EXPERIENCE REPORT ON VARIABILITY IMPROVEMENT IN A PRODUCT LINE ENGINEERING UNAWARE COMPANY

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Virtual Event, 19.10.2020

About us

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FRAUNHOFER IESE – ENGINEERING THE DIGITAL FUTURE

The institute for software and systems engineering

Our mission:

Applied research for innovative solutions for the design of dependable digital ecosystems

- Founded in 1996, headquartered in Kaiserslautern
- More than 200 employees from more than 10 nations
- Part of the Fraunhofer Group ICT Technology
  Associated member of the Fraunhofer Group Defense and Security Research
- Member of the Fraunhofer Alliances Big Data and Artificial Intelligence as well as Ambient Assisted Living

Our most important business areas:

- Automotive & Commercial Vehicles
- Automation
- Healthcare
- Software & Platform Business
- Defense

Variation Management

Systematic Improvement on Strategic and Operational Level

Applied research
since 1997
(= 3-4 innovation cycles)

PuLSE™

Industry Partners (selection)

RICOH, BOSCH, HITACHI Inspire the Next, MARKET MAKER, testo, BLAUPUNKT, JOHN DEERE, KSB, KNORR-BREMSE, Continental, CASSIDIAN, ZF, DAIMLER

Systematic Variation Management Improvement

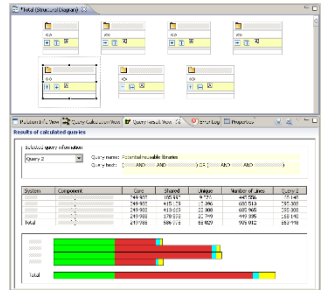
Characterize & Understand

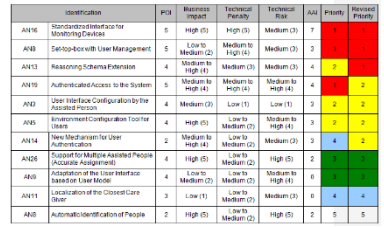
Plan

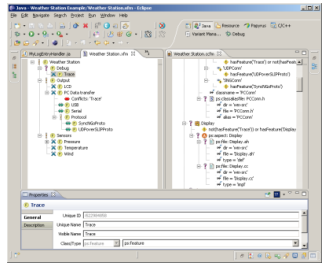
Do

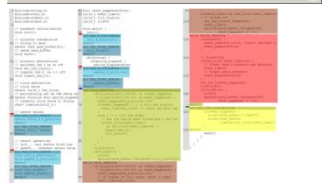
Evolve

- Tool-based Analysis of Artifacts
- Assessment of VM practices
- Scoping Workshop
- Domain Analysis & Modeling
- Improvement of VM Approach
- VM in Artifacts
- Configuration Management
- Change Management









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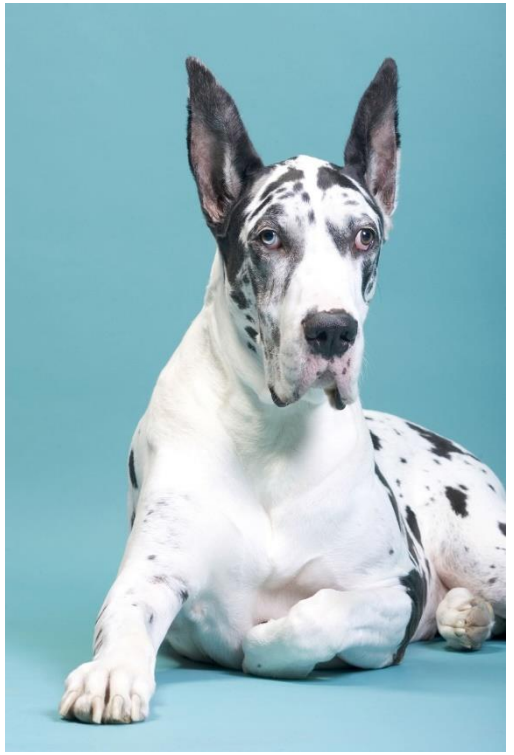
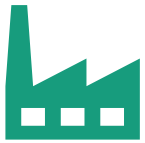
What to expect

