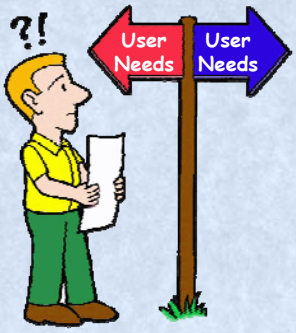
The What, Why, Who, When & How of Software Requirements



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What, Why, Who, When & How

This presentation will discuss:

- What requirements are & the various levels & types of requirements that need to be defined
- Why getting the software requirements right is so important
- Who needs to be involved -- identifying software requirements stakeholders
- When requirements activities occur in the software development lifecycle
- How to elicit, analyze, specify & validate software requirements

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What are Requirements

A requirement can be defined as:

- A statement that identifies a capability, characteristic or quality factor of a system in order for it to have value & utility to a user. [Young-01]
- A user need or a necessary feature, function or attribute of a system that can be sensed from a position external to that system. [Allen Davis in Wiegers-04]
- A specification of what should be implemented:
  - A description of how the system should behave
  - A system property or attribute
  - A constraint on the development process of the system. [Sommerville-97]

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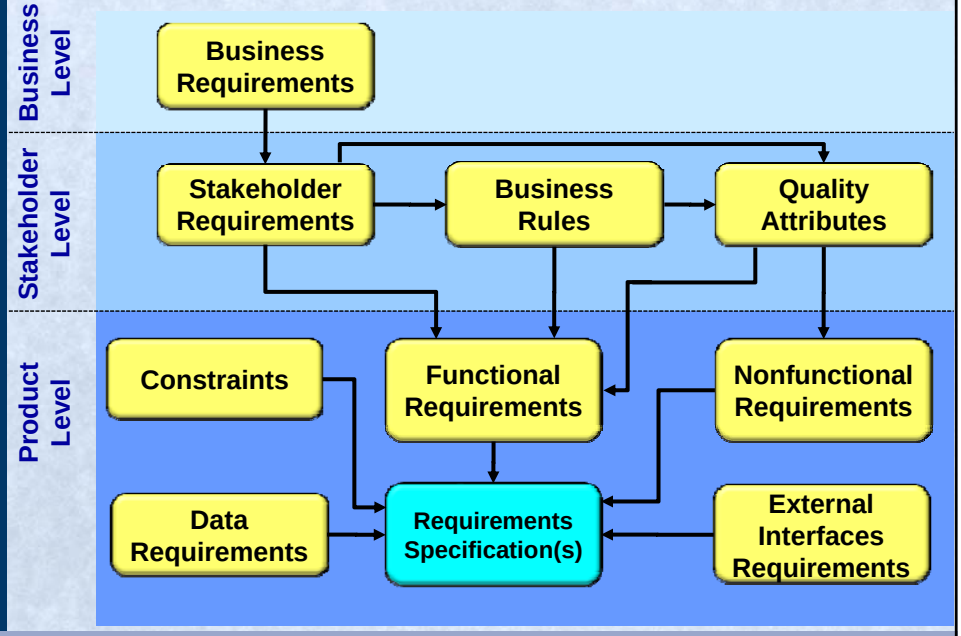
Levels & Types of Requirements



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Quality Attribute - Examples

Examples of quality attributes include:

- Usability
- Reliability
- Availability
- Performance
- Efficiency
- Security
- Safety
- Interoperability
- Accuracy
- Accessibility
- Installability
- Flexibility
- Robustness (fault-tolerance)
- Maintainability
- Reusability
- Portability
- Supportability

Why Are Requirements Important?

"The hardest part of building a software system is deciding precisely what to build. No other part of the conceptual work is as difficult as establishing the detailed technical requirements, including all of the interfaces to people, to machines & to other software systems. No other part of the work so cripples the resulting system if done wrong. No other part is more difficult to rectify later." [Brooks-95]

Issue: Project Failure

According to the Standish Group, five out of the top eight reasons why projects fail are related to requirements.

