THALES

# Arcadia/Capella: Looking back at our implementation issues

## CONSIDERATIONS FOR SYSML V2

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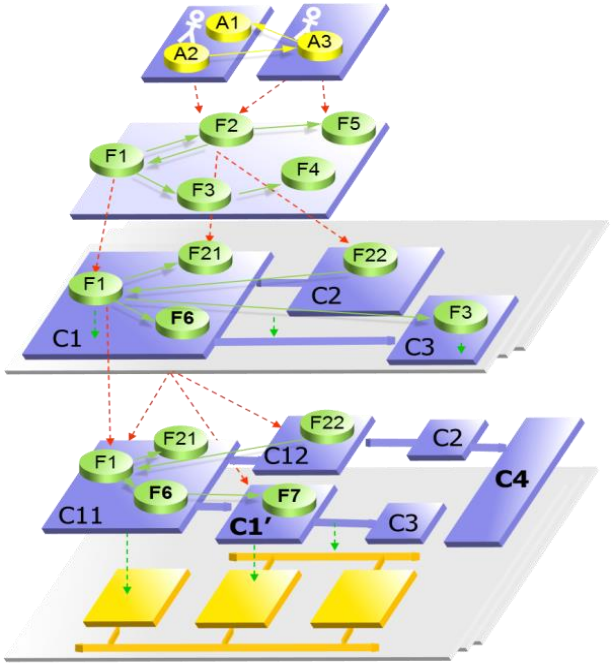
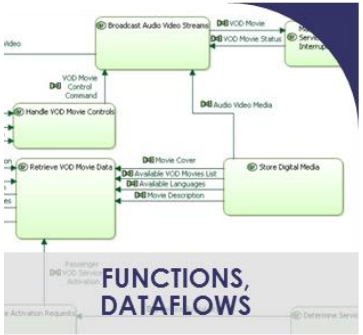
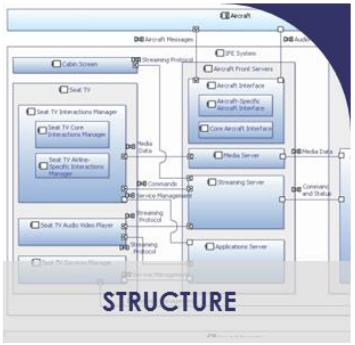
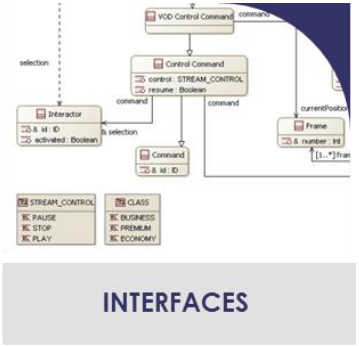
INCOSE WG, , Torrance, Jan 28th, 2017

