

30. Idea Variation for a Mature Feature Model of the Product

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- 1) Variation in Component Trees and Feature Models
- 2) Systematic Inventive Thinking (SIT) on component trees
- 3) SCAMPER
- 4) Raijkar's Hexagon

Obligatory Literature

- ▶ Kwanwoo Lee, Kyo C. Kang, and Jaejoon Lee. Concepts and guidelines of feature modeling for product line software engineering. Lecture Notes in Computer Science, 2319:62--78, 2002. Good overview on feature models
- ▶ Alexander Grots, Margarete Pratschke. Design Thinking – Kreativität als Methode. Marketing Review St. Gallen, April 2009, Volume 26, Issue 2, pp 18–23
 - DOI: 10.1007/s11621-009-0027-4
- ▶ Drew Boyd (Autor), Jacob Goldenberg. Inside the Box: The Creative Method That Works for Everyone. Profile Books Ltd. 2014.
 - Introduces Systematic Inventive Thinking (SIT)
 - <http://www.sitsite.com/method/>
 - https://en.wikipedia.org/wiki/Systematic_inventive_thinking

Any good business model (also an MVP)
should be improved by new variants or extensions.

Other Literature

- ▶ Don S. Batory. Feature models, grammars, and propositional formulas. In J. Henk Obbink and Klaus Pohl, editors, Software Product Lines, 9th International Conference, SPLC 2005, Rennes, France, September 26-29, 2005, Proceedings, volume 3714 of Lecture Notes in Computer Science, pages 7--20. Springer, 2005.
 - Explains the relationship of feature models and propositional logic.
- ▶ Hans de Bruin and Hans van Vliet. Quality-driven software architecture composition. *Journal of Systems and Software*, 66(3):269--284, 2003.
 - Introduces feature-solution graphs, the bipartite graph between feature trees and product-component trees.

Improving a BMC or Developing a New One?

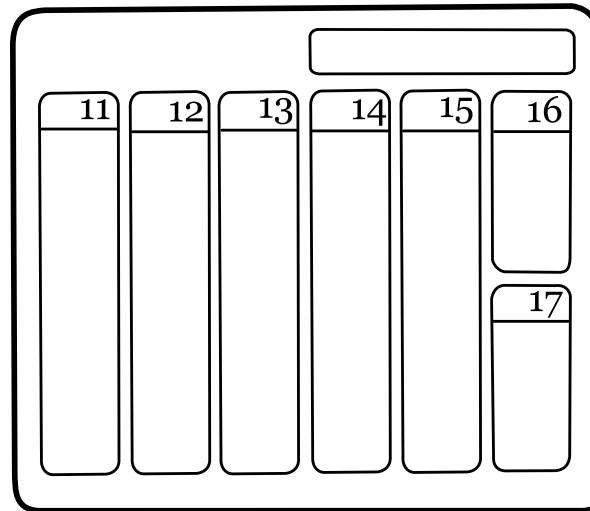
- ▶ When a BMC has been graded and assessed, some its fields may need to be improved or *varied (exchanged)*
 - Variation yields “greener” canvases
- ▶ A *red BMC* or a *red VPC* (failing the assessment) should be changed
 - If there is no successful sticky and viral MVV, there is a problem
- ▶ **Point of Pivot:** [Blank] Sometimes, this does not help and the BMC must be thrown away, and a **plan B** has to be found, another BMC.
- ▶ This chapter introduces systematic ways to change (vary, exchange) the fields of
 - Value proposition
 - Key resources
 - Customer segments



30.1. Canvases for Idea Generation

Shortcomings of Lean Startup from the Viewpoint of Software Product-Line Engineering

No support for consistent modeling of product lines
(no support for feature modeling and feature variation)



No support for canvas modeling
(composition and engineering)

No support for staged feature configuration with suppliers

No support for grading and metrics

Remember the Value of the Variation-Based Business Model (Software Product Lines)

„**Software product lines** represent perhaps the most exciting paradigm shift in software development since the advent of the high-level programming languages. Nowhere else in software engineering have we seen such breathtaking improvements in cost, quality, time to market, and developer productivity, often registering in the order-of-magnitude range.“

„At the Software Engineering institute, we have recorded case study after case study of companies succeeding in one market area with a product line approach, and then taking their production capability to a nearby, under-exploited area of the market, and quickly rising to market dominance in that area as well. And why not? **If you can outperform your competitors by order-of-magnitude levels**, it's hard to imagine what could you keep from becoming a market leader.“

Paul Clements, SEI, in „Software Product Lines in Action“, Springer-Verlag.

Techniques for Idea Generation and Their Canvases

- A canvas can be used for scaling a business

BMC Variation

- For systematic variation of the fields of BMC
- with 4 structured operations of the book „Business Model Generation“

S.I.T. Canvas (Inside-the-box canvas)

- For systematic variation with Systematic Inventive Thinking (S.I.T.)

