7. Requirements for distributed & outsourced projects*

*Part of the material is from our "Requirements Engineering" course

Requirements engineering

Essential in good software projects

Even more essential in oursourcing!

Statements about requirements: Brooks

Source*: Brooks 87

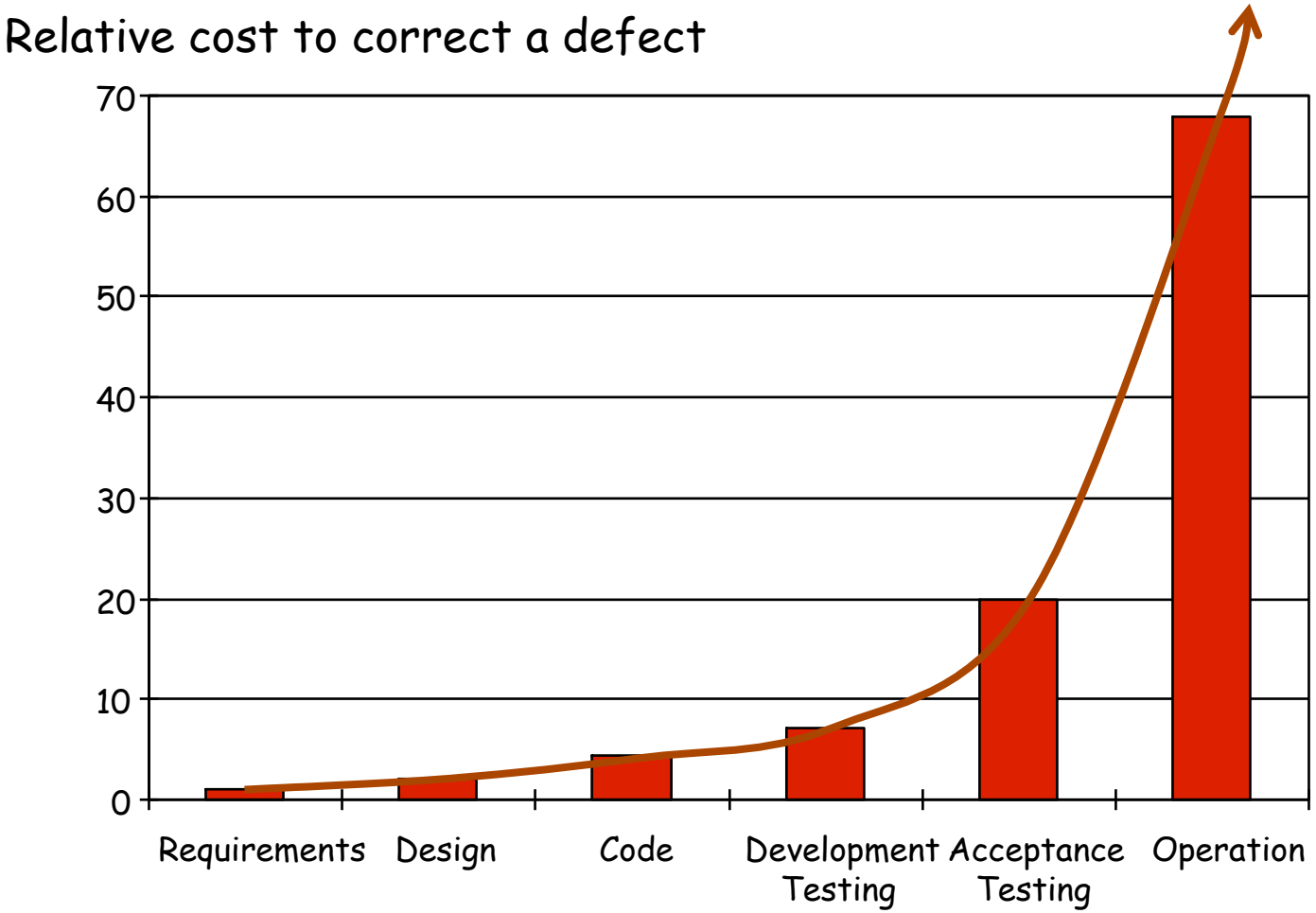
The hardest single part of building a software system is deciding precisely what to build.

