

# Requirements Engineering: Problem Structures and Solution Architectures

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# ``Requirements engineering'' is a misnomer

- **Requirements** are what is wanted
- **Engineering** is calculated manipulation (*Webster's*).
- So RE is calculated manipulation of what is wanted!?
- The term ``RE'' was invented to make requirements respectable to engineers.

# ``What'' versus ``How''

- This is an empty distinction
  - What does a system do? (requirements)
  - What is its structure? (architecture)
  - How does a system behave? (requirements)
  - How is it structured? (architecture)

# Two views of requirements

- A requirement is a **problem description**
  - A **problem** is a difference between what we perceive to be the case and what we would like to be
- A requirement is a **solution specification**
  - A **solution** is an action that reduces the difference
- Both views are valid ...
- Difference between problem and solution is relative

# Requirements as problem description

- **Phenomena:** *e.g. knowledge distributed in a company*
- **Norms:** *Need knowledge sharing*
- **Stakeholders:** *Management, knowledge owners*

NB:

- No mention of a solution
- In this view, RE is theory-building
  - **Description** of the problem
  - Problem frames
  - Goal-oriented RE

# Requirements as solution specification

- **Context:** E.g. *knowledge work*
- **Functions:** *Allow knowledge entry, allow knowledge search*
- **Quality attributes:** *Easy to use*
- **Interface:** *Web browser*
- **Navigation requirements:** ....

NB:

- Problem assumed understood
- **Prescription** of a solution
  - Solution patterns

# Conclusion

- Both views of requirements are needed
- Be clear about which one you use

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# Suggested differences

(S. Jeary & K. Phalp 2004)

- **User domain**
- **Developer domain**
- **Environment**

# Suggested differences

(S. Jeary & K. Phalp 2004)

- **User domain**
  - User divorced from development
  - No traditional entry or exit point
  - Technology more visible to the user
  - High reliance on user interface
  - Non-functional requirements primary
  - Volatility in user requirements
  - Unpredictable publishing environment
- **Developer domain**
- **Environment**

# Suggested differences

(S. Jeary & K. Phalp 2004)

- **User domain**
- **Developer domain**
  - Multidisciplinary teams
  - Aesthetic and cognitive differences
  - Cognitive overhead of developers
  - Developer inexperience
  - Uncertainty
  - Rapidly changing technology
  - Lack of useful methods
  - Methods written for computer scientists
- **Environment**

# Suggested differences

(S. Jeary & K. Phalp 2004)

- **User domain**
- **Developer domain**
- **Environment**
  - Tight linkage between business architecture and the technical design
  - Impact of information structure
  - Aggressive release demands
  - Hype driven
  - Immaturity of web development
  - Development changes the business model
  - Nature of development
  - Highly competitive, market environment
  - Fine grained evolution and maintenance

# Architecture intertwining

- Web systems are distributed
  - They connect independent businesses
  - Easy entry and exit of partners
  - Create new kinds of business
  - Facilitate a wide range of coordination mechanisms
- ∅ The web is an infrastructure for coordination

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# Coordination mechanisms

- Market
- Hierarchy
- Network

# Coordination mechanisms

- Market coordination
  - Supply and demand
  - Price
  - Low switching cost
  - Predictable performance
  - Explicit behavior specification (complete contracts)
- Examples of web-based systems
  - Market places
  - Auctions
  - On-line malls

# Coordination mechanisms

- Coordination by hierarchy
  - Clear goals
  - Management supervision
  - Hierarchical decision structure
  - High switching cost
  - Performance ambiguity
  - Partial behavior specification (incomplete contracts)
  - Trust
- Examples of web-based systems
  - Project reporting
  - Information systems
  - Knowledge sharing

# Coordination mechanisms

- Network coordination
  - Coordination by shared norms
    - e.g. professional networks
    - Kinship networks
  - High switching cost
  - High trust
  - No specification of behavior at all (no contracts)
- Examples of web-based systems
  - Shared workspaces
  - Email

