



Avionics Systems Hosted on a distributed modular electronics Large scale dEmonstrator for multiple tYpe of aircraft

Presented by

Ståle Walderhaug (SINTEF)

Prepared by

Erlend Stav (SINTEF) and Ståle Walderhaug (SINTEF)

Function Modelling Tool for Avionics: DSL design and evaluation

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Preface



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- *Background and motivation*
- *Tool Requirements*
- *Toolchain Interface and structure*
- *Design challenges*
- *Methods*
- *Results*
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- *Verification and validation*
- *Future work*
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Background and motivation



- ❑ The main motivation for having a Function Modelling Tool
 - enable the platform architect to provide a centralized architecture definition with a unified information model.
 - Furthermore, modelling support a complex iterative architecture definition process where:
 - ✓ different viewpoints and abstraction levels are used
 - ✓ several optimization loops are required

- ❑ Modelling is a prerequisite for optimized data management, in this case for the architecture and configuration definition process. Modelling:
 - saves time
 - replaces or complements core configuration documents
 - improves validation and traceability in initial design

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Tool Requirements

❑ Initial requirements

- Support system designer in creating
 - ✓ Overall system architecture (component topology)
 - ✓ (Sub)system resource needs
- Support established design processes
- Integrate with existing toolchain
- Replace well-established excel-based configuration spreadsheet
- Fulfil documentation and version control requirements for the domain

❑ Additional requirements

- Support more tool interfaces
- More details (from Function Supplier)
- Internal validation of constraints
- Layout
- Scale up



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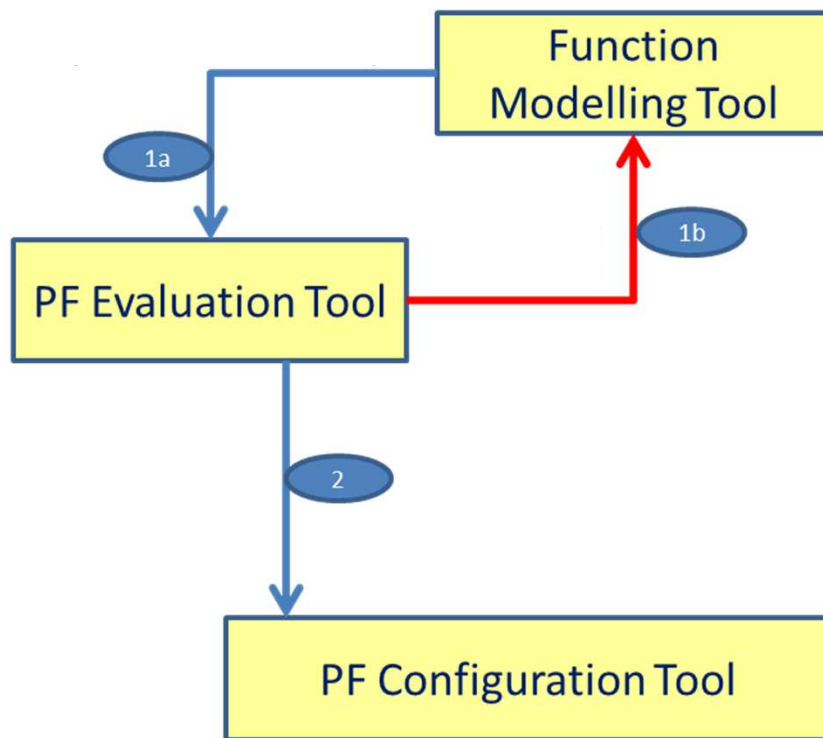
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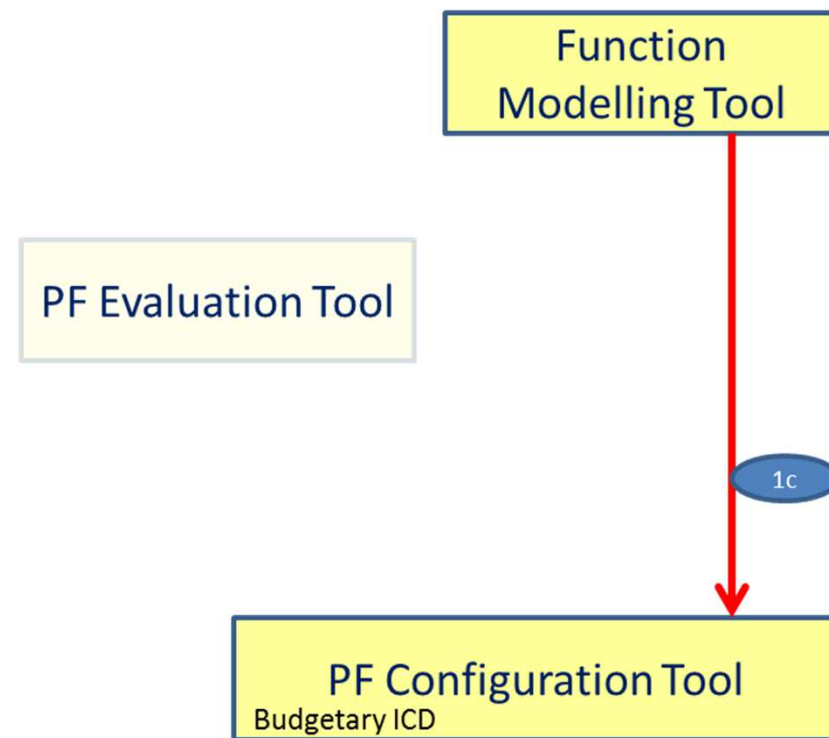
Toolchain interfaces



