Goal-Oriented Requirements Communication in New Product Development

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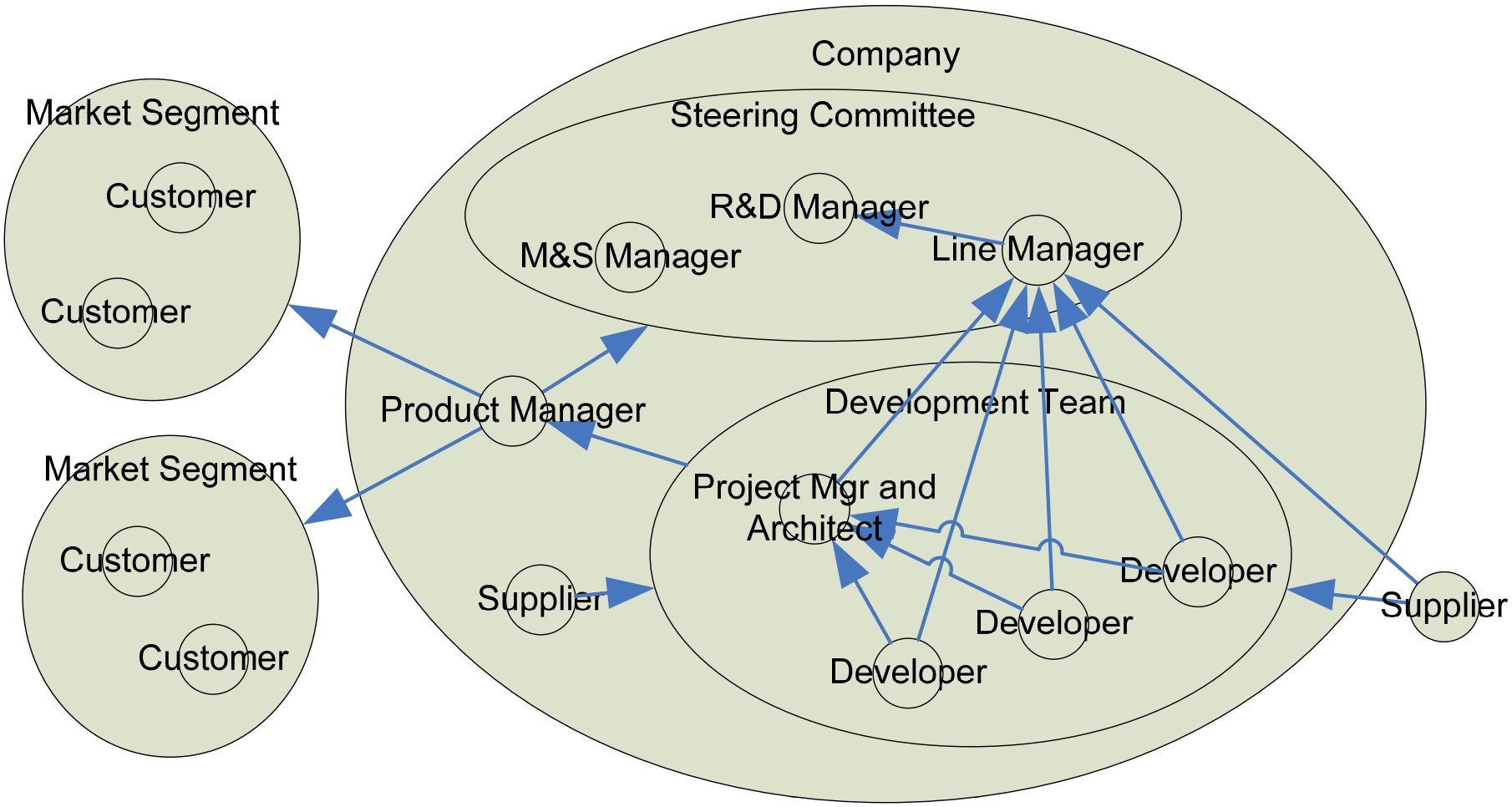
Product Manager in Context: Simplified, Stylized Example



Fricker, Grünbacher: „Negotiation Constellations – Method Selection Framework for Requirements Negotiation“, RefsQ‘08.