No other part of the conceptual work is as difficult as establishing the detailed technical requirements, including all the interfaces to people, to machines, and 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.

*For sources cited, see bibliography

Statements about requirements: Boehm

Source: Boehm 81



A definition

"A requirement" is a statement of desired behavior for a system

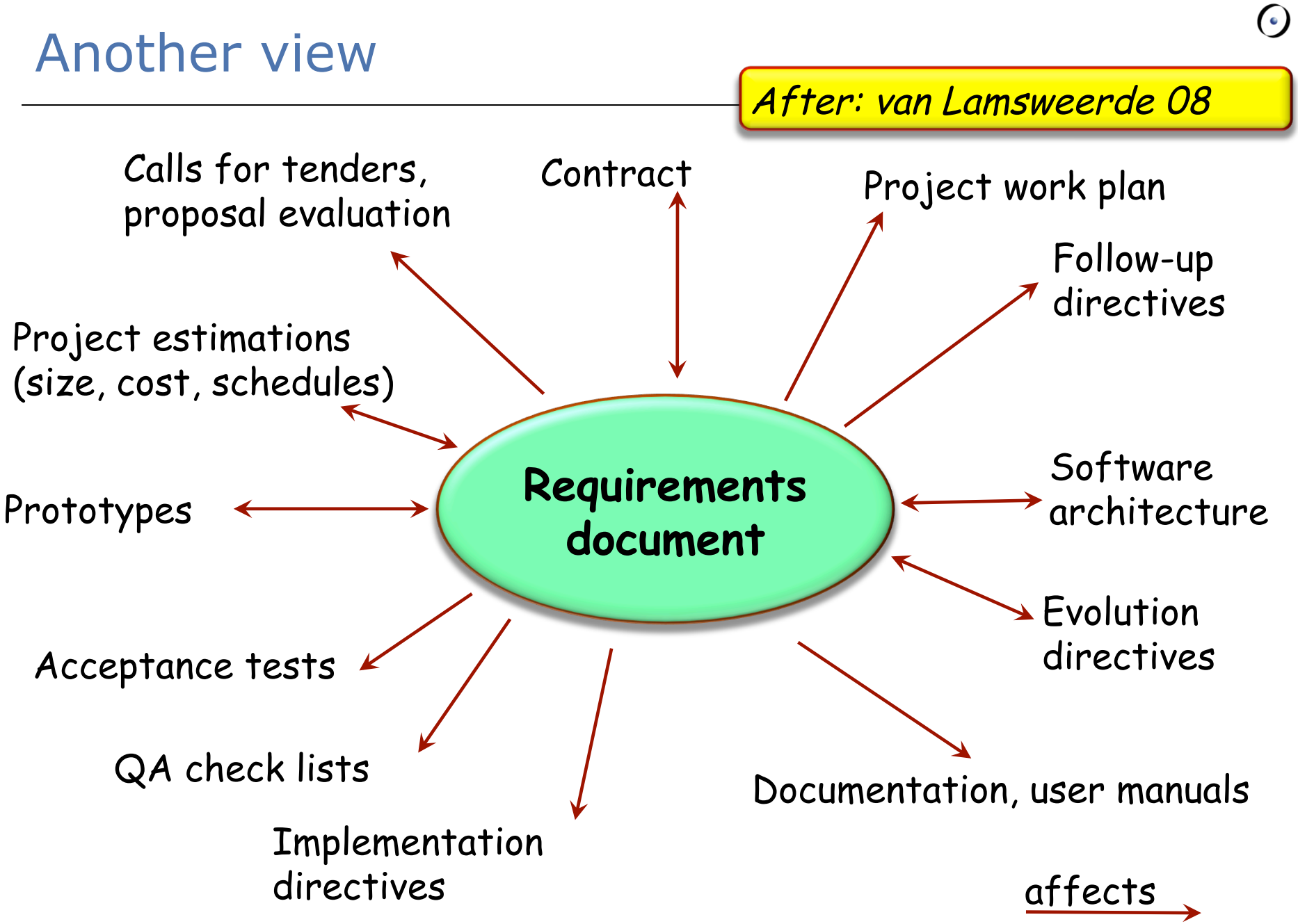
"The requirements" for a system is the collection of all such individual requirements

