Pré-étude Compatibilité : Pré-étude, Modèle, résultat Stage compatibilité

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Référence IRT System X: : ISX-S2C-DOC-478
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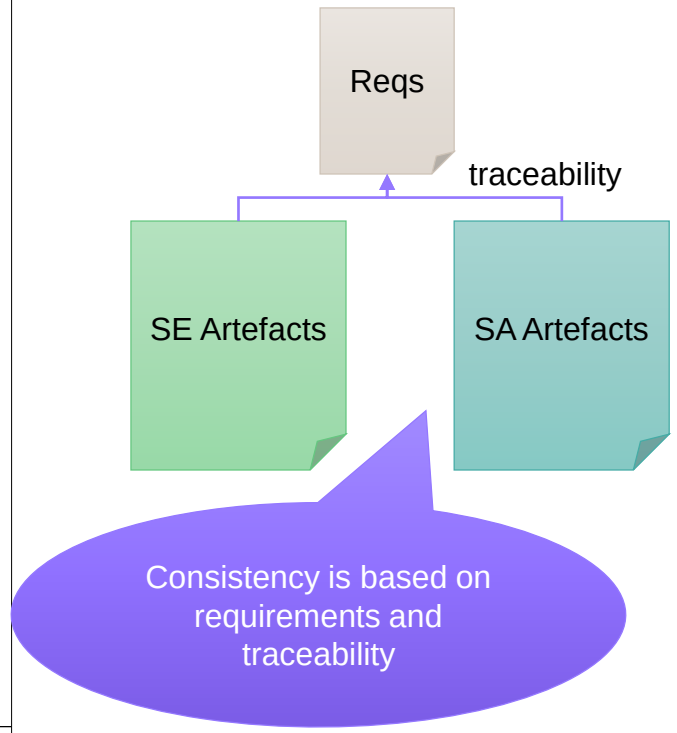
Pre-study on Compatibility

Pre-study, Model, Result
Compatibility internship

Summary

1. Context - two "main streams" of implementation of consistency in systems engineering

- « Traditional » Requirement Driven Approach

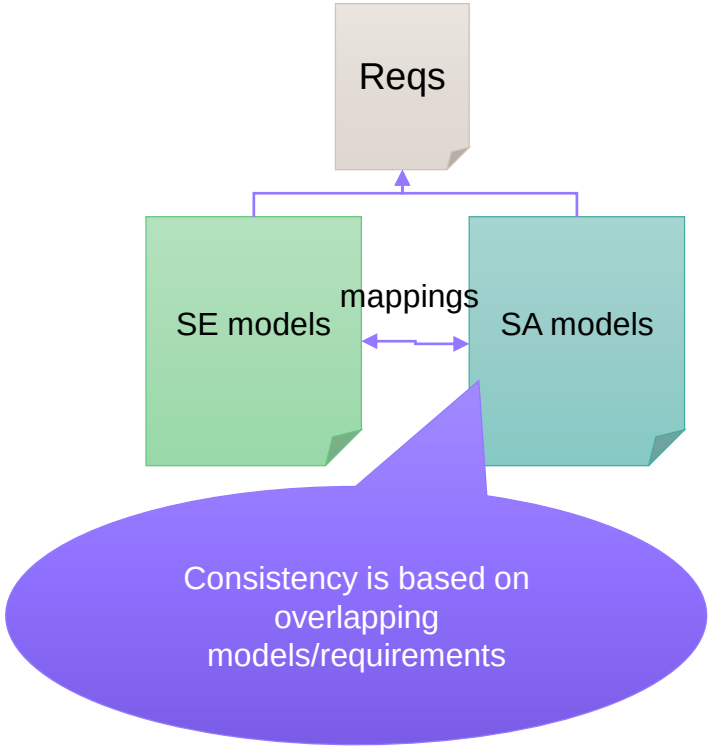


Difficulties: expression of verification rules applicable on unstructured information

Construction of rules, checklists, ... on artifacts (with their level of abstraction and details)

Idea: add a *complementary* new abstraction to reconcile engineering domains

- Model driven approach



Challenges: identification and formalization of exhaustive overlap between models

2. Compatibility : a new abstraction level that supports global consistency

Consistency *: are the data / points of view used by the different domains well aligned?*

vs

Compatibility *: are the different domains constraints or solutions compatible*

3. Exploratory approach - summary

- Philosophy: formalize the abstraction and then bring out the rules of incoherence (incompatibility in a given logical space)
- **Question** : which abstraction to formalize ?
  - Covering critical cases of inconsistency,
  - Presenting a "high level" view of architecture and design decisions,
  - Declined on levels: functional, logical, physical...

Engineering continuity, cost reduction

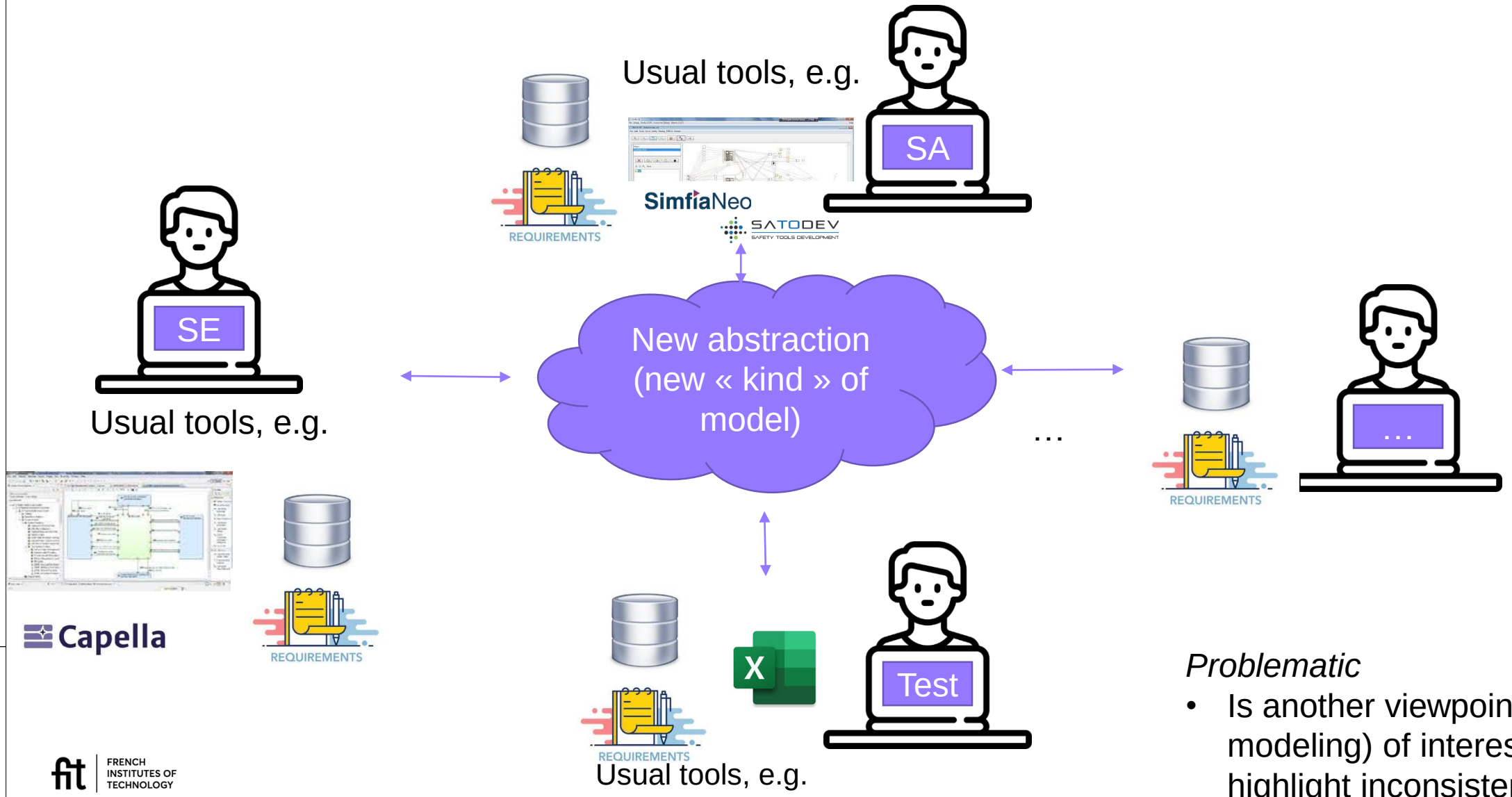
- **Objectives**:

1. Avoid redundancy of measures (solutions) proposed by the business Identification of needs / solution patterns
2. Avoid inconsistencies (incompatibilities) from this abstraction/modeling of a domain of possibilities and incompatibilities at the need and solution level.