- Experience report: pain points, constraints, and goals
- Overview on the improved VITAL method
- Share experiences on collaboration between domain and product line experts
- Lessons learned and recommendations



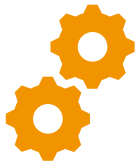
The Case



- Company provides services and products tailored toward both retail and industrial customers
- 10,000 employees spread across multiple countries
- market leader in its field (automation)
- A shift towards software-intensive systems
- Strategic goals
  - Reduce the time-to-market for development of similar products
  - Reduce the overall development and maintenance costs and
  - Increase quality

- Lack of systematic PLE approaches
  - Isolated scoping activities
  - Lack of variability management
  - Lack of traceability
  - Lack of variability management tools
    - no variability model exists
    - no constraints are modelled
    - lack of variant management strategies
- Fragmentation of the technology stack
- Organisational hierarchy

The Case



- Access to the source-code written in C and variant configuration files
- Not able to compile the provided artefacts
  - proprietary build-factory
  - proprietary libraries were missing
- No access to product requirements and marketing documents
- Insights into the product features and variant configurations
  - only be gained by analyzing provided assets
- calling on domain experts

- G1. Understand variability realization in the as-is-situation
- G2. Understand advantages of explicit variability management for documentation and configuration
- G3. Explore to which extent variability management tools provide a benefit
- G4. Understand to which extent domain experts can be relieved

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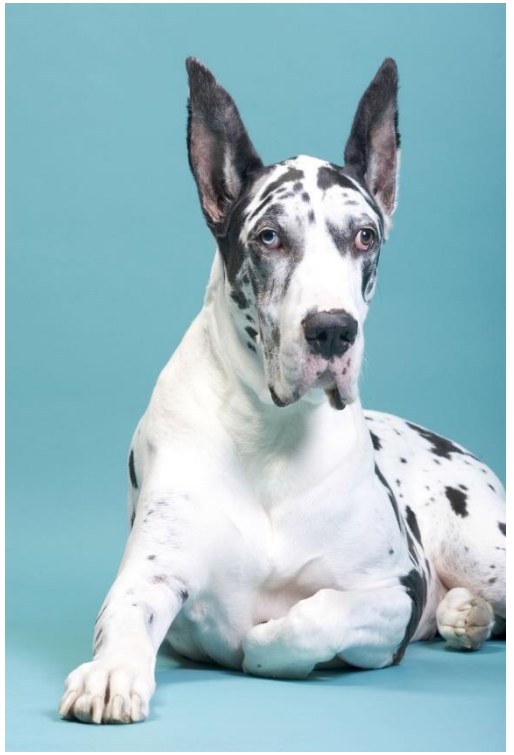
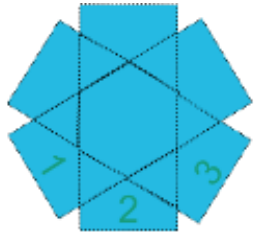
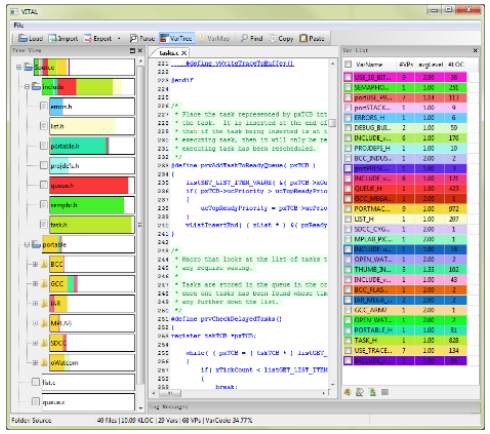


