



**32<sup>nd</sup>** Annual **INCOSE**  
international symposium

hybrid event

Detroit, MI, USA  
June 25 - 30, 2022

Quality Monitoring of Systems Engineering Models

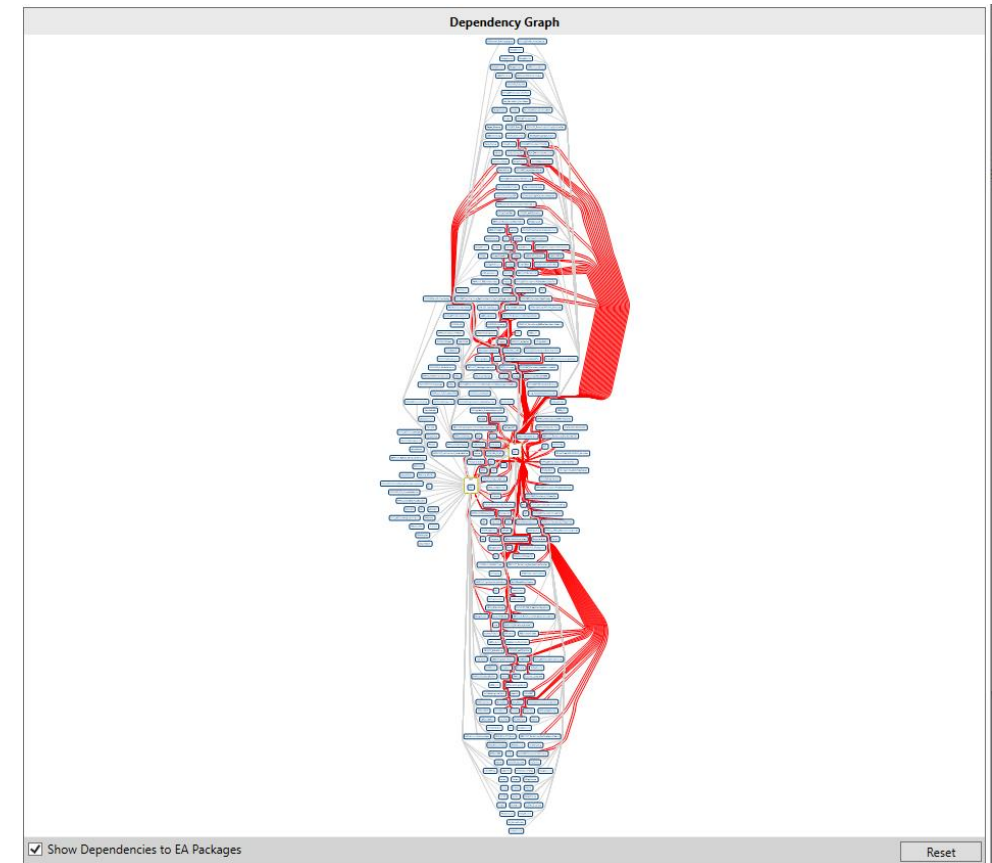
# Git-based Model Management





# Motivation

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





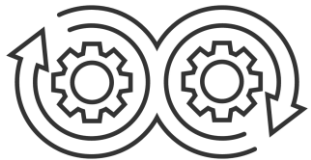
# Problem Statement



What is the quality of an MBSE model?



