



32nd Annual **INCOSE**
international symposium

hybrid event

Detroit, MI, USA
June 25 - 30, 2022

Quality Monitoring of Systems Engineering Models

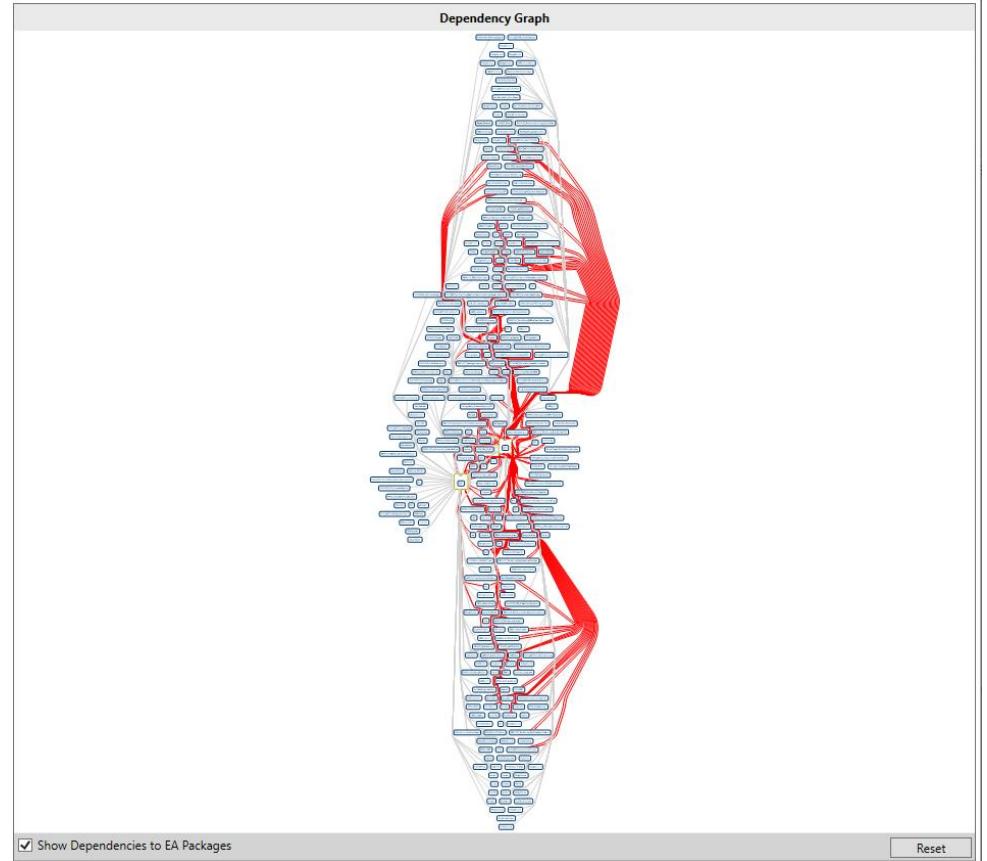
Git-based Model Management





Motivation

- **Complexity of Cyber-Physical Systems**
- **Increasing Model Sizes**
- **How to manage huge models?**





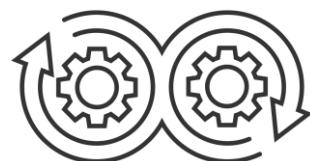
Problem Statement



What is the quality of an MBSE model?