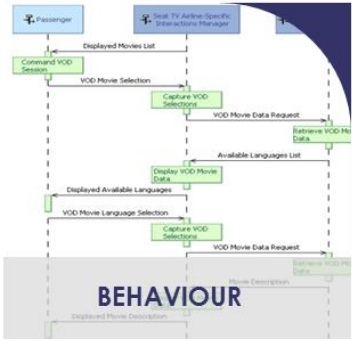
# Tight coupling method/tool

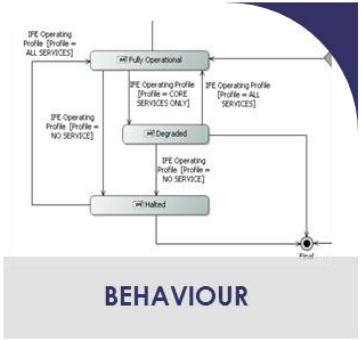


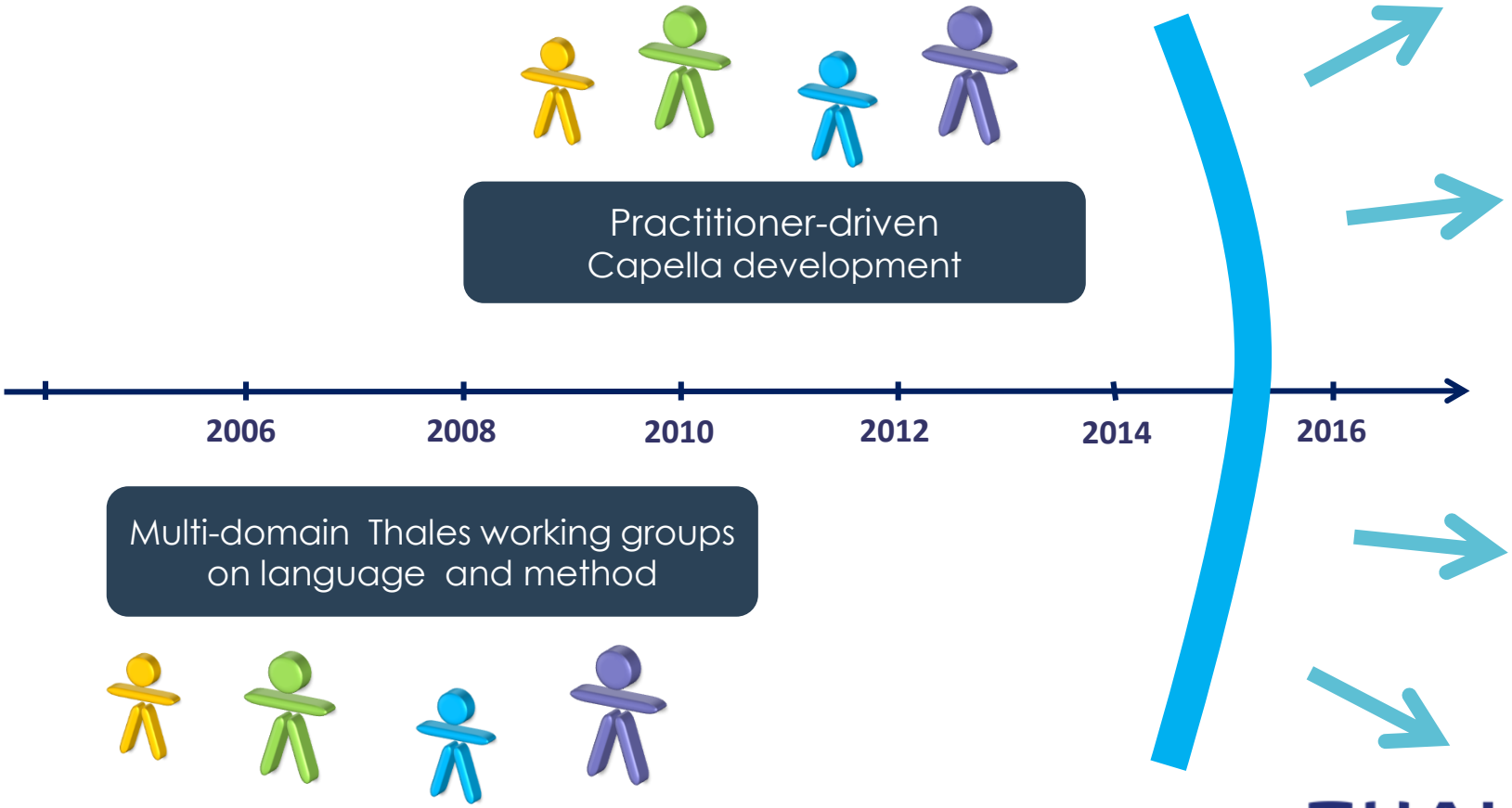



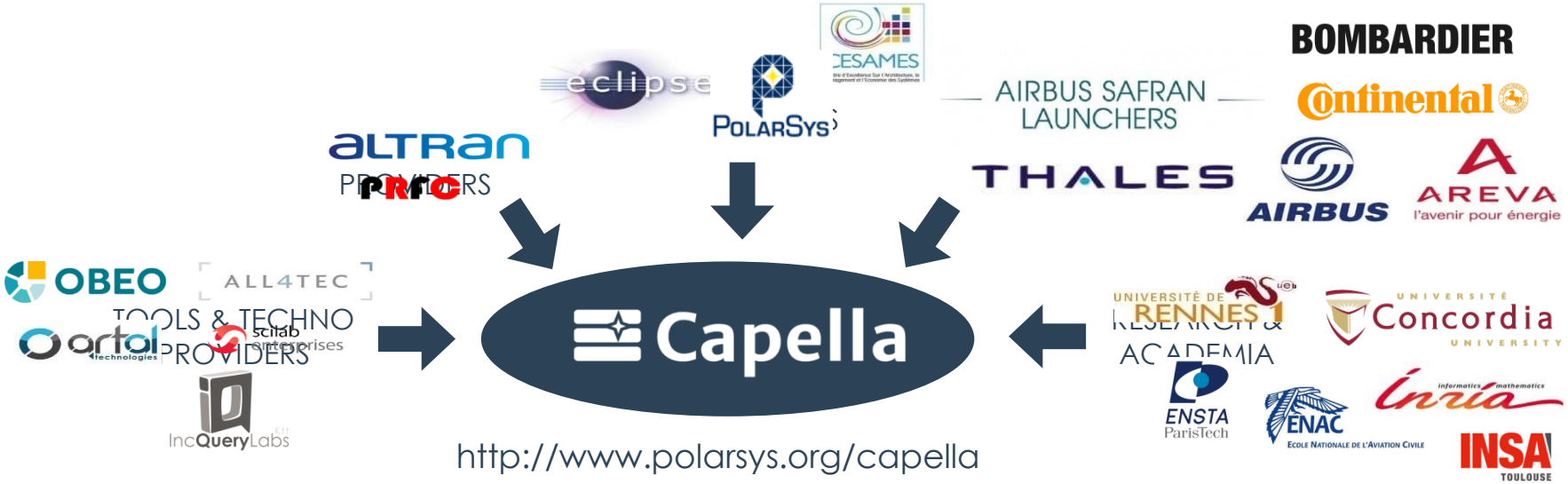

ARCADIA

Capella

# A practitioner-driven journey started in Thales…



# … now open source



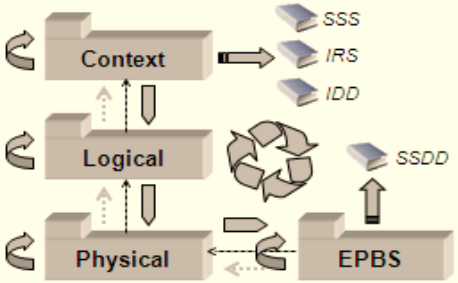

http://www.polarsys.org/capella

Initial 3-year (French) collaborative project

Larger industry consortium currently being initiated

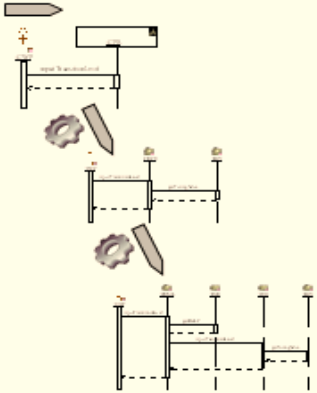
# Back in the past (2003-2007)

