

Focused Inspection to Support Defect Detection in Automation Systems Engineering Environments

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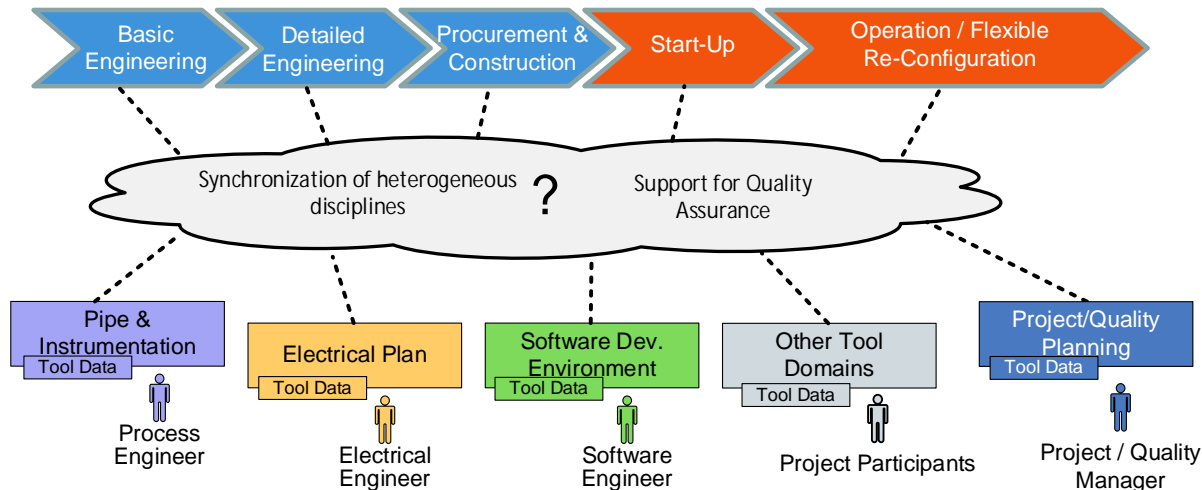
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Context and Goals

Context

- § Automation Systems Engineering Projects.
- § Heterogeneous Disciplines in Distributed Engineering Environments.
- § Isolated tools and incompatible data models.

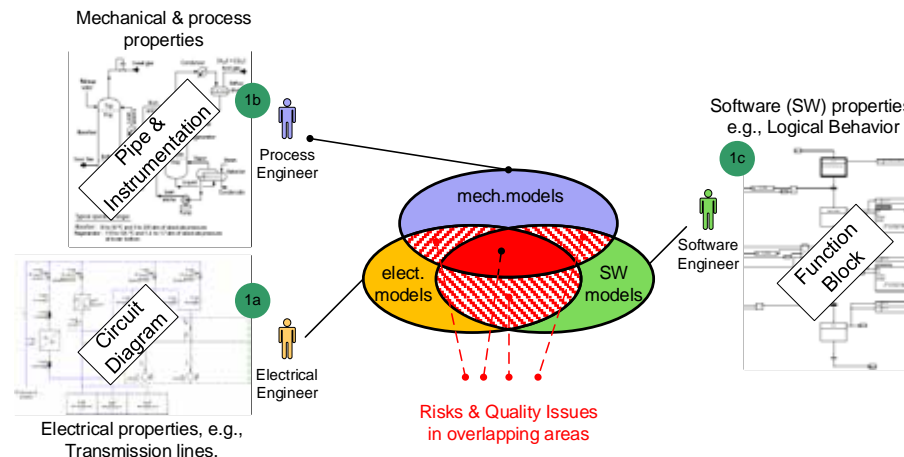


Goals

- § Data synchronization mechanisms to improve engineering processes.
- § Inspection support to improve product, process, and project quality.

Related Work

- § **Engineering Service Bus**¹: Software Platform that closes the semantic gap between heterogeneous data models.
- § **Common concepts**. Overlapping areas of involved disciplines.
- § (Software) **Inspection** is an established approach for early defect detection in Software Engineering.
- § **Reading techniques** support engineers in finding defects more effective and efficient, e.g., checklist based, perspective based, usage based, risk based reading.



Research Issues

- § How can we **support defect detection** in ASE Environments?
- § How can we show the **feasibility** of the adapted inspection approach in the ASE domain?

