Incremental method evolution

Session 9
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Universiteit Utrecht

Who am I?

- Inge van de Weerd, married, two sons

- 2005: MSc Business Informatics (UU)
- 2009: PhD Dept. Information & Computing Sciences (UU)

- 2009-2018: Assistant professor at UU and VU Amsterdam (Business Administration; Computer Science)

- 2019: Back to the UU with entire research group: Business Process Management & Analytics

What do I do?

- Teaching
  – SMI (BSc, formerly known as SMOI)
  – Business Process Management (MSc)
  – Foundations of Information Systems (MSc)

- Research
  – Understanding organizational and user behavior in the context of adoption, using and managing information systems.
  – Business process management, workarounds, robotic process automation

Agenda

- Introduction to incremental method engineering
- Method increments: the theory
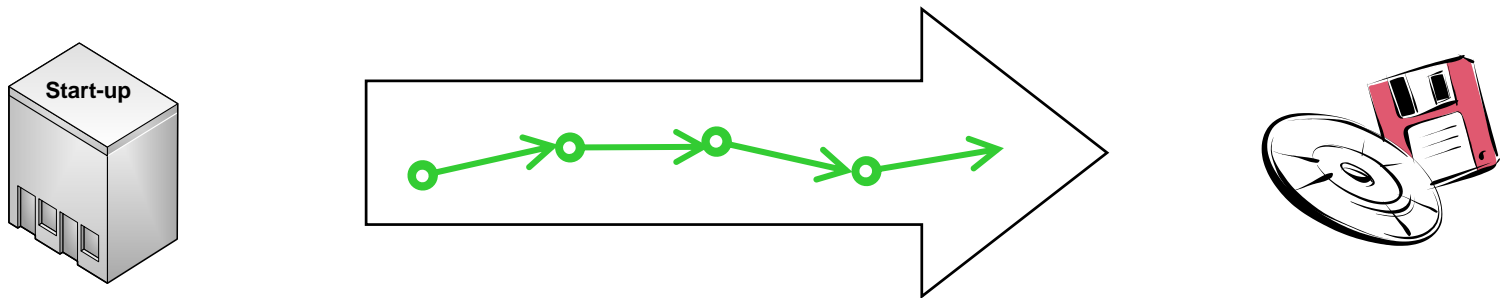- Method increments: the practice

Method change

- Inevitable - adapting to new organizational circumstances: growth, acquisition, restructuring, product/service diversification, …

- Especially in software development: methods used in developing even successive versions of the same software vary considerably → existing methods are normally adapted to meet the increasingly varying needs
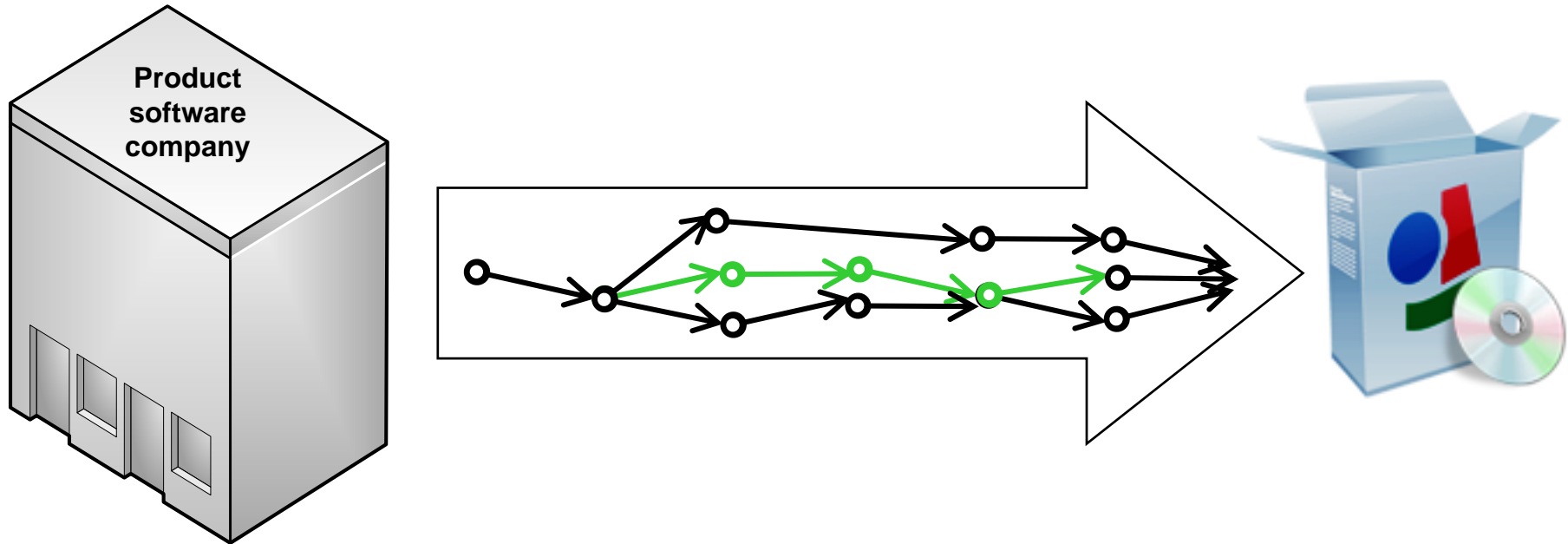
Product software companies

Start with a simple process when they are a start-up

Capability growth

Gradually more extensive processes are added dependent on:
- product and services
- development culture
- internal maturity
- external stakeholders

Why evolutionary?

- The meta-modeling process (done by method engineers) and modeling process (done by developers) are normally separated in time and space → time-space disjuncture

- Several scholars assume a sharp time-space disjuncture and "a 'one shot' blueprint method engineering approach"

- However, in practice, these two processes co-evolve, are intertwined and interdependent, resulting in evolutionary method engineering processes

Rossi et al. (2004)

Incremental method evolution

- Evolutionary change vs. revolutionary change

- In practice it is the natural way for evolving from current method to a new method

- Fundamental way to reduce risk on complex process improvement projects

Agenda

- Introduction to incremental method engineering
- Method increments: the theory
- Method increments: the practice

The theory

Concepts for Incremental Method Evolution:
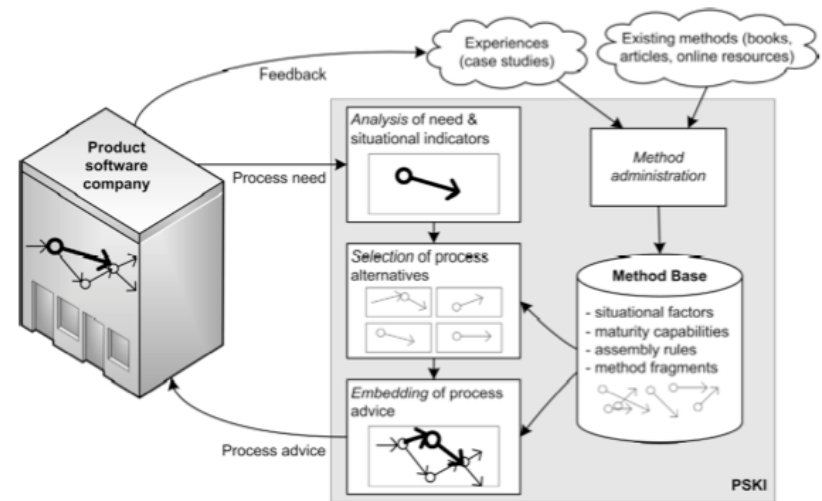**Empirical Exploration and Validation in Requirements**
Management