# RE for the web

- **Problem-oriented:** analyze the coordination mechanisms it will be used for
  - Descriptive
- **Solution-oriented:** Specify its contribution to coordination mechanisms
  - Prescriptive

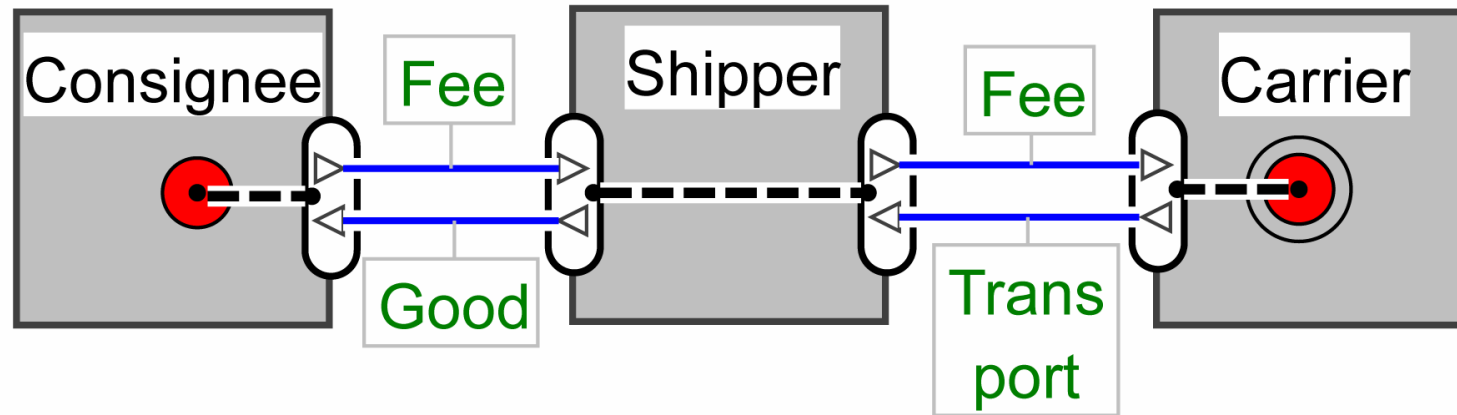
# Web development for markets and networks

- Problem analysis (descriptive RE)
  - Need a list of business actors
  - Non-hierarchical decision making
  - Describe profitability of the network/market for each
- Solution specification (prescriptive RE)
  - Business process design
  - Information system specification

