KEBA
Automation by innovation.

Using Crowdsourcing in FOSD to Support Evolution in Industrial Software Ecosystems

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Industrial Motivation

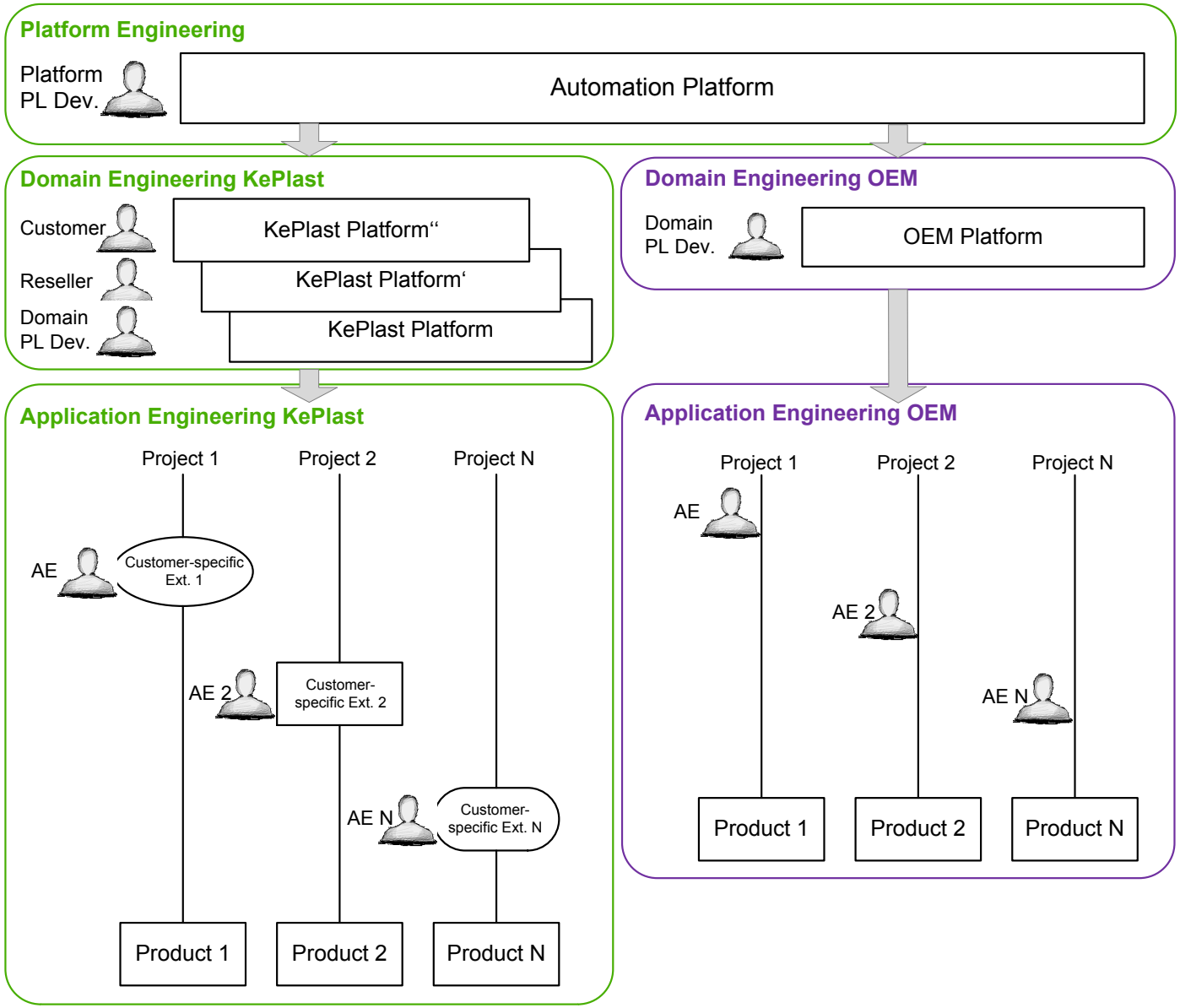
KEBA Automation by innovation.

