Requirements Engineering: A Roadmap

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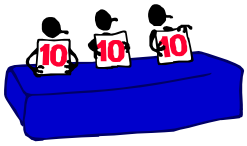
A Roadmap's Roadmap

- **A little motivation**
  - » Or, why RE is important
- **A little background**
  - » Or, before we begin RE
- **A roadmap**
  - » Or, what is RE?
- **"You are here"**
  - » Or, on the RE state-of-the-art
- **A little speculation**
  - » Or, some open research issues …



Quality & Requirements

- **Quality** software systems
  ⇒ meeting stakeholder needs

Engineering Argument

- Primary measure of **success**
  - » is degree to which a system meets the purpose for which it was intended.

Economic Argument

Errors cost more to correct, the longer they go undetected

Requirements Engineering (RE)

- **Requirements** are:
  - » expressions of **stakeholder needs** of a **system** to achieve particular **goals**.
  - » expressed in the vocabulary of the **problem domain**, rather than the system (solution) domain.
- **Requirements Engineering** is about:
  - » **Discovering** stakeholder goals, needs, and expectations
    - » **Adjusting** stakeholder expectations
  - » **Communicating** these to system implementers.

A Definition of RE

"**Requirements engineering** is the branch of **systems engineering** concerned with the real-world **goals** for, **services** provided by, and **constraints** on a large and complex software-intensive system. It is also concerned with the relationship of these factors to precise **specifications** of system **behaviour**, and to their **evolution** over time and across **system families**."

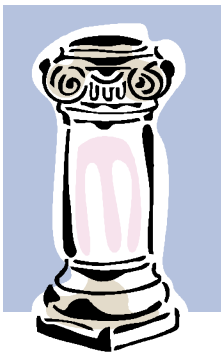
[adapted from **Zave 1997**]

Orientation

- **Foundations**
- **Context** and **Groundwork**
- **Eliciting** Requirements
- **Modelling** and **Analysing** Requirements
- **Communicating** Requirements
- **Agreeing** Requirements
- **Evolving** Requirements
- **Integrated** Requirements Engineering

Foundations of RE

- Computer Science
- Logic
- Linguistics
- Systems Theory
- Cognitive Psychology
- Anthropology
- Sociology
- Philosophy … epistomology … phenomenology … ontology …



Context and Groundwork

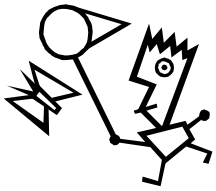
- **Context**
  - » Process improvement and maturity
  - » Contract and procurement procedures
  - » Organisational setting
  - » Personnel and staffing
- **Groundwork**
  - » Feasibility
  - » Risk

[from Finkelstein 1993]

Eliciting Requirements – what & where

- Requirements elicitation is partly a process of **discovering** stakeholder expectations, and **adjusting** these expectations.

- **Things to elicit**
  - » Boundaries
  - » Stakeholders
  - » Goals
  - » Tasks … use cases … scenarios
  - » Feasibility
  - » Risk



- **Where to elicit requirements from**
  - » Stakeholders
  - » Application domain
  - » Existing documentation

Eliciting Requirements - how

- **Traditional techniques**
  - » Questionnaires, surveys, interviews, analysis of existing documentation, etc.
- **Group elicitation techniques**
  - » Brainstorming, focus groups, RAD/JAD workshops, etc.
- **Prototyping**
  - » For early feedback from stakeholders
- **Model-driven techniques**
  - » Goal-based, scenario-based, etc.
- **Cognitive techniques**
  - » Protocol analysis, card sorting, laddering, etc.
- **Contextual techniques**
  - » Ethnography, conversation analysis, etc.

Modelling and Analysing Requirements

- **Enterprise** modelling
- **Data** modelling
- **Behavioural** modelling
- **Domain** modelling
- Modelling **non-functional requirements** (NFRs)

- **Analysing** Requirements Models
  - » Animation
  - » Automated reasoning
  - » Consistency checking
  - » ...