SCAMMPERR Canvas

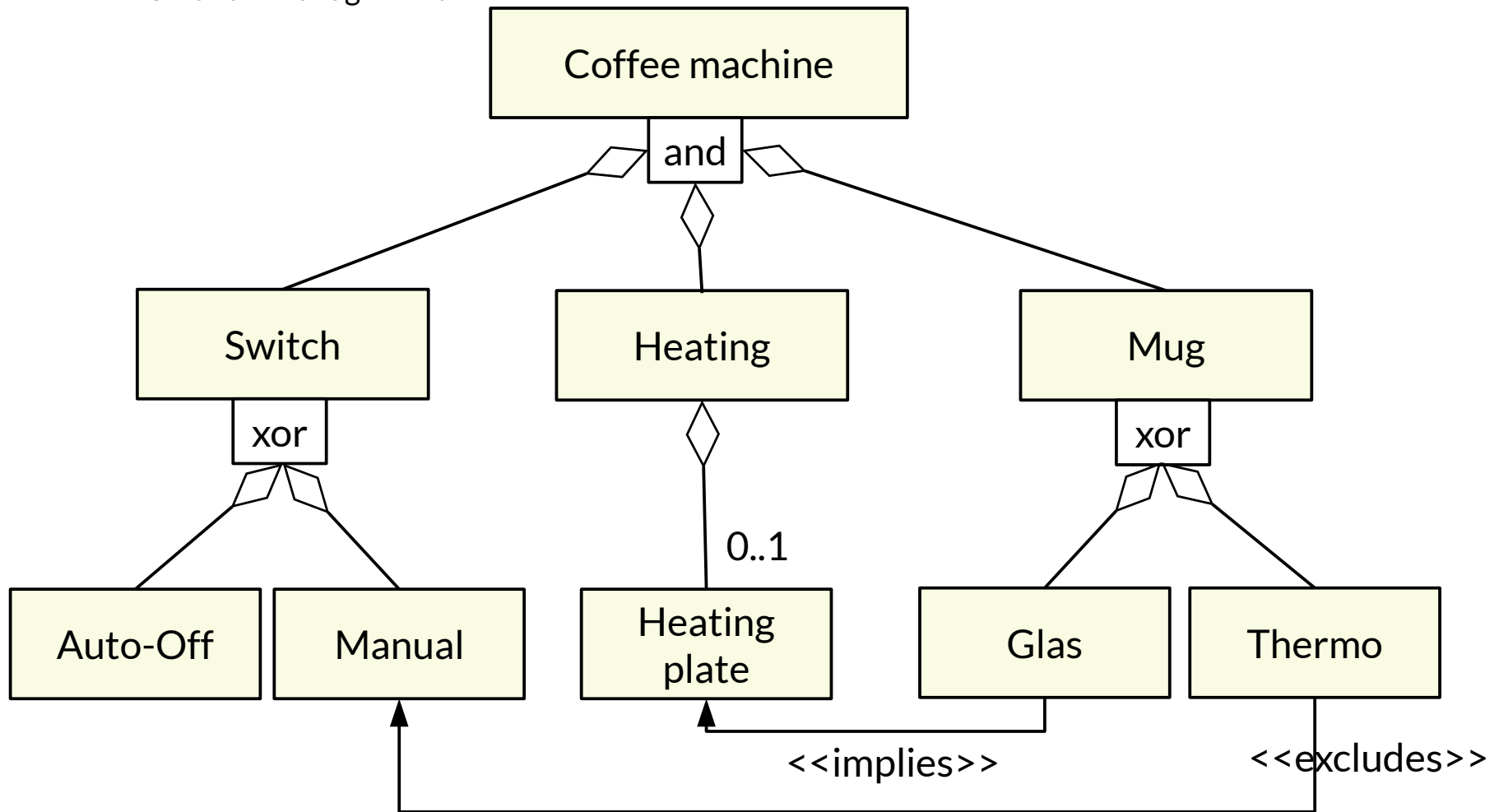
- Structured process for idea variation

Hexagon Variation Canvas

- Structured process for variations
- Priorization of variants
- For scaling

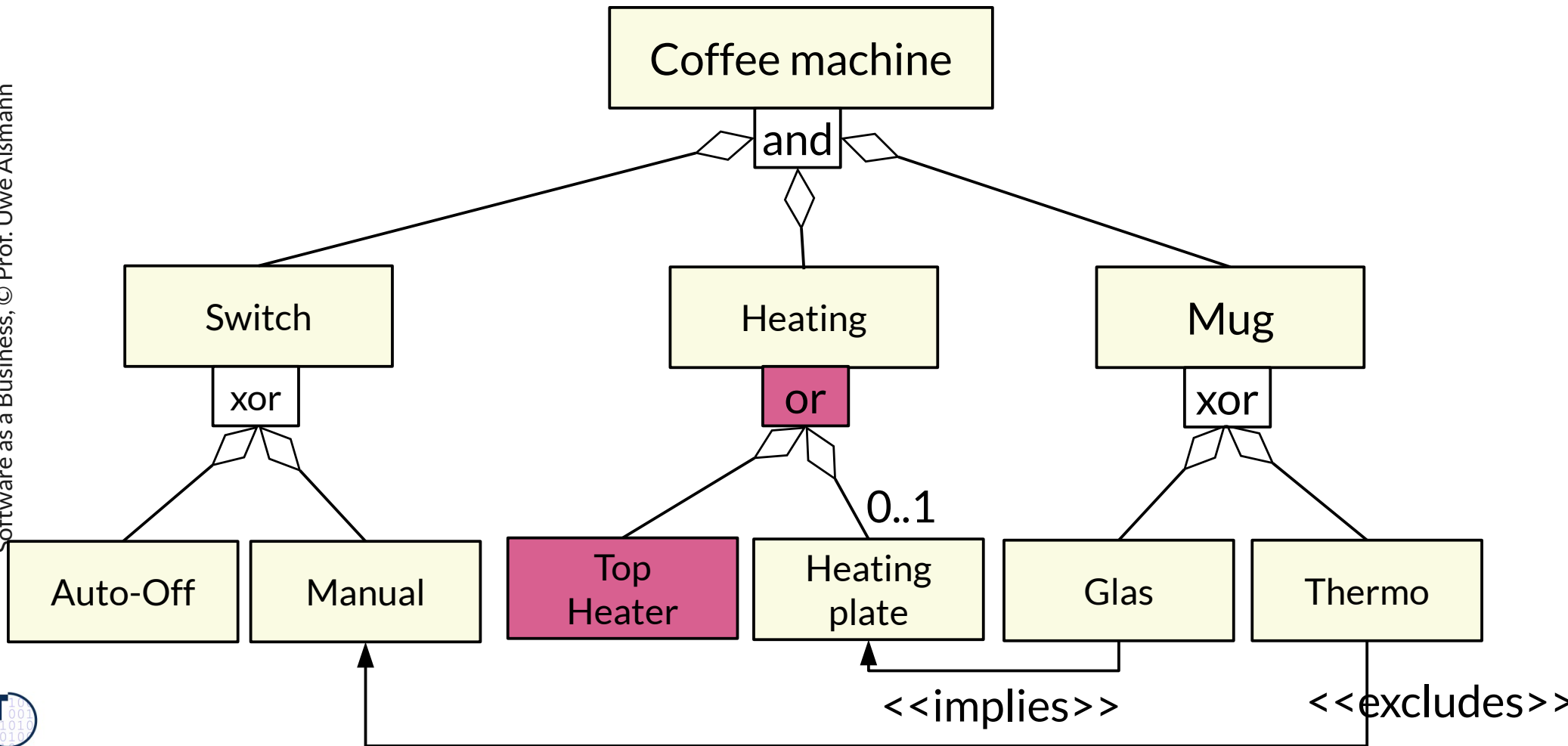
Product Component Tree

- ▶ A **component tree** is a and/or link tree of the components of a product, with options, inclusion and exclusion constraints.
