

# Modeling Variability in Regulatory Requirements

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# Context

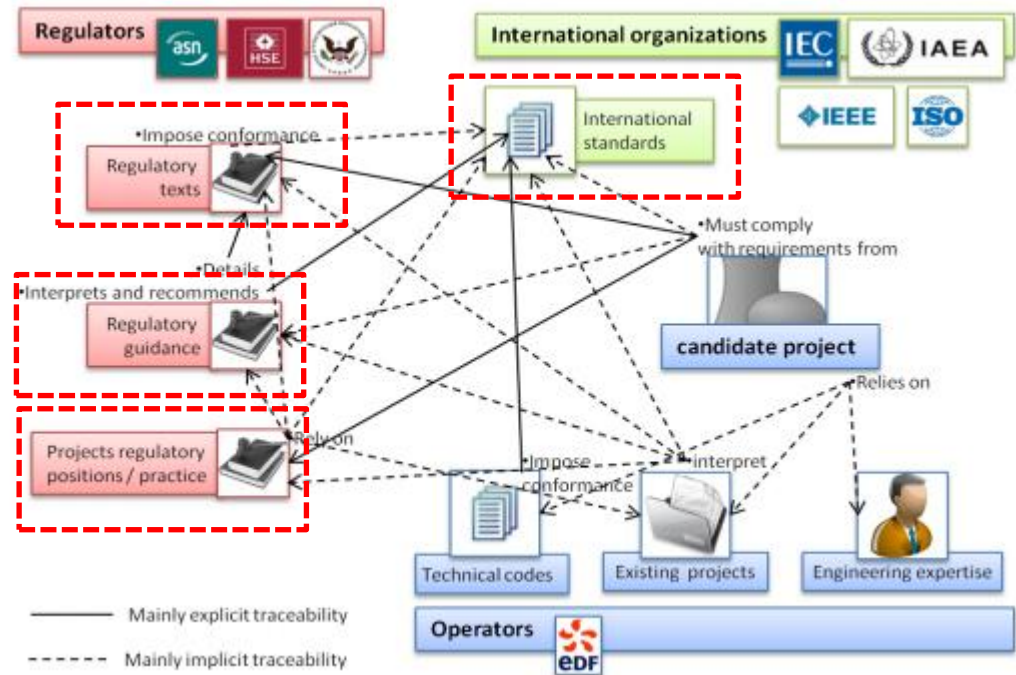
## CONNEXION Project (CONtrôle Commande Nucléaire Numérique pour l'EXport et la rénovation)

### Research Question:

*Can we formalize these safety requirements to assist the requirements compliance demonstration?*

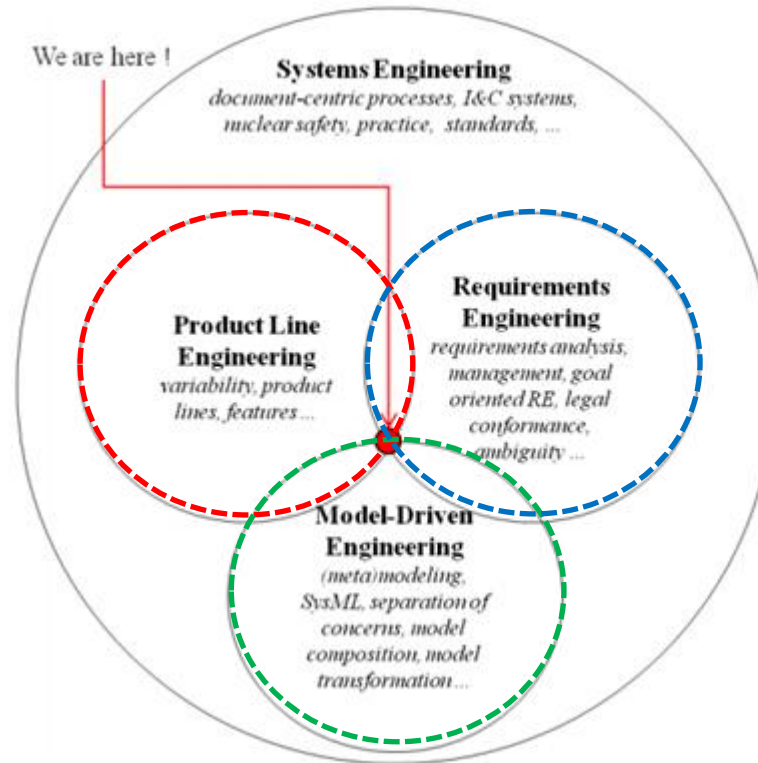
### Regulatory requirements:

- **Heterogeneous** documents
- **disconnected** from the technical system requirements
- **changes** over time and from one country to another



Overview of the nuclear regulatory landscape

# Research Domains



Variability Management

Analysis and Management of Standards

Design and Validation of Technical Systems

Crosscutting multiple research domains techniques and concerns

# Variability Management

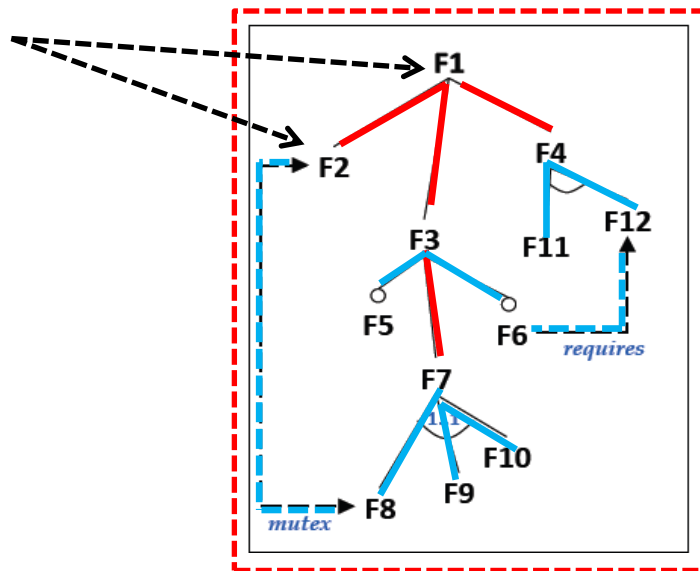
## Variability :

“the ability of a system to be efficiently extended, changed, customized or configured for use in a particular context”

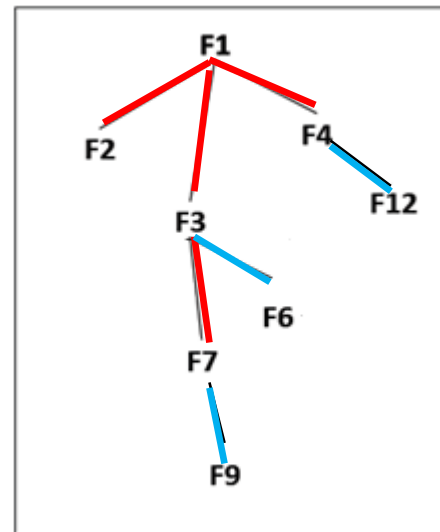
*Mikael Svahnberg, Jilles van Gorp, and Jan Bosch (2005)*

Feature models, the defacto standard for modeling variability

Features



Domain Engineering

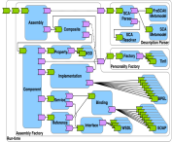


Application Engineering

↓ Obligatoire	∧ Alternatifs	→ Implication
○ Optionnel	∨ Ou	↔ Exclusion

# Reverse Engineering

Component Models



Dependencies Files

```
graph TD
    A[Component A] --> B[Component B]
    A --> C[Component C]
    B --> D[Component D]
    C --> D
    D --> E[Component E]
```

Source Code

```
1 // Source code snippet
2 #include <stdio.h>
3 int main() {
4     printf("Hello World\n");
5     return 0;
6 }
```

Product descriptions

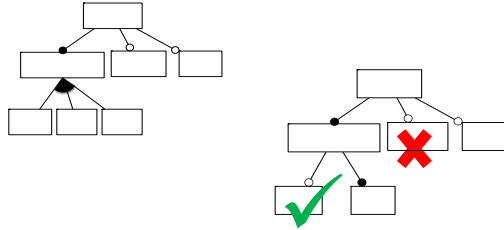
```
1 // Product description snippet
2 #define PRODUCT_NAME "Renault Kangoo"
3 #define PRODUCT_COLOR "Blue"
4 #define PRODUCT_PRICE 15000
```

Web Configurators

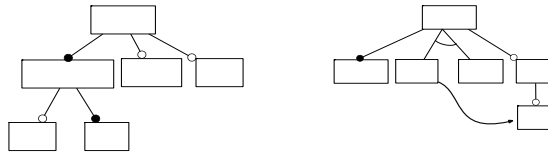


# Feature Model Management

importing, exporting, composing, slicing, editing, configuring, "diffs", testing, and reasoning about (multiple) feature models



# FAMILIAR



# Forward Engineering

Domain analysis (scoping, communication with other stakeholders, etc.)