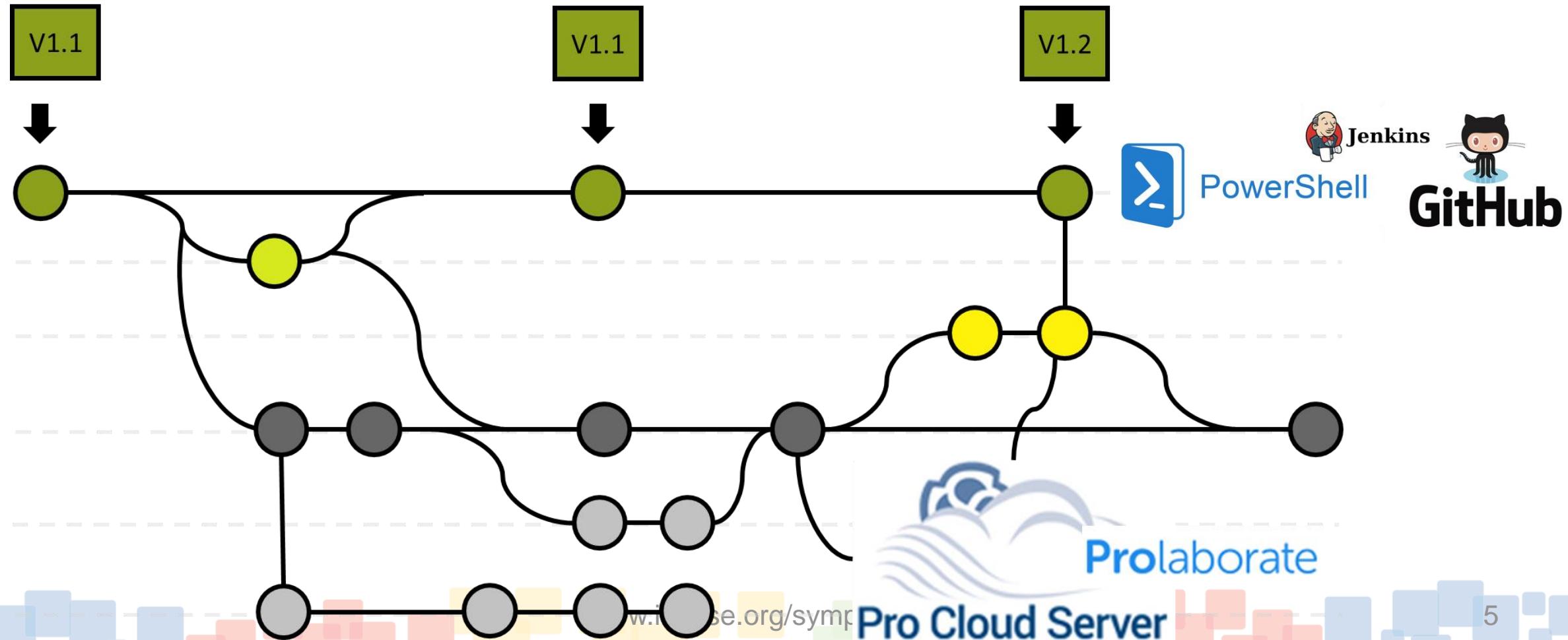
How to visualize model quality?



Is automated improvement possible?