JKU JOHANNES KEPLER UNIVERSITY LINZ

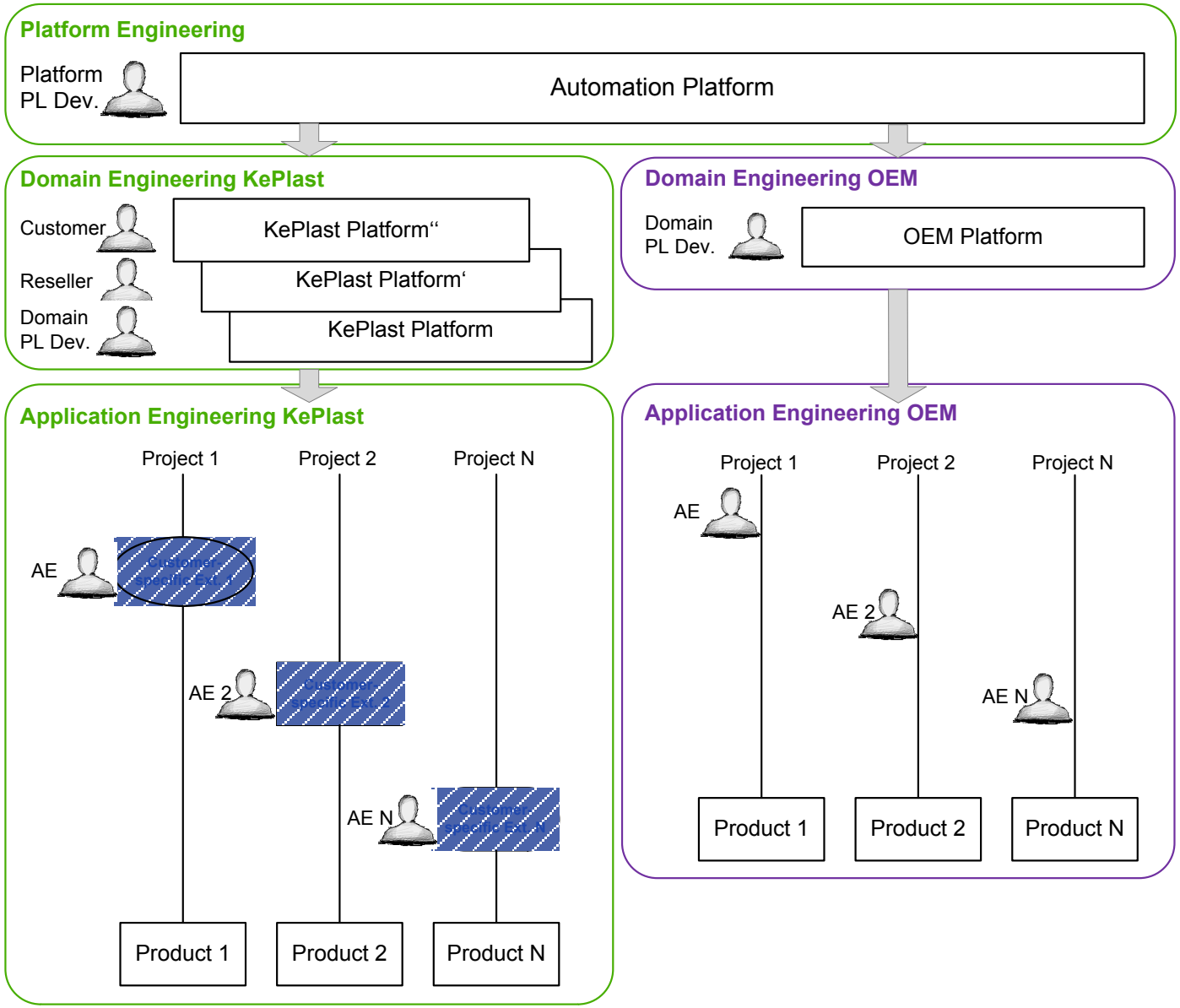
- Industry partner providing automation solutions
  - e.g., for injection molding machines
- Keba operates within industrial software ecosystem (ISECO) context
- Within SECOs internal and external developers create relevant solutions together with a community of domain experts and end users
- ISECOs involve "*mainly internal business units with partially different motivations and interests*" [1]

[1] Schultis, K-B., Elsner, C., and Lohmann, D. Moving Towards Industrial Software Ecosystems: Are Our Software Architectures Fit for the Future? in *Proc. of the 4th Int'l WS on Product Line Approaches in Software Engineering*, 2013.

ISECO Development Context



ISECO Development Context



Challenges

Application engineers are unaware about

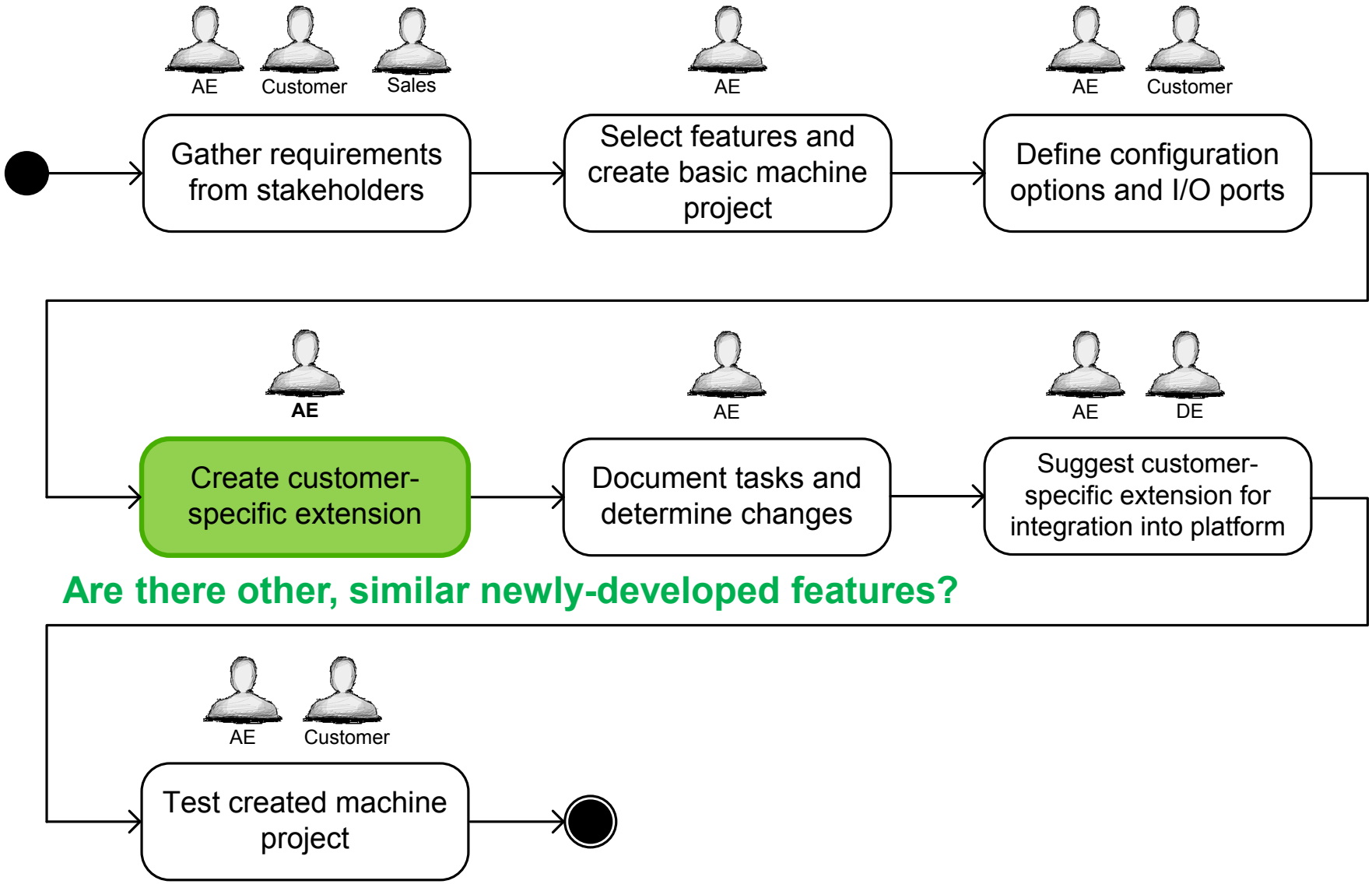
- new and similar features developed in other projects
- mapping of features to code
- current state of a feature