Data Flow btw. MG0 & MG3



Data Flow after MG3



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Design challenges



- ❑ External interfaces to other tools in the toolchain
 - Not defined before project
 - Overlapping functionality between tools
- ❑ Heterogeneous user group
 - Different companies
 - ✓ Different legacy system
 - ✓ Different experiences with modelling tools
 - ✓ Internal procedures and toolchains
- ❑ Intellectual Property Rights (IPR)
 - Challenges when sharing important input to design
 - Integration testing

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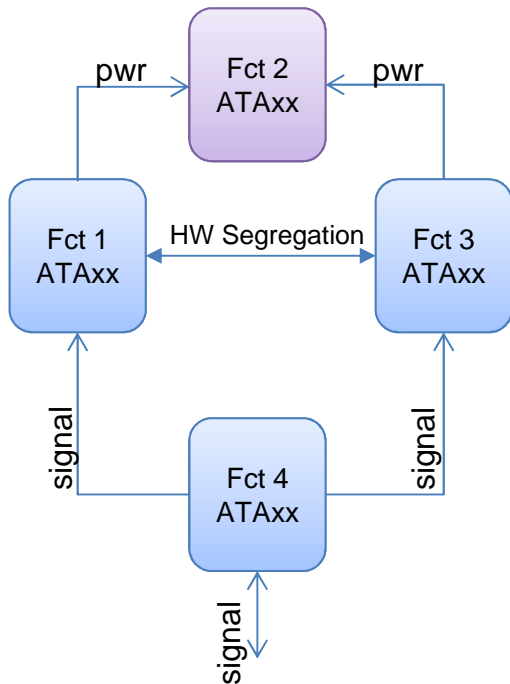
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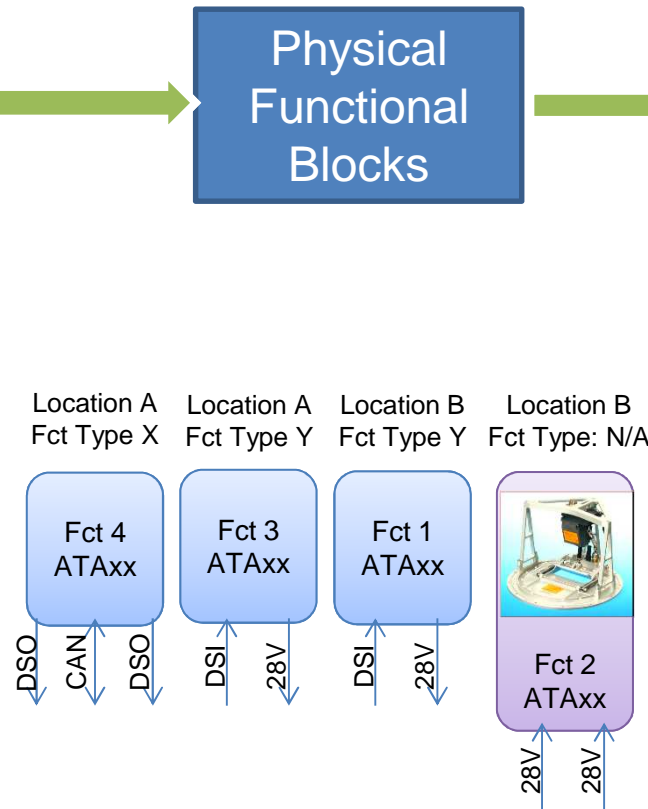
Overall structure Function Model