Automated analyses (on the resulting feature model, for testing, model checking, etc.)

Derivation of "products" (e.g., derivation of models, build systems)

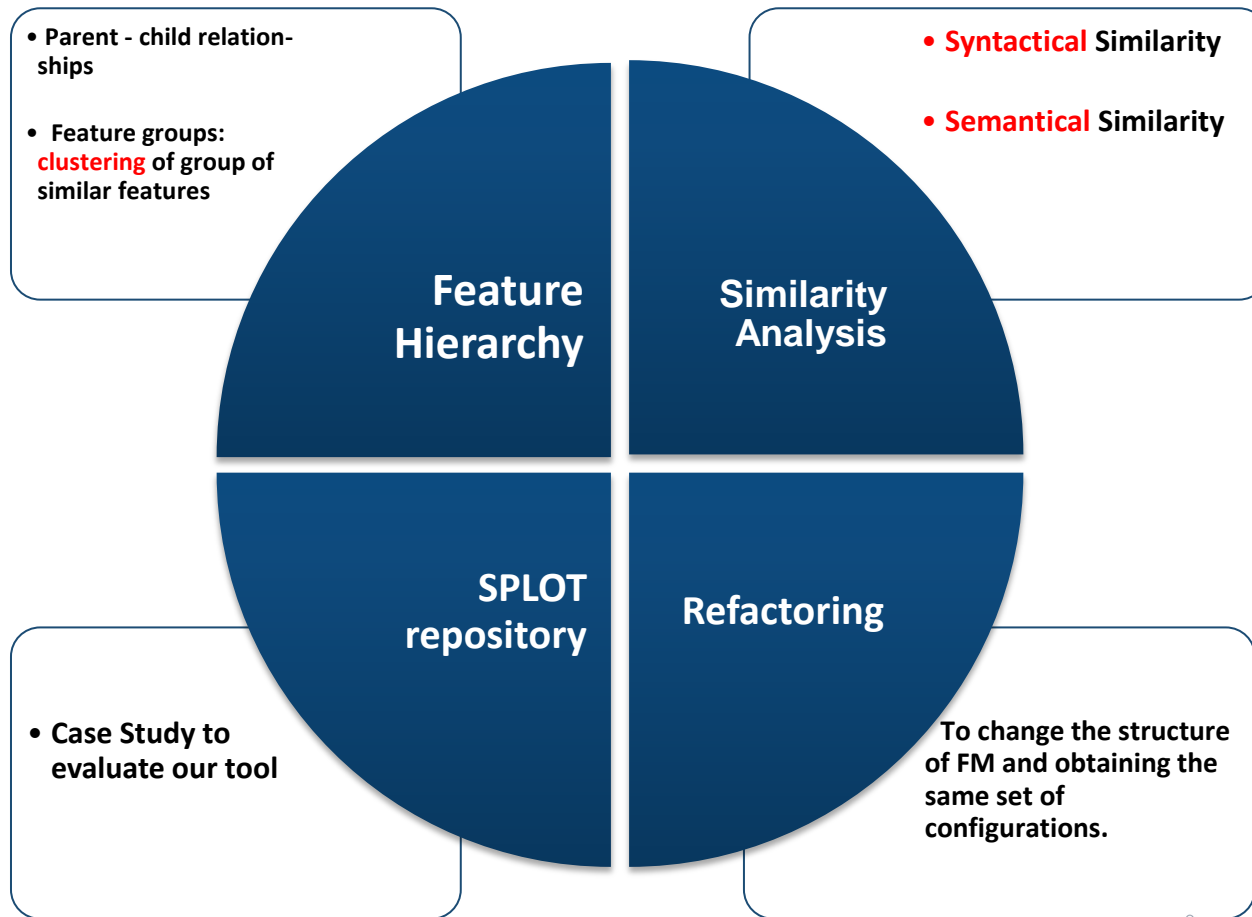
Generation of configurators



[Acher et al. ECSA'11], [Acher et al., VaMoS'12], [Abbasi et al., PLEASE'12], [She et al., ICSE'11], [Weston et al., SPLC'09], [Haslinger et al., WCRE'11], [Rysell et al., SPLC'11]

Acher, Mathieu and Collet, Philippe and Lahire, Philippe and France, Robert « FAMILIAR: A Domain - Specific Language for Large Scale Management of Feature Models » Science of Computer Programming (SCP), 2013

# Increasing Automation of Feature Model Synthesis = Tool + Heuristics



**Thank you for your Attention**