Exercise 3: Student Presentations

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8.6.2016

Product Line Scoping

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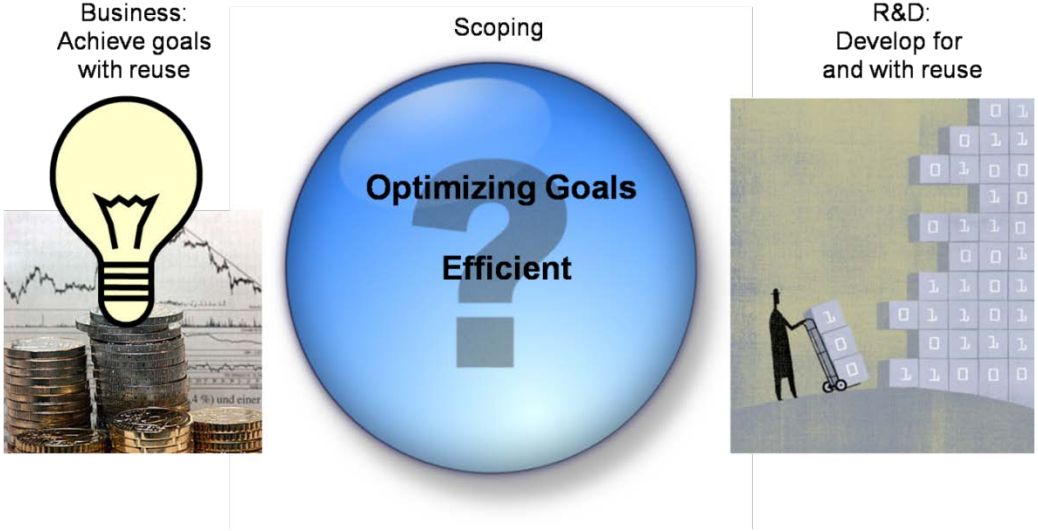
Motivation for Scoping

- Usually companies have existing products/solutions in the domain and domain know-how in business and development

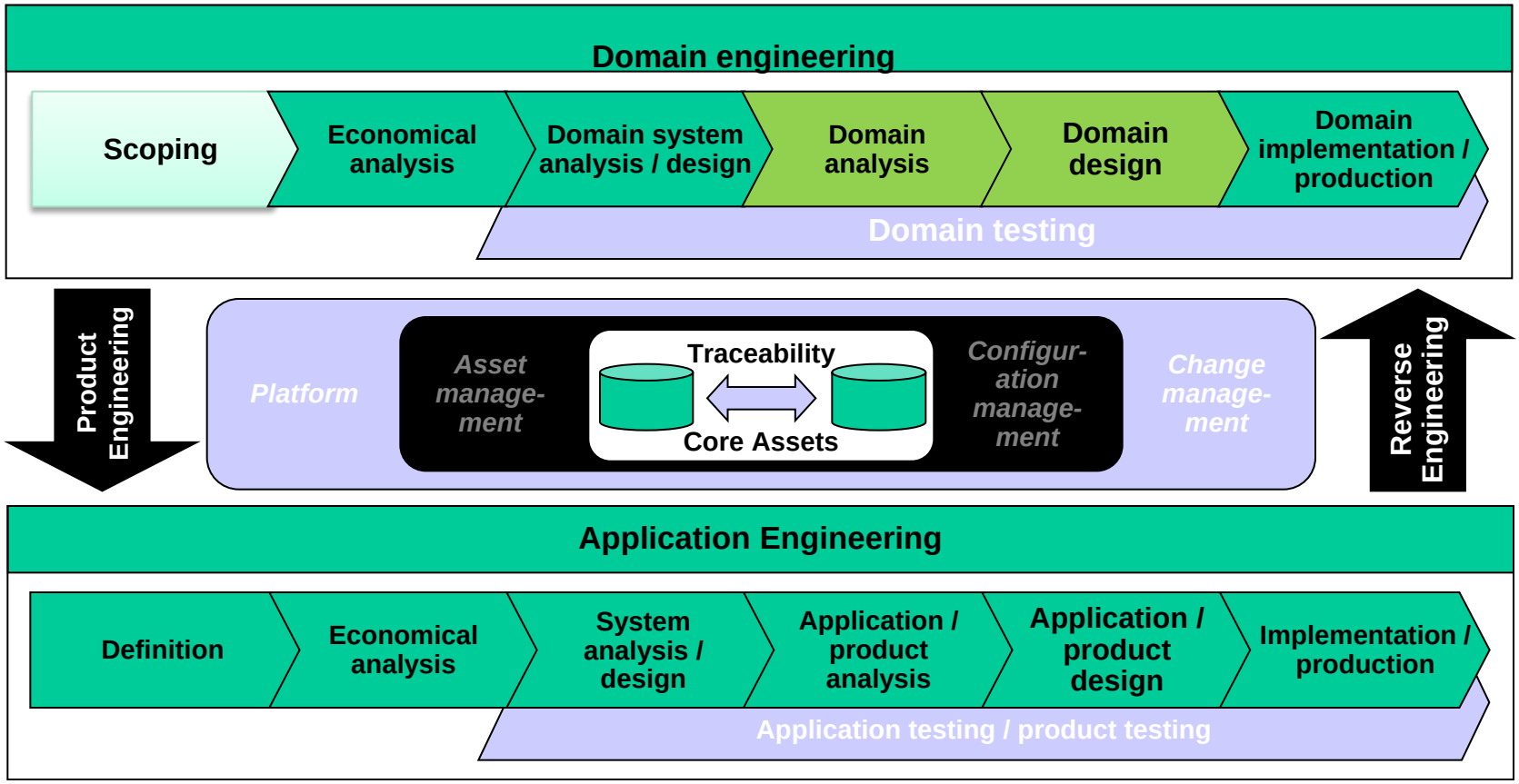
- Goals of reuse differ, like
  - Development cost reduction
  - Maintenance cost reduction
  - Time-to-Market reduction
  - Project risk reduction
  - Quality improvement
  - Expert load reduction