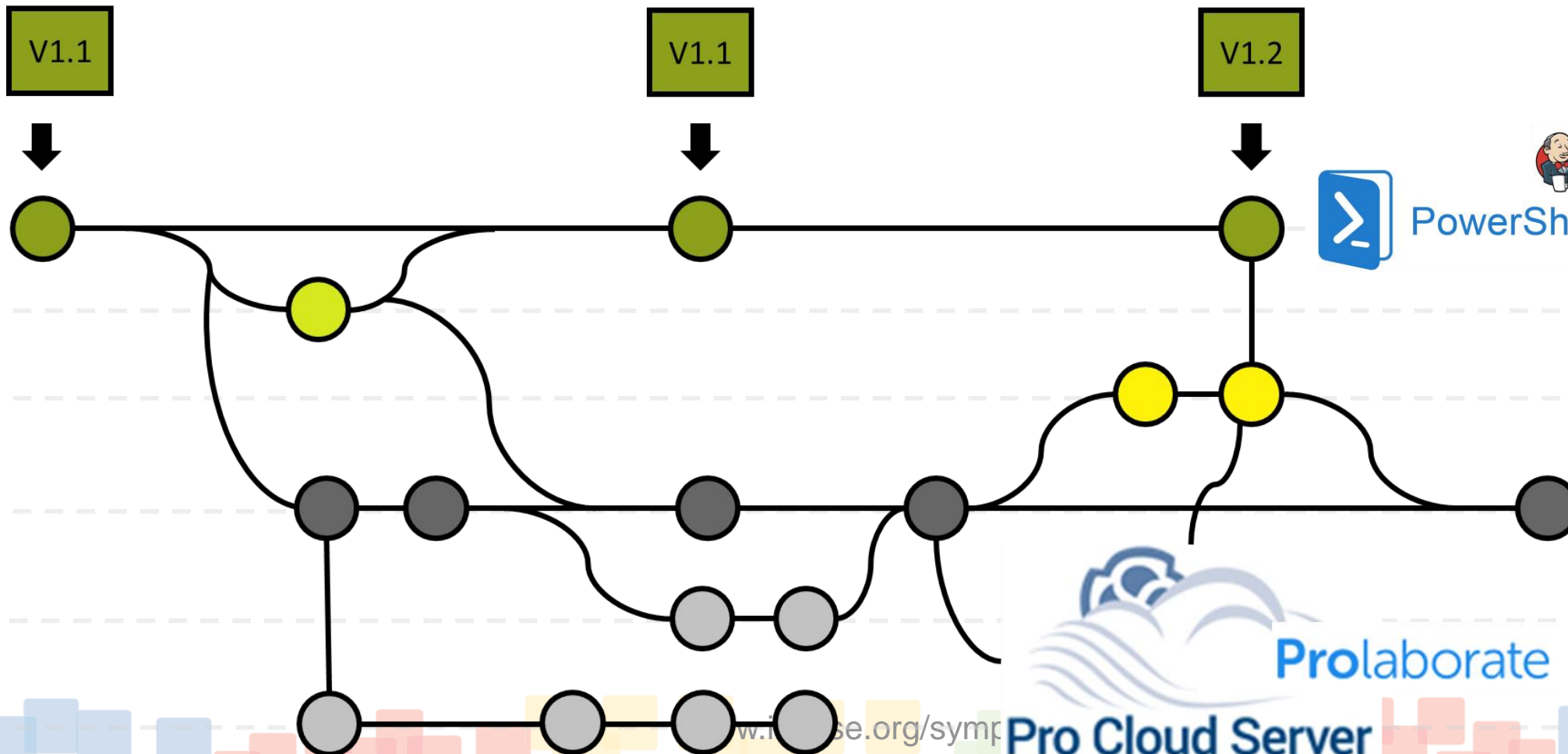
How to visualize model quality?



Is automated improvement possible?



