MathWorks
AUTOMOTIVE CONFERENCE 2023
Europe

CI/CD 2.0: From Scripted Jenkins Pipelines to Process Advisor

Martin Römpert, Continental Automotive Technologies GmbH

MathWorks®

Agenda

- Continental Automotive Technologies GmbH
- Motivation
- Initial CI Pipeline
- CI Pipeline Customization
- Process Advisor
- Modular Software
- Conclusions and Outlook

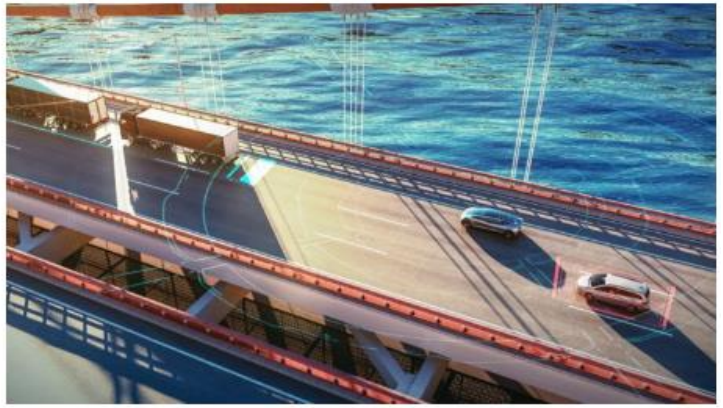
Continental Automotive Technologies GmbH

Safety and Motion

Architecture & Networking

User Experience

Smart Mobility

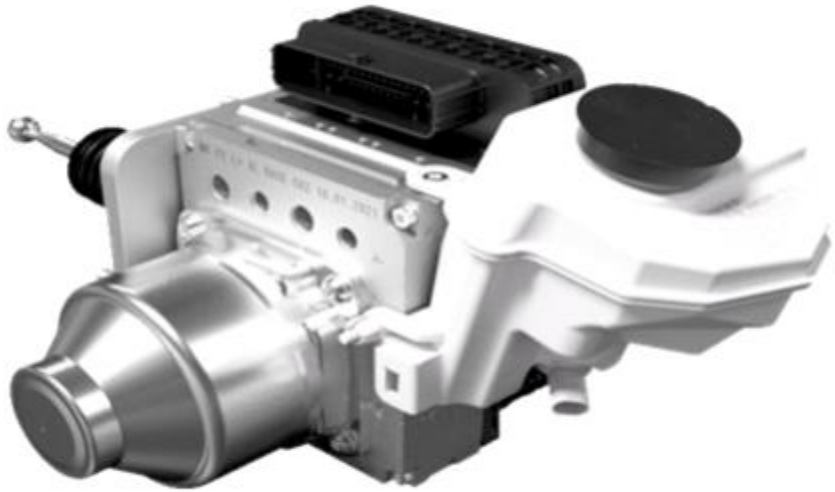


Autonomous Mobility

Public

Continental Automotive Technologies GmbH
Safety and Motion

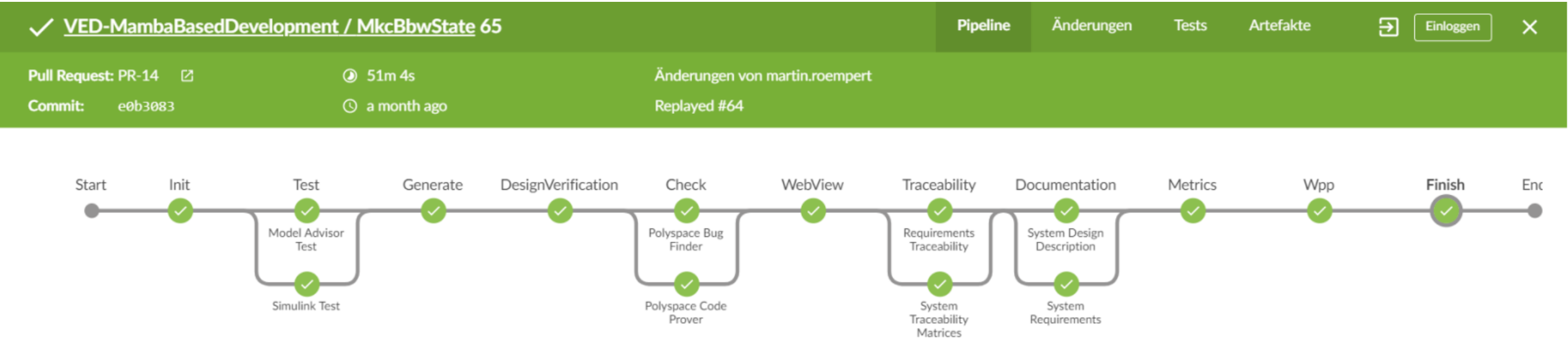
- Dynamics & Comfort
  - Electronic Air Suspension
  - Scalable Chassis Control Unit
- Passive and Integrated Safety
  - Airbag Control Units
- Brakes
  - Parking Brakes
  - Hydraulic
  - Electronic Brake Systems