- Existing product portfolio is the basis for **scoping**
- **Scoping is the first step of and the basis for PL adoption**

[Splettstößer et al. 2009]

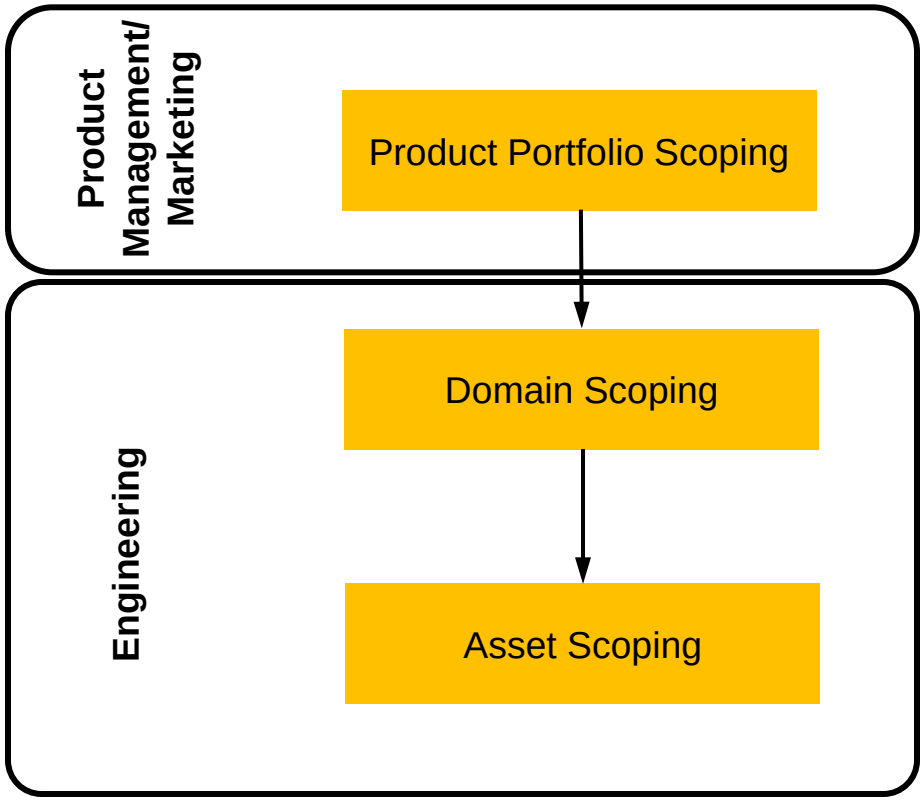
Where in the SPLE Process?



[Splettstößer et al. 2009]

What is PL Scoping?

- Scoping focuses on **identifying products and reusable assets to maximize the value for all stakeholders**



- Product Portfolio Scoping:
  defines the set of products and their main features to be included in the product line.
- Domain Scoping:
  identifies technical domains and their boundaries relevant to the PL.
- Asset Scoping:
  decides which of the required functionality should be implemented as reusable components and which should be considered product-specific.

[Splettstößer et al. 2009]

Scoping in Single-Systems Engineering vs. Scoping in SPLE

- SSE Product development:
  - Possible to concentrate on **one product** vision
  - Cost and benefit ratio to decide on feature inclusion
  - Direct feedback from customer

- Product Line development:
  - Focus on product portfolio optimization concerning cost, time and/or quality. No single product optimum!
  - Reusability influences the product portfolio decisions
  - Indirect feedback through portfolio performance figures

Effects of **not** integrating Scoping with other SPLE processes

- Product Management does not take existing assets and/or reuse into account
  - too much diversity in the portfolio, likely not much reuse possible
  - product development is expensive
- Development does not take business value into account
  - wrong (inconsistent) products, with wrong features from customer's point of view
  - product strategy not fulfilled (e.g. performance leadership vs. cost leadership)

[Splettstößer et al. 2009]