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Context

- Specific research was part of my PhD research → developing a product software knowledge infrastructure

- Research question: How can product software companies improve their software production methods in an evolutionary way, using method fragment increments?
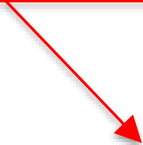
Research approach

Inductive approach (from practice to theory)

1. Explorative case study (HRM company) to identify method increment types and determine root causes
2. Generalizing & formalizing of method increments (theory)

(Partly) deductive approach (test theory in practice)

3. Case study (Baan) to validate method increment types, root causes

Described in both articles that were assigned for today

Explorative case study

- HRM company

- Method:
  - Two explorative interviews with product manager
  - Document study, requirements management tool study

- Goals:
  - Derive a list of method increment types that occur during method evolution
  - Determine an initial set of root causes that may lead to process improvement alternatives

Method increments

Definition

A method increment is an adaptation of an existing method resulting into a new method in order to improve the overall performance of a method

- Examples that were found in the case study:
  - Addition of a phase
  - Removal of a deliverable
  - Change of an activity
  - Addition of a chapter in a deliverable
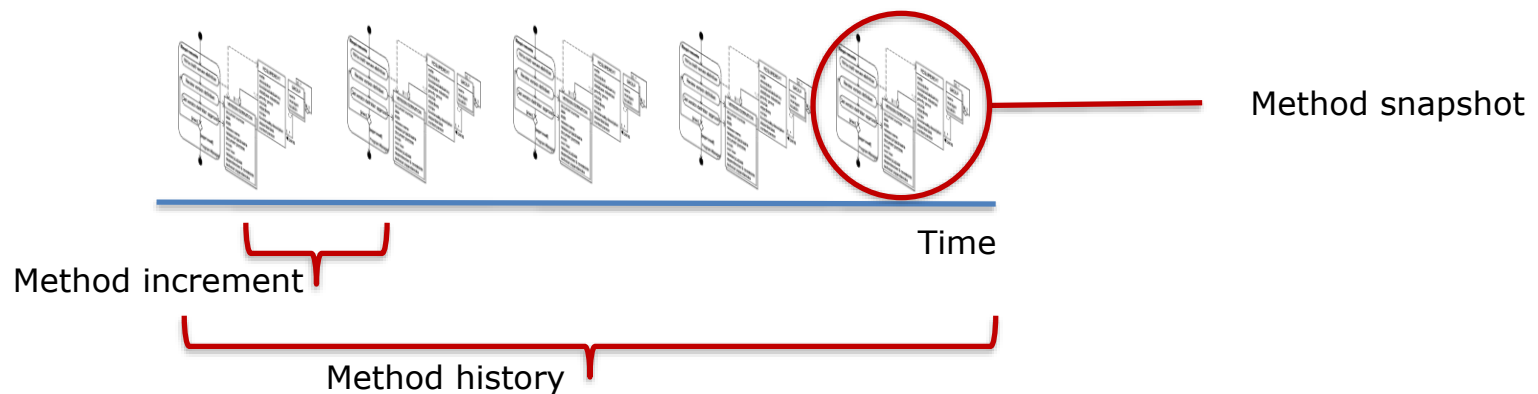 - Addition of a property in a spreadsheet

Formalizing method evolution
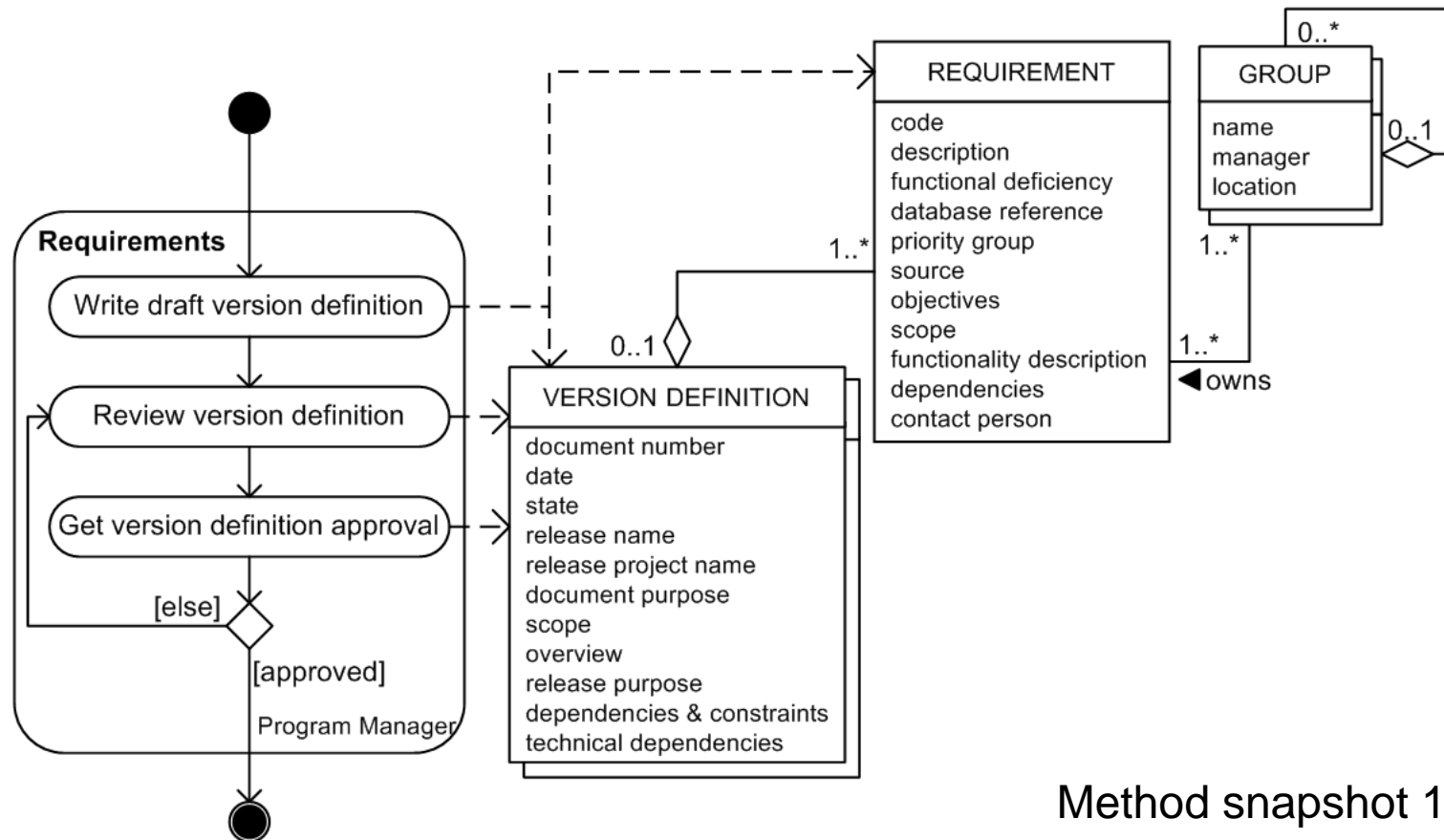
Method Snapshot