 - It describes a combinatorial variant space of *components* and can be mapped to propositional logic
 - Product Component Trees generalize Product Breakdown Structure (PBS) from Course Softwaremanagement



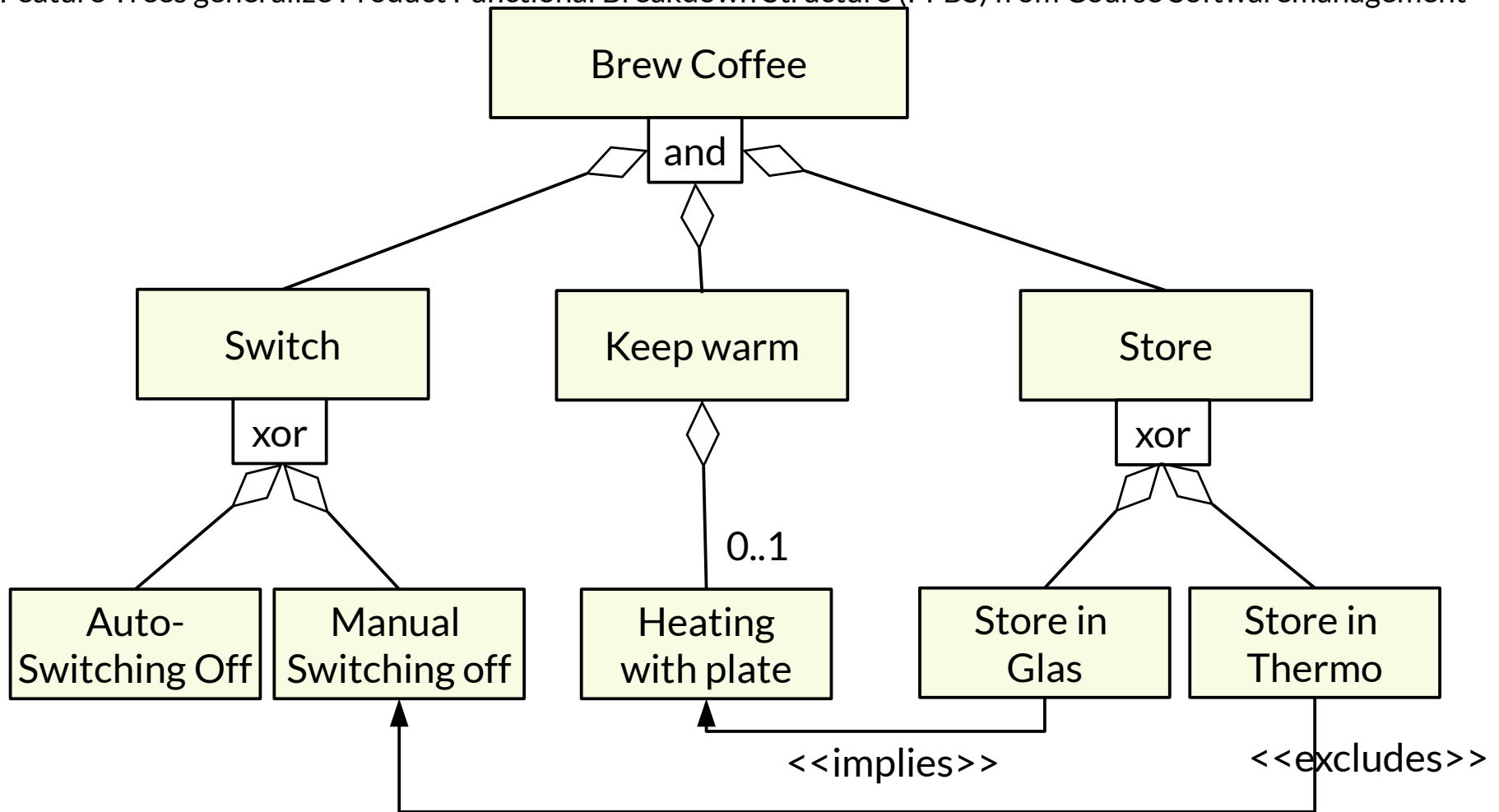
Variating Means to Add Alternatives to a Product Component Tree

- ▶ Variation adds
 - new alternatives to an OR or XOR node
 - New OR or XOR nodes to AND nodes