Early-Phase vs. Late-Phase Requirements Engineering

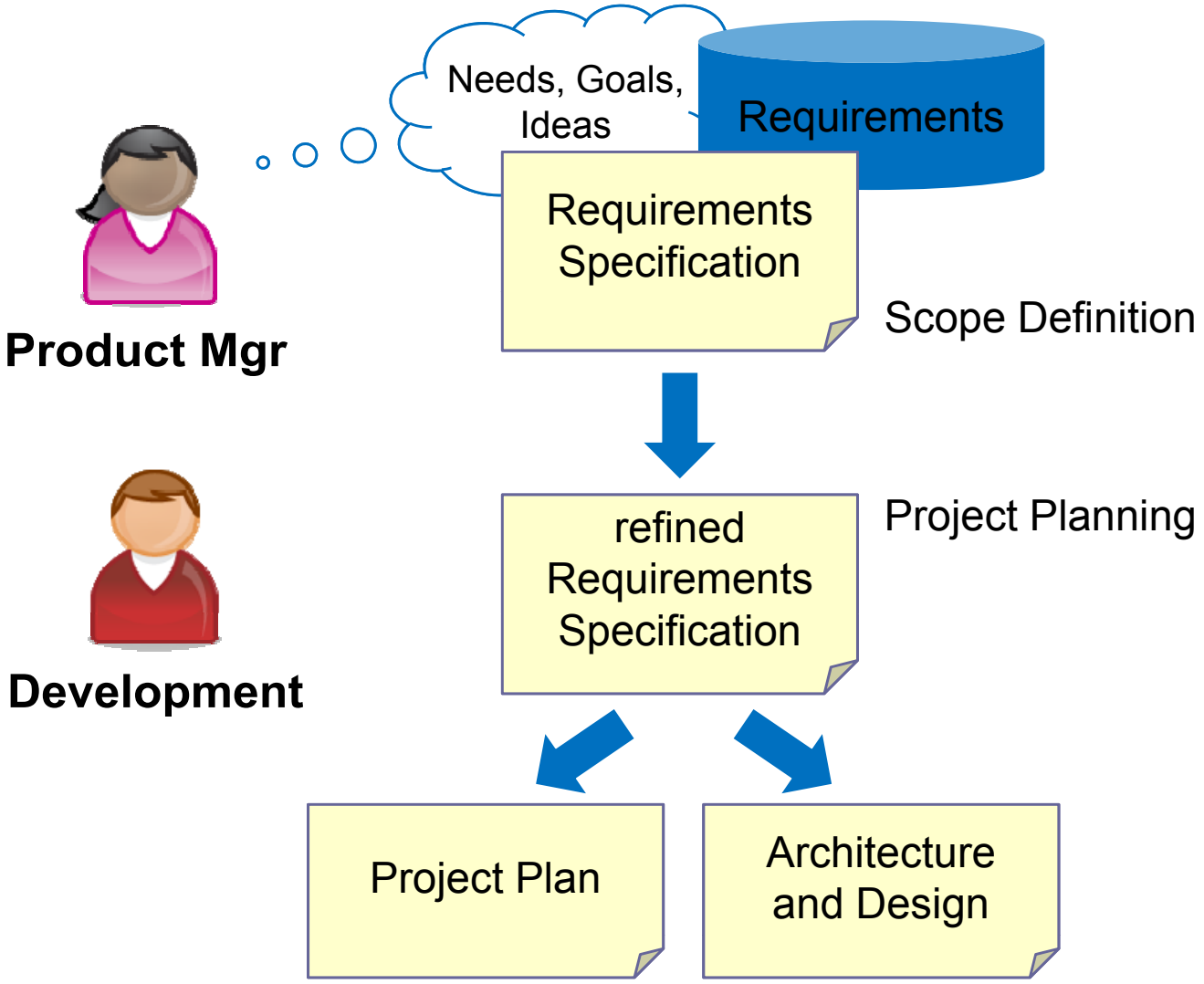
Product Management

- Continuous elicitation and influence of
  - Market needs
  - Product strategy
  - Product innovation
- Planning and steering of
  - Product Development