Motivation

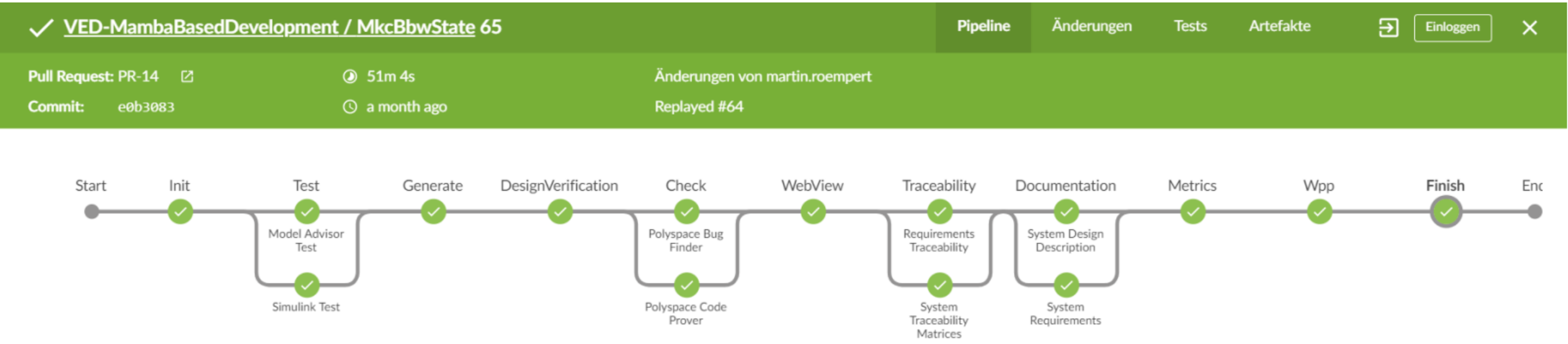
- Continuous Integration
  - Frequent merging of several small changes into a main branch.
- Continuous Delivery
  - When teams produce software in short cycles with high speed and frequency so that reliable software can be released at any time, and with a simple and repeatable deployment process when deciding to deploy.

CI/CD - Wikipedia



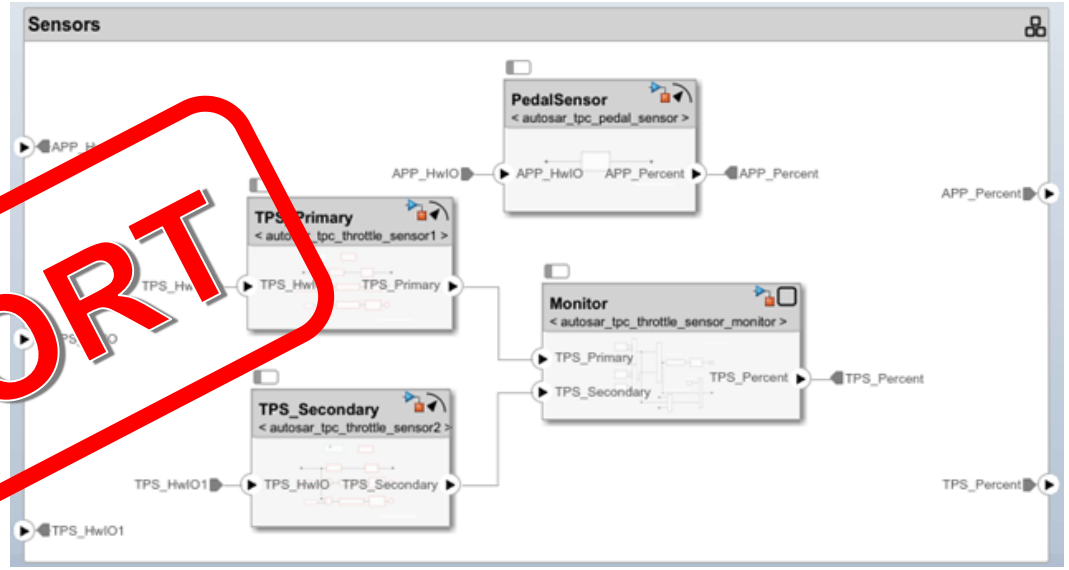
Initial CI Pipeline - Jenkins

- Source Control
- Repository Handling
- Automation
- Implementation
- Artifacts Handling