Communicating Requirements

- **RE facilitates communication among stakeholders**

- Requirements **documentation**
  - » is often the focus of such communication
  - » affects choice of **specification language**
  - » sometimes makes use of documentation **standards**

- Requirements **traceability**

- Requirements **management**

Agreeing Requirements

- To design and implement a system, the requirements have to be **agreed**
- To get agreement requirements have to be
  - » **Validated**
  - » **Negotiated,** and **conflicts** resolved
  - » **Prioritised**

Living with Inconsistency

Evolving Requirements

- **Successful systems will evolve**
  - » When the environment in which they operate changes
- **Managing change** is a fundamental RE activity
  - » **Adding** new requirements & requirements **scrubbing**
  - » **Fixing errors** & **managing inconsistency**
  - » **Impact analysis** & **configuration management**
- Requirements for **product families**
  - » Need to identify **core requirements**
  - » **Reuse** of requirements
  - » **COTS**
  - » Software **architectures**

Integrated Requirements Engineering

- **Method engineering**
  - » Integrating notations and techniques
- **Problem Frames**
  - » Identifying well-understood problems, offers the possibility of selecting corresponding, appropriate, well-understood solutions
- **Tools**
  - » DOORS, Requisite Pro, Cradle, RTM, etc.

You Are Here!

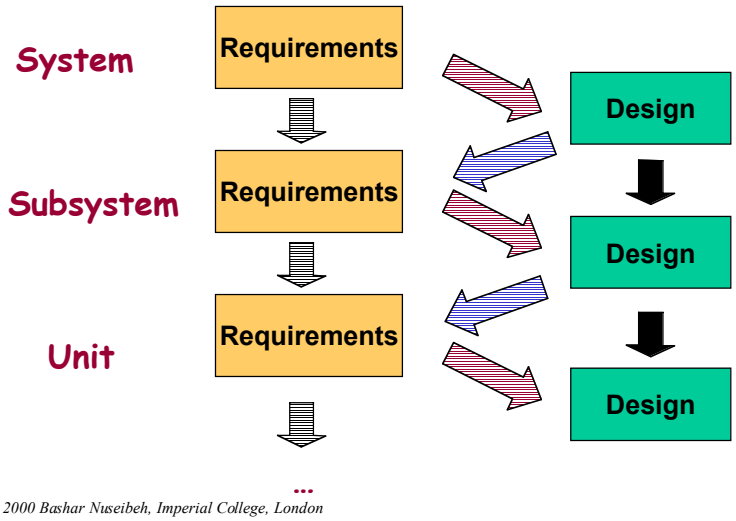
- Modelling in **context**
- Describing indicative and optative properties of the **environment**
- **Inconsistency happens, live with it!**

- **The RE Community:**
  - » REJ, ISRE, ICRE, REFSQ, REP, …

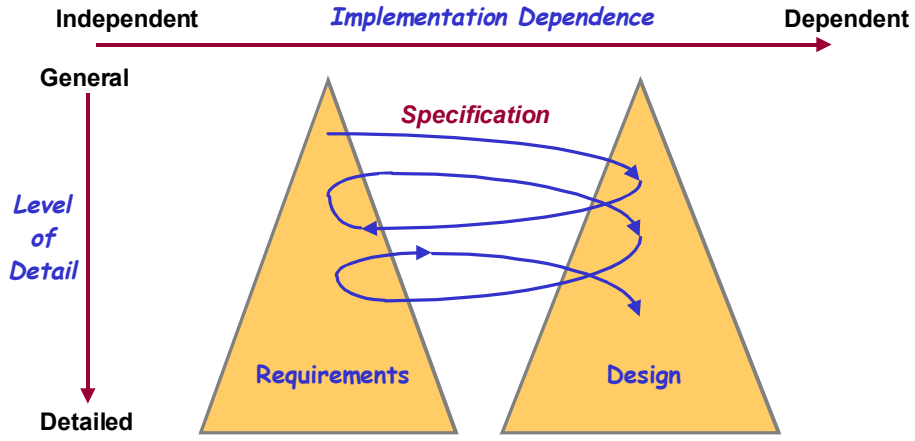
Journey Planner – a research wish list

- Richer models for capturing and analysing **non-functional requirements.**
- Techniques for modelling and analysing **properties of the environment**
  - » to deal with incomplete, inconsistent & evolving models
- **Reuse** of requirements models.
  - » to adapt products into product families
- **Bridging the gap between elicitation approaches** based on contextual enquiry and more formal specification and analysis approaches.

Requirements and Design



A finer grain process?



[adapted from Moffett 1999]

Some difficult questions

- **What is a requirements engineer?**
  - A software architect?
  - A systems engineer
  - … ?
- **The end of RE, as we know it?**
  - Refinement – not realistic?
  - Documentation – not necessary?
  - Time scales – too long?