<u>Consequences</u>

- Reuse potential not fully exploited
- Lack of discoverability of existing solutions
- Code duplicates without link to original solution

Lettner, Angerer, Prähofer, and Grünbacher. *A case study on software ecosystem characteristics in industrial automation software*. ICSSP 2014.

Illustration: Application Engineering Use Case



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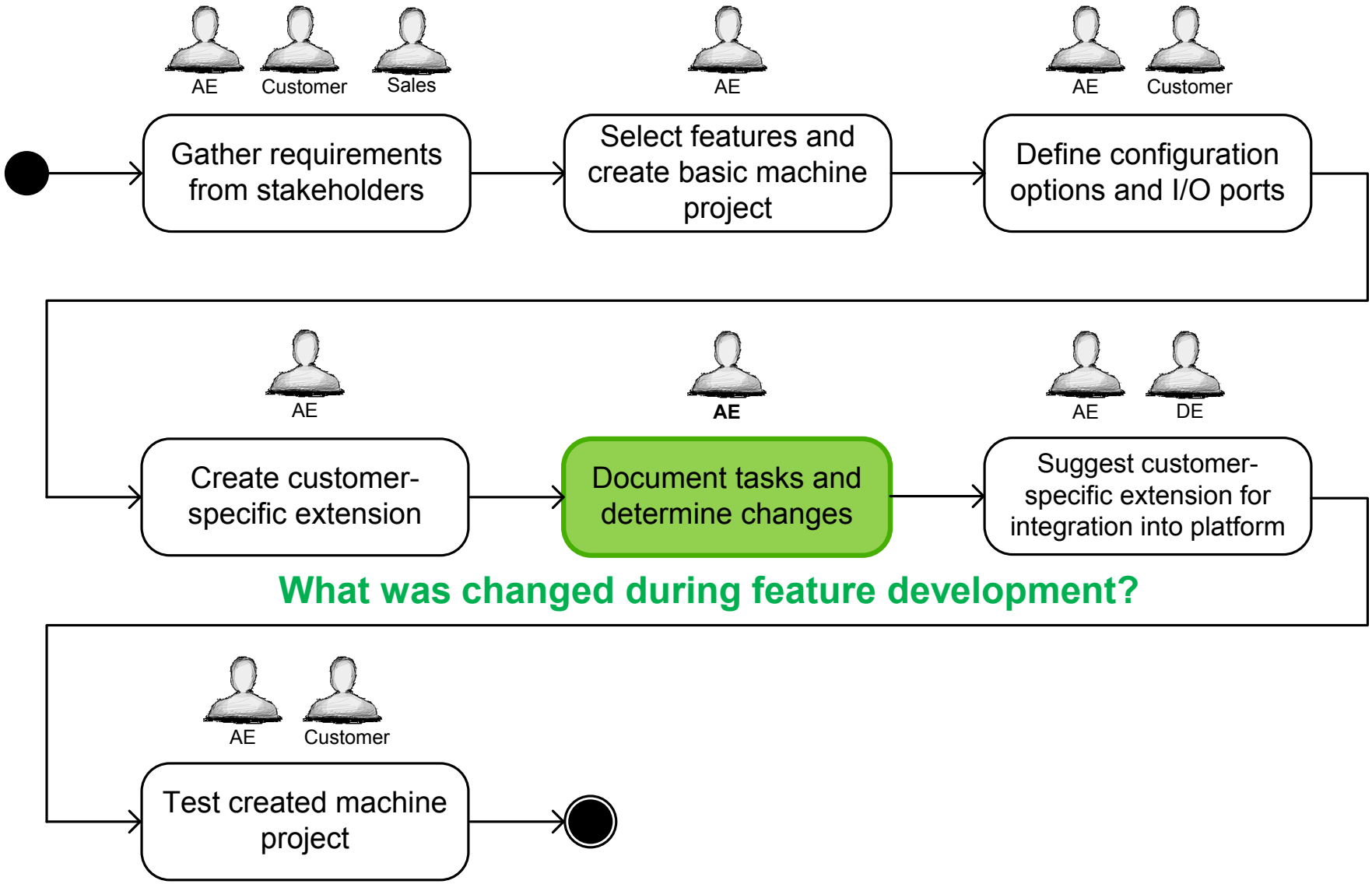

