

Making System Models First-Class Citizens in CI/CD

Rethinking Model Management:
10 Years of SysML in Git with CI/CD



Philipp Kalenda (LieberLieber)

- Studied software engineering and IT consultancy
- Experience with MBSE for over 10 years
- OMG SMC and INCOSE member
- Responsible for consulting & training @LieberLieber



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#Git

#MBSE

#LemonTree

#UML

#SysML

What we build on

+20 years of experience with model version management (based on academia)

+10 years commercial model diff / merge tool

+5 years of commercial DevOps for system models



The History

2005 -> 2008

2009 -> 2011

2012 -> today



Adaptable Model Versioning

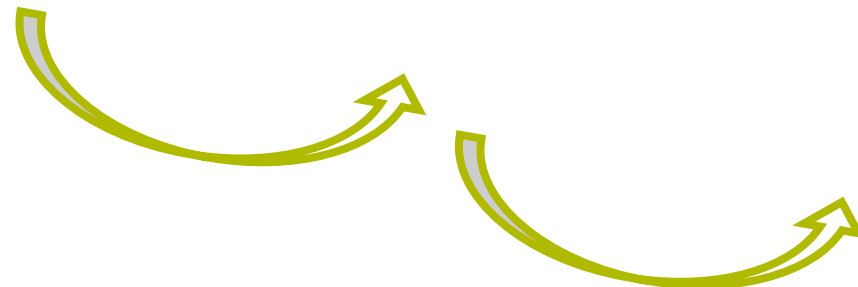
Commercial version control systems are used for handling of variants and feature branches

Merges of variants and feature branches are resolved by LieberLieber LemonTree

TU Wien Research Project
AMOR 2009-2011



↓ ↑ Different Model Read/Write Adapter

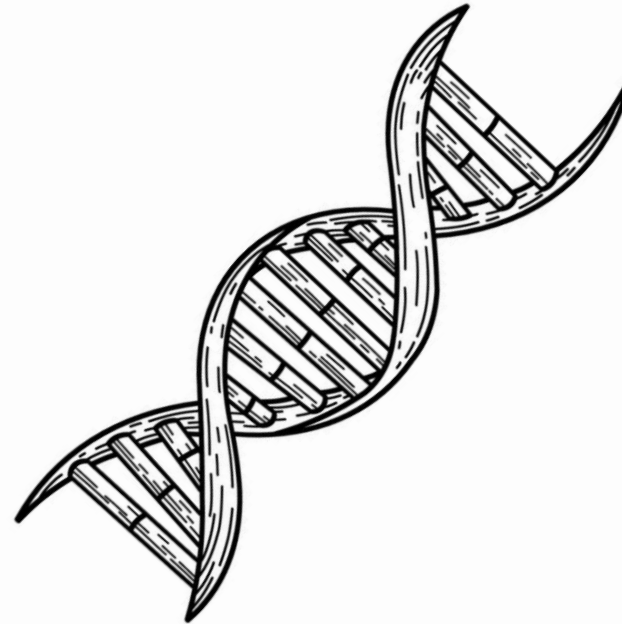


Our DNA

Model Based Team
collaboration using
strategies from Software
Engineering

Tool-agnostic

True product spirit, no custom
binaries



Problem Statement



„Trunk“ only not feasible for systems

Agility also needed in MBSE to meet goals

Complexity of Cyber-Physical Systems

Manage Model quality in distributed Teams

Cross company projects on shared IP

Digital Twin – and the dead meat...

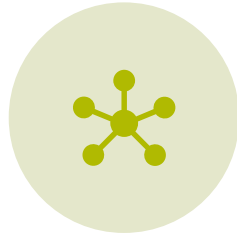
What do users want?



TRACEABILITY



ACCOUNTABILITY



INTEROPERABILITY



AGILITY



DIGITAL TWIN

Ways of collaboration in digital engineering



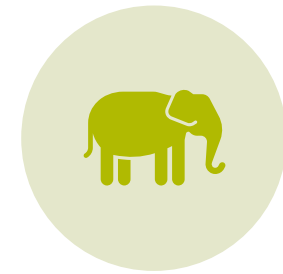
LIVE (OFFICE 365,
GOOGLE DOCS, ...)



PESSIMISTIC EXCLUSIVE
LOCKS (SVN)

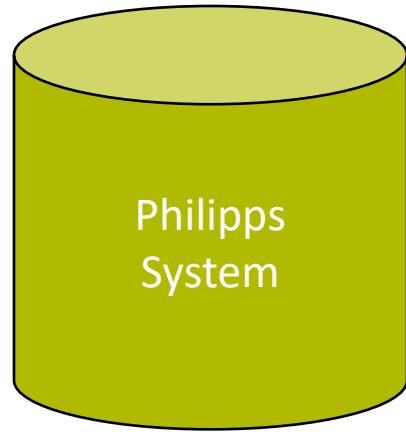


OPTIMISTIC (GIT, ...)



