1

- Requirements Engineering
  - definition, scope
  - roles

Requirements Engineering

- Requirements Engineering deals with how to better establish the **requirements** for a software system
  - what is desired by the "customers"
  - what is feasible
  - what is of interest to the producer
- Requirements Engineering is an interdisciplinary issue
  - technical (computer science, engineering, ...)
  - social (acceptability, ethical, negotiation...)

Requirements Engineering

- The “official” definition by IEEE (1990):

Requirement. (1) A condition or **capability** needed by a **user** to solve a **problem** or achieve an **objective**. (2) A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed documents. (3) A documented representation of a condition or capability as in (1) or (2).

Requirements Analysis. (1) The process of studying **user needs** to arrive at a definition of system, hardware, or software requirements. (2) The process of studying and refining system, hardware, or software requirements.

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Development problem

build a software system with given capabilities (2)
so that the problem/objective (1) is solved/reached

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Elicitation problem

extract and articulate requirements based on interaction with users (later: customers, consultants, domain experts, etc., in general *stakeholders*)

Requirements Engineering

- An alternative definition by Pamela Zave (1997):

“Requirements engineering is the **branch of software engineering** concerned with the **real-world goals** for, **functions** of, and **constraints** on software systems. It is also concerned with the relationship of these factors to **precise specifications** of software behavior, and to their **evolution** over time and across software families.”

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produce a precise specification of software behaviour
(implicitly: so that the goals are reached)

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Elicitation problem

discover the goals, functions and constraints in the real world (by asking stakeholders or from other sources, e.g. documents or ethnography)

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Basic understanding of RE

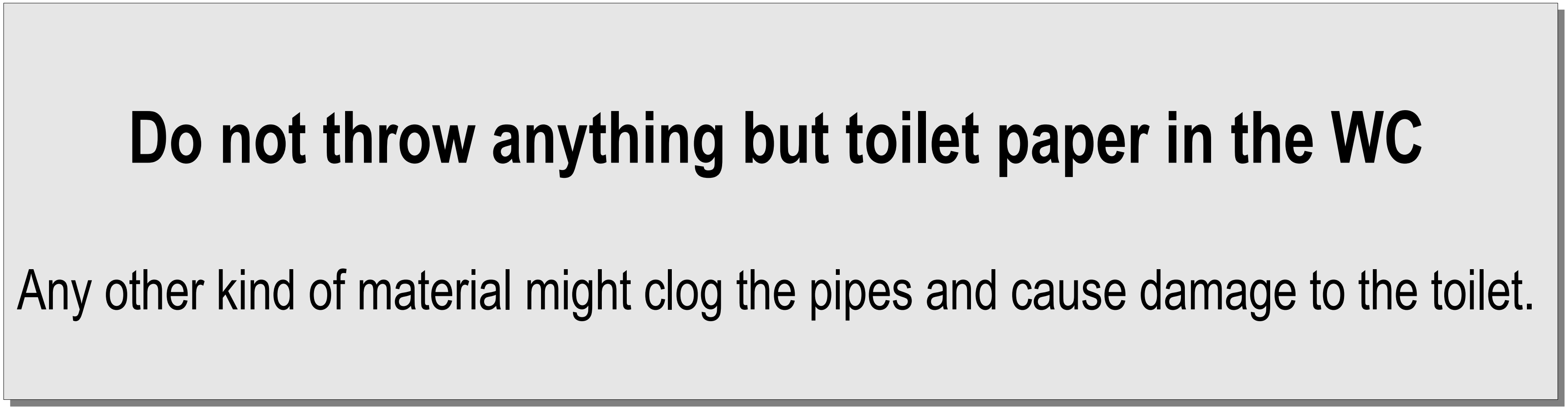
- In theory, RE is simple:
  1. Talk to users, get requirements
  2. Write a precise specification of the same
  3. Hand the spec to programmers, they will build the system accordingly
  4. Happy users will pay your fee
- In practice, it might be not!
  - in theory, theory and practice coincide
  - in practice, they do not

