Continuous MBSE Modeling

Armstrong Process Group, Inc.
www.aprocessgroup.com

APG

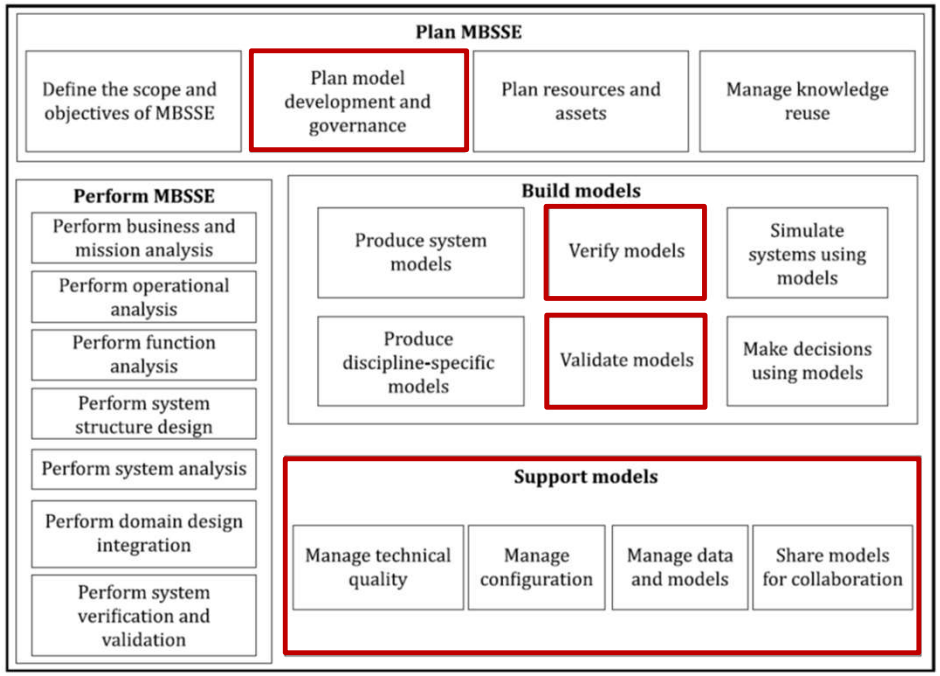
About APG

- APG mission

  "Align architecture and engineering capabilities with business strategy using proven, practical processes delivering world-class results."

- Industry thought leader in enterprise architecture, business architecture, systems and software engineering, business analysis, and agile methods
- Member and contributor to
  - UML®, SysML®, UAF® at the Object Management Group
  - TOGAF®, ArchiMate®, IT4IT™ at The Open Group
  - Architecture, MBSE, and OOSEM Workgroups at INCOSE