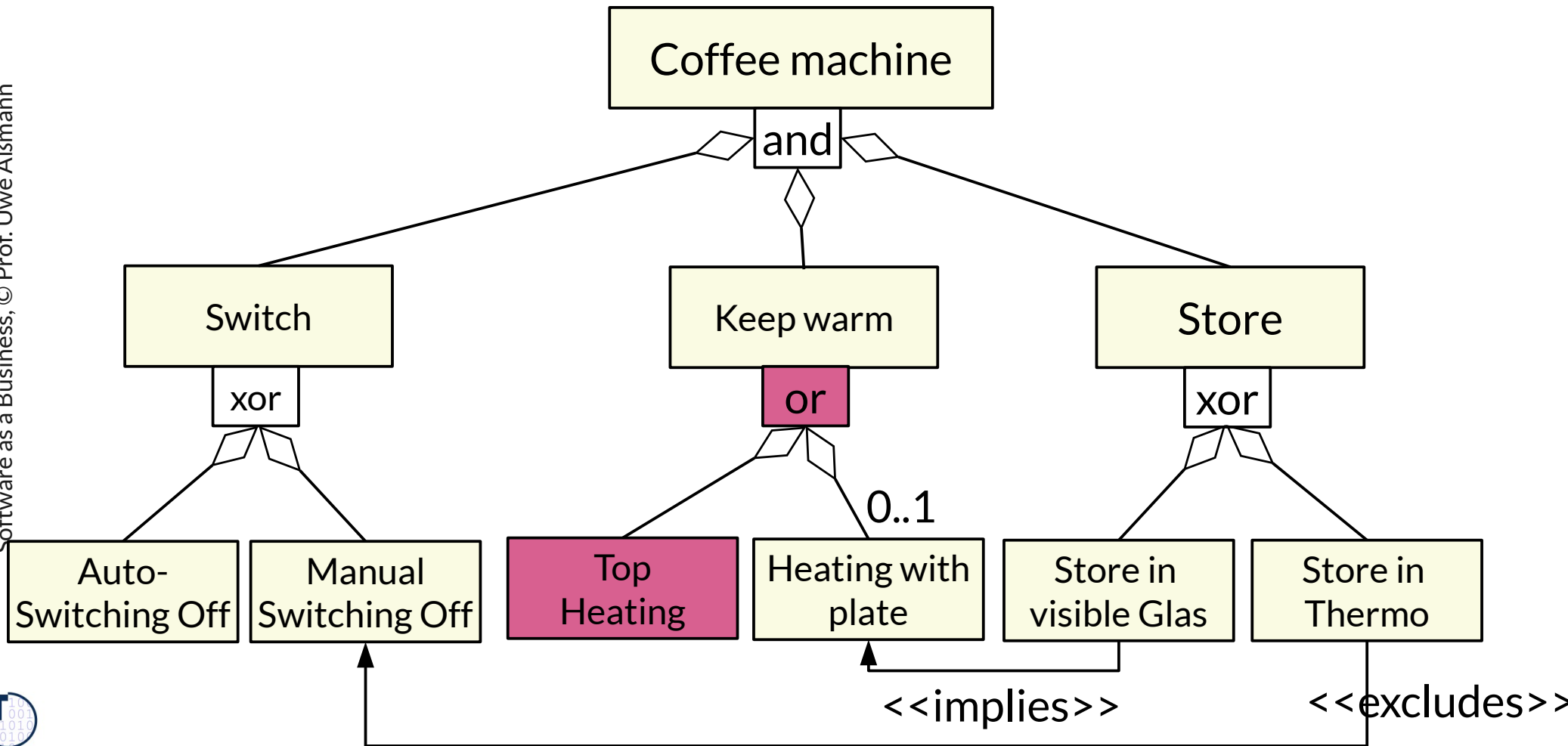
Feature Tree (Feature Model)

- ▶ A **feature tree (feature model)** is a and/or link tree of *functions (features)* with options, inclusion and exclusion constraints.
 - It describes a combinatorial variant space of *functions* and can be mapped to propositional logic over *functions*
- ▶ Feature Trees generalize Product Functional Breakdown Structure (PFBS) from Course Softwaremanagement



Variating Means to Add Alternatives to a Feature Model

- ▶ Variation adds
 - new alternatives to an OR or XOR node
 - New OR or XOR nodes to AND nodes



Idea and Feature Variation with Feature Trees

- ▶ Business model:
 - Product-oriented
 - Product-line-oriented
 - Software ecosystem: Features are distributed into apps on a software platform
- ▶ *Exercise: How to extend the features of a coffee machine?*

Warning - The Scale Trap

- ▶ Many companies start *without* feature tree and product component tree.
- ▶ After 2 years, when they want to scale, they change to a product-line business model
- ▶ Feature trees and product component trees are *indispensable* for the management of a product line
- ▶ Then, the feature tree has to be *reconstructed*

If you want to scale

Maintain a feature tree and a product component tree from the MVP on

First MVP Pitch

- ▶ Prove how you scale!

On Fri, January 10, 2019, there will be the first MVP pitch.

Please also prepare a component tree or feature tree to motivate why you can scale.

On Mon, February 3, 2019, 16:40 there will be the „Dungeon of Dragons“.

30.2. Change-Driven Invention of new Products Variability-Based Design

- Drew Boyd, Jacob Goldenberg. Inside the Box. Why the best business innovations are right in front of you. Profile Books, London, 2013
- http://en.wikipedia.org/wiki/Systematic_inventive_thinking
- http://en.wikipedia.org/wiki/Unified_structured_inventive_thinking

30.2.1 Business Model Development with 4-field Portfolio of BMG, as a Matrix Analysis

[BMG p 231]

Matrix Analysis

- ▶ A Matrix Analysis combines two dimensions, for one canvas a set of questions or concepts
- ▶ With a matrix analysis, we create new ideas

Questions 7W	Key Partners	Key Activities	Key Resources	Costs	Value Propositions	Customer relationships	Channels	Customer Segments	Revenues
Who?									
What?									
When?									
Where?									
Why?									
What for?									
How?									