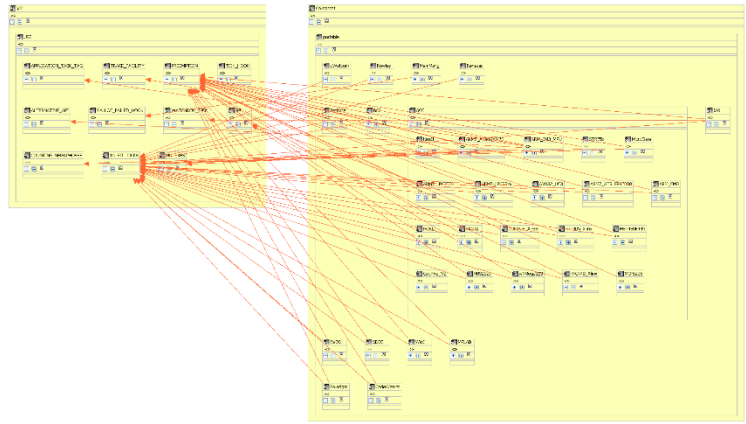
Variability Improvement Analysis (VITAL)

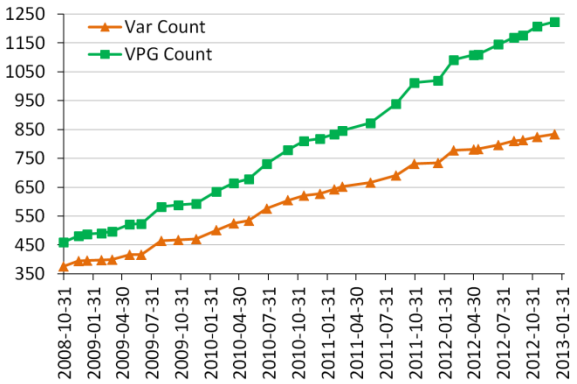


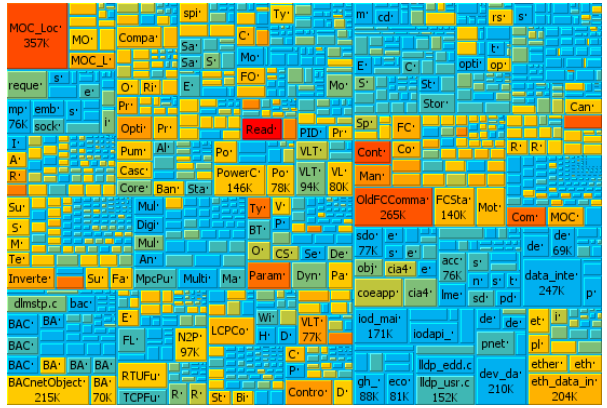
Analysis method & tool to provide overview in the „Preprocessor Hell“

- Analyze CPP-statements
- Identify variable features / parameters
- Identify and interlink variation points
- Assess variability realisation
  - (e.g. Variability-Fan-In / -Out)
- Identify improvement potential