## Assistance tools



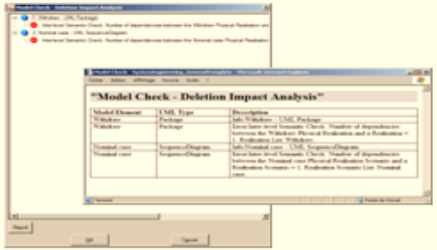

## Generation tools


## Refinement tools

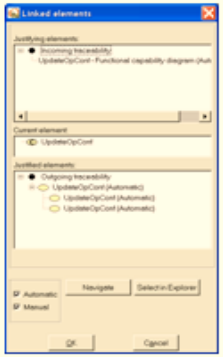


MDSysE

## Checking tools




## Traceability tools



# Some drivers for an MBSE solution

- Be accessible to all practitioners (including non-architects)
- Reduce incidental complexity
- Help cope with design complexity
- Be flexible: support of multiple workflows

# Insights (or, why Capella is not SysML…)

1. Functional analysis

2. Instance-driven modeling

3. Model exploitation

4. Decorrelate model/view

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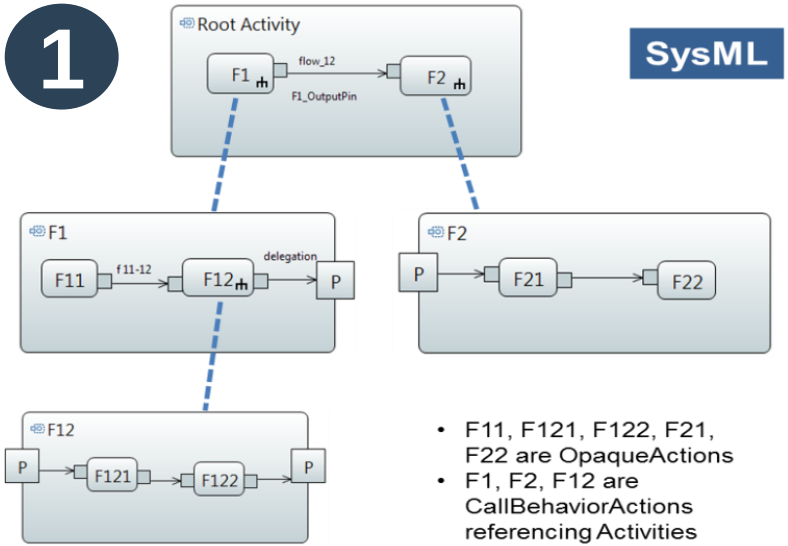
# Functions in SysML vs Capella

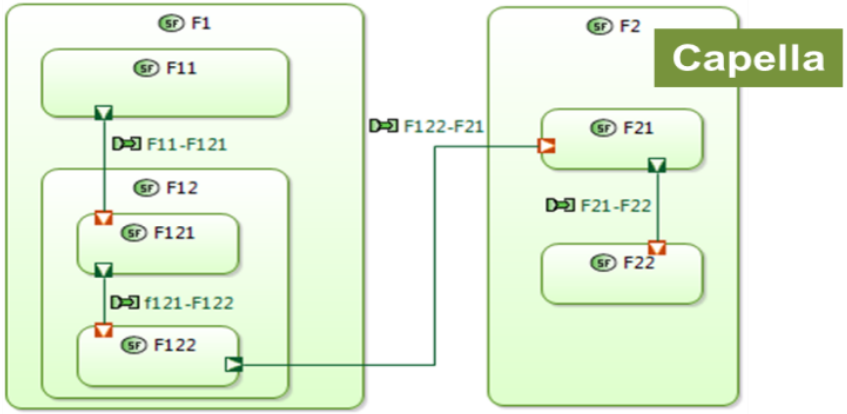


**1**




SysML

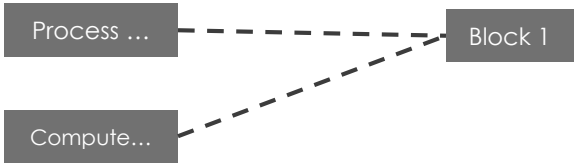
- F11, F121, F122, F21, F22 are OpaqueActions
- F1, F2, F12 are CallBehaviorActions referencing Activities




Alternative representation 1


Alternative representation 2, etc.