A method snapshot is a model of the method that was valid at a certain moment in time : M_t

Method History

A method history is a set of method snapshots in a subsequent series of moments in time: $\{M_t\}_{t=1,2,\ldots n}$

Method snapshot

Time

Method increment

Method history

Example: starting method – M_1
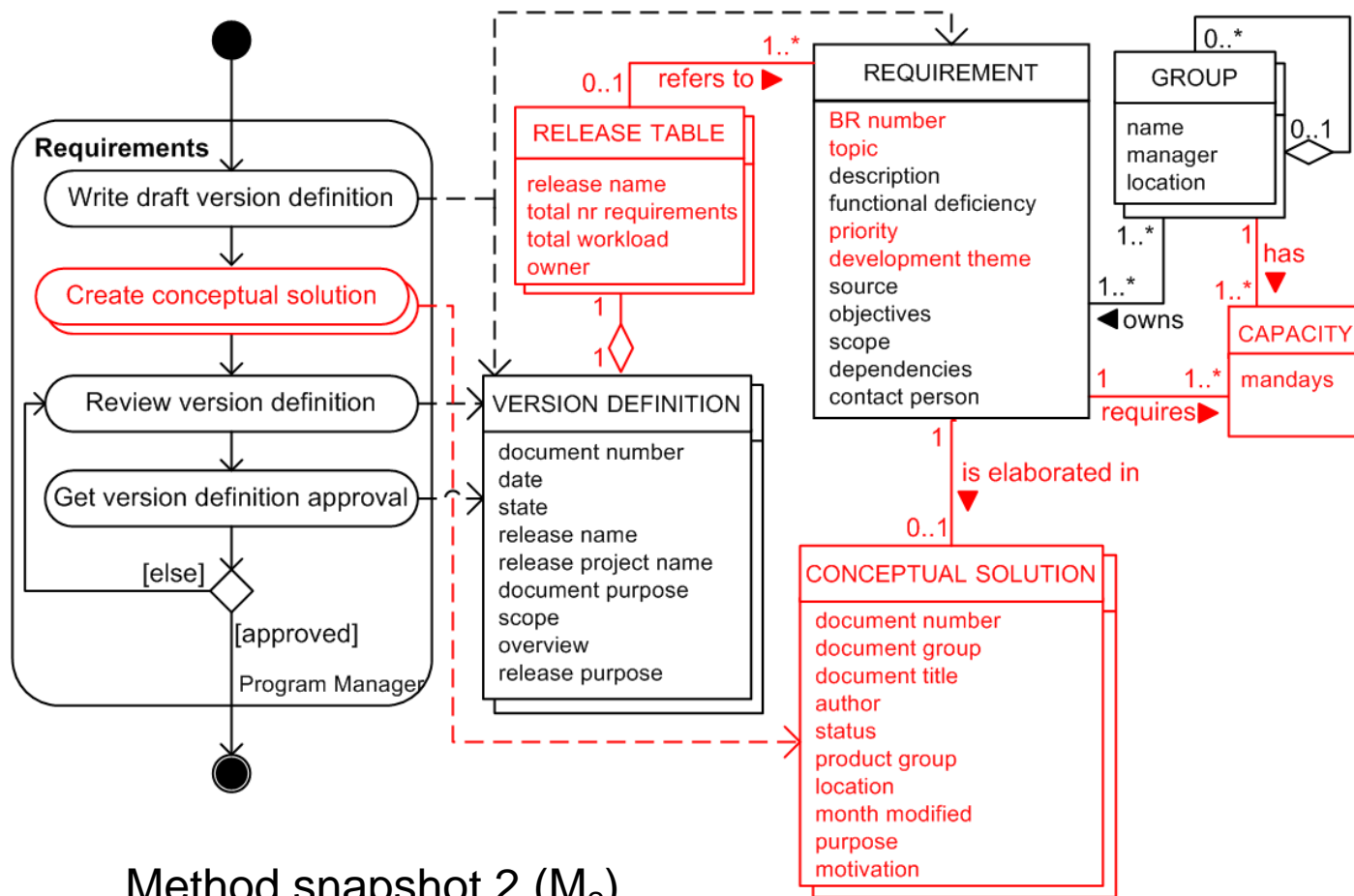

Method snapshot 1 (M_1)

Problems with M_1

- Problems
  - Version Definition too big
  - Not enough info for development
  - No capacity data
  - Version Definition is not a decision document

- Solutions per problem
  - Removal of Requirements info from Version Definition
  - Introduction of Conceptual Solution document
  - Capacity in Release table
  - Introduction of a Release Table