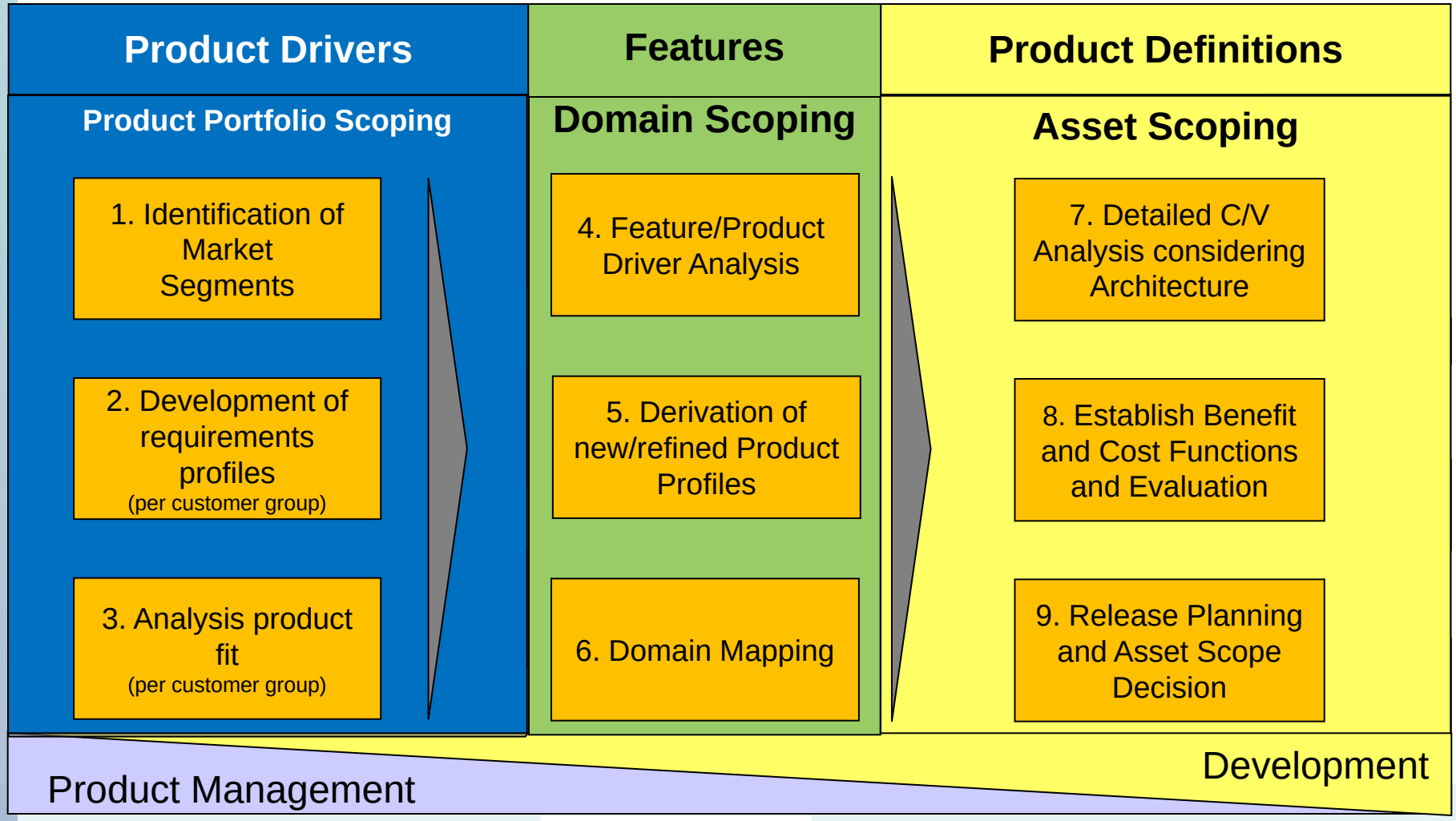
Main Aims of Scoping

- Only close cooperation between product management and development allows to **maximize the benefit from reuse**
  - Avoid: product management defines portfolio and “throws it over the fence”
- **Market information** has to be **transferred to development**
  - Development needs information about business value for each feature
- **Product management understands constraints** in solution space
  - Dependencies and effects of technical constraints become clear

➢ *A methodical framework is required to establish this close cooperation between product management and development*

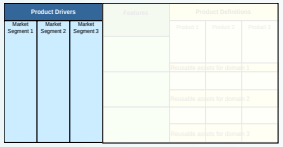
[Splettstößer et al. 2009]

Example 1:
A Framework for Integrated Scoping
(c) Siemens AG 2009

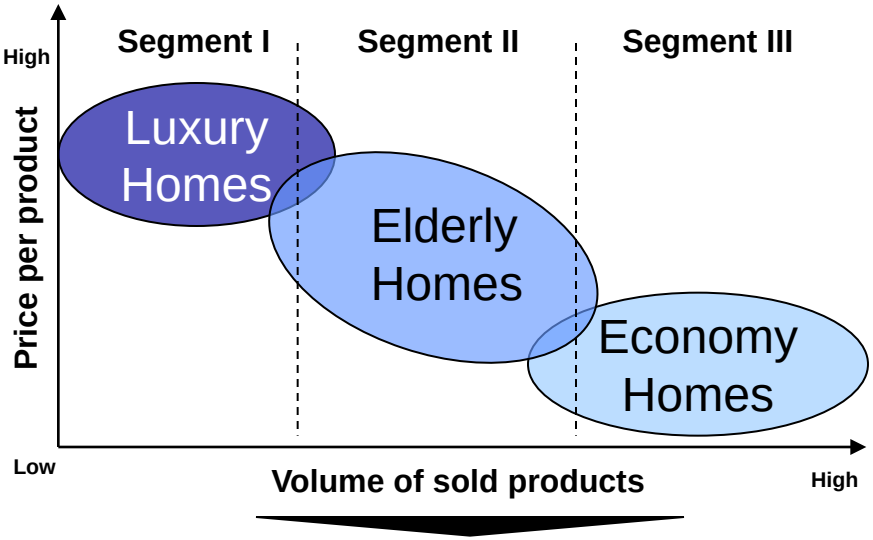


[Splettstößer et al. 2009]

Product Portfolio Scoping – Step 1 Market Segments & Product Drivers



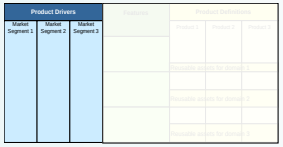
- Identify attractive market segments and their existing product drivers
- Efficiency benefits:
  - Strong focus on the most attractive market segments
  - Concentrate on the product drivers of the targeted market segments