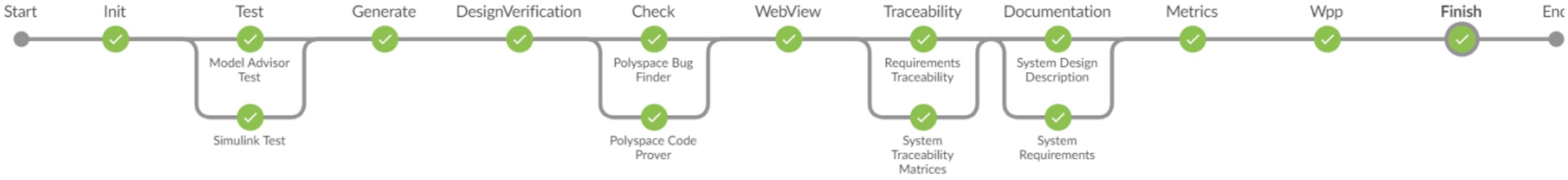


CI Pipeline Customization - Jenkins

- Custom Stages
- Dependency Analysis
- Maturity Level Dependent Actions



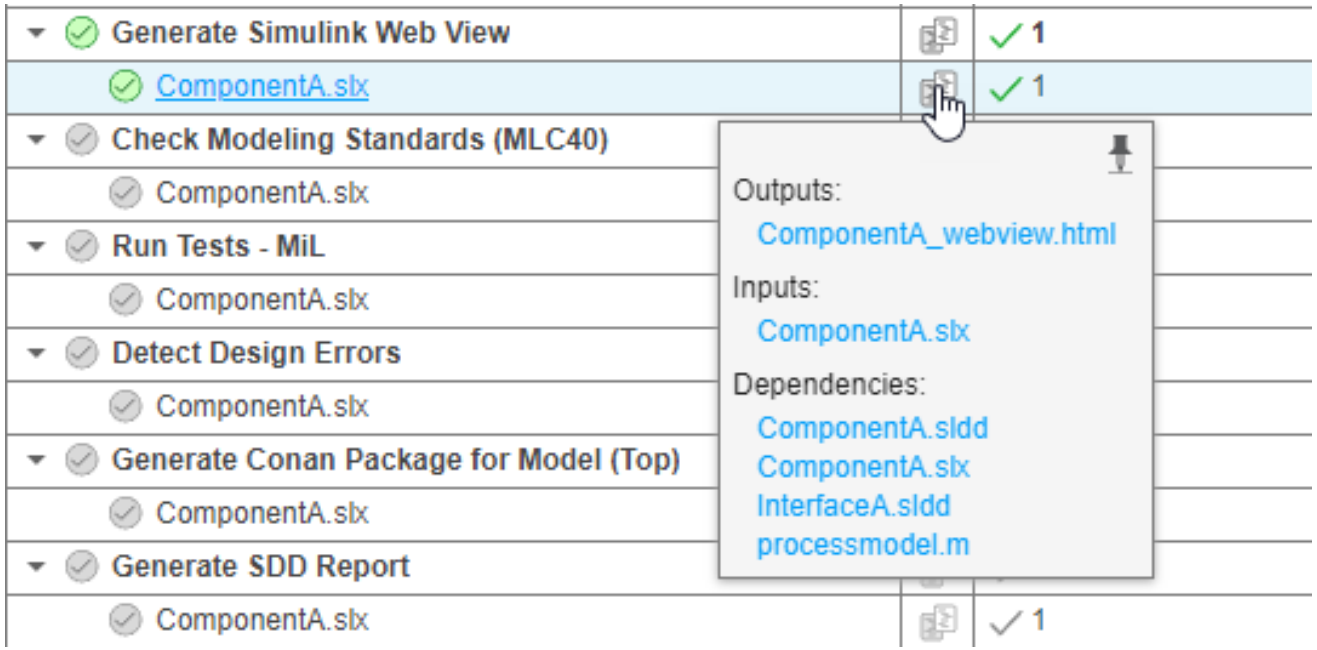
HIGH EFFORT



Process Advisor

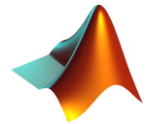
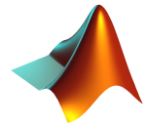
- Tasks
- Input Artifacts
  - Queries
- Output Artifacts
- Assessments
- Relations

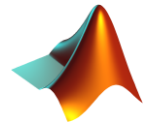
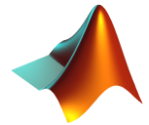
- Interactivity
- Digital Thread
- Staleness