1. Incomplete requirements
2. Lack of user involvement
3. Lack of resource
4. Unrealistic expectations
5. Lack of executive support
6. Changing requirements & specifications
7. Lack of planning
8. Didn't need it any longer

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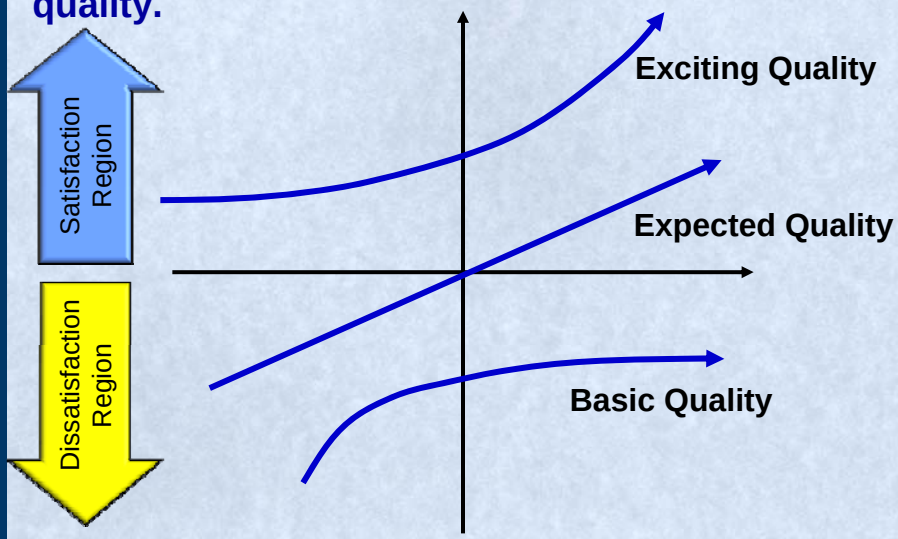
Kano Model

Relationship between customer satisfaction & quality.



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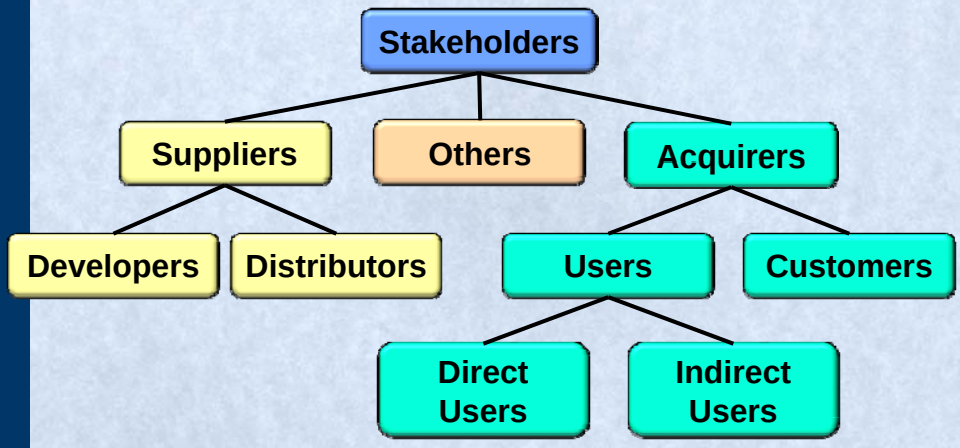
Who – Requirements Stakeholders



"Perhaps the most common single mistake in development efforts is to leave an essential person out of the process." [Gause-89]

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Step 1 - Identify Stakeholders

Benefits of identifying & involving stakeholders in the requirements elicitation process:

- Keeps requirements from being missed
- Provides access to broader experience base & domain knowledge
- Obtains different perspectives
- Results in more buy-in to the new software product through participation & involvement
- Eliminates the need for requirements analysts to be clairvoyant or telepathic

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Step 2: Prune the Stakeholder List

There is never time to include all the potential stakeholders so stakeholder priorities must be established & trade-offs made.