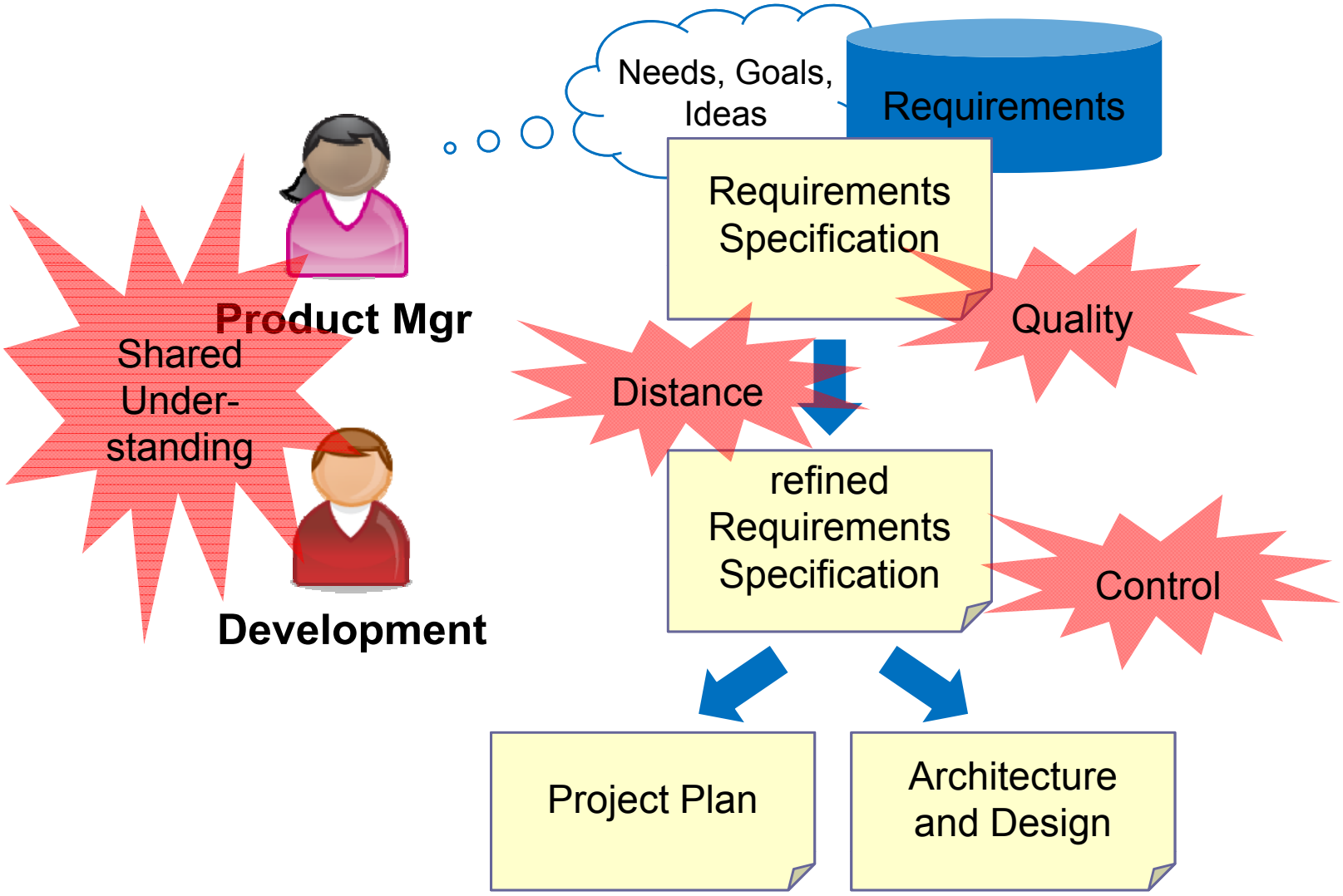
Development Team

- System specification
  - Structure
  - Interfaces
  - Functionality
- Assure quality
  - Product usability
  - Compliance to standards
  - Security
  - ...