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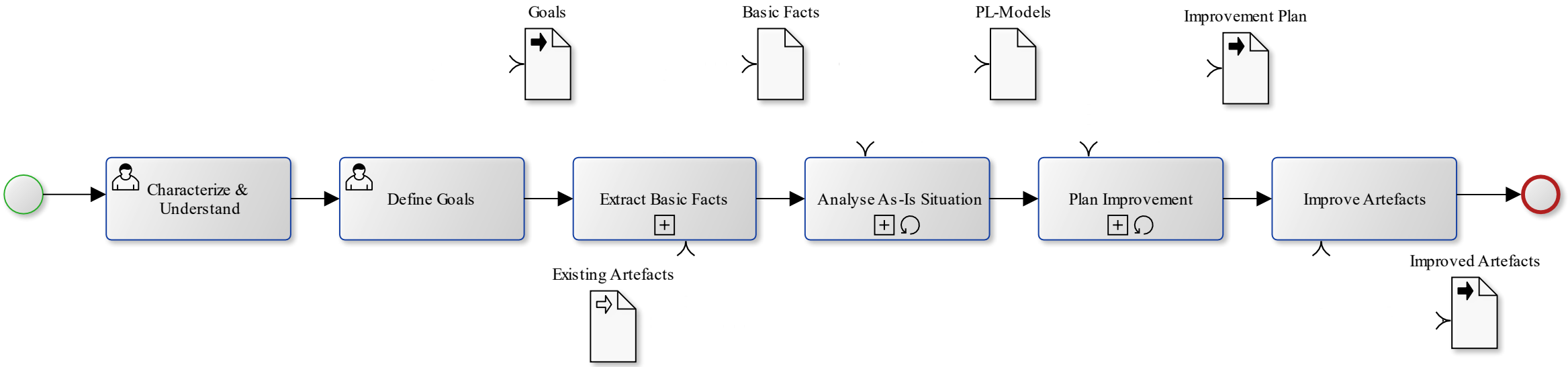
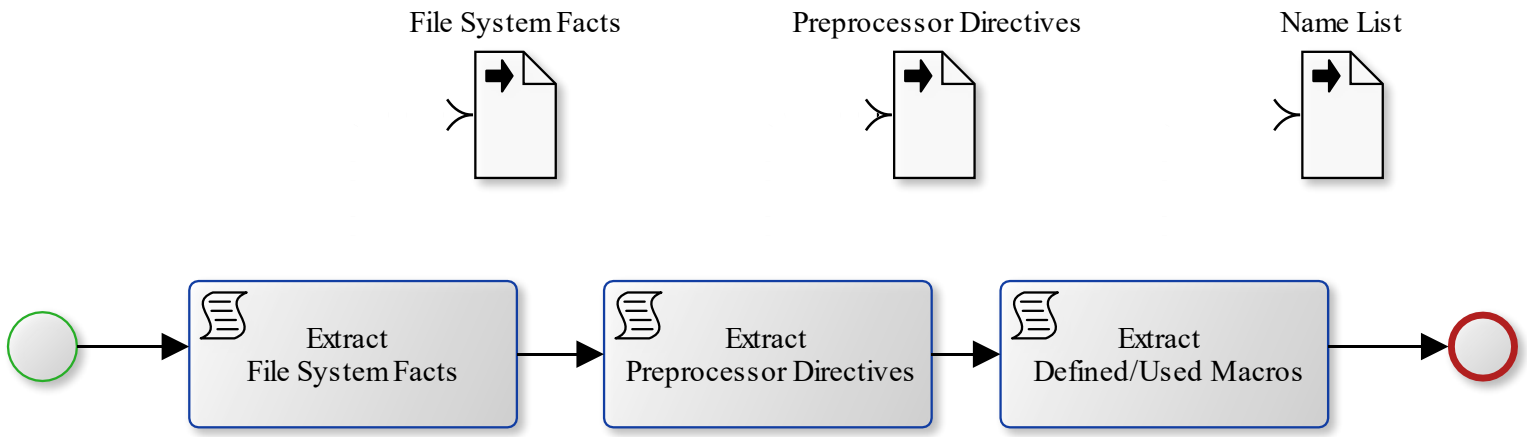
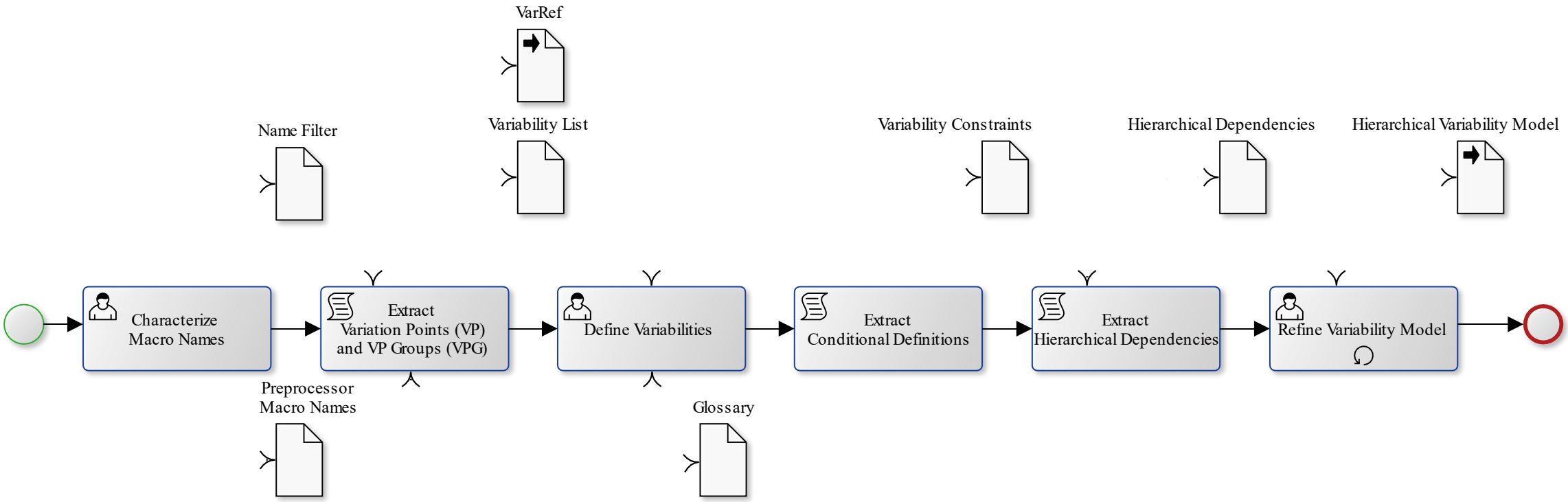
VITAL Approach



