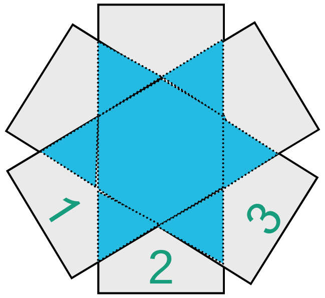
Product Line Engineering Lecture – Introduction (1)

Dr. Martin Becker
martin.becker@iese.fraunhofer.de



Fraunhofer IESE

Technische Universität Kaiserslautern

Contact

Dr. Martin Becker

Fraunhofer IESE

Email: martin.becker@iese.fraunhofer.de

Phone: 0631 / 6800 – 2246

Questions before and after the lecture,
via email/phone, and by appointment.

Organisational Issues

lecture (2h) + exercises (1h)

➔ 4 ECTS credits

Lecture: Friday, 15:30-17:00 in IESE

Exercises:

- separate time slot, once every two weeks?

Examinations: Oral | Written

Exercises

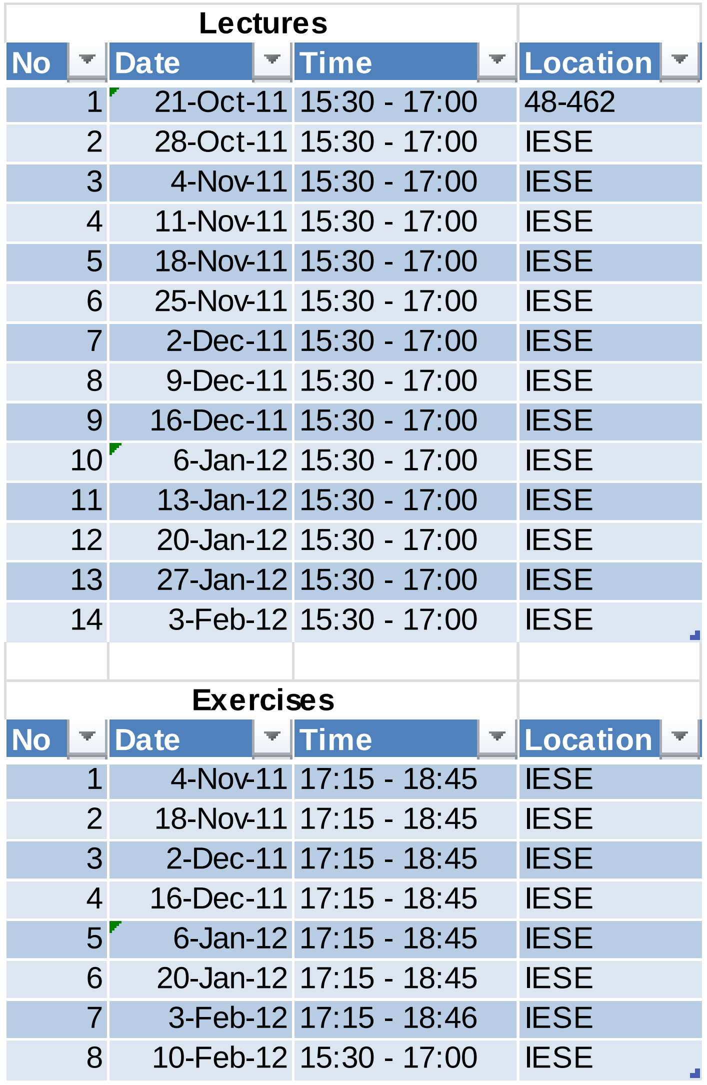
Exercises

- When: Friday, 17:15 - 18:45
- Where: Fraunhofer IESE (Z04.06 –J. Nehmer)