Requirements Communication



Requirements Communication

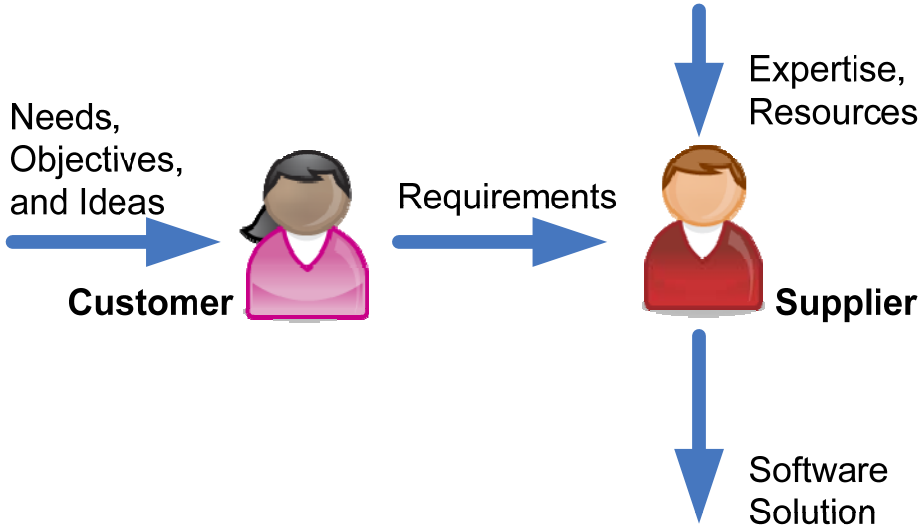


Goal-Oriented Requirements Communication

- Requirements communication
  - Objective: development results to be acceptable
  - Requirements are not perfect
  - Experienced practitioners
  - Not in a tendering situation
  - Steering and control
    Not: informing, apprenticing, or teaching
- Goal-oriented systems
  - Design approach used in many engineering disciplines
  - Other names: regulation, adaptation, control…
  - Controler: device managing behavior of another device

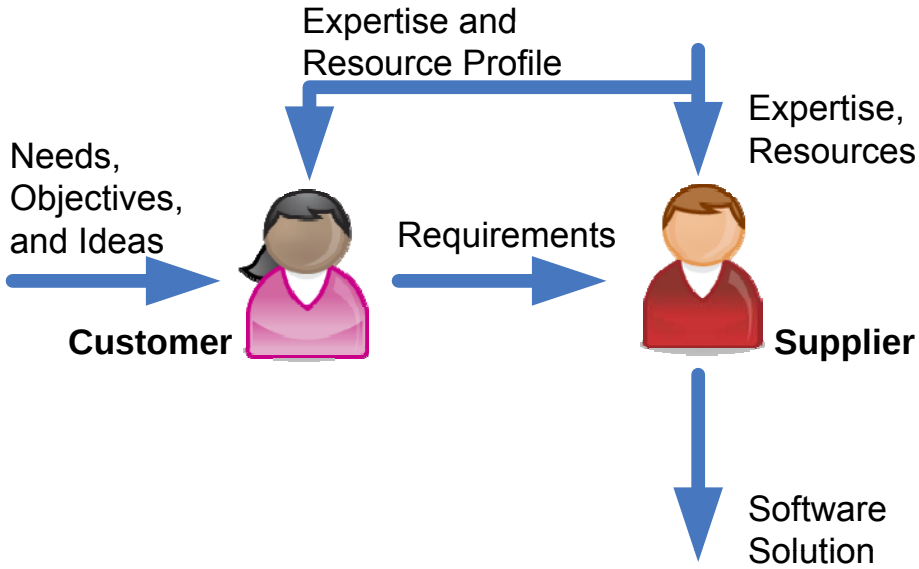
Information-Less Communication Model

- Assure high quality across the board
  - Semantic language analysis to increase understandability
  - Formalization to avoid inconsistencies and ambiguity
  - Other: correctness, completeness, level of detail, verifiability…



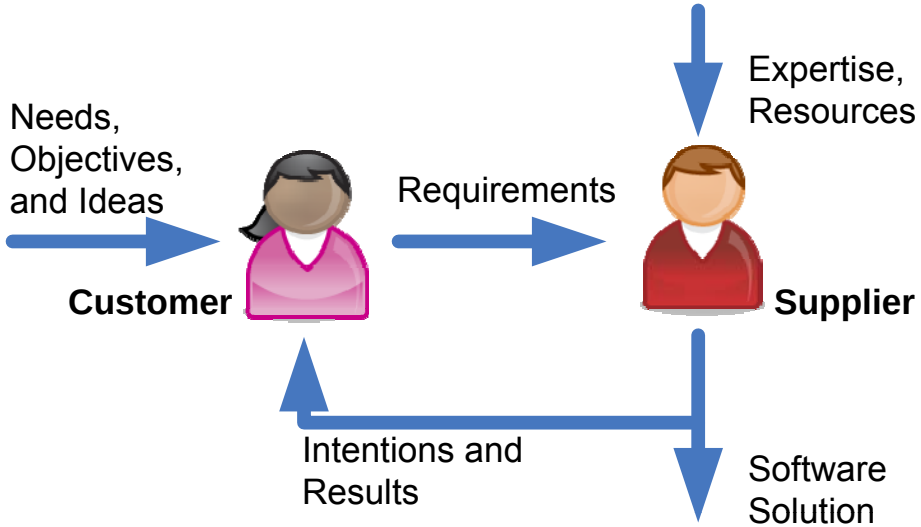
Efficiency and Understandability Increase with Feed-Forward