  → Changes in M_2

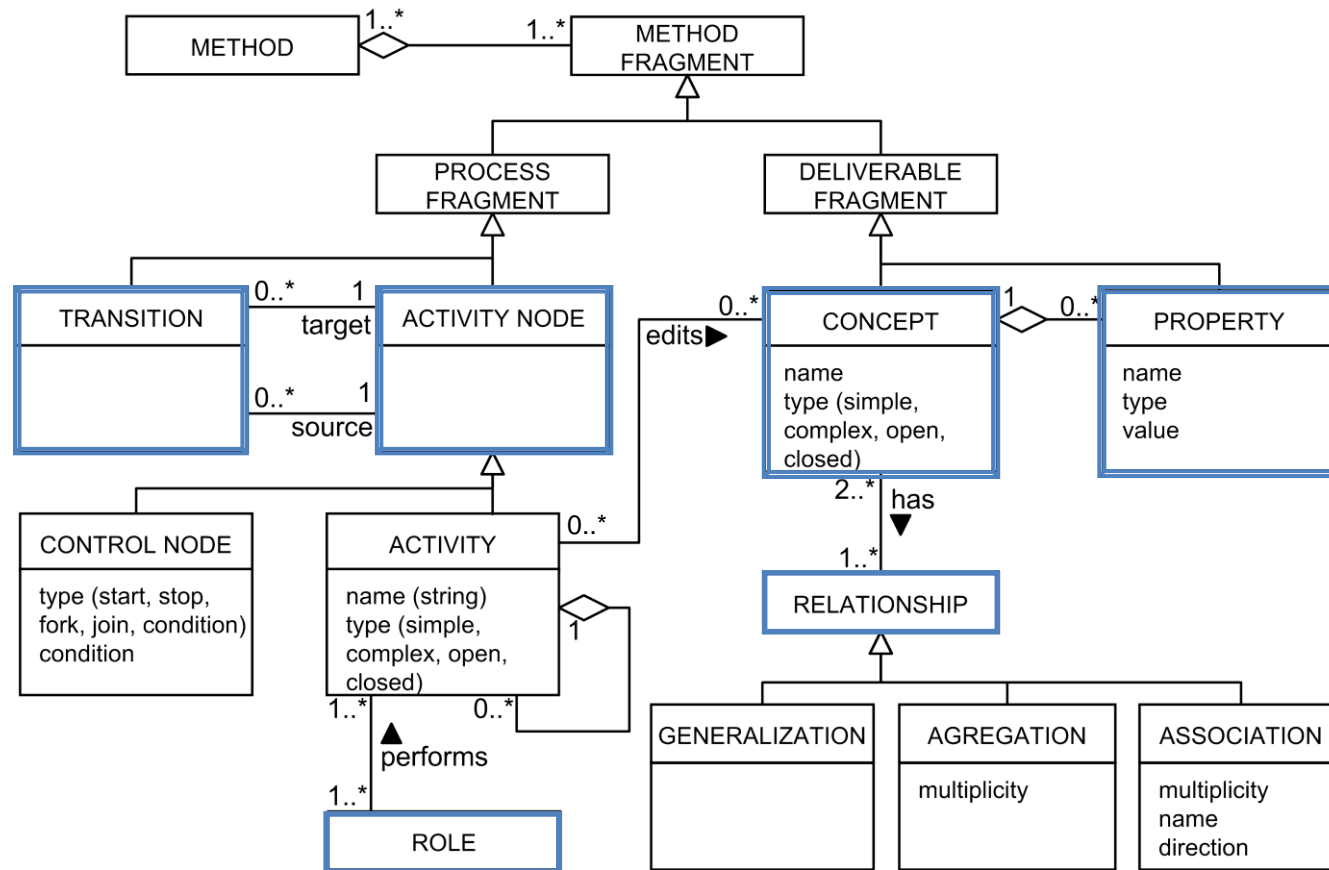# Method increment – M_2

Method snapshot 2 (M_2)

Elementary increment types

- A method increment consists of a series of elementary method increments.

- Elementary method increments are:

  - Introduction of a concept, property, relationship, activity node, transition, role

  - Modification of a concept, property, relationship, activity node, transition, role

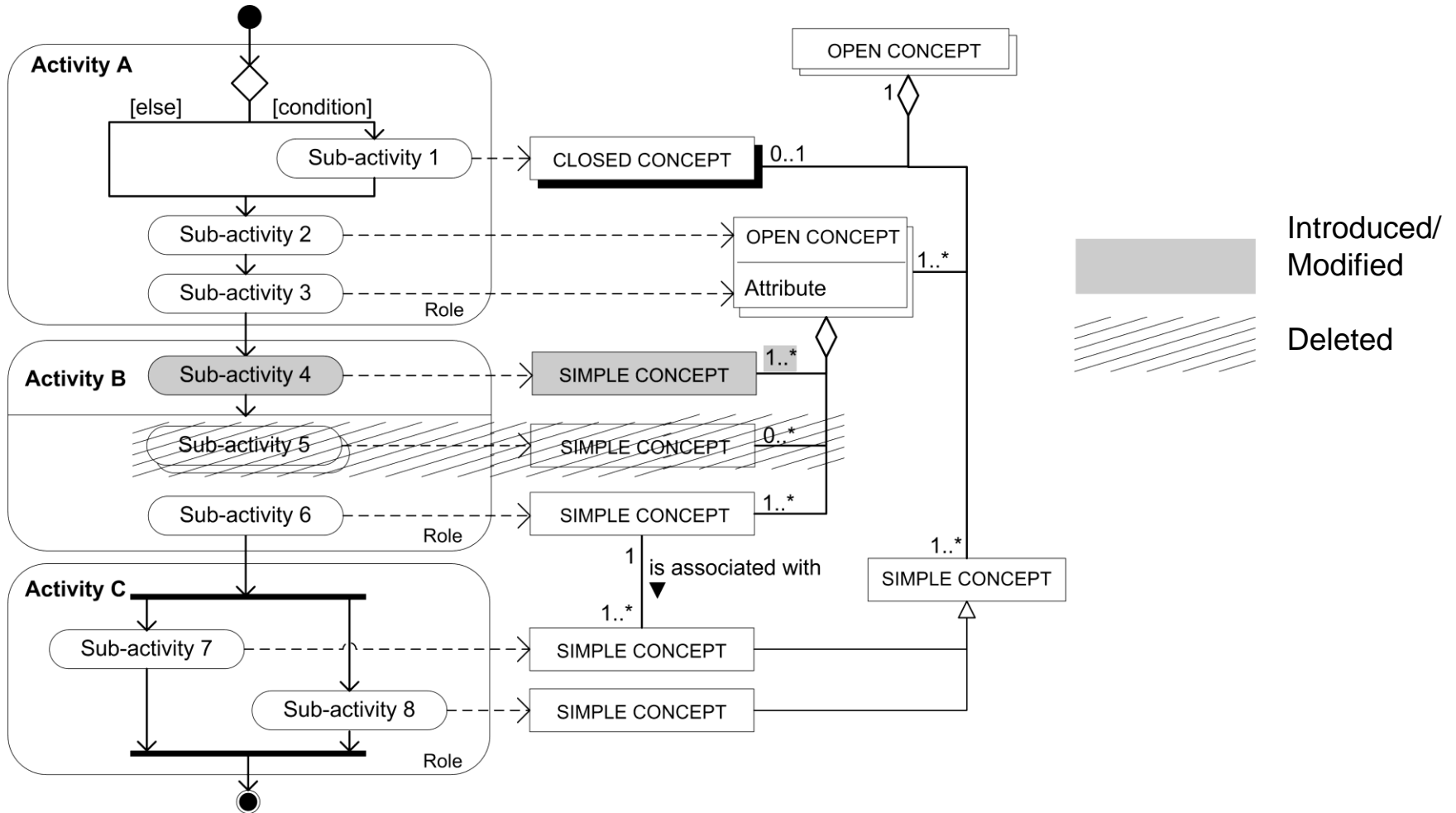 - Deletion of a concept, property, relationship, activity node, transition, role

Meta-model of a PDD

All method increments are based on modifications expressed in a PDD.

Visualization of an increment

Agenda

- Introduction to incremental method engineering
- Method increments: the theory
- Method increments: the practice

Retrospective case study

- At Baan Company, independent software vendor in ERP

Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infsof

Incremental method evolution in global software product management: A retrospective case study ☆

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ARTICLE INFO

ABSTRACT

Company growth in a global setting causes challenges in the adaptation and maintenance of an organization's methods. In this paper, we will analyze incremental method evolution in software product management in a global environment. We validate a method increment approach, based on method engineering principles, by applying it to a retrospective case study conducted at a large ERP vendor. The results show that the method increment types cover all increments that were found in the case study. Also, we identified the following lessons learned for company growth in a global software product management context: method increment drivers, such as the change of business strategy, vary during evolution; a shared infrastructure is critical for rollout; small increments facilitate gradual process improvement; and global involvement is critical. We then claim that method increments enable software companies to accommodate evolutionary adaptations of development process in agreement with the overall company expansion.

