and assessment and graduation.
 - The students whose details are recorded in the system
 - University departmental administrators who supply information to the system and use information from it.
 - Academic staff who use information from the system.
 - Data protection officers (local and national)
 - Potential employers of students (who may require information from the system).

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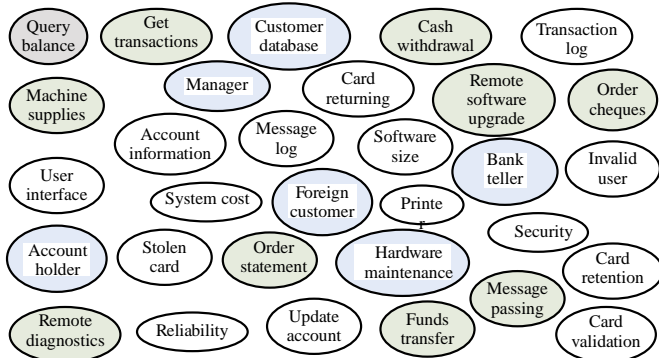
Extended Example: Banking ATM system

- 1 The example used here is an automated teller machine (ATM) which provides some automated banking services.
- 1 Services include cash withdrawal, message passing (send a message to request a service), ordering a statement and transferring funds

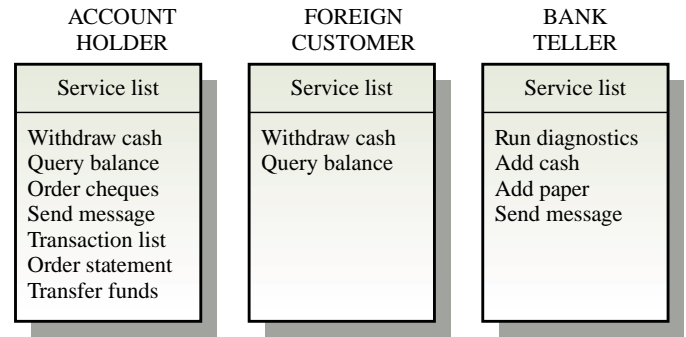
Autoteller viewpoints

- 1 Bank customers
- 1 Representatives of other banks
- 1 Hardware and software maintenance engineers
- 1 Marketing department
- 1 Bank managers and counter staff
- 1 Database administrators and security staff
- 1 Communications engineers
- 1 Personnel department

Viewpoint identification



Viewpoint service information

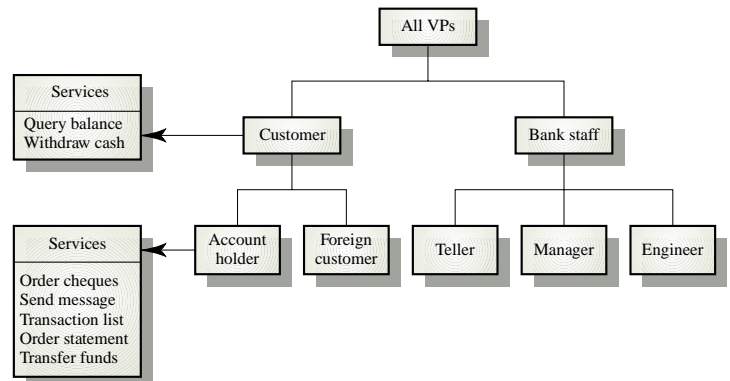


Viewpoint data/control

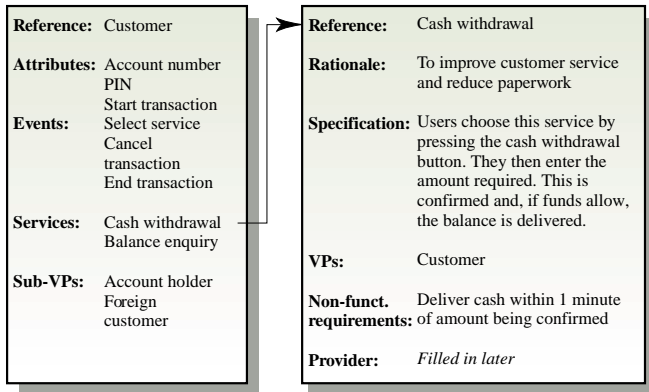
ACCOUNT HOLDER

Control input	Data input
Start transaction Cancel transaction End transaction Select service	Card details PIN Amount required Message

Viewpoint hierarchy



Customer/cash withdrawal templates



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Scenarios

- 1 Scenarios are descriptions of how a system is used in practice
- 1 They are helpful in requirements elicitation as people can relate to these more readily than to an abstract statement of what they require from a system
- 1 Scenarios are useful for adding detail to an outline of requirements description