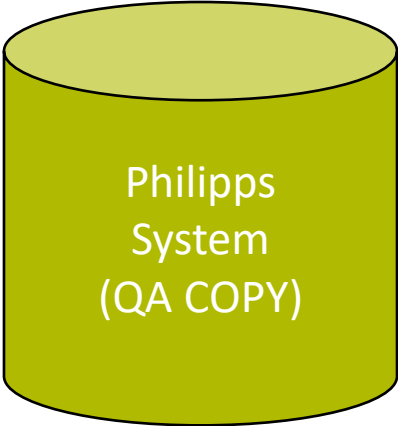
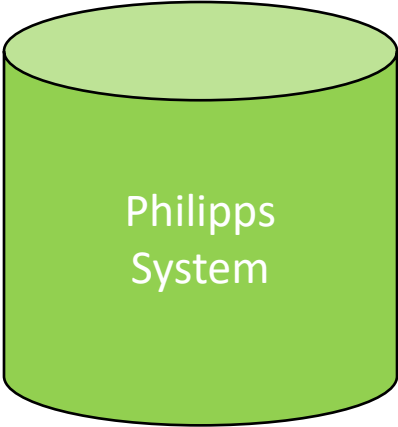
IVORY TOWER (IRONY)

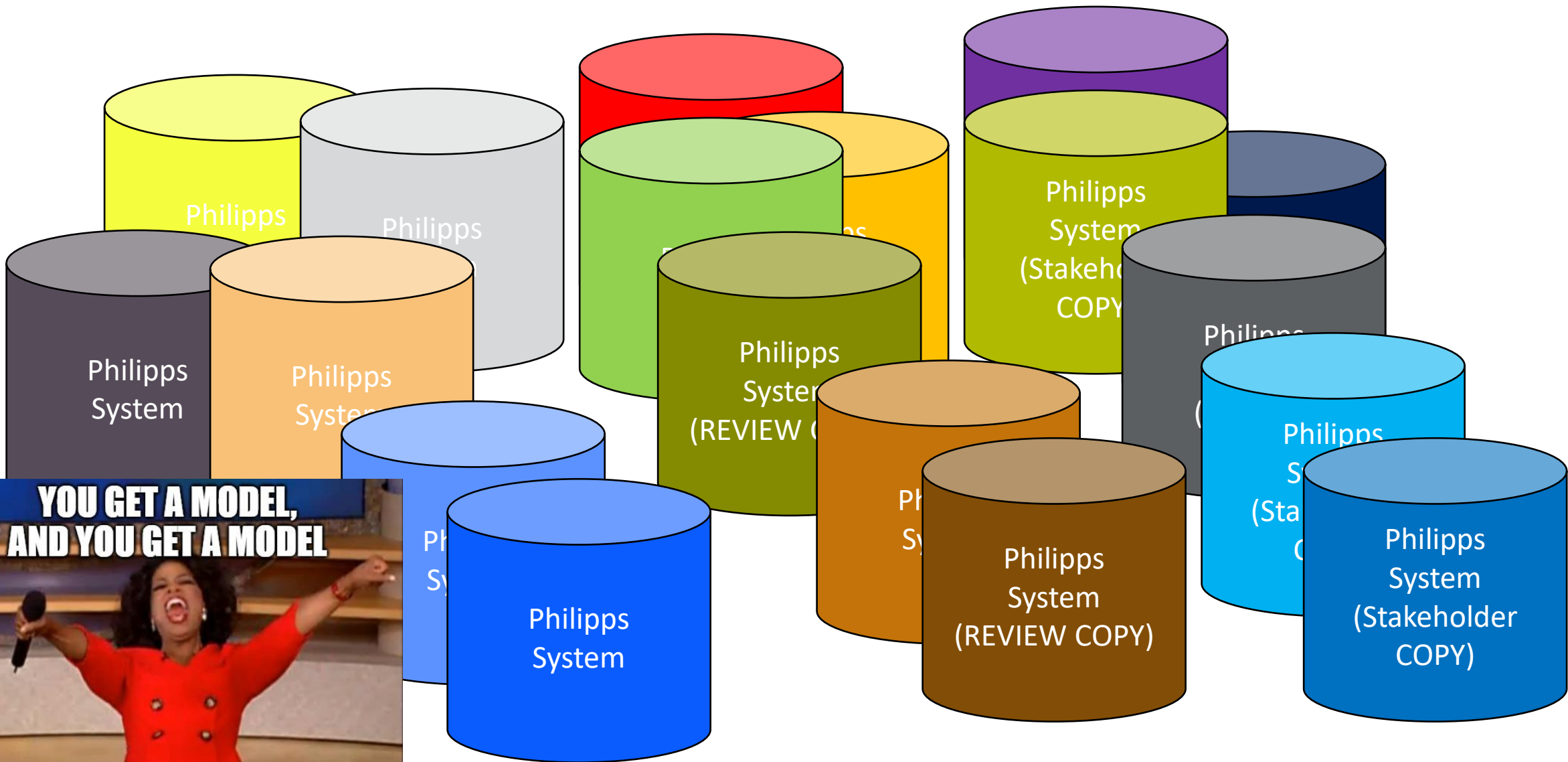
I create a Model



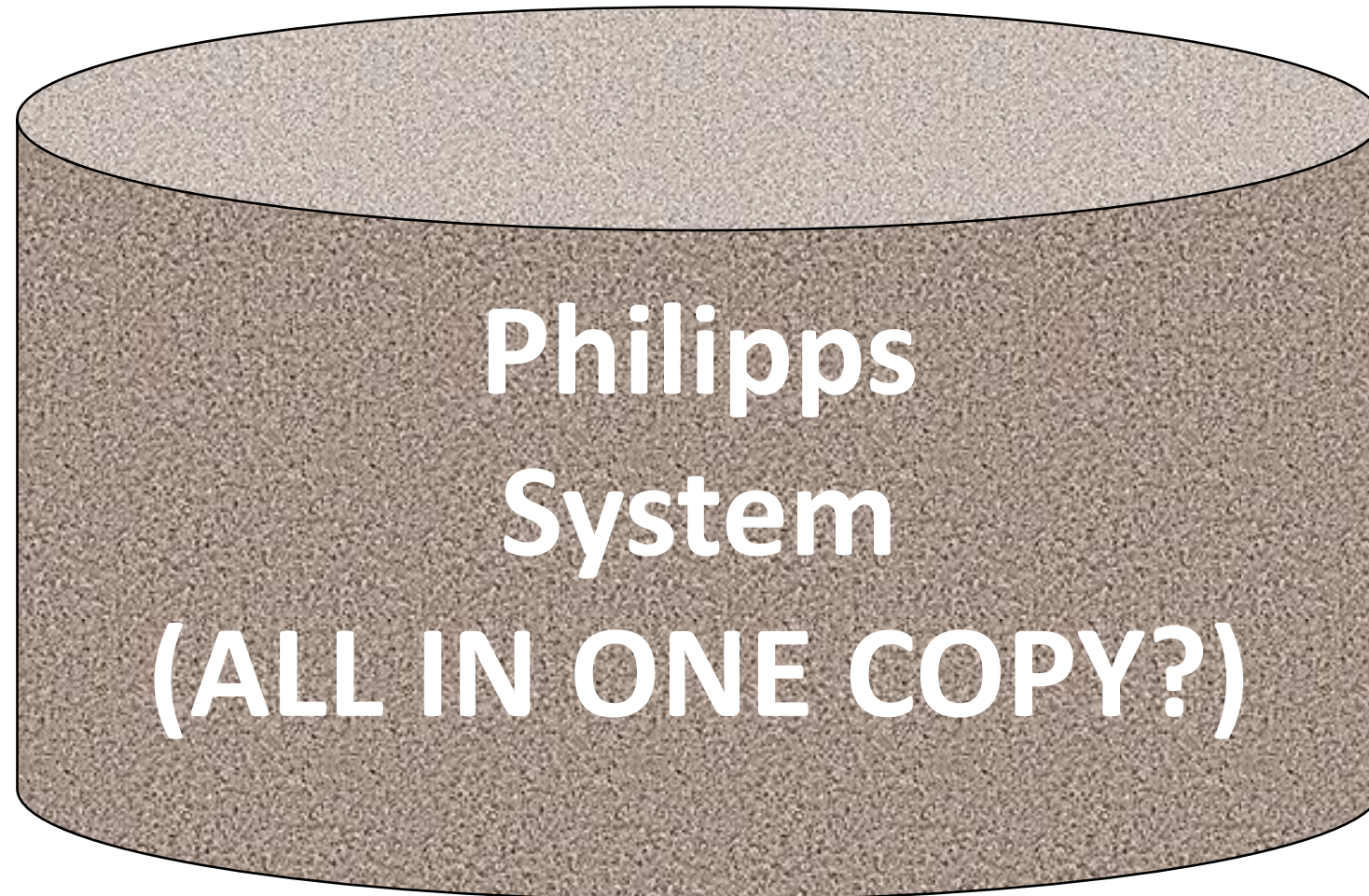
Task is finished

Quality assurance receives a copy

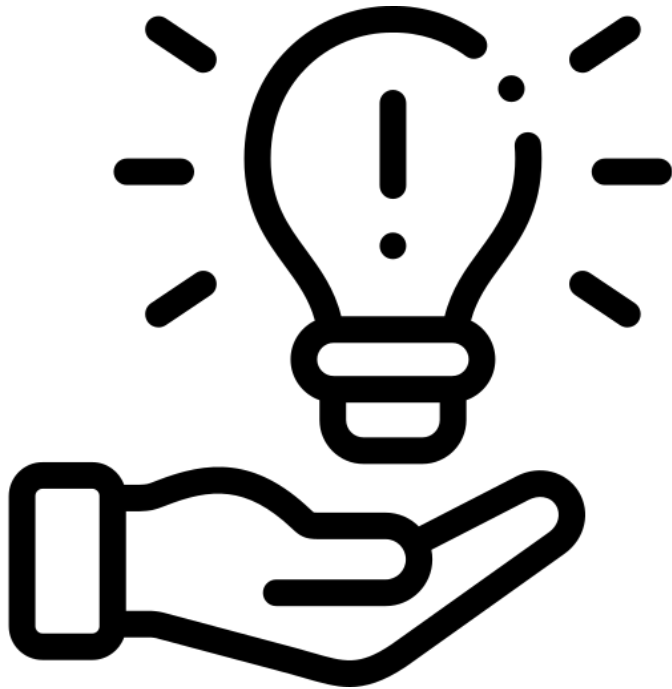