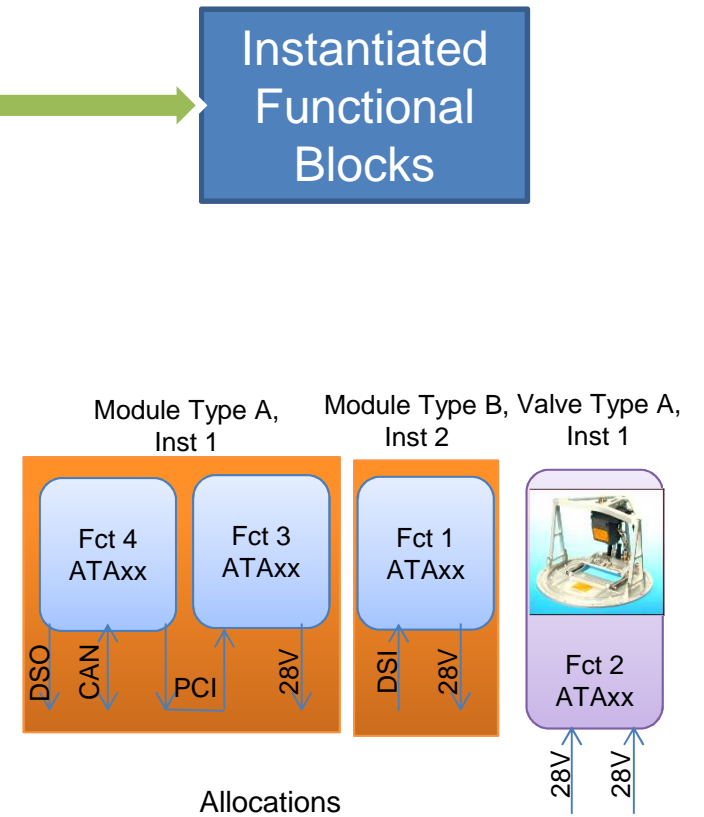
Logical Function Model



Physical Function Model



Architecture Model



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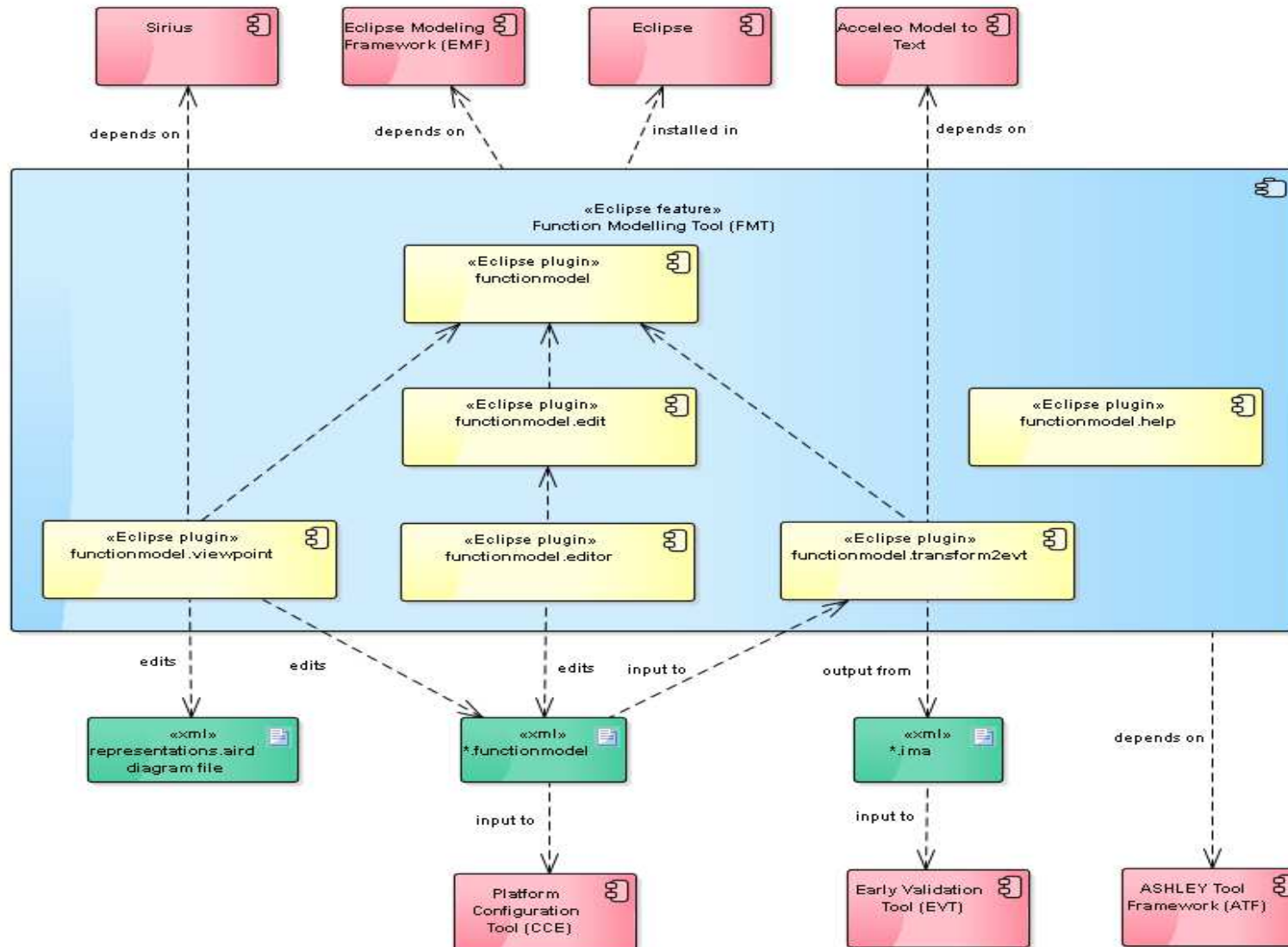
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- ❑ Biweekly workshops with
 - Airframer
 - Other tool developers
 - System Designer Expert
- ❑ Integration testing with tool developers
 - Common and relevant example
- ❑ Evaluation with Nord Micro GmbH & Co. OHG
 - Workshop in Munich August 2015