4-Actions Variation Framework of BMG

- ▶ The BMG book presents 4 operators for new ideas:
 - Eliminate
 - Reduce
 - Augment
 - Create

- ▶ To model the influence of these dimensions of the BMC, we have to span up a matrix with 4x9 elements (matrix analysis)

Matrix Analysis for 4-Actions-BMC

- ▶ For this aspect-oriented matrix analysis for the BMC, create a table (matrix) of 4-actions and BMC, brainstorm on the crossproduct

	Key Partners	Key Activities	Key Resources	Costs	Value Propositions	Customer relationships	Channels	Customer Segments	Revenues
Eliminate									
Reduce									
Augment									
Create									



Matrix Analysis for BeNiSiLo-BMC

- ▶ For this aspect-oriented canvas analysis on AUGMENT, create a table (matrix), brainstorm on the crossproduct
- ▶ The “operations dimension” is BeNiSiLo, a quality-oriented set of improvement operations

Augment	Key Partners	Key Activities	Key Resources	Costs	Value Propositions	Customer relationships	Channels	Customer Segments	Revenues
Better									
Nicer									
Simpler									
Longer Lasting									





30.2.3. Variability-Based Business with Systematic Inventive Thinking (SIT)

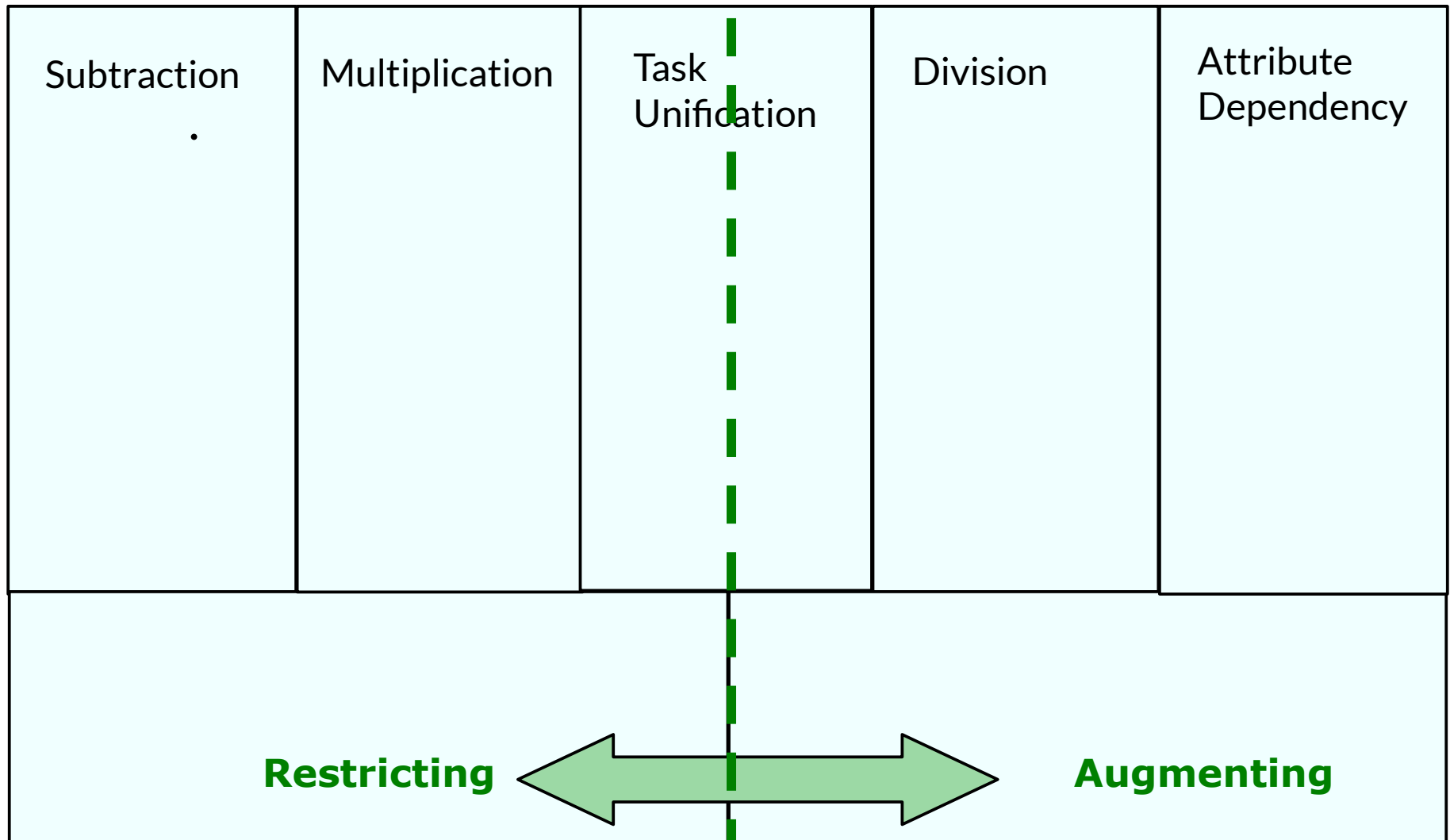
SIT operates on Component Trees (Component Tree Algebra)

- ▶ SMUDAD-operations on products and their component trees
- ▶ Also possible on feature trees

S	Subtract (Elimination)	Remove, subtract components, reduce to core („Steve Jobs pattern“)
M	Multiply	Add another component, potentially different component to the product
U	Unify tasks	Find a new task for a component so that it can deliver two tasks
D	Divide	Re-group the components of the product into subgroups and form a new product (product out-lining). A first step to a product-line oriented business model
AD	Attribute dependency	Remove or create dependencies between parameters of components