Reduce the risk of inconsistency

Perimeter of the domains concerned for the illustration: Archi (IS and SW) + RAMS + Test

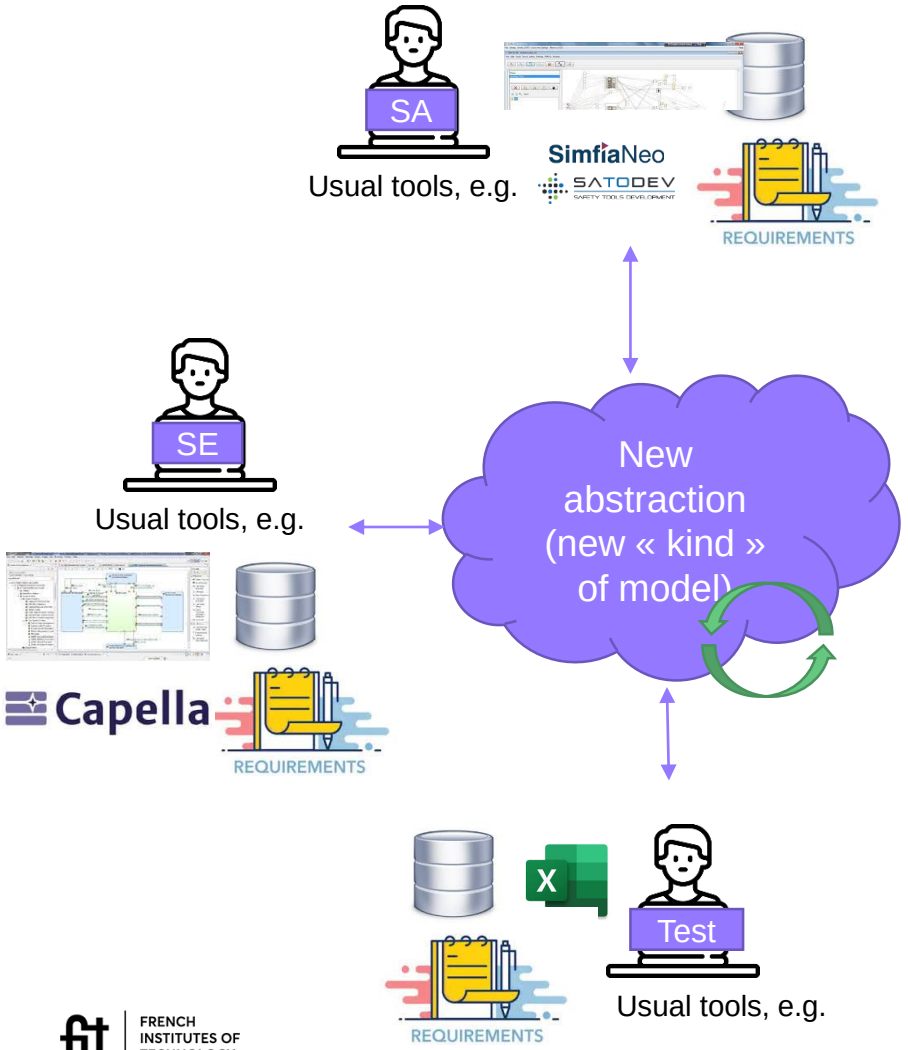
4. Goal: a new abstraction to facilitate the detection of incompatibilities



Problematic

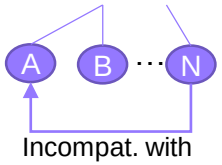
- Is another viewpoint (i.e. modeling) of interest to highlight inconsistencies?

4. Goal: a new abstraction to facilitate the detection of incompatibilities



What to capture in this new abstraction?

- **For each concern** (SE, SA, Test, …)
  - Explain the **objectives / needs**, e.g.
    - SA: Increase reliability, increase robustness, …
    - Test: Increase testability
    - SE: Increase performance, reduce space requirement, …
  - Explain the **measures** applied, e.g.
    - SA: redundancy, diversity, quality of components, …
    - Test: add test links, …
    - SE: NF constraints…
  - **Related them to existing engineering artefacts** (instances), e.g.
    - Model elements in Capella, in SimfiaNeo, Requirements….
- **Between concerns** (architecting)
  - **Capture high level incompatibilities** between measures, e.g.
    - Redundancy != reduce space requirement,
    - Independence != testability
  - **Check if contradictory measures are applied** on a same set of artefacts (instance) to raise warnings!