State of the Art



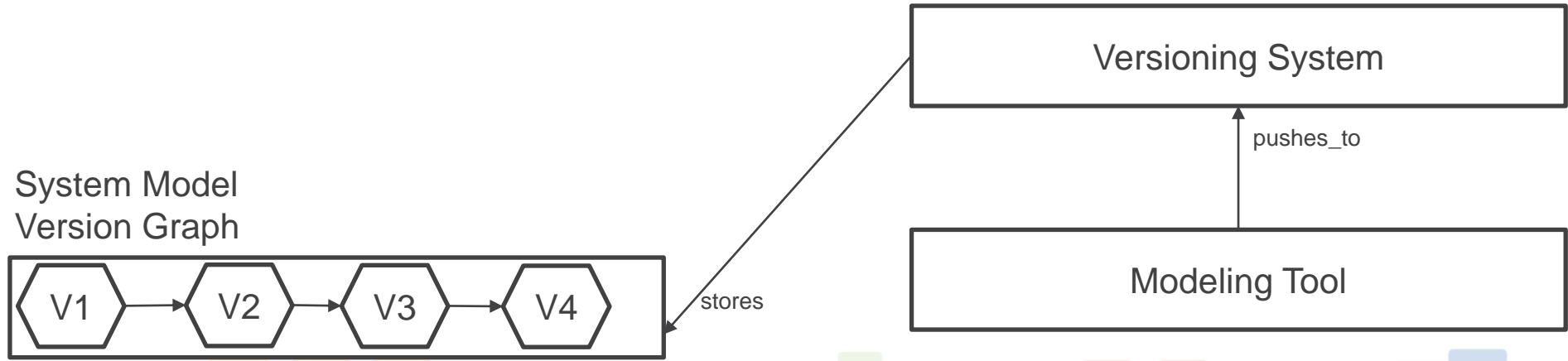


Git-based Model Management

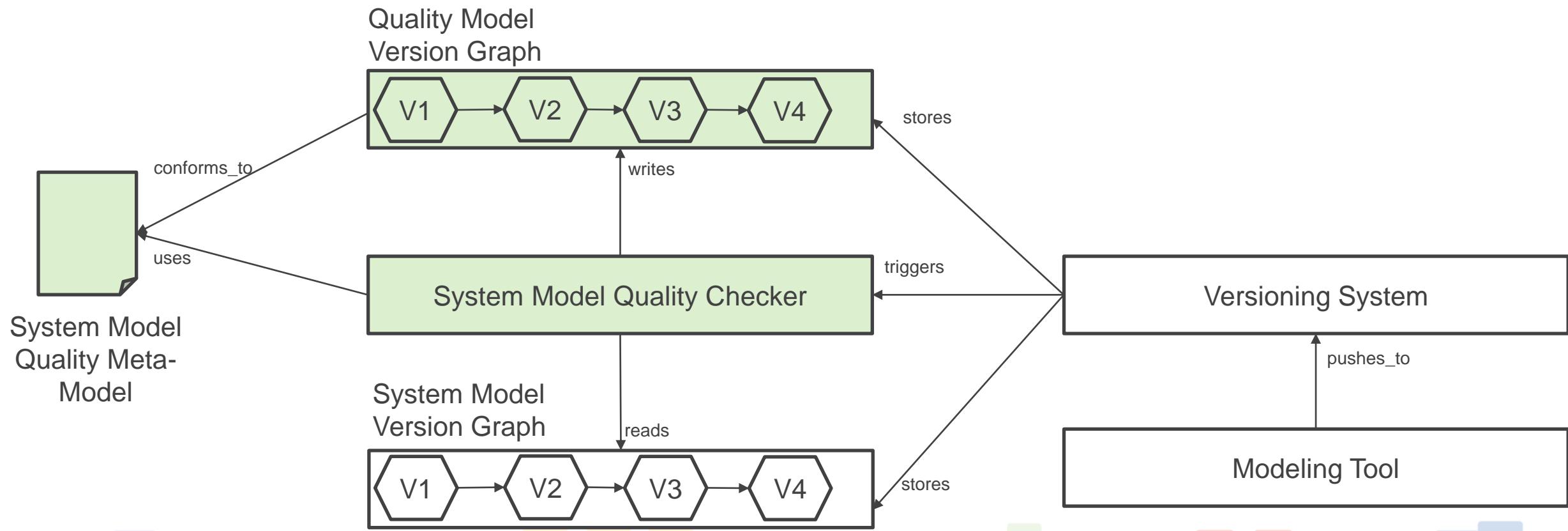
Roughly 200 organizations around the world use Git and GitFlow to manage MBSE Models

What's next?