- Adjust to the supplier profile
  - Refer to known requirements, knowledge, and recources
  - Detailed specification of new requirements
  - Collaborative elaboration of innovations

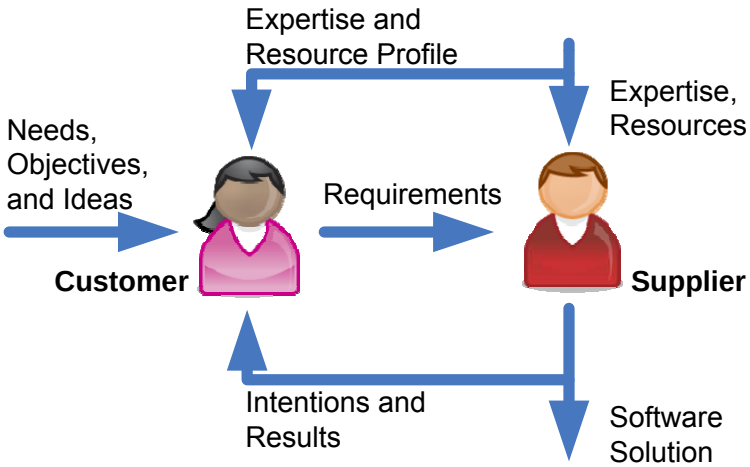


Assurance of Understanding and Acceptance with Feedback

- Check and correct supplier behavior
  - Correct wrong assumptions and misunderstandings
  - Correct unacceptable intentions and results
  - Transfer domain knowledge and business background



Full-Information Goal-Oriented Requirements Communication



- Established quality criteria not satisfied by requirements specifications
- Known development team profile
  - Requirements tailored to receiving team
  - Anticipated understanding maximized
- Feedback sought from development team
  - Realization of requirements known
  - Inadequate solution concepts captured
  - Misinterpretations corrected
- The better the collaboration the more visible the full-information characteristics

Case Study

- Research question
  - What shape does goal-oriented requirements communication take in mature, large-scale industrial product development?
- Product development organization
  - ~ 10 Product managers
  - > 100 R&D employees
- Semi-structured interviews with trusted practitioners
  - Product manager: 20yrs experience
  - Architect: 19yrs experience
- „Good“ requirements specification
  - ~ 500 Requirements

Qualities Achieved Pre-Communication

- Perfect requirements specifications are not an aim
  - *„It is quite often that a bad requirement creates a good solution design anyway.“*

- Requirement qualities

Validity	*„…there shall be a customer demand behind it.“*
Consistency	*„Requirements shall be consistent.“*
Stability	*„…stable for a market release time frame.“*
Importance	Only the most important requirements are put into project scope
Pre-traceability	*„…to provide feedback to originator and to remember rationale.“*
Post-traceability	already-implemented features specified with order-number

italics: quotes from interviews;
regular text: requirements specification

Qualities Achieved While Communicating

- Requirement qualities

Completeness	*„…especially not those that are standard in the business."* *„When the development team proposes a solution they find out that we would need other requirements too."*
Level of Detail	*„I would not go below the competence of the technical specialist."* Innovative requirements are elaborated with collaborative design.
Necessity	*„If these cannot be implemented in time we will evaluate further cuts."*
Correctness	*„Requirements that are changed exist, but are not frequent."*

- Design qualities

Completeness	*„The missing things are usually seen in the design."*
Necessity	*„There is always pressure to having something ready in time. Hence gold-pating always drops off at the end"*
Correctness	*„It happens that we discover incorrect parts of the solution."*

italics: quotes from interviews;
regular text: requirements specification

Trust

- Trust is established through requirements communication
  - *„It is important that the development team believes that they have understood the requirements…“*
  - *„…and that the product manager feels that the team will produce the right solution in time.“*
- Requirements ↔ design traceability contributes to trust
  - *„If I do not know how the various requirements will be implemented, the development team may create the wrong product.“*
  - *„It is necessary that the solution is justified by the requirements.“*
- Shared expectations of effort and timing
  - *„If a proposed implementation is not within cost and time, it may be cancelled.“*

italics: quotes from interviews;