# State of the Art



PowerShell



Jenkins



GitHub



Prolaborate

Pro Cloud Server



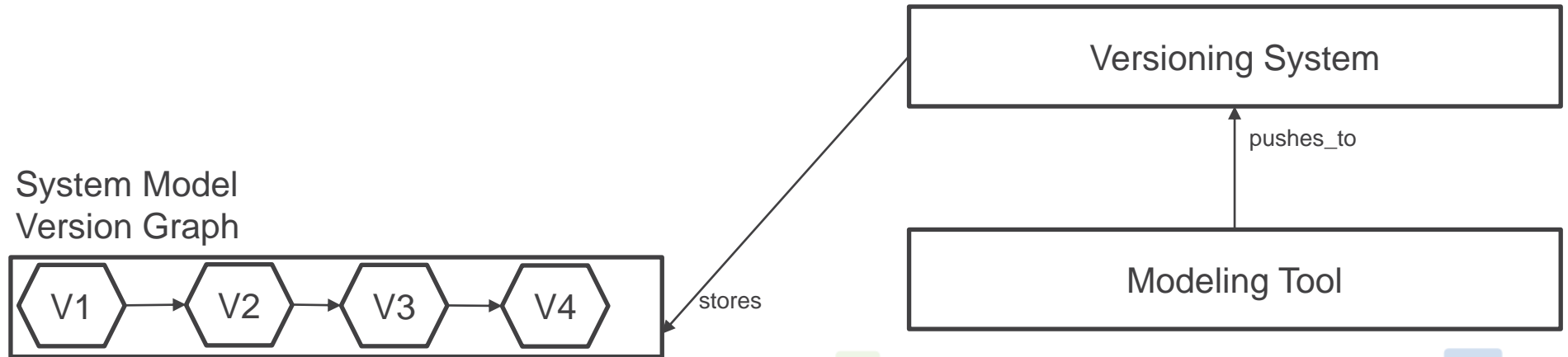
# Git-based Model Management

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

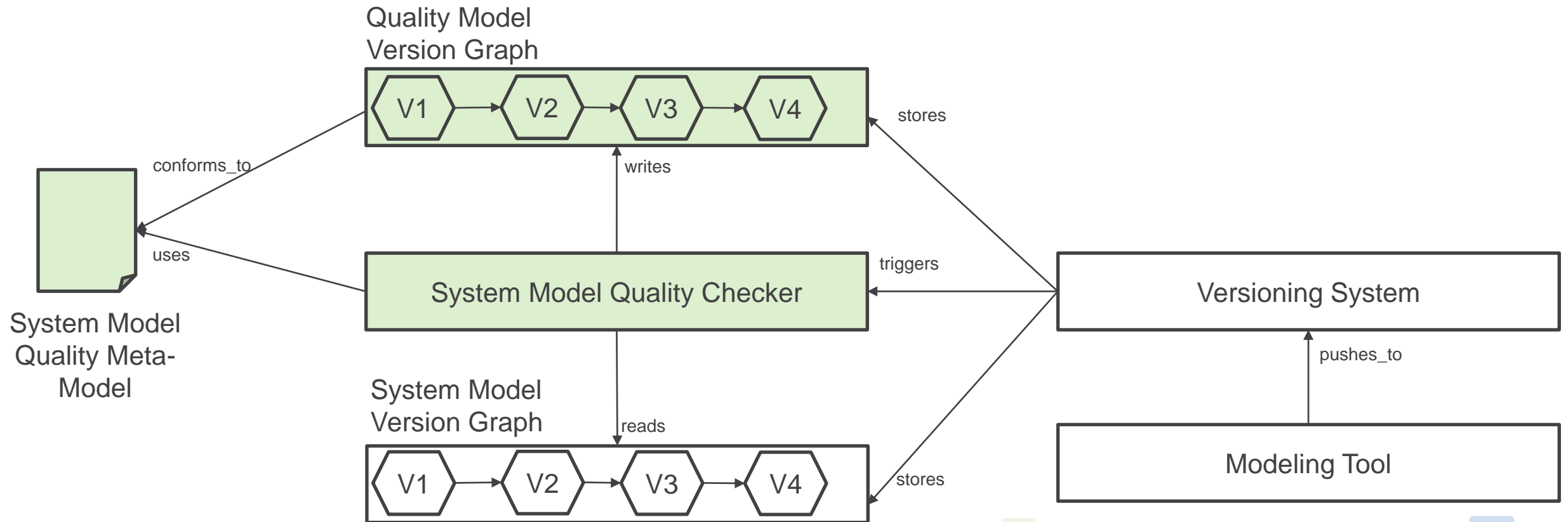
**What's next?**



# Architecture



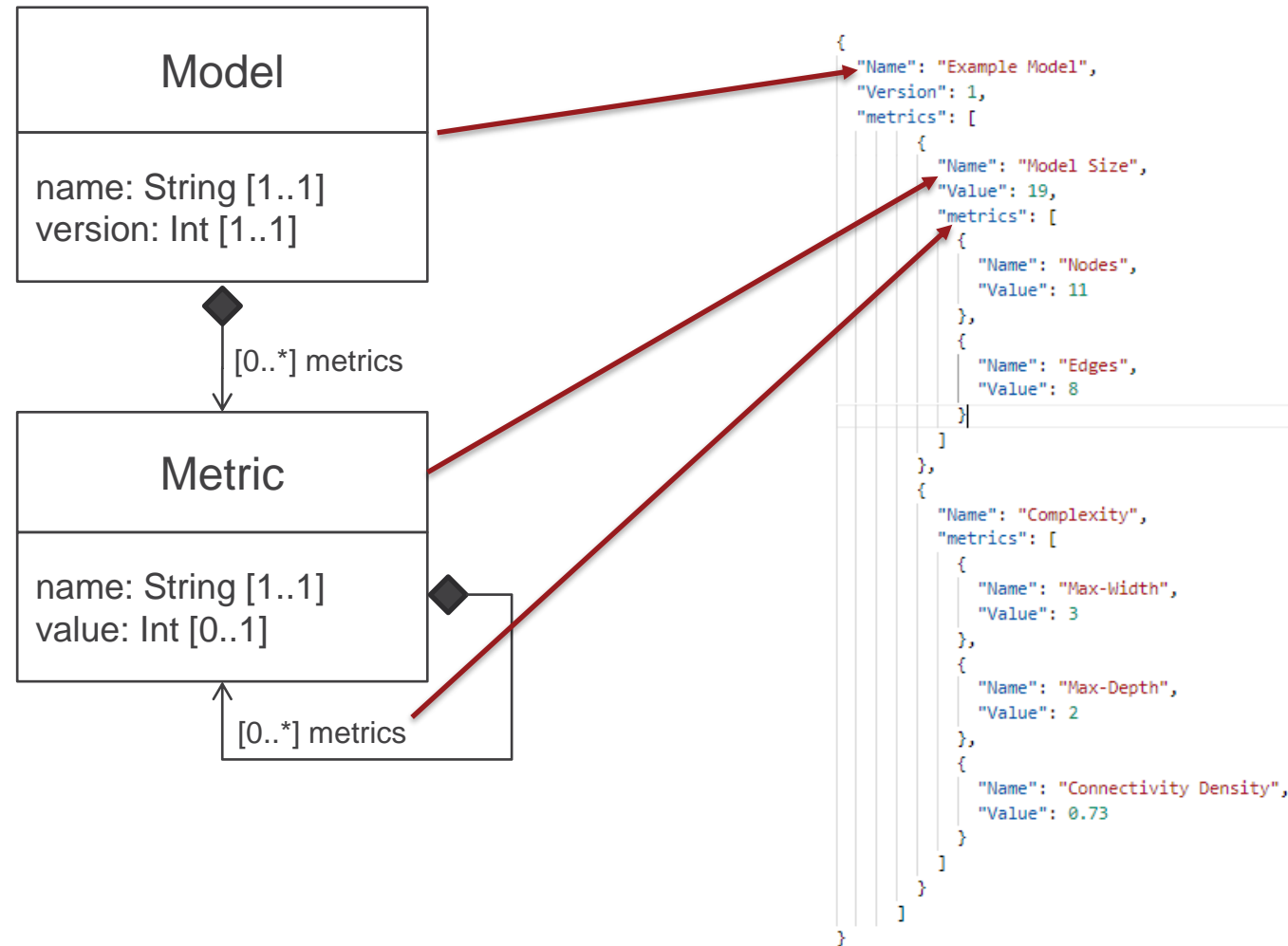
# Architecture



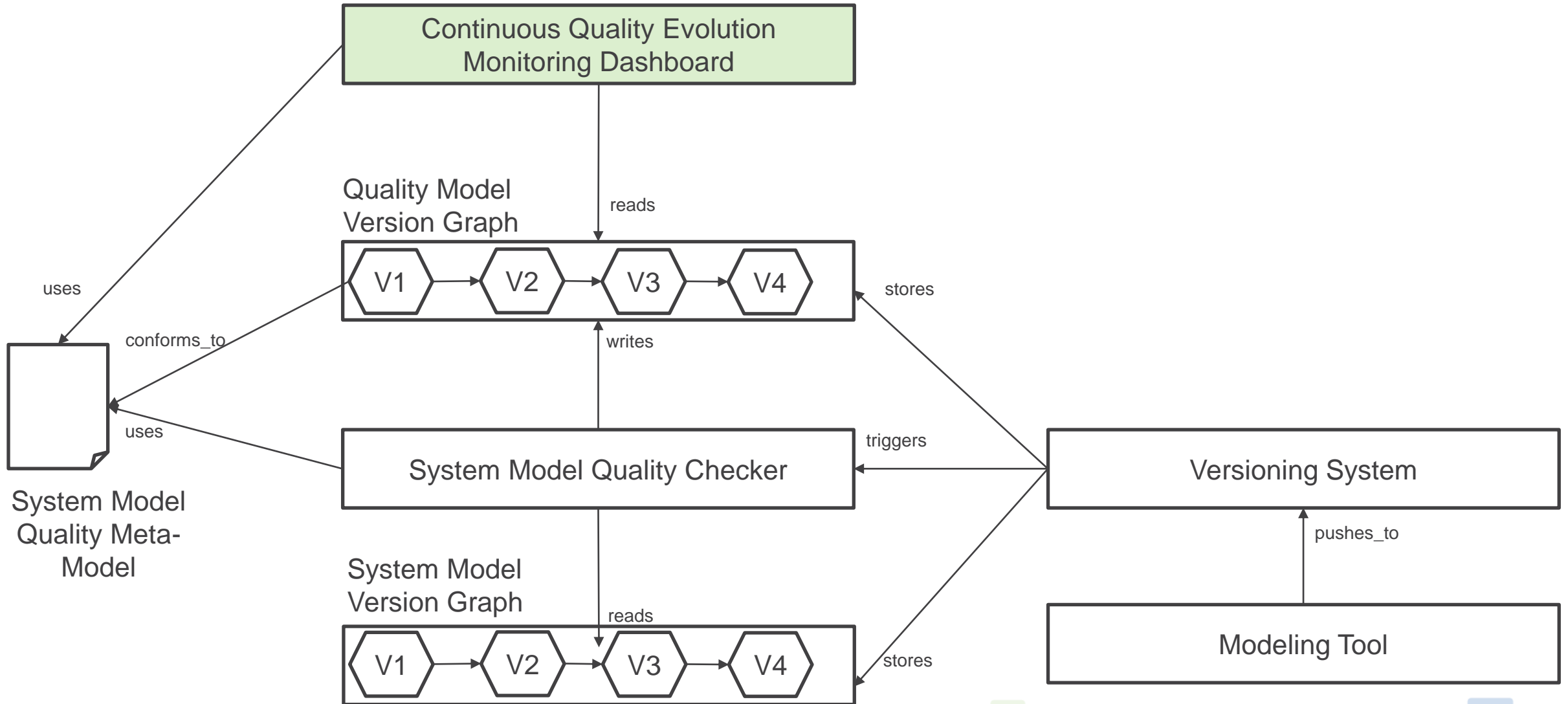




# System Model Quality Meta-Model



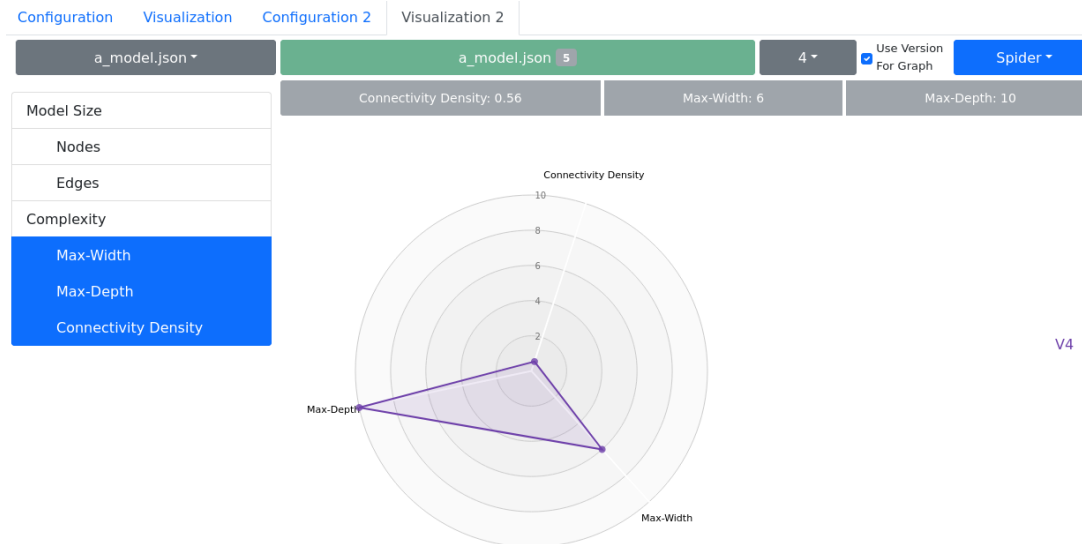
# Architecture



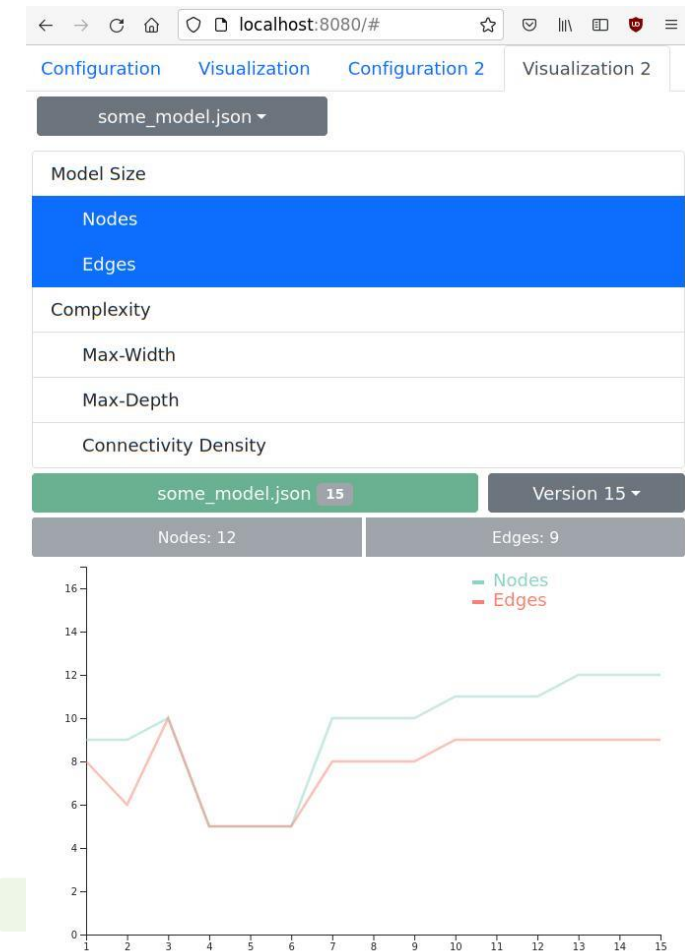


# Quality Monitoring Dashboard

## Current State

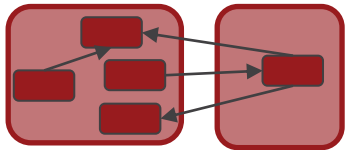


