



Navigating between Tools in Heterogeneous Automation Systems Engineering Landscapes

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Model Mec.

lode SW

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Elec.

Context & Motivation



Context

- Large Scale Engineering Projects in the Automation Systems Domain, e.g., hydro power plants and steel mills.
- Loosely coupled distributed and heterogeneous tools and data models from various disciplines that should collaborate.

Challenges:

- Reduce high manual effort for information retrieval from various disciplines.
- Focus on change management.
- Collaboration support of several heterogeneous disciplines, e.g., mechanical, electrical, and software engineers.
- Efficient (Single-Click) Navigation between Engineering Objects during Engineering and Commissioning.



Automation Systems Engineering



- Efficient collaboration in sequential/parallel engineering processes.
- High effort for synchronizing various disciplines at defined milestones.
- High effort for navigation between various engineering objects.



 Goals: Enable (a) frequent synchronization of data models and (b) Single-Click Navigation between engineering objects across heterogeneous tools and data models

Engineering Environment Integration Vision





- Technical glue: Connectors provide fitting interfaces for relevant functions, e.g., data access
- Semantic glue: Project-level data model and mapping to local tool data models allow data access with project-level concepts.
- Engineering process automation/analysis: Based on the technical/semantic glue many engineering processes can be automated to relieve engineers of repetitive administrative activities.

Common Concepts in the Automation Service Bus



Automation Service Bus (ASB)

- ASB is a middleware platform for enabling efficient engineering process across disciplines and domain borders
- Bridging the gap between various tools (technical integration) and data models (semantic integration) based on common concepts.



Use Cases



- Common concepts link heterogenous data models to enable efficient change management and navigation across disciplines and domain borders.
 - Use Case 1: Efficient Navigation between Signals during Engineering Time.
 - Use Case 2: Efficient Navigation between Signals during Runtime.



Hydro Power Plant Engineering



- Signals represent common concepts as engineering objects (domain specific)
- Up to 40.000 signals in a typical hydro power plant.



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Change Management Prototype



- Minimize defects and risks in distributed engineering projects caused by inconsistent engineering plans.
- Efficient communication of changes across he project team.
- Visualization and decision support with focus on changes.

Signal	Update whole row		channelName	inputOutputModule	functionTextOne		projectid	customer
0	<u>keep all</u>	old value: new value:	6	3	H_U#p 110VDC High oil pres pump feeder (Q12 F71 F72) ready ✓ H_U#p 110000VDC High oil pres pump feeder (Q12 F71 F72) ready	Tyrkie	Kandil	Sabanci
0	keep all	old value: new value:	10	7	H_U#p St Service MV cubicle HV fuse fault	Tyrkie	Kandil	Sabanci

Various views and consistency checking.

	Merge Sigr	e Signals (Signals are replaced on default) - Step 6 of 7									
	view ne	ew signals (2)	view deleted signals (0)			view invalid signals (2)					
I											
(0) view invalid signals (2)											
cpuNumber			isValidSignal	kks3	ОРМ	kks2	kks0	region	projectld		
1		C#30 C1 A301:3	false	XB03	true		00	1	project1		
сри					false		true		00	region	project1

Navigation from logi.CAD to EPLAN



 Navigation from Function Block Diagram (e.g., logi.CAD) to Electric Plans (e.g., EPlan objects)



Navigation from logi.CAD to EPLAN PDF





Summary & Future Work



- Automation Systems Engineering typically involve the collaboration of heterogeneous engineering environments (from different disciplines).
- Need for improved change management approaches and single-click navigation approaches.
- Automation Service Bus Framework uses Engineering Objects as core concepts:
 - Identification of common concepts across engineering disciplines.
 - Improved change management processes across disciplines and tool borders.
 - Engineering Process Automation based on Engineering Objects.
 - Significant effort reduction by providing single-click navigation between engineering objects from different sources.
- Future work
 - Consideration of more and different engineering tools.
 - Extended and more formal evaluation in large engineering projects in large organizations.



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