Extract Basic Facts



Analyse Is-Situation



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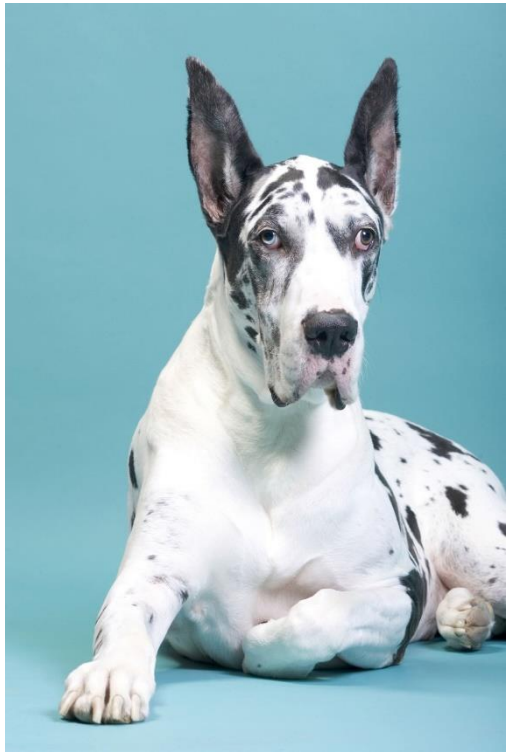