Continuous MBSE Modeling

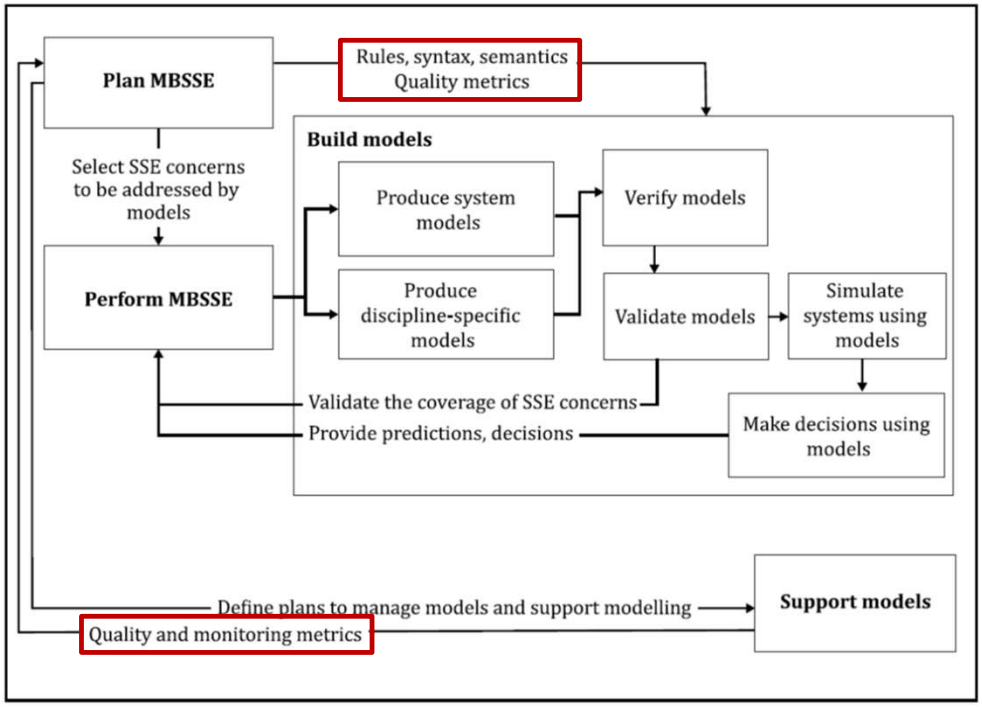


Modeling Tools

Sparx Enterprise Architect

CAMEO SYSTEMS MODELER™

IBM Rational Rhapsody



CI/CD Pipeline Automation

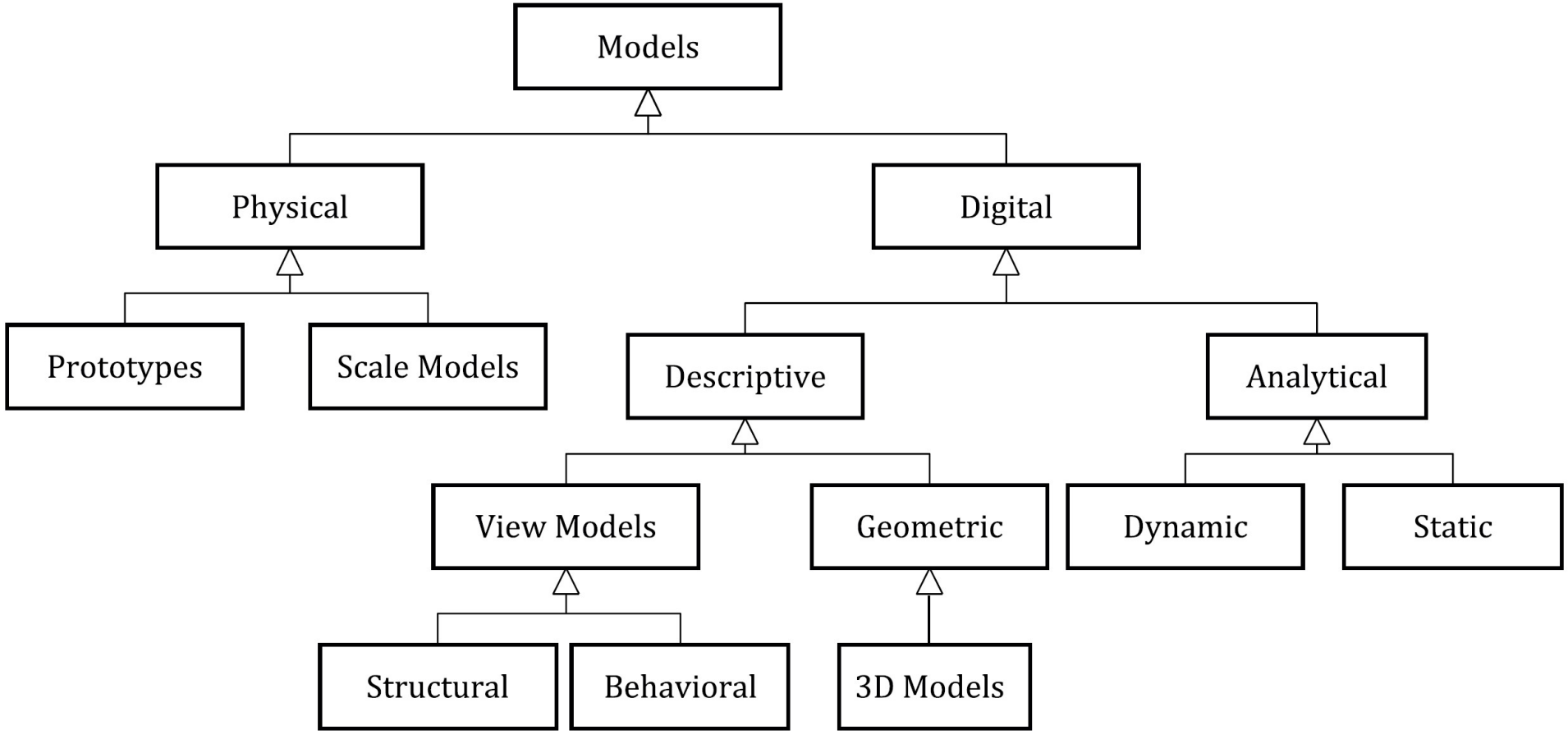
SmartGit

git

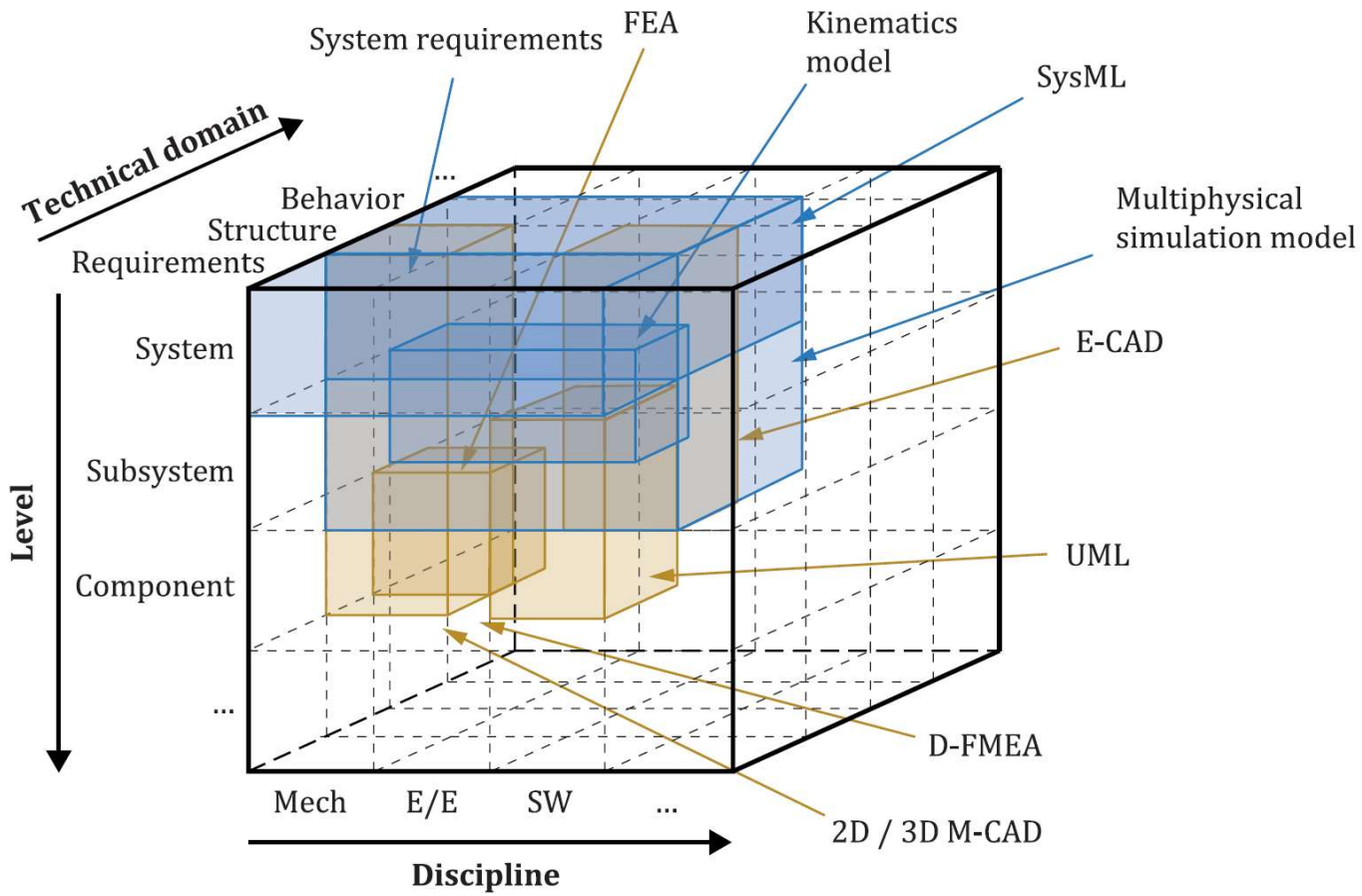
GitHub

LemonTree© Fresh Model Versioning

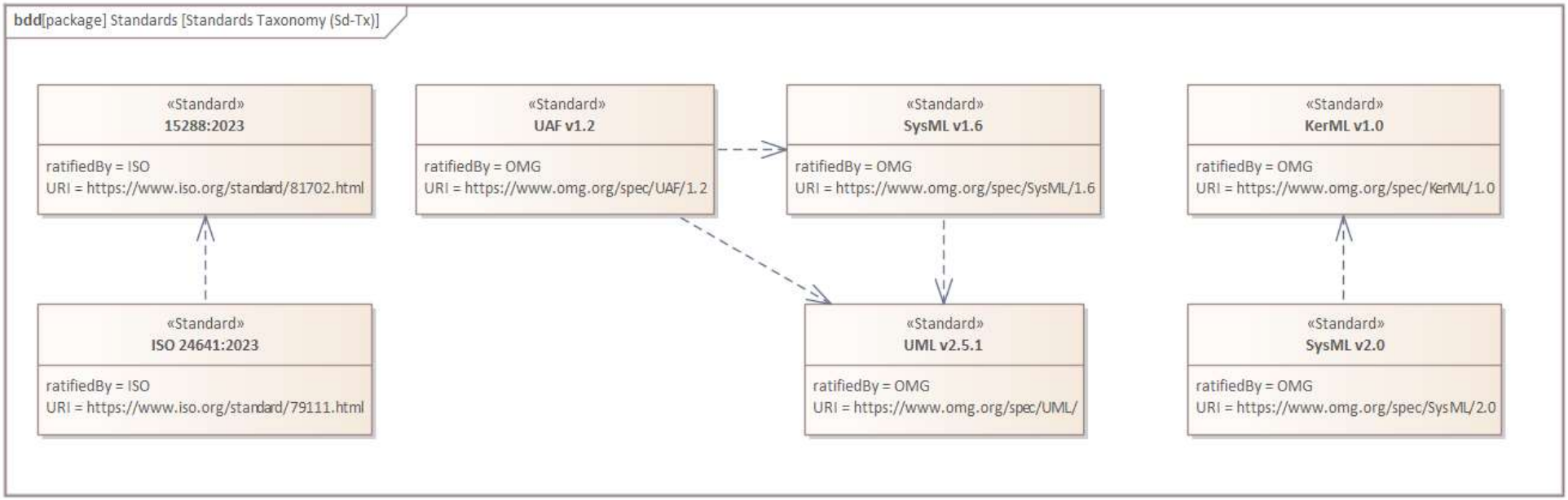
Types of Models



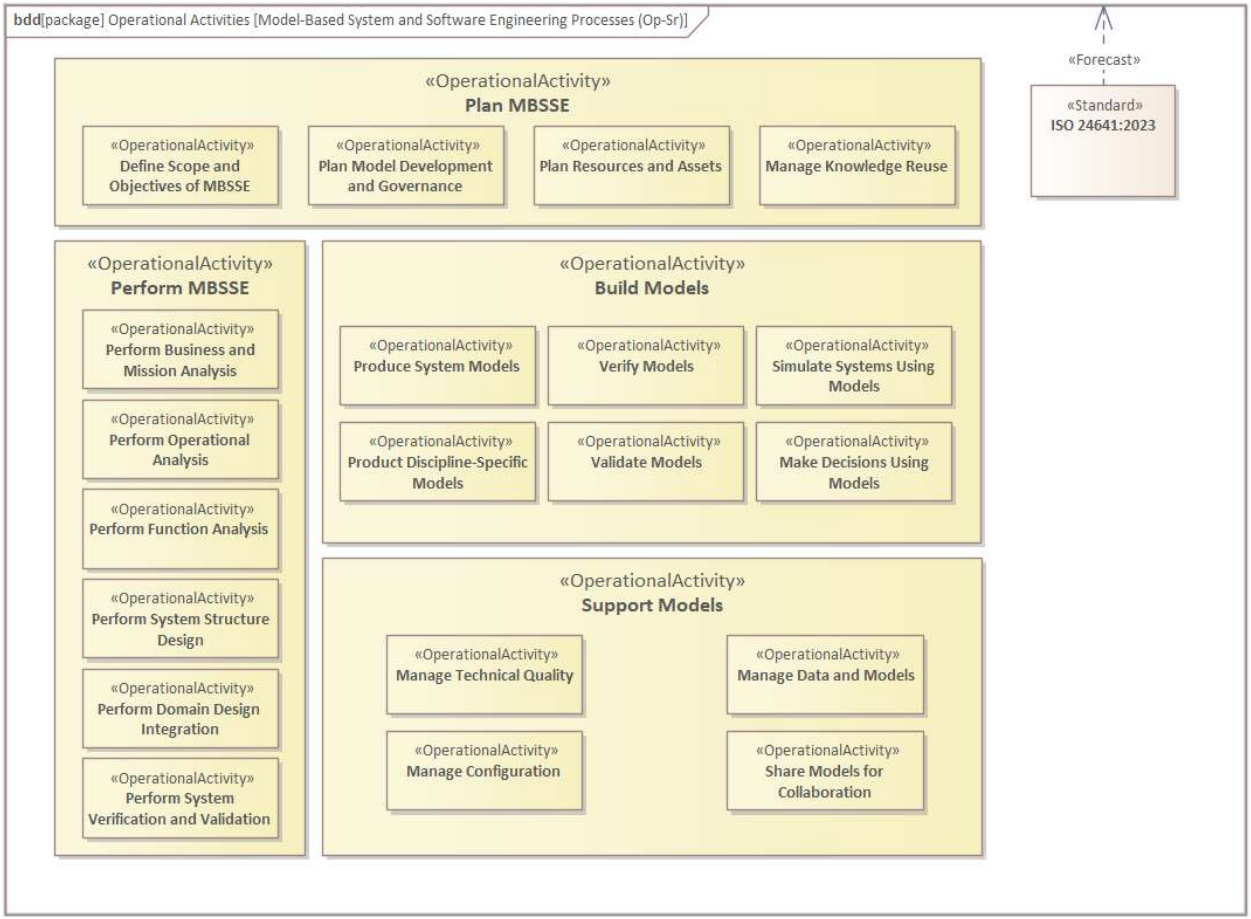
System Model Dimensions



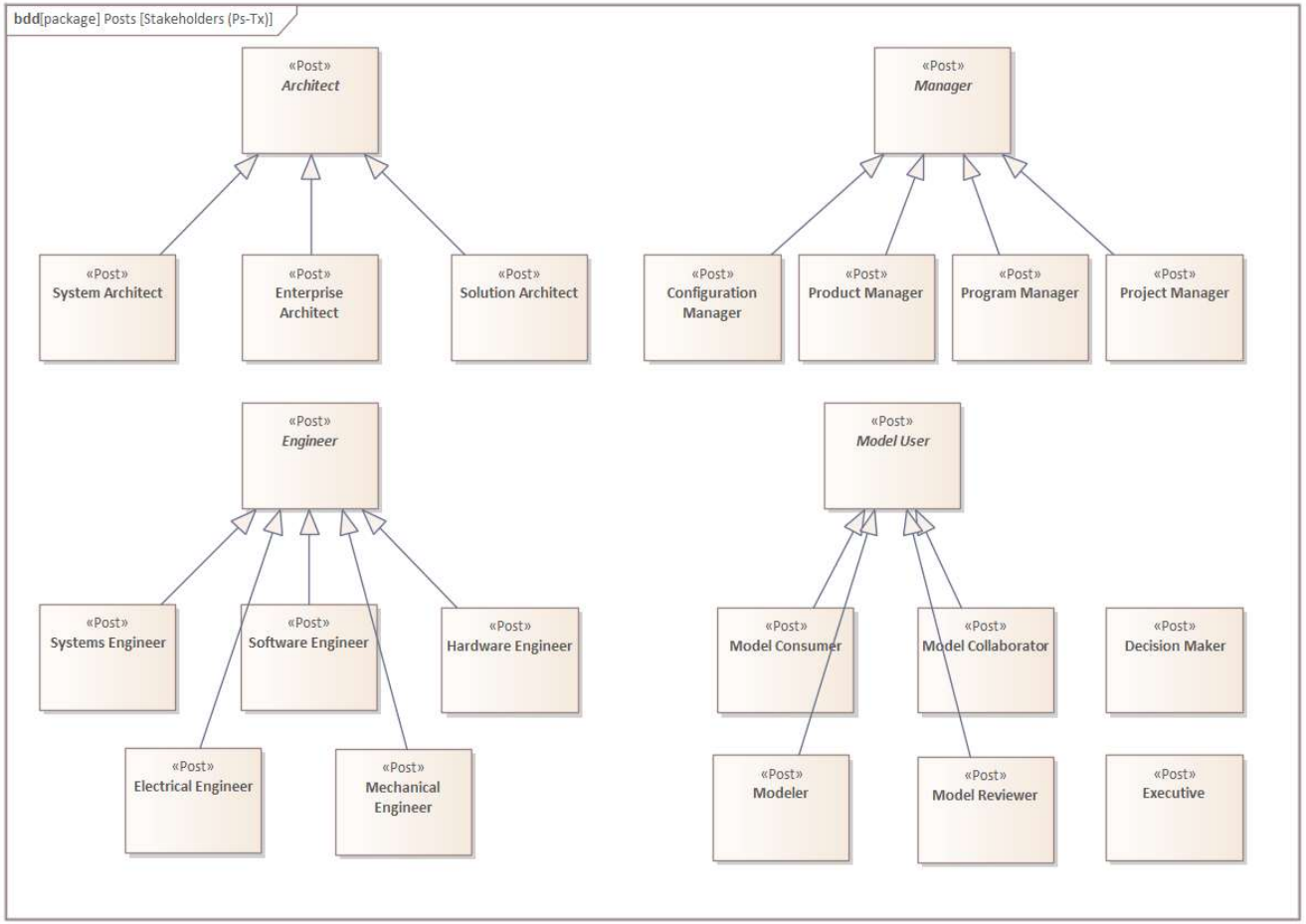
Standards Taxonomy (Sd-Tx)



