Chapter 2 — Software Requirements

March 9, 2009

Outline

"The hardest single part of building a system is deciding what to build."

— Brooks, 1987

Introduction

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  - operational constraints

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- **Requirements Engineering**: for the above:
  - acquire
  - analyze
  - document
  - check

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  - in *natural language* + *diagrams*
  - expectations & operating conditions
- **System requirements**:
  - detailed list of system functions, services, operational constraints
  - *system requirements document* or *functional specification*
  - precise
  - contract between customer and developer

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- **functional**
  - services (functions) to be provided
  - response to inputs
  - what *not* to do
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  - constraints on services; apply to whole system
  - *timing constraints*
  - *development constraints*
  - *standards*
- **domain**

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- **domain**
- not always clear-cut

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- *completeness* and *consistency*

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- usually for *emergent properties* of system
  - reliability
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Non-functional Requirements

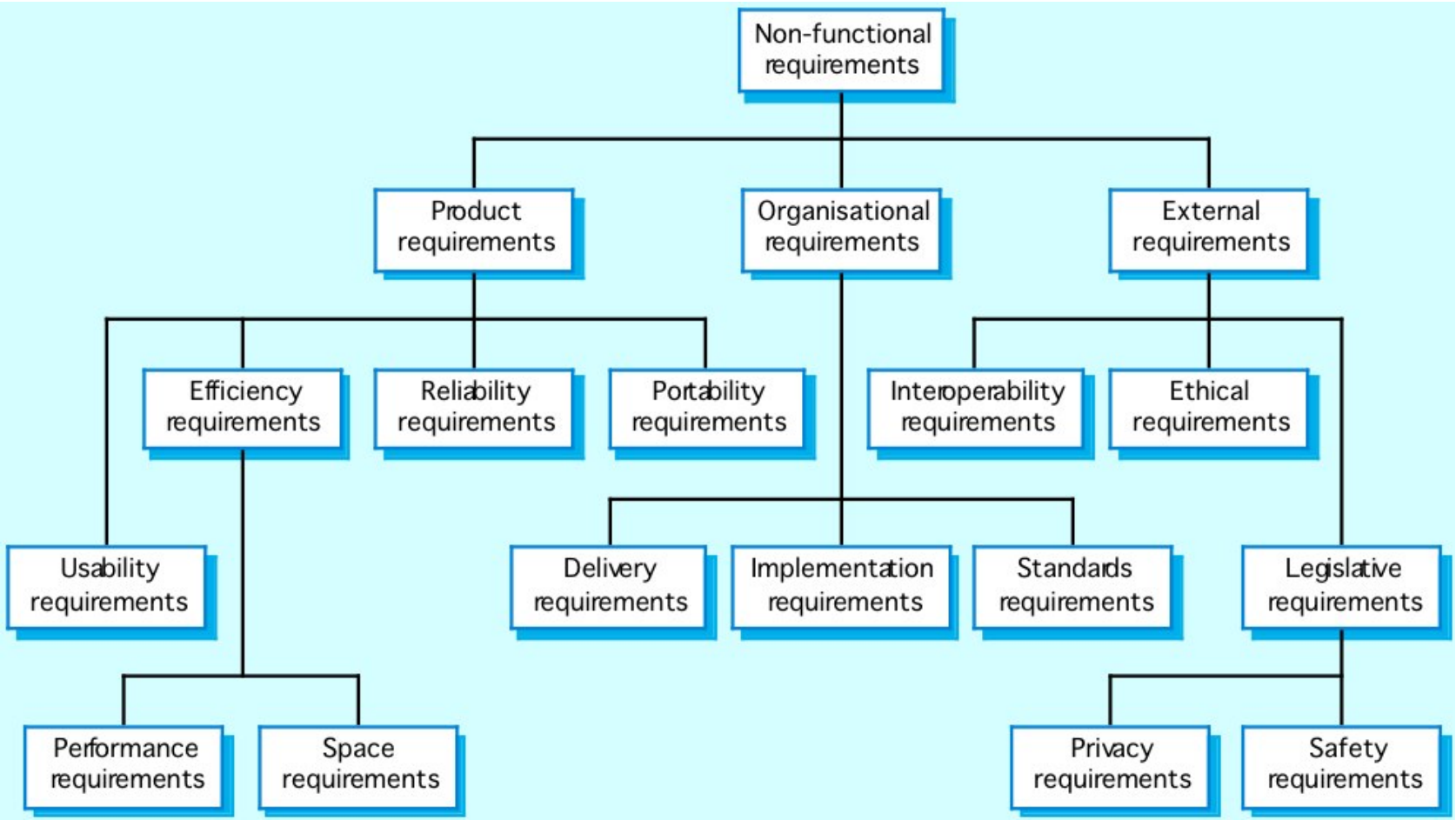

Figure: Types of non-functional requirements

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Property	Measure
Speed	Processed transactions/second User/Event response time Screen refresh time
Size	M Bytes Number of ROM chips
Ease of use	Training time Number of help frames
Reliability	Mean time to failure Probability of unavailability Rate of failure occurrence Availability
Robustness	Time to restart after failure Percentage of events causing failure Probability of data corruption on failure
Portability	Percentage of target dependent statements Number of target systems

Figure: Some Metrics for Non-functional Requirements

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- mix *goals* with *requirements*

Non-functional Requirements

- Non-functional $\leftrightarrow$ functional

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    - 2) use Java
- distinguish between functional & non-functional in documentation

Domain Requirements

- From application domain rather than user needs
- E.g.:
  - **HIPAA** requirements
  - **VPF** data format
  - **delete-on-print** for copyright compliance
  - "Deceleration of train hall be computed as "