➢ Capture a domain knowledge, that will be iteratively enhanced

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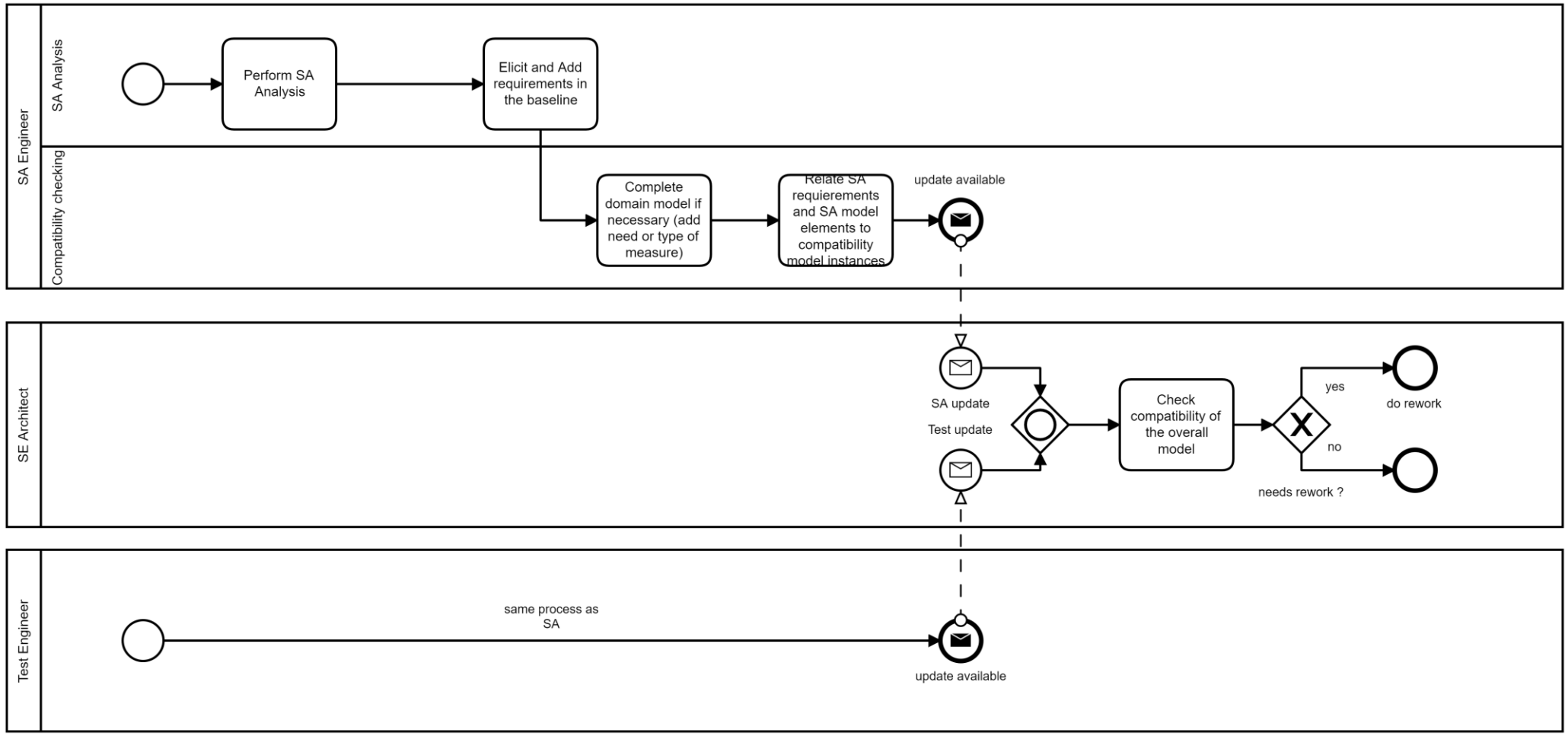
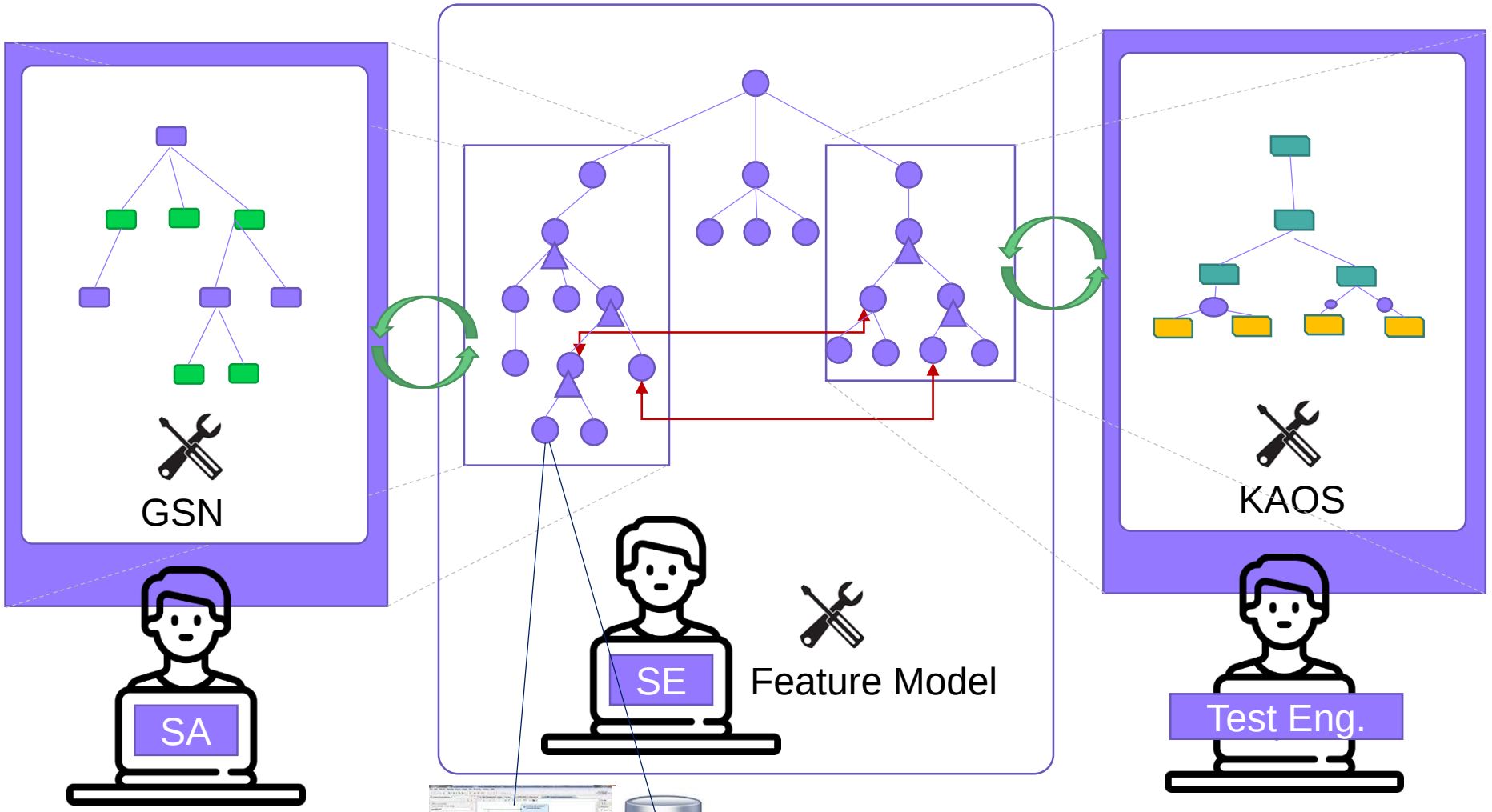
5. Application in an engineering process

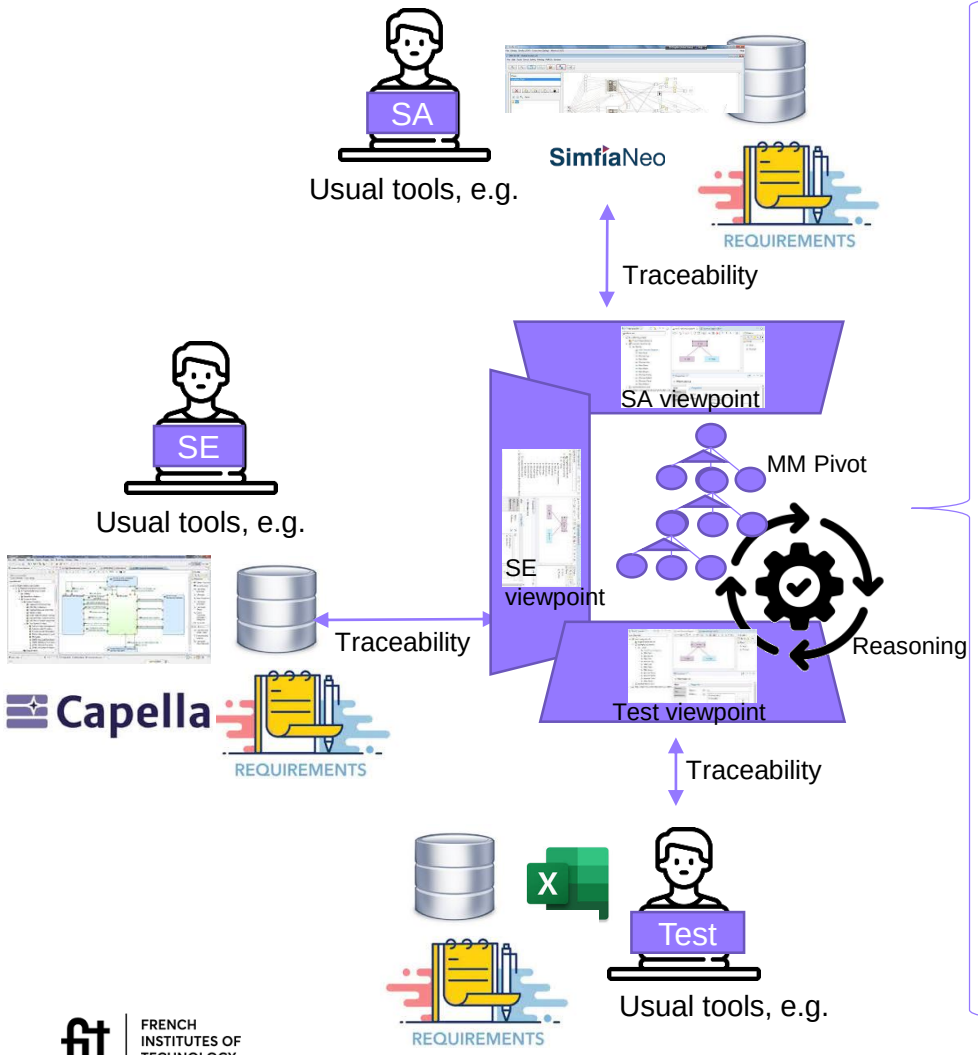


6. Goal: a new abstraction to facilitate the detection of incompatibilities



How to capture in this new abstraction?
-> tooling perspective addressed by internship