Contact

- Adeline Silva
  Fraunhofer IESE
  E-mail: adeline.silva@iese.fraunhofer.de

Lectures - Schedule



Lectures

No	Date	Time	Location
1	21-Oct-11	15:30 - 17:00	48-462
2	28-Oct-11	15:30 - 17:00	IESE
3	4-Nov-11	15:30 - 17:00	IESE
4	11-Nov-11	15:30 - 17:00	IESE
5	18-Nov-11	15:30 - 17:00	IESE
6	25-Nov-11	15:30 - 17:00	IESE
7	2-Dec-11	15:30 - 17:00	IESE
8	9-Dec-11	15:30 - 17:00	IESE
9	16-Dec-11	15:30 - 17:00	IESE
10	6-Jan-12	15:30 - 17:00	IESE
11	13-Jan-12	15:30 - 17:00	IESE
12	20-Jan-12	15:30 - 17:00	IESE
13	27-Jan-12	15:30 - 17:00	IESE
14	3-Feb-12	15:30 - 17:00	IESE

Exercises

No	Date	Time	Location
1	4-Nov-11	17:15 - 18:45	IESE
2	18-Nov-11	17:15 - 18:45	IESE
3	2-Dec-11	17:15 - 18:45	IESE
4	16-Dec-11	17:15 - 18:45	IESE
5	6-Jan-12	17:15 - 18:45	IESE
6	20-Jan-12	17:15 - 18:45	IESE
7	3-Feb-12	17:15 - 18:46	IESE
8	10-Feb-12	15:30 - 17:00	IESE

Class Infrastructure

Register via email to adeline.silva@iese.fraunhofer.de ➔ access to Google group

Subject: Register – Lecture

Content

- Name: <your name>
- Course of studies and Semester
- Email
- Experience in Software Engineering
  - University (lectures, classes)
  - Industry
  - Other

Get slides via AGSE Web-Site

Contents of the Lecture

Engineering
of variant-rich
software / system families

Our Goals

After this course …

… **you will have learned** …

a… what challenges development organizations are facing due to variants

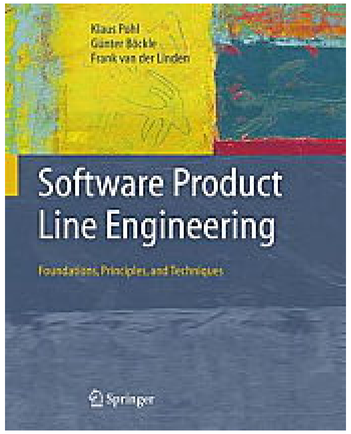
… why opportunistic reuse does not work

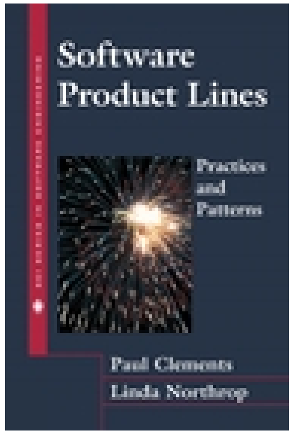
… how to systematically reuse software

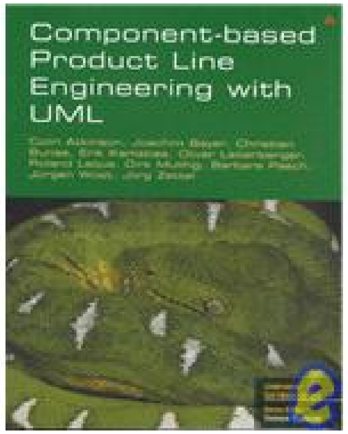
… methods, techniques, and tools for
systematic variation management

Your Expectations?

Literature


Klaus Pohl
Günter Böckle
Frank van der Linden
Software Product Line Engineering
Foundations, Principles, and Techniques
Springer





