
The Requirements Engineering Process for Custom and COTS Based Systems

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What is a "Requirement" ?

A statement identifying a capability, physical characteristic, or quality factor that bounds a product or process need for which a solution will be pursued.

- IEEE Standard 1220 - 1994

Types of Requirements

- **System, segment, and element requirements ideally are:**
 - Performance
 - Functional
 - Design constraints / standards / "ilities" availability, maintainability
- **Requirement Relationships**
 - Singular
 - Non-redundant
 - Non-conflicting

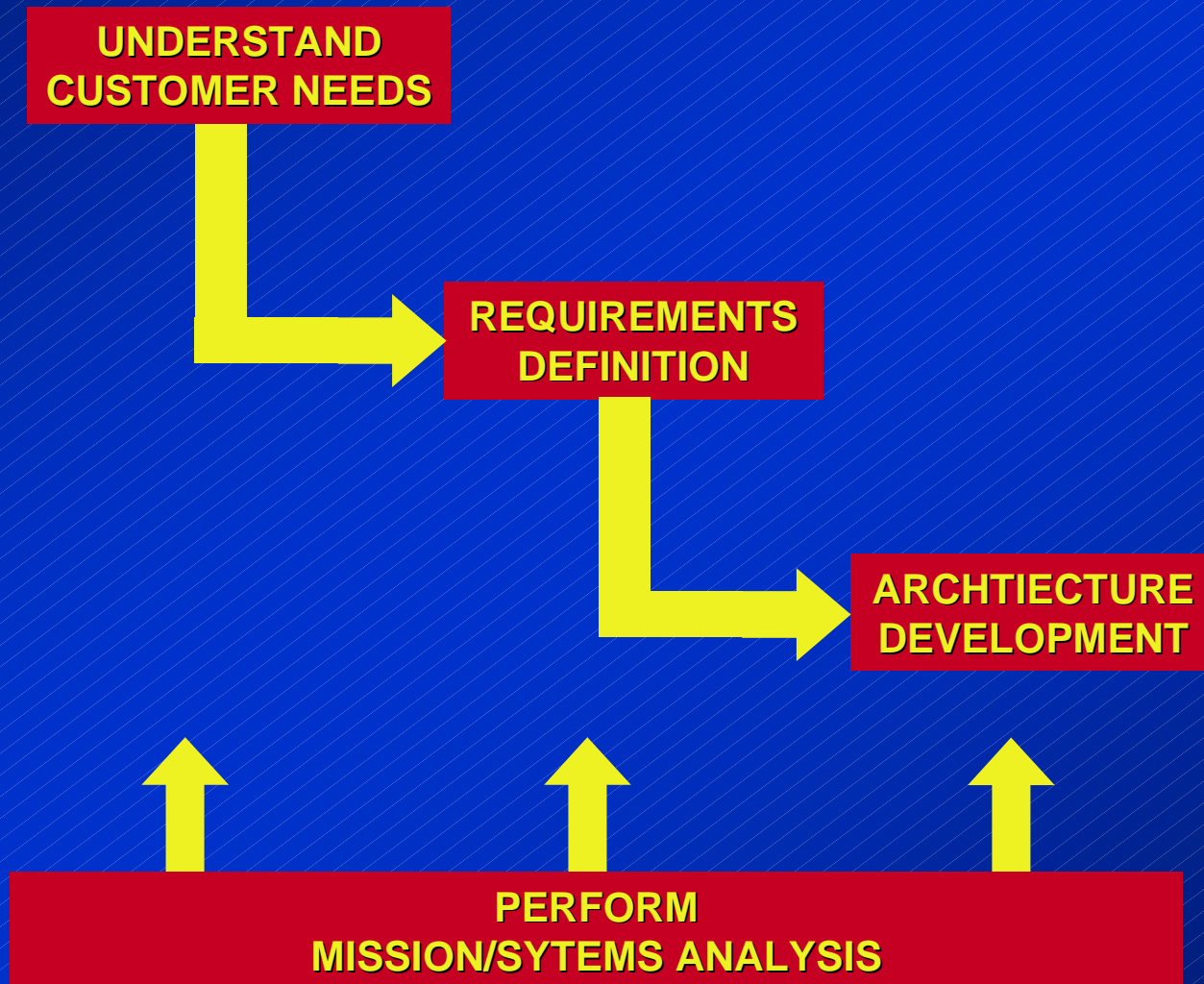
Requirements Criteria

- **Good requirements have five primary characteristics:**
 - **F**easible (able to be satisfied)
 - **A**mbiguity-Free (no vague terms)
 - **C**omplete (all essential information)
 - **T**estable (able to be verified)
 - **S**imple (short and concise sentence)

Requirements Engineering Process

- **Understand Customer Needs**
- **Perform Mission/Systems Analysis**
- **Requirements Definition**
- **Architecture Development**

Requirements Engineering Process



Understand Customer Needs

- Elicit customer needs
- Develop and review operational concepts
- Document customer needs
- Deconflict inputs
- Perform cost/risk trades
- Develop top-level requirements
- Analyze requirements feasibility
- Validate the requirements with the customer

Mission/System Analysis

- Understand the customers problem or question
- Define objectives and evaluation criteria of the analysis
- Develop trade study alternatives
- Review the results
- Formulate conclusions
- Document and and communicate the results

Requirements Definition

- Translate top-level requirements into system requirements and Technical Performance Measures (TPMs)
- Determine internal and external interfaces
- Identify verification method for requirements
- Expand & maintain requirements tracibility

Architecture Development

- Develop functional architectures