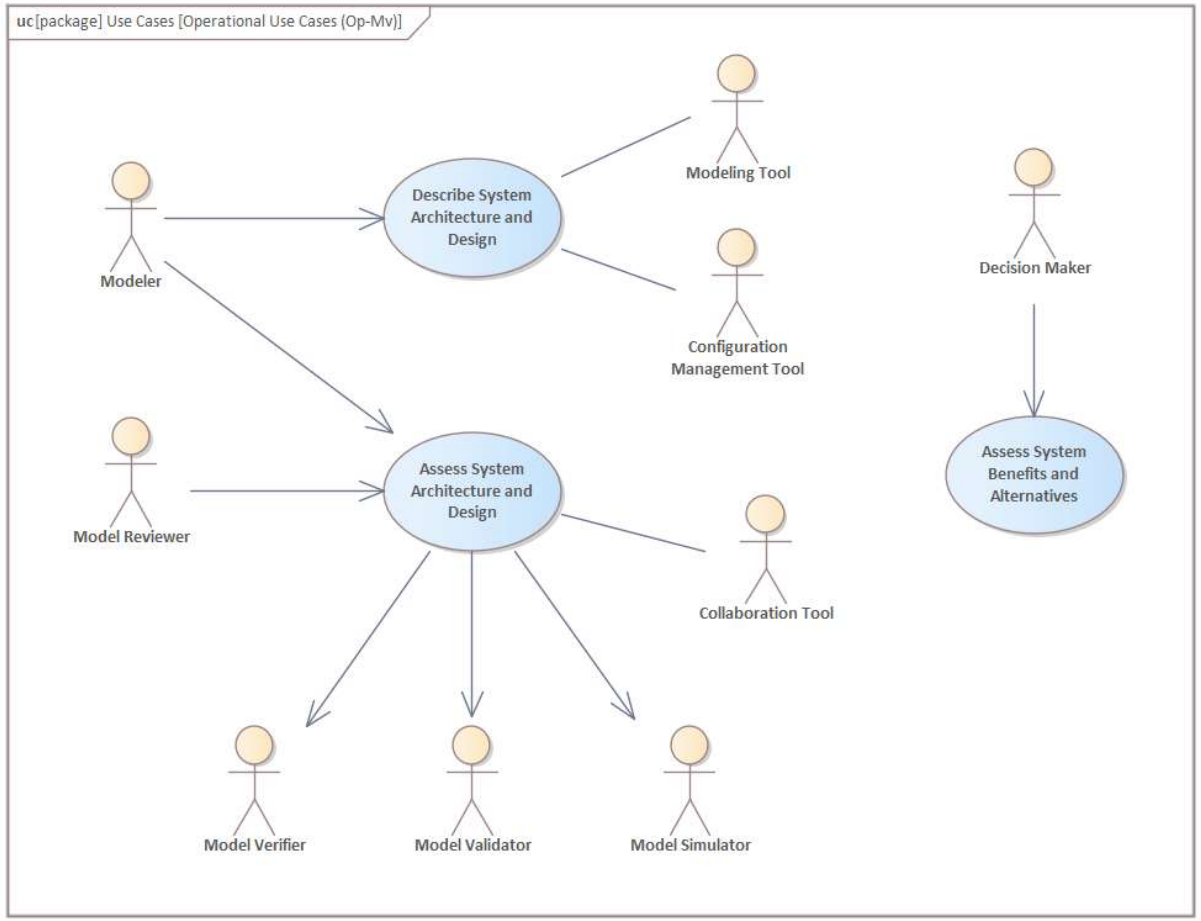
MBSSE Processes (Op-Sr)



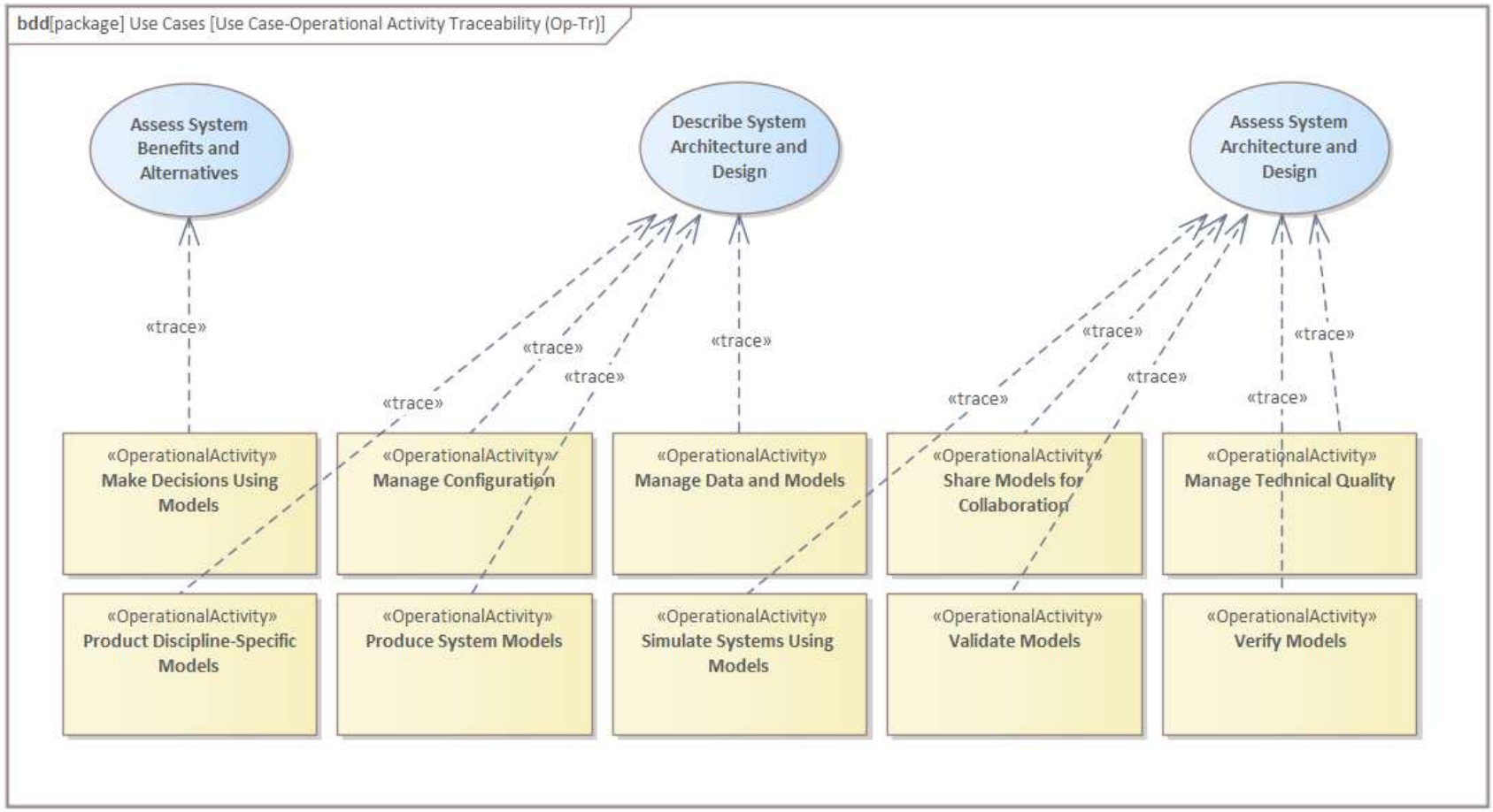
Stakeholders (Ps-Tx)



Operational Use Cases (Op-Mv)

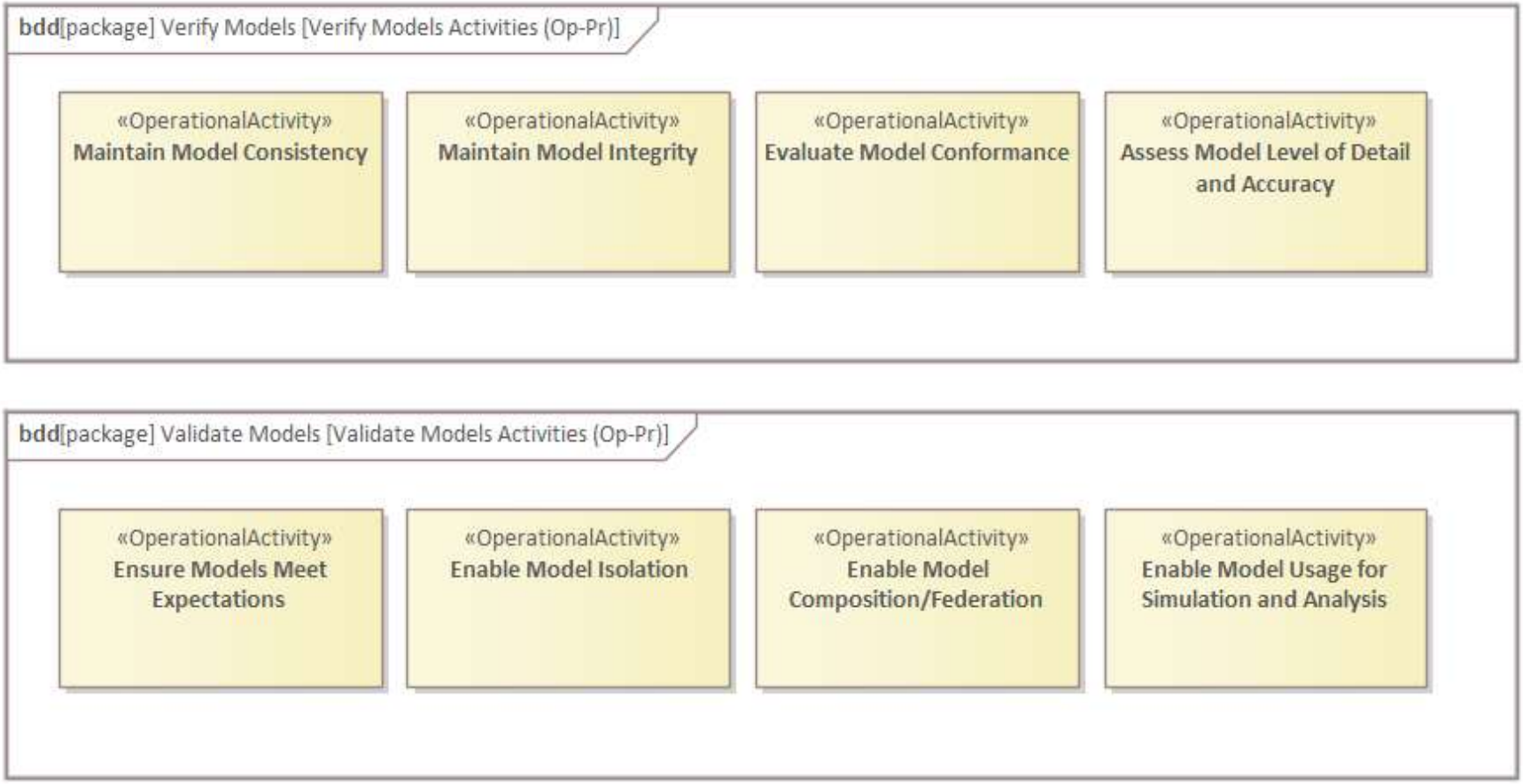


Use Case-Operational Activity Traceability (Op-Tr)