Architecture

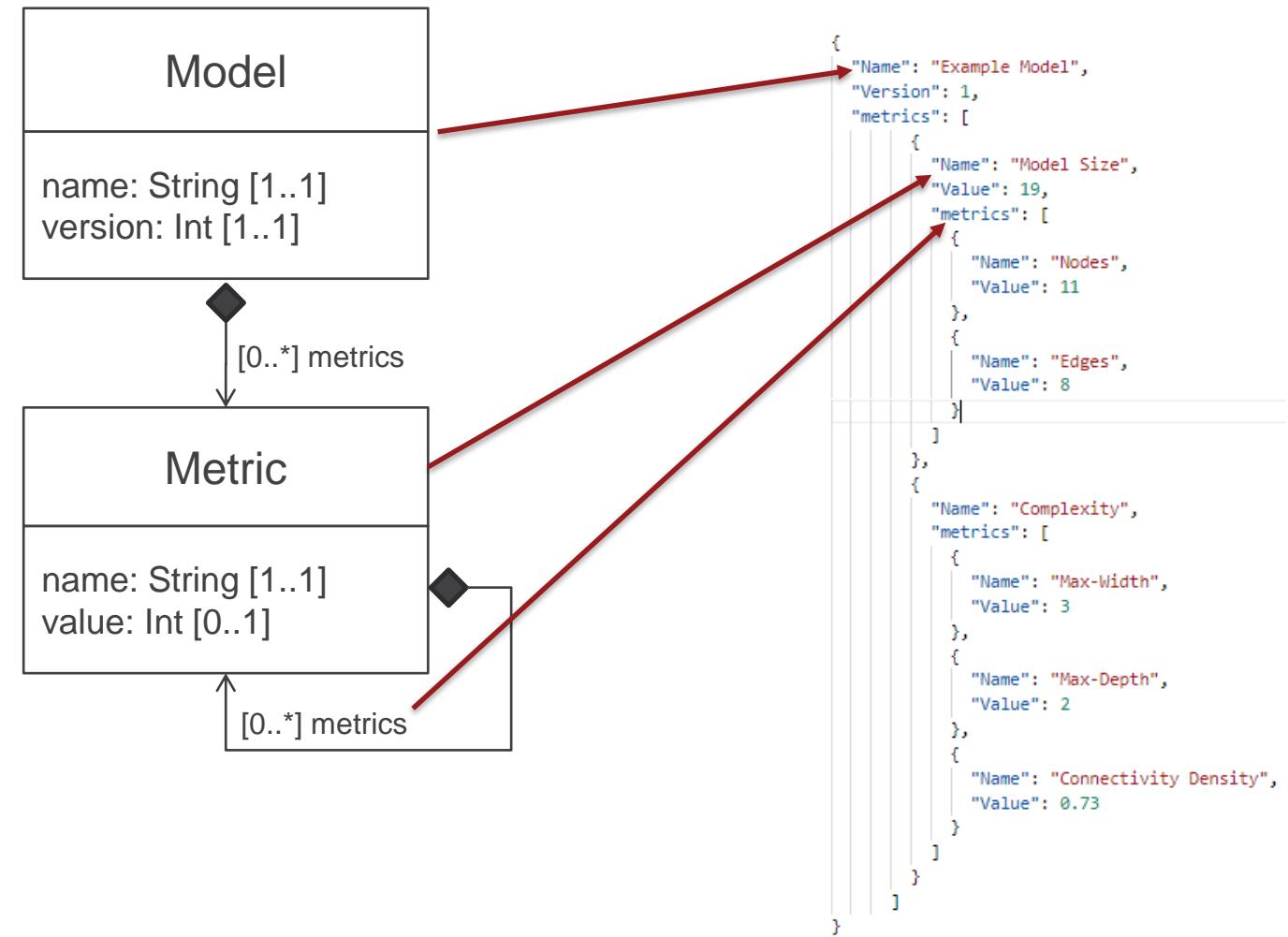


Architecture

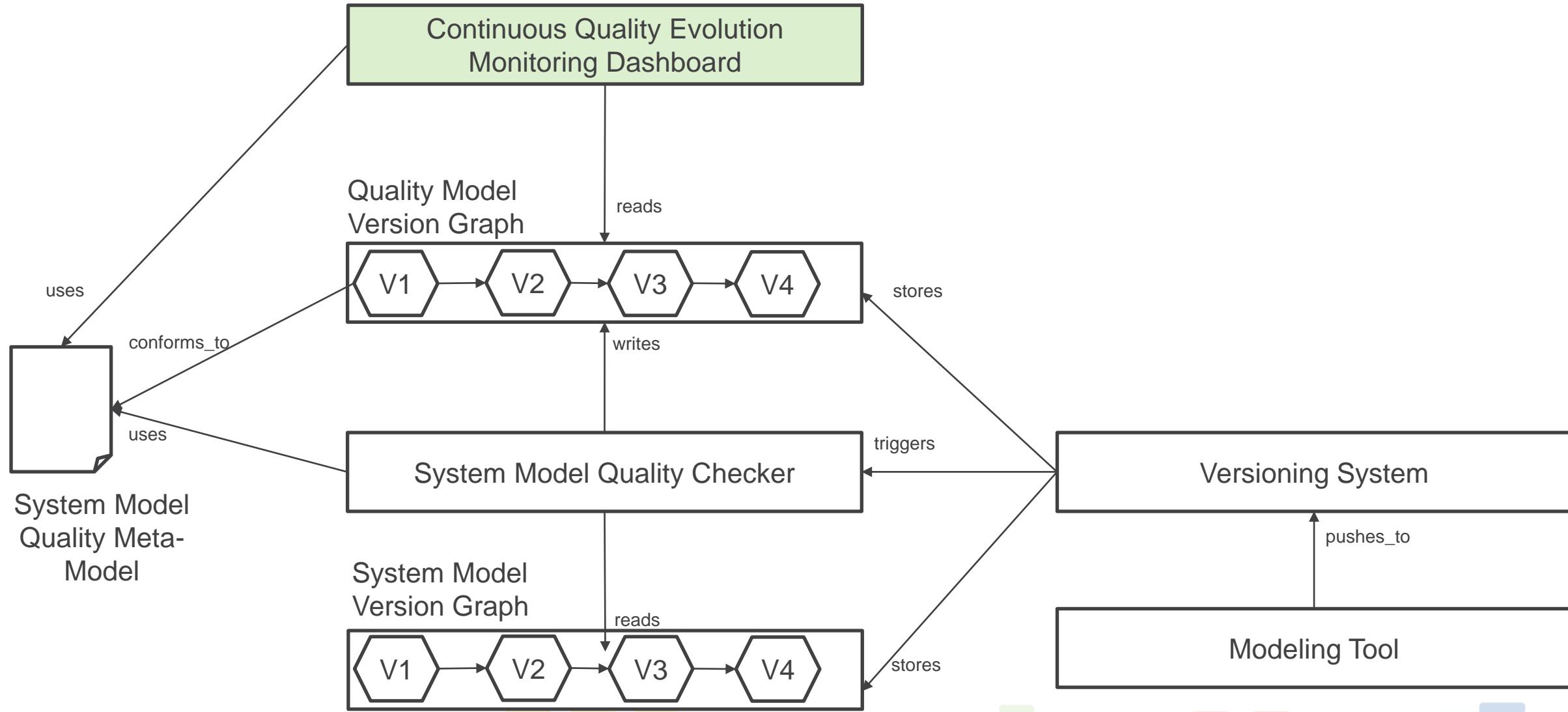




System Model Quality Meta-Model



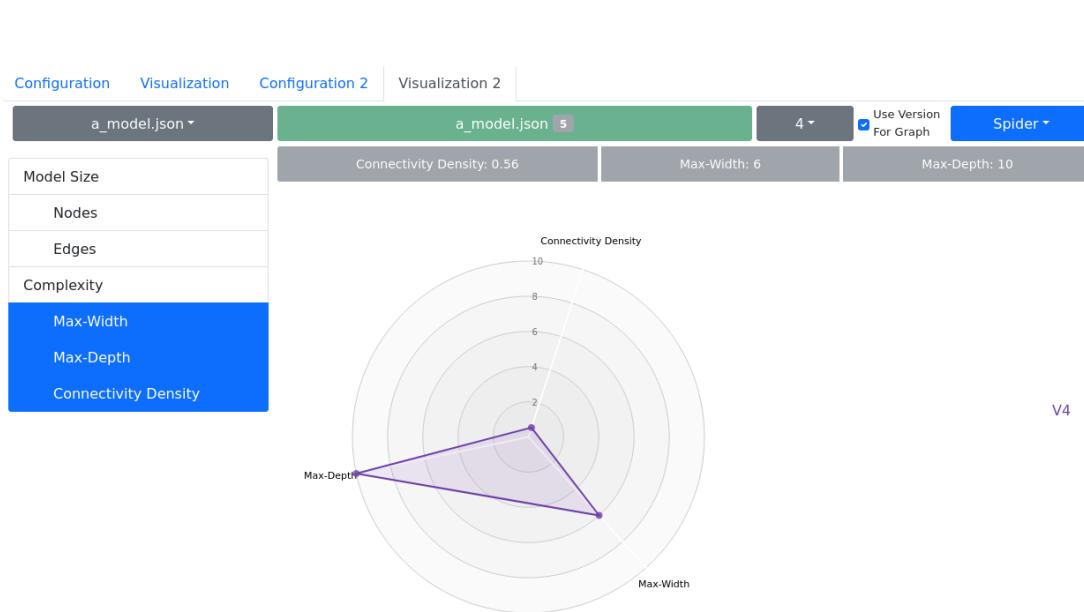
Architecture



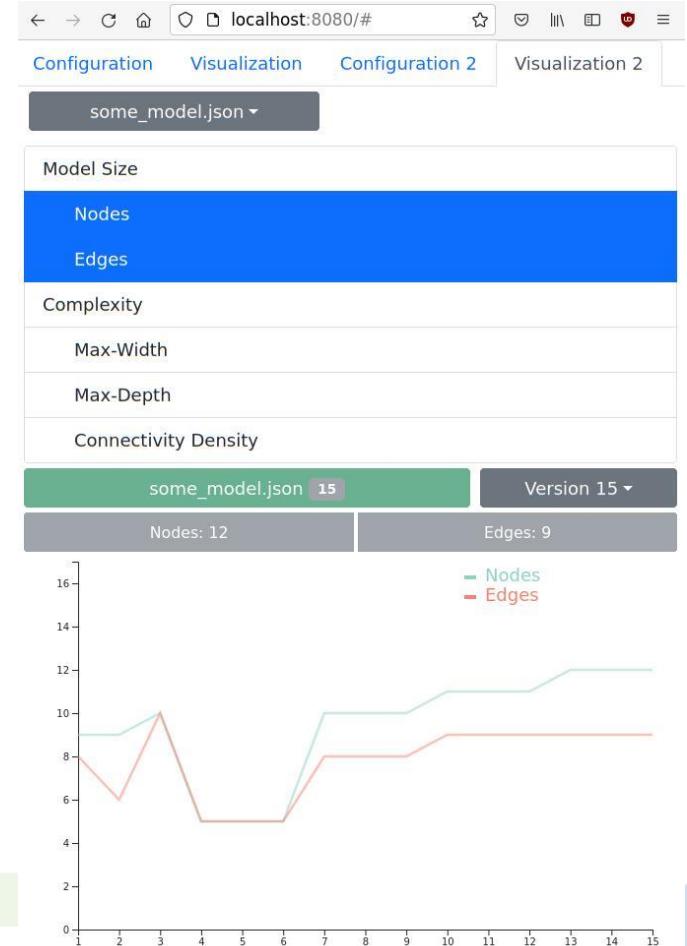


Quality Monitoring Dashboard

Current State

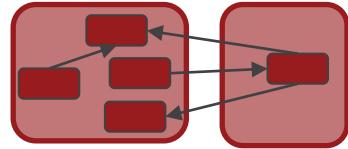


Trend Analysis

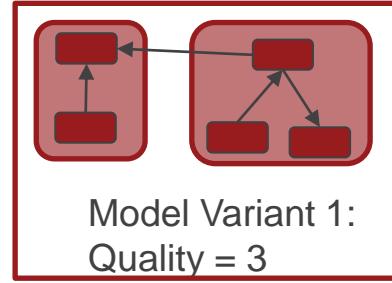




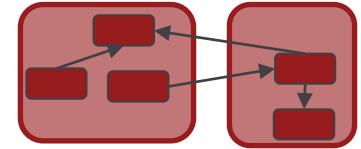
Automated Improvements



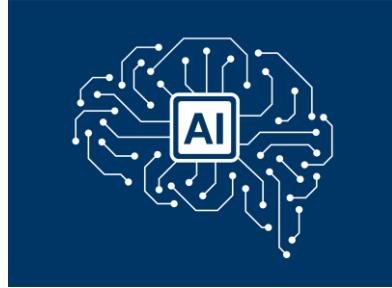
Baseline Model:
Quality = 1/3



Model Variant 1:
Quality = 3



Model Variant 2:
Quality = 1



Quality = Cohesion / Coupling

Cohesion = # Intra-Package-Dependencies

Coupling = # Inter-Package-Dependencies

