The Illusion of Certainty

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Summary

- Traditional acquisition practice relies on certainty in requirements.
- Uncertainty is unavoidable but seen as a weakness to be eliminated.
- Ill-founded resolutions of uncertainty provide an illusion of certainty, preempting proper analysis.
- Some uncertainty, due to incomplete knowledge or information, can be resolved with due effort.
- Some uncertainty, due to diverse and changing needs, requires changeable solutions.
Requirements is a *model* of a product

A model exists to answer specific questions:

- What is the product’s purpose and value?
- What behavior does its users need it to exhibit?
- What is the context in which it operates?
- What interfaces does it have with other devices and systems?
- What are constraints on a solution?

Complete answers are possible only with

- The existing as-built product
- Full documentation of the product’s development
An empirical premise

Requirements certainty is always an illusion

- Incomplete knowledge or understanding
- Incomplete or inaccurate information
- Differing experiences and opinions (among subject matter experts or experienced users)
- Inability to envision all implications of a solution
- Needs and technology that change over time

Normal acquirer viewpoint

- Indecision causes delay
- Make decisions – eliminate uncertainties
When is a requirement not certain

- When it is tradeable (conflicts with a higher priority, costs too much, …)
- When it is only a preference (wished for, not essential)
- When it has unacceptable side effects (performance, security, …)
- When the need has since changed
The acquirer’s dilemma

Reactions to finding uncertainties in requirements:

• Indecision and delay (“somebody has to decide”)
• An ill-founded decision, without proper rationale or exposure, for an inferior product and rework
• Acceptance and accommodation
  – Identify and document uncertainties
  – Analyze implied alternatives, tradeoffs, and rationale to reach a substantiated decision
  – Establish unresolvable uncertainties as product variabilities with decision criteria, enabling deferred change at will
Dealing with uncertainty

Uncertainty → Investgate → Best “guess”

- Weak

Better

Best

Decision + Rationale

Changeable Decision + Criteria
Sources of uncertainty in requirements

Transient (second order) uncertainty

• Incomplete knowledge or information
• Disagreements among experts or users
• Complex alternatives requiring tradeoff analyses or experimentation

Persistent (first order) uncertainty

• Changing circumstances, capabilities, or expectations across time or place
• Differing needs or preferences of customers having similar needs (a product line)
Goals for addressing uncertainty

Awareness
• Expose and characterize all uncertainty

Understanding
• Analyze alternative resolutions and tradeoffs

Reduction
• Eliminate transient uncertainty, minimize persistent uncertainty, document rationale

Accommodation
• Track and manage implications of persistent uncertainty throughout the product life cycle
A traditional software process

- **Requirements**
- **Design**
- **Coding**
- **Test and Fix**
- **Install**
A concurrent software process

- Requirements
- Design
- Coding
- Testing
- Install

Product

knowledge
A product line software process

Institute & improve a product line business

Develop and evolve a capability for building similar products

Build customized products for customers

source: www.domain-specific.com
DoD acquisition life cycle, recast

Mission Need → Concept & Technology Development

Requirements (RFP) → System Development & Demonstration

Production Capability → Production & Deployment

Customized Products (Mission Capability) → Operations & Support

Key
- Baselined information
- Feedback