Results: FMT Tool architecture



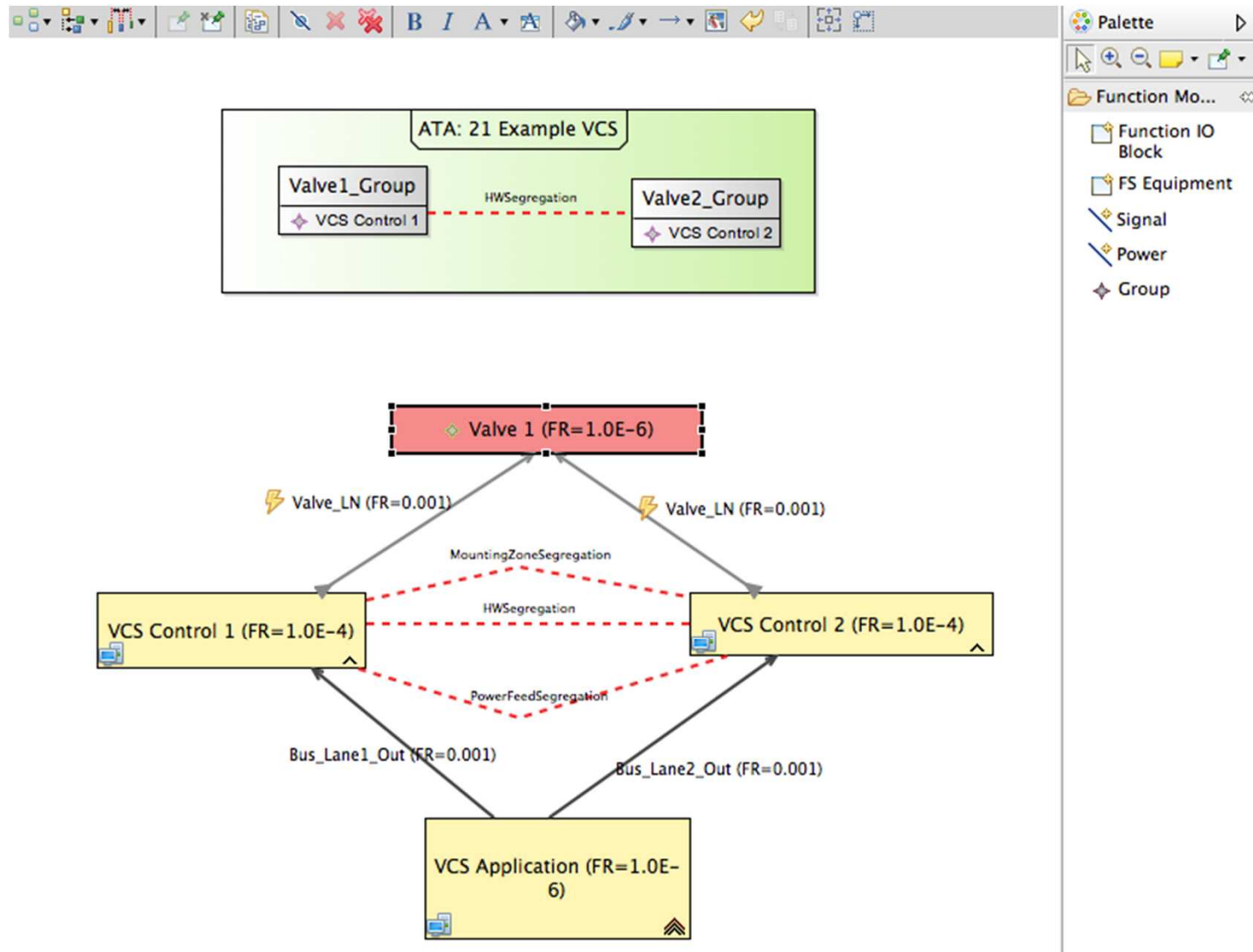
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- ❑ A function model describes the set of **functions a system consists of** and how they are organized
- ❑ Function Blocks:
 - **Properties:** define the details of the function blocks
 - ✓ type of function, position where equipment is mounted, power feeds, and needs for resources such as memory and computation.
 - **Topology:** specifies how the different function blocks are connected with each other, and by which means they communicate.
 - ✓ communication lines, types of busses and io used, and power connections
 - **Constraints** between them
 - ✓ for segregation of the hardware function blocks can be deployed on
 - ✓ segregation of power feeds and mounting zones, and for
 - ✓ required dissimilarity of hardware for function blocks
- ❑ Library model referred to by design model
 - Standard values for properties such as power, ATA, routes, bus speed