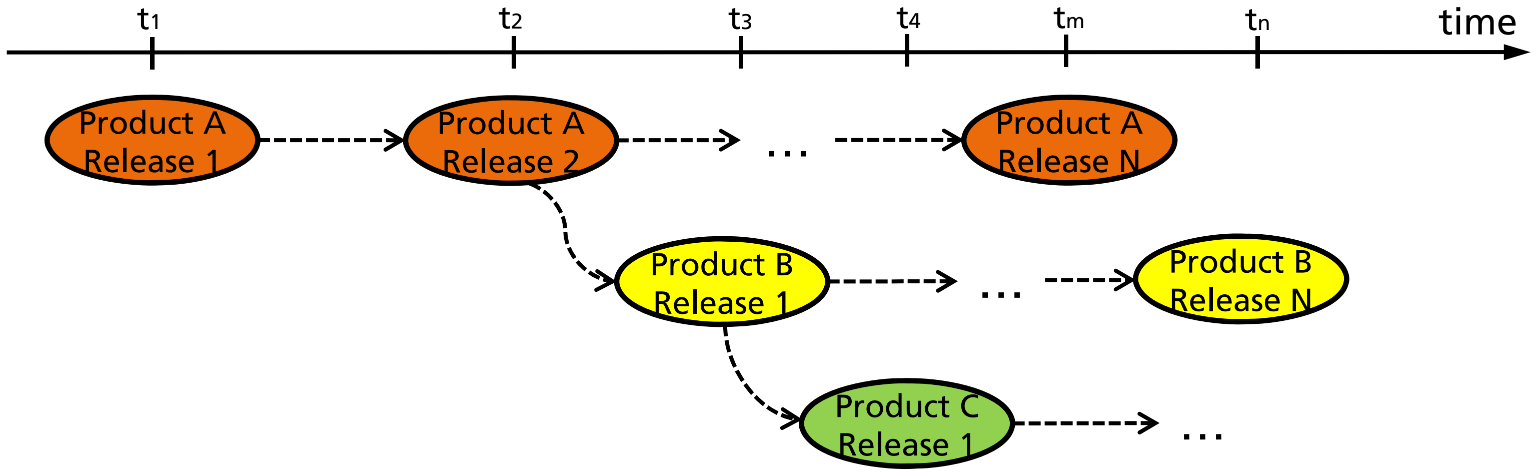
1. Software Product Line Engineering: Foundations, Principles and Techniques by Klaus Pohl, Günter Böckle and Frank J. Linden
2. Software Product Lines: Practices and Patterns by Paul Clements and Linda Northrop
3. Component-Based Product Line Engineering with UML by Colin Atkinson, Joachim Bayer, Christian Bunse and Erik Kamsties