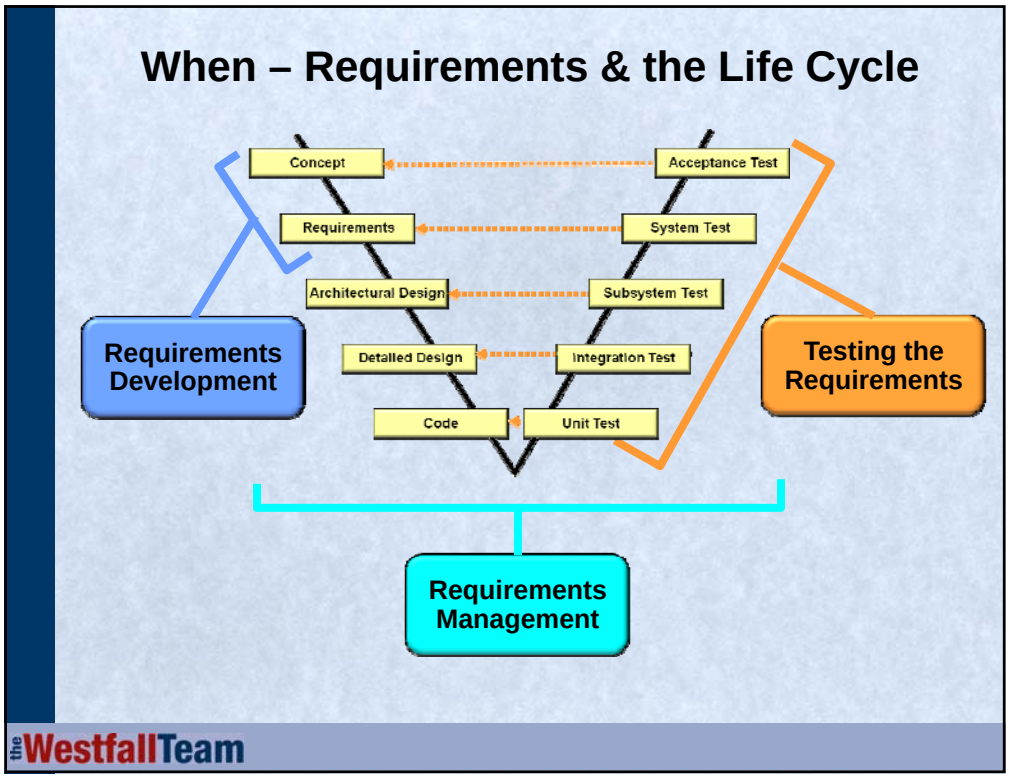
Stakeholder inclusion strategies:

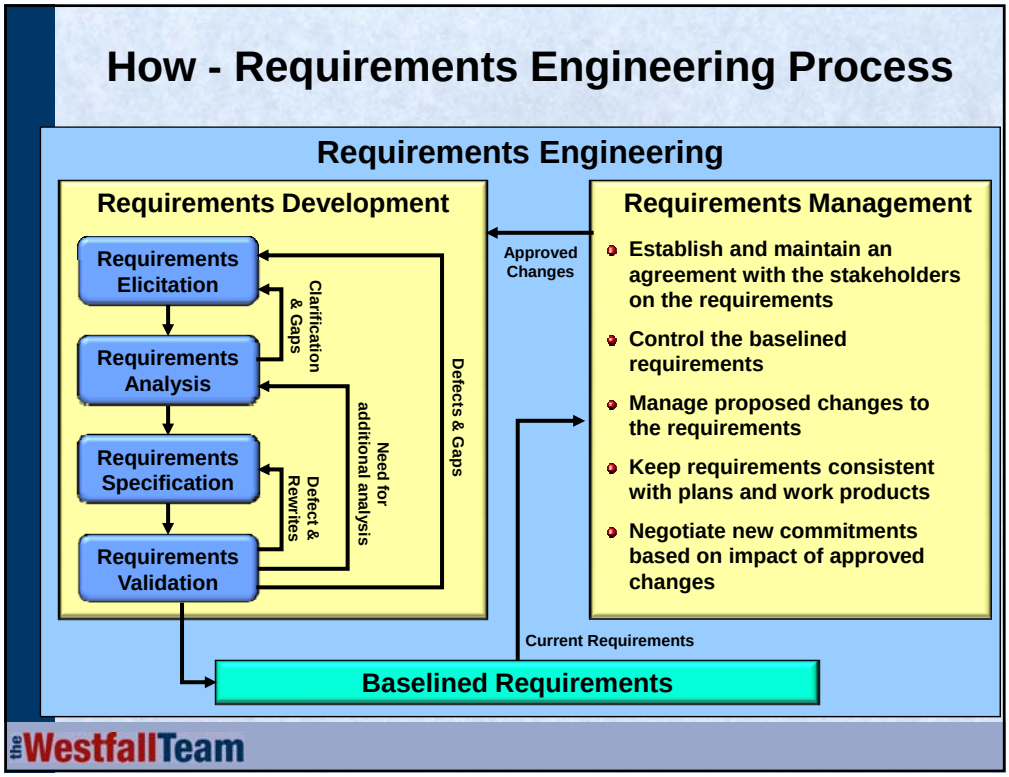
- Must include - this stakeholder must be included in the requirements engineering activities
- Like to include - this stakeholder's requirements are considered but they will only be included in the requirements engineering activities if time allows
- Ignore - this stakeholder's requirements are considered but they will not be directly included in the requirements engineering activities