## Trend Analysis

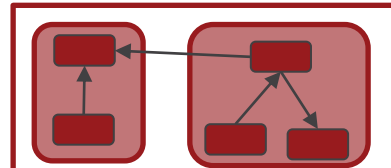




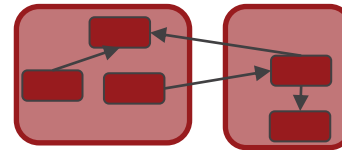
# Automated Improvements



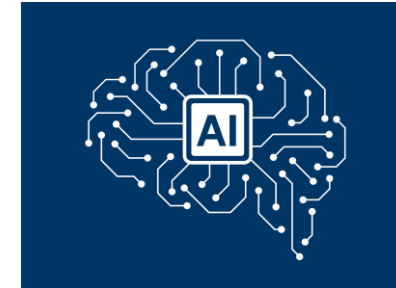
Baseline Model:  
Quality = 1/3



Model Variant 1:  
Quality = 3



Model Variant 2:  
Quality = 1



**Quality = Cohesion / Coupling**

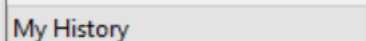
Cohesion = # Intra-Package-Dependencies

Coupling = # Inter-Package-Dependencies

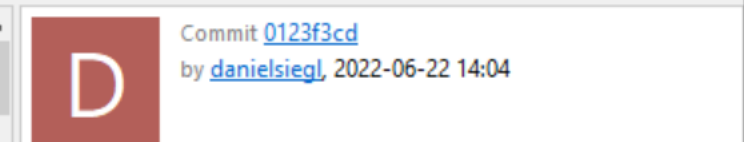
# LemonTree 3.3.0



Model Based Team collaboration using strategies from Software Engineering



