Topic 6:
Requirements Analysis

References

- [Pressman] Pressman, Roger S., Software Engineering: A Practitioner's Approach, 7th Edition, Mc. Graw Hill International, USA, 2010.
- [Dennis] Dennis, Alan, et. al., System Analysis and Design with UML 3rd Edition, John Wiley & Sons, 2010.
- [Sommerville] Sommerville, Ian, Software Engineering, 9th Edition, Pearson-Addison Wesley, England, 2011.

Outline

- How to create requirements definition?
- How to analyse requirements?
- What technique can be used to gather requirements?

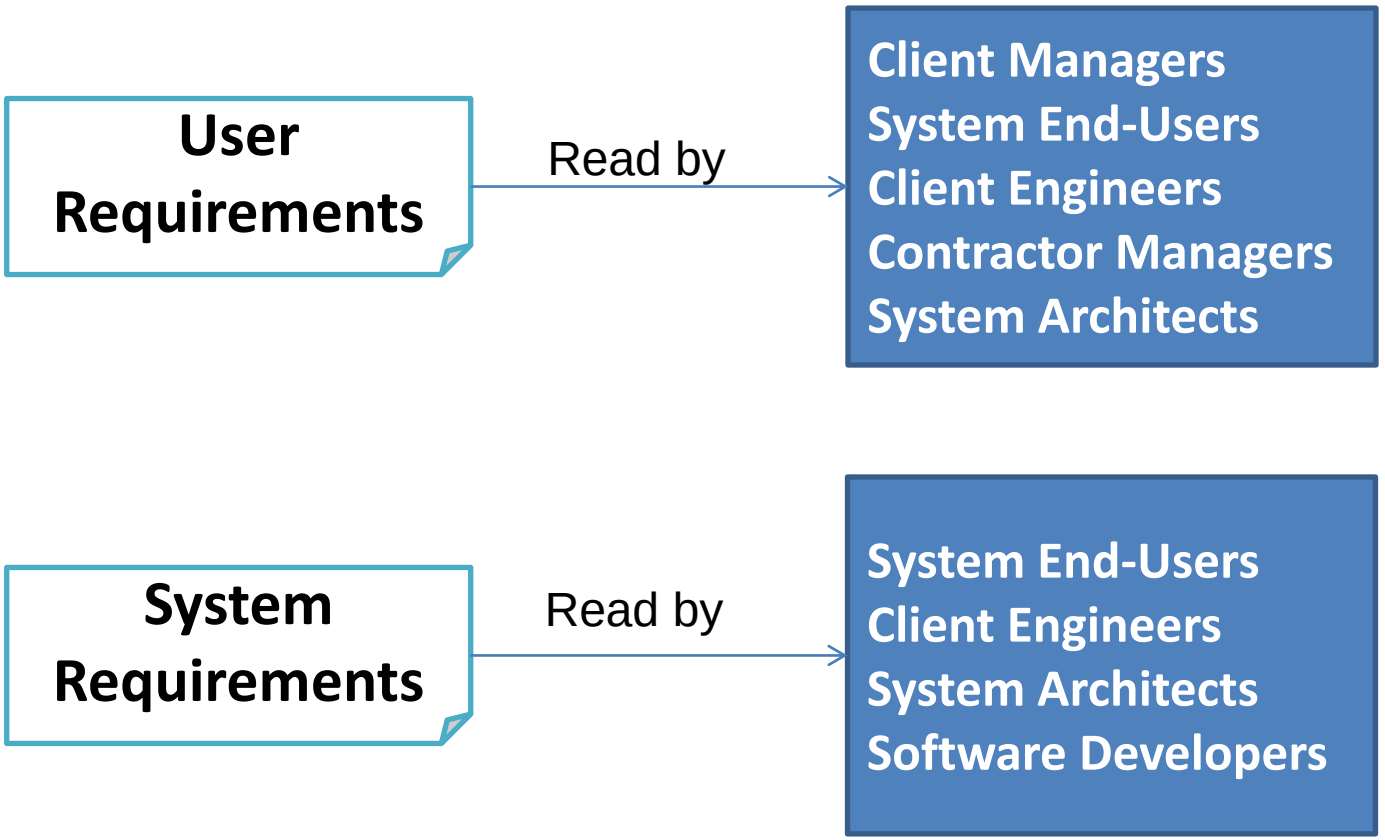
The SDLC and Requirements

- The SDLC transforms the existing (as is) system into the proposed (to be) system
- Requirements determination step is the single most critical step of the entire SDLC
  - ❖Studies show that more than half of all system failures are due to problems with requirements