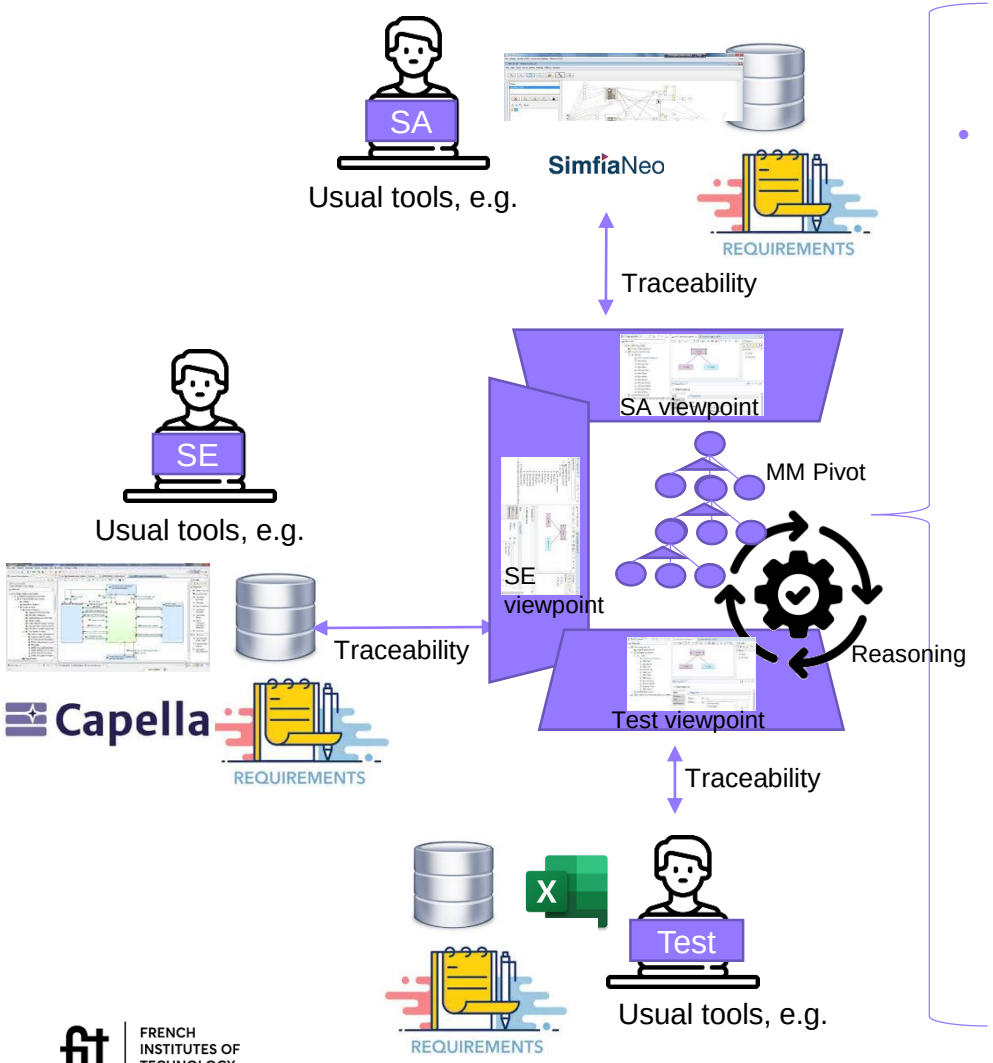
6. Tooling, what are the issues ?



Tooling, what are the problematics?

- Provide a consistent high-level view of the system
- Allow different views of the system for different teams
- Ensure all views are synchronized
- Detect and resolve incompatibilities in the overall view
- Extract a model from existing work (engineering artefacts, in Capella, Simfia, …)

6. progress report on the tooling



How to capture this new abstraction?

- **Provide a new tool** to engineers to capture this knowledge
  - A **new viewpoint** (i.e. language) for each concern, e.g.
    - GSN for SA,
    - KAOS for Test Eng.,
    - Generic Feature Model Notation for SE.
  - **A pivot MM to align these viewpoints**
    - Generic (abstract) language for compatibility
      - Operator needed: variability, compatibility/incompatibility
    - Synchronisation between viewpoints
      - Logical
      - Language (abstract / concrete syntax, semantics)
  - **Reasoning capability** to assist the engineers
    - In *detecting potential inconsistencies*,
    - In *extracting « features »* to feed this new abstraction from existing tools.
  - **Traceability/link support** to existing tools

WIP

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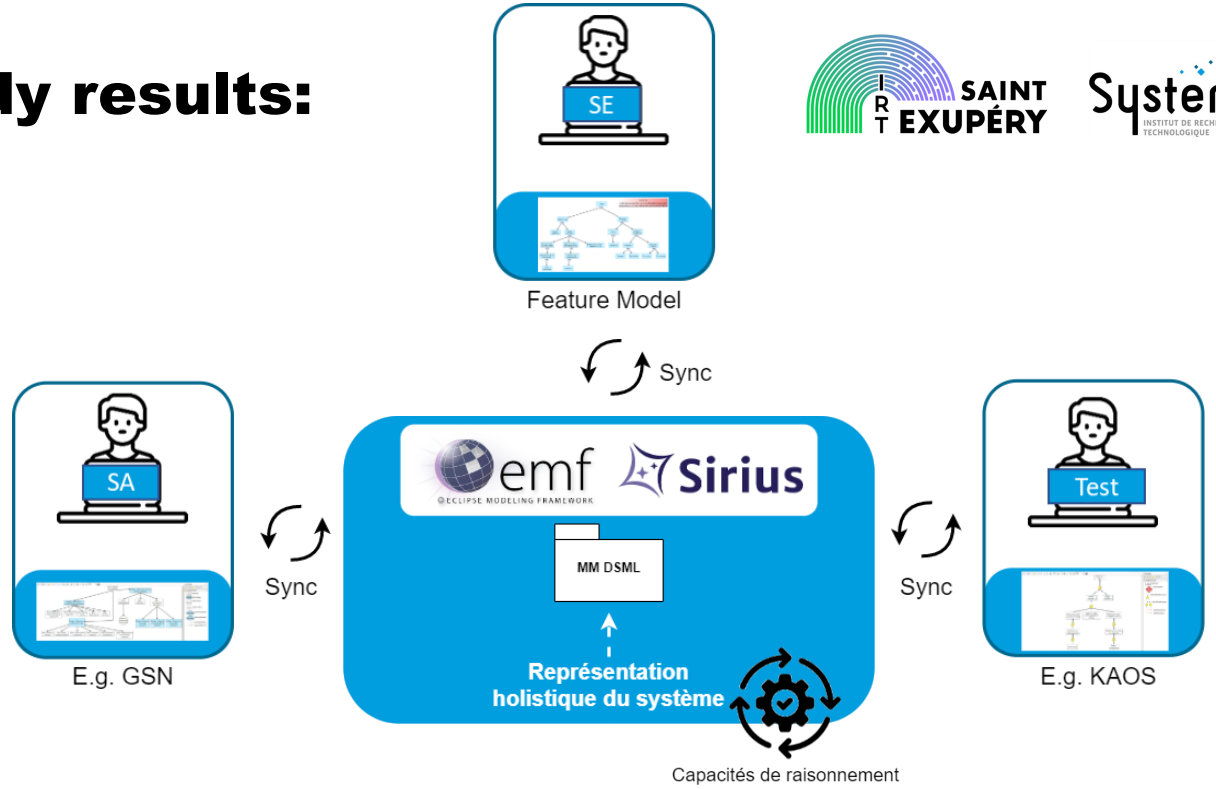
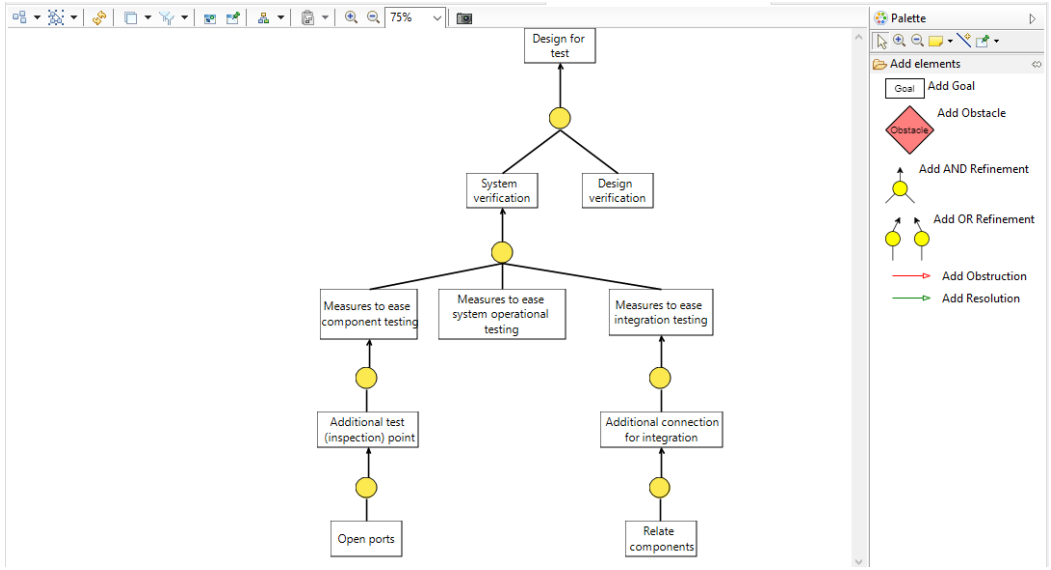
6. Tooling Incompatibility Pre-study results:

- **What has been produced:**
  - A framework based on Eclipse to
    - Model the domain
    - Represent synchronized viewpoints (feature model, GSN, KAOS),
    - Analyze incompatibilities between models, with a propositional logic (SAT solver).
  - An application on
    - An academic case study (e-shop)
    - A partial representation of 3 engineering domains (SE, SA, and Test)

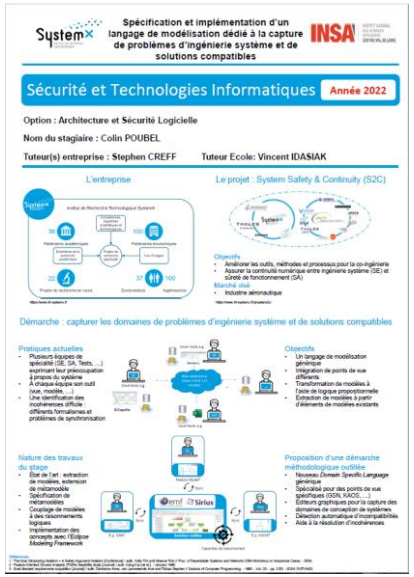
- **What is missing:**
  - Connection to engineering domain tools
    - And more over Feature extraction from existing domain artifacts
  - Application to the AIDA case study





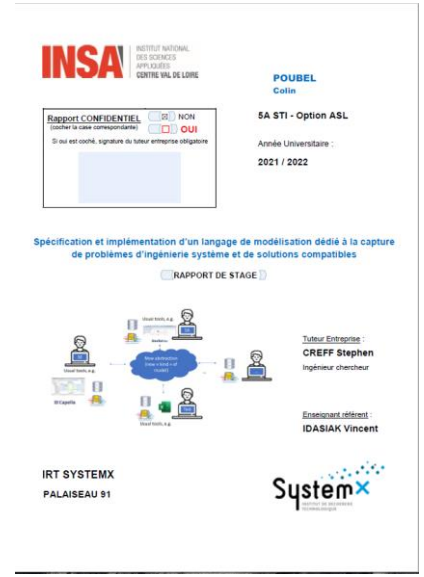
7. Internship result materials

- Poster



- Presentation support

- Report



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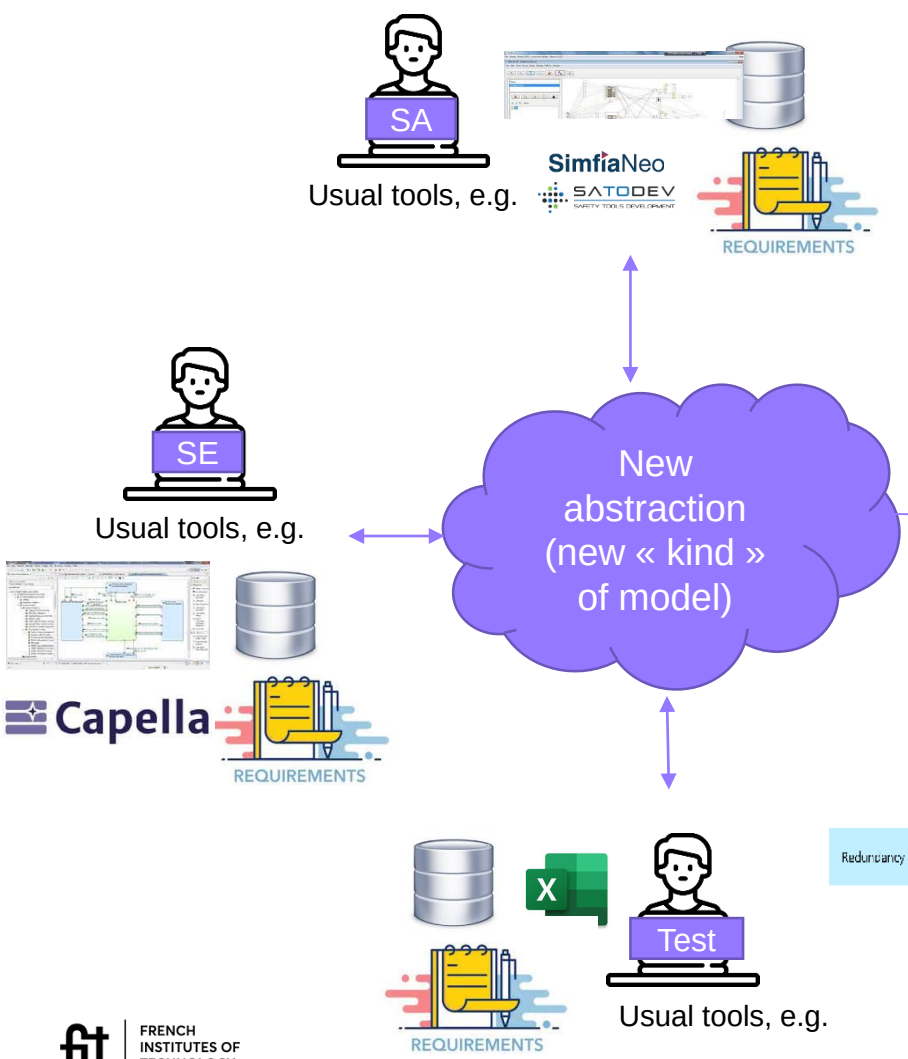
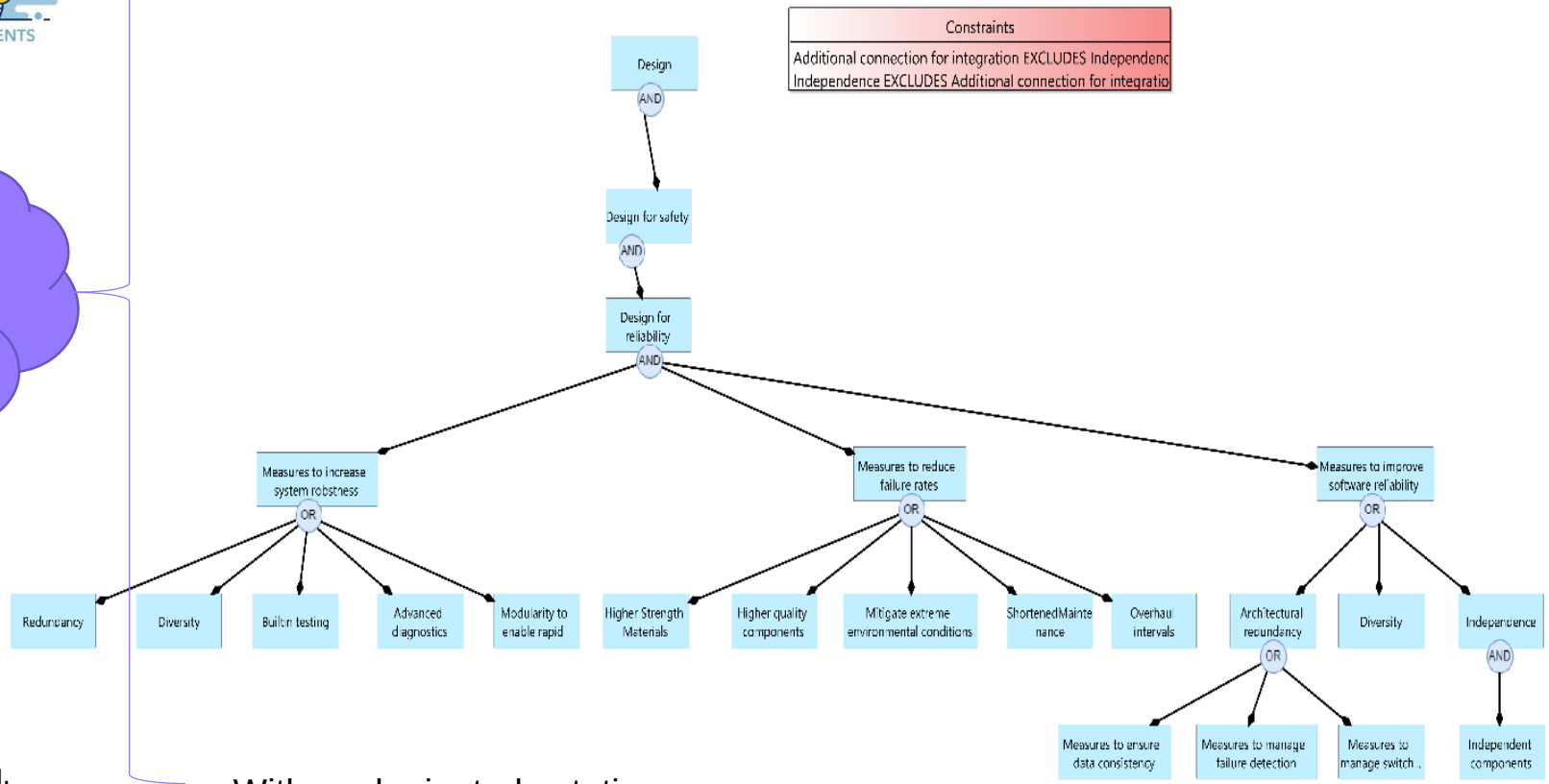
8. Example of domain models