Goals of performing requirements

- Understand problem or problems that the eventual software system, if any, should solve
- Prompt relevant questions about problem & system
- Provide basis for answering questions about specific properties of problem & system
- Decide what system should do
- Decide what system should not do
- Ascertain that system will satisfy the needs of its stakeholders
- Provide basis for development of system
- Provide basis for V & V* of system

*Validation & Verification, including testing

Another view

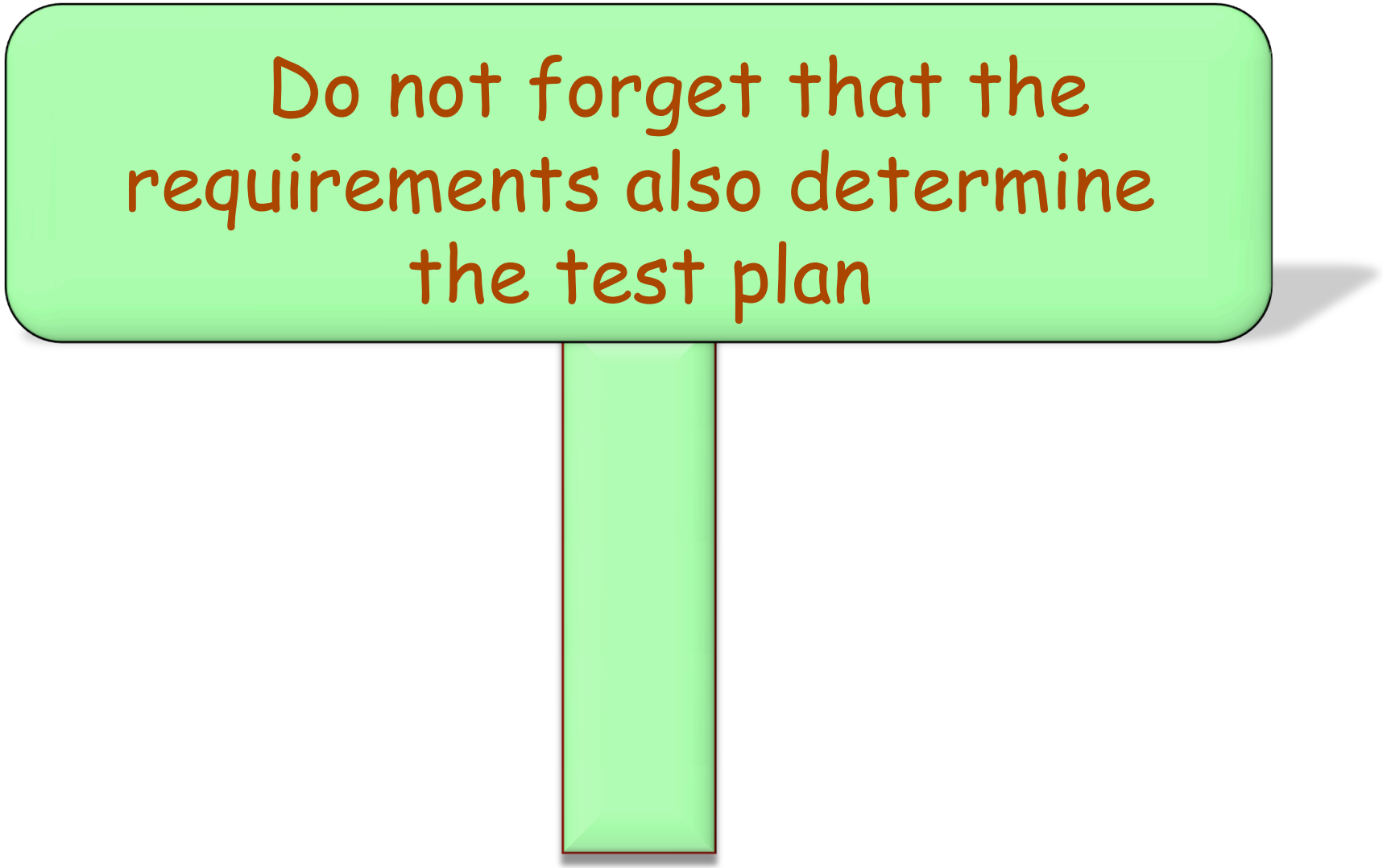


Benefits of a good requirements process

After: Wiegers 03

- Fewer requirements defects
- Reduced development rework
- Fewer unnecessary features
- Lower enhancement costs
- Faster development
- Fewer miscommunications
- Less scope creep
- Better project organization
- More accurate testing estimates
- Better testing process
- Higher team satisfaction