LemonTree 3.3.0



Model Based Team collaboration using strategies from Software Engineering

LemonTree.Automation.Workflows

LemonTree.PCS.Demo

+

v

Local Files History

Pull v Push

Start Integrate Finish

Cherry-Pick Revert

My History

main
127-check-the-model
123-we-need-to-change-the-model
119-demo +2-1

All branches

- origin = 127-check-the-model added bild
- Changes in Branch
- origin = main Merge branch 'ddd'
- no basjh
- fdf
- cdx
- g
- new test
- update
- fixed commandline?
- neww action
- Added kismod demo
- Added lfs for .eapx
- 123-we-need-to-change-the-model (#124)...
- origin = 123-we-need-to-change-the-model Changed the model added a new section for publishing

D Wednesday 14:14
 D Wednesday 14:06
 D Wednesday 14:04
 D Wednesday 14:03
 D Wednesday 14:00
 D Wednesday 13:58
 D Wednesday 13:56
 D Wednesday 13:53
 D Wednesday 13:47
 D Wednesday 13:44
 D Wednesday 13:41
 D Wednesday 13:40
 D Wednesday 13:28
 GA 2022-06-02 15:04
 D 2022-06-02 15:03

Commit 0123f3cd
by danielsiegl, 2022-06-22 14:04

Merge branch 'ddd'

Changed files

.github/workflows/Kismod.yml

Kismod.yml

```

19  - uses: actions/checkout@v2
20    with:
21      lfs: true
22      fetch-depth: 0
23
24
25
26  - name: Run Kismod Check Tool
27    id: modelcheck
28    run:
29      echo "starting validation"
30      &"c:\kismod\KISMod.Console.exe" "${{env.ModelName}}"
31      type "summary.md"
32
33  echo "finished validation with $LASTEXITCODE"