Product Driver	Luxury	Elderly	Economy
Usability	80	60	20
Scene management	80	50	20
Security	100	80	20
Comfort	60	30	20
Entertainment	90	20	40
Communication	80	20	50
Energy Management	20	40	100

[Splettstößer et al. 2009]

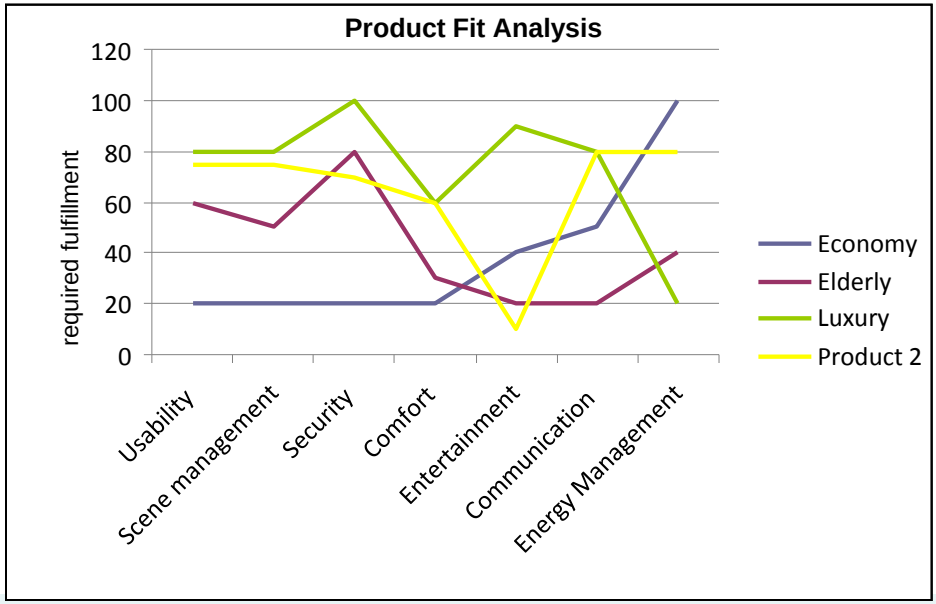
Product Portfolio Scoping – Step 2&3 Analysis Product Fit



- Definition of requirements based on product drivers per market segment and identification of fulfillment gaps

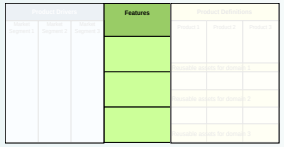
- Efficiency benefits:
  - Targeted product innovation: concentrate on real innovation needs

Product Driver	Luxury	Elderly	Economy
Usability	80	60	20
Scene management	80	50	20
Security	100	80	20
Comfort	60	30	20
Entertainment	90	20	40
Communication	80	20	50
Energy Management	20	40	100



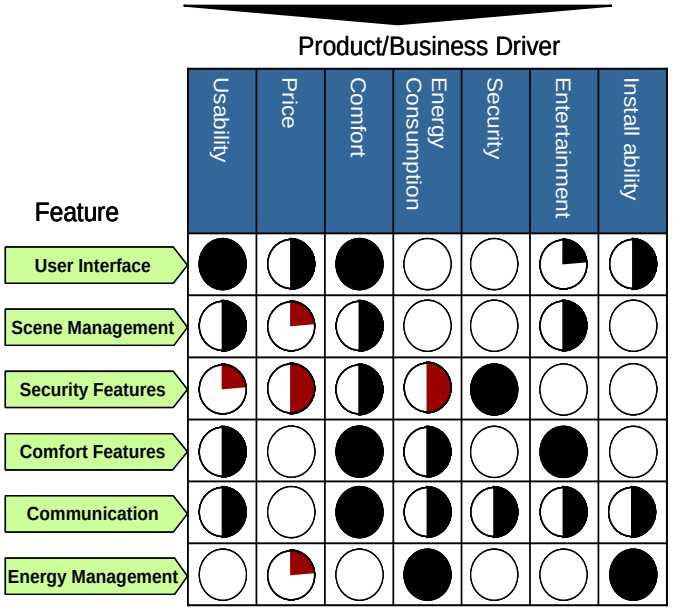
[Splettstößer et al. 2009]

Domain scoping – Step 4 Feature/Product Driver Analysis



- Develop features and mapping of product features to product drivers, identify dependencies
- Efficiency benefits:
  - Concentrate on features with the main impact on product drivers

features with refinement:		business drivers:		
Detail Level 1	Detail Level 2	Useability	Price	Comfort
User Interface (Usabilty)		**9**	**3,5**	**9**
	Conventional Pushbuttons	9	9	9
	Keypads	9	3	9
	Touch Panel	9	1	9
	Voice Control	9	1	9
Scene management		**6**	**-2**	**6**
	pre-defined scenarios	9	-1	3
	self-defined scenarios	3	-3	9
Security		**-1**	**-3**	**3**