Process Advisor

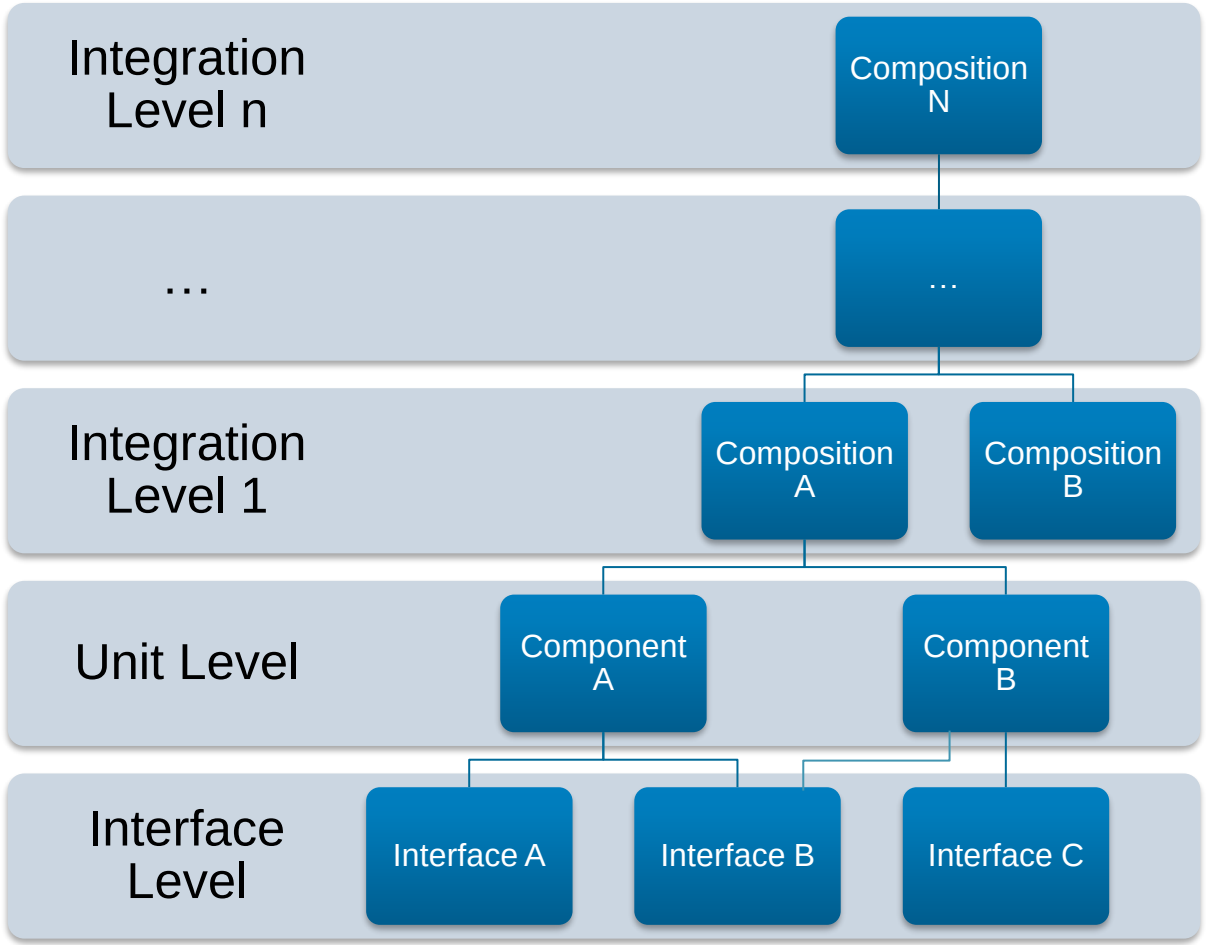
- Artifact Handling

System Calls 
- Package Manager
System Calls 
- Repository Handling

File Exchange 
- Source Control
File Exchange 
- Bring everything into MATLAB!