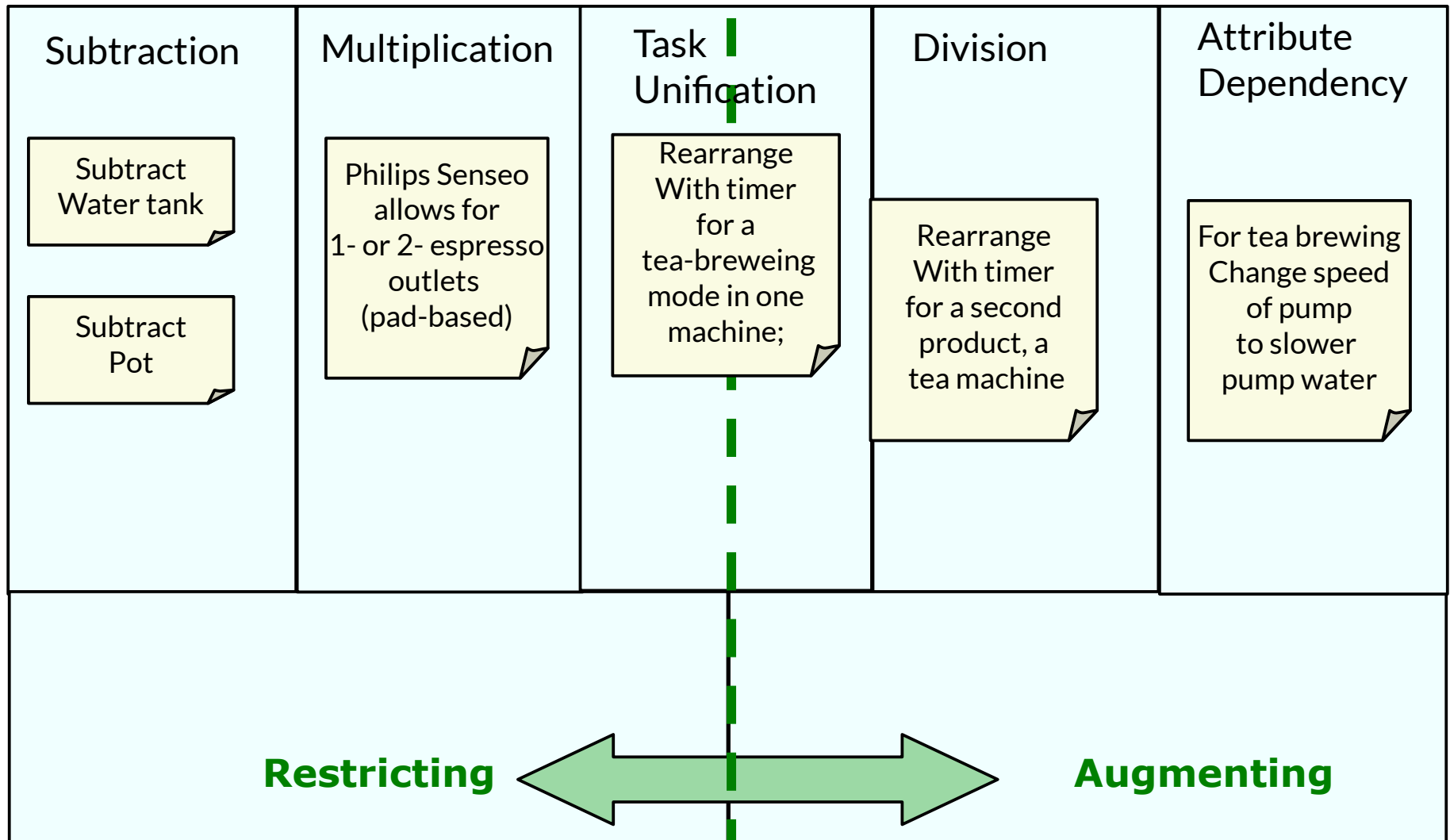
SIT Canvas

- ▶ SIT Canvas is based on simple modification operations of existing product component trees