Solution Approach

Common Concepts

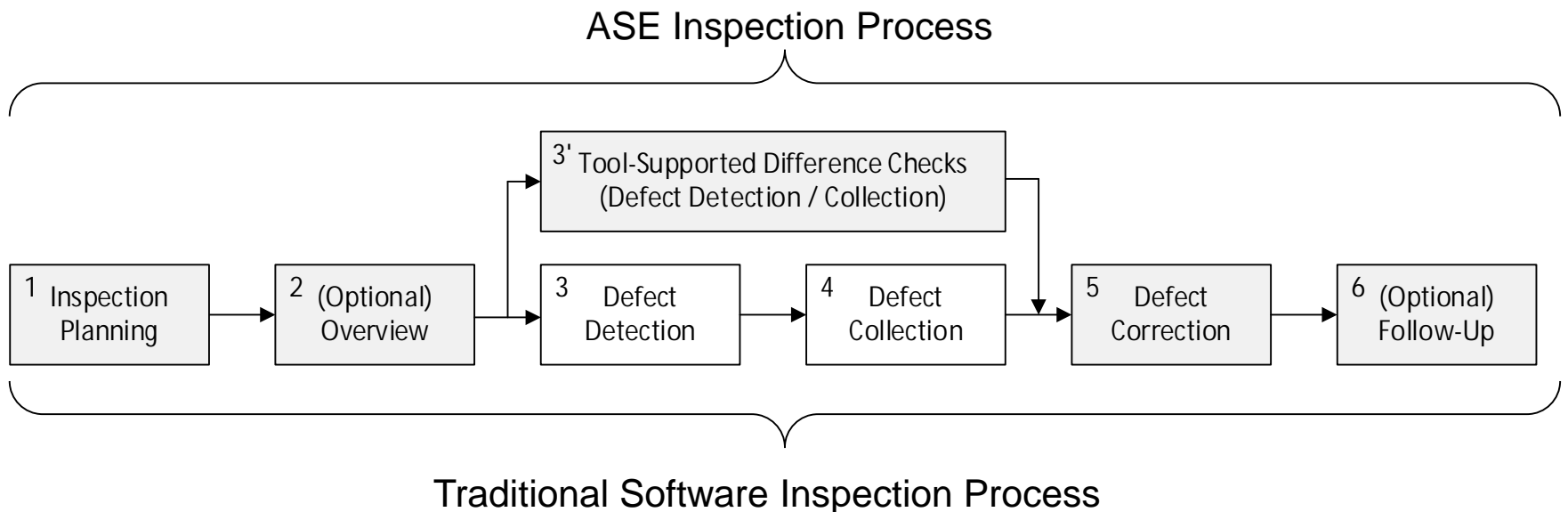
§ Tool Supported Difference Checks of Changes based on Common Concepts.

Adapted ASE Inspection Approach

§ Inspection planning based on project plan and synchronization strategy (1)

§ Tool-Supported Difference Checks (defect detection / collection) → merge view to focus on candidate defects and changes (3').