```

```

19  - uses: actions/checkout@v2
20    with:
21      lfs: true
22      fetch-depth: 0
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24
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```

All Branches + Tags

Reflod

Command succeeded.

changed by danielsiegl · Pull Req +

github.com/LieberLieber/LemonTree.Automation.Workflows/pull/159

LL LieberLieber/Lemo... dolthub/dolt: Dolt ... Dashboard - Prolab... Pull requests · Liebe... Übersicht [Jenkins] Eventbrite – Bestell... 4bes Create a composite...

Open changed #159 danielsiegl wants to merge 1 commit into [main](#) from [158-test-von-github](#)

github-actions bot commented 15 days ago

Review Session file

✓ No merge conflicts in model

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

github-actions bot commented 13 days ago

New commit on target branch

[Review Session file](#)

✗ Please resolve merge conflicts in model first

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

Add more commits by pushing to the [158-test-von-github](#) branch on [LieberLieber/LemonTree.Automation.Workflows](#).

Some checks were not successful

1 failing and 2 successful checks

✗ [SysML validation by IncQuery Labs / SysMLValidation \(push\)](#) Failing after 2m — SysMLValidation [Details](#)

✓ [Publish Review Session / PublishReviewSession \(pull_request_target\)](#) Successful in 2m [Details](#)

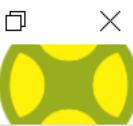