**2**



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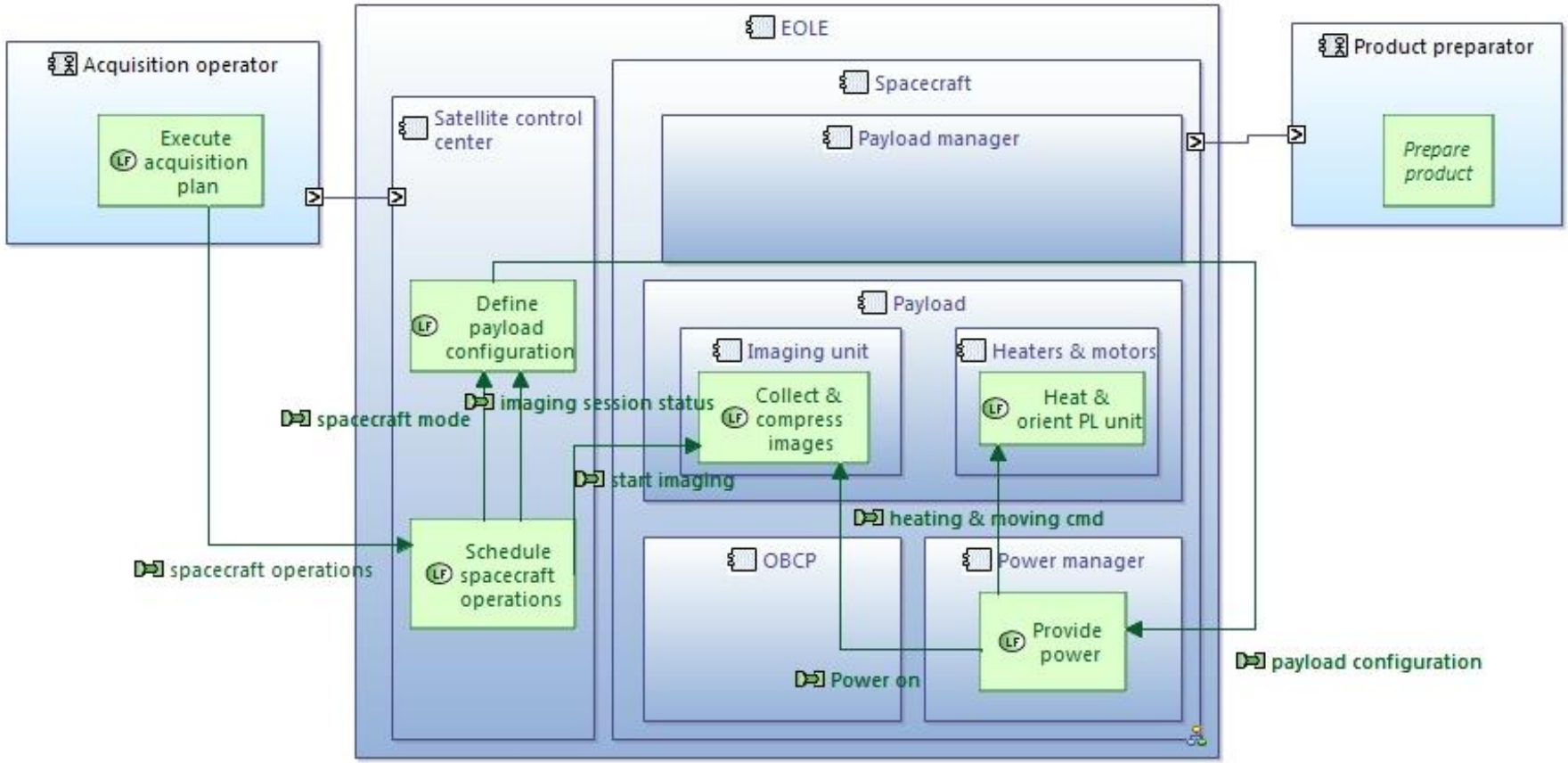
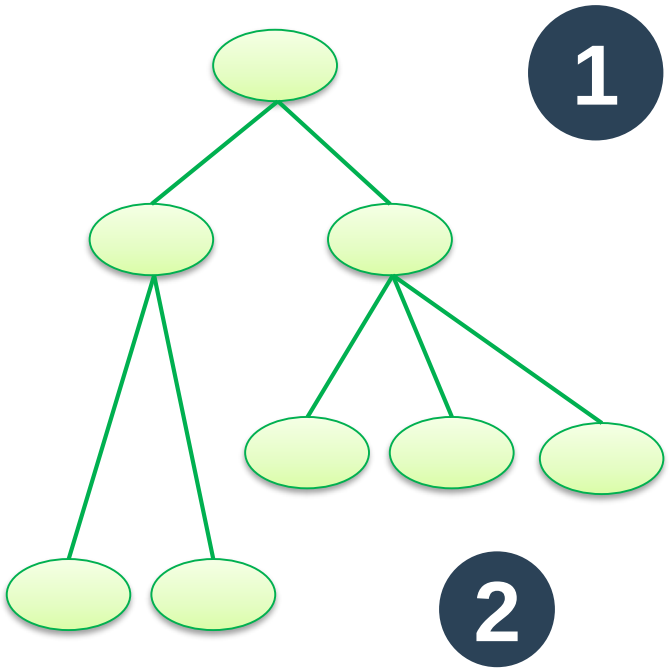
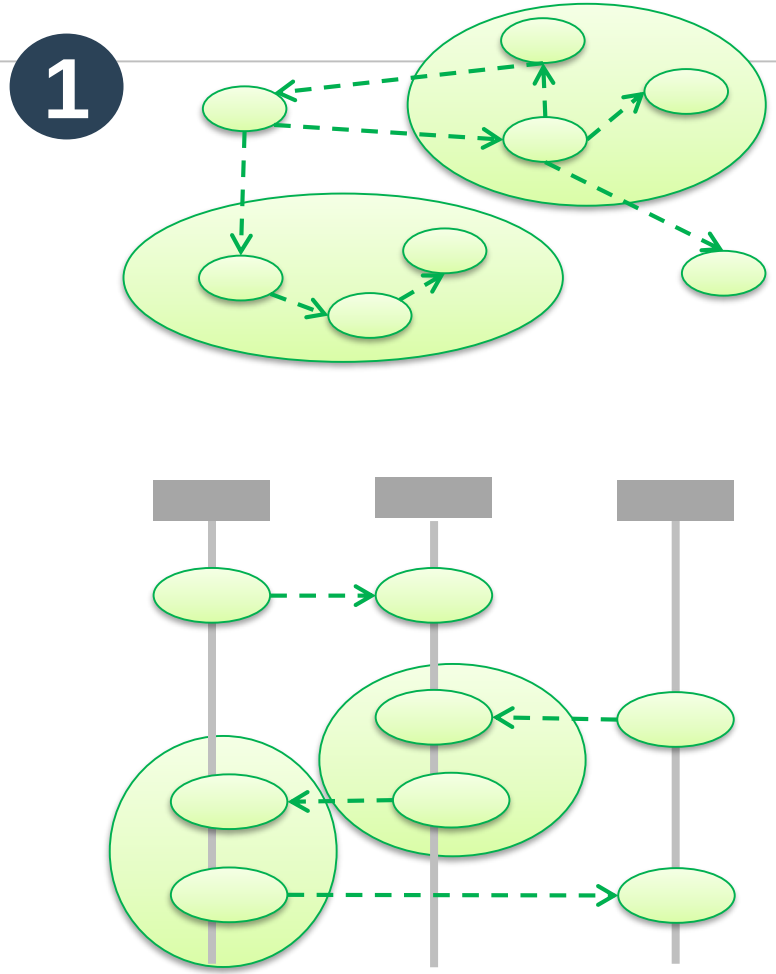
# “Natural representation”