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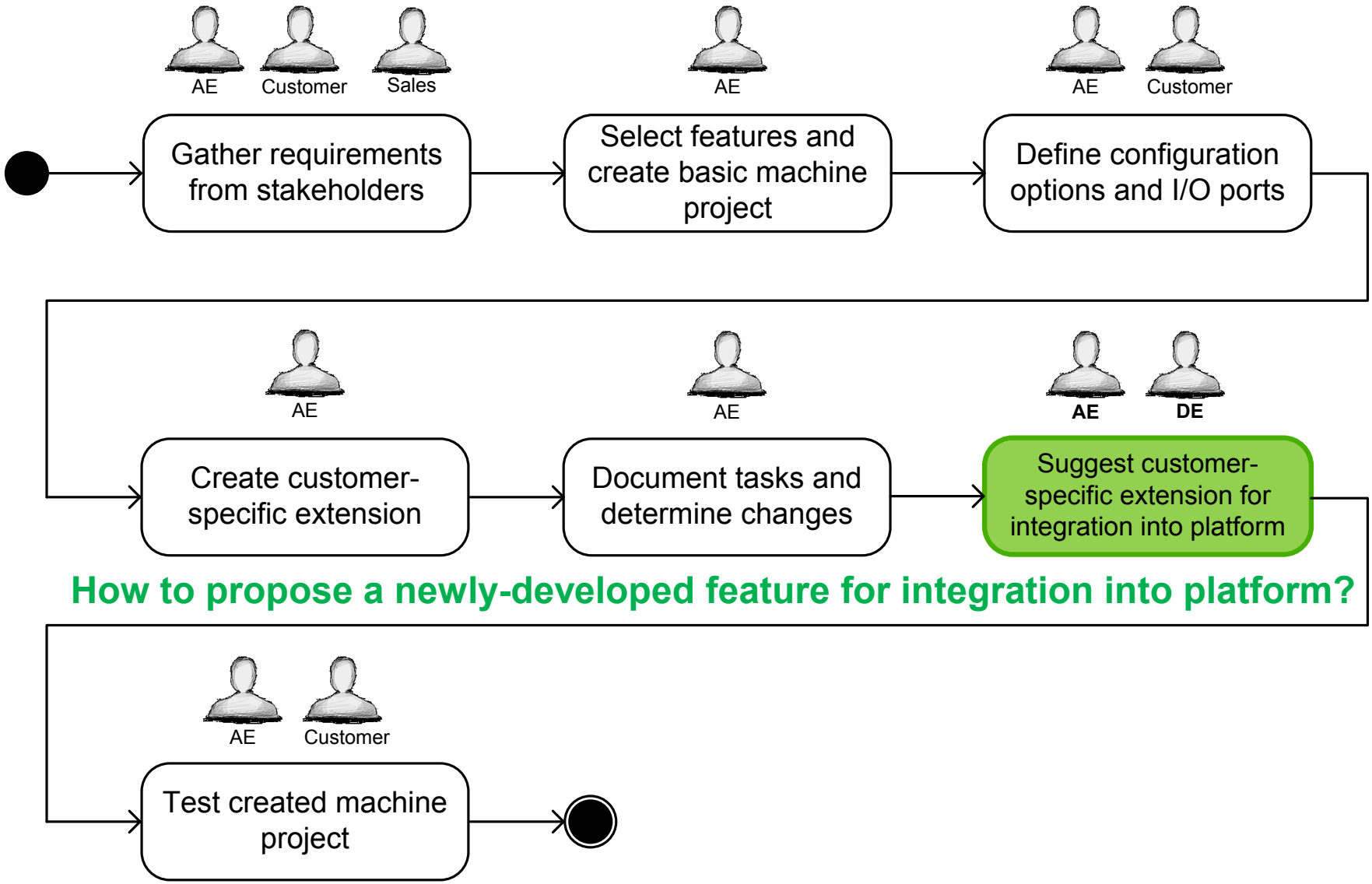
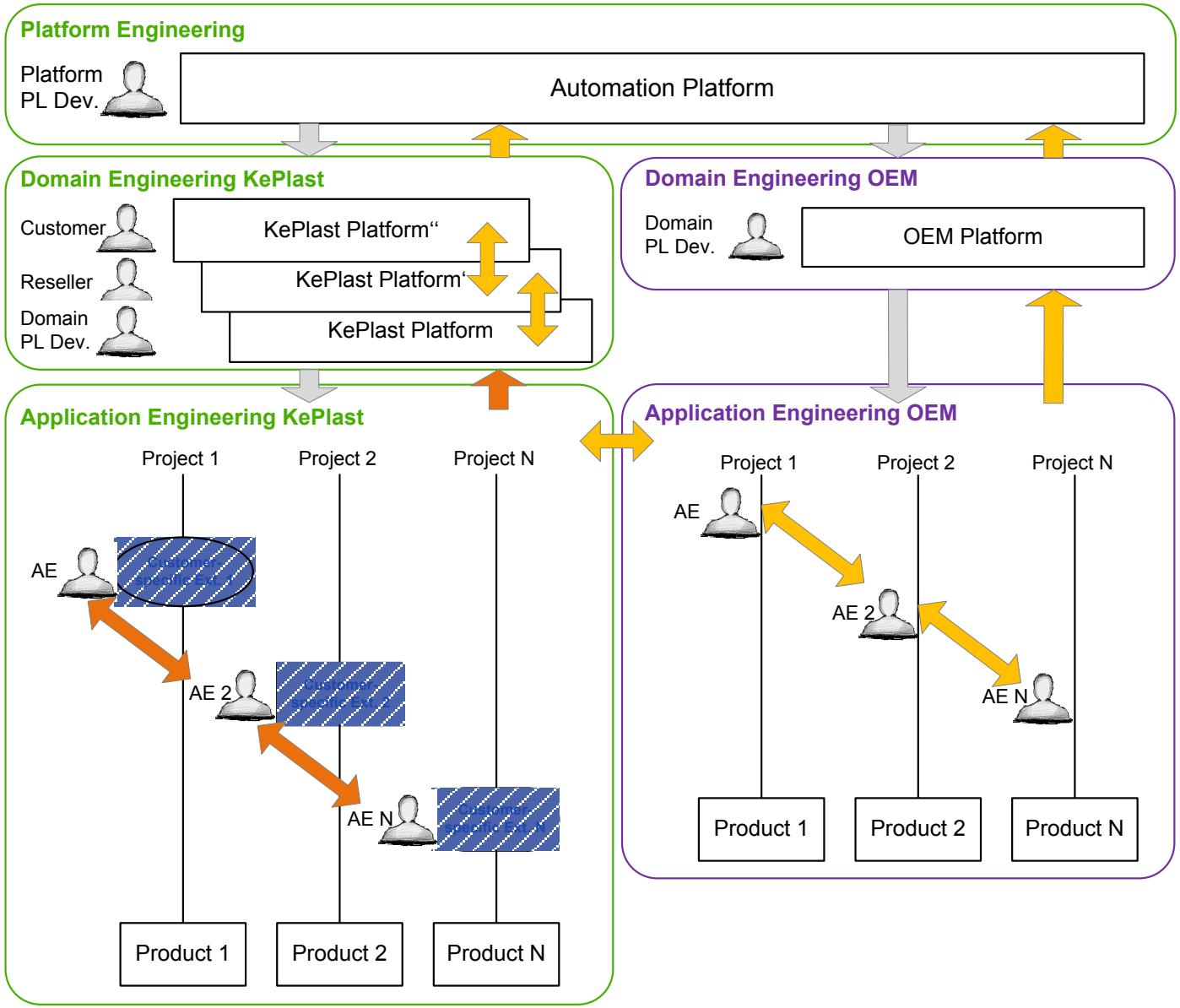