Practical advice



Possible requirements stakeholders

- Clients (bespoke system)
- Customers (product for general sale)
- Clients' and customers' customers
- Users
- Domain experts
- Market analysts
- Unions?
- Legal experts
- Purchasing agents
- Software developers
- Software project managers
- Software documenters
- Software testers
- Trainers
- Consultants

15 quality goals for requirements

- Justified
- Correct
- Complete
- Consistent
- Unambiguous
- Feasible
- Abstract
- Traceable
- Delimited
- Interfaced
- Readable
- Modifiable
- Verifiable
- Prioritized*
- Endorsed

Marked attributes are part of IEEE 830, see below
* "Ranked for importance and/or stability"

Difficulties of requirements

Natural language and its imprecision

Formal techniques and their abstraction

Users and their vagueness

Customers and their demands

The rest of the world and its complexity

The two constant pitfalls

Committing too early to an implementation

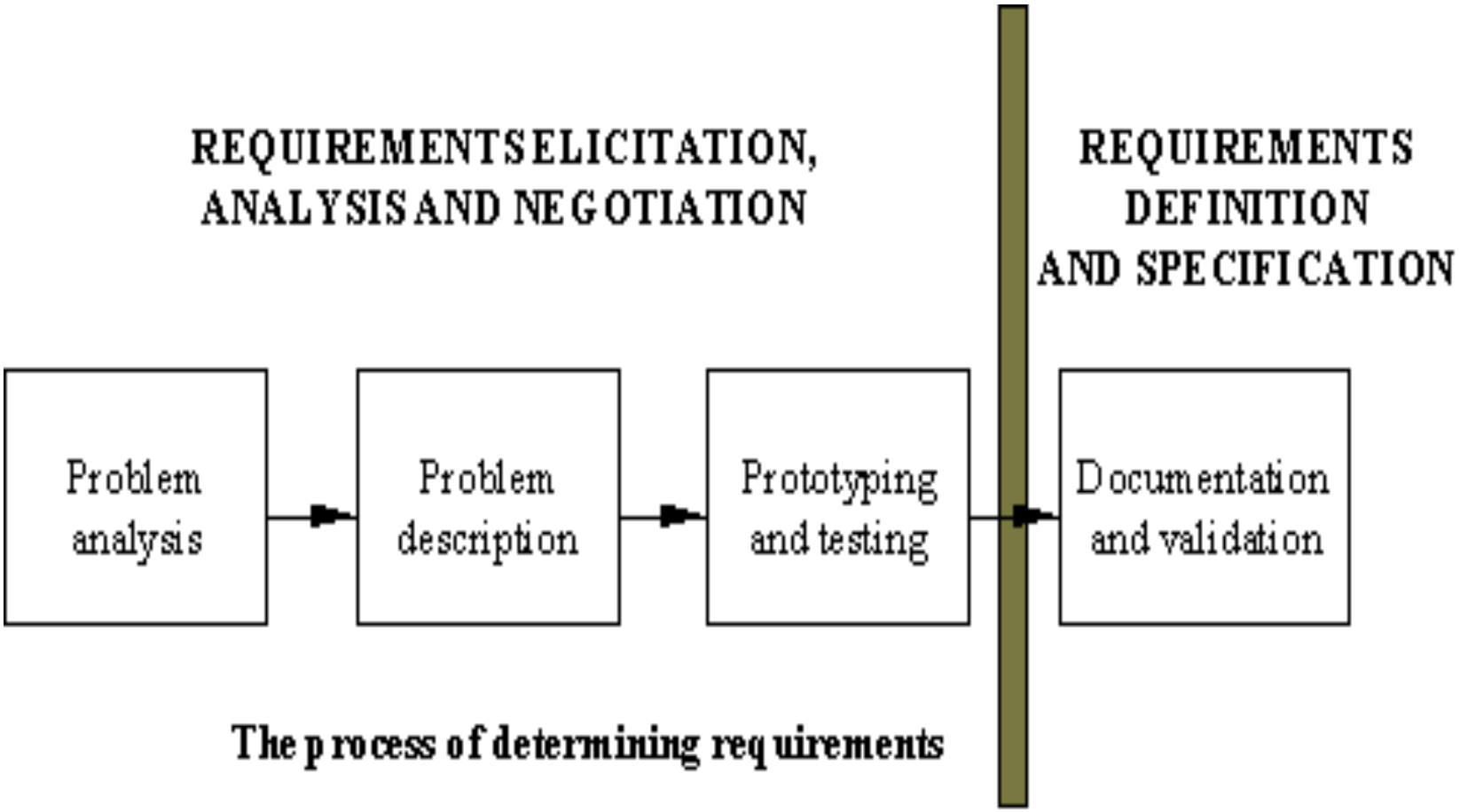
Overspecification!