… and some more research papers

--- Motivation ---

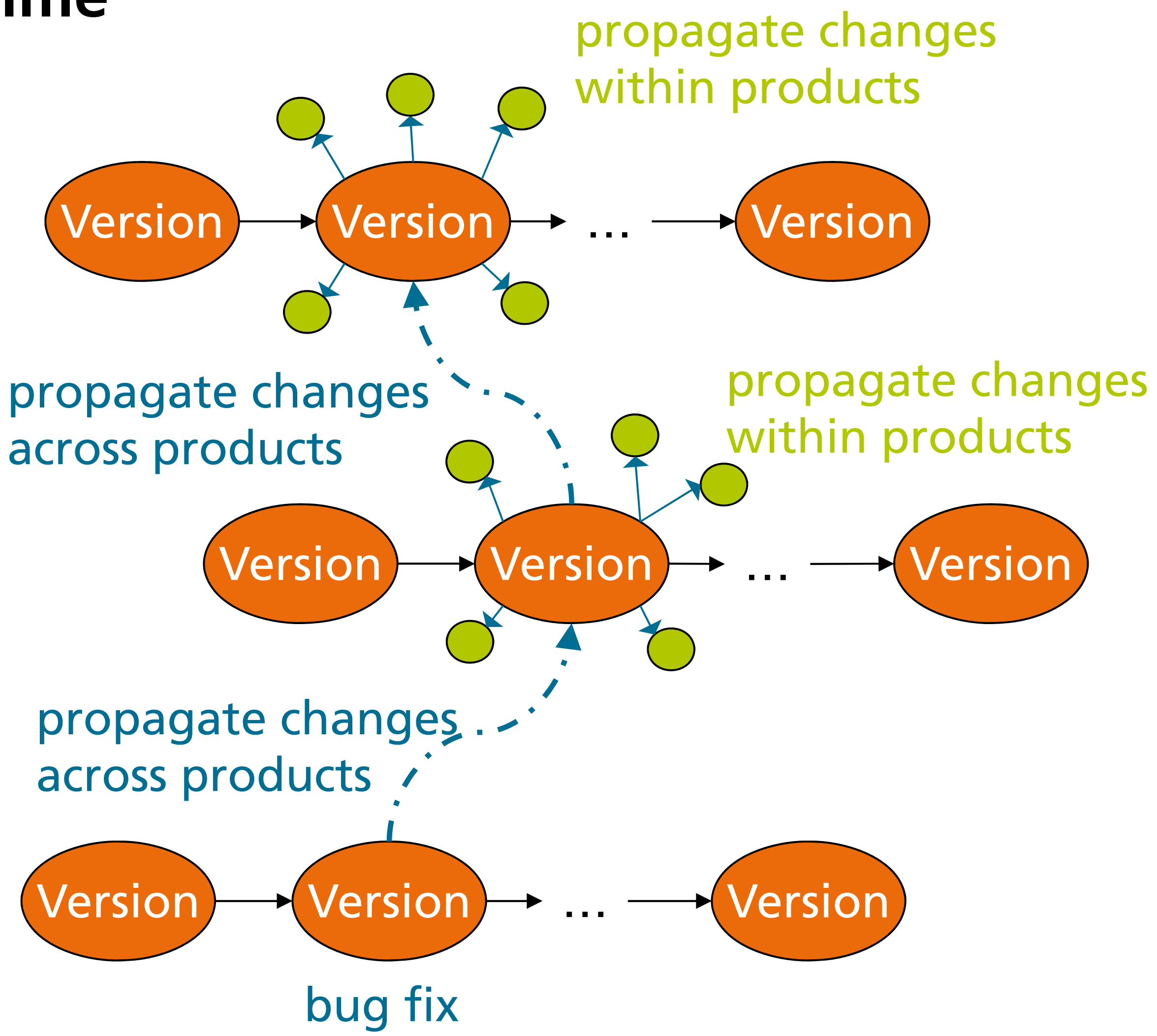
The Beginning

- Most organizations usually do not develop a single system (product), but a set of products in a certain business area
- Many similar products arise over time

