Requirements Engineering

Lecture 5

Topics covered

❖ Functional and non-functional requirements

❖ The software requirements document

❖ Requirements specification

❖ Requirements engineering processes

❖ Requirements elicitation and analysis

❖ Requirements validation

❖ Requirements management

Requirements engineering

❖ The process of establishing the services that the customer requires from a system and the constraints under which it operates and is developed.

❖ The requirements themselves are the descriptions of the system services and constraints that are generated during the requirements engineering process.

What is a requirement?

❖ It may range from a high-level abstract statement of a service or of a system constraint to a detailed mathematical functional specification.

❖ This is inevitable as requirements may serve a dual function
  ✓ May be the basis for a bid for a contract - therefore must be open to interpretation;
  ✓ May be the basis for the contract itself - therefore must be defined in detail;
 ✓ Both these statements may be called requirements.

Requirements abstraction (Davis)

"If a company wishes to let a contract for a large software development project, it must define its needs in a sufficiently abstract way that a solution is not pre-defined. The requirements must be written so that several contractors can bid for the contract, offering, perhaps, different ways of meeting the client organization's needs. Once a contract has been awarded, the contractor must write a system definition for the client in more detail so that the client understands and can validate what the software will do. Both of these documents may be called the requirements document for the system."

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.

❖ In practice, RE is an iterative activity in which these processes are interleaved.

A spiral view of the requirements engineering process
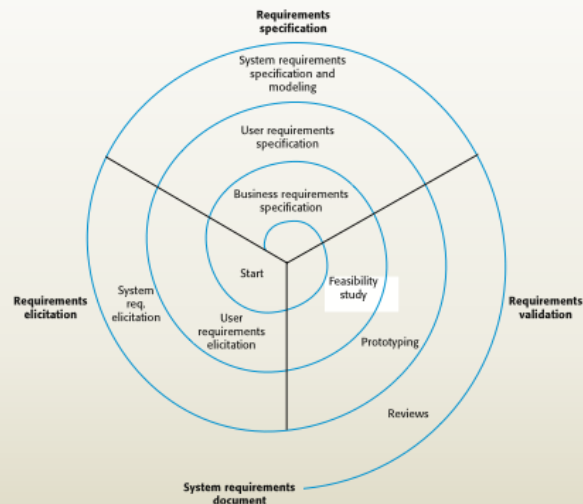
Requirements elicitation and analysis

❖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 may change.

Requirements elicitation and analysis

❖ Software engineers work with a range of system stakeholders to find out about the application domain, the services that the system should provide, the required system performance, hardware constraints, other systems, etc.

❖ Stages include:
  ✓ Requirements discovery,
  ✓ Requirements classification and organization,
  ✓ Requirements prioritization and negotiation,
  ✓ Requirements specification.

The requirements elicitation and analysis process
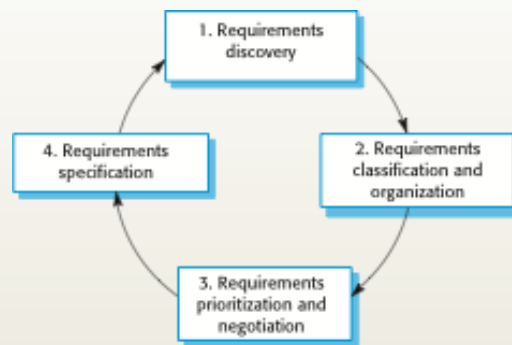
Process activities

- ❖ 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 specification
  - ✓ Requirements are documented and input into the next round of the spiral.

Problems of requirements elicitation

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Requirements discovery

❖ The process of gathering information about the required and existing systems and distilling the user and system requirements from this information.

❖ Interaction is with system stakeholders from managers to external regulators.

❖ Systems normally have a range of stakeholders.

MHC-PMS

❖ The MHC-PMS (Mental Health Care-Patient Management System) is an information system that is intended for use in clinics.

❖ It makes use of a centralized database of patient information but has also been designed to run on a PC, so that it may be accessed and used from sites that do not have secure network connectivity.

❖ When the local systems have secure network access, they use patient information in the database but they can download and use local copies of patient records when they are disconnected.

Stakeholders in the MHC-PMS

❖ Patients whose information is recorded in the system.