Feedback Scenario in the ISECO



Can the Scenario be supported with Software Crowdsourcing?

- What is Software Crowdsourcing?
  - Utilizes large group of distributed people to help accomplish tasks
  - Online, distributed problem-solving model [2]
  - Organizes work into short-duration, self-descriptive tasks (microtasks) [3]

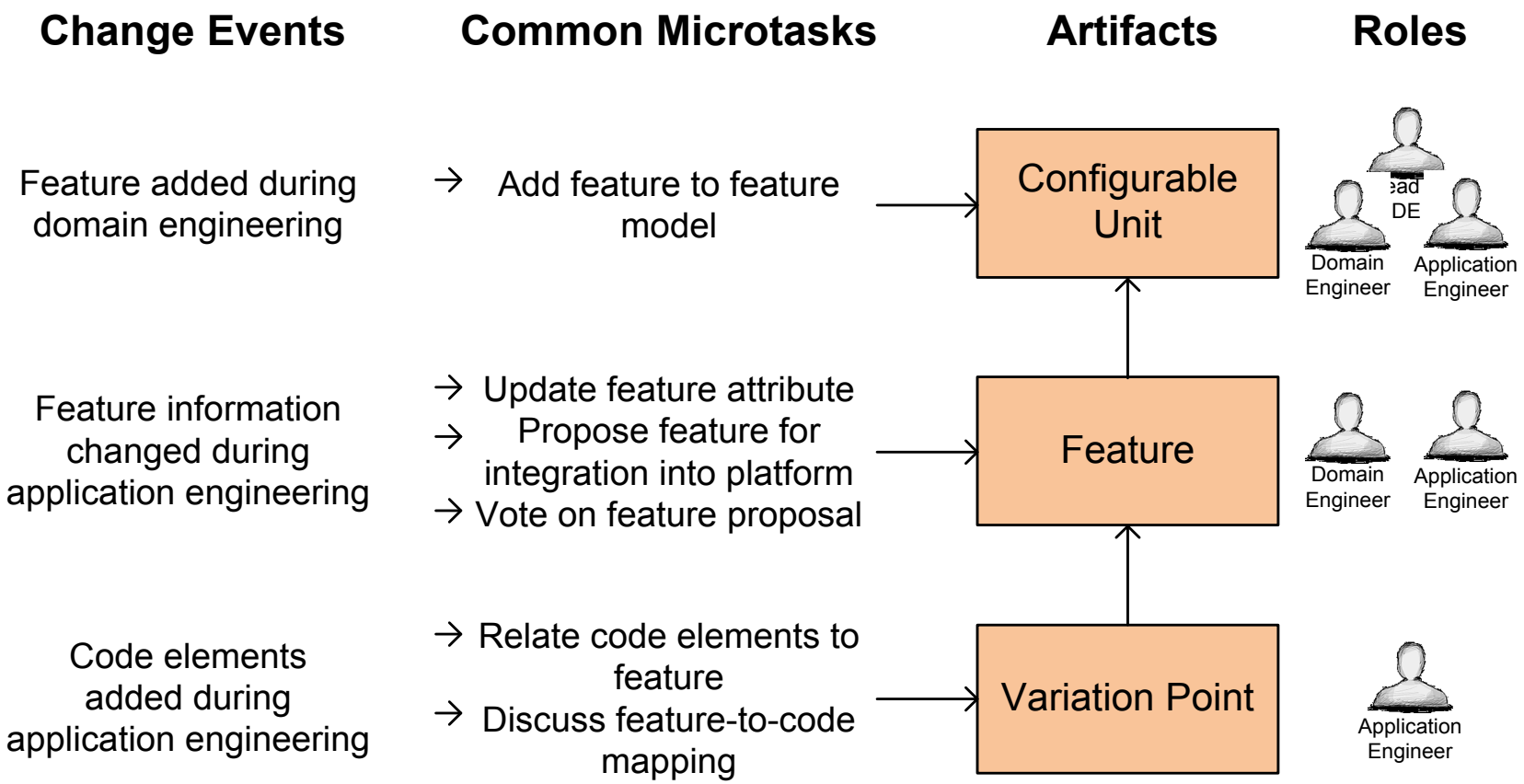
- Scenario can benefit from Software Crowdsourcing
  - Feedback loop from products, to product lines, to ISECO level
  - Support for multiple distributed users performing product customization

[2] Brabham. *Crowdsourcing as a Model for Problem Solving: An Introduction and Cases*. Int. Journal of Research into New Media Technologies 14 (1): 75–90. 2008.
[3] LaToza, Towne, van der Hoek, and Herbsleb. *Crowd development*. WS on Cooperative and Human Aspects of SE at ICSE 2013.