- Decompose into lower-level functions
- Develop candidate physical architectures
- Use development cost, risk, technology constraints and life cycle costs (including O&M) in selecting architecture
- Expand & maintain tracibility
- Establish interface requirements
- Verify system architecture meets system requirements and customer needs

Requirements for Commercial-Off-The-Shelf Systems

- **Commercial-Off-The Shelf (COTS) products and open systems have made it possible to deliver systems with minimal custom development**
- **Requirements still meet the same tests but are often less detailed and more constrained by the COTS market.**
 - Feasible Ambiguity-free, Complete, Testable, Simple (FACTS)
 - E.G., word processing, E-mail, IBM compatible desk-top P.C.
- **Be careful to not over-specify, where you unnecessarily force a custom design**
- **Be careful to not under-specify and miss essential customer needs**
 - Word processing having to handle English and a foreign language
 - E-mail that interfaces with other E-mail systems
 - Interface to legacy systems

Maturing COTS Requirements

- Requirements for both COTS and customer developments should be subject to cost/benefit trades throughout the project
 - It is essential on COTS programs to do cost/benefit trades
- Prototypes are a good approach to obtaining customer acceptance of cost effective requirements
- Requirements documents are then RFC'd to reflect customer agreements

Tools

- **Computer Aided System Engineering (CASE) tools can aid in:**
 - Requirements development
 - Requirements maintenance
 - Requirements traceability
- **Some Examples:**
 - Requirements driven design - (RDD100) from Ascent Logic
 - Cayenne Teamwork - Structured analysis and design tool for software development
 - Dynamic Object-Oriented Requirements System (DOORS) - OO tool from Quality Systems and Software, Inc.
 - RTM from Integrated Chipware
 - SLATE from TDS Technology
 - Requisite Pro from Rational Software