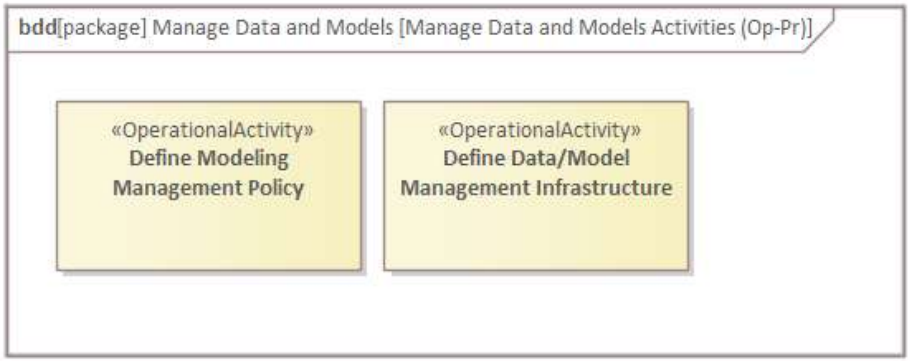


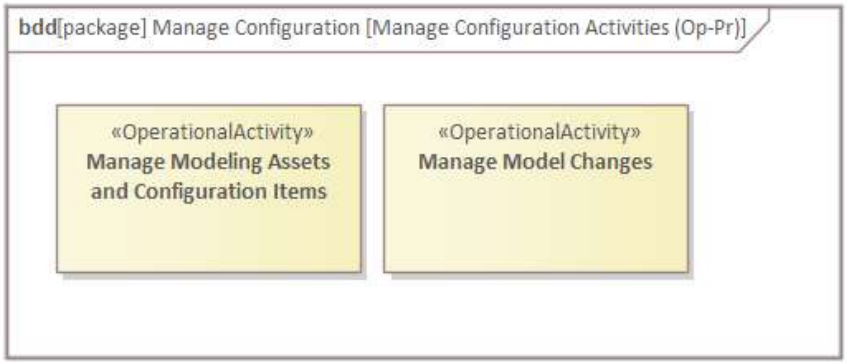
Plan Model Development and Governance

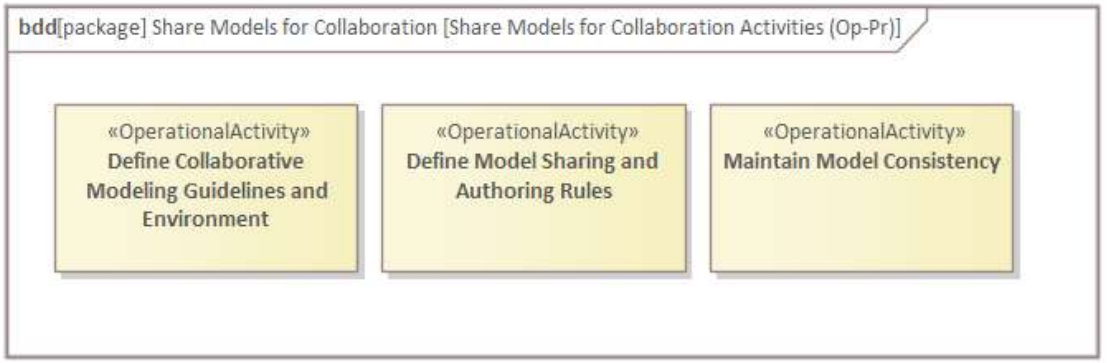
Produce Models



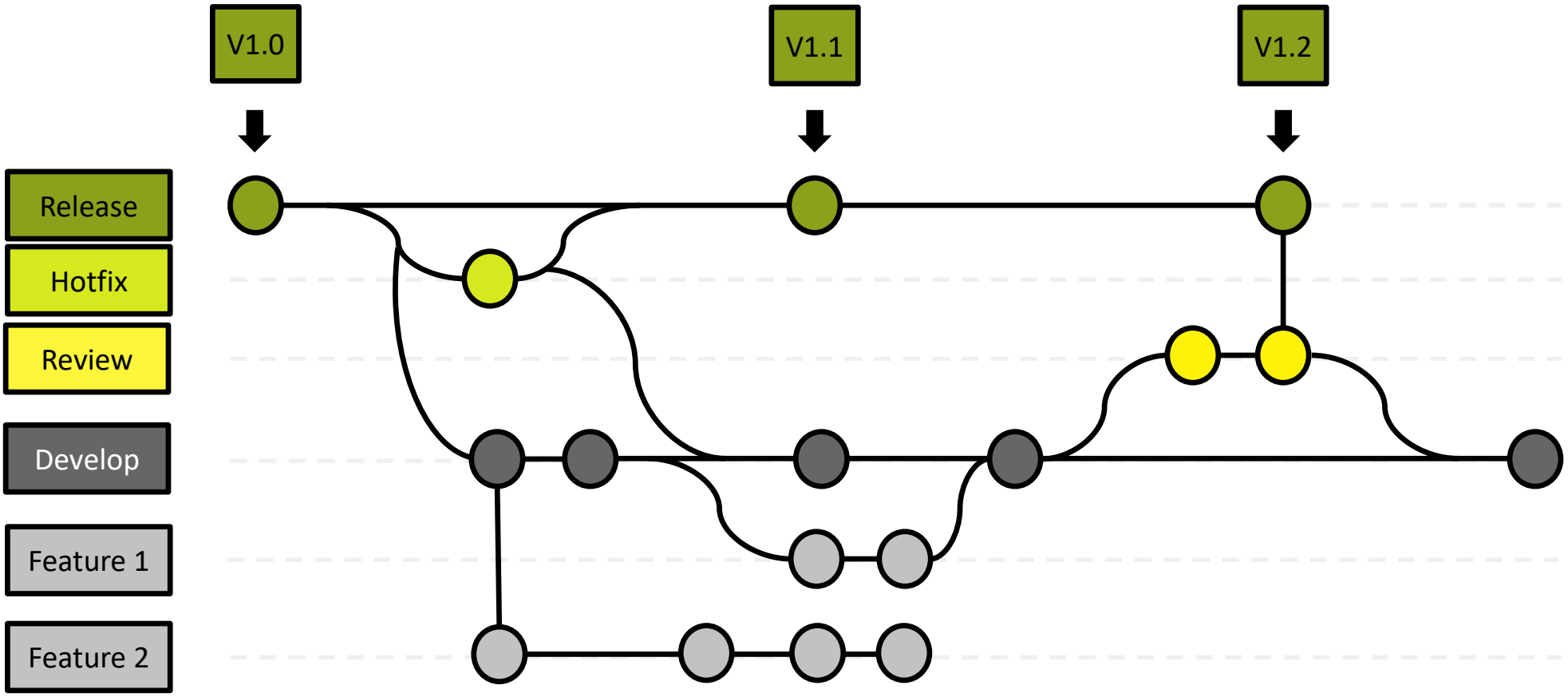
Support Models







Gitflow Branching Strategy



"A Successful Git Branching Strategy"
- Vincent Driessen

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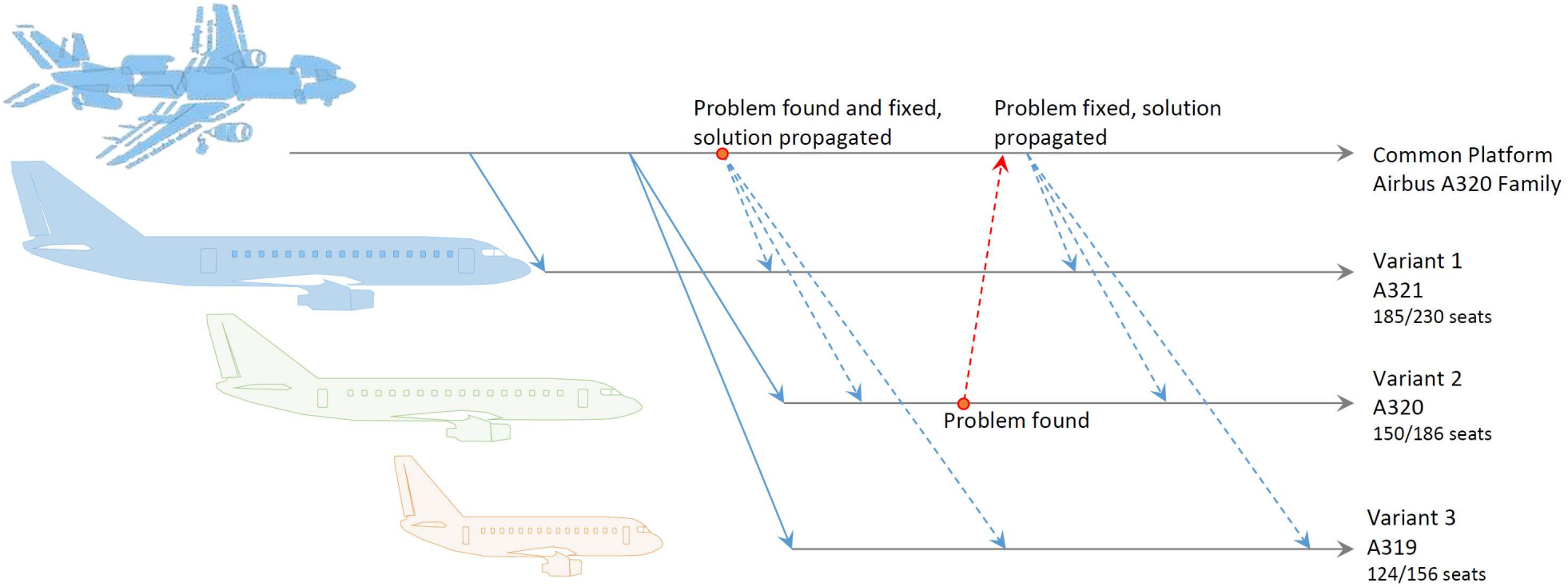
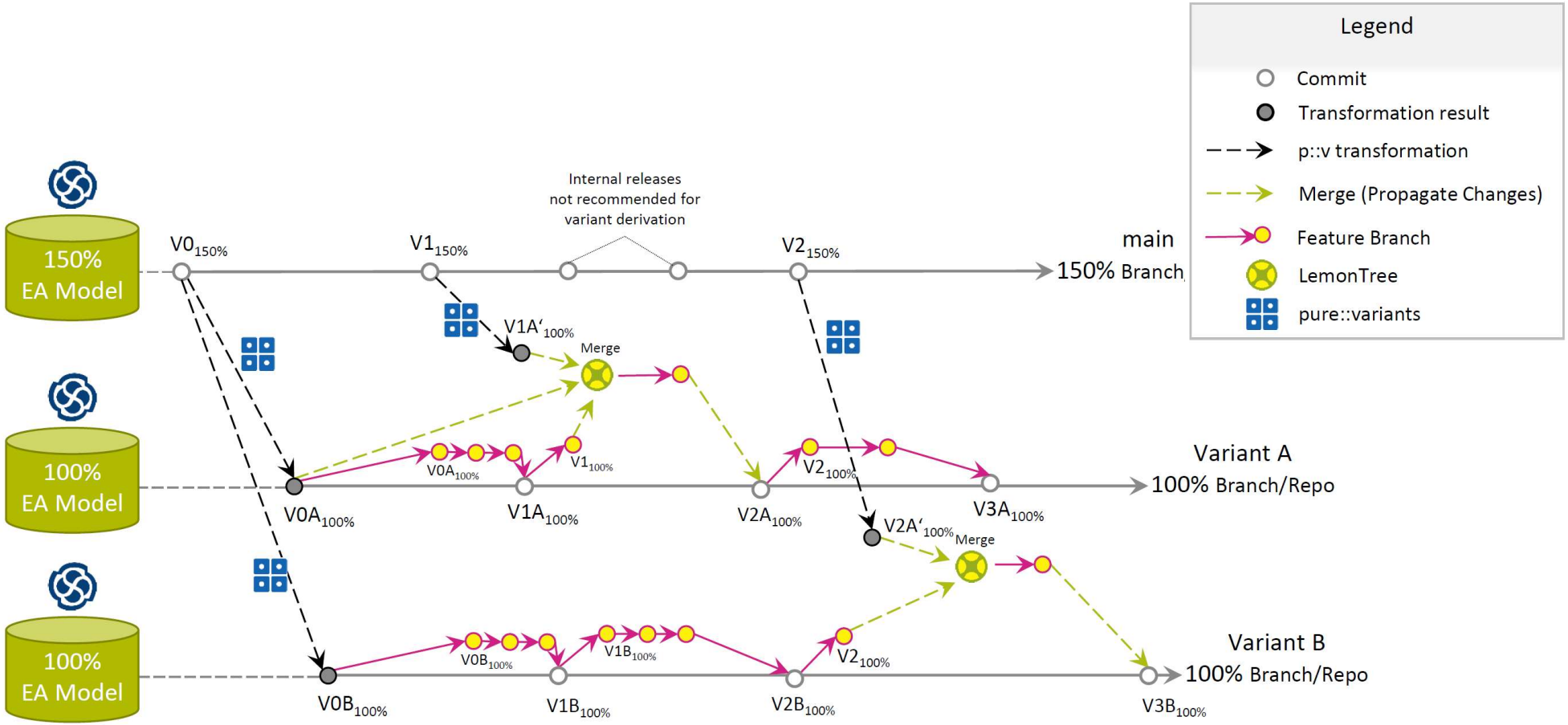
Variant Management