Feature Feeds

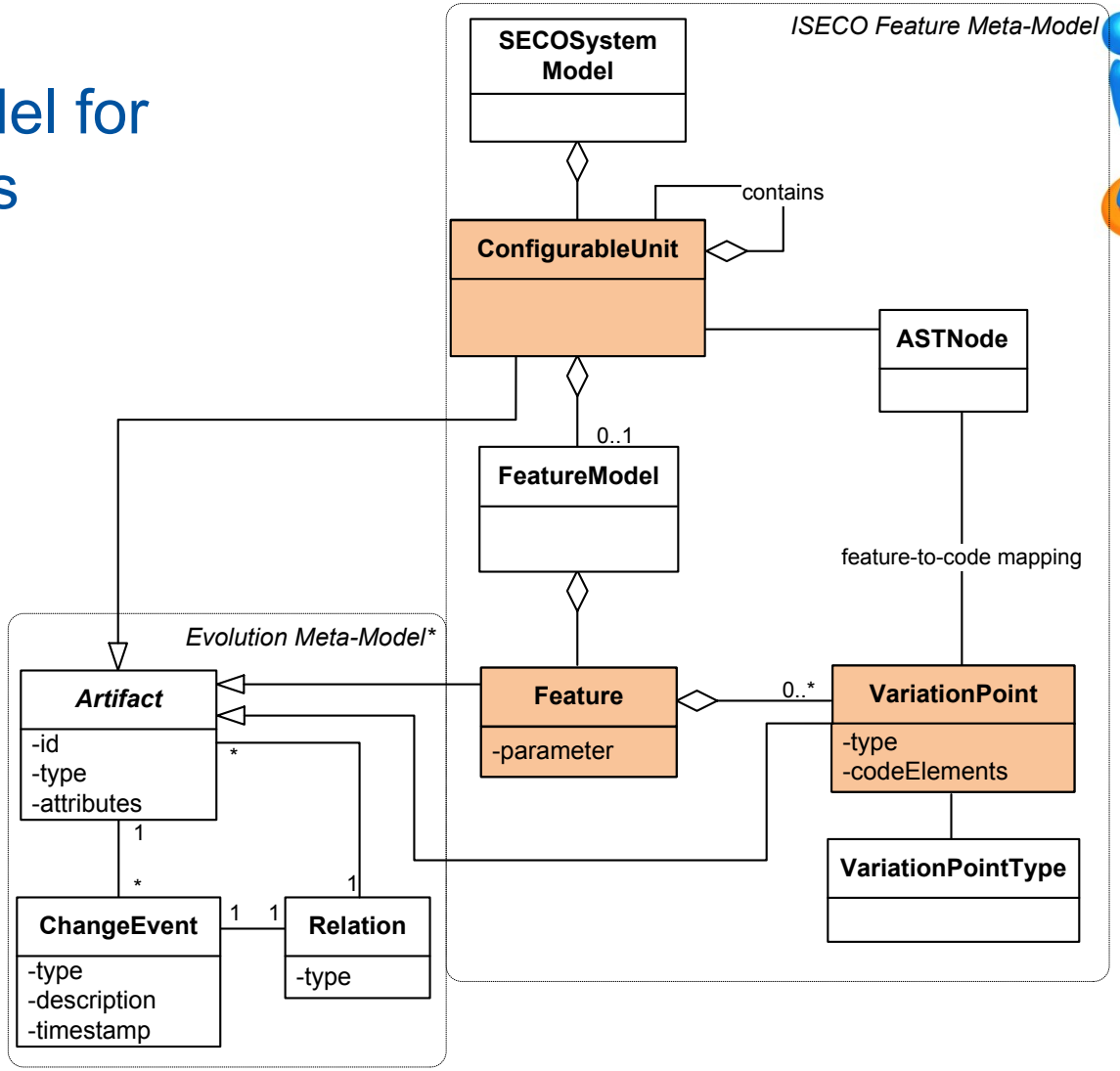
- Goal: Improve awareness of developers regarding evolution in the ISECO
- Communicate evolving ISECO features to interested developers
- Provide support for proposing customer-specific features for integration into ISECO platform
- Make project-specific developments visible that are not yet integrated into platform
  - because they might have reuse potential in the future