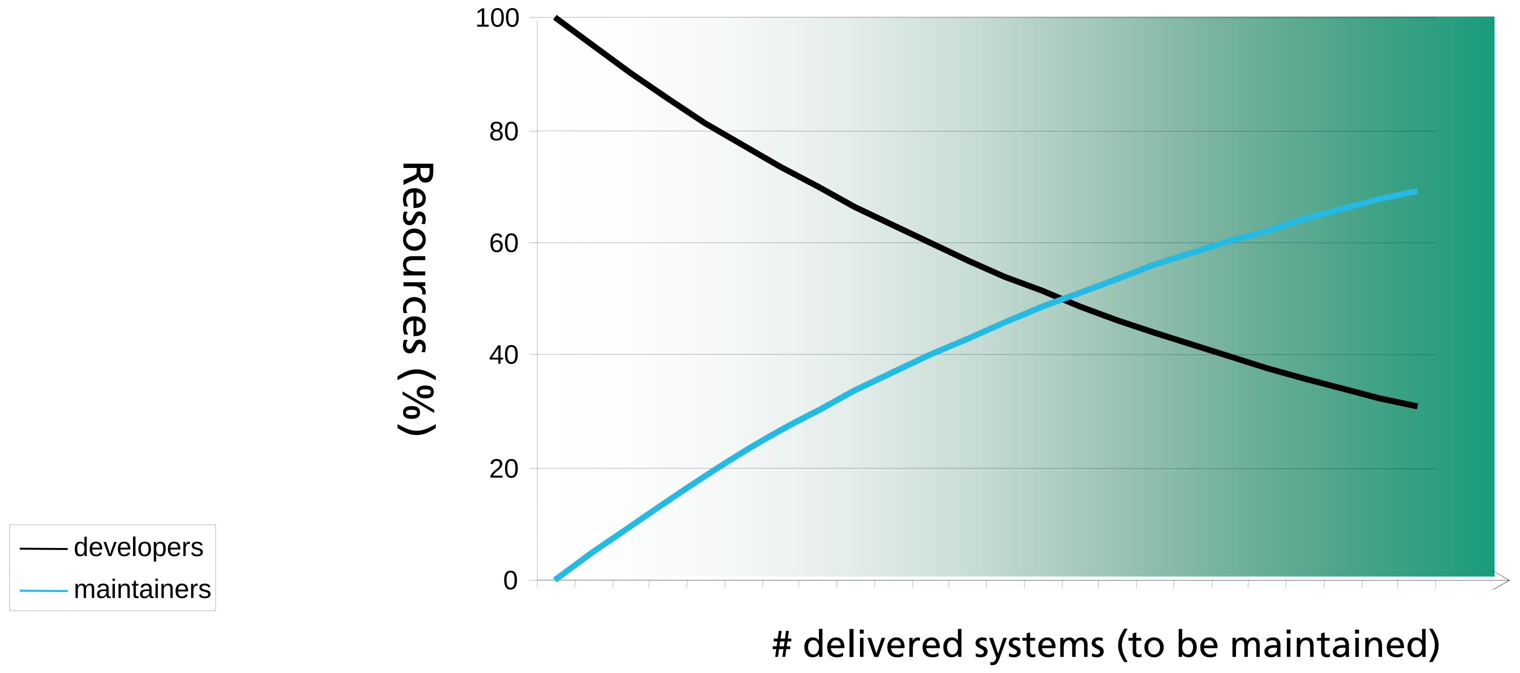


- Developing similar products always from scratch is unproductive
  - it costs effort, time and money
  - it leads to redundant effort in maintenance and quality assurance

In the Meantime


propagate changes within products
Version
Version
…
Version
propagate changes across products
propagate changes within products
Version
Version
…
Version
propagate changes across products
Version
Version
…
Version
bug fix

Developers versus Maintainers (No Reuse!)



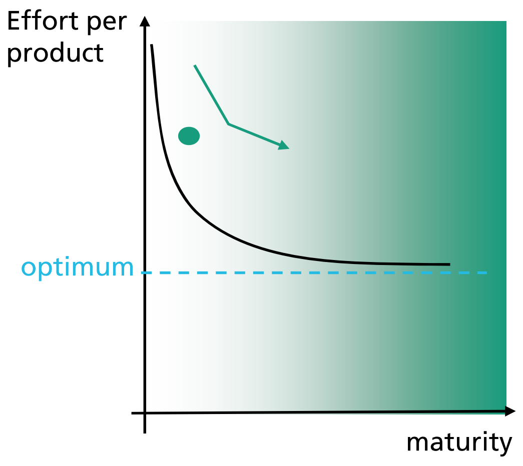
Some more Challenges

- Increasing complexity of systems
- Need for reducing cost, effort, and time-to-market
- Increasing request for quality solutions
- Increasing demand for customized products
- Increasing inter projects/systems dependencies

Problem is well known is SE-Community:
→ Software Crisis (1968)

→You can expect solutions
Problem is not limited to SE-Community

Approach I: Mature single system engineering



[schematic illustration]

- Improvements of 5-10% per year possible
- Of course you must apply the state-of-the-practice
  - You must adopt new approaches from time to time