Versions and Variants



CI/CD Principles

Principle	MBSE Perspective
Repeatable Reliable Process	• Consistency of process across lifecycle and environments is critical • Leverage proven software engineering practices for MBSE
Automate Everything	• Humans need to build models (although AI might assist) • Automate model merging, conflict resolution, verification, and reviews
Version Control	• Critical for regulatory certification/auditing and feature-based MBSE • Three-way merging essential for parallel development
Build In Quality	• Ensure projects are following organizational processes and modelers are using modeling languages appropriately
Do Hard Parts First	• Tackle complexity of MBSE modeling lifecycle as soon as possible • Manage technical debt associated with MBSE models
Everyone Is Responsible	• Provide accessibility and visibility of modeling activities to all team members
“Done” Means Released	• Define and enforce criteria for releasing MBSE models and derived artifacts
Continuous Improvement	• Difficult to improve something that is not defined, controlled, and measured

https://www.atlassian.com/continuous-delivery/principles

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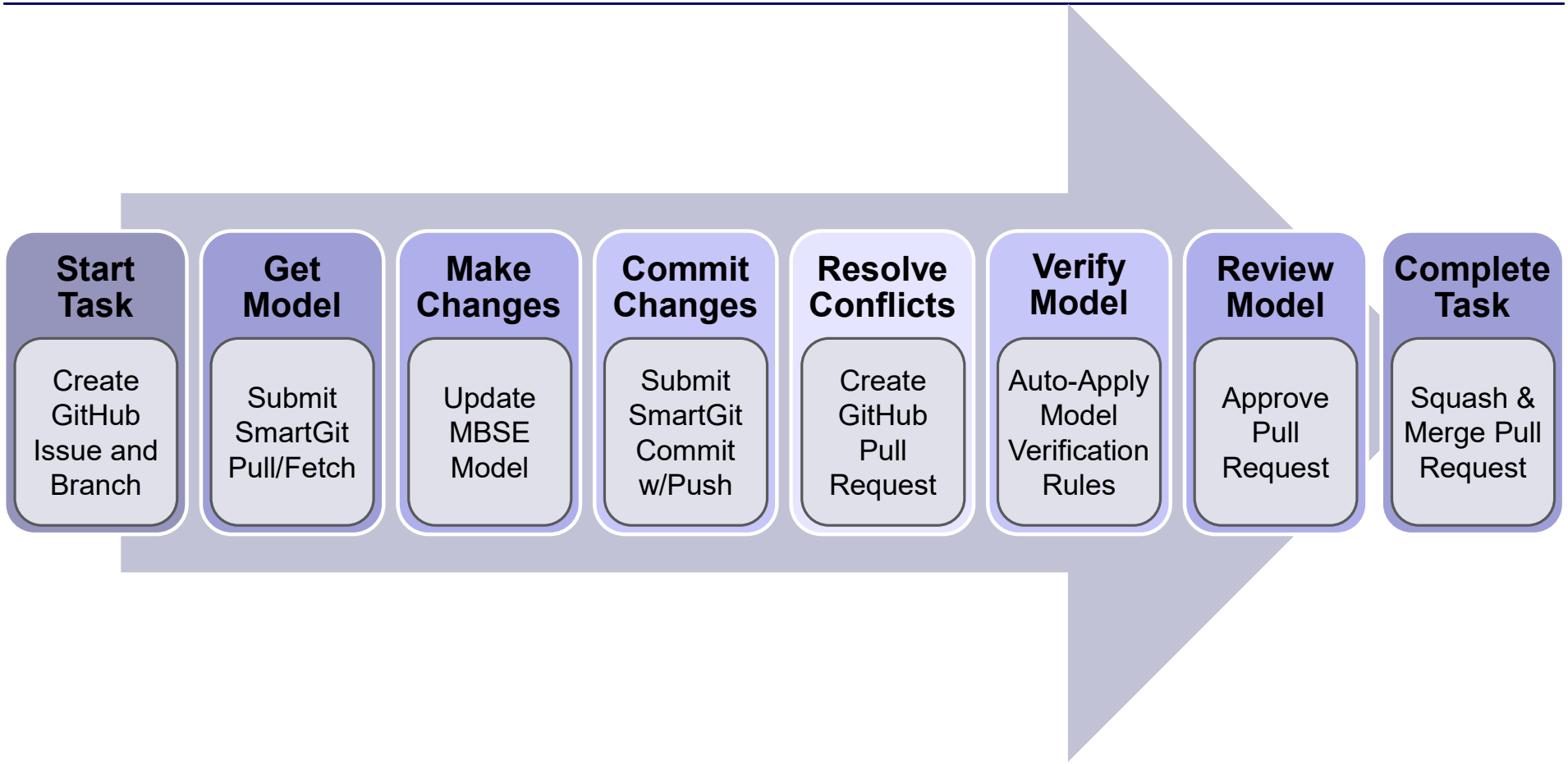
Approach – GitHub Flow



https://docs.github.com/en/get-started/using-github/github-flow

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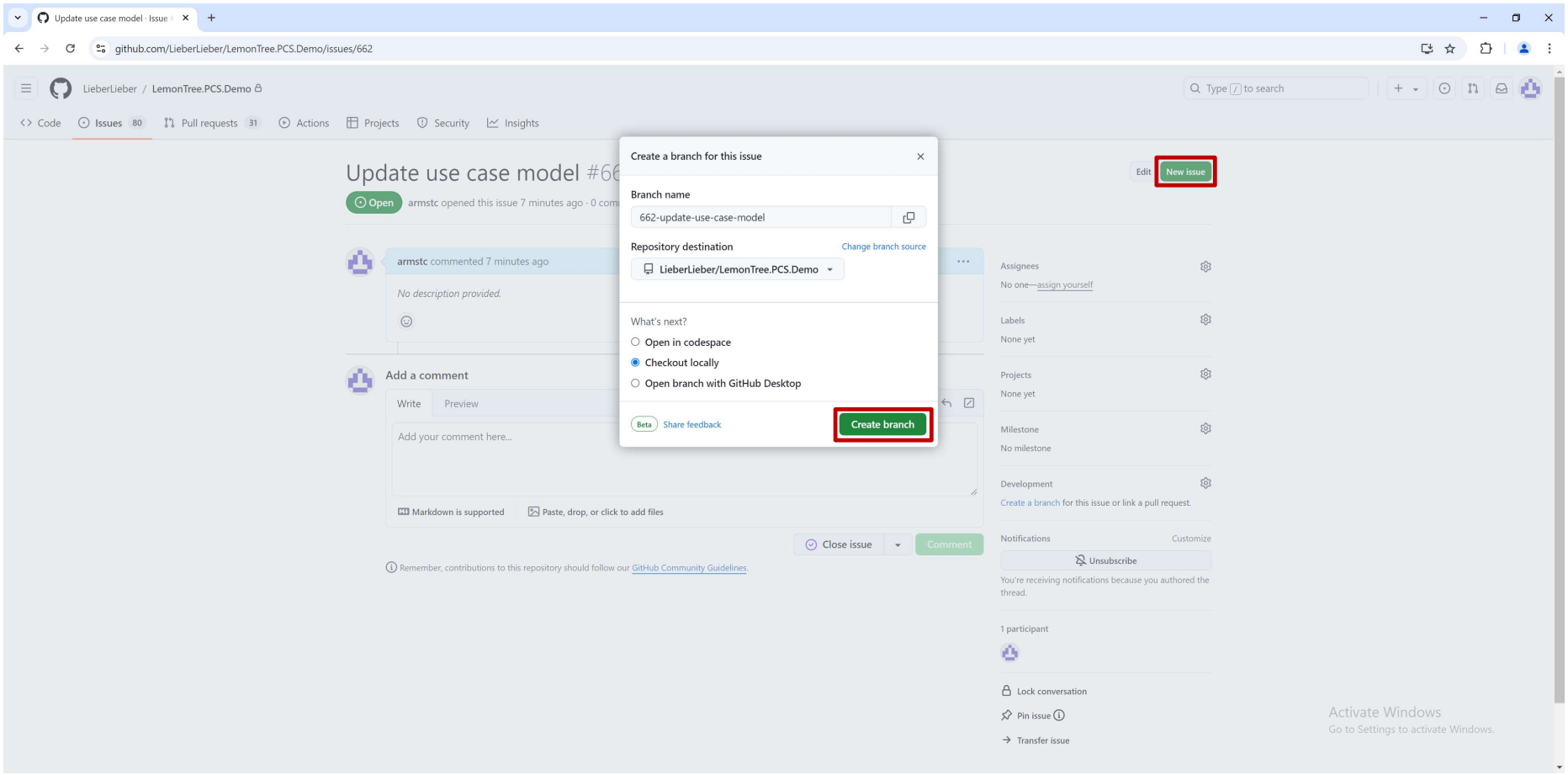
Start Task: Create GitHub Issue and Branch