Results: logical model example

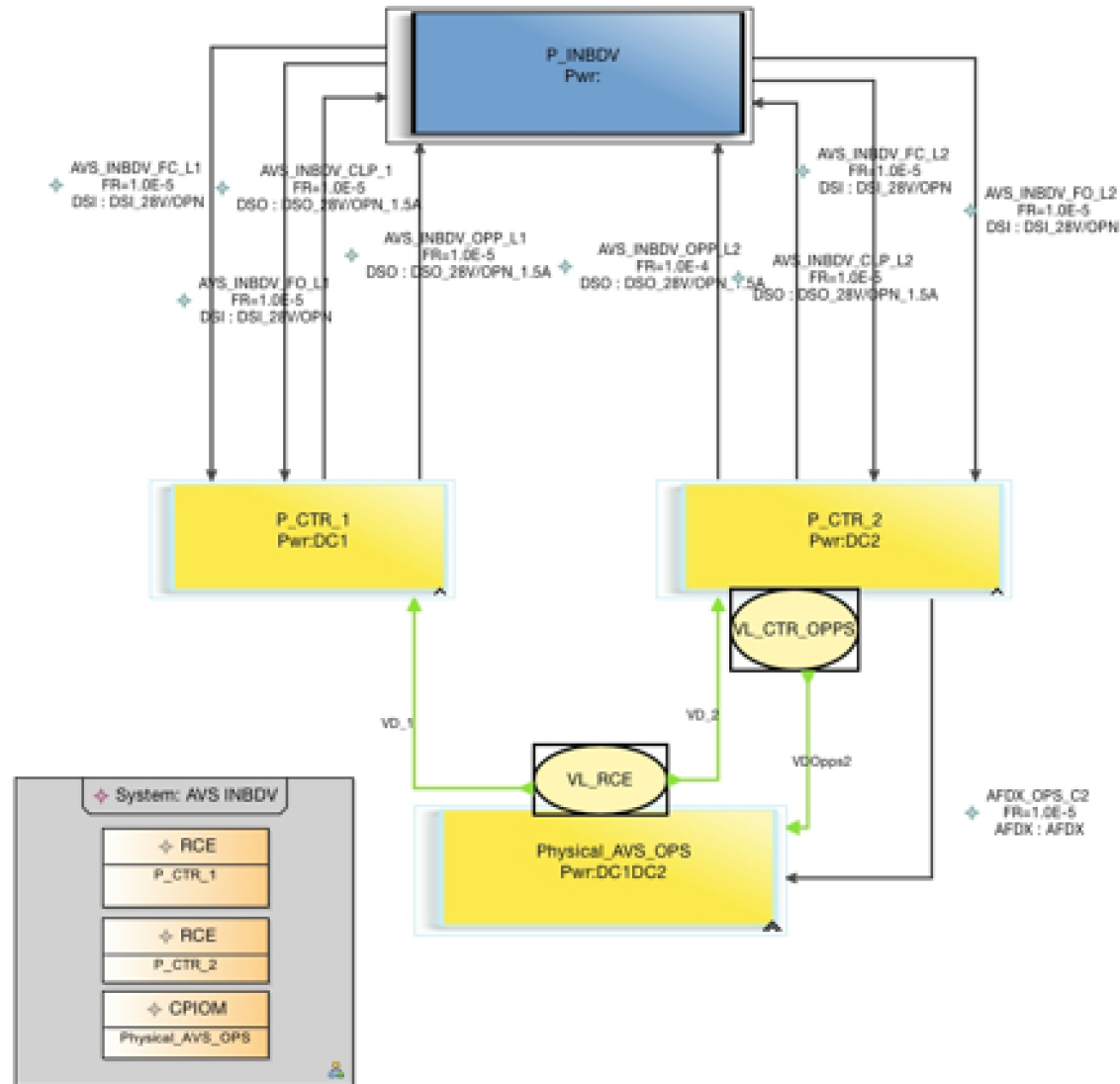


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Results: physical and architecture model example



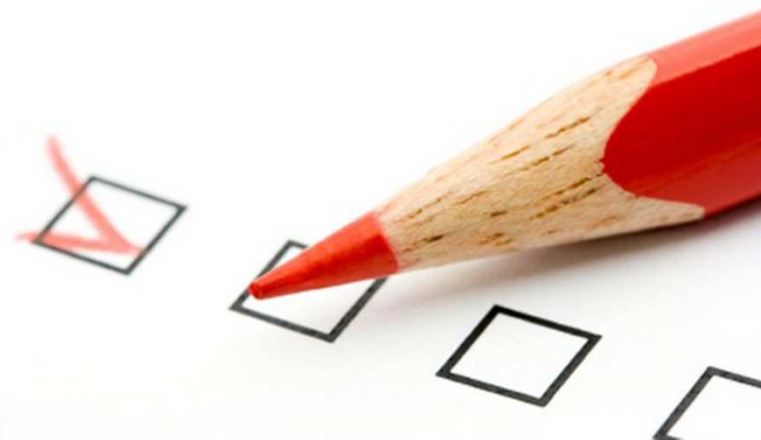
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Evaluation

- ❑ Internal evaluation
 - Local testing with airframer and other tool developer
- ❑ External evaluation
 - Workshop with Function Supplier
 - ✓ Installation of tool on FS computers
 - ✓ Modelling of real FS system
 - Review of feedback and updating.
- ❑ Domain Specific Language
 - Quality evaluation