Defining a Requirement

- Requirement: “A statement of what the system must do or what characteristic it must have.”
- During **analysis**, requirements:
  - ❖ are written from the perspective of the business person
  - ❖ focus on the “what” of the system
  - ❖ are usually called **business requirements** or **user requirements**
- Later in **design**, user requirements evolve to become **system requirements**
- However, some companies use the terms interchangeably

Readers of Requirement Specification



Types of Requirements

- Two kinds of requirements:
  - ❖Functional
    - **processes** that the system has to perform
    - **information** that the system needs to contain
    - **functions** that the system must have
  - ❖Nonfunctional
    - **behavioral properties** that the system must have
    - **quality attributes**, **quality requirements**, or the "**-ilities**" of a system
    - E.g. **URPS+** (usability, reliability, performance, supportability) in [Larman]

Nonfunctional Requirements

Requirement type	Example
Operational	• The system should be able to fit in a pocket or purse • The system should be able to integrate with the existing inventory system.
Performance	• Any interaction between the user and the system should not exceed 2 seconds. • The system should receive updated inventory information every 15 minutes.
Security	• Only direct managers can see personnel records of staff • Customers can see their order history only during business hours.
Cultural & Political	• The system should be able to distinguish between United States and European currency • The system shall comply with insurance industry standards.

Requirements Engineering Phases

- Inception—establish basic understanding of …
  - ❖ the problem, the stakeholders, the desired solution, and the communication among stakeholders
- Elicitation—elicit requirements from all stakeholders
- Elaboration—create a requirement model (*e.g. use case diagrams, analysis class diagrams*) that identifies the software function, behavior, and information
- Negotiation—developers and customers discuss about priority, cost & risk of each requirement

Requirements Engineering Phases

- Specification—can be any one (or more) of the following:
  - A written document
  - A set of models
  - A formal mathematical
  - A collection of usage scenarios
  - A prototype
- Validation—examine the specification to ensure that each requirement is valid
- Requirements management – identify, control, and track requirements changes

Requirements Definition

- A strightforward text report that simply lists the functional and nonfunctional requirements

Requirements Validation

To examine the specification to ensure that each requirement is:

- Correct
- Unambiguous
- Complete
- Consistent
- Verifiable
- Modifiable
- Traceable
- Ranked for importance

A Bad Requirement

Initial Specification: **Software will not be loaded from unknown sources onto the system without first having the software tested and approved.**

Critique:

- Ambiguous – if the software is tested and approved, can it be loaded from unknown sources?
- (not) Testable – it is stated as a negative requirement making it difficult to verify.
- (not) Traceable – a unique identifier is missing.

Re-specification: **3.4.5.2 Software shall be loaded onto the operational system only after it has been tested and approved.**

Unambigous requirement

- *REQ1 The system shall be implemented using ASP.*

- Does ASP mean Active Server Pages or Application Service Provider? To fix this, we can mention a full name and provide an acronym in parentheses:

- *REQ1 The system shall be implemented using Active Server Pages (ASP).*

Unambigous requirement (2)

- *REQ1 The system shall not accept passwords longer than 15 characters.*

- It is not clear what the system is supposed to do:
  - ❖ The system shall not let the user enter more than 15 characters.
  - ❖ The system shall truncate the entered string to 15 characters.
  - ❖ The system shall display an error message if the user enters more than 15 characters.

- *REQ1 The system shall not accept passwords longer than 15 characters. If the user enters more than 15 characters while choosing the password, an error message shall ask the user to correct it.*