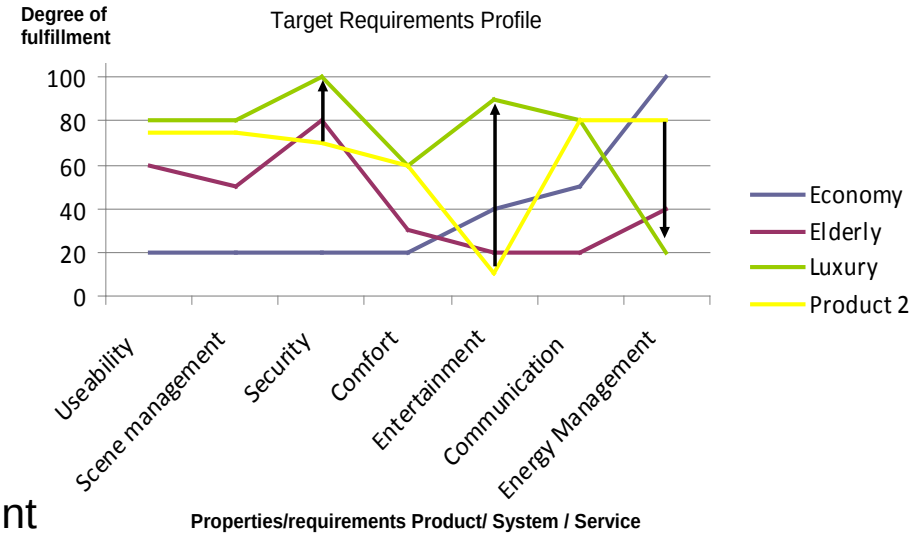


[Splettstößer et al. 2009]

Domain scoping – Step 5 Derivation of new/refined Product Profiles

- Defined target product portfolio, with refined product profiles
- Characteristics optimized for the targeted market segment/customer group

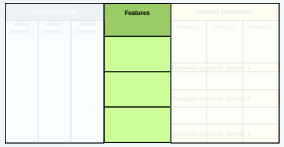
- Efficiency benefits:
  - Clear targets for feature development
  - High prioritization of feature development with the main innovation needs



	Economy	Elderly	Luxury
High end	Comfort Economy	Medical Home	Home Deluxe
Low end	Basic Economy	Support@Home	Home Security

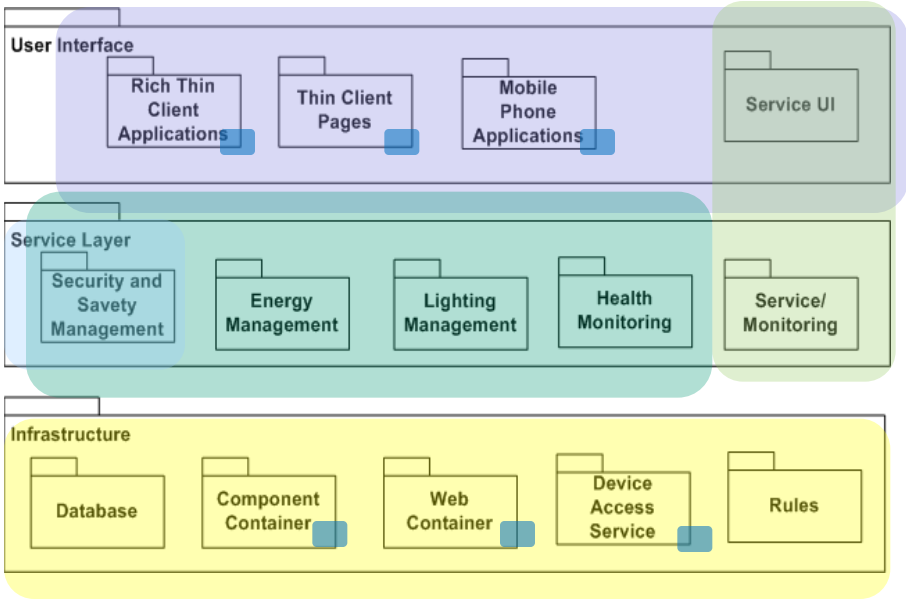
[Splettstößer et al. 2009]

Domain scoping – Step 6 Domain mapping / domain potential analysis



- Close the gap between market (benefit) and development (cost) view; features are grouped in consistent technical areas

- Efficiency benefits:
  - Only sub-domains with high reuse potential are further investigated
  - Only the part of each technical domain is further considered that is covered by products in the portfolio



[Splettstößer et al. 2009]

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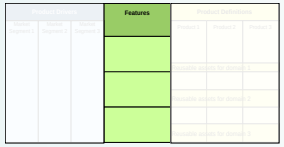
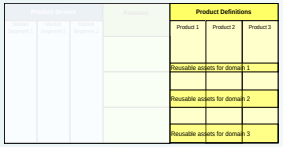


			Economy		Elderly		Luxury	
			Basic Economy	*Comfort Economy*	*Support @Home*	*Medical Home*	*Home Security*	*Home Deluxe*
User Interface								
	Popular Concepts							
		Conventional Pushbuttons	X	X	X	X	X	X
		Keypads		X	X	X	X	X
		Touch Panel		X				X
		Voice Control				X	X	X
External Communication								
	Communi cation							
		Email		X			X	X
		Internet		X		X	X	X
		Phone		X	X	X	X	X
Security/Savety								
	IT Security							
		Authentication/ Authorization					X	X
		Privacy					X	X
		SecureCommunication		X			X	X
	Savety							
		redundancy				X	X	X
		manual operation	X	X	X	X	X	X
Sensors and Actors								

[Splettstößer et al. 2009]

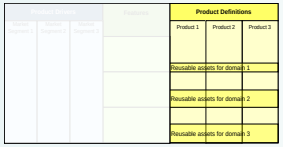
Asset scoping
– Step 7 Detailed Commonality/Variability analysis