One truth? Reality? History?



MBSE Collaboration User Requirements



It should be **easy to release Models**

It shall be possible **to view and modify past versions** of the Model

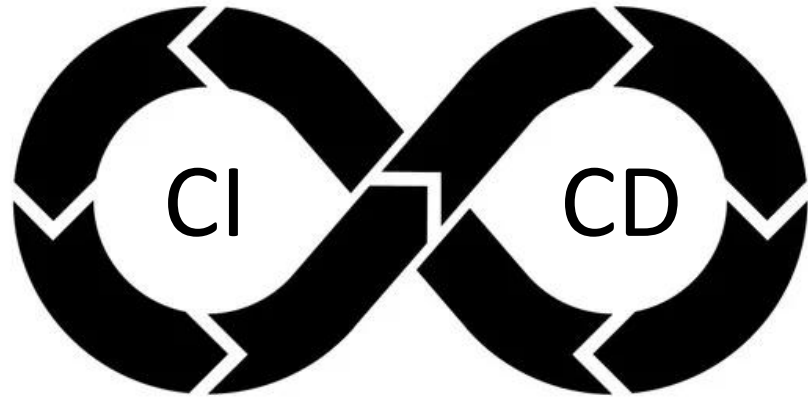
It shall be possible to evaluate **alternative scenarios**

It shall be possible to give new users a sandbox

Stakeholders shall **only** be able to **access** „Staging/Review“ and „Production“ Models

Stakeholders need to be able to **consume** and review the model via a Web browser

Why DevOps matters for models!



