

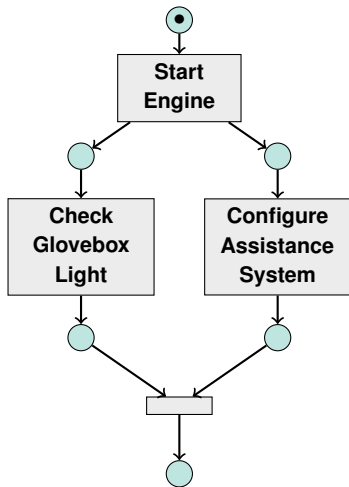
User-Friendly Property Specification and Process Verification a Case Study with Vehicle-Commissioning Processes

12th International Conference on Business Process Management

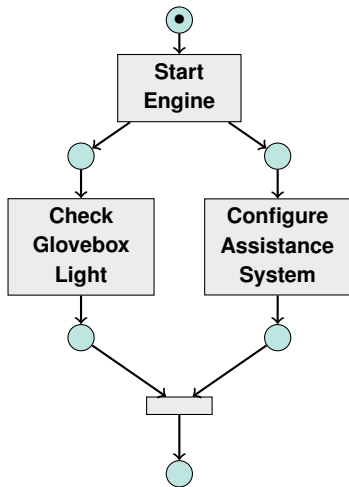
Richard Mrasek, Jutta Mülle, Klemens Böhm, Michael Becker, Christian Allmann | September 16, 2014

INSTITUTE FOR PROGRAM STRUCTURE AND DATA ORGANIZATION (IPD)





Prop: 'Start Engine' precedence 'Configure Assistance System'



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- 1 Distributed Knowledge
- 2 Heterogeneous Environment
- 3 Huge Amount of Properties
- 4 Specification in Formal Language

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\Rightarrow User-Friendly Approach required!

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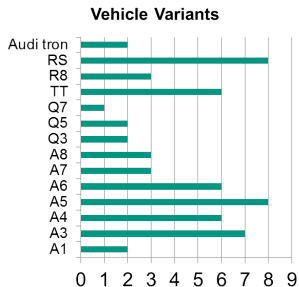
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- 1 Motivation
- 2 Case Study
- 3 Approach
 - 1 Property Specification
 - 2 Model Checking
- 4 Evaluation
- 5 Conclusion



- 14 Vehicle Series
- >55 Variants



- >10 factories (only AUDI)