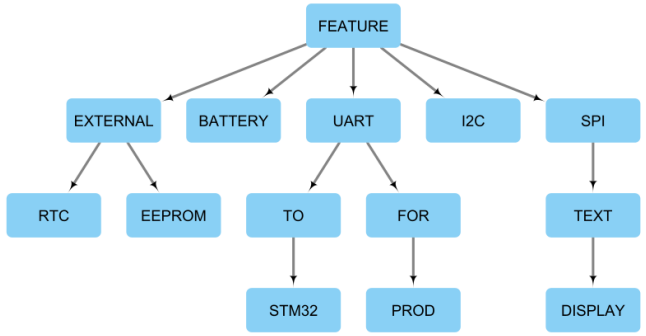
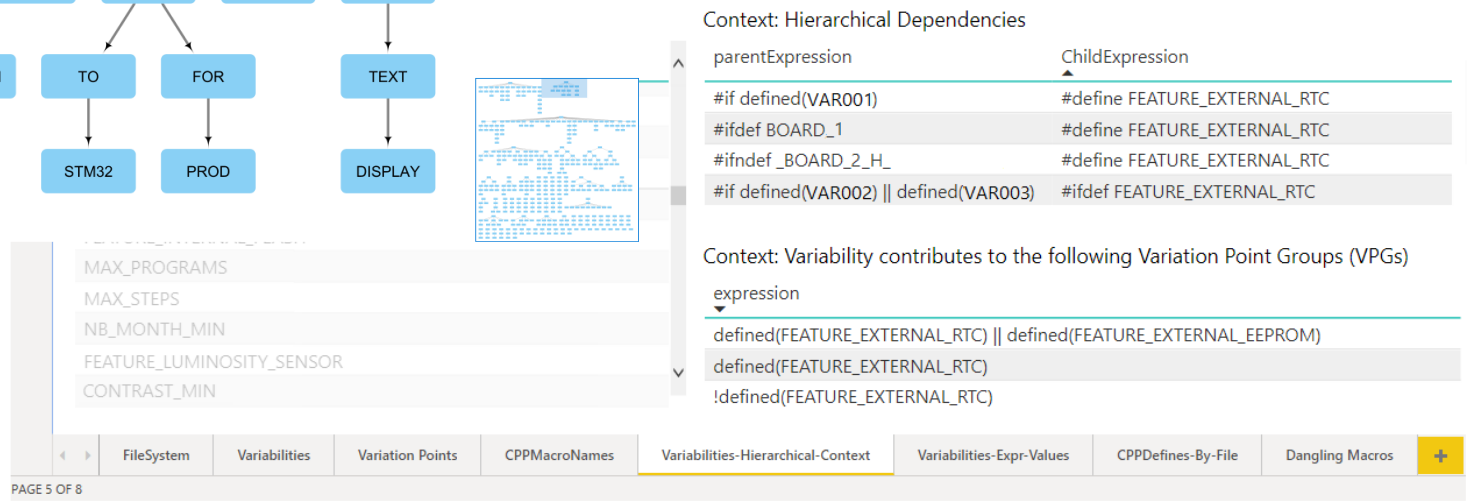
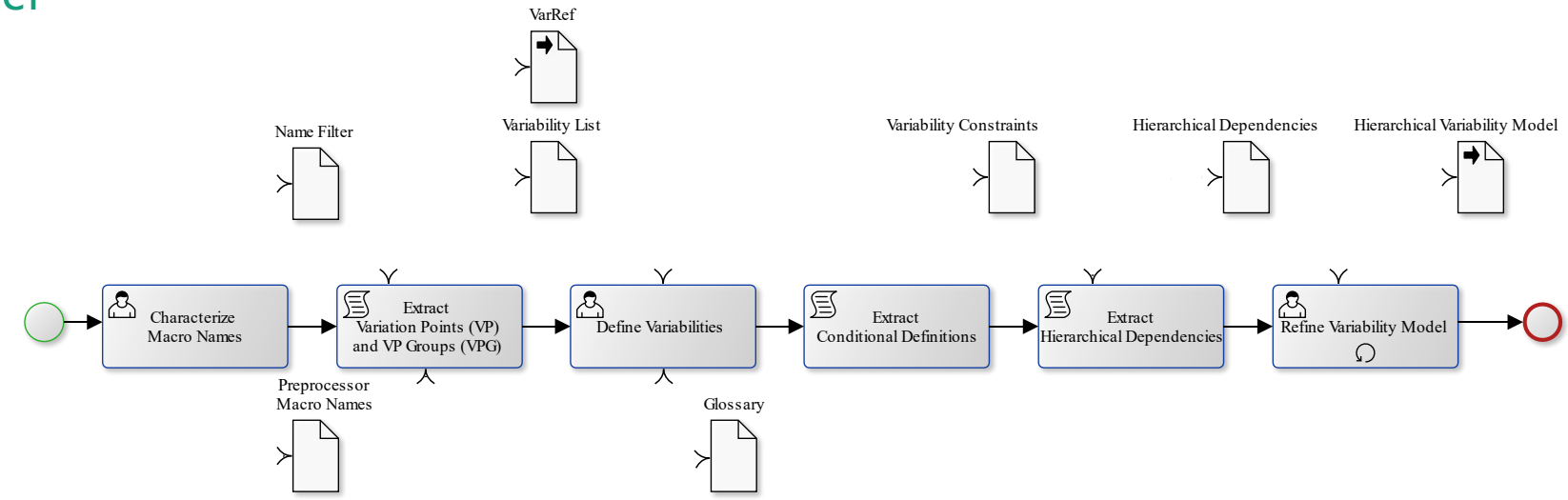