What to capture in this new abstraction?

Domain specific intentions: « Design for X »

e.g. Design for Safety (feature model representation)



With goal oriented notations:

- GSN (Goal Structuring Notation), or KAOS for example

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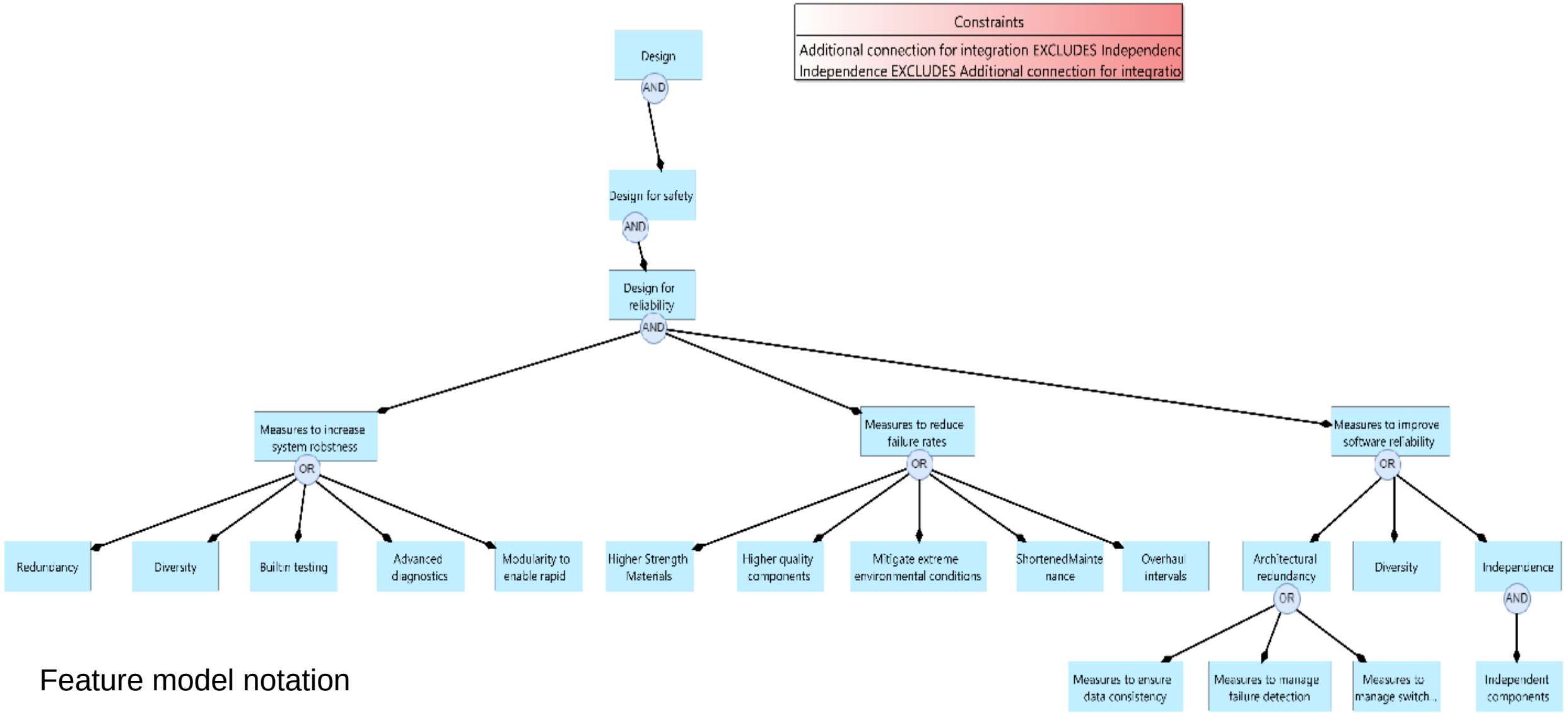
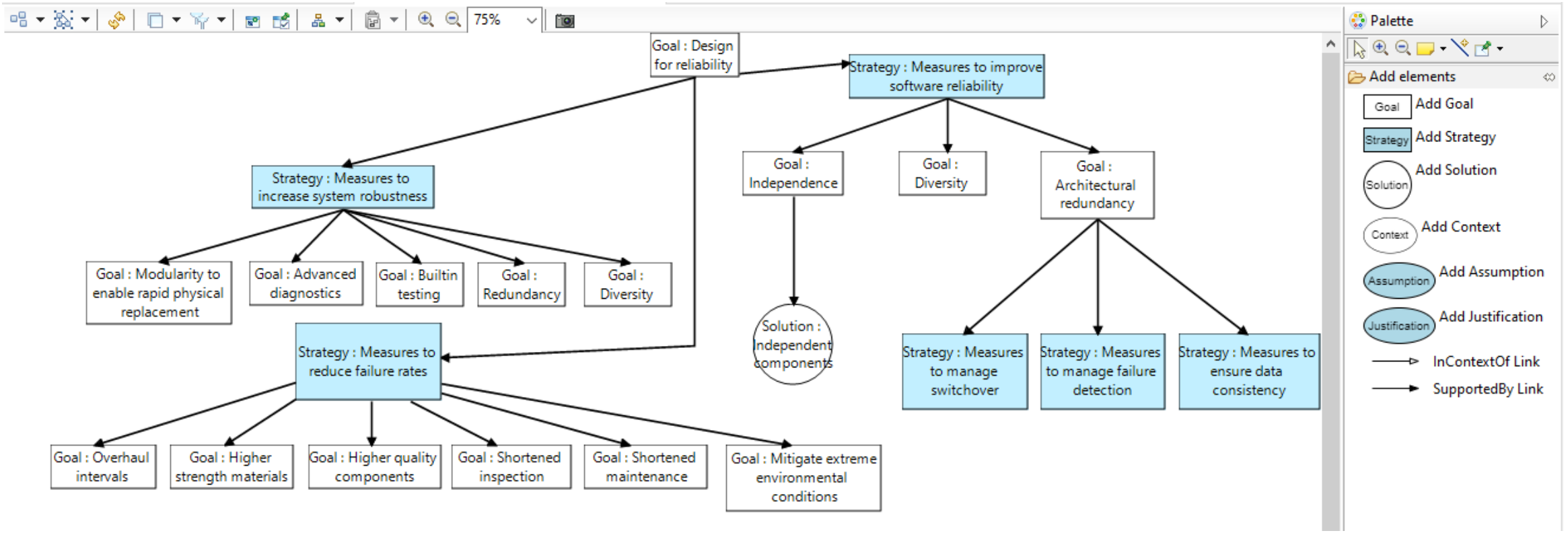