$$D_{train} = D_{control} + D_{gradient}$$

"where $D_{gradient}$ is 9.81 ms^2 * compensated gradient / alpha and the values of 9.81 ms^2 are known for different types of trains."

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- Developers must work with domain experts

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  Example: "The website should allow editing of content on all pages. The admin should be able to grant various levels of access to the editors."
- separate **user** from **system** requirements

User Requirements Example

Bad

Grid facilities: To assist in the positioning of entities on a diagram, the user may turn on a grid in either centimetres or inches, via an option on the control panel. Initially, the grid is off. The grid may be turned on and off at any time during an editing session and can be toggled between inches and centimetres at any time. A grid option will be provided on the reduce-to-fit view but the number of grid lines shown will be reduced to avoid filling the smaller diagram with grid lines.

User Requirements Example

“Less” bad

2.6.1 Grid facilities

The editor shall provide a grid facility where a matrix of horizontal and vertical lines provide a background to the editor window. This grid shall be a passive grid where the alignment of entities is the user's responsibility.

Rationale: A grid helps the user to create a tidy diagram with well-spaced entities. Although an active grid, where entities 'snap-to' grid lines can be useful, the positioning is imprecise. The user is the best person to decide where entities should be positioned.

Specification: ECLIPSE/WS/Tools/DE/FS Section 5.6
Source: Ray Wilson, Glasgow Office

User Requirements Guidelines

- Invent and adhere to a format
- Consistent use of language
  - “shall”, “should”
- text highlighting: bold, italics, color
- avoid jargon

System Requirements

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  - add detail
- Starting point for system design
- Serve as contract

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  - may need an initial architecture
  - a specific architecture may be enforced *in the requirements*

Structured Language

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- Use **structured language**
- Helped by forms

Structured Language

Insulin Pump/Control Software/SRS/3.3.2

Function Compute insulin dose: Safe sugar level

Description Computes the dose of insulin to be delivered when the current measured sugar level is in the safe zone between 3 and 7 units.

Inputs Current sugar reading (r2), the previous two readings (r0 and r1)

Source Current sugar reading from sensor. Other readings from memory.