Collaboration

- Initial kick-off meeting
- Provision and inspection of data
- VITAL analysis
- Characterization of macro names
- Creation of variability model
- Join revision of VM
  - in workshop
  - in mindmapping tool
- Export of VM to pure::variants







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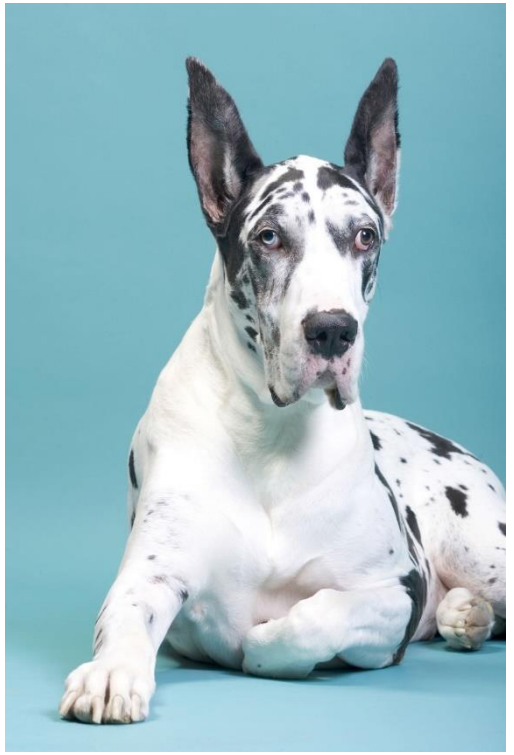

Lessons Learned

- Use descriptive feature names
- Prefer simple machine-readable data formats to complex file formats
- Source-code comments are good
- Start small, scale up
- Use the right tools for the job
- Structure and present your findings properly

Conclusion

- G1. Understand variability realization in the as-is situation
  - VITAL tool, 2,200 unique macro names ➔ 93 relevant variabilities
- G2. Understand advantages of explicit variability management
  - Graphical VM was perceived as very helpful
  - Restrictions and constraints to the variability model in pure::variants
  - Demonstration how traceability between variability management tools and assets can be realized
- G3. Explore to which extent variability management tools provide a benefit
  - VM tool could eliminate the need for manually generating make files, or proprietary equivalents
  - VM tools made it very simple to explain product variability to engineers from other business areas
- G4. Understand to which extent domain experts can be relieved
  - 38 hours for the senior manager
  - 10 hours for the domain expert

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Thank you for your interest

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