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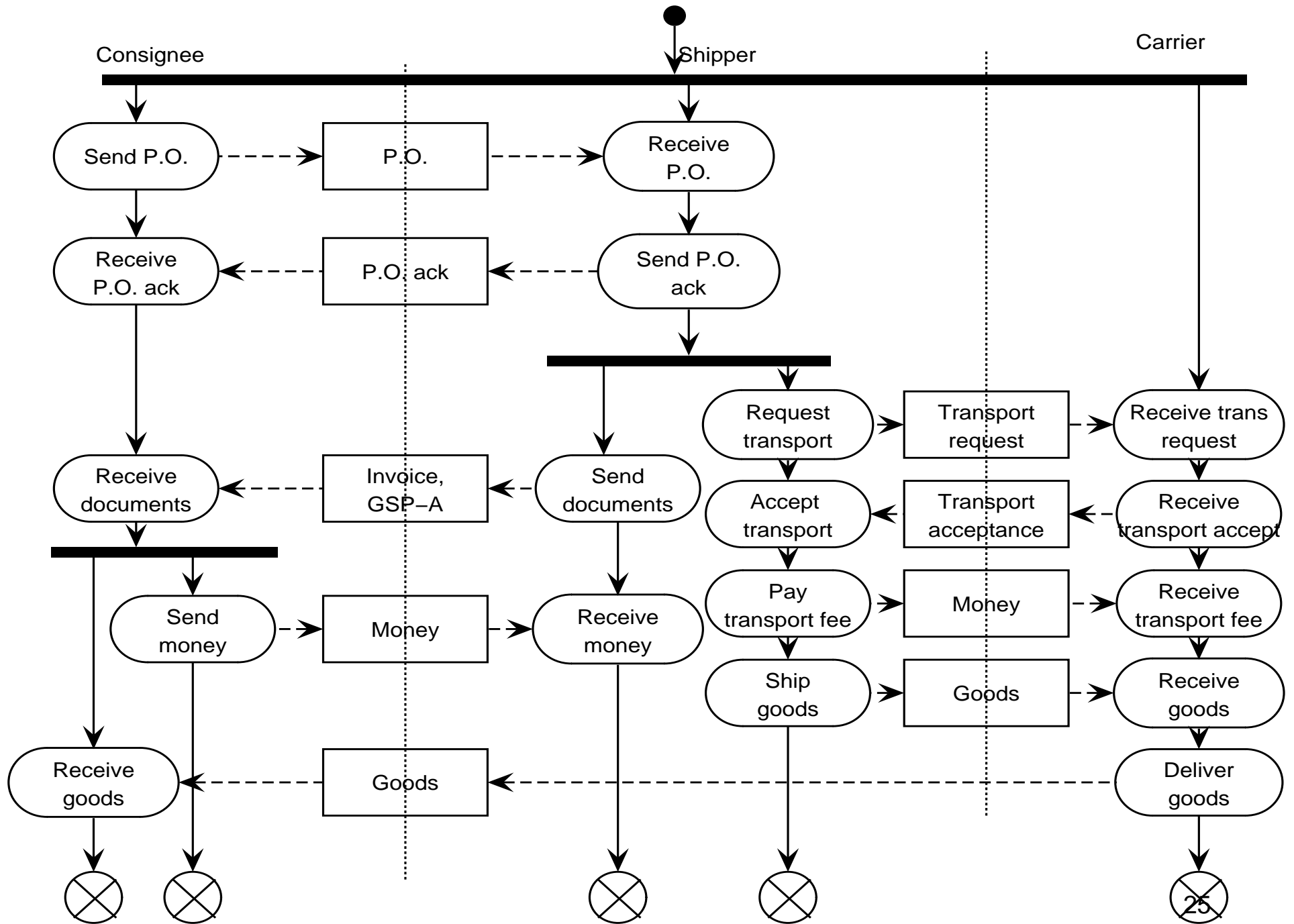
# Example of descriptive RE: Value models (J. Gordijn)



- Model of value exchanges in a business network (or market)
- Profitability computations
- Process model has same actors, many more activities

# Purpose of value models

- Makes clear whether the cooperation is profitable/valuable for each participant
- It represents a distributed goal structure
- Understandable to managers
- Validation for process models
- Process model represents coordination mechanisms



# Information system model

- All other aspects are similar to classical development
  - Identify activities supported or performed by software
  - Web services and browser interfaces where needed
- Crucial difference is intertwining of business architecture and software architecture
- To determine viability, need to identify business goals, i.e. value model

# Research topics

- Coordination mechanisms emerging by the web.
  - Empirical
- Description techniques for these
- Design techniques for coordination support

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# The future is service-oriented

- The web is a network to offer services
- A service of A to B is an interaction between A and B that is of value to B
- Services are understandable to business managers
  - they can be costed and valued
- The things that offer services are not understandable to business managers

# Service-oriented coordination architectures

- Shared service centers
  - Used in hierarchies
  - One service provider
  - Fixed small set of consumers
- Value networks
  - Used in value chain automation
  - Many service providers and -consumers
  - Slowly changing set of participants
- Service markets
  - Dynamic networks

- There is no relation between the type of architecture and the type of coordination
- nor between the type of coordination and the desired functionality
- But there is intertwining:
  - Coordination mechanism motivates service architecture
  - Shared goals motivate coordination mechanism

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# Conclusions

- Requirements can be about problems or about solutions
- We need to understand the business problems that can be solved with web technology
  - Coordination problems
- Web architectures are service architectures