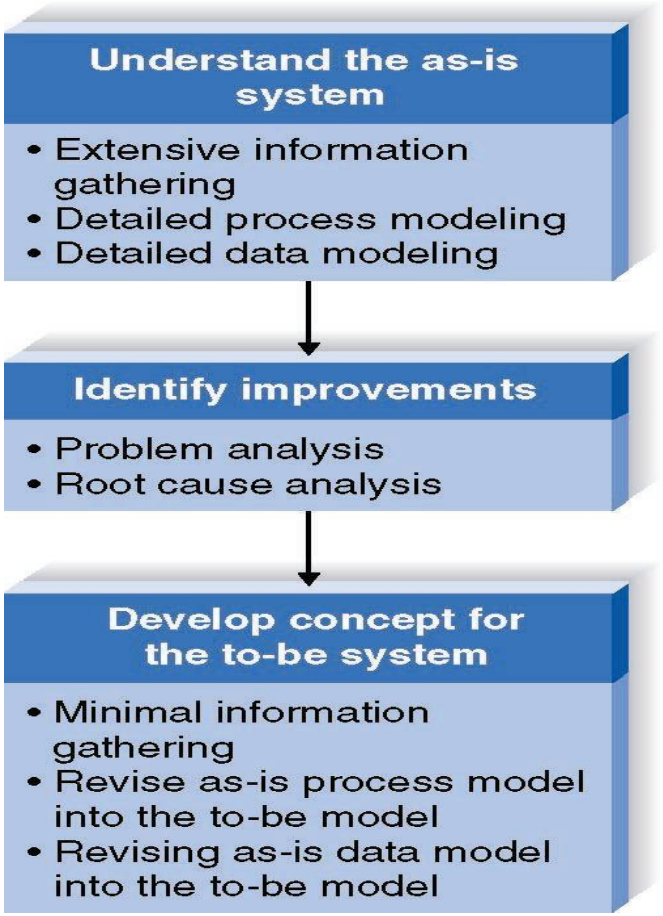
Determining Requirements

- Participation by business users/experts and IT analyst is essential
  - If done only by IT analyst, may not address true business needs
  - If done only by business experts, may not take advantage of technology
- Requirements are best determined by systems analysts ***and*** business people together
- Three techniques help users discover their needs for the new system:
  - Business Process Automation (BPA)
  - Business Process Improvement (BPI)
  - Business Process Reengineering (BPR)

Basic Process of Analysis (Determining Requirements)

- Understand the “As-Is” system
- Identify improvement opportunities
- Develop the “To-Be” system concept
- Techniques vary in amount of change
  - ❖ BPA – small change
  - ❖ BPI – moderate change
  - ❖ BPR – significant change
- Additional information gathering techniques are needed as well

Business Process Automation

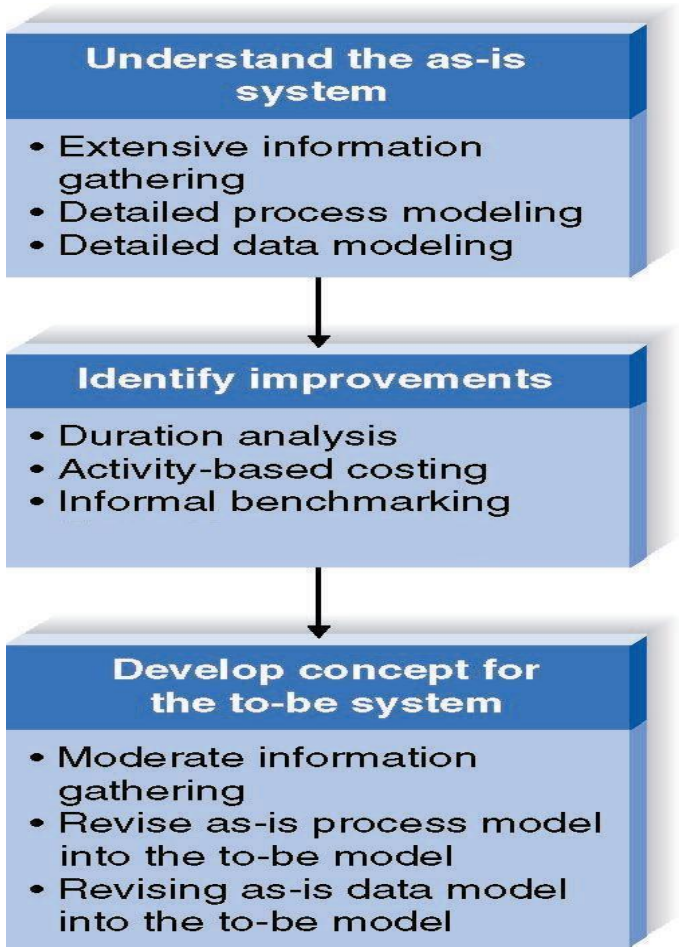


- Doesn't change basic operations
- Automates some operations

Goal:

Efficiency for users

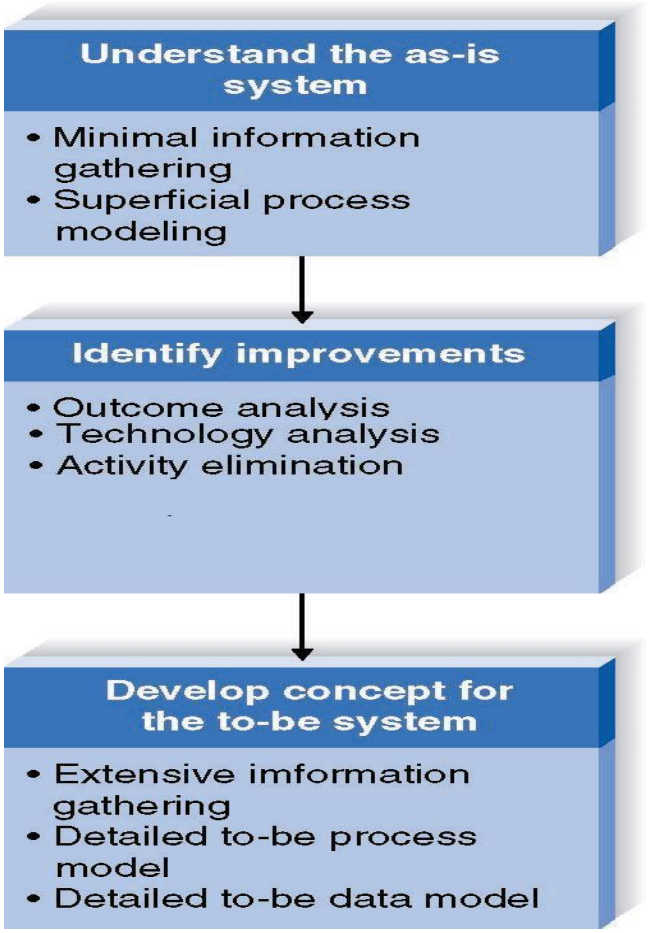
Business Process Improvement



Goal:

Efficiency and effectiveness for users

Business Process Reengineering (BRP)



Changes fundamentally how the organization does certain operations

Goal:

Radical redesign of business processes

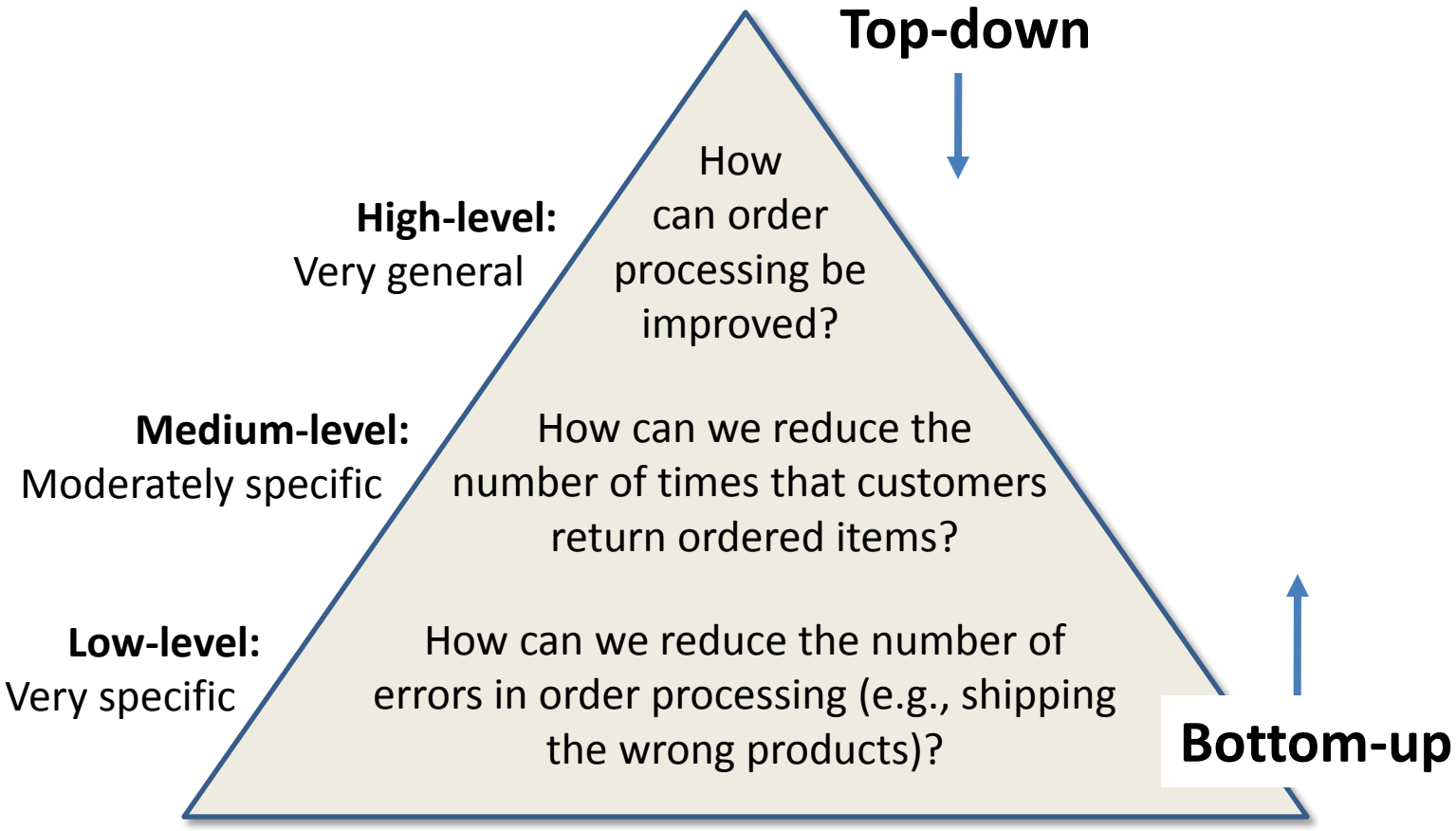
Requirements-Gathering Techniques

- Interviews
- JAD (Joint Application Development)
- Questionnaires
- Document Analysis
- Observation

Five Basic Steps of Interviews

- Selecting interviewees, e.g:
  - ❖Managers, Users, (Ideally all key stakeholders)
- Designing interview questions
- Preparing for the interview
- Conducting the interview
- Post-interview follow-up