Missing parts of the problem

Underspecification!

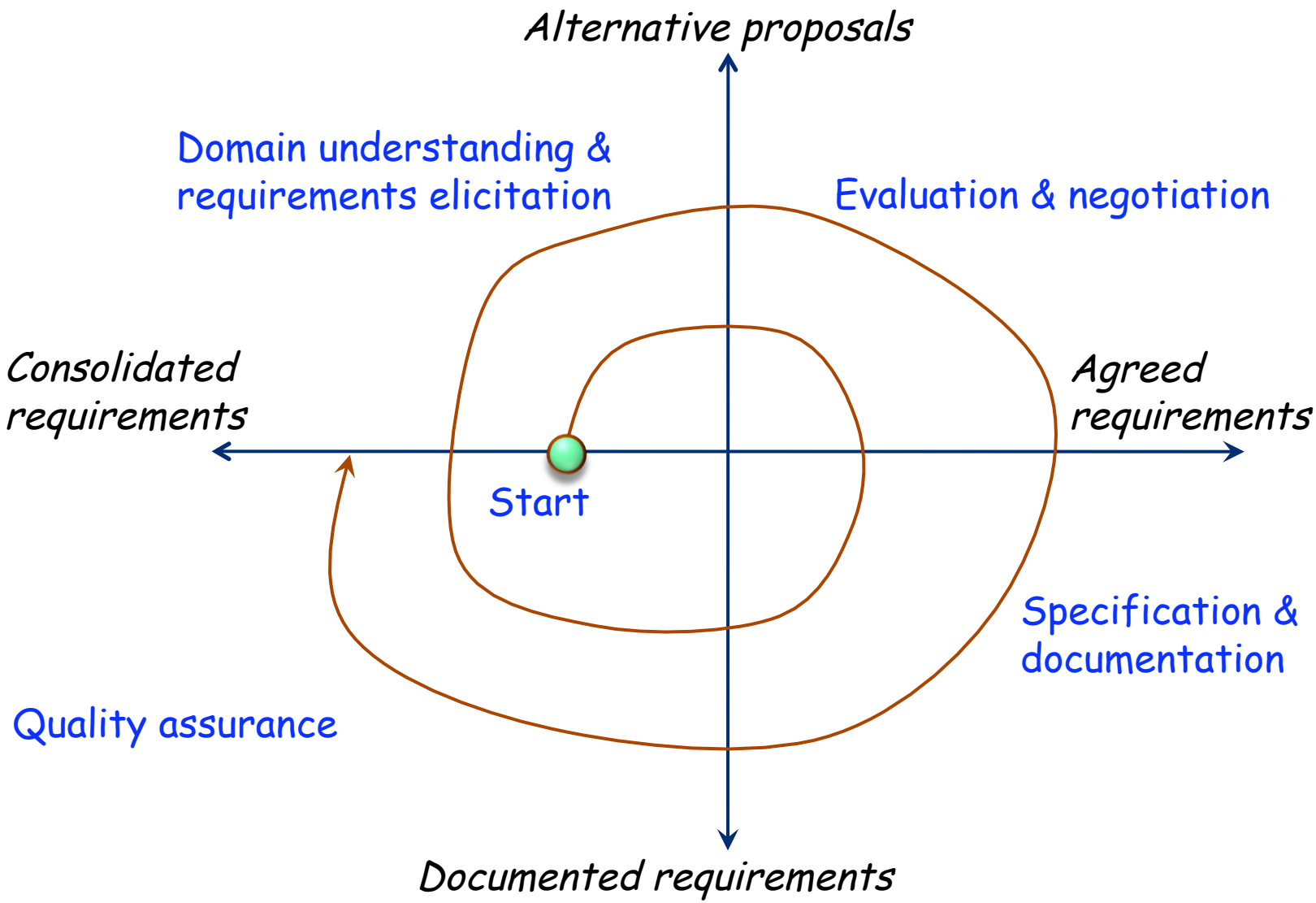
The requirements process

Source: Pfleeger & Atlee 05



A spiral model

From: van Lamsweerde 08



Requirements elicitation: who?

Users/customers?

Software developers?

Requirements engineers (analysts)?

Requirements elicitation: what?

Example questions:

What will the system do?

What must happen if…?

What resources are available for…?

What kind of documentation is required?

What is the maximum response time for…?

What kind of training will be needed?

What precision is requested for…?

What are the security/privacy implications of …?

Is … an error?

What should the consequence be for a … error?

What is a criterion for success of a … operation?

Requirements elicitation: how?

Contract

User interviews

Requirements workshops

Study of existing non-computer processes

Study of existing computer systems

Study of comparable systems elsewhere

Stereotypes

Source: Scharer 90

How developers see users

- Don't know what they want
- Can't articulate what they want
- Have too many needs that are politically motivated
- Want everything right now.
- Can't prioritize needs
- Refuse to take responsibility for the system
- Unable to provide a usable statement of needs
- Not committed to system development projects
- Unwilling to compromise
- Can't remain on schedule

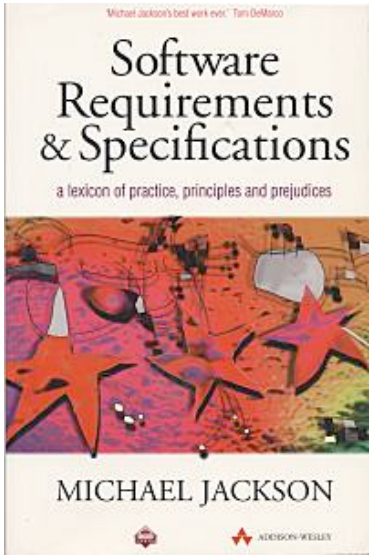
How users see developers

- Don't understand operational needs
- Too much emphasis on technicalities.
- Try to tell us how to do our jobs
- Can't translate clearly stated needs into a successful system
- Say no all the time
- Always over budget
- Always late