Feature model notation

8. Example of domain models



GSN notation

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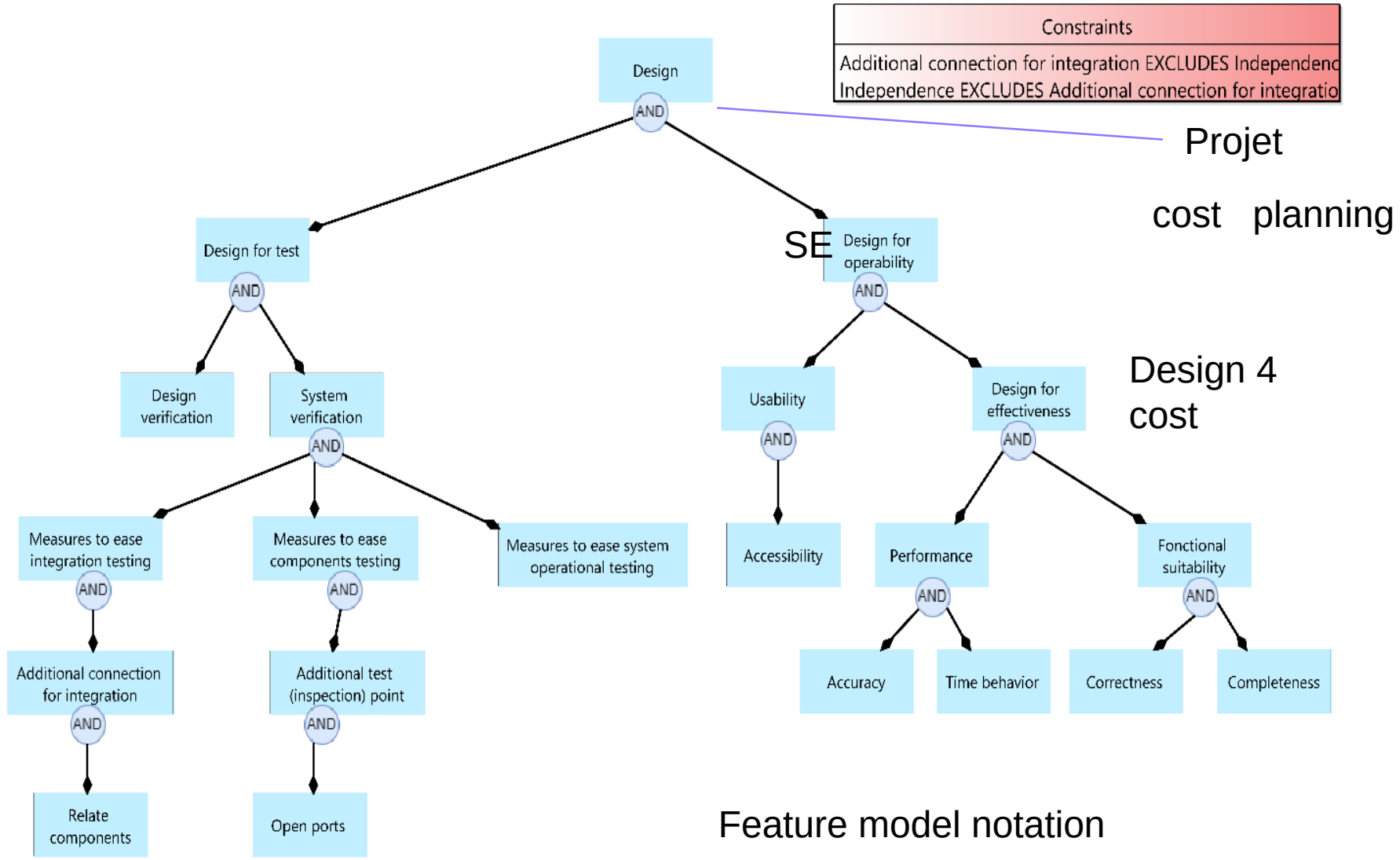

