

Requirements Analysis

- ◆ Understanding the customer's requirements for a software system

Objectives

- ◆ To describe different approaches to requirements discovery
- ◆ To explain the need for multi-perspective analysis
- ◆ To illustrate a structured approach to requirements analysis
- ◆ To explain why social and organisational factors influence system requirements

Topics covered

- ◆ Viewpoint-oriented analysis
- ◆ Method-based analysis
- ◆ System contexts
- ◆ Social and organisational factors

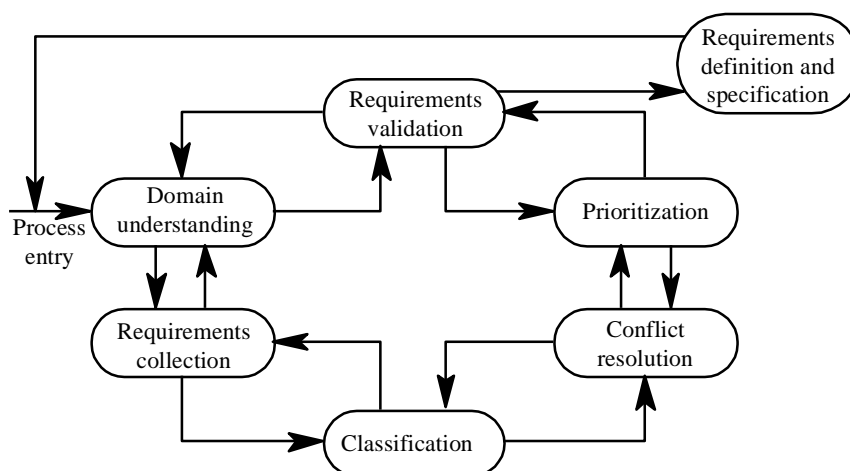
Requirements analysis

- ◆ 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

The requirements analysis process



Process activities

- ◆ Domain understanding
- ◆ Requirements collection
- ◆ Classification
- ◆ Conflict resolution
- ◆ Prioritisation
- ◆ Requirements validation

System models

- ◆ Different models may be produced during the requirements analysis activity
- ◆ Requirements analysis may involve three structuring activities which result in these different models
 - **Partitioning**. Identifies the structural (part-of) relationships between entities
 - **Abstraction**. Identifies generalities among entities
 - **Projection**. Identifies different ways of looking at a problem
- ◆ System models covered in Chapter 6

Viewpoint-oriented analysis

- ◆ Stakeholders represent different ways of looking at a problem or problem viewpoints
- ◆ This multi-perspective analysis is important as there is no single correct way to analyse system requirements

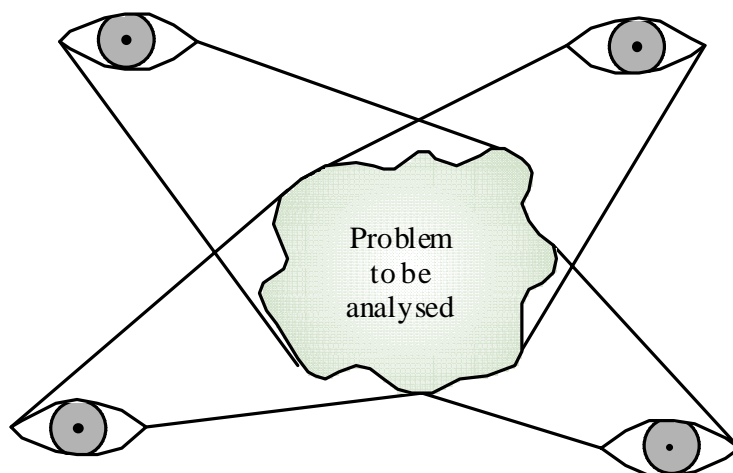
Autoteller system

- ◆ The example used here is an auto-teller system which provides some automated banking services
- ◆ I use a very simplified system which offers some services to customers of the bank who own the system and a narrower range of services to other customers
- ◆ Services include cash withdrawal, message passing (send a message to request a service), ordering a statement and transferring funds