Research question
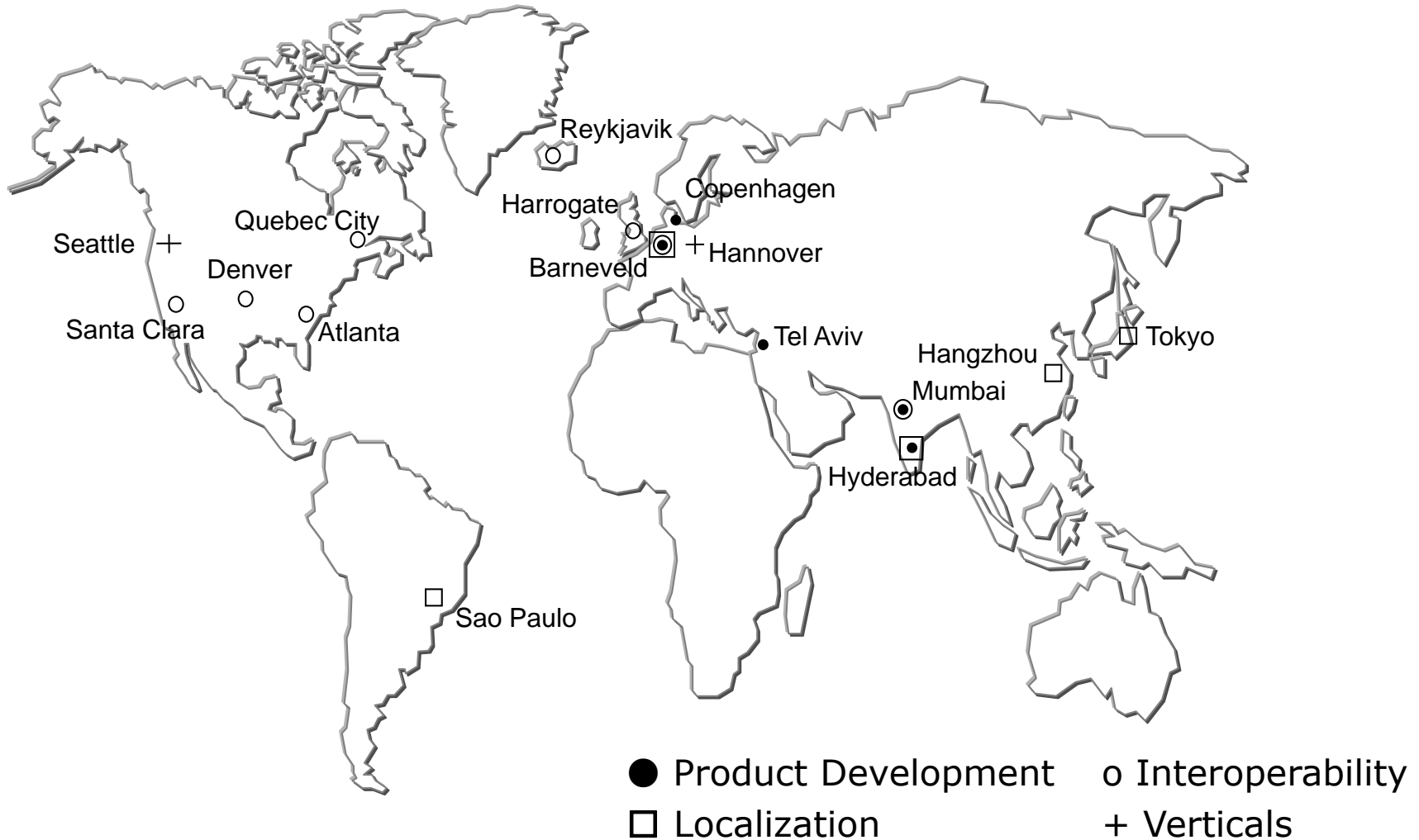
Which method increment types occur in incremental method evolution, and which general increment drivers can be identified?

Context: Baan R&D

Reykjavik

Copenhagen

Harrogate

Quebec City

Seattle +

Barneveld + Hannover

Denver

Santa Clara

Atlanta

Tel Aviv

Hangzhou

Mumbai

Tokyo

Hyderabad

Sao Paulo

● Product Development   o Interoperability
□ Localization   + Verticals

Case study approach

- Interviews
  - Two explorative 3-h interviews were conducted with the Process Engineer
  - Result: PDDs of method evolution between 1994 and 2002
  - Result was cross-checked by conducting 2-h follow-up interviews with five other employees of Baan
  - Based on these interviews, method snapshots of 1994, 1996, 2003, 2004 and 2006 were identified and modeled.

- Document study
  - 26 documents: process descriptions, templates and examples of methods and work products used in the period 1997 until 2006
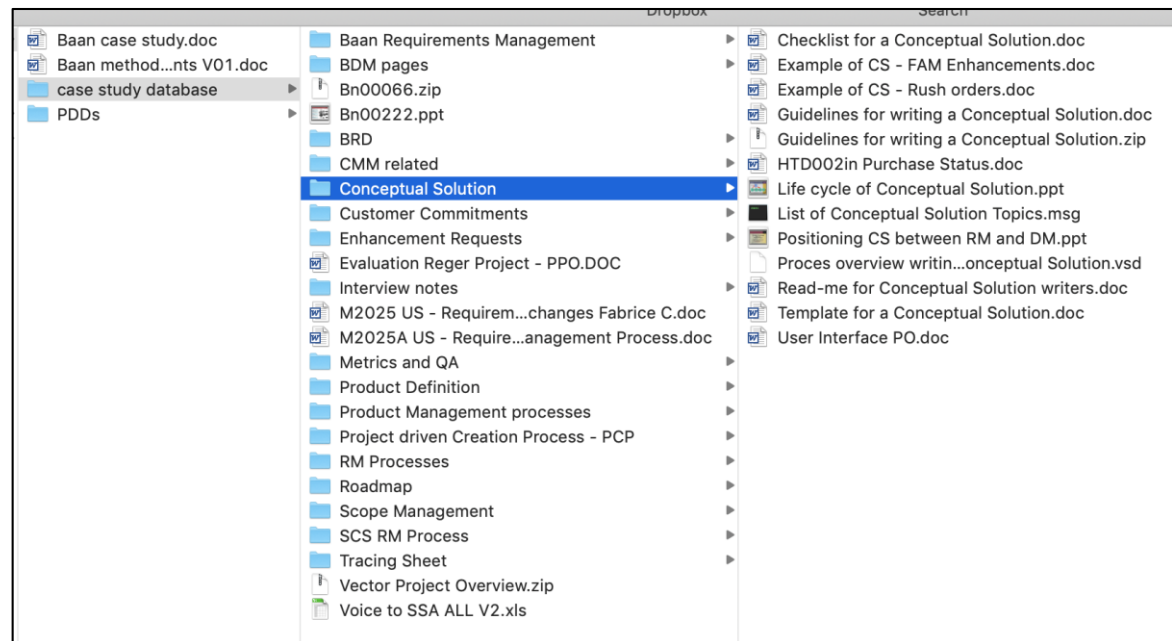 - used to complement and validate the interview results

Case study questions

- Which snapshots can you identify in the method evolution?
- Which methods were used per stage? Which activities can be distinguished?
- Which deliverables resulted from these methods?
- Which process difficulties arose in this stage?
- Why was an increment needed?