All branches



Changed files ▾

Kismod.yml

-1~2 Unified **Side by Side** | Compact   

```

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 kiamod with $LASTEXITCODE"


```

Reflog

Open

changed #159

danielsiegl wants to merge 1 commit into `main` from `158-test-von-github`




github-actions bot commented 15 days ago

Contributor

⋮

[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


Contributor

⋮

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**

Hide all checks

1 failing and 2 successful checks

✖	 SysML valdiation by IncQuery Labs / SysMLValidation (push)	Failing after 2m — SysMLValidation	<a href="#">Details</a>
✔	 Publish Review Session / PublishReviewSession (pull_request_target)	Successful in 2m	<a href="#">Details</a>
✔	 Update Review Session Files for Pull Requests on base commit / build (push)	Successful in 14s	<a href="#">Details</a>

 **This branch has conflicts that must be resolved**

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

Resolve conflicts

Conflicting files





Impacted Elements [3 / 3] ✓ 0 Conflicted

Search...



▶ Block with Ports

● A ● B ✓

▶ Block6

● A ● B ✓

▶ Daniel Validation

● A ● B ✓

Impacted Diagrams [1 / 1] ⚠ 1 Conflicted

Search...



▶ Daniel Validation 2

● A ● B ✓

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

Theirs

Daniel Validation (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

Daniel Validation (2)

Daniel Validation 2 (2)

«block» Block with Ports

MyPort

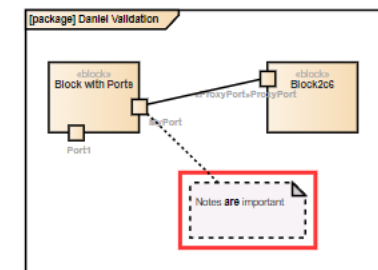
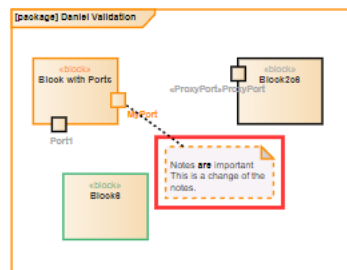
«block» Block2c6

«block» Block6

[unnamed]

Diagrams

Daniel Validation 2:LogicalDiagram



Properties

[unnamed]:Comment

Modified Set All

● Modified

● Unmodified

Documentation

Notes are important  
This is a change of the notes.