Autoteller viewpoints

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

Multiple problem viewpoints



Types of viewpoint

- ◆ Data sources or sinks
 - Viewpoints are responsible for producing or consuming data. Analysis involves checking that data is produced and consumed and that assumptions about the source and sink of data are valid
- ◆ Representation frameworks
 - Viewpoints represent particular types of system model. These may be compared to discover requirements that would be missed using a single representation. Particularly suitable for real-time systems
- ◆ Receivers of services
 - Viewpoints are external to the system and receive services from it. Most suited to interactive systems

External viewpoints

- ◆ Natural to think of end-users as receivers of system services
- ◆ Viewpoints are a natural way to structure requirements elicitation
- ◆ It is relatively easy to decide if a viewpoint is valid
- ◆ Viewpoints and services may be used to structure non-functional requirements

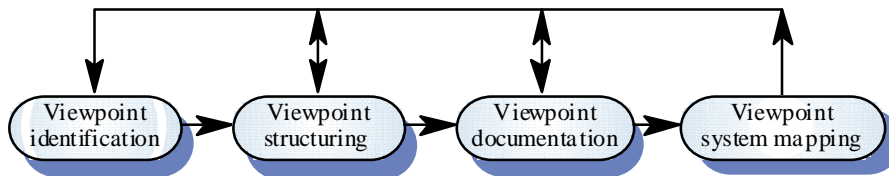
Method-based analysis

- ◆ Widely used approach to requirements analysis. Depends on the application of a structured method to understand the system
- ◆ Methods have different emphases. Some are designed for requirements elicitation, others are close to design methods
- ◆ A viewpoint-oriented method (VORD) is used as an example here. It also illustrates the use of viewpoints

Structured methods

- ◆ Process model
- ◆ System modelling notations
- ◆ Rules applied to the system model
- ◆ Design guidelines
- ◆ Report templates

The VORD method



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VORD process model

- ◆ Viewpoint identification
 - Discover viewpoints which receive system services and identify the services provided to each viewpoint
- ◆ Viewpoint structuring
 - Group related viewpoints into a hierarchy. Common services are provided at higher-levels in the hierarchy
- ◆ Viewpoint documentation
 - Refine the description of the identified viewpoints and services
- ◆ Viewpoint-system mapping
 - Transform the analysis to an object-oriented design

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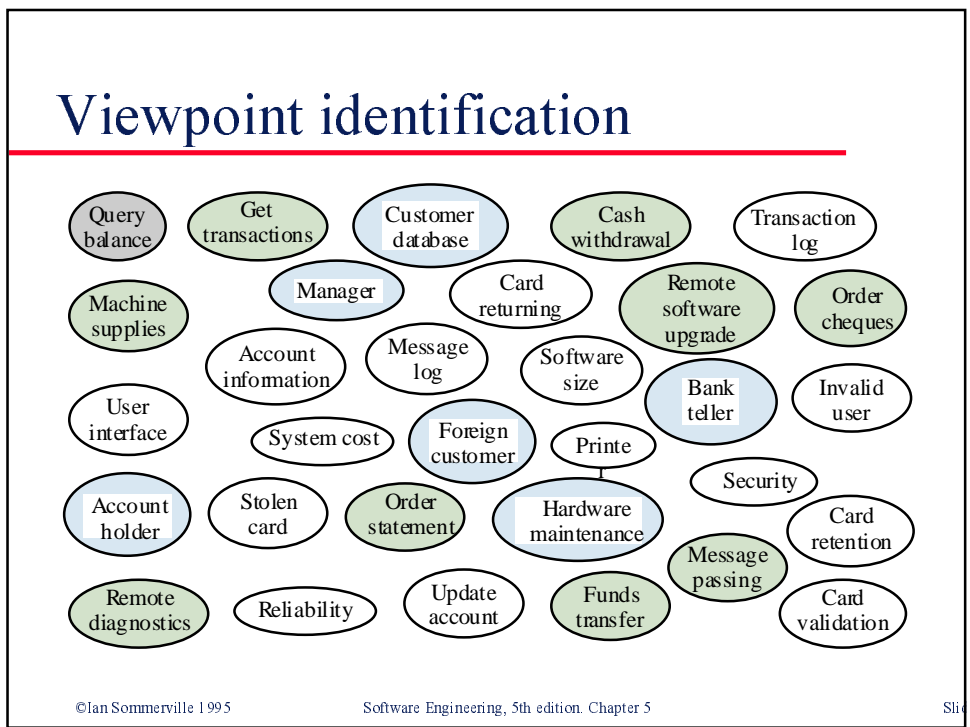
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VORD standard forms

