Requirements Analysis, Modelling & Specification

Basic RE Process Revisited

Conceptual Modelling

Object Orientation

What are RE Processes?

A Framework

for initial model construction & subsequent reengineering

3 fundamental concerns:

- understand (formally) describe
- attain an agreement on
- the problem

The process is not discrete, but a continuous loop

Elicitation

- determine what’s really needed, why needed, whom to talk to
- acquire as much knowledge as possible

Specification

- produce a (formal) RS model: translate "vague" into "concrete", etc.
- make various decisions on what & how

Validation

- assure that the RS model satisfies the users’ needs

The process is a model construction process through analysis
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Requirements Analysis, Modelling & Specification

Problem

Problem Elicitation

Text, Notes, Knowledge (often informal models)

Reflective

Problem Analysis

Diagrams, Charts, Tables (concrete models)

Problem Specification

Diagrams, Charts, Tables (reqs. spec. models)

Modelling

Problem Elicitation

exploratory, brain-storming, open-ended thinking
elaboration of unclear goals and needs
identification of sources, views, needs & wants

Why is it difficult?

A wicked problem

many sources
databases, files, chapters, literature, standards, legal issues
(what are they, who are they, how successful are they)
different views on wants and needs
different notations, mental models

why do they change their minds?

User

User reqs.

identification process complex (repetitive interactions)

Domain Knowledge

domain experts (accountants, bankers, loan managers, etc.)
databases, files, chapters, literature, standards, legal issues

the “say-do” problem: people know how to do things they normally don’t describe (tacit knowledge); descriptions of such things may be highly inaccurate

requirements volatility:
Reqs. change because the problem being solved changes, because people’s perception changes, because some involved persons were not contacted or were contacted but not in an appropriate manner.

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**Requirements Analysis, Modelling & Specification**

**Problem Analysis**

- Detect Defects → Resolve Defects

  Intermediate representations

- Determination of "real" users (identification of sources)
  
  (e.g., stratification during sampling, questionnaires & interviewing)

- Clarification of goals (e.g., Goal-directed approach)

- Detecting differences in views and integrating them, & recording rationale

- Resolving a mismatch of wants and needs

- Prioritization of defects

- Understanding (all constraints on the) solutions and evaluating them

- Risk analysis (e.g., scenarios)

**Problem Specification**

- Choose formal notations

- Create a formal model of the requirements

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**Requirements Analysis, Modelling & Specification**

*From Problem Elicitation to Specification*

"Carving the Product Space"

- User Needs → Wants → Customer Needs

- Admissible Product Space Solution

- Technology Risks
  
  (acceptable) → (unacceptable)

- Developer Perspective
  
  (acceptable) → (unacceptable)

- Laws & Standards
  
  (acceptable) → (unacceptable)
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E.g., Wired/Wireless phone & PCS

User Needs

Wants

Customer Needs

Developer Perspective

Acceptable

Unacceptable

Technology

Risks

(acceptable)

(acceptable)

(acceptable)

(acceptable)

Admissible Product

Space Solution

Unacceptable:

95% guarantee w. CDMA only

only 7-layer

Acceptable:

90% guarantee w. CDMA & FDMA

Sprint:

Wants: 2 yr

22 billion, across US

Syr., FIB, M.A.N.S, CDMA & FDMA

Nortel:

Unacceptable

hand-over of ownership

creeping reqs. rate > 1 %

Acceptable: mtce warantee

adaptable(10 new features/mo)

Unacceptable:

towers/cells every 100 meters

use any frequency -> hearing aid

Acceptable:

close to hexagonal, but special BSs

in subway, dense areas

Varying degrees of acceptable/unacceptable solutions

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Conceptual Modelling

The process is a model construction process through analysis

Purpose

"model things as perceived by the user"

-> "concept", "conceptualization"

-> knowledge aspect: philosophy

How to elicit?

E Goal-Directed Strategy 2: Using more expressive power

F Expressive Power

Revisited

"Propositional and predicate logic provide all the basic concepts needed for a systematic engineering design methodology."

G Ontology

on-tol-o-gy n. The branch of philosophy that deals with being what exists in reality? what are essential things in reality? entities, activities, constraints goals, agents, roles, rationales

G Epistemology

e-pis-te-mol-o-gy n., pl. -gies. 1. The division of philosophy that investigates the nature and origin of knowledge.


how do we organize them?

-> cognitive aspect: psychology

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Who’s Behind Object-Oriented Programming?

- Knowledge Representation
  - Psychological Validity
  - Philosophical Validity
  - Computational Validity

- Data Bases
  - Persistent Data
  - Relational-Net
  - Hierarchical
  - OO

- Programming Languages
  - Non-permanent program
  - Efficiency
  - Simula
  - SmallTalk
  - C++
  - Protel
  - O Pascal
  - Eiffel

Conceptual Modelling

Requirements

- Why?
- What?
- How?

Knowledge Representation

- SDM
- ERD
- ADT

Design

Implementation

Why?

What?

How?
Object-Orientation

an attempt towards conceptual modelling

What is Object-Orientation?

What focuses on the "things" in the world

What are they? Ontology

What a way of organizing our knowledge "conceptually"

How? Epistemology

What "object" is the central notion

"... provides an index for our knowledge expressed
in terms of rules, logic, functions, relational languages,
neural networks, client-server architecture, business reengineering, etc."

[Martin & Odell]

What "Actions" (services/activities/functions) are associated with objects

What "State changes" effected by actions performed on objects

Let us get

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