✓ [Update Review Session Files for Pull Requests on base commit / build \(push\)](#) Successful in 14s [Details](#)

⚠ This branch has conflicts that must be resolved

Use the [web editor](#) or the [command line](#) to resolve conflicts.

[Conflicting files](#) [Resolve conflicts](#)

07:55 DEU 28.06.2022



Impacted Elements [3 / 3] ✓ 0 Conflicted

Search...



Block with Ports



Block6



Daniel Validation



Details ▾ A - LemonTree.Automation.Workflows-PR-159-1b6...

Theirs

DanielValidation (0)

- Daniel Validation 2 (3)
- «block» Block with Ports (1)
 - MyPort (1)
- «block» Block2c6
- «block» Block6 (1)
- [unnamed] (1)

B - LemonTree.Automation.Workflows-PR-159-1b6...

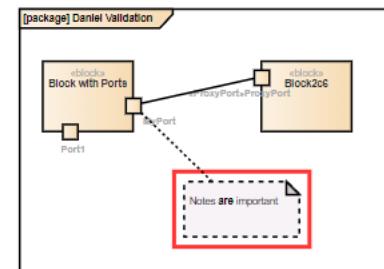
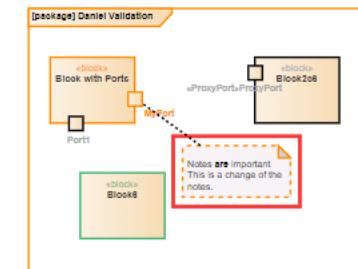
Mine

DanielValidation (2)

- Daniel Validation 2 (2)
- «block» Block with Ports
 - MyPort
- «block» Block2c6
- «block» Block6
- [unnamed]

Diagrams ▾

Daniel Validation 2:LogicalDiagram



Impacted Diagrams [1 / 1] ⚠ 1 Conflicted

Search...



Daniel Validation 2



Properties

Modified

[unnamed]:Comment

Modified Set All

Unmodified



Documentation

Notes are important

This is a change of the notes.

Element Properties



Documentation

Notes are important

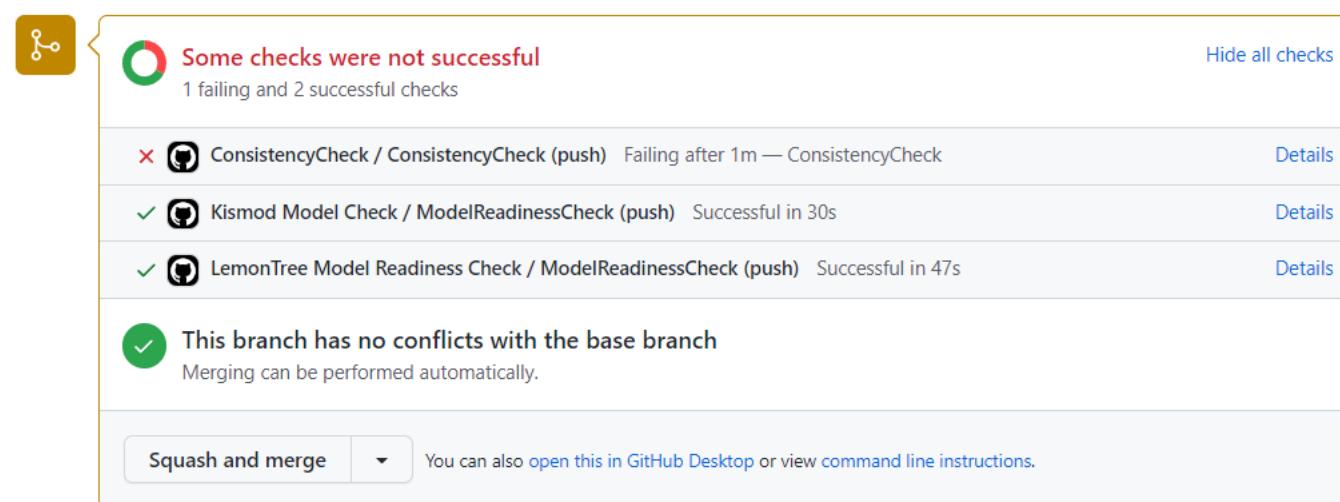
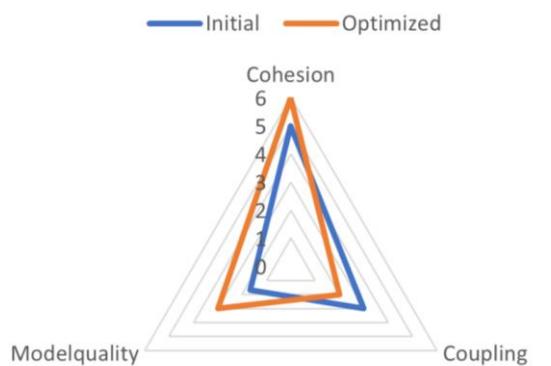
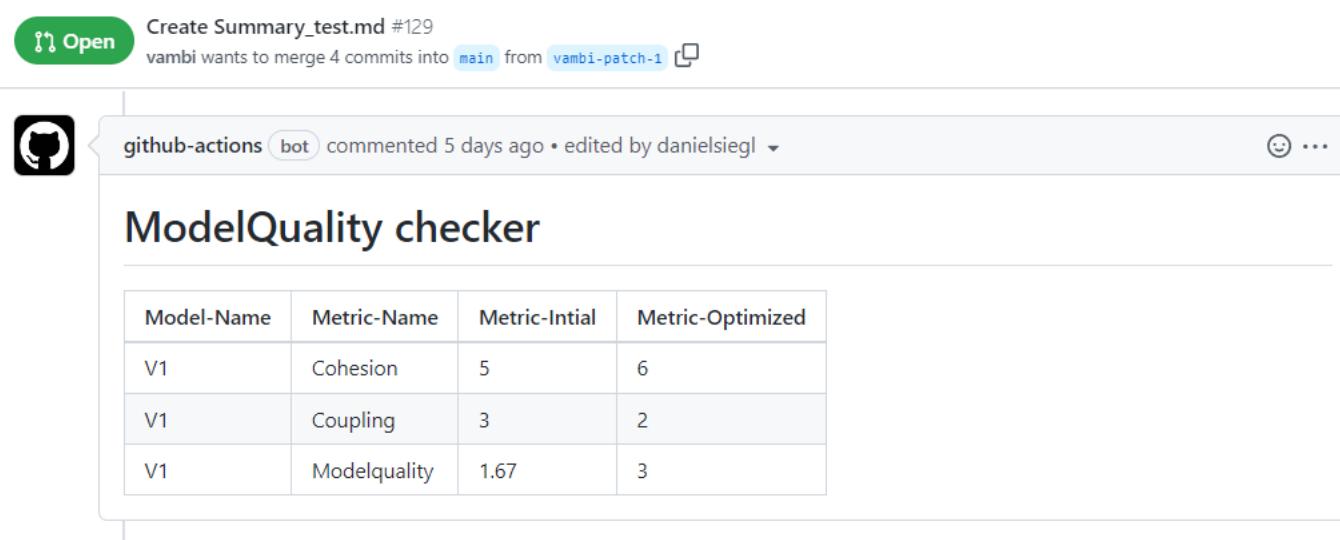
Preview

Element Metadata 1.0

LemonTree ready

07:56

28.06.2022







DEVOPS ISN'T IT?



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www.incose.org/symp2022