Outputs CompDose – the dose in insulin to be delivered

Destination Main control loop

Action: CompDose is zero if the sugar level is stable or falling or if the level is increasing but the rate of increase is decreasing. If the level is increasing and the rate of increase is increasing, then CompDose is computed by dividing the difference between the current sugar level and the previous level by 4 and rounding the result. If the result, is rounded to zero then CompDose is set to the minimum dose that can be delivered.

Requires Two previous readings so that the rate of change of sugar level can be computed.

Pre-condition The insulin reservoir contains at least the maximum allowed single dose of insulin..

Post-condition r0 is replaced by r1 then r1 is replaced by r2

Side-effects None

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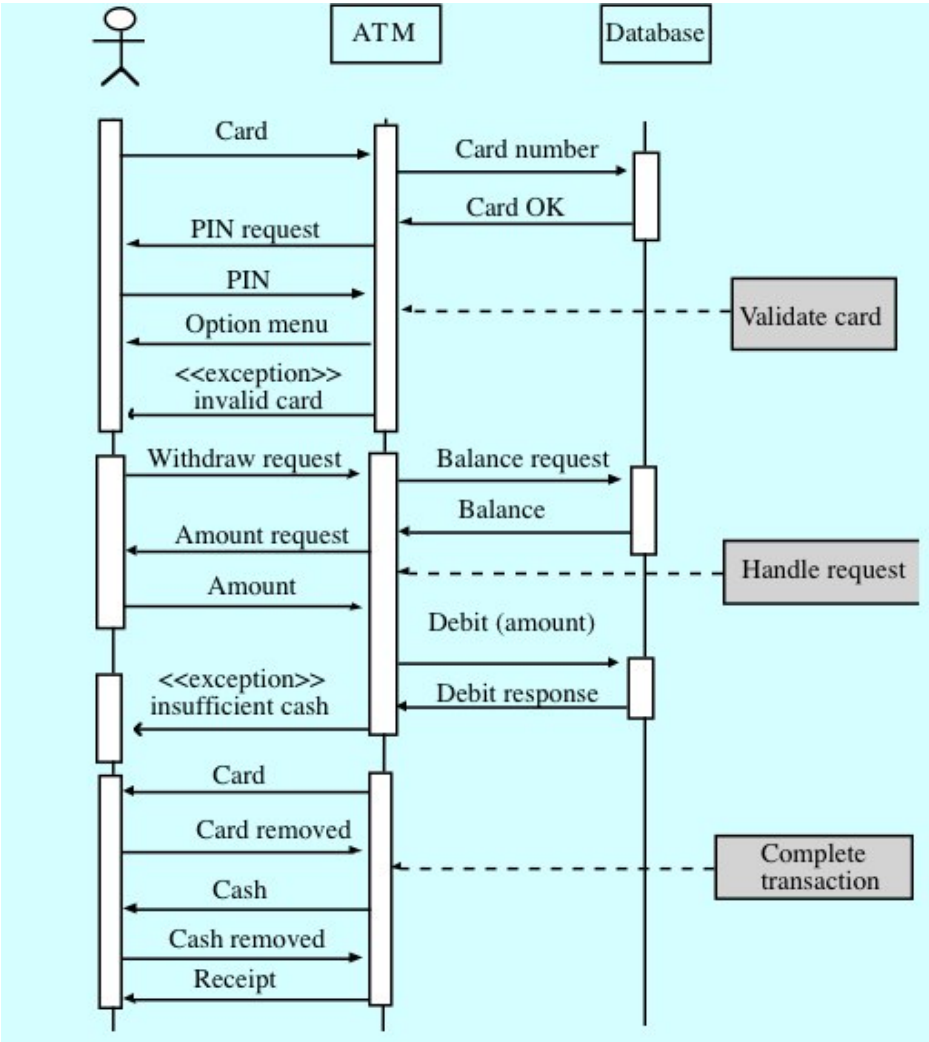

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  - *procedural interfaces*, also called APIs
  - *data structures* exchanged
  - *data representation* (bit-byte level)

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interface PrintServer {

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// provides: initialize, print, displayPrintQueue, cancelPrintJob, switchPrinter