- Analyze variability and commonality and map to architecture
  - Fold feature map to variability model
  - Mine technical features and technical feature dependencies
  - Relate features to architecture
- Allow reasoning about technical implications of variability
- Efficiency benefits:
  - Input for architecture to estimate effort for reusable and for product-specific assets
  - Features inherited from product management are still basis for estimations

[Splettstößer et al. 2009]

Asset scoping
– Step 7 Detailed



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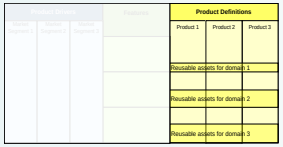
- Analyze variability to architecture
  - Fold feature ma
  - Mine technical f dependencies
  - Relate features
- Allow reasoning a variability
- Efficiency benefits
  - Input for archite reusable and fo
  - Features inherit are still basis fo

				Economy		Elderly		Luxury	
				Basic Economy	*Comfort Economy*	*Support @Home*	*Medical Home*	*Home Security*	*Home Deluxe*
Service Orchestration Platform									
	Scene management								
		pre-defined scenarios				x	x	x	x
		self-defined scenarios						x	x
	Comfort								
		Intelligent air quality monitoring		x	x			x	x
	Energy Management								
		Temperature regulation in individual rooms		x	x	x	x	x	x
		Weather and presence dependent control			x				
		Presence driven lighting		x	x				
		Energy monitoring		x	x				
		Intelligent load balancing		x	x				
	Security								
		Safety related components outside							
			Access Control	x		x	x	x	x
			Biometric Verification Technology					x	x
			Intelligent Video Survillaince system					x	x
			Security lighting				x	x	x
		Safety related components internal							
			Motion detector						x
			Door & Window Control					x	x
			Smoke and Water Alarm	x					

[Splettstößer et al. 2009]



Asset scoping
– Step 7 Detailed Commonality/Variability analysis

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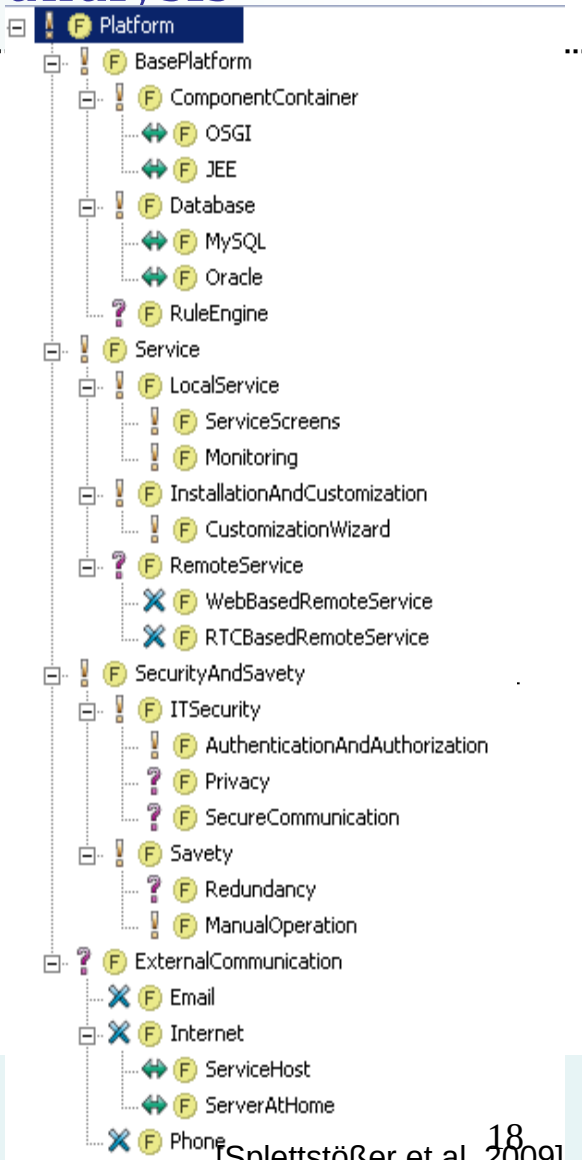
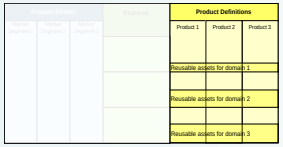


[Splettstößer et al. 2009]

Asset scoping
– Step 8 Establish Benefit and Cost Functions, Evaluate



- Evaluate the cost and benefit of the product portfolio
  - Product line goals (e.g. cost reduction, time to market reduction, risk reduction)
  - Cost factors (risk, complexity, confidence in estimation …)
  - Reassign results of C/V analysis to product portfolio