❖ Doctors who are responsible for assessing and treating patients.

❖ Nurses who coordinate the consultations with doctors and administer some treatments.

❖ Medical receptionists who manage patients' appointments.

❖ IT staff who are responsible for installing and maintaining the system.

Stakeholders in the MHC-PMS

❖ A medical ethics manager who must ensure that the system meets current ethical guidelines for patient care.

❖ Health care managers who obtain management information from the system.

❖ Medical records staff who are responsible for ensuring that system information can be maintained and preserved, and that record keeping procedures have been properly implemented.

Interviewing

❖ Formal or informal interviews with stakeholders are part of most RE processes.

❖ Types of interview
  ✓ Closed interviews based on pre-determined list of questions
  ✓ Open interviews where various issues are explored with stakeholders.

❖ Effective interviewing
  ✓ Be open-minded, avoid pre-conceived ideas about the requirements and are willing to listen to stakeholders.
  ✓ Prompt the interviewee to get discussions going using a springboard question, a requirements proposal, or by working together on a prototype system.

Interviews in practice

❖ Normally a mix of closed and open-ended interviewing.

❖ Interviews are good for getting an overall understanding of what stakeholders do and how they might interact with the system.

❖ 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.

Scenario for collecting medical history in MHC-PMS

Initial assumption: The patient has seen a medical receptionist who has created a record in the system and collected the patient's personal information (name, address, age, etc.). A nurse is logged on to the system and is collecting medical history.

Normal: The nurse searches for the patient by family name. If there is more than one patient with the same surname, the given name (first name in English) and date of birth are used to identify the patient.

The nurse chooses the menu option to add medical history.

The nurse then follows a series of prompts from the system to enter information about consultations elsewhere on mental health problems (free text input), existing medical conditions (nurse selects conditions from menu), medication currently taken (selected from menu), allergies (free text), and home life (form).

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Scenario for collecting medical history in MHC-PMS

What can go wrong: The patient's record does not exist or cannot be found. The nurse should create a new record and record personal information.

Patient conditions or medication are not entered in the menu. The nurse should choose the 'other' option and enter free text describing the condition/medication.

Patient cannot/will not provide information on medical history. The nurse should enter free text recording the patient's inability/unwillingness to provide information. The system should print the standard exclusion form stating that the lack of information may mean that treatment will be limited or delayed. This should be signed and handed to the patient.

Other activities: Record may be consulted but not edited by other staff while information is being entered.

System state on completion: User is logged on. The patient record including medical history is entered in the database, a record is added to the system log showing the start and end time of the session and the nurse involved.

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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.

❖ High-level graphical model supplemented by more detailed tabular description (see Chapter 5).

❖ Sequence diagrams may be used to add detail to use-cases by showing the sequence of event processing in the system.

Use cases for the MHC-PMS
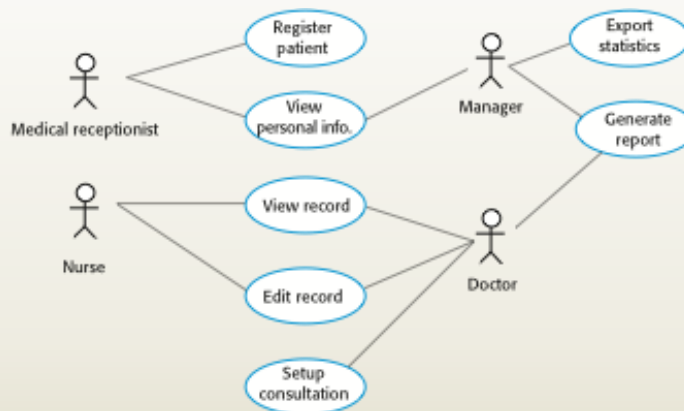
Ethnography

❖ 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.

Scope of ethnography

❖ Requirements that are derived from the way that people actually work rather than the way I which process definitions suggest that they ought to work.

❖ Requirements that are derived from cooperation and awareness of other people's activities.
  ✓ Awareness of what other people are doing leads to changes in the ways in which we do things.

❖ Ethnography is effective for understanding existing processes but cannot identify new features that should be added to a system.

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.

❖ The problem with ethnography is that it studies existing practices which may have some historical basis which is no longer relevant.

Ethnography and prototyping for requirements analysis