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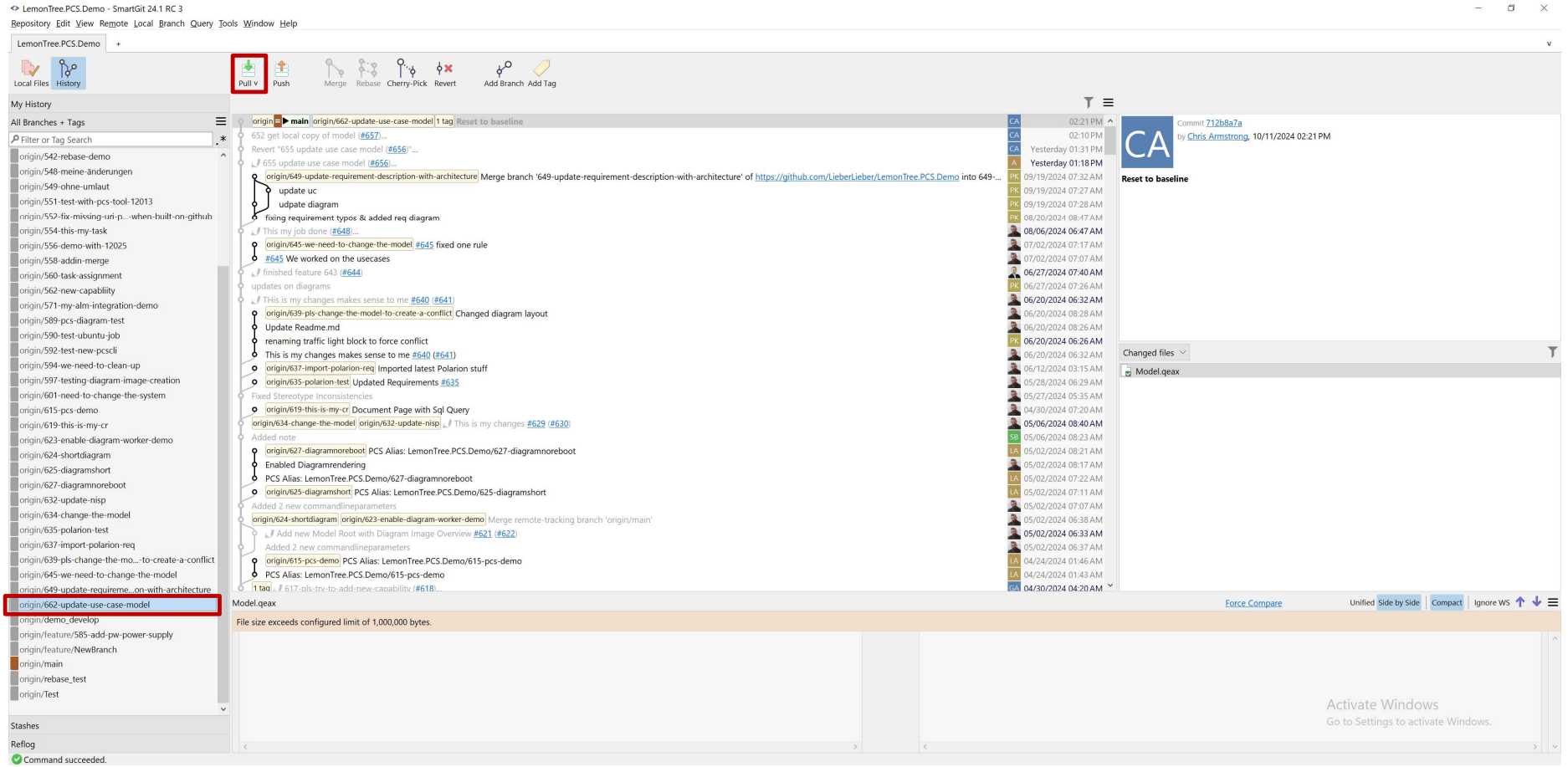
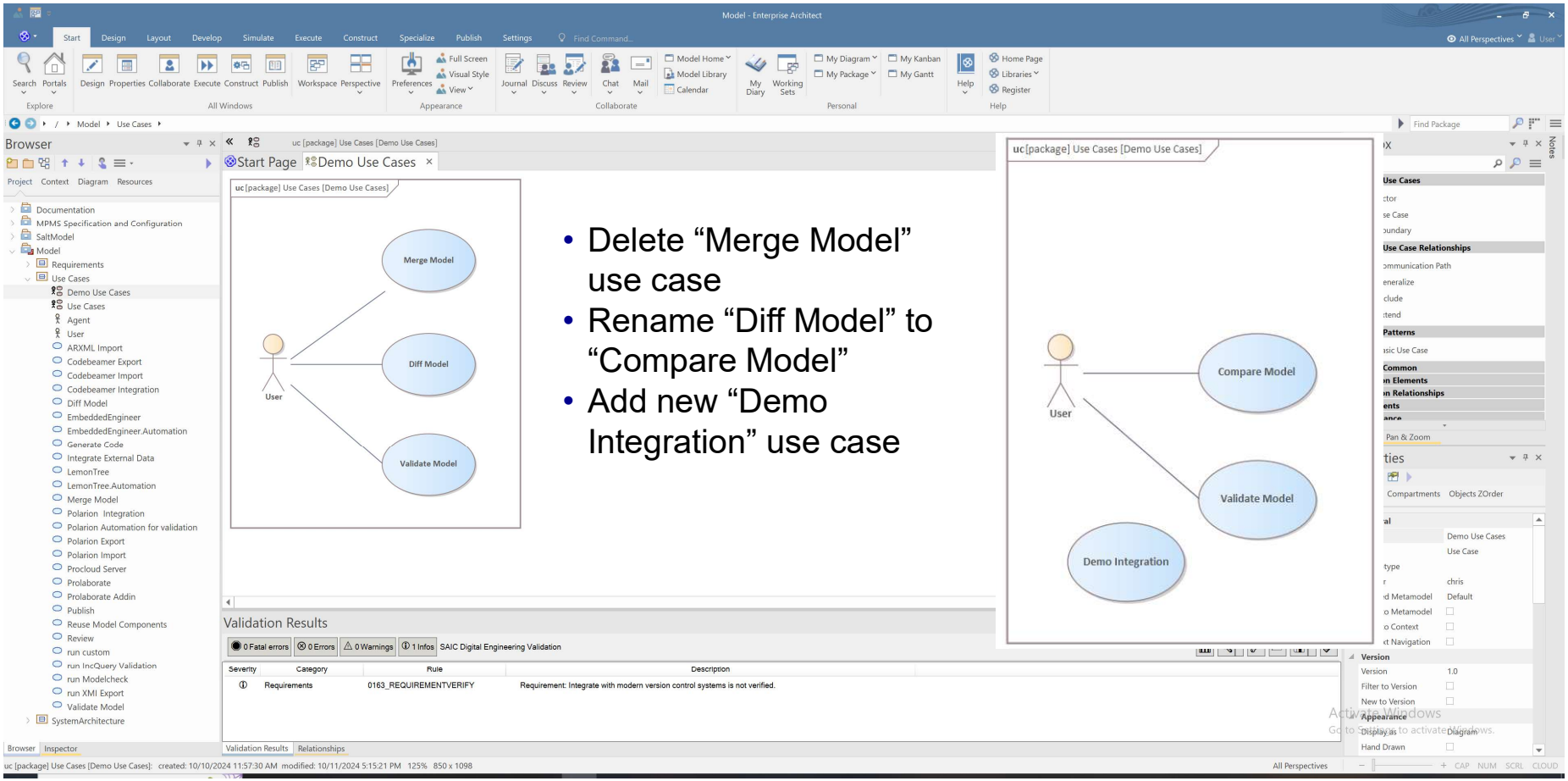
Get Model: Submit SmartGit Pull/Fetch