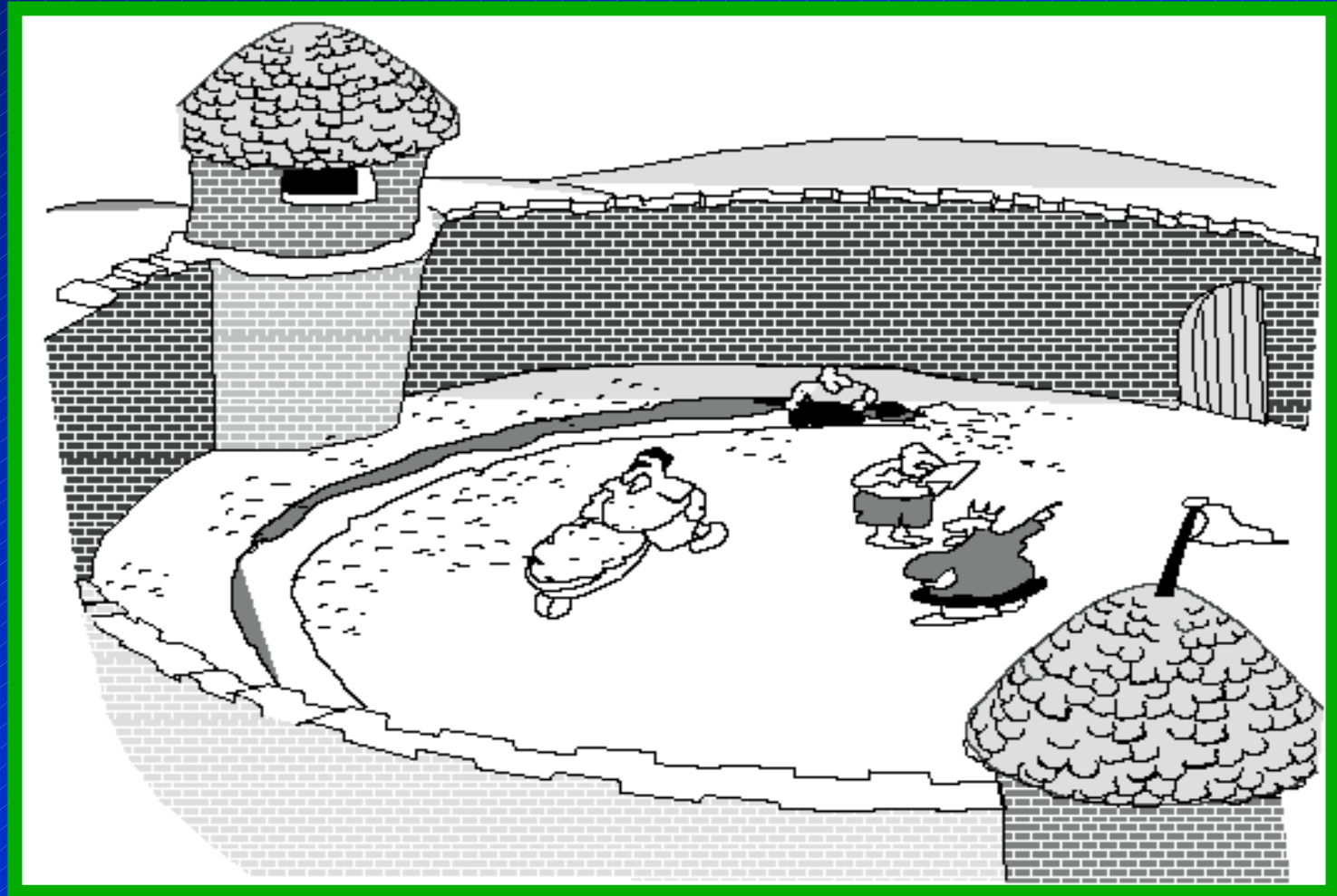
Combined Lessons Learned

- Develop prototypes to understand customer needs and gain acceptance
- Differentiate between required criteria and desirable criteria and relative importance
- Document all assumptions made during analysis
- Define selection criteria and success criteria before identifying trade alternatives
- Ensure all design constraints are essential to customer satisfaction
- Retain performance margin consistent with mission criticality and risk.
- Minimize and simplify interfaces
- Maintain tracibility as requirements are developed
- Encourage user involvement

References

- EIA Standard 632, Systems Engineering, Electronics Industries Association, Dec 1994
- IEEE Standard 1220-1994, IEEE Standard for Application and Management the Systems Engineering Process
- Mil Standard 961

A Flawed Requirements Process



Suddenly, a heated exchange took place between the King and the moat contractor.

03/14/2000

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Questions?