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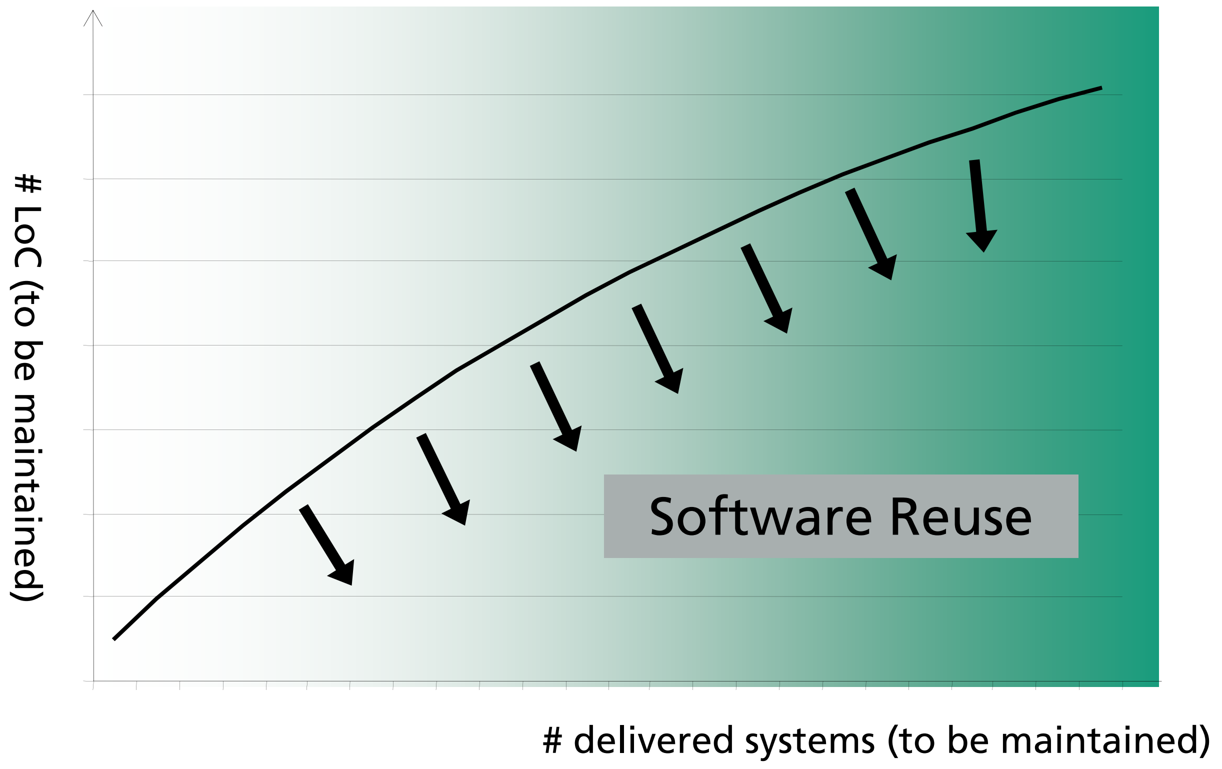
Approach II: Reuse

- Inherent to human nature ➔ natural approach
  1. Use of existing solution