Viewpoint template	Service template
<p>Reference: The viewpoint name.</p> <p>Attributes: Attributes providing viewpoint information.</p> <p>Events: A reference to a set of event scenarios describing how the system reacts to viewpoint events.</p> <p>Services: A reference to a set of service descriptions.</p> <p>Sub-VPs: The names of sub-viewpoints.</p>	<p>Reference: The service name.</p> <p>Rationale: Reason why the service is provided.</p> <p>Specification: Reference to a list of service specifications. These may be expressed in different notations.</p> <p>Viewpoints: List of viewpoint names receiving the service.</p> <p>Non-functional requirements: Reference to a set of non-functional requirements which constrain the service.</p> <p>Provider: Reference to a list of system objects which provide the service.</p>

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Viewpoint identification



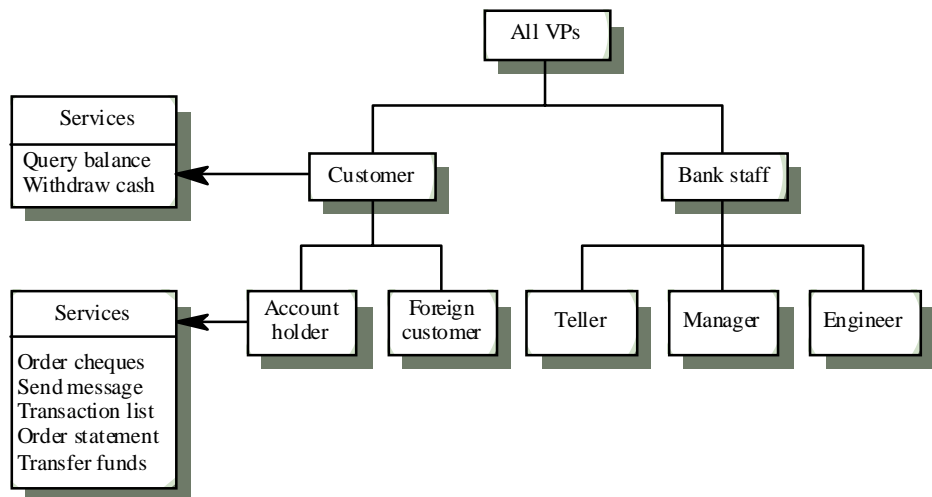
Viewpoint service information

ACCOUNT HOLDER	FOREIGN CUSTOMER	BANK TELLER
Service list	Service list	Service list
Withdraw cash Query balance Order cheques Send message Transaction list Order statement Transfer funds	Withdraw cash Query balance	Run diagnostics Add cash Add paper Send message