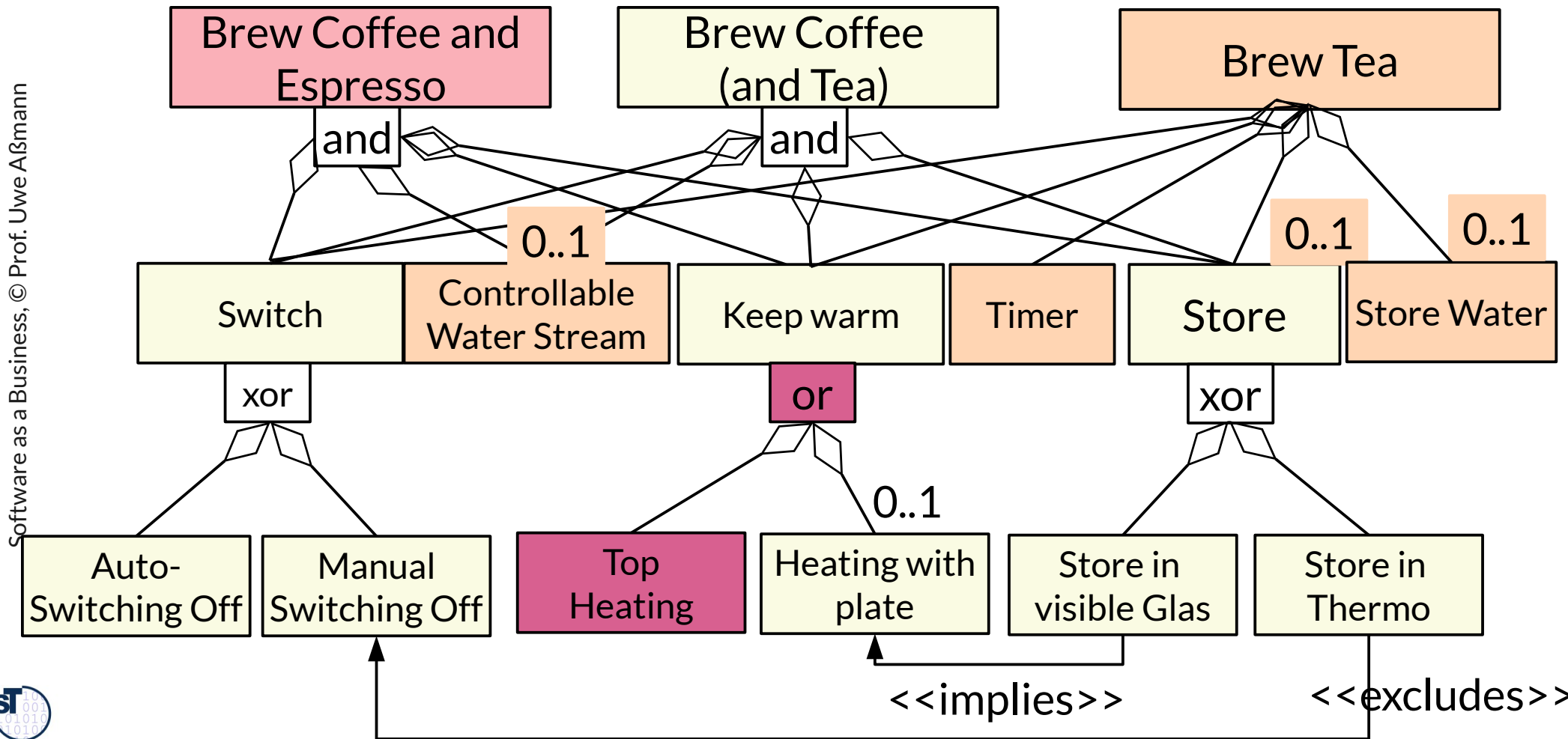
Example: SIT Canvas on Coffee Machine

- ▶ SIT Canvas is based on simple modification operations of existing product component trees



Extended Feature Model (of Product Line)

- ▶ Variation adds 2 new products (Tea machine, coffee+pad-espresso machine)
- ▶ CoffeeMachine with enriched feature set
- ▶ Feature model may become too complex → refactoring necessary



SIT thinking

Subtraction Technique

- ▶ Subtracting components from the component set of a product
- ▶ Implied: removing features from the feature set of a product
 - Make it simpler and easier to use
 - Reduce costs

Examples:

- ▶ Steve Jobs was great in subtractions
 - Ipad with very few knobs
 - Ipad has no keyboard (compare to Microsoft Surface)
 - No USB
 - No CD/DVD
 -

Division (Decomposition) Technique

- ▶ A CD, radio, cassette player all contain amplifiers.
- ▶ An *integrated music center* contains a CD, radio, cassette player and amplifier.
 - One amplifier provides amplification for every other device.
 - Function is *divided*
- ▶ A *modular music center* is composed of components that can be replaced
 - Function is divided and replaceable

Matrix Analysis SITxBMC

- ▶ For this aspect-oriented canvas analysis, create a table (matrix), brainstorm on the crossproduct

	Key Partners	Key Activities	Key Resources	Costs	Value Propositions	Customer relationships	Channels	Customer Segments	Revenues
Subtraction									
Task Unification									
Multiplication									
Division									
Attribute dependency									

30.3 SCAMPER Idea Variation

- SCAMPER is a Solution process (see course ASICS)

Analysis

Design
Solution

Realize
Solution

Evaluate
Solution

Diffuse

<http://de.wikipedia.org/wiki/SCAMPER>

- ▶ SCAMPER is a variation technique with 6 algebraic variation operators
- ▶ Derived from OSBORN checklist
- ▶ Kilbride's SCAMMPERR (SCAMPER+) adds two variation operations

S	Substitute (Vary)	Substitute some parts of the solution, resources, channels etc.
C	Combine	Combine partial solution elements to a more complete solution
A	Adapt	Change the solution or function
M	Modify	Scale, change an attribute of the solution
<i>M</i>	<i>Magnify</i>	<i>Change the size of the solution</i>
P	Put	Put to (find) another use
E	Eliminate (Subtract)	Remove, subtract, reduce to core
R	Reverse	Invert order
<i>R</i>	<i>Rearrange</i>	<i>Change order</i>



SCAMMPERR with Sensor-Based Diapers

- ▶ Remember the water-sensor-based diapers...

S	Substitute (Vary)	Substitute a part: Substute cable of sensor against wireless
C	Combine	Combine partial solution elements to a more complete solution: Second app to do social community analysis, taking the analytics of other parents into account
A	Adapt	Change the solution or function: Do a sensor-based diapers for elderly and handicapped people
M	Modify	Scale, change an attribute of the solution:
M	Magnify	Change the size of the solution: Make the wireless sensor smaller to be taken into the bladder; and use it for incontinent people
P	Put	Put to (find) another use
E	Eliminate	Remove, subtract, reduce to core: Let the sensor ring – no app
R	Reverse	Invert order
R	<i>Rearrange</i>	<i>Change order</i>



Matrix Analysis SCAMPERxBMC

- ▶ For this aspect-oriented canvas analysis, create a table (matrix), brainstorm on the crossproduct
- ▶ Exercise: do the same for VPC and PainCanvas

	Key Partners	Key Activities	Key Resources	Costs	Value Propositions	Customer relationships	Channels	Customer Segments	Revenues
Subtraction									
Combine									
Adapt									
Magnify/Modify									
Put									
Rearrange/Reverse									



Matrix Analysis SCAMPERxVPC

- ▶ For this aspect-oriented canvas analysis, create a table (matrix), brainstorm on the crossproduct
- ▶ Exercise: do the same for VPC and PainCanvas

	Customer Tasks	Gains	Pains	Pain Killers	Gain creators	Advantages	Features
Subtraction							
Combine							
Adapt							
Magnify/ Modify							
Put							
Rearrange/ Reverse							