  2. Adapt similar solutions
  3. Develop anew

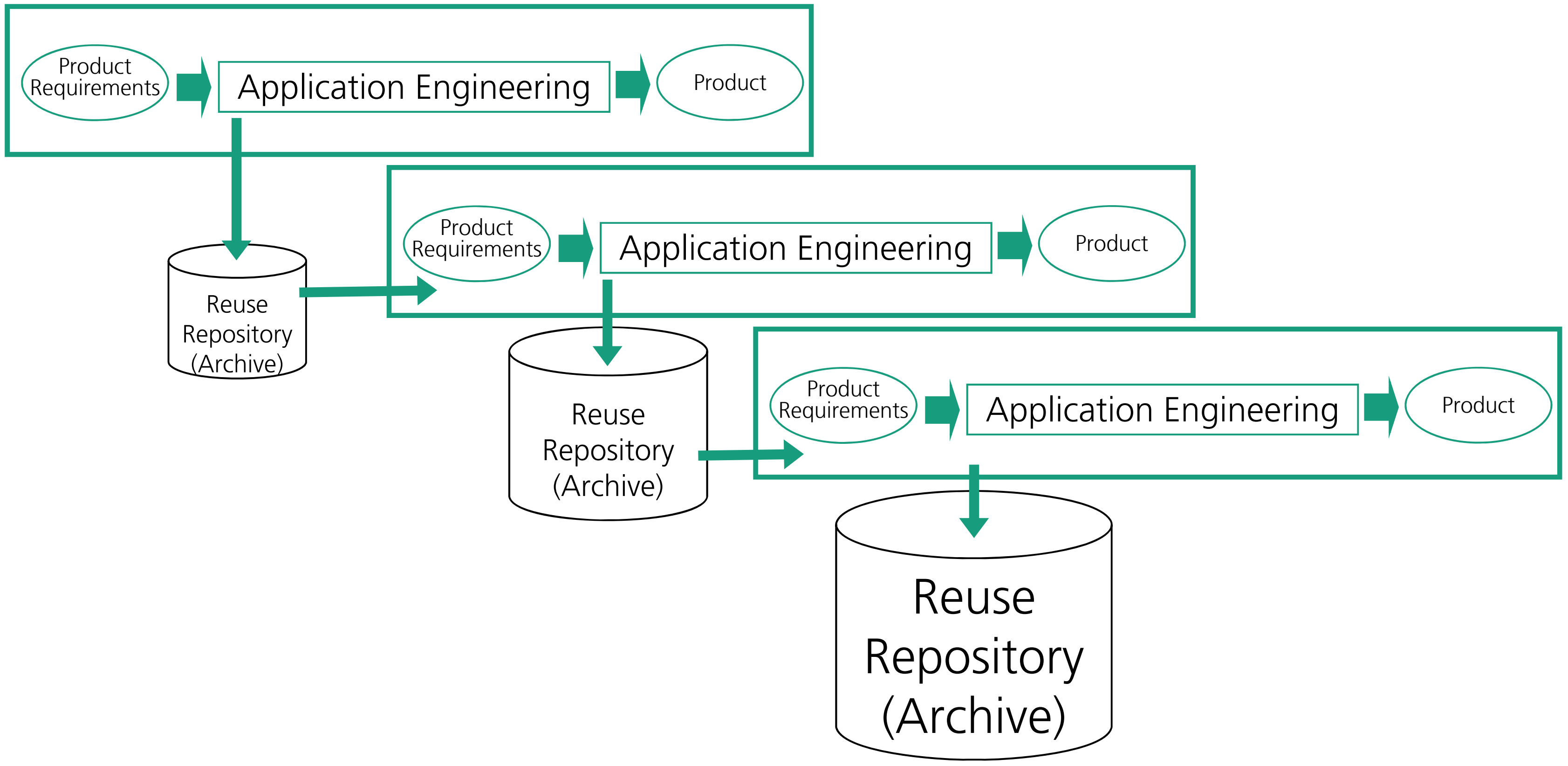
- Reusing existing solutions
  - saves time and effort
  - brings quality
  - avoids complexity due to replica