# Functional analysis workflows




Top-down





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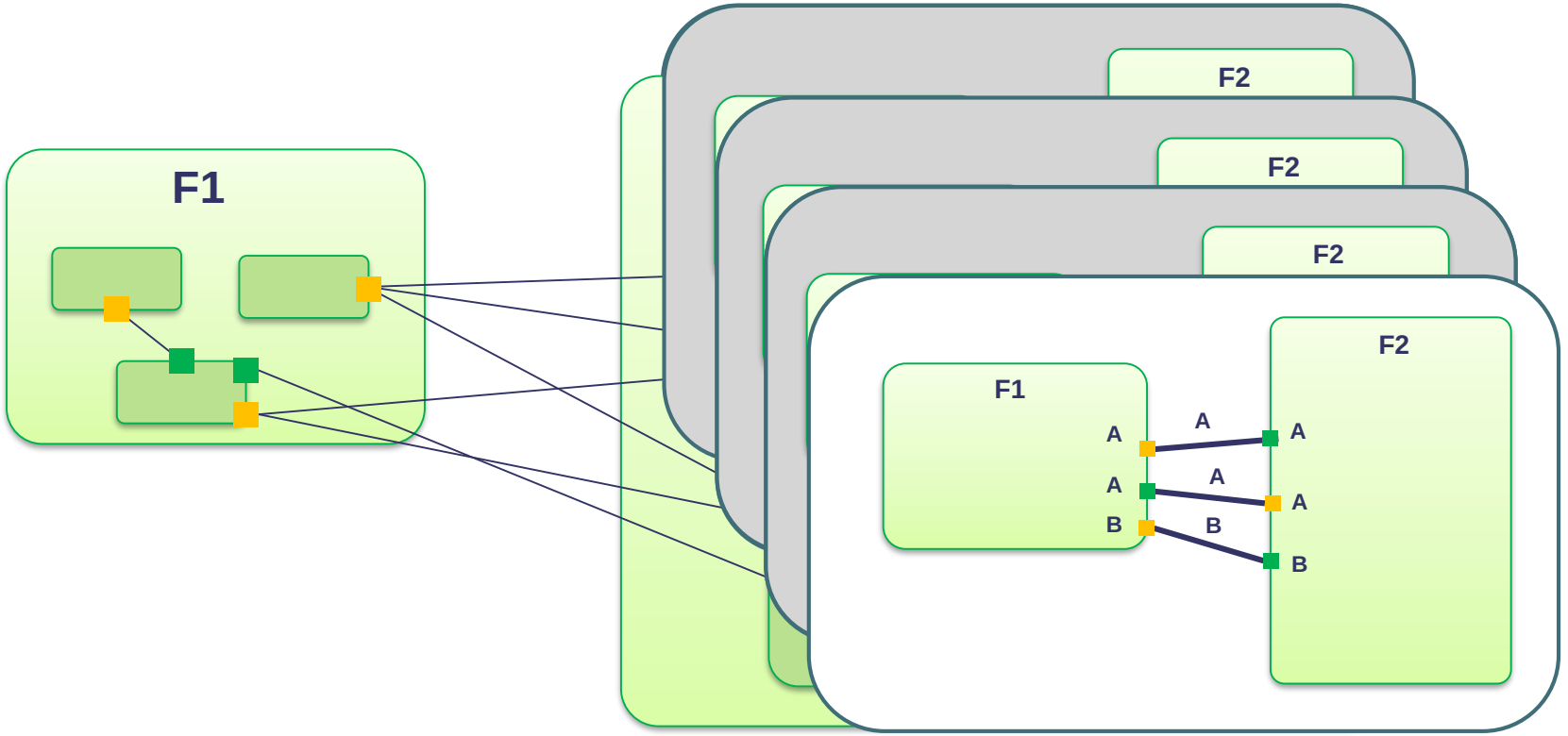
# Functional analysis with Capella