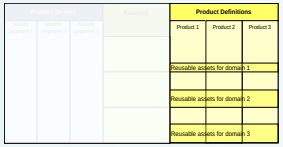
			economy				elderly				luxury			
			Basic Economy		Comfort		Support@Home		Medical Home		HomeSecurity		HomeDeluxe	
		Estimated sales numbers	100		50		50		20		20		5	
		Price	20		30		30		30		50		70	
		Cost for reusable impl.	Strategic value	Cost w/o reuse	Strategic value	Cost w/o reuse	Strategic value	Cost w/o reuse	Strategic value	Cost w/o reuse	Strategic value	Cost w/o reuse	Strategic value	Cost w/o reuse
User Interface														
	Conventional Pushbuttons	4	9	1 2	9	1 2	9	1 2	9	1 2	9	1 2	6	1 2
	Keypads	5		1 3		1 3	3	1 3	3	1 3	3	1 4	3	1 4
	Touch Panel	9		3 4		3 4		3 4		3 5		4 6	6	4 6
	Voice Control	12		3 7		3 7		3 9	9	3 9	3	3 9	9	3 10
Energy Management														
	Temperature regulation in individual rooms	4	8	1 4	8	1 4	5	1 4	5	1 4		1 4	4	1 4
	Weather and presence dependent control	8	4	1 8	4	1 8	4	1 8	4	1 8	4	1 8	2	1 8
	Presence driven lighting	5	6	2 5	6	2 5	6	2 5	6	2 5	5	2 5	4	2 5
	Energy monitoring	3	9	1 3	9	2 3	3	1 3	3	1 3	2	1 3	6	1 3
	Intelligent load balancing	9	9	2 7	9	3 9	3	2 7	3	2 7		2 7		2 14
	Cost													
	Expected earning													

Cost without reuse	Cost with reuse	Effort saving	Average value
12	10	2	8,5
20	11	9	2
29	29	0	1
51	30	21	3,5
24	10	14	5
48	14	34	3,67
30	17	13	5,5
18	10	8	5,33
51	22	29	4

- Efficiency benefits:
  - Condensed view on the multi-dimensional optimization problem
  - Allows experimenting with parameters, e.g., for release planning

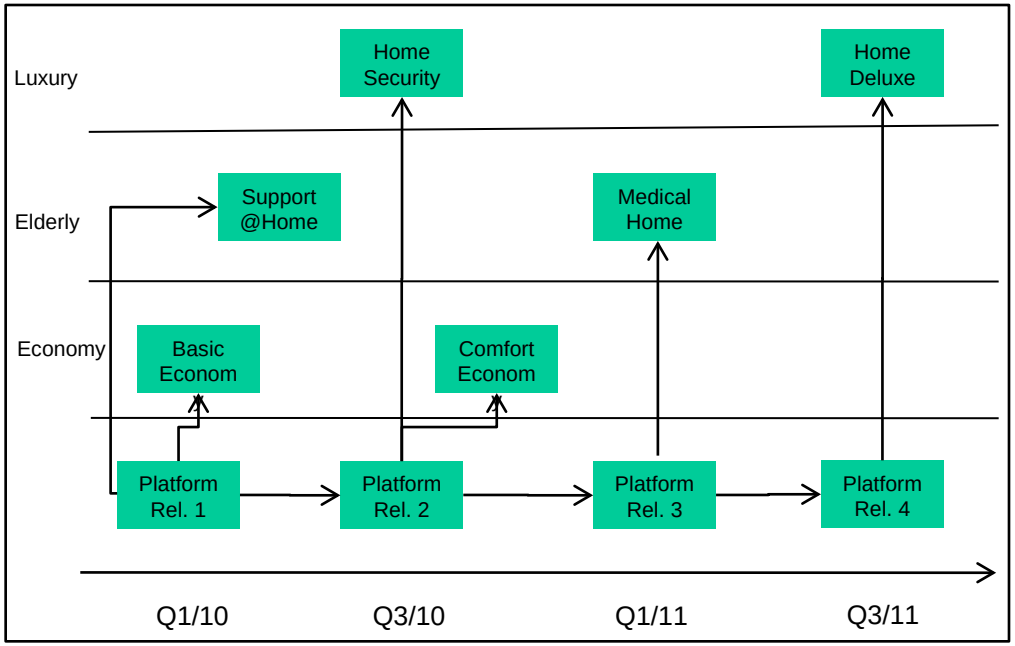
[Splettstößer et al. 2009]

Asset scoping
– Step 9 Release Planning and Asset Scope Decision



- Finish scoping with release planning and asset scope decision
  - Add timing constraints: consider market entry times for each product and relate back to evaluation results
  - Plan iteration scope and development strategy (proactive/reactive)

- Efficiency benefits:
  - Aligns but decouples platform and product development



[Splettstößer et al. 2009]