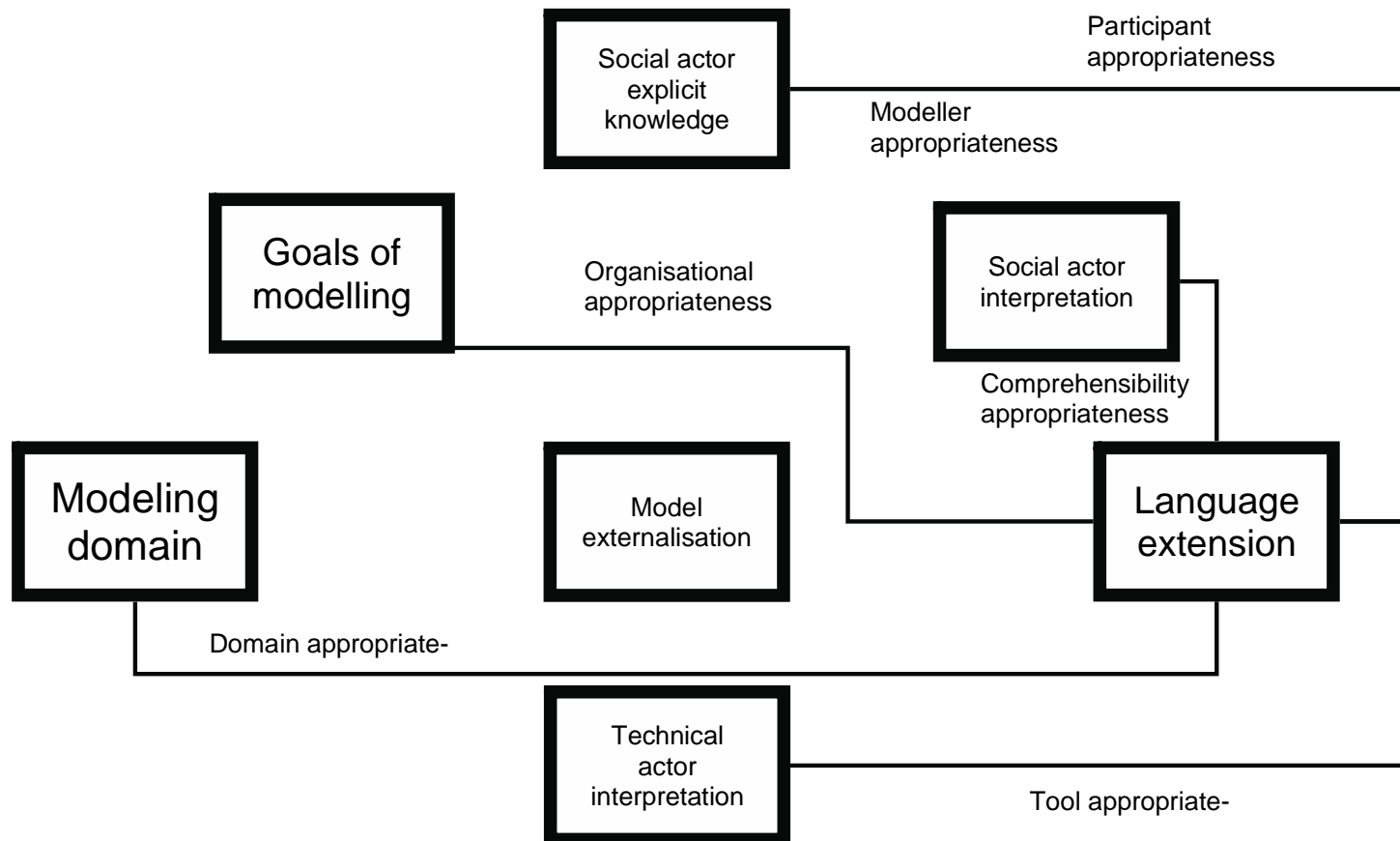


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Evaluation: DSL Quality



http://www.researchgate.net/profile/John_Krogstie/publication/230636097_Model-Based_Development_and_Evolution_of_Information_Systems_A_Quality_Approach/links/00463527e4b12bae30000000.pdf

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Verification: is the tool correct?



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- ⚠ Scale up



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Validation: is it the correct tool?



- ❑ The main motivation for having a function modelling tool is to
 -  enable the platform architect to provide a centralized architecture definition with a unified information model.
 -  Furthermore, modelling support a complex iterative architecture definition process where:
 - ✓ different viewpoints and abstraction levels are supported
 - ✓ several optimization loops are required

- ❑ Modelling is a prerequisite for optimized data management, in this case for the architecture and configuration definition process. Modelling:
 -  saves time of data conversion in computable readable format (textual requirements)
 - replaces or complements the Configuration Control Document (CCD)
 - improves validation and traceability in initial design

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- Iterate on tool
 - Evaluate
 - Update

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Contacts



Ståle Walderhaug (SINTEF)

Email:

stale.walderhaug@sintef.no

Phone:

+47 90766069



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