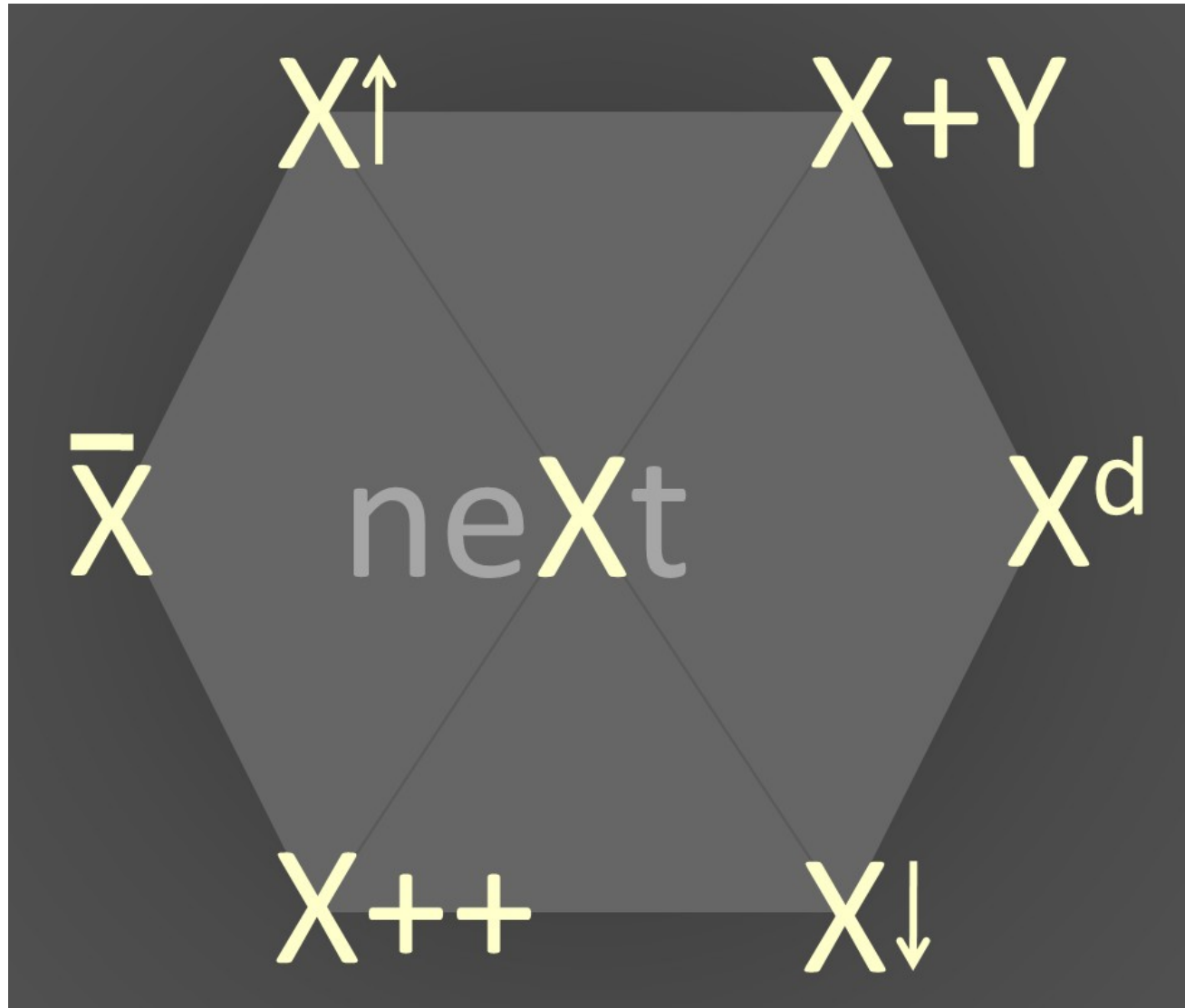
30.4. Variability-Based Business with Rajkar's Idea Hexagon

Slideshare Lecture of Rajkar / MIT.

The 6 Operations of Rajdar's Idea Hexagon

- ▶ 6 Operations (DROHNF) to get new ideas (not only for products, also for technology)

D	Dimensional extension	Add another dimension to the idea
R	Restricting adjective	Add a new constraining adjective to the solution
O	Opposite	Do exactly the opposite
H	Find a hammer for a nail (abstracting, frameworking)	Search a new generic idea for an application; a new solution for a problem
N	Search for a new nail for the hammer (re-concretizing, framework re-instantiating)	Search a new application for a generic idea; a new problem for a solution
F	Fusion	Fuse dissimilar ideas into one idea



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Idea Hexagon x VPC

- ▶ The operations are important for Product Line Engineering:
 - Dimensional extension (creates Product Matrices)
 - Hammer (creates frameworks)
 - Nail (instantiate frameworks)

	Customer Tasks	Gains	Pains	Pain Killers	Gain creators	Advantages	Features
Dimensional extension							
Restricting							
Opposite							
Find Hammer							
Find Nail							
Fuse							

No Idea?

- ▶ From an MVP, use an idea variation technique to arrive at:
 - Products with more features
 - Products with parameters
 - Feature and component outlining lead to product lines
 - Software ecosystems result if you allow third parties to do the idea variation, i.e., program their own apps
- ▶ Plan the scaling early on, but implement step by step
 - The first customers have to finance the next ones
 - Keep the IPR inhouse, only sell non-exclusive licenses to customers

The End

- ▶ What is the difference of a component tree and a feature tree?
- ▶ Why does the MVP focus on minimal viable *features* instead of minimal viable *components*?
- ▶ How do you extend a feature model of an MVFS with more alternative features? Give an overview of the major process steps.
- ▶ Explain Raijdar's Idea Hexagon and how to use it to generate new ideas.
- ▶ How do you use SCAMPER to get new product features?
- ▶ Explain the difference of SCAMPER and S.I.T.
- ▶ Suppose you have identified a MVFS, how to find more features?
- ▶ Why is it important to cross the 4 BMG operations with the BMC?