1. Functional analysis

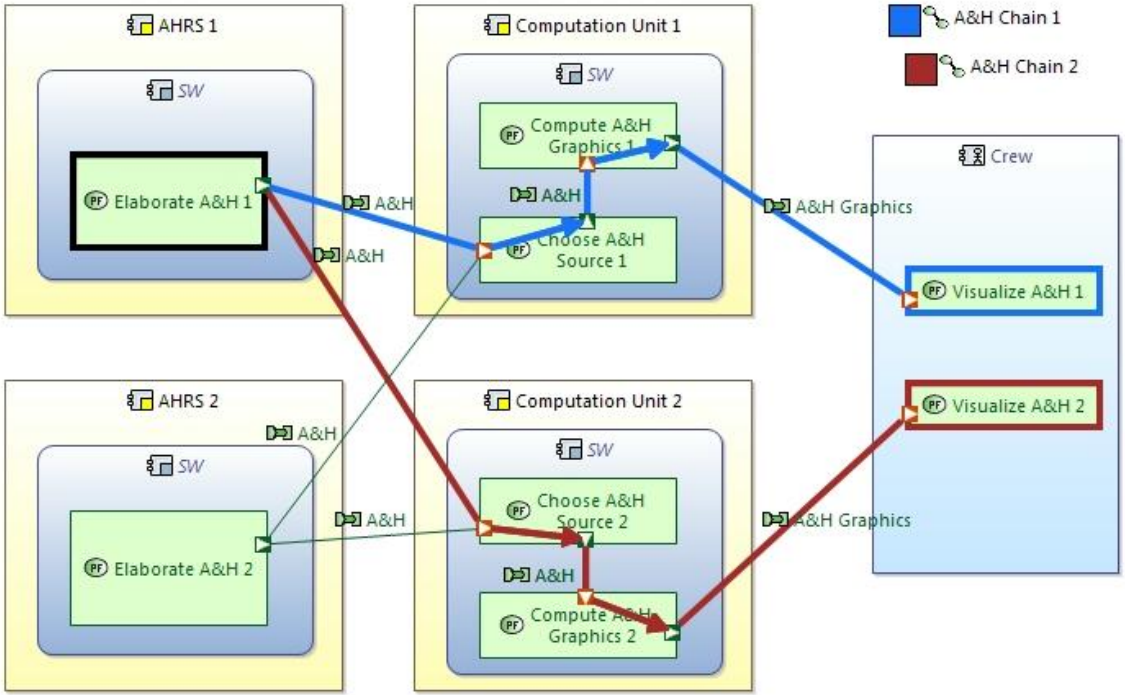
**2. Instance-driven modeling**

3. Model exploitation

4. Decorrelate model/view

# Instance-Driven Modeling

## A lot of systems engineers think first in term of instances





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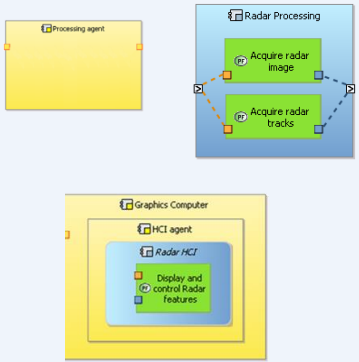
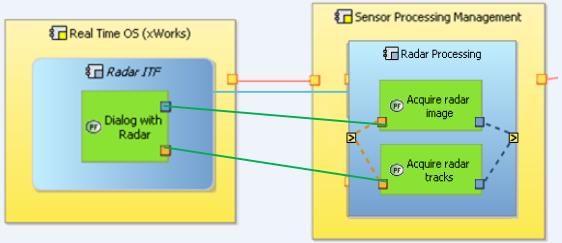
# Instance-Driven Modeling