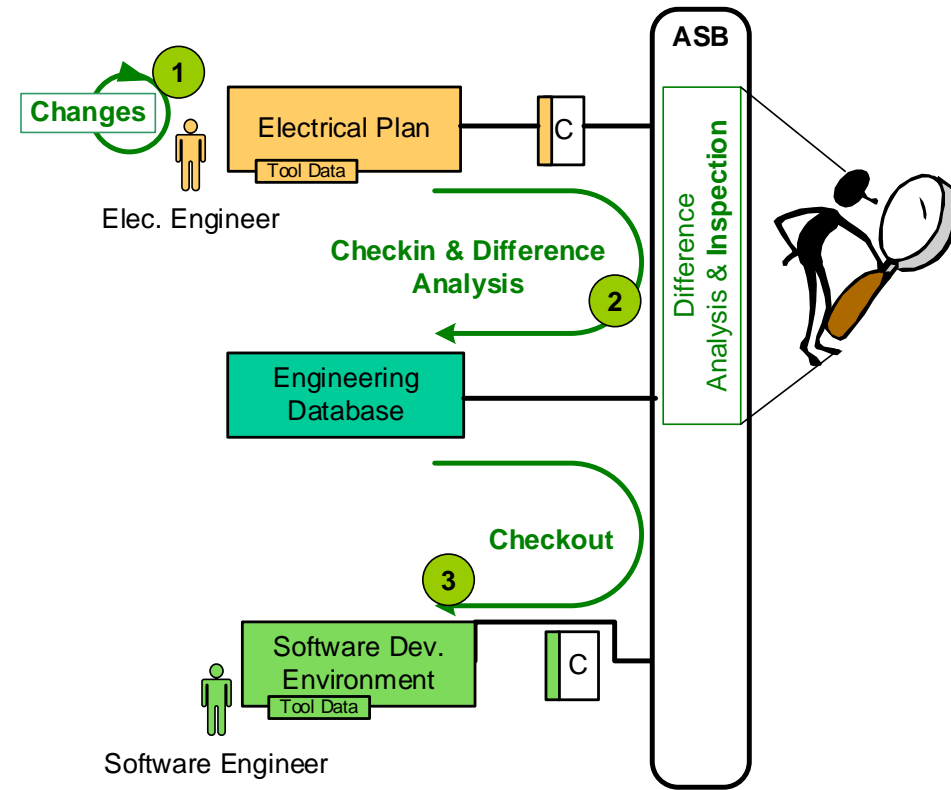
§ Defect correction based on notification of affected disciplines / engineers (5).



Feasibility Study

Study Context

- § Real-world data from industry partner (i.e., Hydro Power Plant Project).
- § Change Management Process Approach:
 1. Changes provided by Electrical Engineers.
 - 2. Difference Analysis & Focused inspection.**
 3. Checkout of synchronized Data Sets by Software Engineer.
- § Initial Data Setup: 152 signals (individual data sets that identifies engineering entities).
- § Inspection team: electrical, mechanical, software, and engineer (moderator of the inspection session).



Difference View on Updated Signals

- § New Testing Data Set (4 signals):
- 3 new signals has been introduced.
 - 1 signal updated.
 - 151 signals removed.

- § Set of changes (new, updated, removed signals) can be inspected by the inspection team.
- Accept changes if change is acceptable (or false positive)
 - Reject changes if change is not acceptable (or agreed as defect)

view changes (1)

Tick checkboxes to the left of the new value in order to update a property.

Show only conflicts.

[replace all](#) | [keepAll](#)

Change number of rows: 50

line	Update whole row	project	region	componentNumber	cpuNumber	channelName	rackid	position	kks0	kks1	kks2	kks3	functionalDescription(longText)	status	dp	cat	
1	keep all	old value: new value:	project	001	007		20	05	position	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Unit 1 VT U1 U2 U3 not ok Unit 1 Feeder 380kV current phase L2	2041 04053	<input checked="" type="checkbox"/>

Choose Separator | create csv

Benefits and Limitations

Benefits:

- § Based on inspection team participants (i.e., different disciplines), inspectors apply their individual viewpoints, i.e., comparable to perspective based reading.
- § State-of-the-Practice (Manual) vs. tool-supported synchronization & Inspection.

	Manual*	ASB	Change
Individual Synchronization Effort (without inspection & discussion)	30min	5min	Effort Improvement (-83%)
Avg. Frequency of Synchronization	2 / month	20 / month	Frequency increased: factor 10
Analysis of Data	Days	Seconds	Significant improvement
Inspection and Discussion	-	-	comparable effort

Limitations:

- § No guidance for inspectors provided (implicitly given by participating roles).
- § Small set of sample data (feasibility study)

Summary

- § Automation Systems Engineering Projects include various disciplines with heterogeneous tools and data models
 - à need for synchronization support.
- § Defects in different disciplines can have a critical impact on other disciplines
 - à need for quality assurance support (e.g., by inspections)
- § Integrated data (and common concepts) can help to
 - support synchronization of various disciplines
 - drive inspection processes based on (automatically) identified deviations.
- § Feasibility study in the ASE domain, i.e., hydro power plant engineering showed benefits for improving process, project, and product quality.

Future Work

- § Towards guidance of individual inspectors (e.g., checklists, domain-specific guidelines).
- § Evaluation in larger industry settings to investigate performance and scalability.
- § Additional support of change analysis with semantic technologies.

Thank you ...



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