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

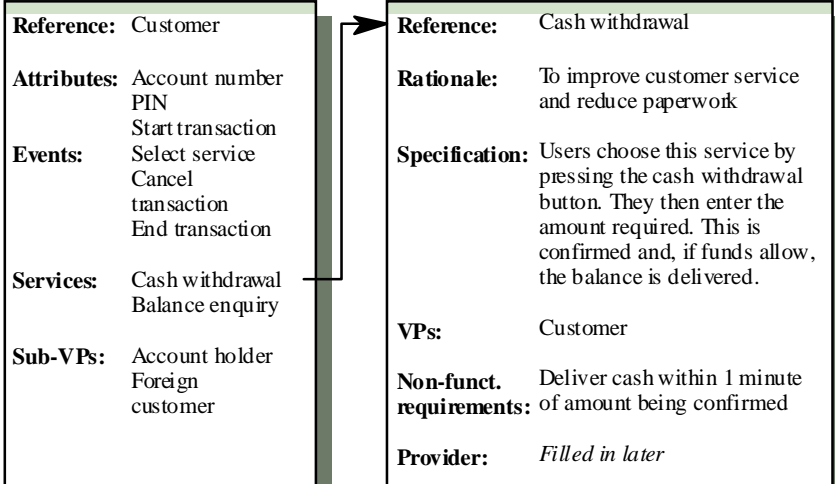


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Customer/cash withdrawal templates

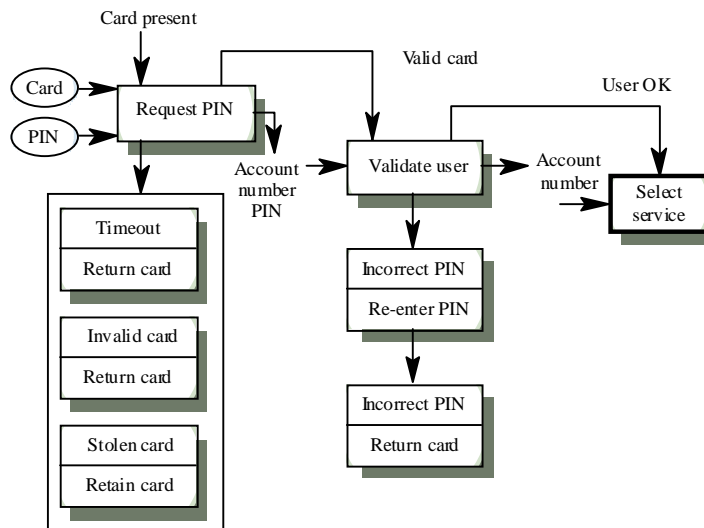


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Data and control analysis



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Notation for data and control analysis

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

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Exception description

- ◆ Most methods do not include facilities for describing exceptions
- ◆ In this example, exceptions are
 - Timeout. Customer fails to enter a PIN within the allowed time limit
 - Invalid card. The card is not recognised and is returned
 - Stolen card. The card has been registered as stolen and is retained by the machine

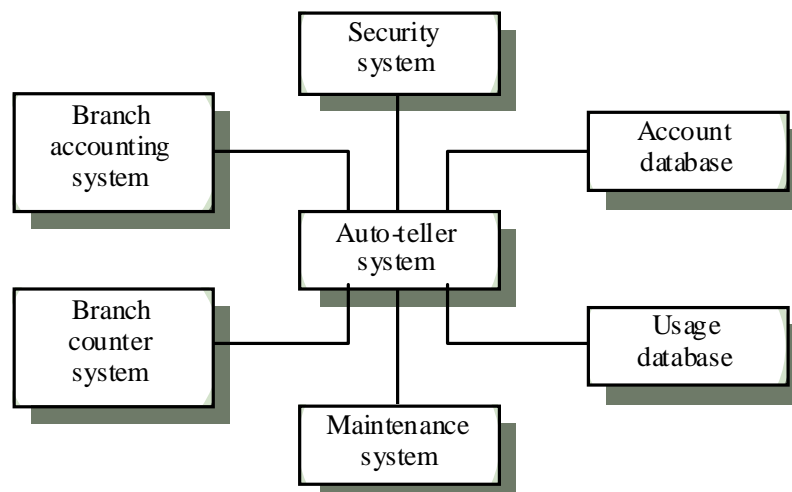
Method advantages/disadvantages

- ◆ Methods impose structure on the requirements analysis process
- ◆ May be supported by CASE tools
- ◆ Can be applied systematically and can lead naturally to design
- ◆ However, forces system modelling using a computational framework
- ◆ Methods fail to adequately provide for the description of human activities