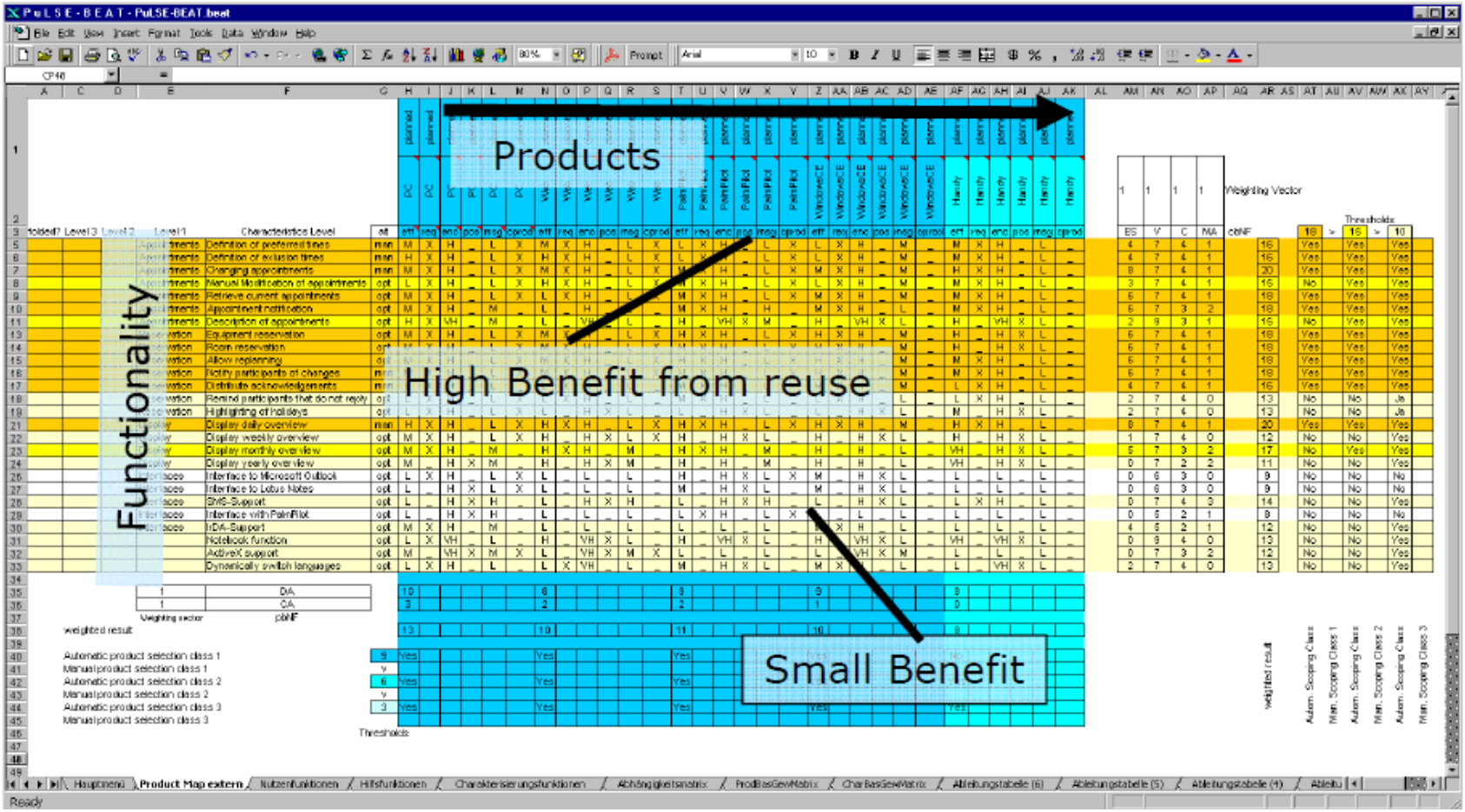
Summary

- The integrated scoping framework by Siemens
  - integrates product line scoping and asset scoping
  - supports incremental engineering processes
  - creates transparency: business value and cost of features
  - defines common vocabulary: features as smallest units for functionality for efficient discussion and evaluation
  - fosters collaboration between stakeholders

Other Examples

- CMU SEI Scoping Framework
  http://www.sei.cmu.edu/productlines/frame_report/productls.htm
- Philips Scenario-based Scoping
  http://www.plees.info/Plees03/Papers/presentation_rommes.pdf
- PuLSE Eco
  http://www.software-kompetenz.de/servlet/is/2209/?print=true

PuLSE Eco Tool



Conclusions

- Scoping is a collaborative effort between product management and development to define the scope of a product line based on existing products and market analyses
- SPLE aims to increase R&D performance → scoping has to be efficient
  - Focus and expand iteratively
  - Generate reusable scoping assets

Next week

- 15.6. Lopez: Reverse Engineering SPLs
- 22.6. Final exam! (here, in this room)
  - General Questions on PLE
  - Variability Modeling
  - FOSD
  - Analysis and Testing (representing feature models as propositional logic/formulae, 2-wise sets)
  - Product Derivation
- One last note: I‘m always searching for good students (master‘s theses, practica, div. projects, ...) – just contact me if you want and we can have an informal chat...

Used/Useful References

- [Splettstößer et al. 2009]

  Uwe Splettstößer, Jörg Bartholdt, and Christa Schwanninger, Scoping – Optimizing Return on Investment with Reuse, Siemens AG, Corporate Technology, 2009.

- [Rabiser et al. 2008]

  R. Rabiser, D. Dhungana, P. Grünbacher, and B. Burgstaller, "Value-Based Elicitation of Product Line Variability: An Experience Report, "Proc. of the *Second International Workshop on Variability Modelling of Software-intensive Systems, Essen, Germany, ICB-Research Report No. 22, University of Duisburg Essen, 2008, pp. 73-79.*

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- [Bayer *et al.* 1999]

  J. Bayer, O. Flege, P. Knauber, R. Laqua, D. Muthig, K. Schmid, T. Widen, and J.-M. DeBaud, "PuLSE: a methodology to develop software product lines, "Proc. of the *1999 Symposium on Software Reusability, collocated with the 1999 International Conference on Software Engineering (ICSE'99), Los Angeles, CA, USA, ACM Press, 1999, pp. 122-131.*

- [Briggs *et al.* 2003]

  R. O. Briggs, G. J. de Vreede, and J. F. Nunamaker Jr., "Collaboration Engineering with ThinkLets to Pursue Sustained Success with Group Support Systems," *Journal of Management Information Systems, vol. 19(4), pp. 31-64, 2003.*

- [Boehm *et al.* 2001]

  B. W. Boehm, P. Grünbacher, and R. O. Briggs, "EasyWinWin: A Groupware-Supported Nethodology for Requirements Negotiation, "Proc. of the *International Conference on Software Engineering (ICSE 2001), IEEE, 2001, pp. 720-721.*