Post-Communication or Not Achieved Qualities

- Requirement qualities improved post-communication

Verifiability	*„…difficult to state acceptance criteria beforehand, as they depend on the design of the solution.“*

- Considered impossible

Unambiguity	*„Impossible, we are not that good in that.“*
Formalization	*„Only if necessary. This is pointing to a solution.“*

- Considered of low importance

Structure	*„A reasonable structure suffices.“*

italics: quotes from interviews;
regular text: requirements specification

Evidence for Goal-Orientation

- Feedforward

Guide development decisions	Referencing of existing development artifacts
Save specification effort	Specification of just enough detail
Increase likelihood of understanding	Collaborative elaboration of innovative requirements

- Feedback

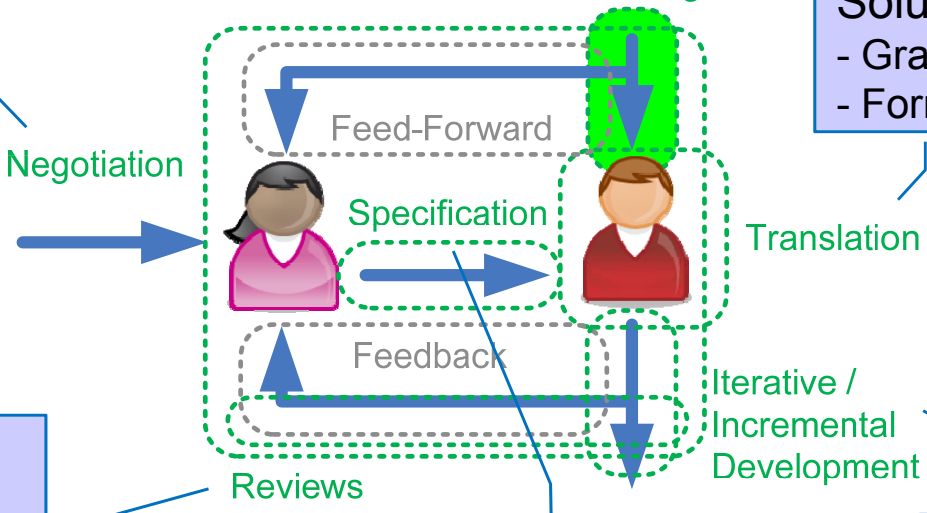
Account for true R&D situation	Development team informs about feasibility
Respond to development interests	Development team shares intentions
Identify misunderstandings	Product manager evaluates planned design
Transfer tacit knowledge	Product manager criticizes planned design
Build trust	Product manager confirms requirements understanding by accepting the justified solution

Relations with Established Knowledge

Collaborative Decision-Making
- Adjusting positions and expectations
- Conflict resolution and value creation
- 1 out of 16 negotiation constellations

Elicitation
- Inquiry cycles
- System analysis
- Collaborative design

Solution-Oriented Requirements
- Graphical system specification
- Formal methods



Reviews
- Assure quality
- Verify acceptance

High-Quality Specification
- Understandability
- Testability
- Completeness

Agile Development
- Small increments
- On-site customer

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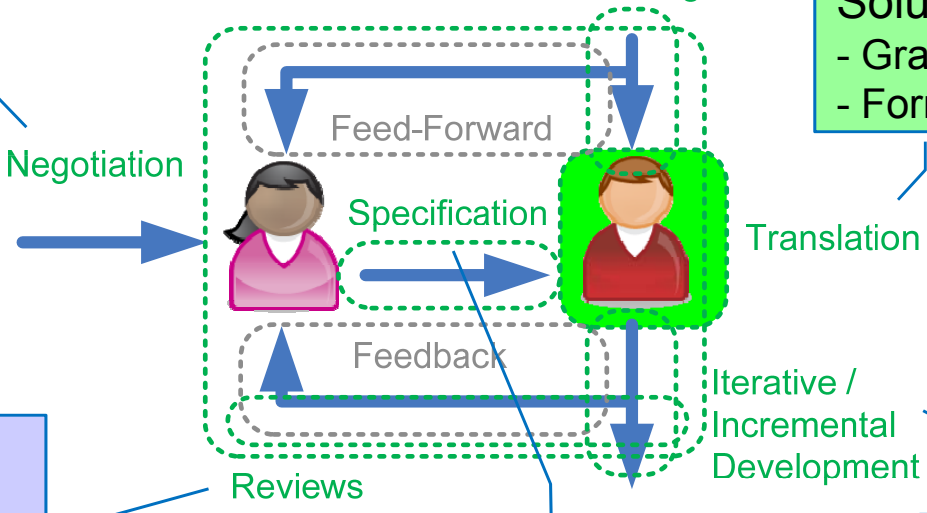