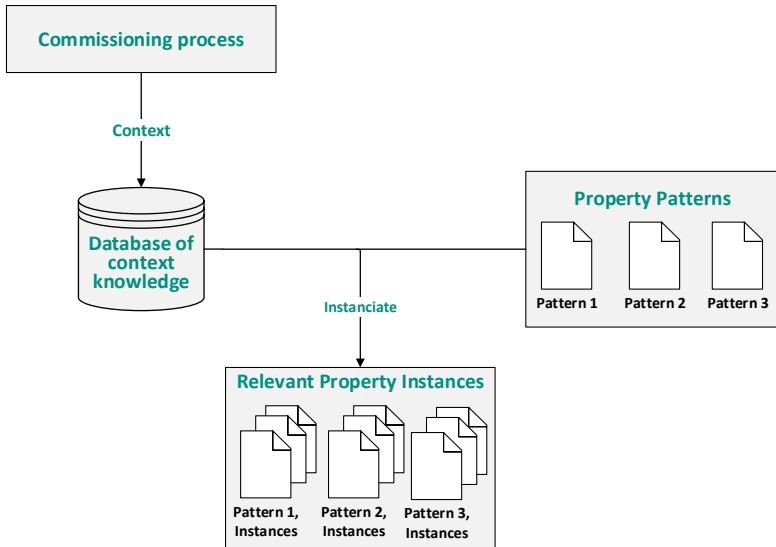
production cycle: i

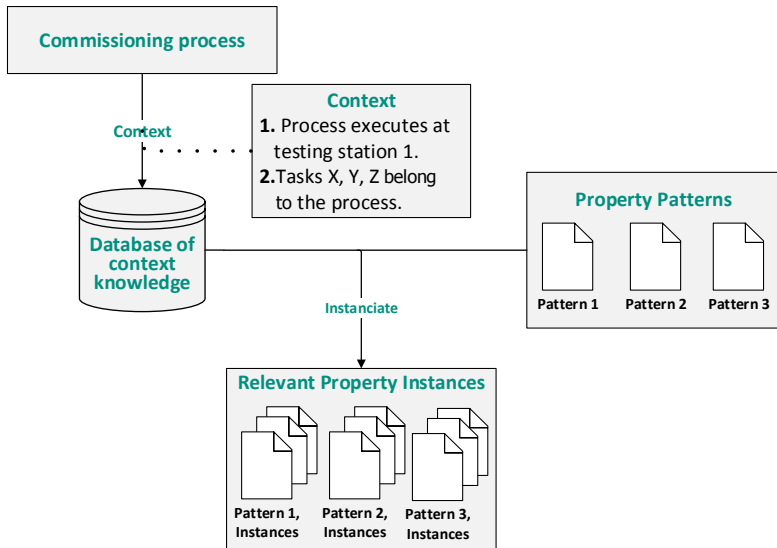


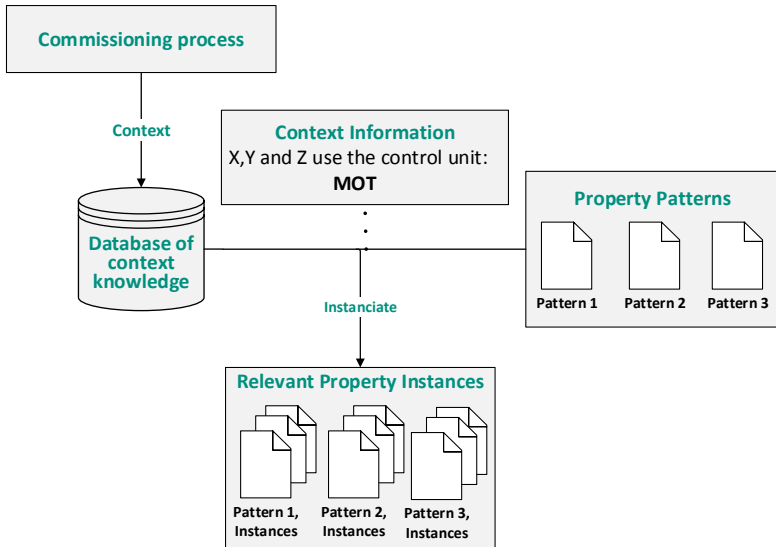
production cycle: $i+1$

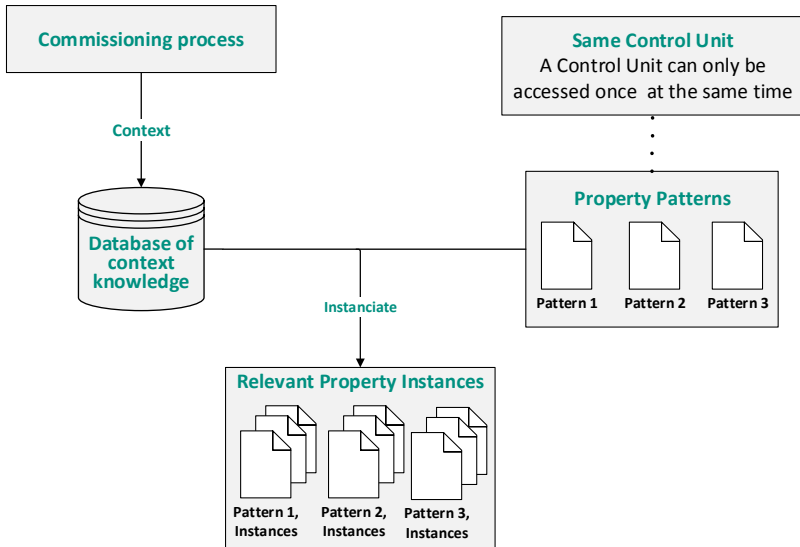


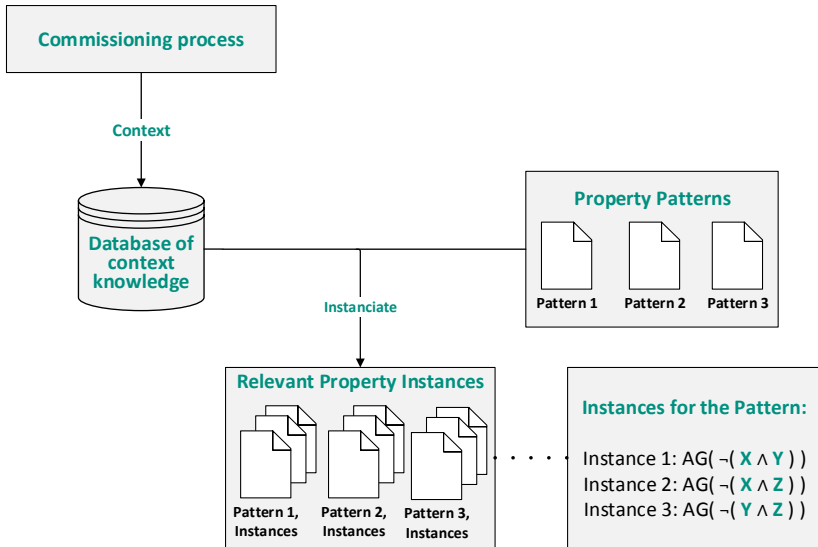
PROPERTY PATTERN	DESCRIPTION
...	...
Precedence	Task A requires the earlier execution of task B
Response	The occurrence of task A leads to the occurrence of task B.
Maximal Connections	The number of connections should not exceed the maximal capacity.
Close Connection	Each connection has to be closed.
...	...







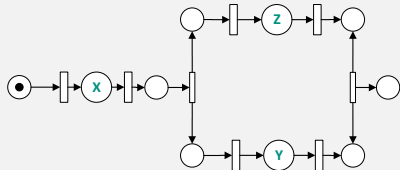




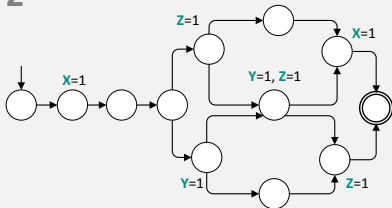
Benefits

- 1 Only relevant properties
- 2 Simplified maintenance of the properties
- 3 More user-friendly specification of properties