Step 3: Define the Participation Strategy

The participation strategy has 4 dimensions:

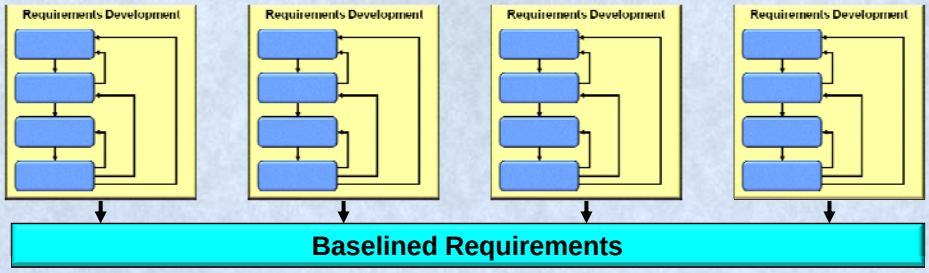
1. Who: representative, sample or exhaustive
2. When:
   - Continuous or at specific times
   - On the team or on call
3. How:
   - Experience/knowledge based
   - Prototypes, mock-ups, simulations
4. Priority





Incremental Requirements Development

This class does not assume any specific life cycle model. In fact, requirements development may be incremental.



But whether you are defining all the requirements or just a part of them – each part must be defined before you can build that part of the software.

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Requirements Elicitation Techniques

Techniques for eliciting requirements include:

- Interviews
- Focus groups
- Facilitated requirements workshops
- Documentation studies:
  - Industry standards, laws and/or regulations
  - Product literature (ours or the competition's)
  - Process documentation & work instructions
  - Change requests, problem or help desk reports
  - Reports & other deliverables from the existing system

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Requirements Elicitation Techniques (cont.)

- Observation of work in progress
  - Site visits
  - In simulated environments
- Questionnaires or surveys:
  - Customer satisfaction surveys
  - Marketing surveys
- Analysis of competitor's products
- Reverse engineering existing products
- Benchmarking & best practices
- Use cases & storyboards
- Human factors studies

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Requirements Analysis – Use Models

Object-Oriented :

- Use case diagram
- Use case
- Class diagram
- Sequence diagram
- Activity diagram

Structured Analysis:

- Data flow diagram
- Entity relationship diagram
- State transition diagram

Other Models:

- Process flow diagram
- Decision tree
- Event/response table

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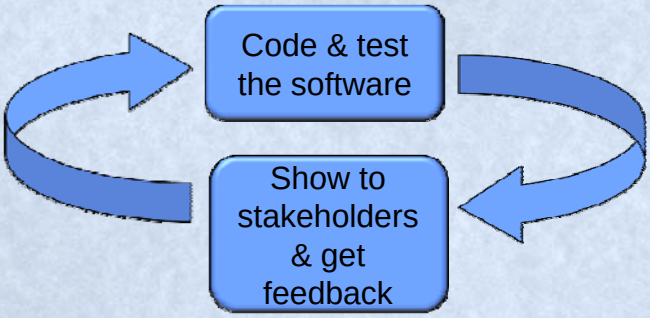
Prototyping