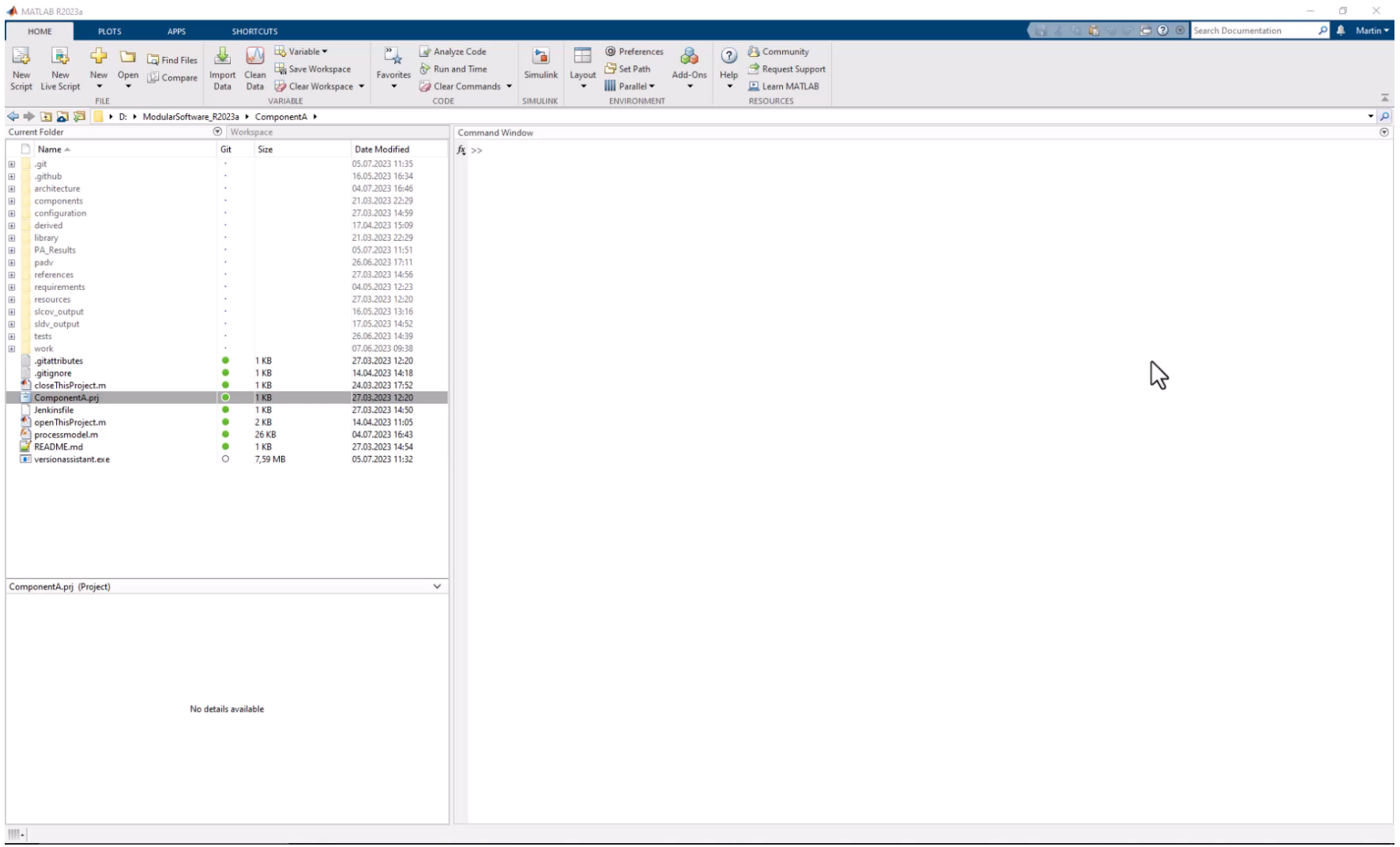
Modular Software

- Goals
  - Scalability
  - Reuseability
  - AUTOSAR Compatibility
- Design Decisions
  - Multiple Repositories
  - Repository Management
  - Package Manager
  - Process Advisor
  - CI / CD System



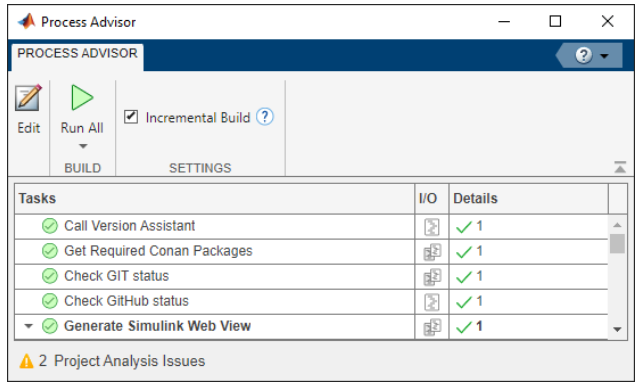
Public

Modular Software



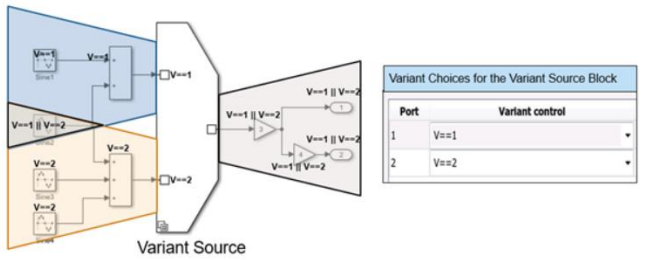
Conclusions

- Process Modeling Framework
- Digital Thread
- Independency from CI / CD system
- Package Manager
- Collaboration with MathWorks



