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RSSRail 22
Generating and verifying configuration data with OVADO

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Summary

Project context

RATP: Paris metro Line 6, system OCTYS VTPA

ALSTOM: providing the railway system

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- Verification of configuration data with OVADO® (property of RATP) using a formal model of data rules (based on the B Language)
- For the first time generation of equipment configuration data with OVADO

Safety context: SIL4 process regarding CENELEC EN50128

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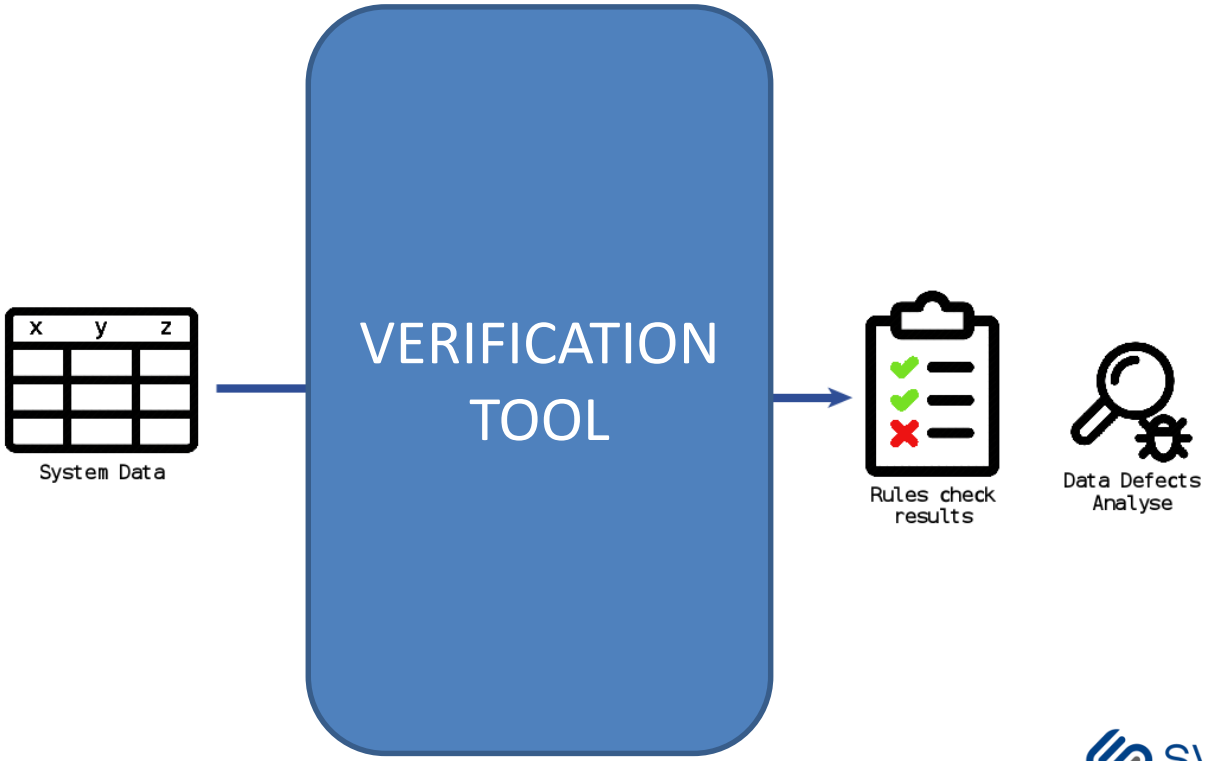
OVADO to verify system configuration data

Verifying system rules on configuration data (system data)