System contexts

- ◆ The boundaries of the system must be established to determine what must be implemented
- ◆ These are documented using a description of the system context. This should include a description of the other systems which are in the environment
- ◆ Social and organisational factors may influence the positioning of the system boundary

Auto-teller system context



Social and organisational factors

- ◆ Software systems are used in a social and organisational context. This can influence or even dominate the system requirements
- ◆ Social and organisational factors are not a single viewpoint but are influences on all viewpoints
- ◆ Good analysts must be sensitive to these factors but currently no systematic way to tackle their analysis

Example

- ◆ Consider a system which allows senior management to access information without going through middle managers
 - Managerial status. Senior managers may feel that they are too important to use a keyboard. This may limit the type of system interface used
 - Managerial responsibilities. Managers may have no uninterrupted time where they can learn to use the system
 - Organisational resistance. middle managers who will be made redundant may deliberately provide misleading or incomplete information so that the system will fail

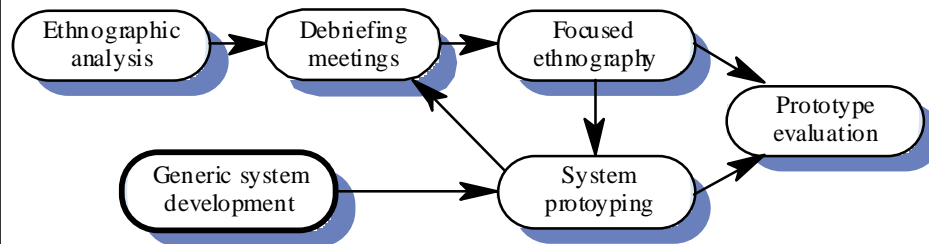
Ethnographic analysis

- ◆ A social scientist 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

Focused ethnography

- ◆ Developed in a project studying the air traffic control process
- ◆ Combines ethnography with prototyping
- ◆ Prototype development results in unanswered questions which focus the ethnographic analysis
- ◆ Problem with ethnography is that it studies existing practices which may have some historical basis which is no longer relevant

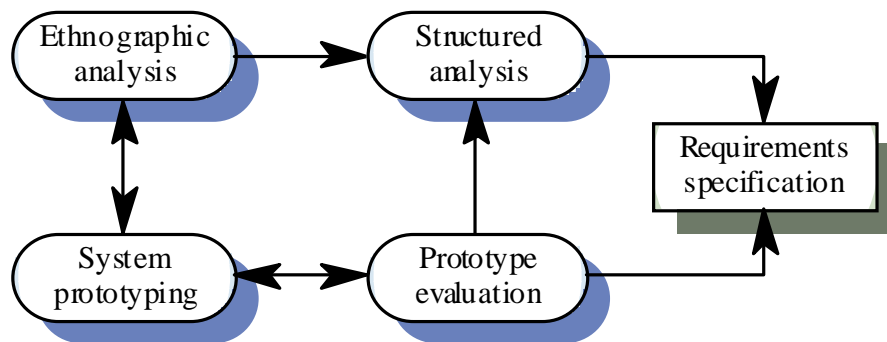
Ethnography and prototyping



Development of ethnography

- ◆ The use of ethnography in requirements analysis needs to be developed so that it can be combined with the use of more systematic methods
- ◆ As the importance of human, social and organisational factors becomes more widely recognised, these methods are likely to be developed

Ethnography and structured analysis



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Key points

- ◆ Requirements analysis requires domain understanding, requirements collection, classification, structuring, prioritisation and validation
- ◆ Complex systems should be analysed from different viewpoints
- ◆ Viewpoints may be based on sources and sinks of data, system models or external interaction

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Key points

- ◆ Structured methods may be used for requirements analysis. They should include a process model, system modelling notations, rules and guidelines for system modelling and standard reports
- ◆ The VORD viewpoint-oriented method relies on viewpoints which are external to the system
- ◆ The boundaries between a system and its environment must be defined
- ◆ Social and organisational factors have a strong influence on system requirements