Projet

cost planning

SE

Design 4 cost

Feature model notation

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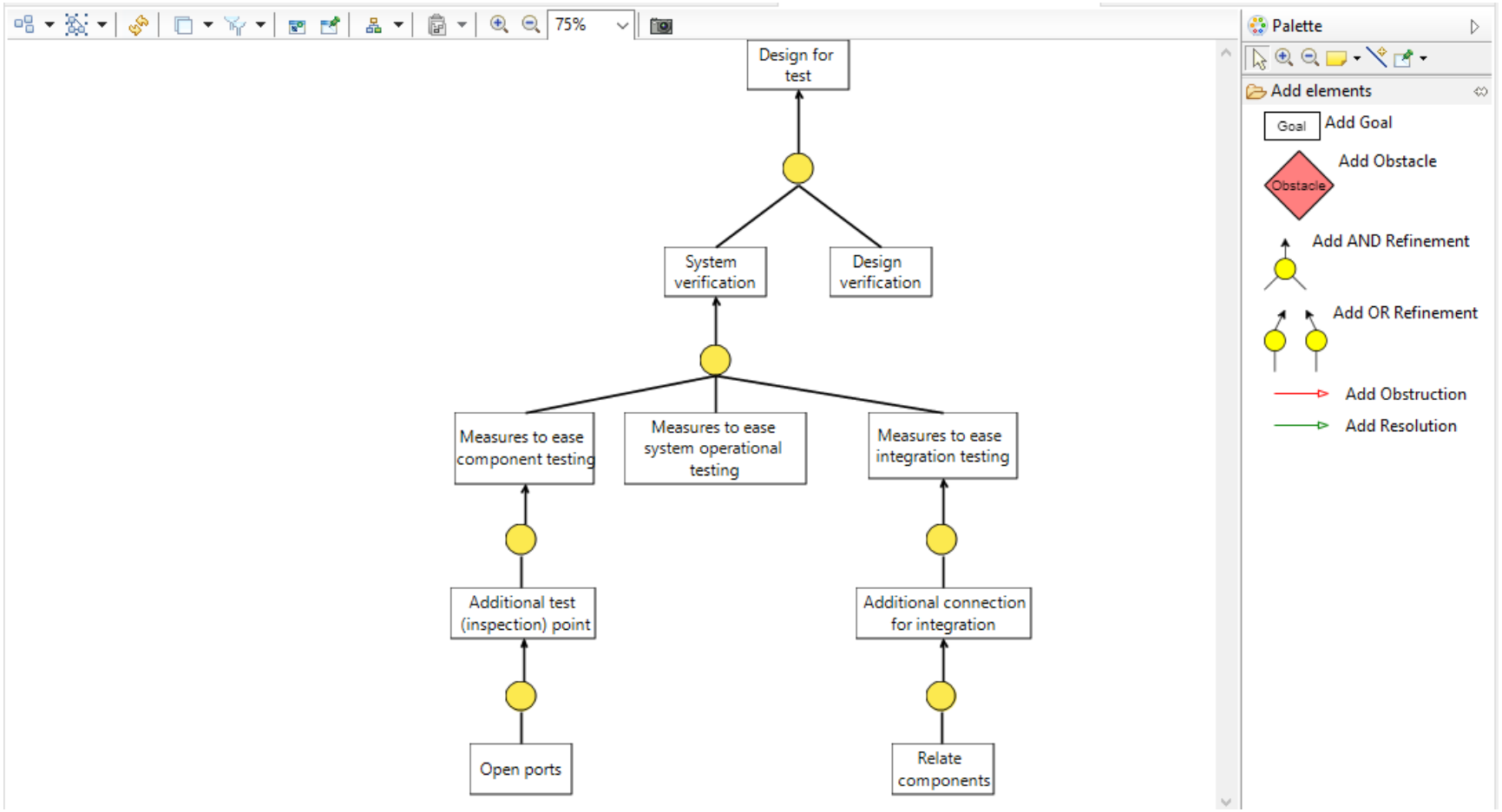
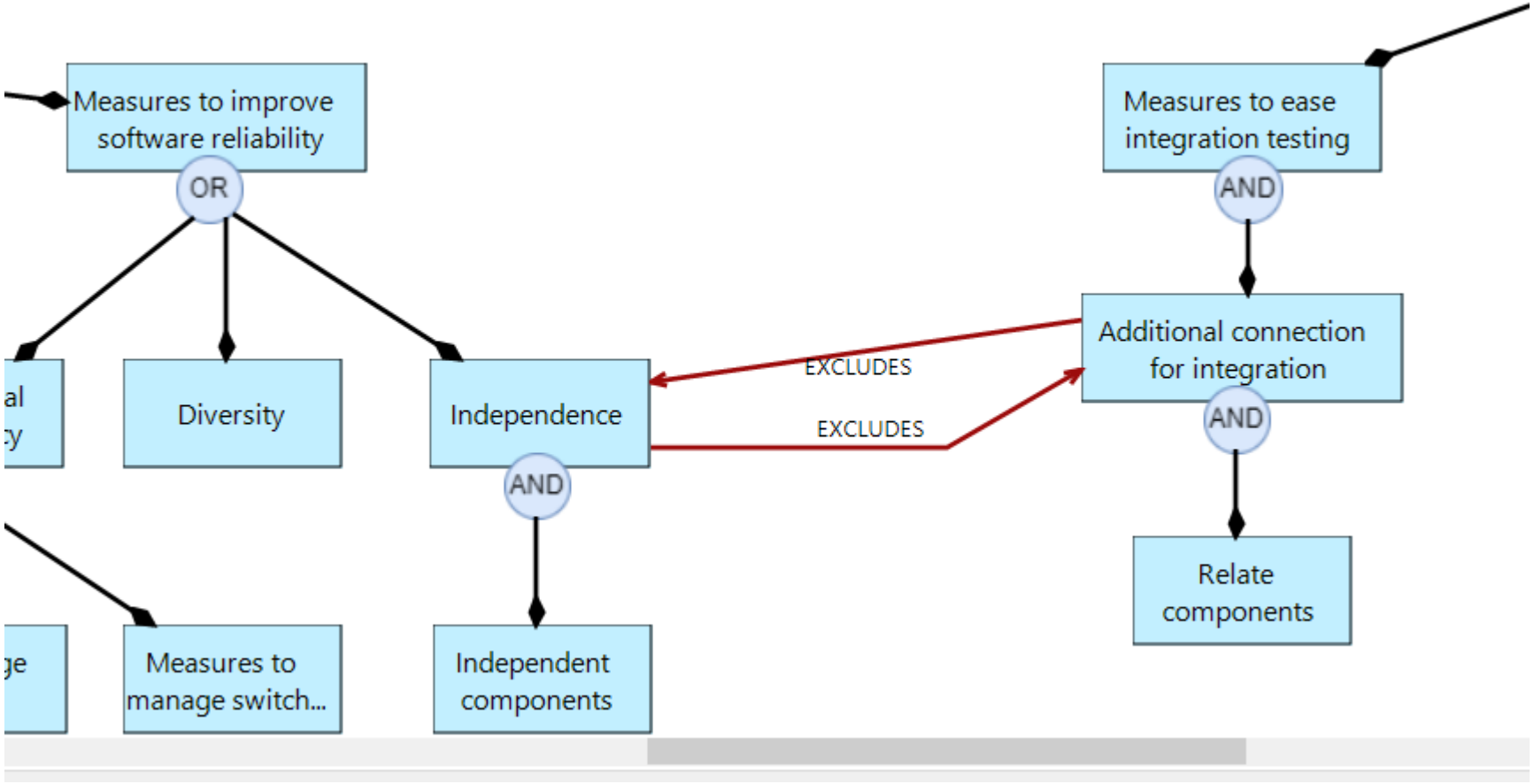


KAOS notation

8. Example of domain models



Feature model notation

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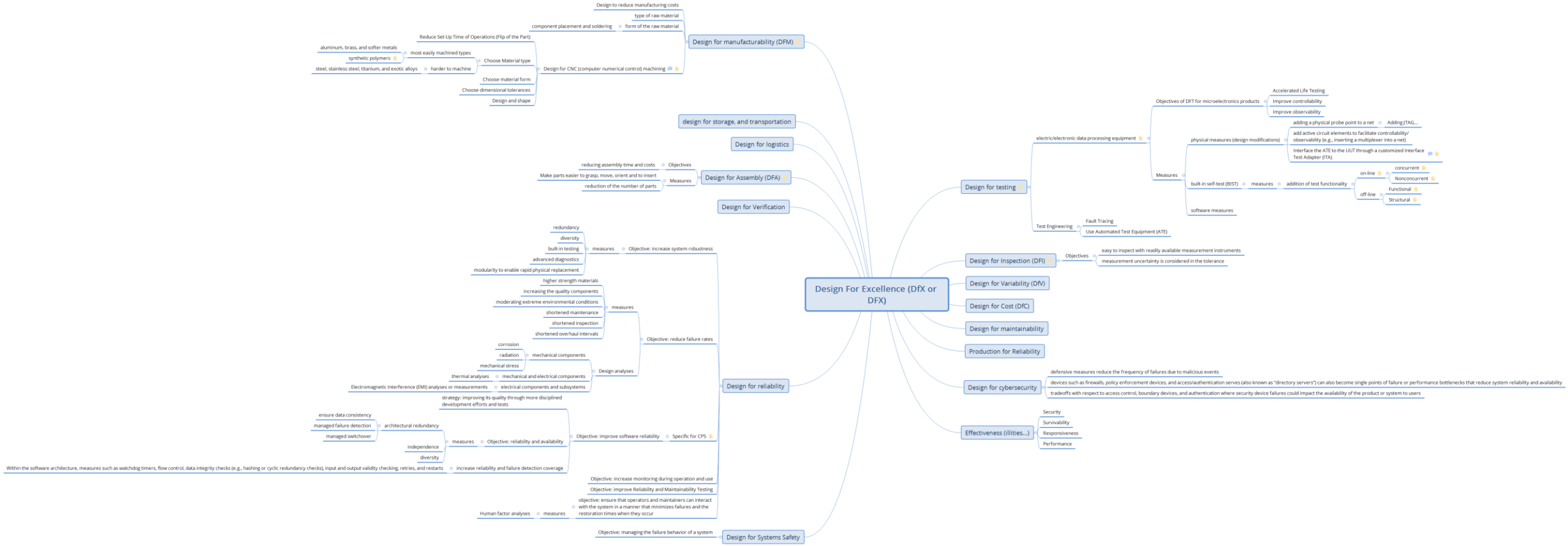

Example of Design for X domain model