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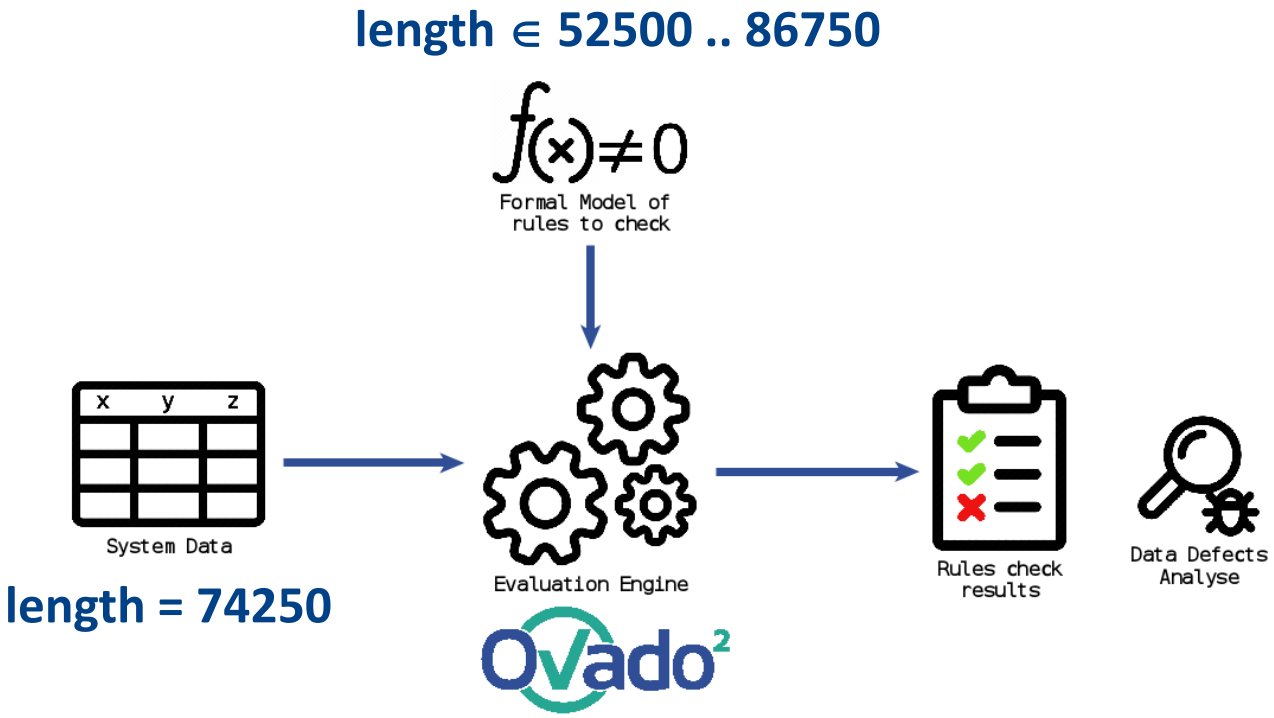

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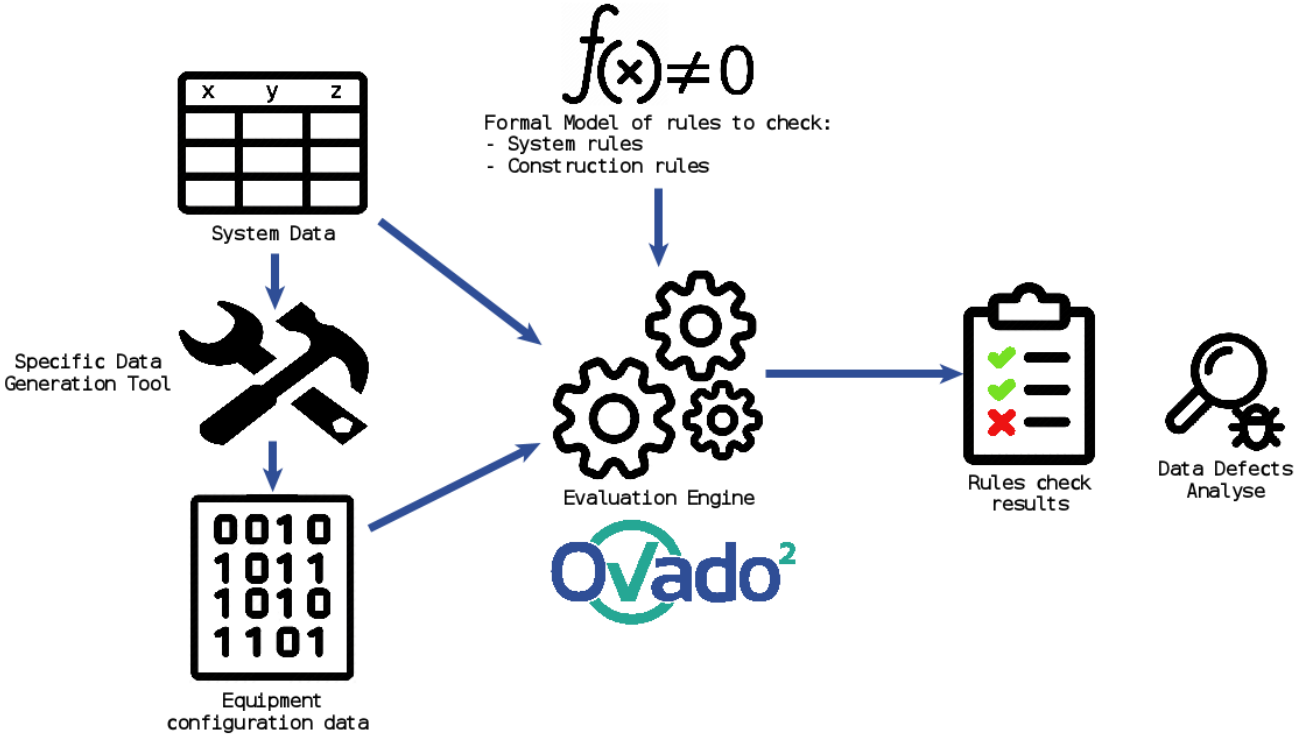
OVADO to verify equipment configuration data