(1) Model-based Reviews

(2) Automated Code Generation

(3) Model Ware House

(4) Model Publishing

(5) Integration

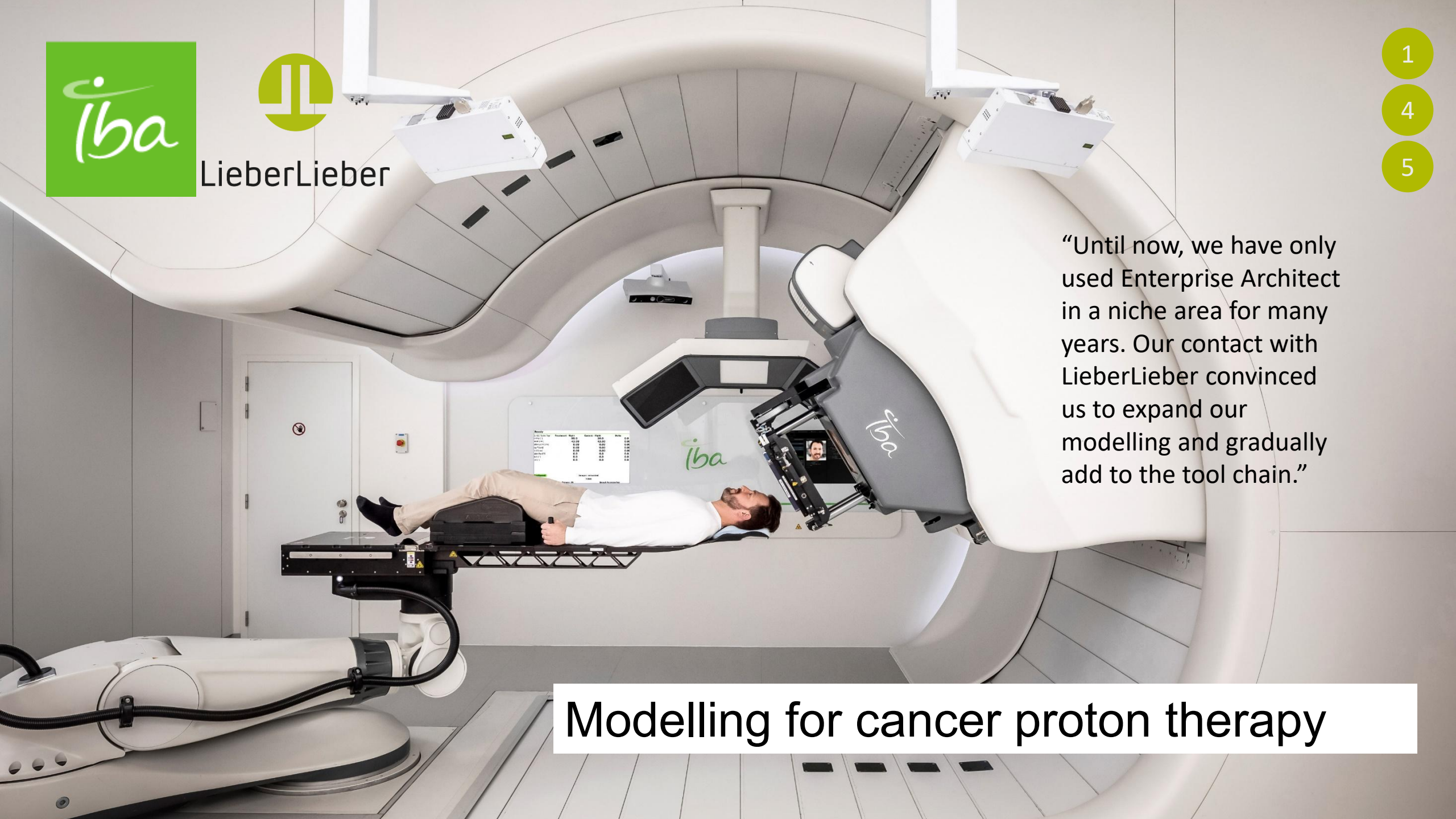


LieberLieber


- 1
- 4
- 5

“Until now, we have only used Enterprise Architect in a niche area for many years. Our contact with LieberLieber convinced us to expand our modelling and gradually add to the tool chain.”

Modelling for cancer proton therapy



Agriculture is going digital



“The importance of SysML, UML and other models for system development thus takes on a completely new level of significance. Enterprise Architect as a modelling platform and LemonTree as an enabler for current versioning of the models are crucial to achieving this goal.”



- 1
- 2
- 3
- 5

“With the good support of LieberLieber, we are sure that we will be able to keep the increasing complexity in our development projects firmly under control in the future.”

“Thanks to LemonTree, we can now also use the proven processes and workflows from classic software engineering for models. Therefore, we are now very happy to use the tool ”

Configuration Management:
Infineon relies on LemonTree



LieberLieber





BOSCH

DevOps for MBSE: Manage models with Pipelines

<https://www.lieberlieber.com/en/lieberlieber-software-devops-for-mbse-at-bosch/>