1 Commissioning process (Petri Net)



2 State Space

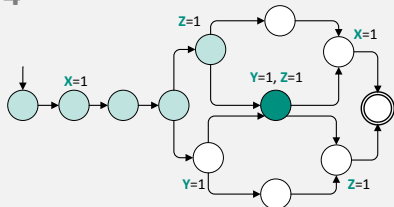


3 Property Instance

The Control Unit **C2** can only be accessed once

$$AG(\neg((Y > 0) \wedge (Z > 0)))$$

4 Witness Path



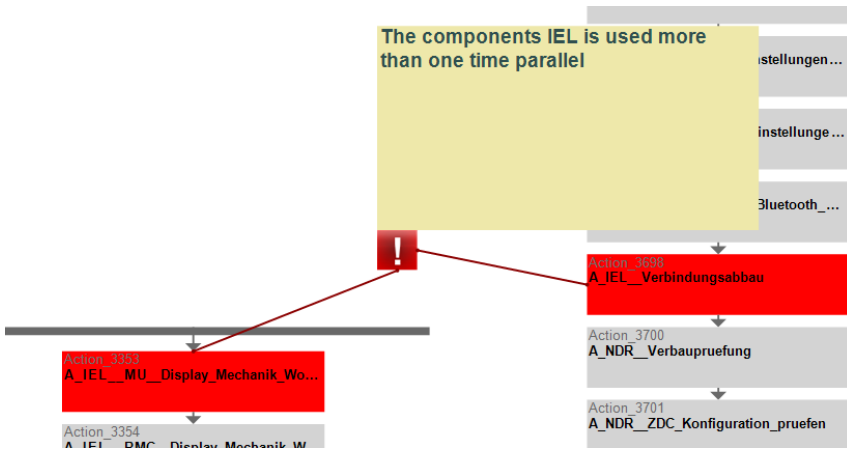
A screenshot of a software application window titled "AU57x_ABL_BZD_FKT.otx - CoVA". The window has a menu bar with "File", "Edit", "View", "Settings", and "Help". Below the menu bar is a toolbar with icons for "Verify", a pencil, a folder, a document, and a zoom control with a minus sign, "Zoom", and a plus sign. The main area is divided into two tabs: "Visualization" and "Verification". The "Verification" tab is active and contains a list of error messages under the heading "Errors:". The error messages are:

- ... Error: The sequencename of
- ... Error: The sequencename of
- ... Error: The sequencename of
- ... Error: The components HUD
- ... Error: The components IEL is
- ... Error: The components LWR
- ... Error: The components NSS
- ... Error: The Precondition GE_

To the right of the error list, there are two grey rectangular boxes containing text:

- Action_4192
A_FTR_LI_P_Moc
- Action_4198
A_FTR_LI_Verbin

At the bottom of the error list, there is a small box containing a less-than sign (<), with two thick horizontal lines extending to the right from its right side.



1 **Functional Evaluation:**

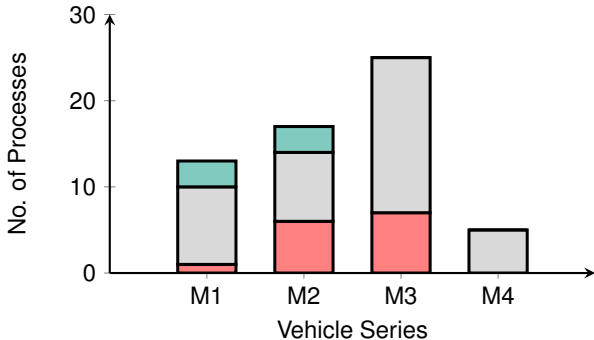
Does the approach detect disturbances?

2 **Expert Interview:**

Does the approach meets the requirements of the shareholders?

- 1 60 commissioning processes
- 2 Four vehicle series
- 3 Realistic process models in development
- 4 Analyzed to find disturbance of the process flow, e. g., that will extend the processing time or can block the process
- 5 Domain expert categorizes the found property violations

	M1	M2	M3	M4
No. of Processes	13	17	25	5
Correct	3	3	0	0
Minor Disturbance	9	8	18	5
Major Disturbance	1	6	7	0



1 Process Quality:

Has the framework increased the quality of the commissioning processes?

2 Generality:

Can the framework be used in a different factory within the company?

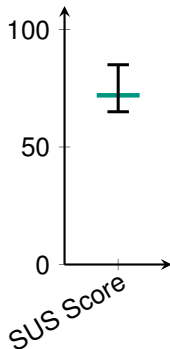
3 Usability:

Can the framework be used in an intuitive way?

- All experts say that the tool increases the process quality significantly.
- Issues with false positive.
- Experts think that the verification tool will not change the development time for the processes.

- Can easily used in another factories.
- Some issues exist with integrate them into the tool chain.
- Overall good usability, but some experts would wish for less information presented.

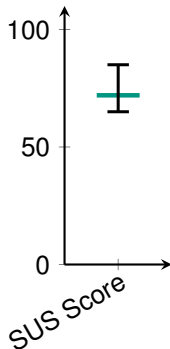
Usability



Score	71.67
Average	69.69
Median	70.91

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- 2 We can manage a huge amount of properties in a heterogeneous environment
- 3 Domain experts do not have to specify the properties in a formal language
- 4 Framework is usable in a real production environment

Framework is user-friendly and does enhance the process quality

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