Ensuring validity

- Multiple sources of evidence
- Case study protocol
- Case study database
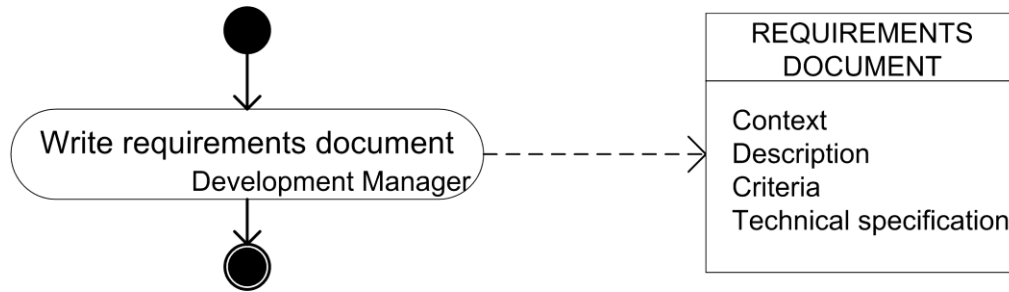
Method increments at Baan

#	Increment	Date	Increment Driver	Locations
1	Introduction requirements document	1994	Development mgt.	NL
2	Introduction design document	1996	Development mgt.	NL
3	Introduction version definition	1998, May	Development mgt.	NL & US
4	Introduction conceptual solution	1998, Nov	Business mgt.	NL & India
5	Introduction requirements database, division market and business reqs	1999, May	Development mgt.	NL & India
6	Introduction tracing sheet	1999, July	Certification	NL, US & India
7	Introduction product definition	2000, March	Departm. interfacing	NL
8	Introduction customer commitment process	2000, April	Business mgt.	NL & US
9	Introduction enhancement request process	2000, Sep	Departm. interfacing	NL & India
10	Introduction roadmap process	2001	Departm. interfacing	NL
11	Introduction process metrics	2002, Aug	Certification	NL & India
12	Removal of prod.families & cust. commitment	2003, May	Business mgt.	US
13	Introduction customer voting process	2004, Nov	Business mgt.	US
14	Introduction master planning	2006, Oct	Development mgt.	NL

Increment drivers

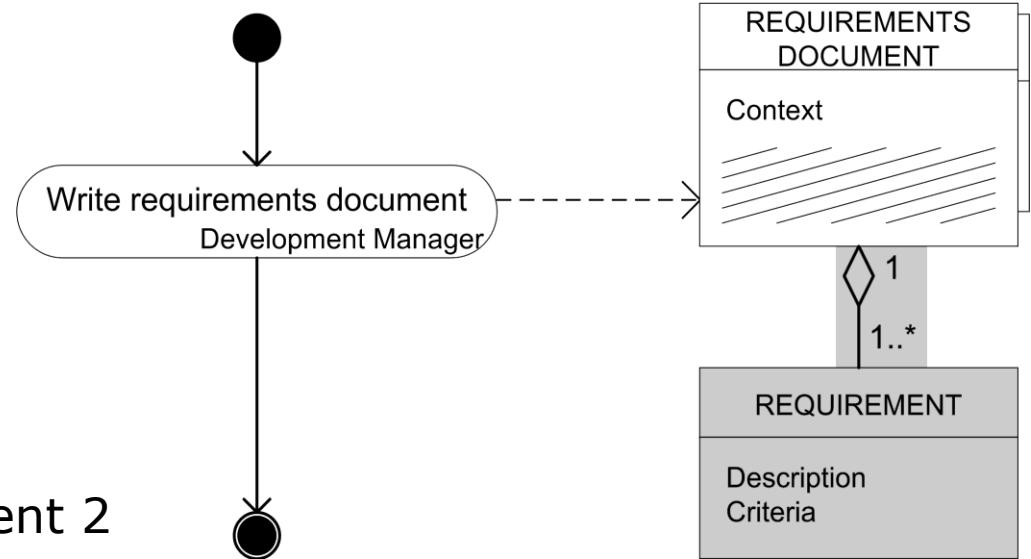- Development management: The growth of the development effort requires that the role of the product manager is established, with expanding responsibilities for requirements management and release planning.

- Business management: The change of corporate business strategy requires process changes.

- Departmental interfacing: Other departments, such as marketing and customer services, require process adaptations for smooth interoperations and performance improvement.