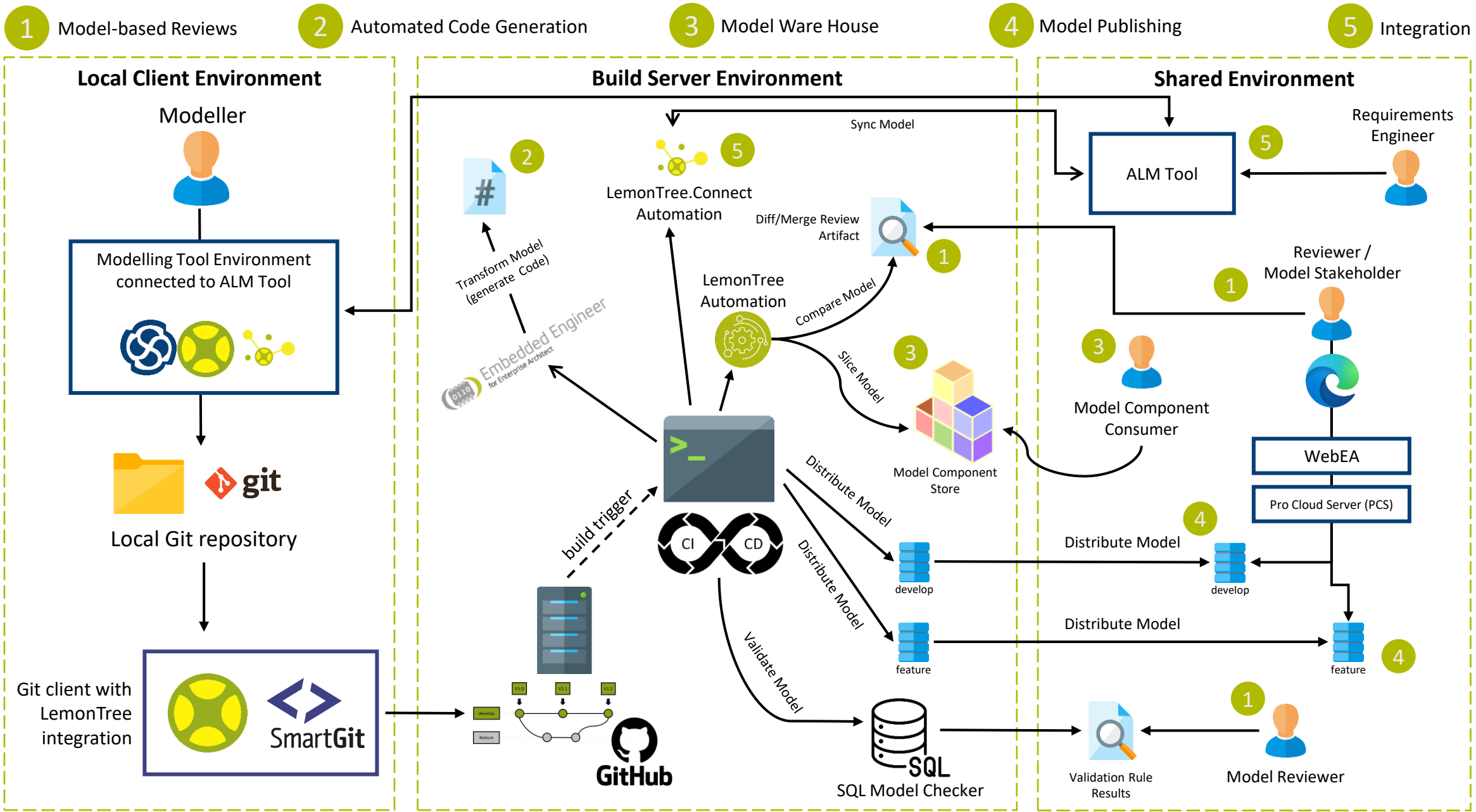
1

3

4



CI / CD Pipeline for Models



[← Verify Modelcheck](#)✓ added LIN BUS port to windows to serve as alternative to this data ch... #82[Summary](#)

All jobs

✓ ModelReadinessCheck

Run details

 Usage Workflow file

Triggered via push 1 hour ago

 philippkalenda pushed  63db2c7 [47-implement-new-interface-...](#)

Status

Success

Total duration

48s

Artifacts

-





ReviewModelCheck.yml

on: push

✓ ModelReadinessCheck 44s

ModelReadinessCheck summary

LemonTree ModelCheck results

	Severity	Issue	Message
	Warning	Model has 35 unsatisfied requirements	Each requirement should be linked to at least one design element using a 'satisfy' relationship.
	Warning	Model has 6 ports without interface definition	All ports should have an interface definition assigned.
	Passed	There are no orphaned InterfaceBlocks	
	Passed	No Journal entries in the model	