Feature Feeds – Change Event and Microtask Examples



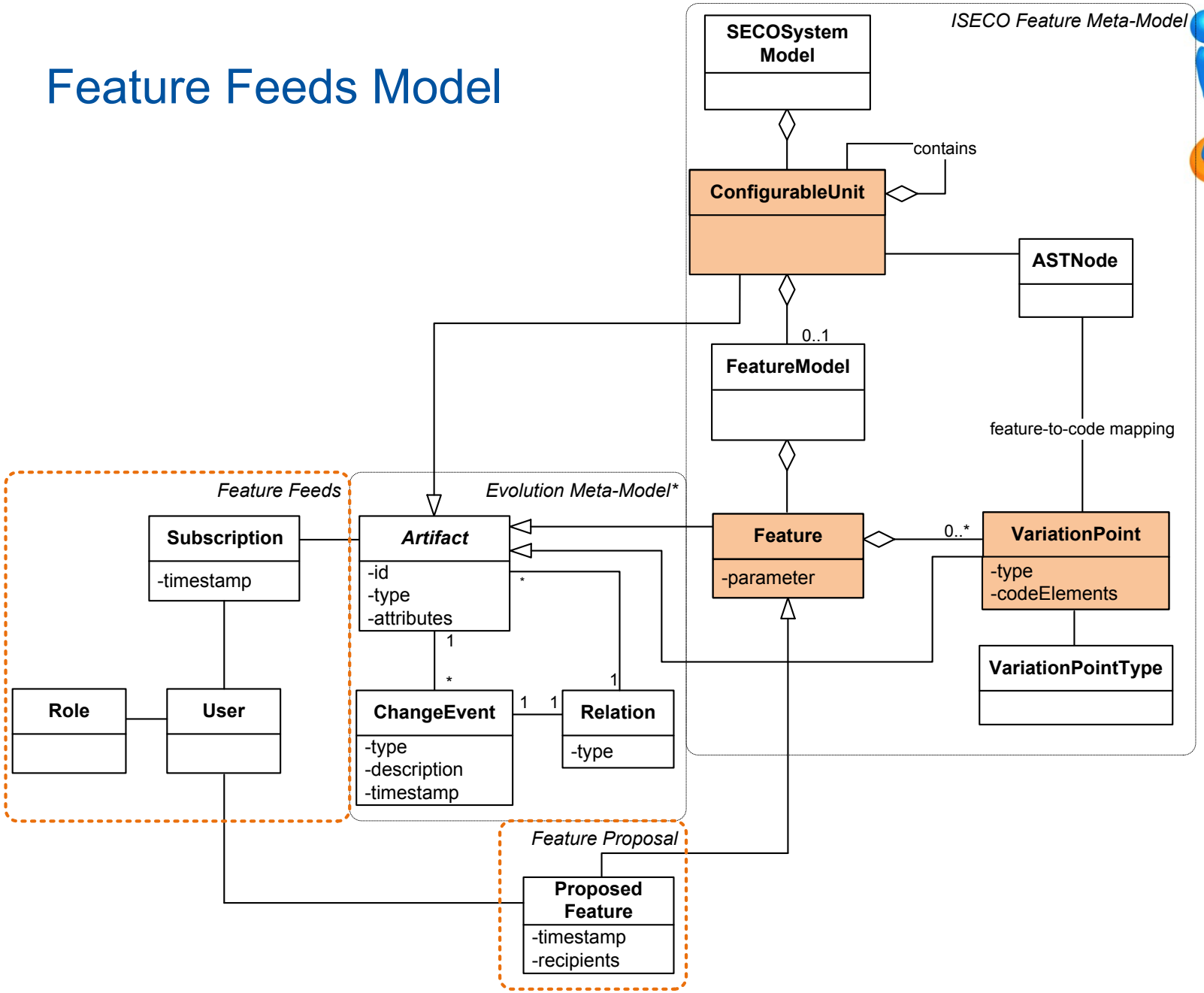
Common Variability Language contributors. Common Variability Language. http://www.omgwiki.org/variability/doku.php, 2013.

Evolution Model for Feature Feeds



*Heider, Grünbacher, Rabiser, Lehofer: *Evolution-Driven Trace Acquisition in Eclipse-Based Product Line Workspaces.* Software and Systems Traceability 2012: 195-213.

Feature Feeds Model



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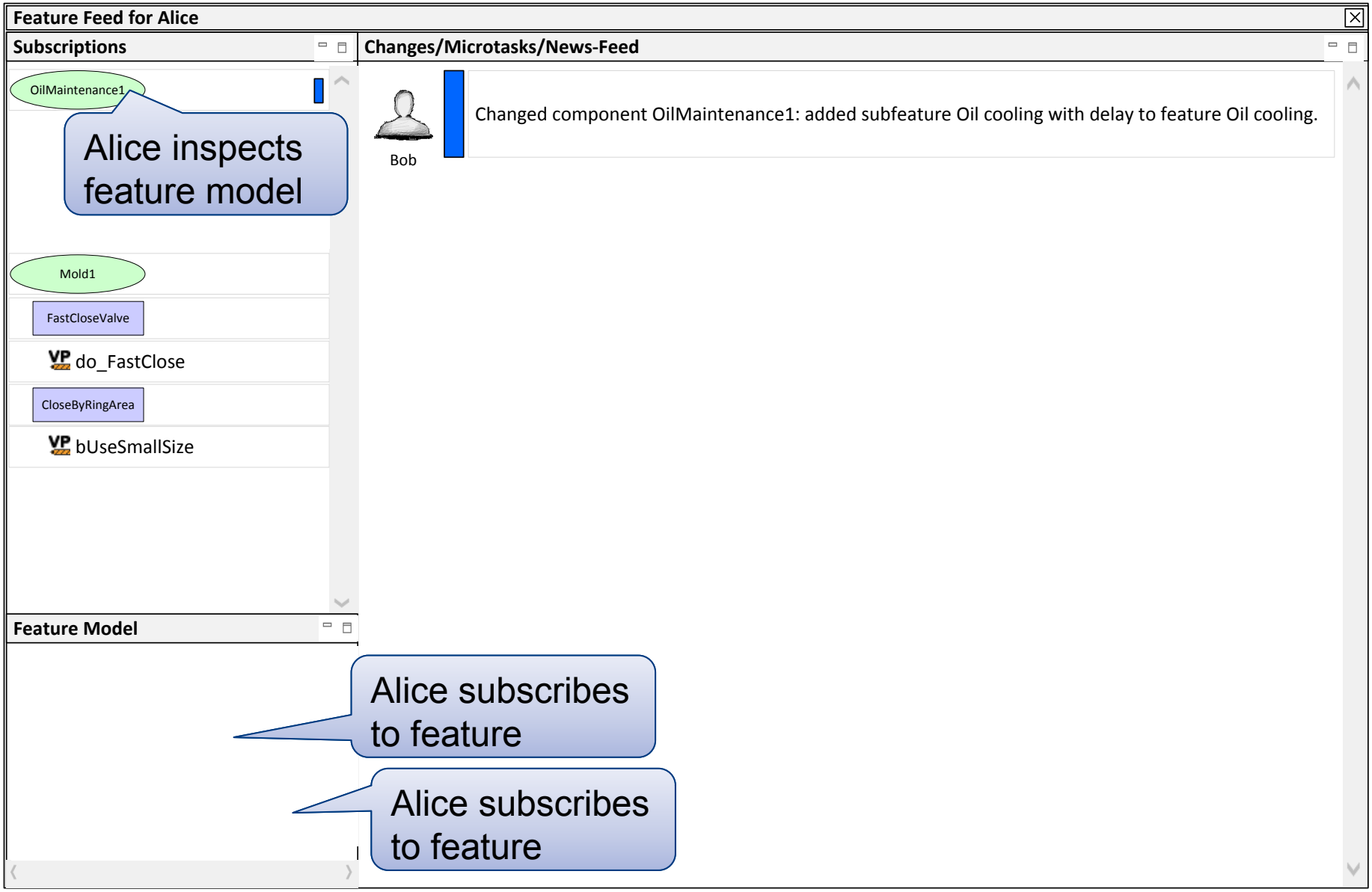
Envisioned Tool Prototype for AEs