- Certification: The ambition to achieve higher maturity levels in CMMi requires the implementation of certain process extensions, although those processes may not strictly speaking be critical to the business.
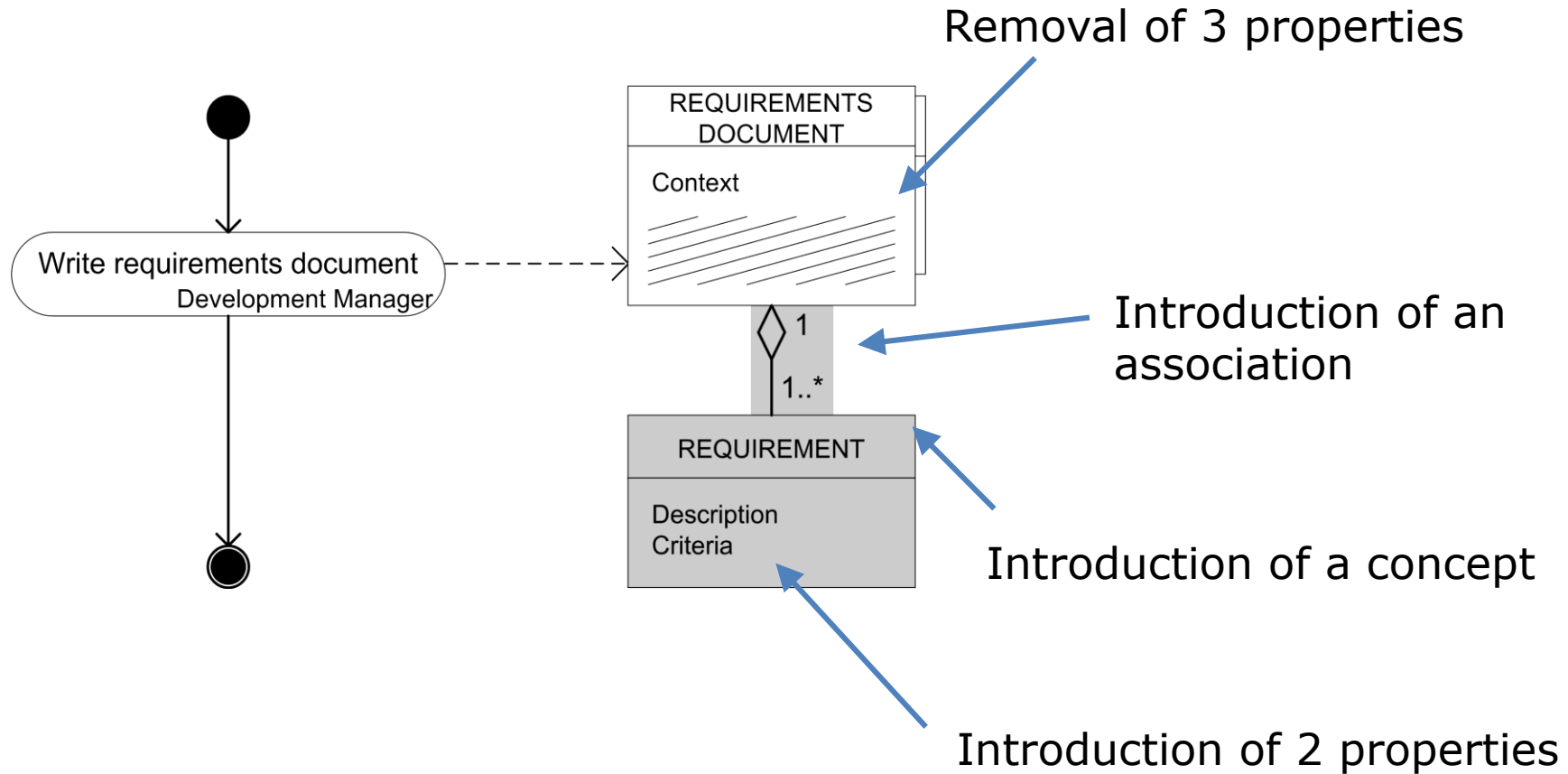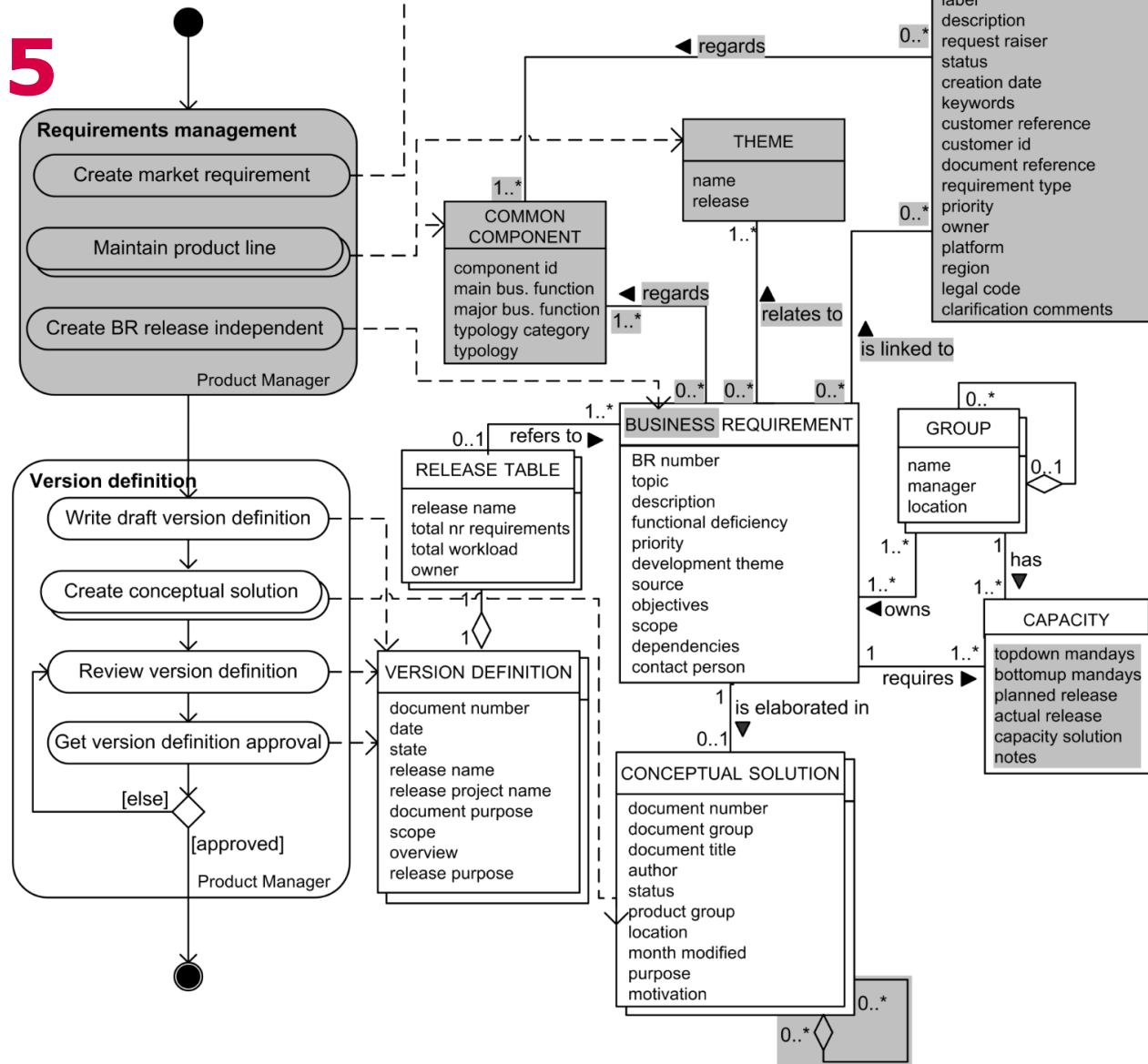
First changes

Method increment 1

Method increment 2

Increment 2

Removal of 3 properties

Introduction of an association

Introduction of a concept
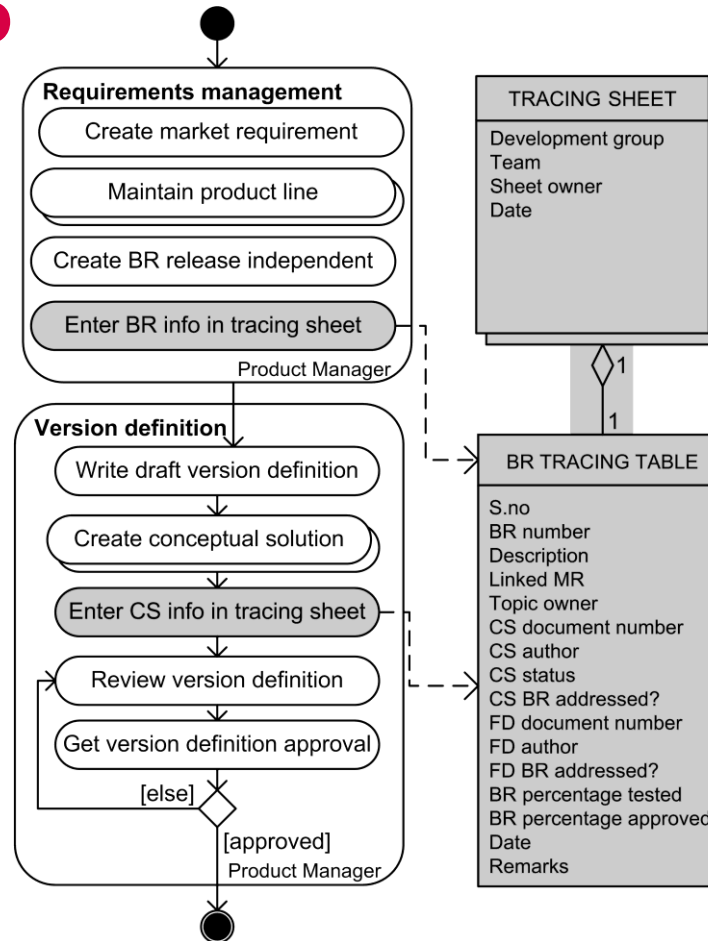
Introduction of 2 properties