Major hurdles in RE

- Elicitation
  - users might not be able to articulate their needs
  - different users might have conflicting needs
  - some stakeholder might not be identified as such
  - interaction with users might produce lots of “noise” (irrelevant facts)
  - part of the needed knowledge might be tacit (hard to make explicit)

The trouble with language

- Appeared two days ago in a public toilet in our department:



Do not throw anything but toilet paper in the WC

Any other kind of material might clog the pipes and cause damage to the toilet.

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SHALL I TAKE MY SHIT HOME WITH ME?

Major hurdles in RE

- Specification
  - what language to write the SRS in?
    - natural language: easy to work with, imprecise
    - formal languages: precise, difficult to work with
  - how to incorporate relevant domain knowledge in a SRS?
- Verification and Validation
  - is the SRS correct? (verification)
  - will it solve the problem? (validation)
  - will the quality of the solution be sufficient?

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Human-Computer interaction

How to properly elicit and document interaction requirements in an SRS?

A badly-engineered interaction design might make even a correct solution worthless in practice.

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Performance and satisfaction

In distributed applications, level of performance can make or break a product.

Transmission delays, resilience to faults, multiple appliances, cost of data transmission, execution speed, distribution channel.

Major hurdles in RE

- The hurdles mentioned above will be (in part) addressed in the following
- Other issues we will not touch:
  - how to trace requirements from source to implementation and back
  - how to collect, structure and organize requirements for whole families of products
  - how to *guarantee* certain properties, for high-assurance systems
  - how to evolve requirements in response to evolving needs and real-world
  - ... and countless others

Roles in RE

- The king: **user**
- The treasurer: **customer**
- The public: **others affected**

- The wise: **domain expert**
- The artisan: **requirements analyst**
- The worker: **developer**
- The supervisor: **quality control**
- The conductor: **project manager**

Roles in R

- **Different disciplines**
  - **HCI** is concerned mostly with users
  - **RE** is concerned mostly with customers, domain experts & requirements anaysts
  - **Soft Eng** considers developers, quality control, project managers
  - **Sys Eng** considers others affected

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•Complementary approaches

- Usability requirements
- “Voice of the customer”
- Participative design
- Rapid prototyping
- Usability testing
- Social approaches

ts analyst

control

manager

Roles in RE

- “Others affected” can cover a variety of scenarios:
  - shareholders of both the customer and the developer
  - governing bodies, e.g. local councils or standard bodies
  - public at large, e.g. for environmental consequences
  - competitors in the same market
  - etc.

Roles in RE - example

- An **intensive care unit** monitoring station
  - **user**: nurses, doctors
  - **customer**: hospital
  - **others affected**: patients (& their heirs)
  - **domain expert**: physiologists & bioengineers
  - **requirements analyst**: company or independent (consultant)
  - **developer**: company or contracted (outsurced)
  - **quality control**: company
  - **project manager**: company

Human-centered design

Bring together the social and technical issues involved in inventing, marketing, deploying and operating a new technology to the maximum benefit of all involved parties, within given constraints

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Way **more** than just User Interfaces!

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Not only a piece of technology must be *usable*, it has also to satisfy the ***desires*** of involved humans!

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de **nology**

olved

In distributed systems, expectations are still high, but technological hurdles are greater

han just User Interfaces!

RE as the study of desires

- RE is thus about the study of **desires** of **humans**
- in particular,
  - how to elicit those desires
  - how to compose conflicting desires
  - how to document them
  - how to build a software system so that the desires will come true
- ... given certain **constraints**

Sources of constraints

- Economics
  - Costs for users
  - Costs for customers
  - Costs for developers
- Technology
  - Basic components
  - Infrastructure (especially for distribution)
- Legal and social issues
  - What is socially and legally acceptable