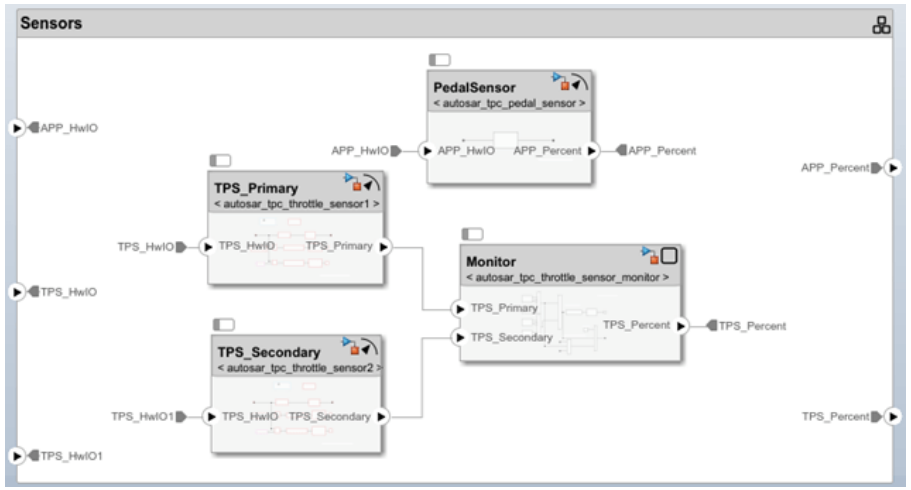
Outlook

- Modular Software Process Library
- Variants
- Handwritten C-Code
- Complex Device Drivers



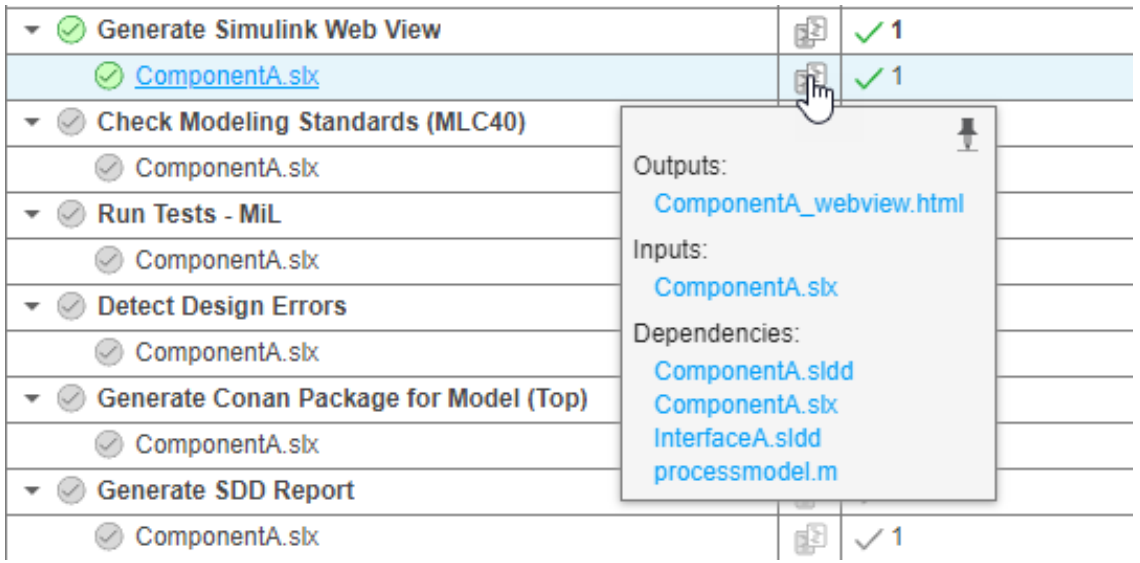
AUTOSAR

- Scaling it up …
  - More than 500 Interfaces
  - More than 1000 Sw-Components
  - More than 100 Sw-Compositions



Thank you for your attention!

- Questions?