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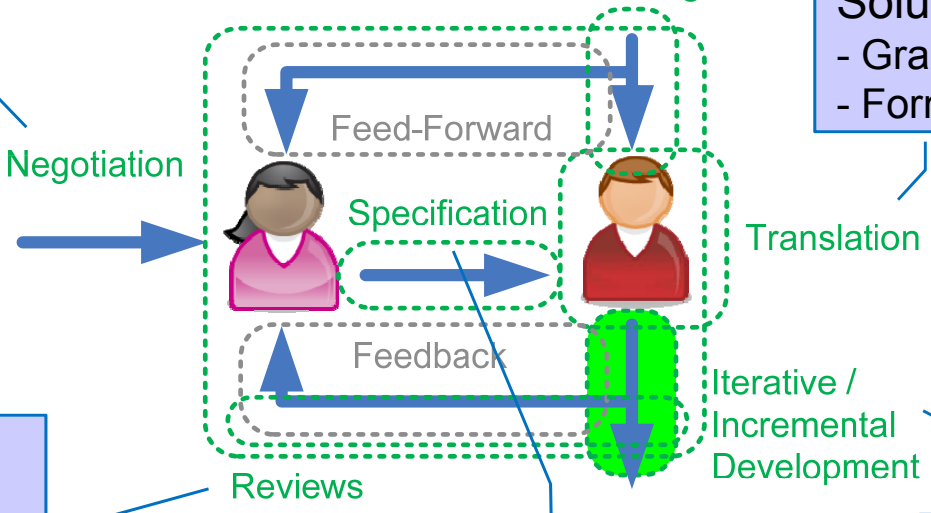

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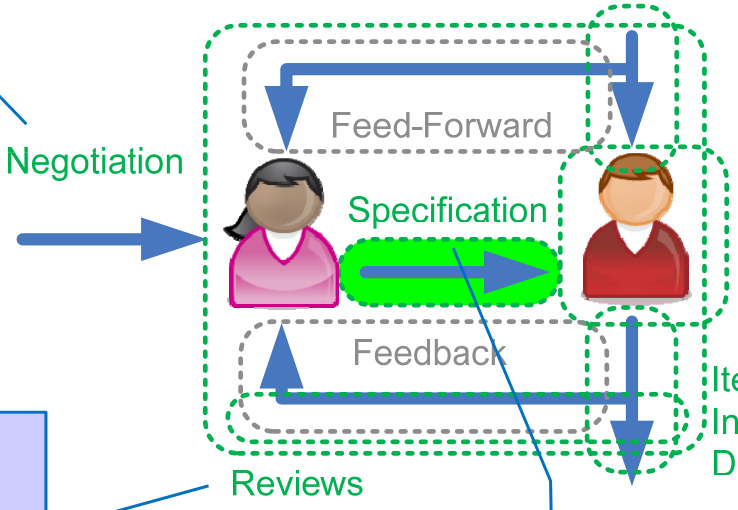

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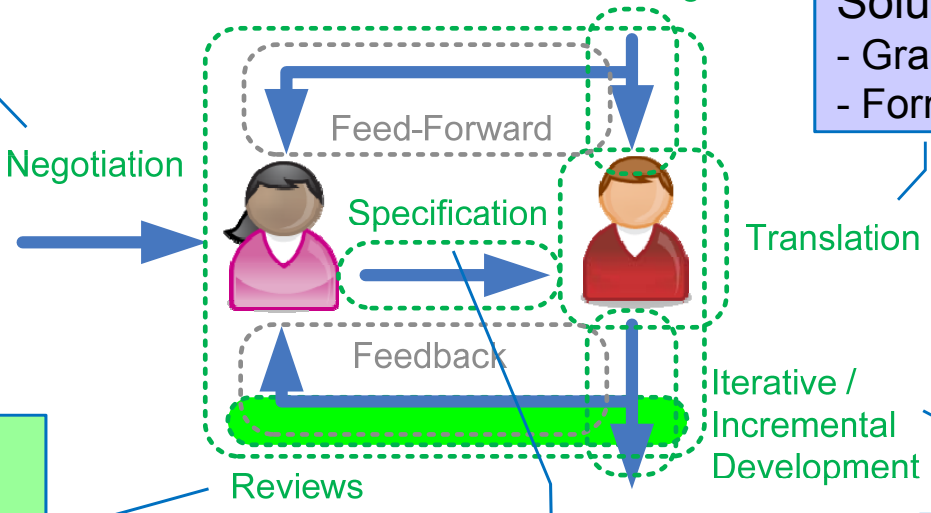