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- may need more description

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Software Requirements Document

- Also *Software Requirements Specification* (SRS)
- Official statement
- Both **system** & **user**
  - sometimes combined

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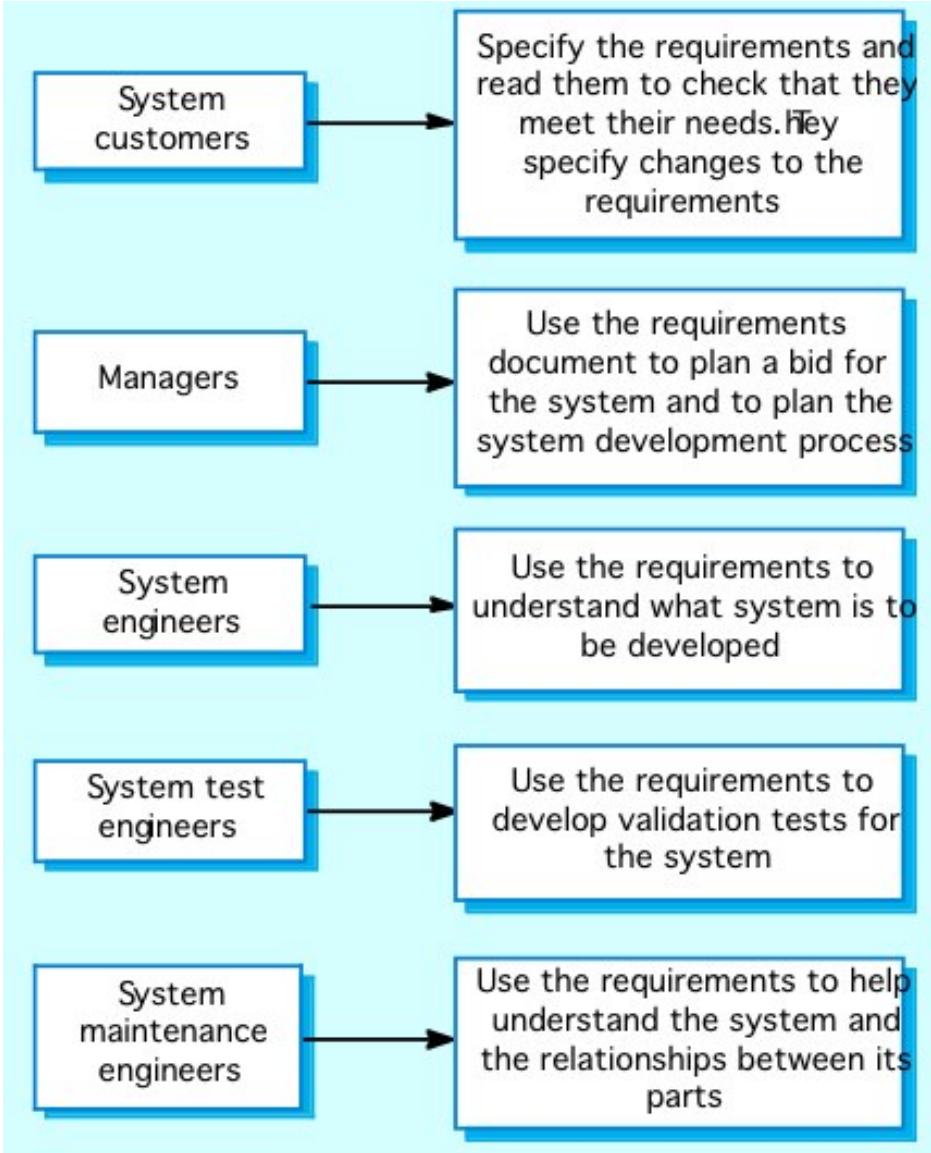

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- Appendices
  - if any
  - hardware / DB / data descriptions

Other SRD Guidelines

- In PDF or HTML
- properly sectioned

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- properly sectioned
- **comprehensive** or
- **agile**
  - *keep up-to-date*