- Ask users for time and effort, even to the detriment of users' primary duties
- Set unrealistic standards for requirements definition
- Unable to respond quickly to legitimately changing needs

The two parts of requirements

Source: Michael Jackson

Purpose: to capture the user needs for a "machine" to be built



Define success as

machine specification ∧ *domain properties* ⇒ *requirement*

- *Domain properties*: outside constraints (e.g. can only modify account balance as a result of withdrawal or deposit)
- *Requirement*: desired system behavior (e.g. withdrawal of *n* francs decreases balance by *n*)
- *Machine specification*: desired properties of the machine (e.g. request for withdrawal will, if accepted, lead to update of balance)

Components of requirements

1. Domain properties

2. Functional requirements

3. Non-functional requirements (reliability, security, accuracy of results, time and space performance, portability...)

4. Requirements on process and evolution

How to ensure good requirements?

Managerial aspects:

- Involve all stakeholders
- Establish procedures for controlled change
- Establish mechanisms for traceability
- Treat requirements document as one of the major assets of the project; focus on clarity, precision, completeness

Technical aspects: how to be precise?

- Formal methods?
- Design by Contract

IEEE 830-1998

"IEEE Recommended Practice for Software Requirements Specifications"

Approved 25 June 1998 (revision of earlier standard)

Descriptions of the content and the qualities of a good software requirements specification (SRS).

Goal: "The SRS should be correct, unambiguous, complete, consistent, ranked for importance and/or stability, verifiable, modifiable, traceable."