Can be applied to any kind of system

Size of Code Base to be Maintained



Reuse approaches: Ad-hoc



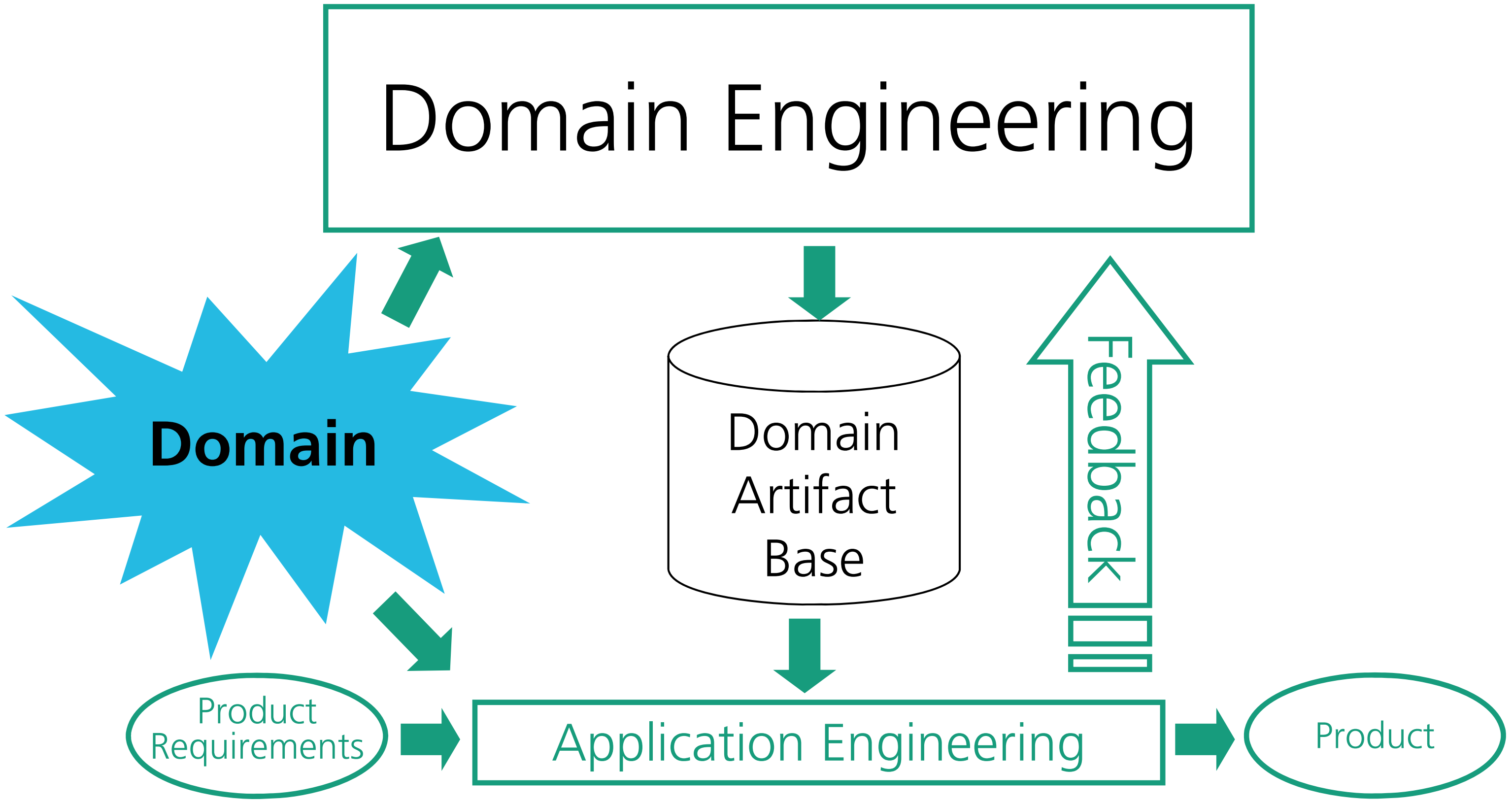
Problems with Ad-hoc reuse

Experiences

- Applied widely: *Clone and Own*
- Does not scale within an organization and across time due to
  - Lacking means for organizing and managing reusable artifacts
    - ➔ Search efforts
    - ➔ Evaluation efforts
    - ➔ Adaptation efforts (80:20 rule holds here)
    - ➔ Integration efforts

In most cases a no go!

Reuse Approaches: Domain Engineering



Idea: Proactively develop for reuse

Problems of Domain Engineering

Domain Engineering: *Development for reuse*

- Understand domain concepts, entities, and relationships
- Set up, maintain, evolve reuse infrastructure

Application Engineering: *Development with reuse*

- Product development based on large-scale reuse
- Reuse is driven by domain concepts
- No searching for reusable artifacts required

Emphasis is on Domain Engineering

- No clear termination criteria => It takes forever
- Unclear domain boundaries
  - Reusable artifacts become more general or generic then required
  - And thus much harder to reuse and maintain
- Application engineering assumed as requiring no effort (ideal vision)

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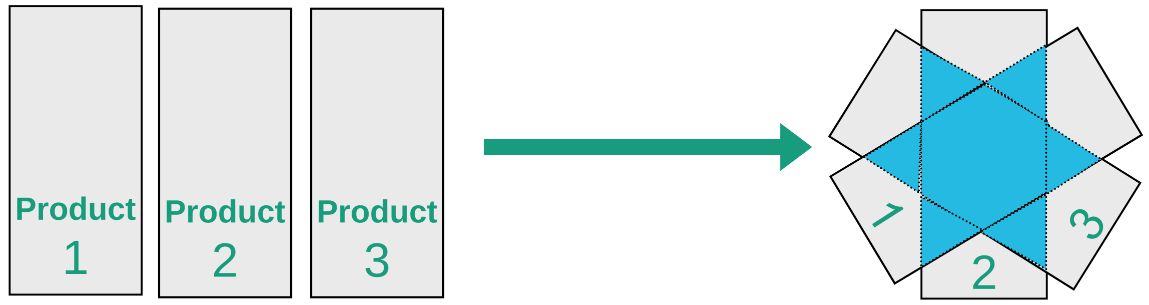
Domain Engineering – Successes Cases

- GUI Libraries
- Databases
- Middleware
- Operating Systems
- …

Horizontal, well-understood domains
with limited variability

High risk that effort spent
in variability support
does not pay of

Optimizing Reuse – Product Line Engineering



- Considering the different products an organization or organizational sector delivers as *Product Family* or *Product Line*
- Taking advantage of commonality
- Clear understanding about variability
- Strategic planning of software reuse
- Efficient production

Proactively plan the reuse:
Just the right variability support

More about PLE

Product Line

- Concepts
- Success Stories

… in the next lecture …

… see you there again