ELE 491
Senior Design Project Proposal

These slides are loosely based on the book Design for Electrical and Computer Engineers by Ford and Coulston. I have used the sources referenced in the book freely and without re-attribution. Please see the book for full source attribution

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Class 5 – Requirements Specification

Requirements Specification

Overview

- Project Flow
  - Identify problems
  - Create requirements
  - Generate/evaluate conceptual solutions
  - Decomposition
  - Modeling and Design
  - Validation
  - Delivery

Requirements Specification

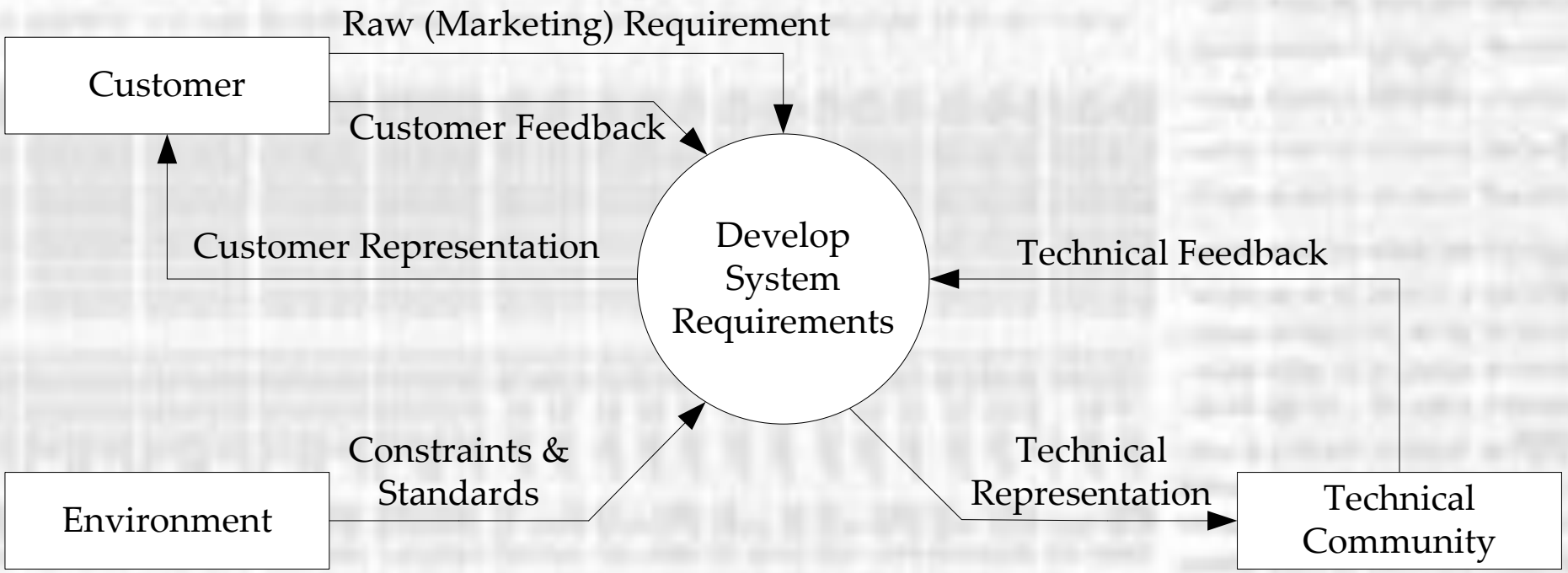
Overview

- Requirements Specification
  - Identifies the requirements a design must satisfy to be successful
  - Gates most decisions in the design process
    - Does the proposed solution meet the requirements?
  - Complete, but flexible enough to allow innovation
  - Common document used by all stakeholders to define expectations
    - Customer, marketing, design, test, manufacturing

Requirements Specification

Overview

- Influence Diagram



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Requirements Specification

Engineering Requirements

- Key Properties of Engineering Requirements
  - Abstract
    - What – NOT How
    - Minimized
  - Verifiable
    - Measurable
    - Can be demonstrated
    - Provable
  - Unambiguous
  - Traceable
    - Can be tracked back to a marketing or product requirements
  - Realistic

Requirements Specification

Engineering Requirements

- Inputs to Engineering Requirements
  - Marketing requirements
  - Business requirements
    - Cost, strategy, manufacturing, distribution
  - Constraints
    - External conditions
  - Standards
    - Formalized constraints
    - Safety, Reliability, Communications, Data format, Mechanical, Medical

Requirements Specification

Engineering Requirements

- Engineering Requirement Chart

Marketing Requirements	Engineering Requirements	Justification
1, 2	1. The *total harmonic distortion* should be <0.1%.	Based upon competitive benchmarking and existing amplifier technology. Class A, B, and AB amplifiers are able to obtain this level of THD.
Marketing Requirements 1. The system should have excellent sound quality. 2. The system should have high output power.		