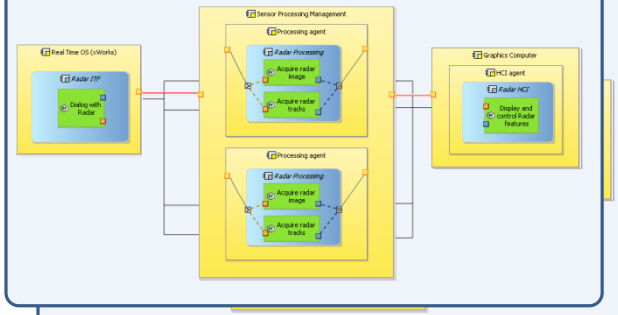
## Building Blocks



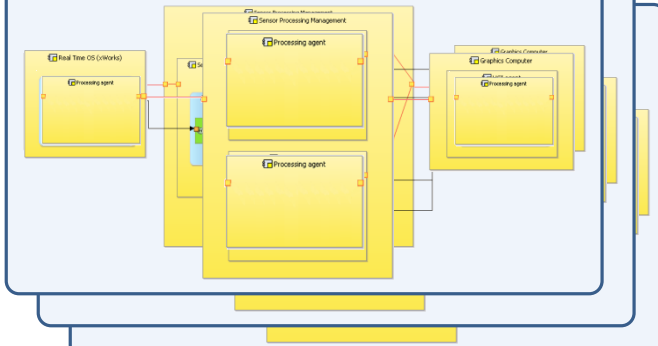

## Assembly description



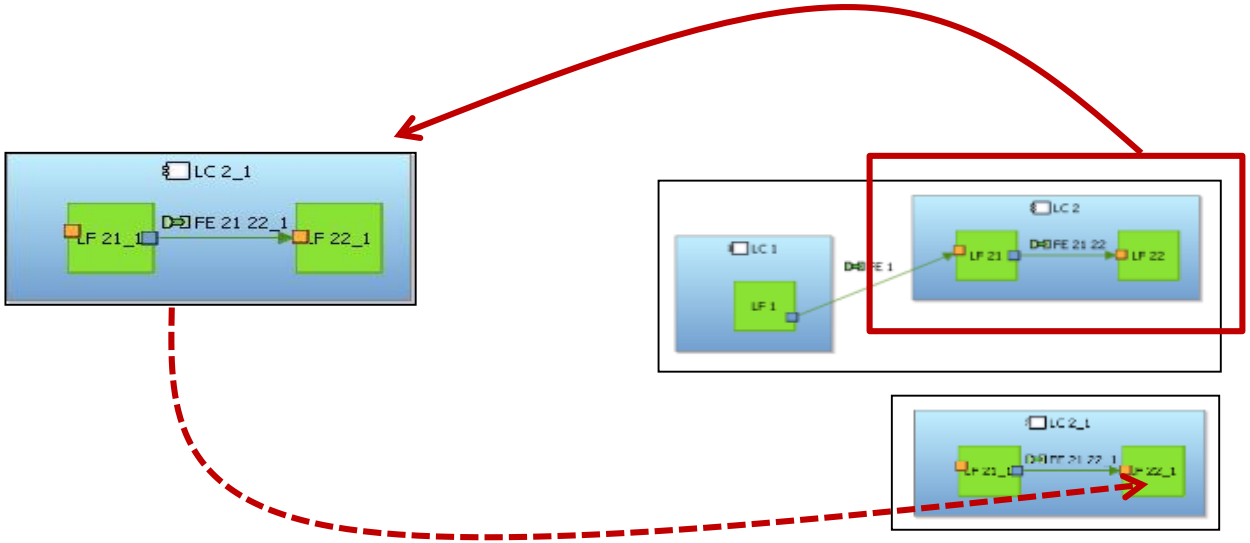

## Focused analyses



## Deployments



# Flexible Type/Instance Modeling



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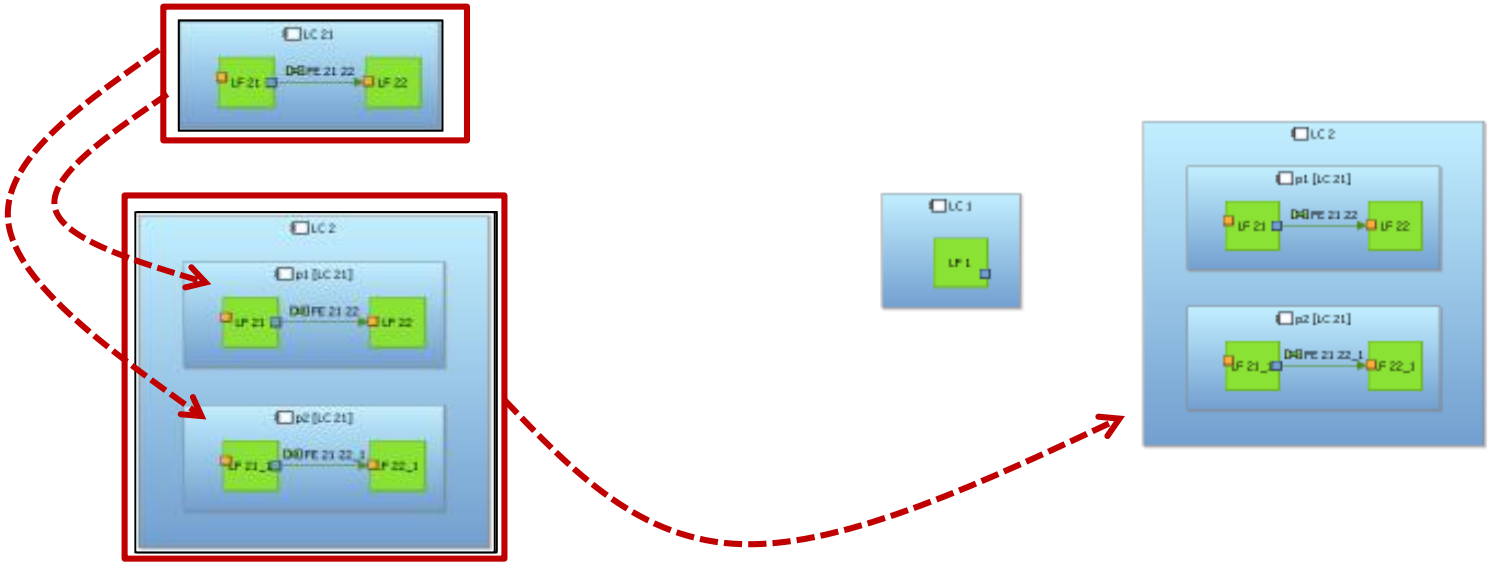