Backup

Process Advisor

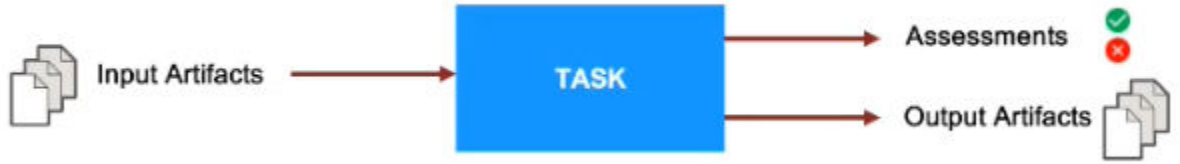
- Customizable process modeling system to define your build and verification process
- Build system to generate and optimally execute the process in your CI system
- Process Advisor app to deploy and automate your prequalification process
- Examples for integration with common CI systems

CI/CD Automation for Simulink Check

by MathWorks Model Verification and Validation Team STAFF

Simplify adoption and optimize Continuous Integration/Continuous Delivery (CI/CD) workflows for Simulink

Process Advisor



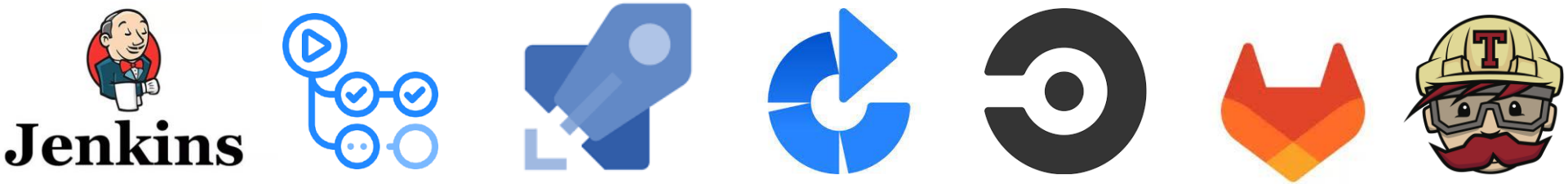
- Input Artifacts
  - Input / Iteration Queries
    - Predefined Queries
    - Custom Queries
- Tasks
  - Predefined Tasks
  - Custom Tasks
- Output Artifacts
  - E.g. HTML, PDF …
- Assessments
  - Pass, Fail, Warning
- Depends On
- Runs After