Verifying construction rules on configuration data

(Final equipment configuration data / system data)

Eqpt_data1 = Eqpt_data1_computed_from_syst_data



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OVADO to generate equipment configuration data

The idea

- Using also OVADO to generate equipment configuration data

The goals

- Rising quality: taking advantage of a formal model
- Decreasing budget: factorizing data generation/data verification

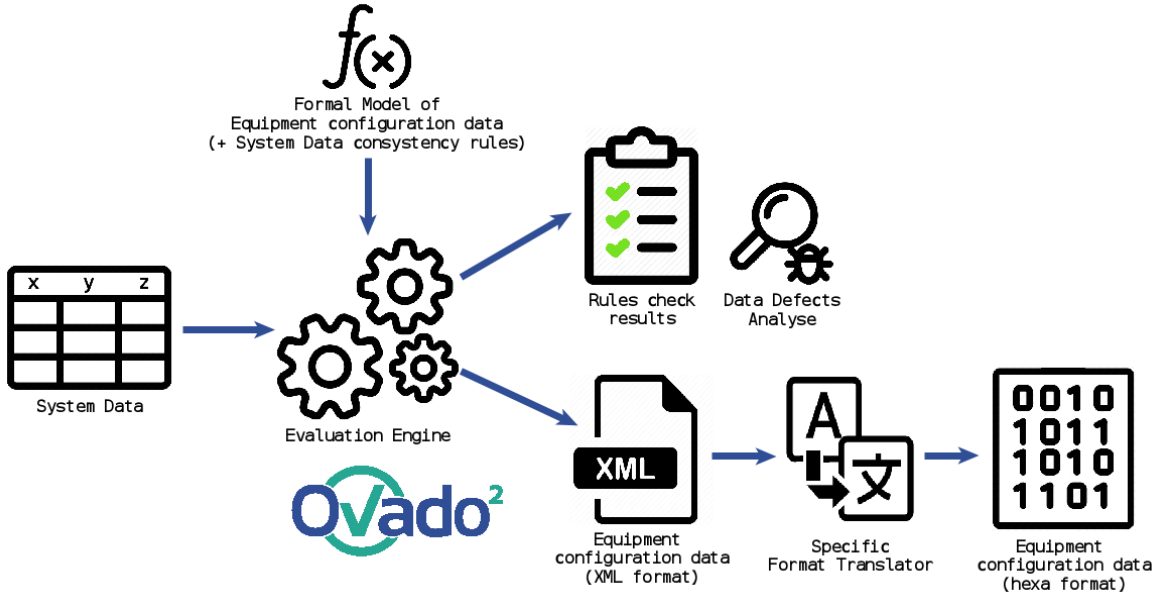
Let’s do it!