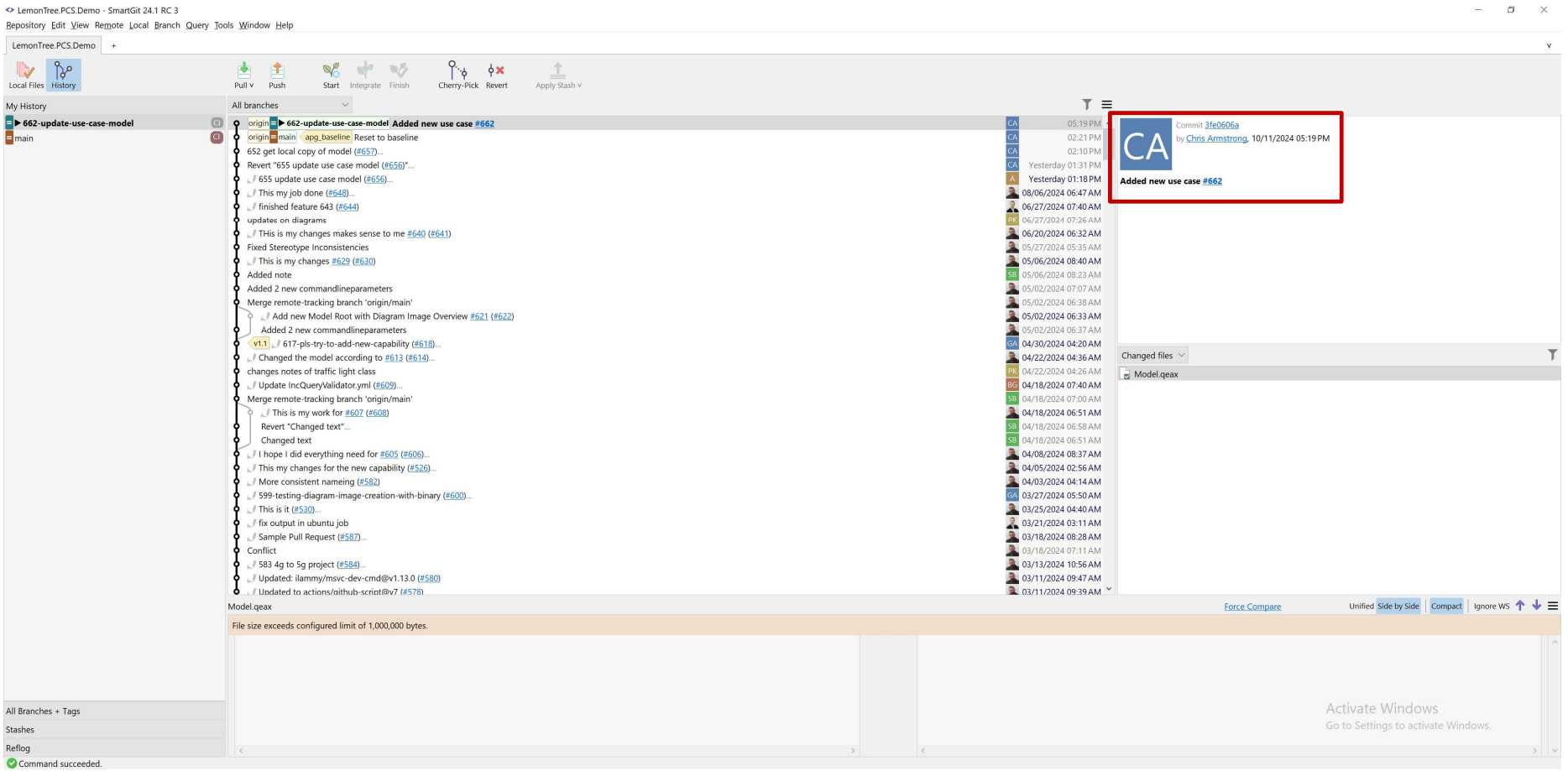


Make Changes: Update MBSE Model

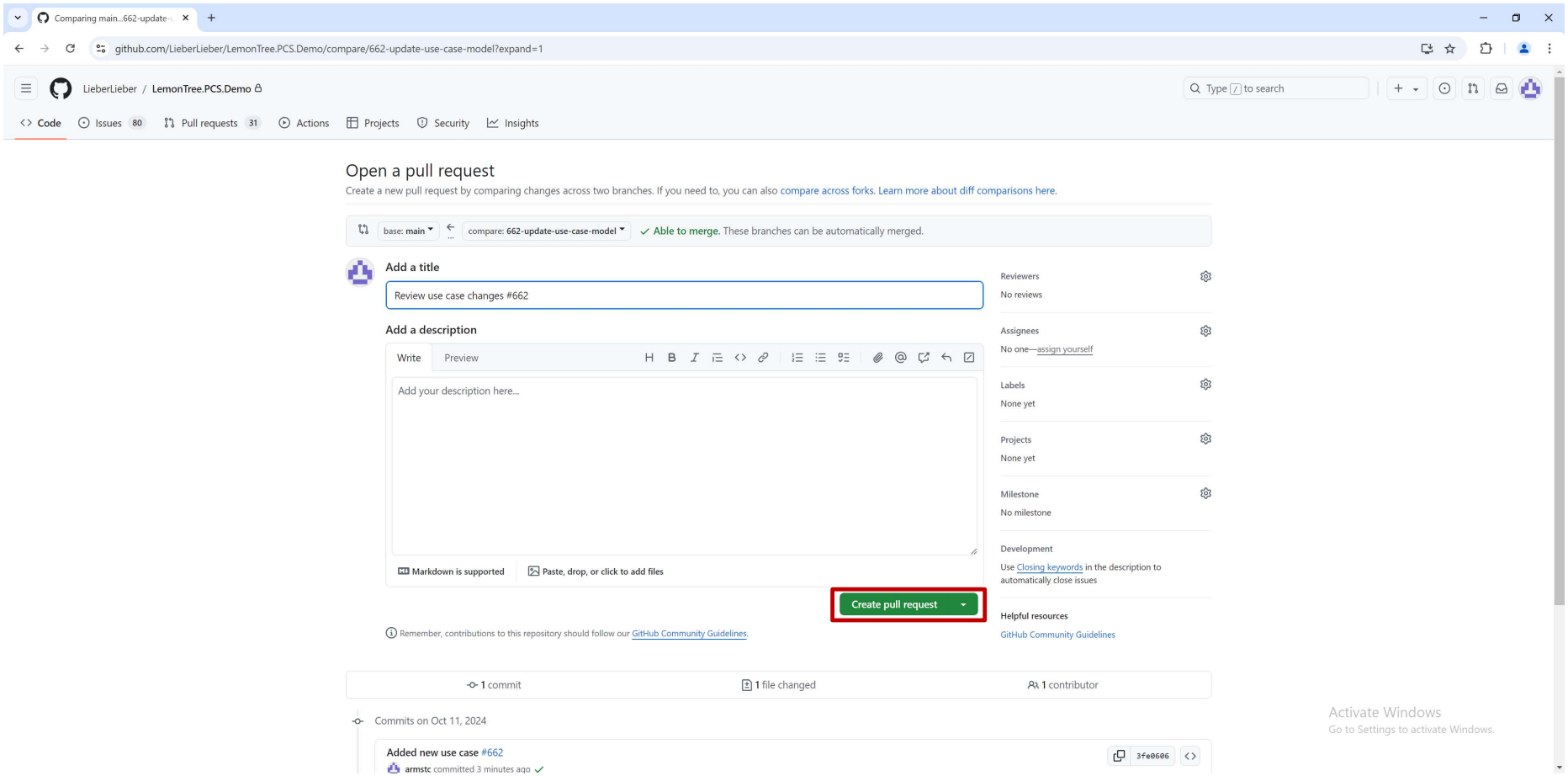


- Delete “Merge Model” use case
- Rename “Diff Model” to “Compare Model”
- Add new “Demo Integration” use case

Commit Changes: Submit SmartGit Commit w/Push



Resolve Issues: Create GitHub Pull Request



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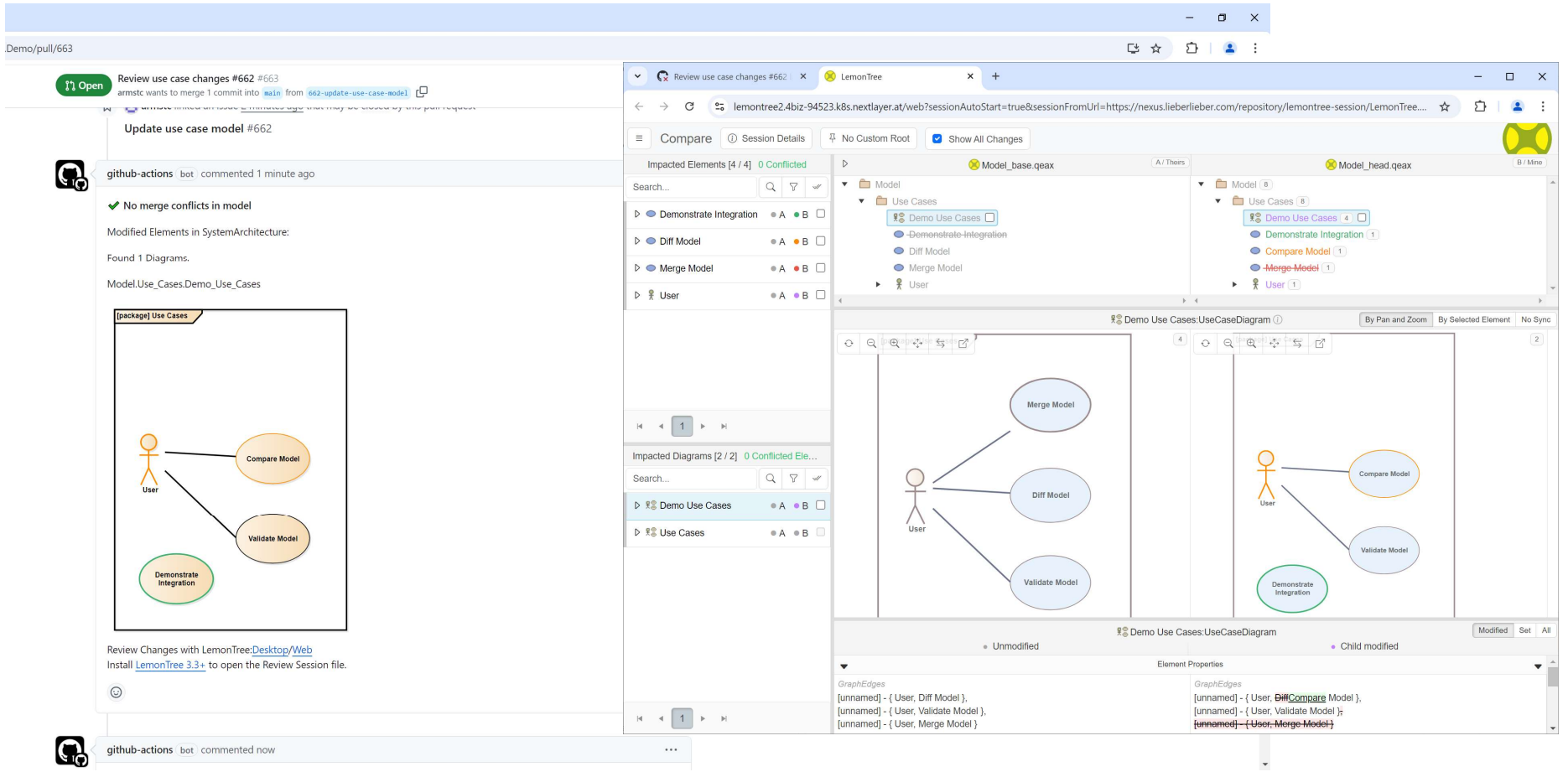
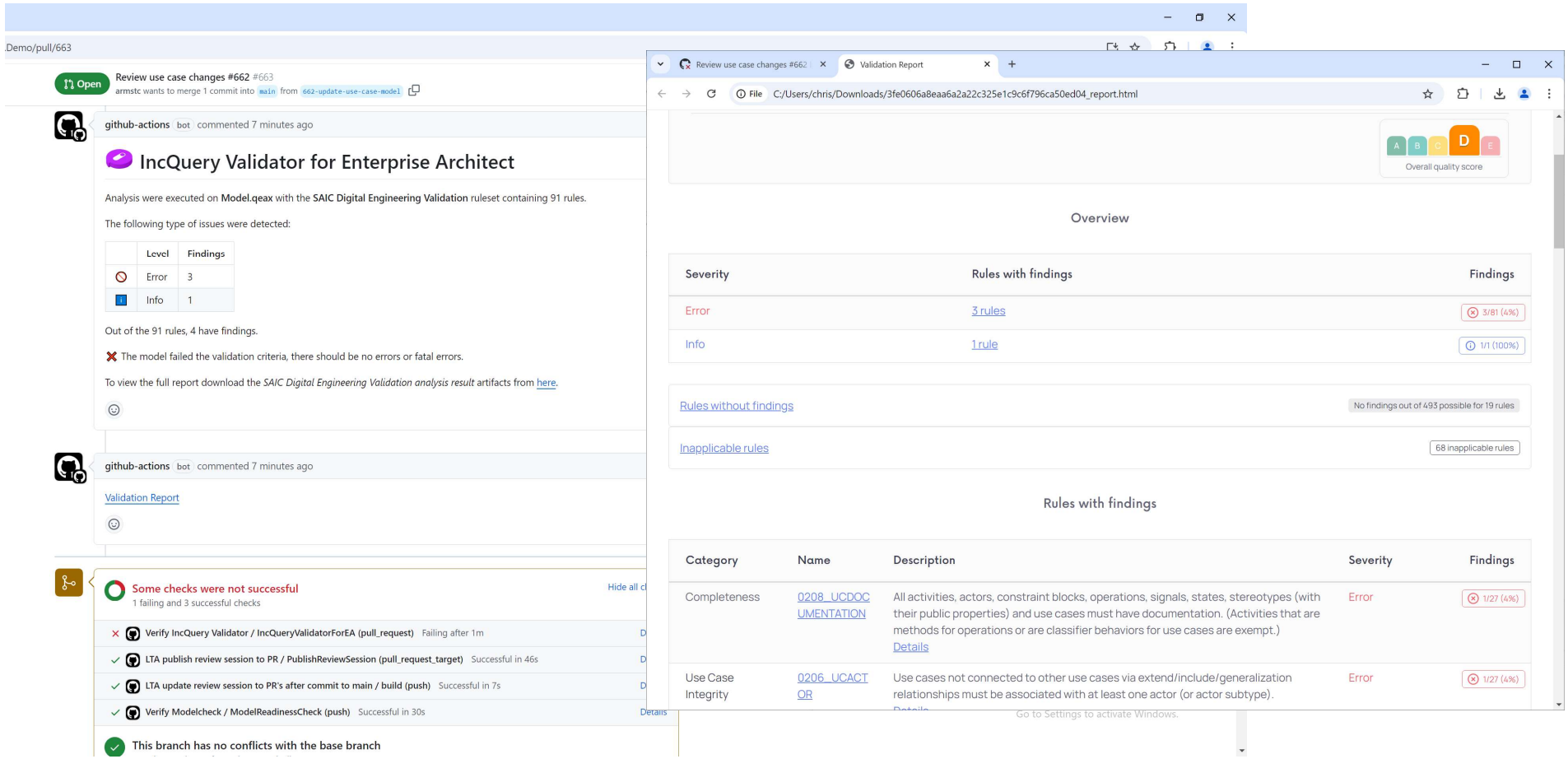
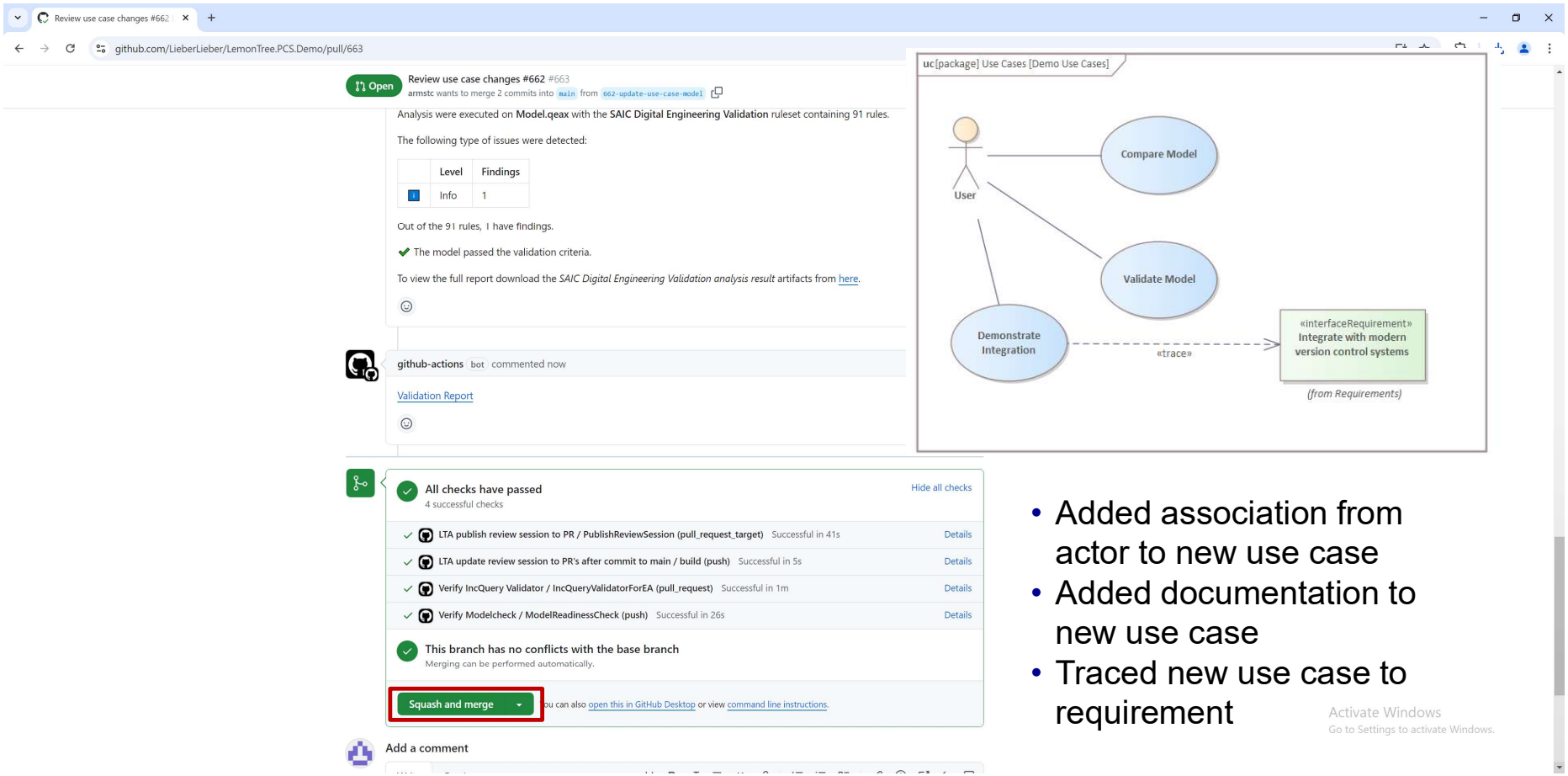
Resolve Issues: Review Model Changes