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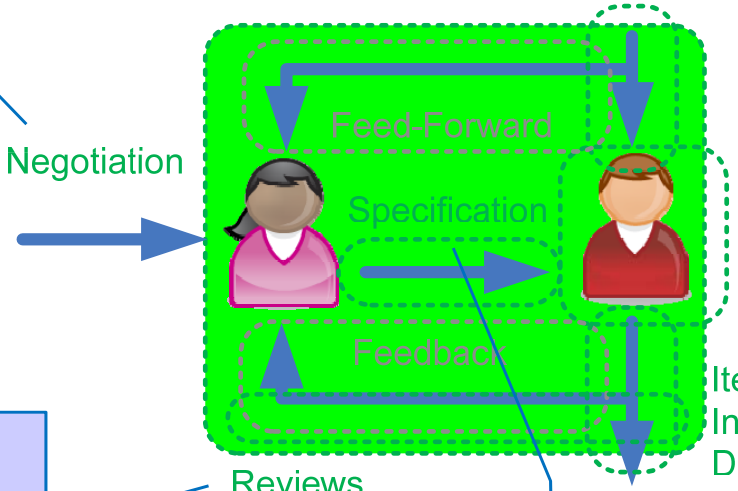

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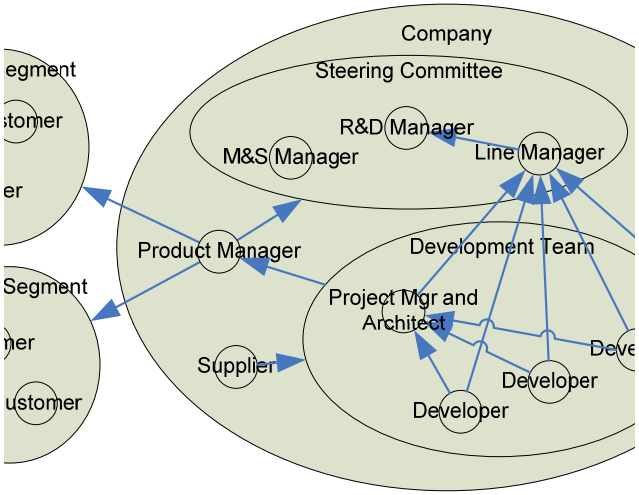
Contributions

- Goal-oriented systems model for requirements communication
  - Stand on shoulders of system sciences
- Four paradigms for optimizing requirements communication
  - Information-less: frequently assumed naïve paradigm
  - Feed-forward: increased efficiency and understandability
  - Feedback: checking and correcting understanding
  - Full-information: feed-forward and feedback
- Case study
  - Thinking scheme that enables goal-oriented reqs. communication
  - Benefits of feedforward and feedback
- Established RE knowledge put into perspective
  - Activities supporting hand-over of requirements

Validity and Further Research

- Research stance
  - Constructivist case study
- Validity
  - 2 interviews: trusted, experienced collaborating practitioners
  - 1 artifact analysis: good requirements specification
  - Confirmation of research results by practitioners
- Open questions
  - Generalization
    - When can the model be applied, when not?
  - Comparison
    - Similarities of and differences between methods
    - Impact on requirements understanding, effort, social relationships

Summary



- Interface between product management and development
- Requirements communication: balancing of
  - Capacity for handling early-phase RE
  - Requirements specification quality
- Goal-oriented systems
  - Reduced dependence on requirements specification quality
  - Wholistic view on requirements communication
  - Empirical evidence for usefulness
- Product management
  - Can steer and build on expertise...
  - ...instead of teaching and fighting late-phase problems