OVADO to generate equipment configuration data

Formal model of equipment data computed from system data

- + XML export plugin
- + specific translator

Verification of system data consistency by rules verified by OVADO



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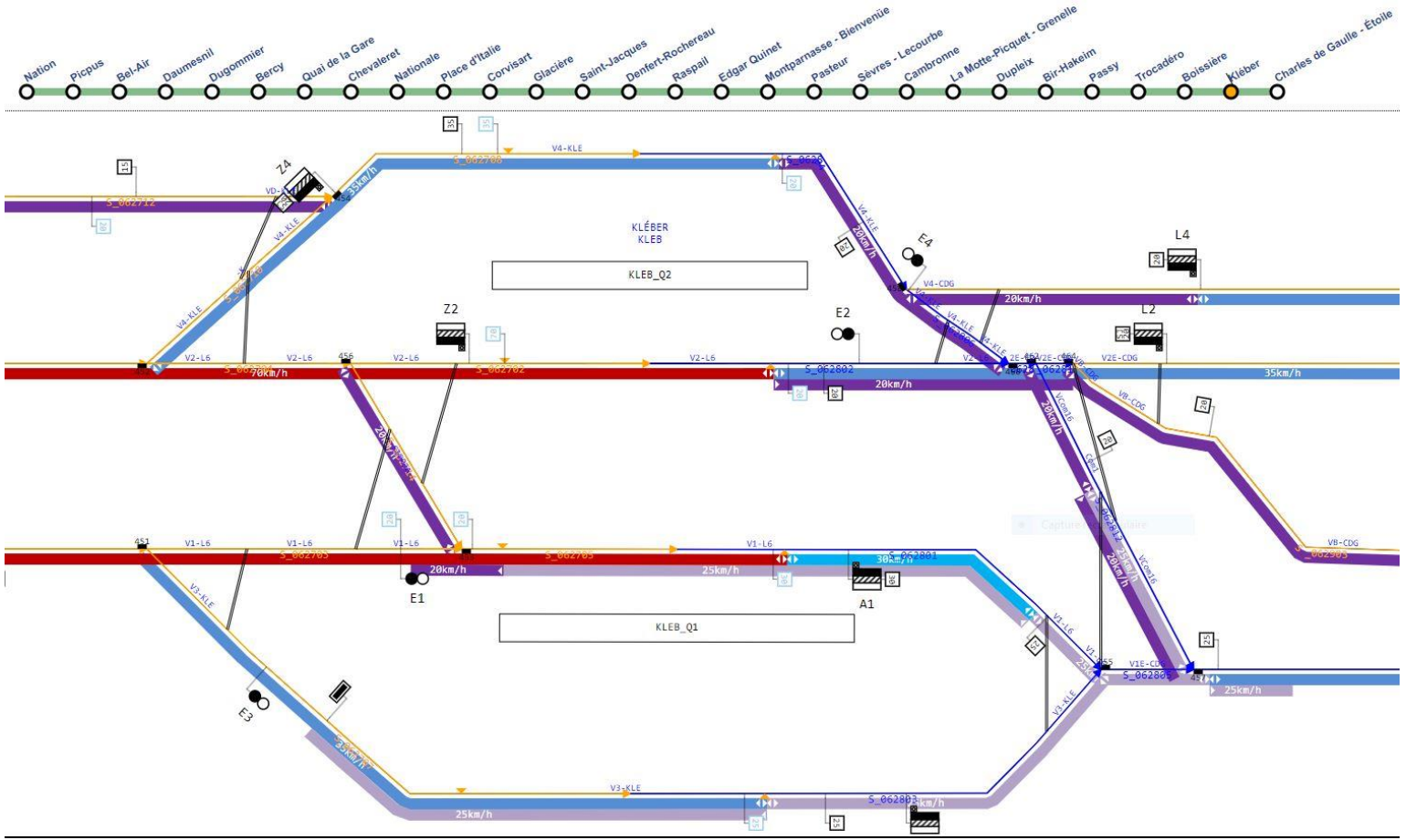
Example: bidirectionnal speed limit zones

- Verifying data
- Generating data
- Safety
- Conclusion



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Example: bidirectionnal speed limit zones

System data

- Start position (track/abscissa, direction), end position (track/abscissa)
- Speed limit, anticipation distance at start/end

Semantics

- Zone = from start, in the given direction, follow the direct track, to the end
- An anticipation distance is significant at the border of 2 zones, entering a decreasing speed zone. 0 means no anticipation distance

System rules

- R2: bidirectionnal speed limit zones should cover all the tracks
- R3: there should not be 2 anticipation distances at some position

Equipment data: for each block [$segment_{(fr)}$]

- block_id, nb_obj, speed0, anticip_dist0, anticip_dir0
- Array of 6 objects: abs, speed, anticip_dist, anticip_dir

Safety issues: context + previous approach

Global context

- SIL4 process according to CENELEC EN50128 (2011)

Previous approach: OVADO only for data verification

- OVADO was used only for verification: tool class = **T2**
- Ovado²® = a double tool + double input plugins (diversified techno + tools called one after another)
- A complete process (planification, description, justification against the norm, verification, traceability, auditable)
- **Not much is required on the data generation tool: safety is based on output verification**
- The OVADO model of rules is a common mode for both tools:
  - Independent verification of rules (tracing only comments)
  - A few tests (ability to detect erroneous data)

Safety issues: current approach

Current approach: OVADO for data generation and verification

- OVADO is now used to produce (and verify) data: tool class = **T3**
- Ovado² = a double tool + double input plugins (diversified techno + tools called one after another)
- A complete process (planification, description, justification against the norm, verification, traceability, auditable)
- **Around 80% of the OVADO model is common to generation/verification!**
  - 20% to model rules
- **How to mitigate this common mode?**

Detailed verification of (all) the OVADO model

Activity of detailed verification of the OVADO model

Principle

- OVADO model is structured with: interface with data, definitions, rules
- Foreach structuring element: a detailed verification form based on 13 items
- Independent verification
- Auditable forms
- Precised references (elements, commits, dates, autors, reviewers)

Verification form items

- Element naming rule, typing, physical units
- Consistency of abscissae comparison on tracks, on blocks, on switch points
- Cases completeness
- Well-definedness: f(x), …
- Inner comments
- **Consistency/Completeness of description and model**
- Major enhancements
- Address of interface data, consistency/completeness with rule specification

Conclusion

Results

- This new approch using OVADO to factorize generation+verification of configuration data was a success
- We raised the formal model quality level (detailed verification activity)
- The overcost of the detailed verification activity is ≈10% of model dev
- This new use of OVADO still complies with a SIL4 process

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Thank you. Any question?