Preview



Documentation

Notes are important

Preview



Element Metadata 1.0

LemonTree ready

Open

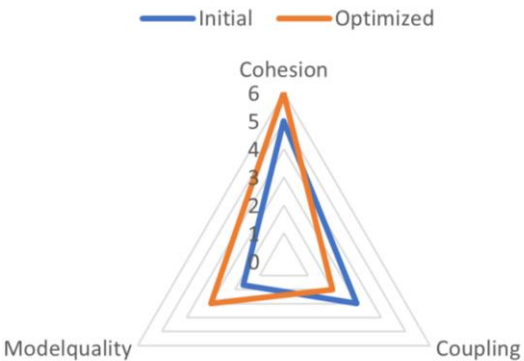
Create Summary\_test.md #129

vambi wants to merge 4 commits into `main` from `vambi-patch-1`

github-actions bot commented 5 days ago • edited by danielsiegl

ModelQuality checker

Model-Name	Metric-Name	Metric-Intial	Metric-Optimized
V1	Cohesion	5	6
V1	Coupling	3	2
V1	Modelquality	1.67	3



Add more commits by pushing to the `vambi-patch-1` branch on `LieberLieber/LemonTree.PCS.Demo`.

Some checks were not successful

1 failing and 2 successful checks

ConsistencyCheck / ConsistencyCheck (push)

Failing after 1m — ConsistencyCheck

Details

Kismod Model Check / ModelReadinessCheck (push)

Successful in 30s

Details

LemonTree Model Readiness Check / ModelReadinessCheck (push)

Successful in 47s

Details

This branch has no conflicts with the base branch

Merging can be performed automatically.

Squash and merge

You can also [open this in GitHub Desktop](#) or view [command line instructions](#).

Open

changed #159

danielsiegl wants to merge 1 commit into main from 158-test-von-github

github-actions bot commented 15 days ago

Contributor

### Validation results

- Compartment URI: ea-index:/root-element-oid/bc525e3609b08f9bc4b46336d2156272a7e2e6b6c866c4d502a20aae18a24f13
- Results:

Severity	Element	Message
ERROR	{93FDC9A7-80F5-46fe-AE2C-D1CA9F468274}	Ports of Blocks are not allowed to be connected.
WARNING	{15354505-BBB5-477d-A51E-FDDF75D44FA2}	Port is connected to another one, but it does not have an interface.
WARNING	{5860AA13-3F78-4ce5-992B-5FC78788DB7D}	Port is connected to another one, but it does not have an interface.
WARNING	{E433C166-C5C1-49e4-A052-E83AF3F71FFA}	Connector does not connect only Ports.
WARNING	{BEA9A03E-5491-4252-A007-F2042806A997}	Connector does not connect only Ports.
WARNING	{454E5514-B1E1-40e2-B035-F8409217F1B1}	Connector does not connect only Ports.
WARNING	{ED3CACA8-2BB4-4b51-B28C-D470B05275AF}	Connector does not connect only Ports.

github-actions bot commented 15 days ago

Contributor

No one—assign yourself

Labels

None yet

Projects

None yet

Milestone

No milestone

Development

Successfully merging this pull request may close these issues.

None yet

Notifications

Customize

Unsubscribe

You're receiving notifications because you authored the thread.

1 participant

Lock conversation



# DEVOPS ISN'T IT?



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[www.incose.org/symp2022](http://www.incose.org/symp2022)