IEEE Standard 830-1998

Recommended practice for Software Requirements Specifications

Recommended document structure:

1. Introduction
   - 1.1 Purpose
   - 1.2 Scope
   - 1.3 Definitions, acronyms, and abbreviations ← Glossary!
   - 1.4 References
   - 1.5 Overview
2. Overall description
   - 2.1 Product perspective
   - 2.2 Product functions
   - 2.3 User characteristics
   - 2.4 Constraints
   - 2.5 Assumptions and dependencies
3. Specific requirements

   Appendixes

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Use cases

One of the UML diagram types

A use case describes how to achieve a single business goal or task through the interactions between external actors and the system

A good use case must:

- Describe a business task
- Not be implementation-specific
- Provide appropriate level of detail
- Be short enough to implement by one developer in one release

Use case example

Place an order:

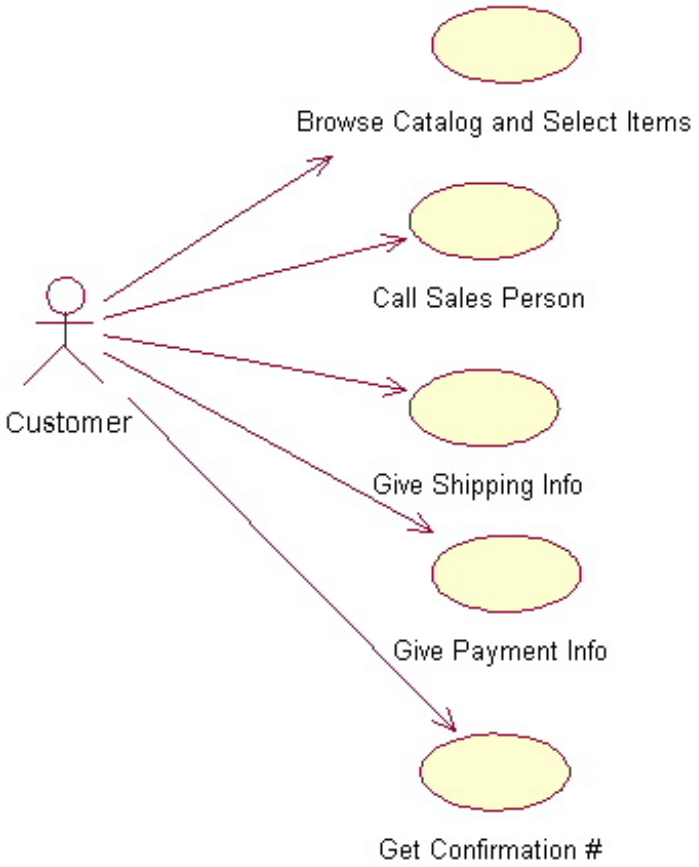
Browse catalog & select items

Call sales representative

Supply shipping information

Supply payment information

Receive conformation number from salesperson



May have precondition, postcondition, invariant

Note on use cases

Use cases cannot suffice to define the requirements:

- Not abstract enough
- Too specific
- Describe current processes
- Do not support evolution

Use cases are to requirements what tests are to software specification and design

Major application: for testing

Requirements: key lessons

Requirements are software

- Subject to software engineering tools
- Subject to standards
- Subject to measurement
- Part of quality enforcement

Requirements is both a lifecycle phase and a lifecycle-long activity

Since requirements will change, seamless approach is desirable

Distinguish domain properties from machine properties

- Domain requirements should never refer to machine requirements!

Key lessons (continued)

Identify & involve all stakeholders

Requirements determine not just development but tests

Use cases are good for test planning

Requirements should be abstract

Requirements should be traceable

Object technology helps

- Modularization
- Classifications
- Contracts
- Seamless transition to rest of lifecycle

Requirements in a distributed/outsourced setting

Special points to consider:

- Include both customer and supplier in requirements process
- Use distributed meeting techniques, centered on documents (see discussion of weekly meeting and code review)
- Enforce endorsement by all major stakeholder representatives
- Pay special attention to document structure and configuration management
- Perform a special step of consistency checking between requirements and legal documents (contract, supplier agreement management)
- Pay special attention to glossary, include translation if appropriate
- Pay special attention to the change process
- Consider including a prototype implementation as a validation of requirements