Characteristics of prototyping:

- Straight to an operational prototype
- No formal design or test levels



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Prioritizing Requirements

By prioritizing our requirements we can:

- Understand what's important to our stakeholders
- Work on the most important requirements first, thus avoiding the major risks of "rapid de-scoping"
- Balance project scope against project schedule, cost & staff constraints, & quality goals
- Trade-off new high priority requirements against lower priority requirements that can be deferred
- Provide the highest possible value at the lowest possible cost
- Deliver the most valuable functionality sooner – saving less valuable functionality for later releases

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Requirements Specification

Good practices:

- Adopt a Software Requirements Specification (SRS) template
- Identify sources of requirements
- Label each requirement
- Record business rules
- Create a requirements traceability matrix

Writing "Good" Requirements

Tips for writing "good" requirements include:

- Use short, direct, complete sentences
- Use active, not passive, voice
- Use consistent terminology & define it
- Remove ambiguity
- Drill requirements information down to the appropriate level of detail for the expected audience
- Use models, graphs, tables, etc.
- Include only one requirement per requirement

Writing “Good” Requirements (cont.)

- Uniquely identify each requirement
- Be specific
- Avoid pronouns
- Make them measurable
- Make them finite

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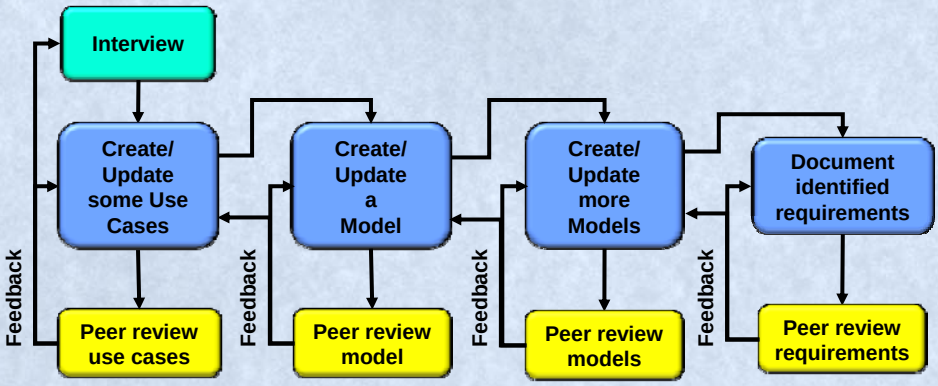
Requirements Validation – Peer Reviews

Every time we create a model or write down some of the requirements we can conduct an informal peer review to validate that part of the requirements.



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Requirements Completeness

Requirements are specified at the appropriate level of detail for:

- All functions
- Needed quality attributes
- External interfaces
- Data
- Constraints
- Operational adaptability
- System modes
- Future expansion
- User types:
  - Normal
  - Power
  - Novice
  - Operator
  - Special needs

Requirements Completeness (cont.)

There are product level requirements for:

- All friendly & unfriendly stakeholders
- Handling all the business rules
- Each element in each model, including:
  - Each step in every use case
  - Each function in the data flow diagrams
  - Each event in the event/response tables
- Creating, Updating, Reading, Deleting & Listing (CURDL) each item in the data dictionary

Evaluating Requirements

The requirements documentation is:

- Complete
- Internally & externally consistent
- Modifiable
- Compliant with the standards

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Requirements Checklist - Each Requirement

Each requirement is:

- Clear & unambiguous
- Concise
- Finite
- Measurable
- Feasible (reasonable)
- Testable
- Traceable
- Value added

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Test Matrix - Example

Decide how to test each requirement.

Requirement #	Requirement	Test Level	Test Strategy
R00103	The system shall respond to all user commands and data entries within 3 seconds	System	Black-Box - Demonstration
R00200	The software shall store all currently active transactions in memory to allow access if the storage media fails	Unit	White-Box
R00397	The source code shall be written in C++	Peer Reviews of Code	Inspection
R00560	The system shall calculate sales tax at current tax rates	Unit System	White-Box Black-Box - Analysis
R00050	The system shall work with all credit cards issued by all banks	---	Not Testable

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