Verify Model: Auto-Apply Model Validation Rules

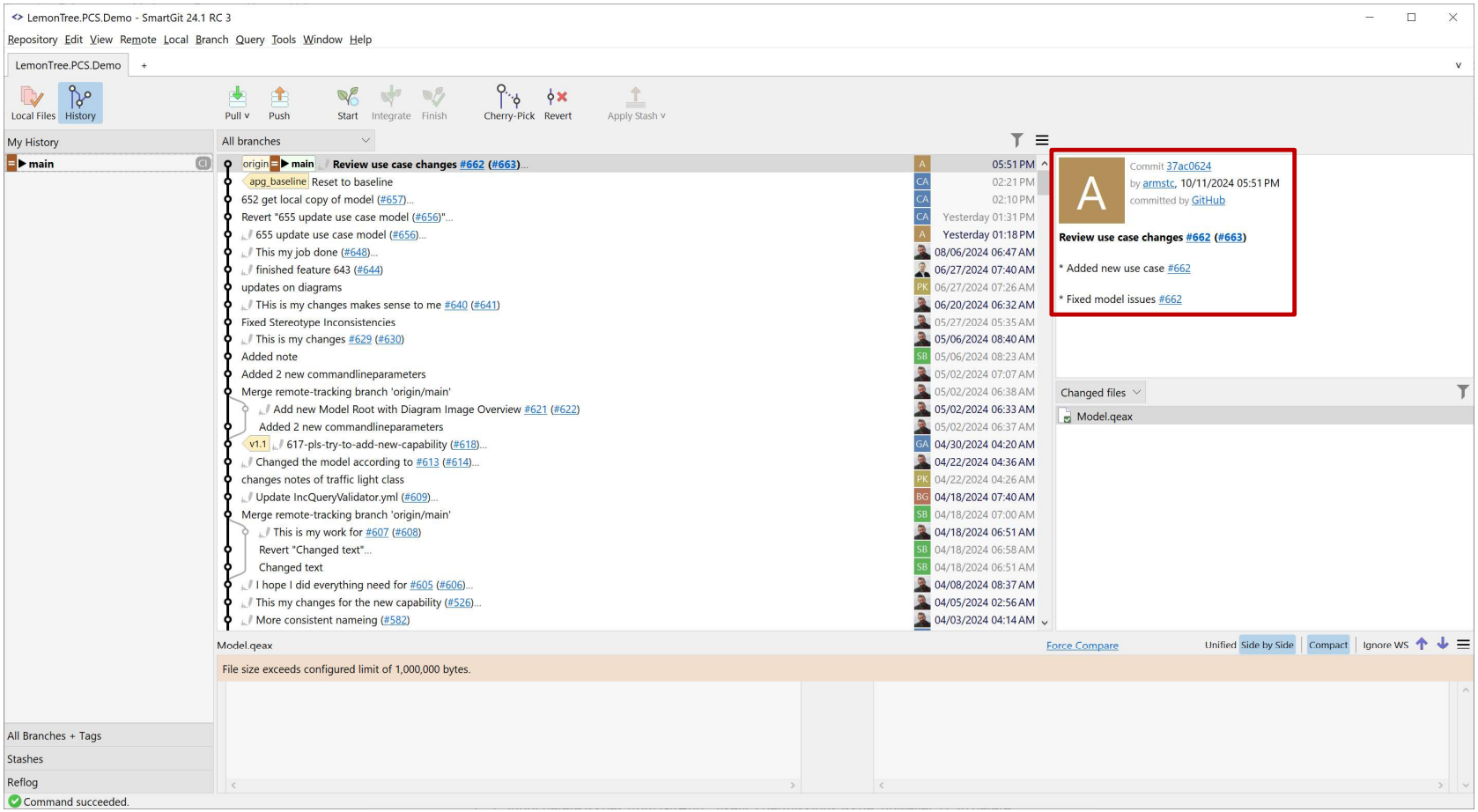


Complete Task: Squash & Merge Pull Request



- Added association from actor to new use case
- Added documentation to new use case
- Traced new use case to requirement

Refresh Local Repository



SysMLv2 Model Example

Base

```
package Car{
    part def Engine{
        part cylinder;
    }

     part def Chassis{
        part wheel;
        part def Breaksystem{
            part break;
            part tractionControl;
        }
    }
}
```

A

```
package Car{
    part def Engine{
        part cylinder;
    }

     part def Chassis{
        part wheel;
        part def Breaksystem{
            part diskBreak;
            part tractionControl;
        }
    }
}
```

B

```
package Car{
    part def Engine{
        part cylinder;
    }

     part def Chassis{
        part wheel;
        part def Breaksystem{
            part drumBreak;

            part tractionSystem;
        }
    }

    part def body{
        part door;
        part trunk;
        part windshield;
    }
}
```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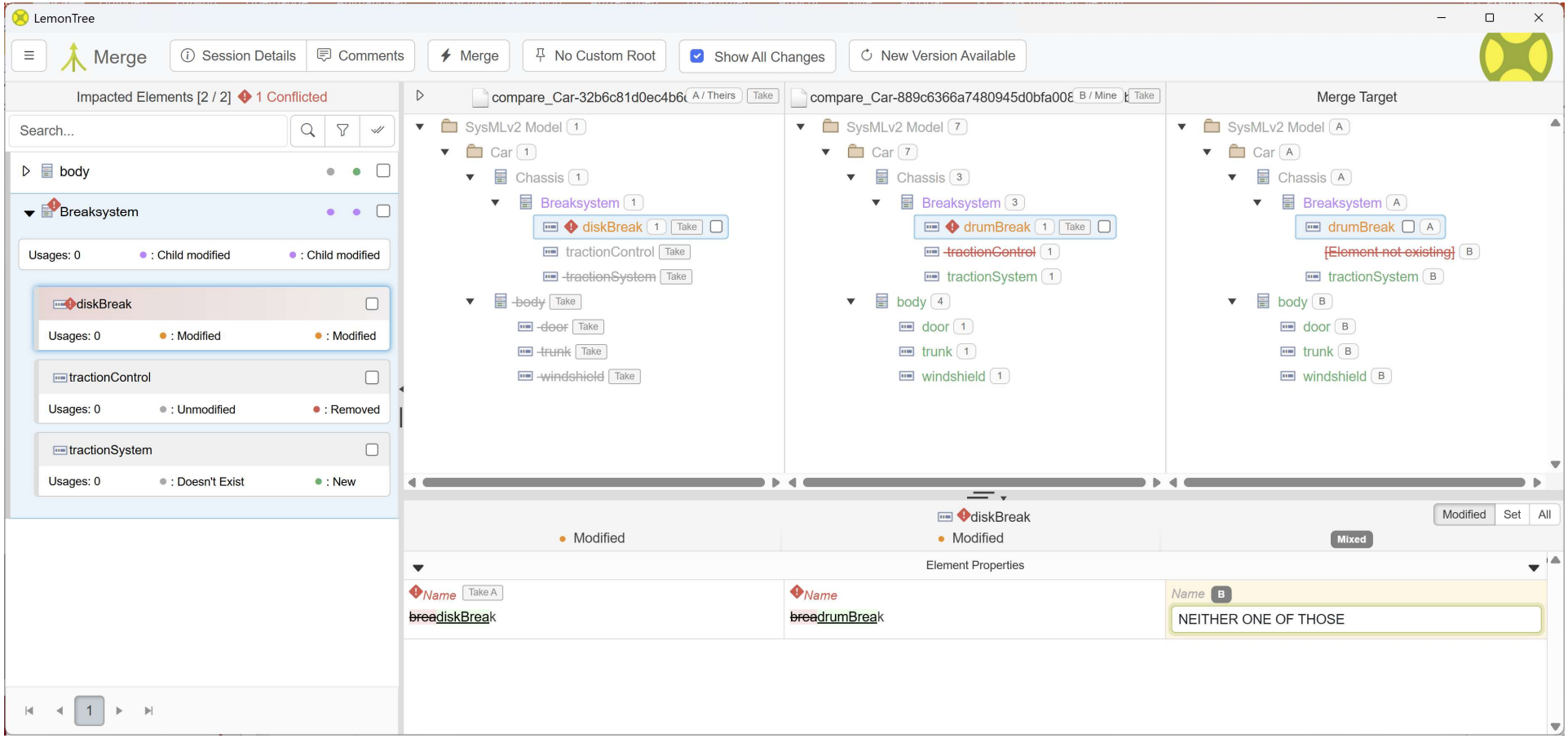
SysMLv2 Model Merging



Conclusions

- ISO/IEC 24641 provides best practices for developing, managing, and leveraging models for systems engineering
- CI/CD is an accepted best practice in software engineering
  - Key to sustainable agile development
  - While ISO/IEC 24641 doesn't explicitly mention CI/CD, some of its requirements can be satisfied by CI/CD adoption
- CI/CD is natural evolution towards next level of MBSE performance and capability

Q&A

Armstrong Process Group APG

Proven ▸▸▸ Practical ▸▸▸ Process™

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Thanks for your attention and participation!