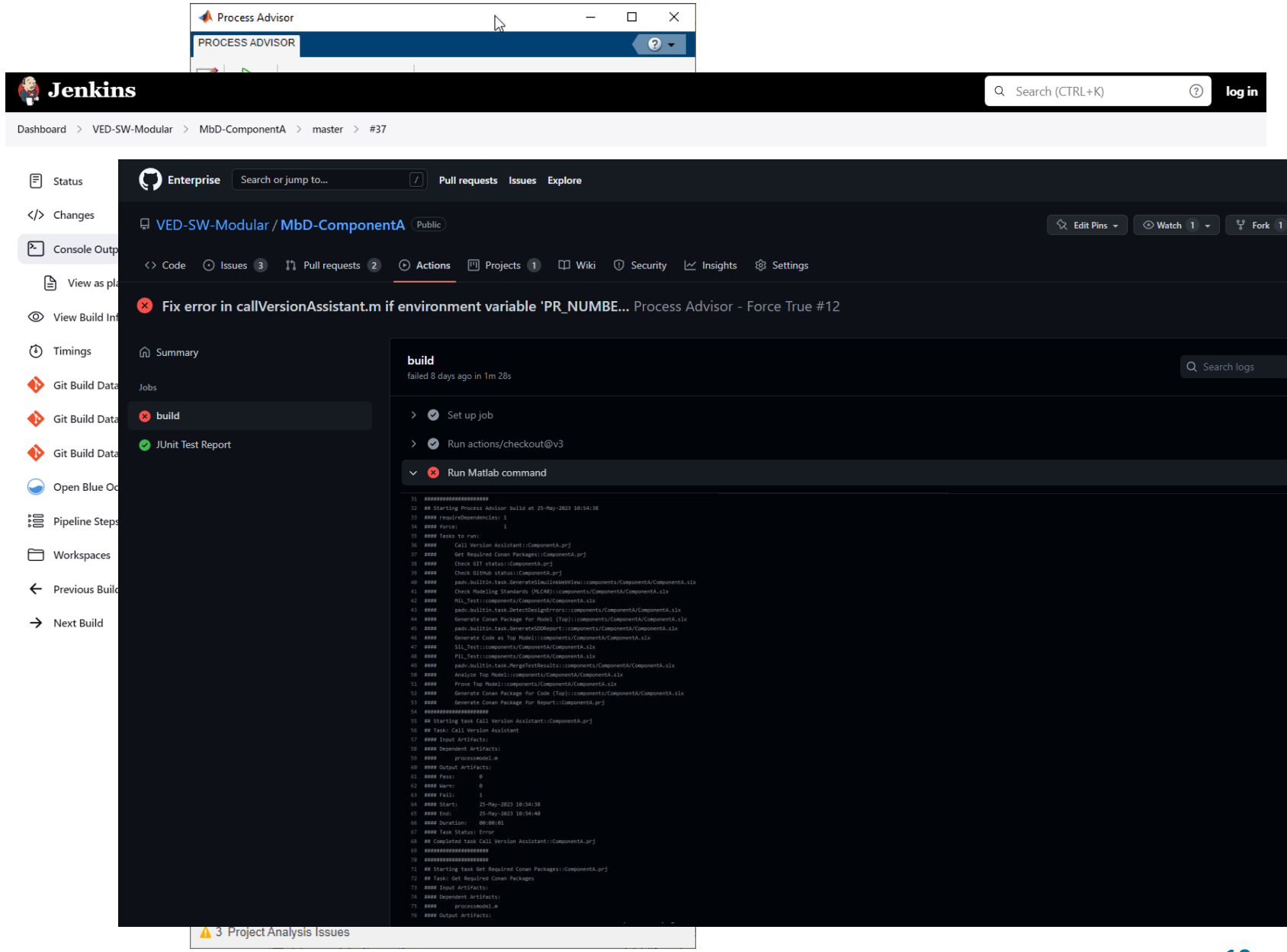
Query Instance	Description
`padv.builtin.query.FindArtifacts`	Returns each of the artifacts in project that meet the specified criteria For information, enter: `help padv.builtin.query.FindArtifacts`
`padv.builtin.query.FindFilesWithLabel`	Returns each of the files in the project that have the specified project label and project label category
`padv.builtin.query.FindFileWithAddress`	Returns the file at the specified address in the project
`padv.builtin.query.FindModels`	Returns each of the models, including System Composer models, in the project
`padv.builtin.query.FindModelsWithLabel`	Returns each of the models in the project that have the specified project label and project label category
`padv.builtin.query.FindModelsWithTestCase`	Returns each of the models that are associated with a test case
`padv.builtin.query.FindProjectFile`	Returns the project file
`padv.builtin.query.FindReferencedModels`	Returns each of the referenced models in the project
`padv.builtin.query.FindRequirementSets`	Returns each of the requirement sets within a project
`padv.builtin.query.FindRequirementsWithModel`	Returns each of the requirement links associated with a model
`padv.builtin.query.FindTestCasesWithModel`	Returns each of the test cases associated with the models in the project
`padv.builtin.query.FindTopModels`	Returns each of the top models in the project
`padv.builtin.query.GetDependentArtifacts`	Returns the dependent artifacts for the specified artifact
`padv.builtin.query.GetIterationArtifact`	Returns the artifact that the task is iterating over

Task Title	Task Name and Source Code File
Check Coding Standards	• Name: `"padv.builtin.task.AnalyzeModelCode"` • File: `AnalyzeModelCode.m`
Check Modeling Standards	• Name: `"padv.builtin.task.RunModelStandards"` • File: `RunModelStandards.m`
Detect Design Errors	• Name: `"padv.builtin.task.DetectDesignErrors"` • File: `DetectDesignErrors.m`
Generate Code	• Name: `"padv.builtin.task.GenerateCode"` • File: `GenerateCode.m`
Generate SDD Report	• Name: `"padv.builtin.task.GenerateSDDReport"` • File: `GenerateSDDReport.m`
Generate Simulink Web View	• Name: `"padv.builtin.task.GenerateSimulinkWebView"` • File: `GenerateSimulinkWebView.m`
Inspect Code	• Name: `"padv.builtin.task.RunCodeInspection"` • File: `RunCodeInspection.m`
Merge Test Results	• Name: `"padv.builtin.task.MergeTestResults"` • File: `MergeTestResults.m`
Run Tests	• Name: `"padv.builtin.task.RunTestsPerModel"` • File: `RunTestsPerModel.m`
Run Tests	• Name: `"padv.builtin.task.RunTestsPerTestCase"` • File: `RunTestsPerTestCase.m`

Process Advisor

- Digital Thread
  - The digital thread is a set of metadata information about the artifacts in a project, the artifact structure,
    and the traceability relationships between artifacts.
- Run Process Advisor locally or in CI



Process Advisor

- Local Execution
  - GUI / API
- Jenkins
  - Jenkinsfile
- GitHub Actions
  - .github/workflows