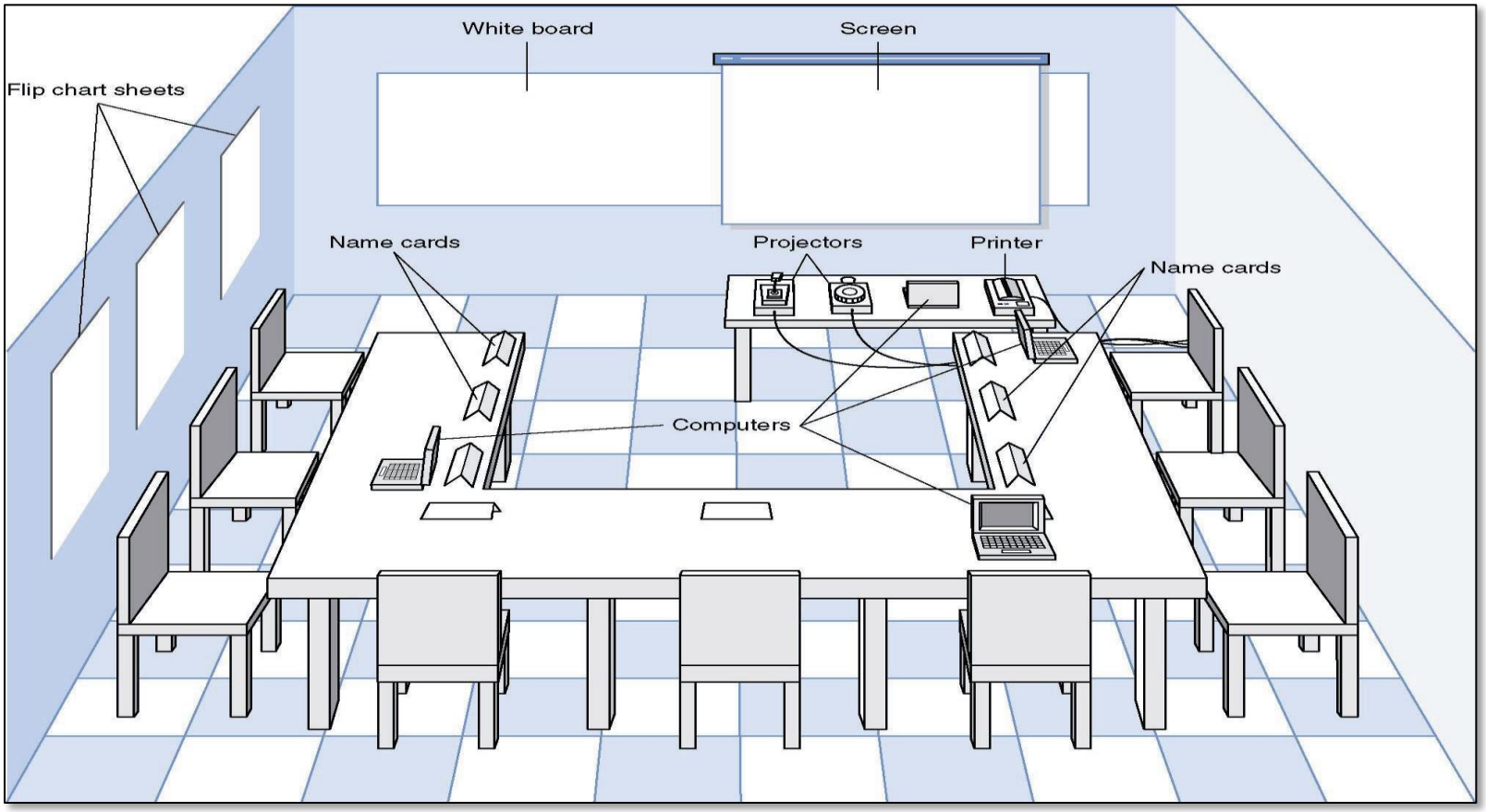
Interviewing Strategies



Joint Application Development

- Allows the project team, users, and management to work together to identify requirements for the system
- Often the most useful method for collecting information from users
- Key roles:
  - ❖Facilitator
  - ❖Scribe

JAD Meeting Room



The JAD Session

- Tend to last 5 to 10 days over a three week period
- Prepare questions as with interviews
- Facilitator has to do:
  - ❖Keep session on track
  - ❖Help with technical terms
  - ❖Record group input
  - ❖Help resolve issues
- Post-session follow-up

Questionnaires

- A set of written questions used to obtain information from individuals
- Often used for large numbers of people from whom information and opinions are needed
- Common technique with systems intended for use outside the organization
- Response rates vary, but typically are significantly less than 50%

Questionnaire Steps

- Selecting participants
  - Using samples of the population
- Designing the questionnaire
  - Careful question selection
- Administering the questionnaire
  - Working to get good response rate
- Questionnaire follow-up
  - Send results to participants

Document Analysis

- Provides clues about existing “as-is” system
- The main document is a technical document. Unfortunately, most systems are not well documented
- Other helpful documents:
  - ❖User training manuals
  - ❖User interface of the existing system
  - ❖Policy manuals
  - ❖Forms, look for:
    - additional information (made by user) to an existing forms
    - unused form elements

Observation

- Why observation? Because:
  - ❖ Users/managers often don't remember everything they do
- How to observe?
  - ❖Observe the business system as it functions
  - ❖Do not interrupt those who are working
  - ❖Do not influence those being observed
  - ❖Checks validity of information gathered other ways
- Watch out, Behaviors change when people are watched
- Observation is often used to supplement interview information

Other Requirement Gathering Techniques

- Throw-away prototyping
- Role playing CRC cards with use cases
- Mind/concept mapping

Selecting Appropriate Techniques

	Interview	JAD	Question-naires	Document Analysis	Observation
Type of information	As-is, improves, to-be	As-is, improves, to-be	As-is, improves	As-is	As-is
Depth of info	High	High	Medium	Low	Low
Breadth of info	Low	Medium	High	High	Low
Info integration	Low	High	Low	Low	Low
User involvement	Medium	High	Low	Low	Low
Cost	Medium	Low-medium	Low	Low	Low-medium

Building the Analysis Model as requirement modelling

- Elements of the analysis model
  - ❖Scenario-based elements
    - Functional—processing narratives for software functions
    - Use-case—descriptions of the interaction between an “actor” and the system
  - ❖Class-based elements
    - Implied by scenarios
  - ❖Behavioral elements
    - State diagram
  - ❖Flow-oriented elements
    - Data flow diagram

Q & A