added LIN BUS port to windows to serve as alternative to CAN #48

philippkalenda wants to merge 1 commit into `main` from `47-implement-new-i...`



github-actions bot commented 1 hour ago

✓ No merge conflicts in model

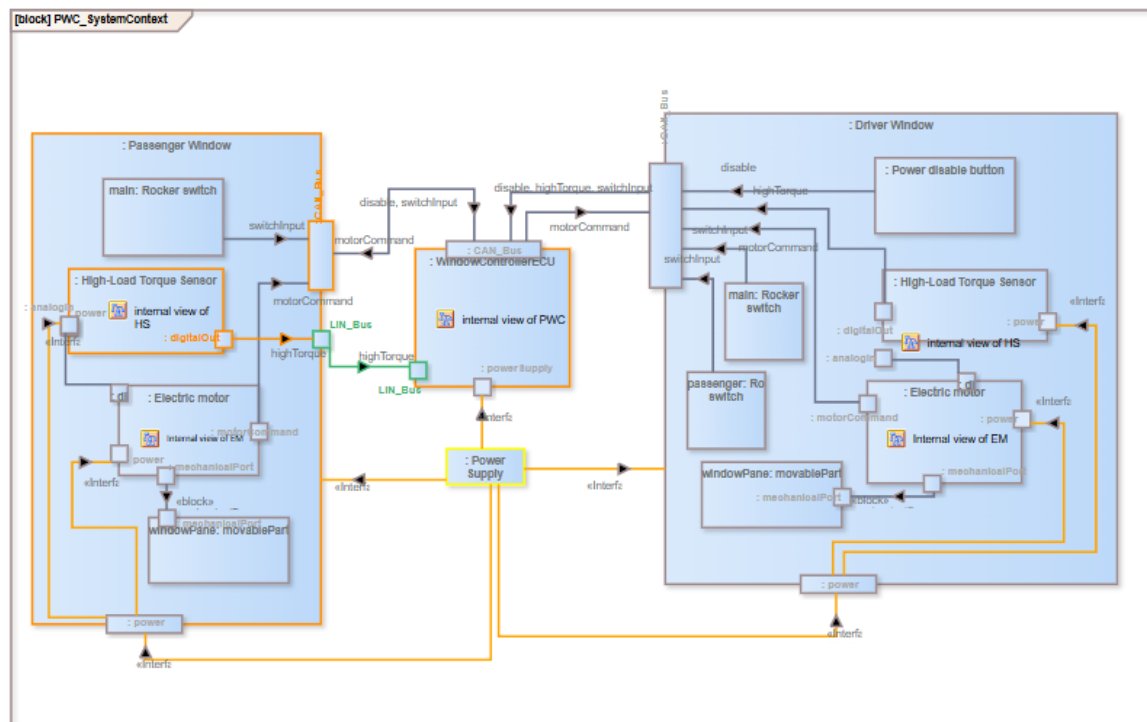
Modified Elements in SystemArchitecture:

Found 1 Diagrams.

Review Changes with LemonTree: [Desktop/Web](#)

Install [LemonTree 3.3+](#) to open the Review Session file.

Model.Architecture.SystemContext.PWC_SystemContext.PWC_internal_SystemContext



Milestone



No milestone

Development



Successfully merging this pull request may close these issues.

🕒 Implement new interface between torque sensor...

Notifications

Customize

🔔 Unsubscribe

You're receiving notifications because you authored the thread.

1 participant



🔒 Lock conversation

Compare

Session Details | No Custom Root | Show All Changes

Impacted Elements [7 / 7] 0 Conflicted

Search...

- :High-Load Torque Sensor**
Usages: 1 | A: Unmodified | B: Child modified
- :digitalOut**
Usages: 1 | A: Unmodified | B: Child modified
- :digitalOut -> :CAN_Bus**
Usages: 1 | A: Unmodified | B: Modified
- [unnamed] - { [unnamed], [unnamed] }**
Usages: 1 | A: Unmodified | B: Modified

base_LemonTree.DevOps.Demo.qeax

A / Theirs

- Model
 - Architecture
 - Subsystems
 - SystemContext
 - Window Assembly
 - «block» PWC_SystemContext
 - PWC_internal_SystemContext
 - :WindowControllerECU
 - :Passenger Window

«diagram text» High Torque Sensor : HighTorqueSensor_ibd [moved here in B]