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Scenario descriptions

- 1 System state at the beginning of the scenario
- 1 Normal flow of events in the scenario
- 1 What can go wrong and how this is handled
- 1 Other concurrent activities
- 1 System state on completion of the scenario

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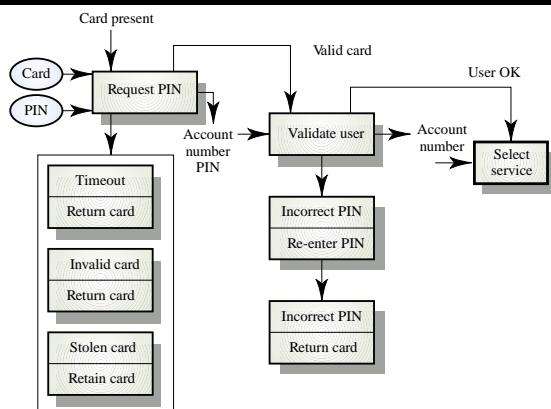
Event scenarios

- 1 Event scenarios may be used to describe how a system responds to the occurrence of some particular event such as 'start transaction'
- 1 A diagrammatic convention for event scenarios might include:
 - Data provided and delivered
 - Control information
 - Exception processing
 - The next expected event

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Event scenario - start transaction



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Key to diagram in the previous slide

- 1 Ellipses (ovals): data provided from or delivered to a viewpoint
- 1 Control information enters and leaves at the top of each box
- 1 Data leaves from the right of each box
- 1 Exceptions are shown at the bottom of each box
- 1 Name of next event is in box with thick edges

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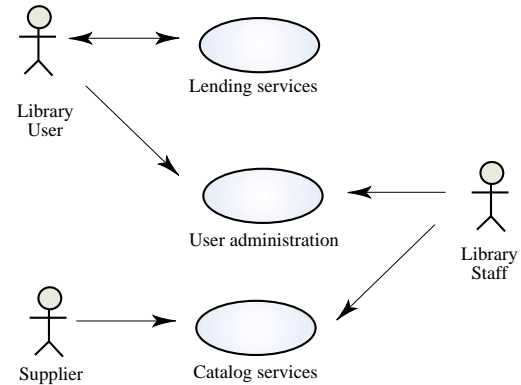
Use cases

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

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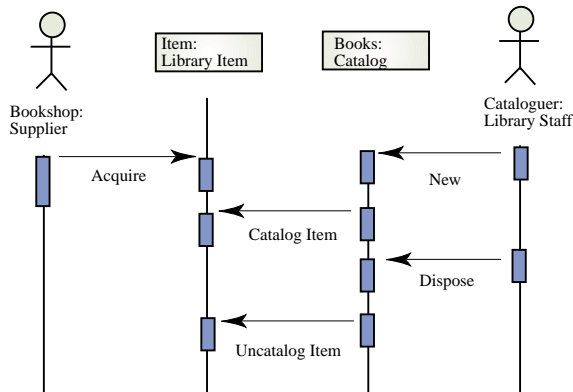
Library use-cases



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Catalogue management



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Exercise

- 1 6.5 Using your own knowledge of how an ATM is used, develop a set of use cases that could be used to derive the requirements for an ATM system.

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Requirements validation

- 1 The process of demonstrating that the requirements define the system that the customer really needs.
- 1 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

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Issues to validate

- 1 Completeness. Are all functions required by the customer included?
- 1 Consistency. Are there any requirements conflicts?
- 1 Realism. Can the requirements be implemented given available budget and technology
- 1 Verifiability. Can the requirements be checked?

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Requirements validation techniques

- 1 Prototyping
 - Using an executable model of the system to check requirements. Covered in Chapter 8
- 1 Test-case generation
 - Developing tests for requirements to check testability
- 1 Requirements reviews
 - Systematic manual analysis of the requirements

Requirements reviews

- 1 Regular reviews should be held while the requirements definition is being formulated
- 1 Both client and contractor staff should be involved in reviews
- 1 Reviews may be formal (with completed documents) or informal. Good communications between developers, customers and users can resolve problems at an early stage

Exercise

- 1 6.7 Who should be involved in a requirements review? Draw a process model showing how a requirements review might be organized.

Requirements management

- 1 Requirements management is the process of managing changing requirements during the requirements engineering process and system development
- 1 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

Traceability

- 1 Traceability is one aspect of requirements management, and is concerned with the relationships between requirements, their sources and the system design
- 1 Source traceability
 - Links from requirements to stakeholders who proposed these requirements
- 1 Requirements traceability
 - Links between dependent requirements
- 1 Design traceability
 - Links from the requirements to the design

A traceability matrix and requirements cross-reference

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

Notation used in this diagram:

U = The requirement in the row uses that in the column
R = Some other weaker relationship between the two

Requirements Engineering Processes—Summary

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

Requirements Engineering Processes—Summary

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