Increment 5

1. New phase: Requirements Management
2. Different handling of Capacity
3. Themes and Common Components,
4. Introduction of Market Requirements

Increment 6
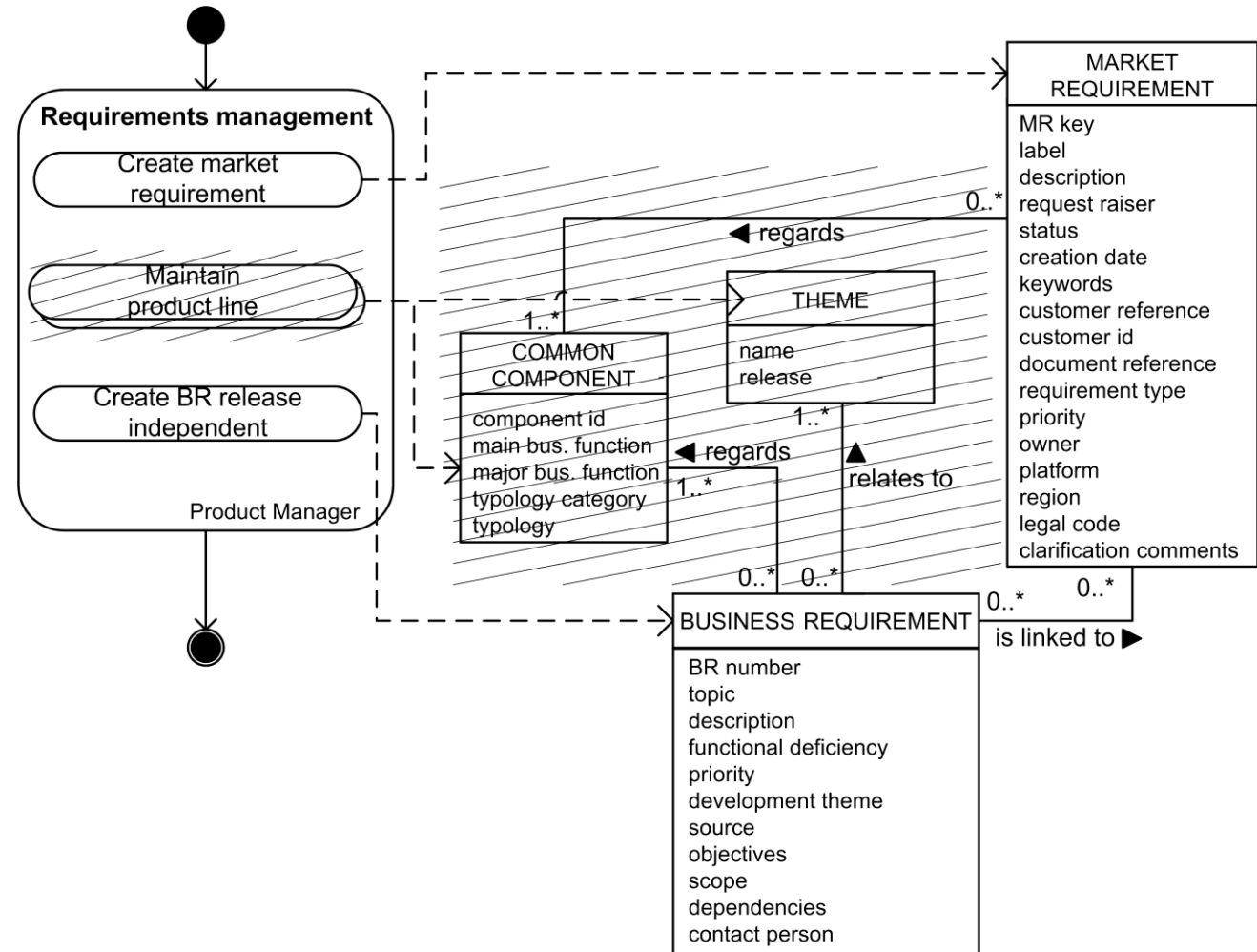
Addition of Requirements Tracing

Tracing sheet example

Dev. Group	ERP
Team	Barneveld
Sheet Owner	Bovenkamp
Date	7-Apr-2000

				Conceptual Solution		
S.no	BR no	Description	Linked MR	Topic Owner	Doc. No.	Author
1	BR1-10075	Hours Accounting	MR1-100934	Johnson	DO994A US	Burnet
2	BR1-10092	Hours budgetting	MR1-100954	Johnson	DO996A US	Burnet
3	BR1-10072	User support	MR1-100824	Jansen	DO987B NL	Jansen

Increment 12

Conclusions (1)

Analysis of method increments:

	Concept	Property	Relationship	Activity node	Transition	Role
Introduction	17	147	17	24	21	2
Modification	2	10	2	2	0	0
Deletion	3	38	5	2	1	0

- Properties are most often inserted, modified or deleted
  - As side effect of another, more essential, change in the method
  - Easy to implement withoud changing method rationale

- Method fragments inserted regularly, but not often deleted

- 'Role' is the method fragment that changes the least

Conclusions (2)

- Increment drivers vary during evolution. We identified four:
  - Development management
  - Business management
  - Departmental interfacing
  - Certification

- Several lessons learned regarding global software product management.
  - Out of scope for this talk, read the paper if you are interested.

QUESTIONS?

References

Rossi, M., Ramesh, B., Lyytinen, K., & Tolvanen, J. P. (2004). Managing evolutionary method engineering by method rationale. Journal of the Association for Information Systems 5(9), 356-391.

Weerd, I. van de, Brinkkemper, S., & Versendaal J. (2007). Concepts for incremental method evolution: empirical exploration and validation in requirements management. *Proceedings of the 19th International Conference on Advanced Information Systems Engineering, LNCS 4495*, 469–484.

Weerd, I. van de, Brinkkemper, S., & Versendaal, J. (2010). Incremental method evolution in global software product management: A retrospective case study. *Journal of Information & Software Technology 52*(7), 720-732.