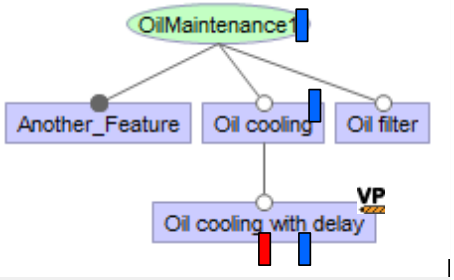
Envisioned Tool Prototype for AEs

Feature Feed for Alice

Subscriptions

- OilMaintenance1
  - Oil cooling
    - Oil cooling with delay
      - do_OilCooler
- Mold1
  - FastCloseValve
    - do_FastClose
  - CloseByRingArea
    - bUseSmallSize

Feature Model



Changes/Microtasks/News-Feed

Bob

Changed component OilMaintenance1: added subfeature Oil cooling with delay to feature Oil cooling.

Alice

Changed feature Oil cooling with delay: added variation point do_OilCooler.

Alice

Changed variation point do_OilCooler: related code elements to feature:

```
Δ %PLAUSIBILITY t#0s..t#180s
RETAIN %VARIABLE_GROUP VG_MachineData %DISPLAY_LEVEL 1
%INPUT_LEVEL cLevelStartupTechnician
Δ <resolution width="729" height="501"/>
Δ <attributeValues key="ActivePage" value="0"/>
Δ numFieldTextOilCool.setText = Oil cooler delay:
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Envisioned Tool Prototype for AEs

Feature Feed for Alice

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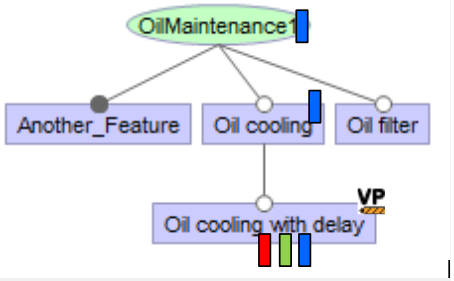
Feature Model



Changes/Microtasks/News-Feed

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Alice: Changed feature Oil cooling with delay: added variation point do_OilCooler.

Alice: Changed variation point do_OilCooler: related code elements to feature:

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Bob: Changed feature oil cooling with delay: proposed feature for integration into platform.

Carol: Changed feature oil cooling with delay: voted on feature proposal.

```
Voting result: Add realization of feature in HMI to variation point.
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Envisioned Tool Prototype for AEs

Feature Feed for Alice

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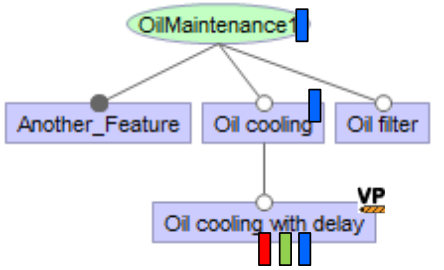

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Carol: Changed feature oil cooling with delay: voted on feature proposal.

```
Voting result: Add realization of feature in HMI to variation point.
```

Alice: Changed variation point do_OilCooler: related code elements to feature:

```
panelQSTempSet.add(numfieldStdSetValue);
numfieldStdSetValue.setValue(kvarSetValueZone1.getStringValue());
numfieldStdSetValue.setPreferredSize(PlastConstants.dimNUMFIELD_SIZE);
```

Carol: Changed feature oil cooling with delay: voted on feature proposal.

```
Voting result: Feature ready for integration into platform.
```

Current State and Outlook

- **Case Studies** on Software Ecosystem Characteristics and Software Evolution in ISECOs
- **Design and Implementation of Envisioned Tool Prototype**
  - supporting feature feeds
  - extending the FeatureIDE
- **User study** on the usefulness of feature feeds for application engineers

Thank You!

Questions now or later at daniela.lettner@jku.at