head_LemonTree.DevOps.Demo.qeax

B / Mine

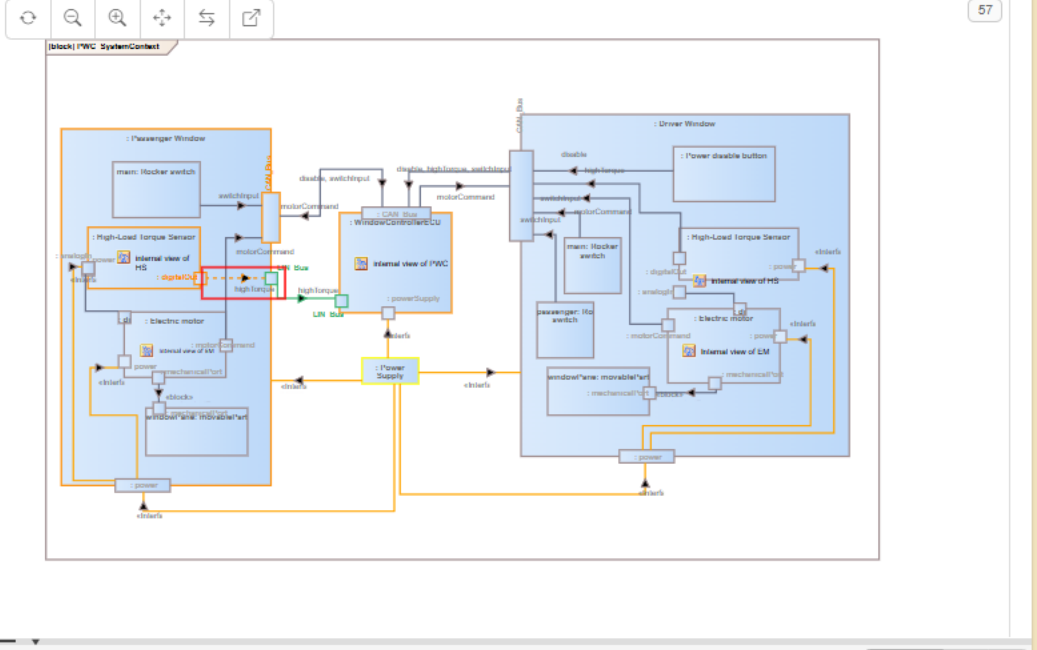
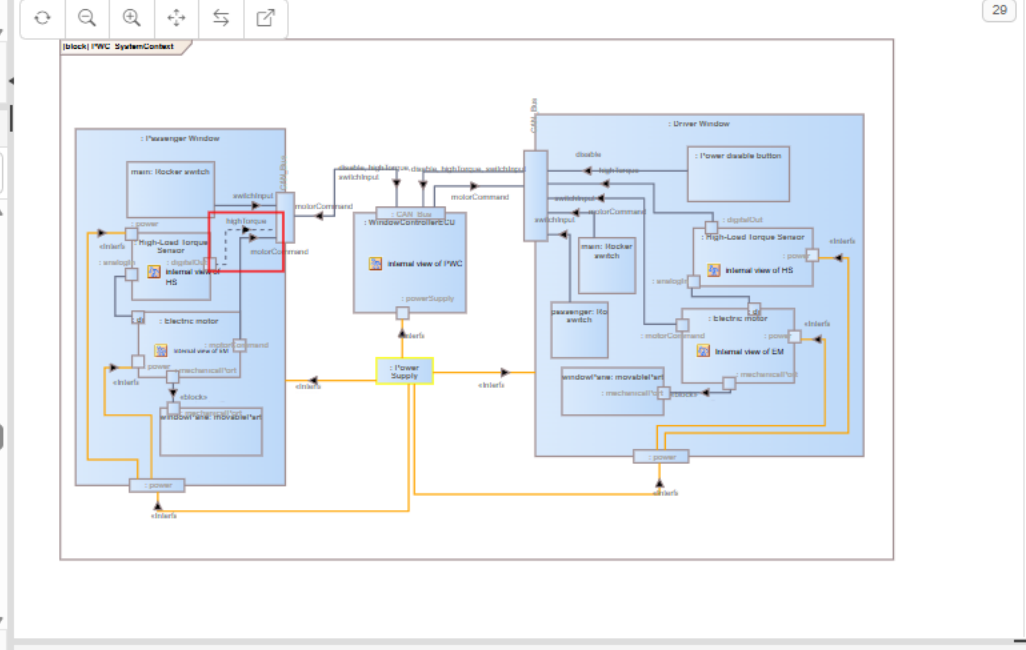
- Model (41)
 - Architecture (41)
 - Subsystems (2)
 - SystemContext (39)
 - Window Assembly (1)
 - «block» PWC_SystemContext (38)
 - PWC_internal_SystemContext (29)
 - :WindowControllerECU (1)
 - :Passenger Window (8)

«diagram text» High Torque Sensor : HighTorqueSensor_ibd (1)

PWC_internal_SystemContext: CompositeStructureDiagram

By Pan and Zoom | By Selected Element | No Sync

Info! Diagram visualization may differ from your modeling tool.



Impacted Elements on Diagrams [6 / 6] 0 Conflicted E...

Search...

- Diagram Representation**
A: Unmodified | B: Unmodified
- [unnamed] - { [unnamed], [unnamed] }**
A: Unmodified | B: Unmodified
- Diagram Representation**
A: Unmodified | B: Modified
- [unnamed] - { [unnamed], [unnamed] }**
A: Unmodified | B: Modified
- Diagram Representation**
A: Unmodified | B: Modified

What about the future?