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Requirements Specification

Engineering Requirements

- Engineering Requirement Generation
  - Workshops
  - Brainstorm sessions
  - Surveys, interviews
  - Observation
  - Benchmarking
  - Prototyping
  - Literature search

Requirements Specification

Engineering Requirements

- Typical Engineering Requirements
  - Functionality
    - Convert altitude to a 5 digit number
    - Initiate and receive calls
    - Sense wheel/tire position
  - Device performance
    - Altitude accuracy of +/- 3 ft
    - Operate on UMTS and LTE systems at full data rates
    - Position accuracy of 0.025 radians wrt. TDC
  - These include not only operational aspects but also
    - Energy, health and safety, maintainability, manufacturability, reliability and usability

Requirements Specification

Engineering Requirements

- Typical Engineering Requirements
  - Business
    - Direct costs
      - Components, manufacturing, unit licenses, distribution
    - Indirect costs
      - Development, licenses, marketing, warranty/repair
    - Time to market
    - Strategic impact

Requirements Specification

Engineering Requirements

- Properties of a Good Requirements Specification
  - Orthogonal
  - Complete
  - Consistent
  - Bounded
  - Modifiable

Requirements Specification

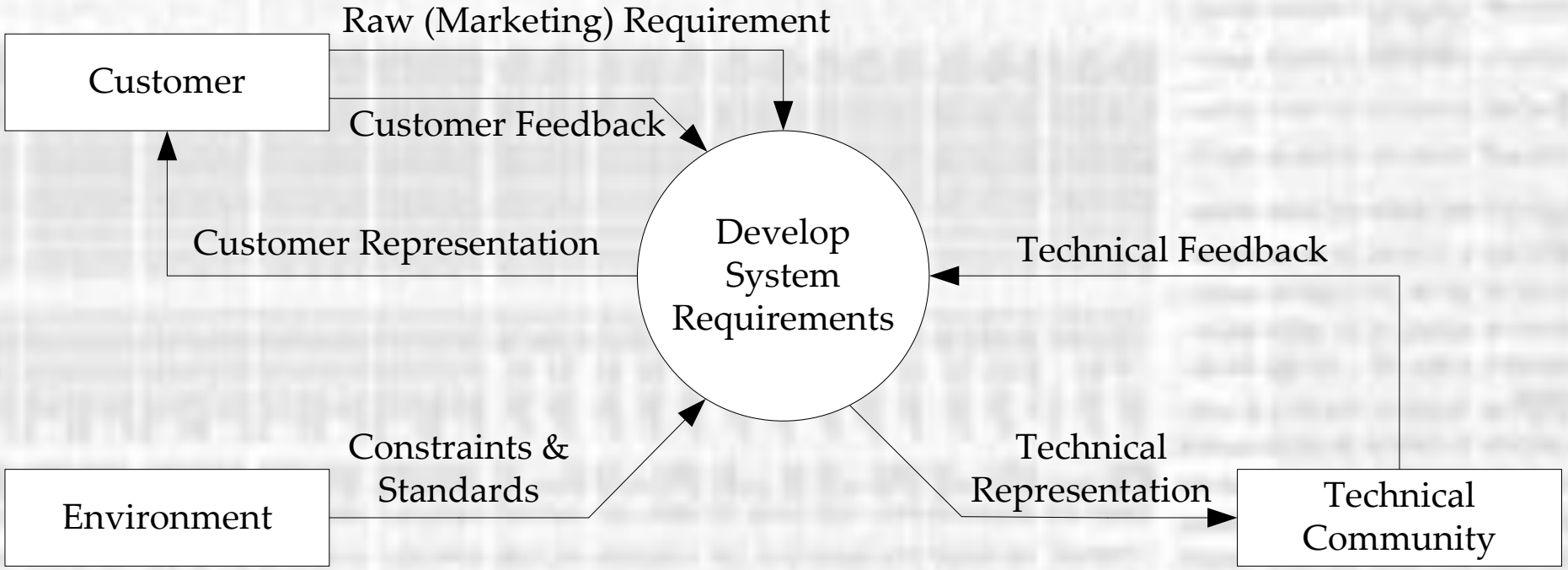
Engineering Requirements

- Test of a Good Requirements Specification
  - Is each requirement traceable to a product or business requirement
  - Is it reasonable
  - Is it necessary (possibly a duplicate)
  - Is it consistent with the other requirements

Requirements Specification

Review

- Iterative Process !
  - Some requirements will be impossible or impractical
  - Must reconcile the requirements with all stakeholders



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Requirements Specification

Case Study

Car Audio Amplifier

Marketing Requirements	Engineering Requirements	Justification
1, 2, 4	1. The *total harmonic distortion* should be <0.1%.	Based upon competitive benchmarking and existing amplifier technology. Class A, B, and AB amplifiers are able to obtain this level of THD.
1–4	1. Should be able to sustain an *output power* that averages ≥ 35 watts with a peak value of ≥ 70 watts.	This power range provides more than adequate sound throughout the automobile compartment. It is a sustainable output power for projected amplifier complexity.
2, 4	1. Should have an *efficiency* (η) >40 %.	Achievable with several different classes of power amplifiers.
3	1. *Average installation time* for the power and audio connections should not exceed 5 minutes.	Past trials using standard audio and power jacks demonstrate that this is a reasonable installation time.
1–4	1. The *dimensions* should not exceed 6″ x 8″x 3″.	Fits under a typical car seat. Prior models and estimates show that all components should fit within this package size.
1–4	1. *Production cost* should not exceed $100.	This is based upon competitive market analysis and previous system designs.

Marketing Requirements

1. The system should have excellent sound quality.
2. The system should have high output power.
3. The system should be easy to install.
4. The system should have low cost.

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In Class Activity