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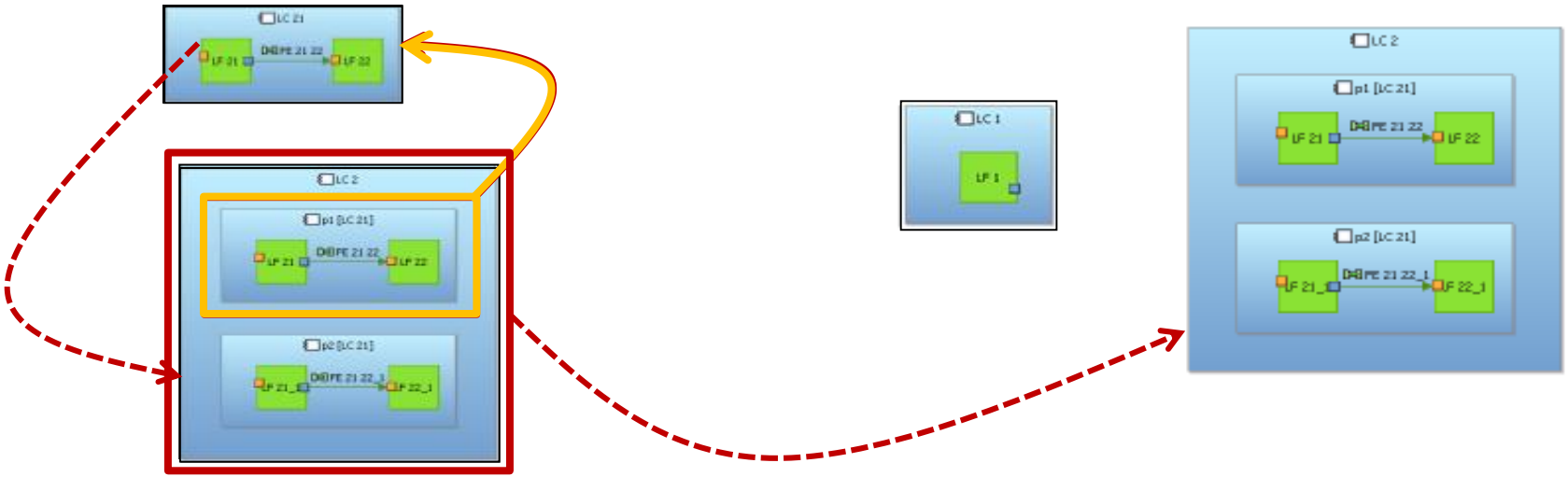
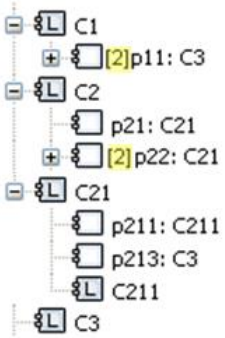
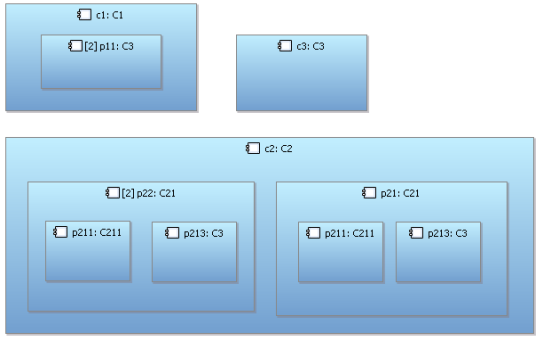


# 4 years ago: Explicit & implicit, semi-failure



Implicit

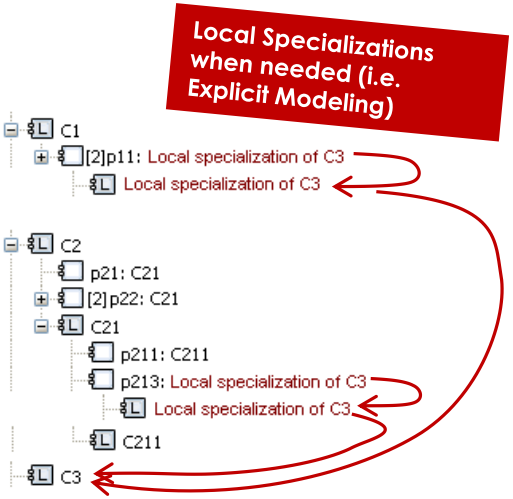


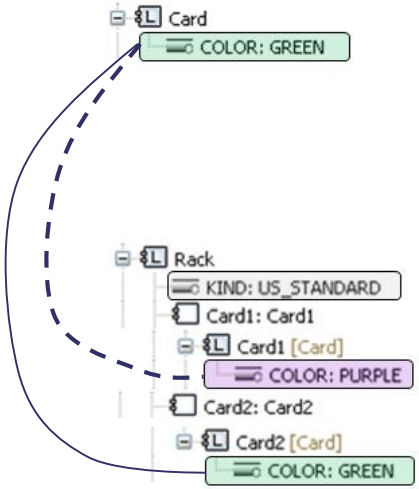




- « Types » oriented representation, very common in UML / SysML
  - **Parts specify the multiplicity and the role of the usage of one component in another**
- Avoids the multiplication of elements in the models
  - Describes the assembly of Components from an abstract point of view
  - **Exactly the same as Class / Property relationships**
- Limitations
  - If Component Properties are defined on C3, **it is not possible to specify that the occurrences of C3 in C1 and in C2 have different default values**

# 4 years ago: Explicit & implicit, semi-failure

- A dedicated SysML construction (PropertySpecificType) allows specifying specific information when needed (valuation of Component Properties for example)
  - **Local specialization of the referenced Type**
  - Still not equivalent to a real instance-level modeling



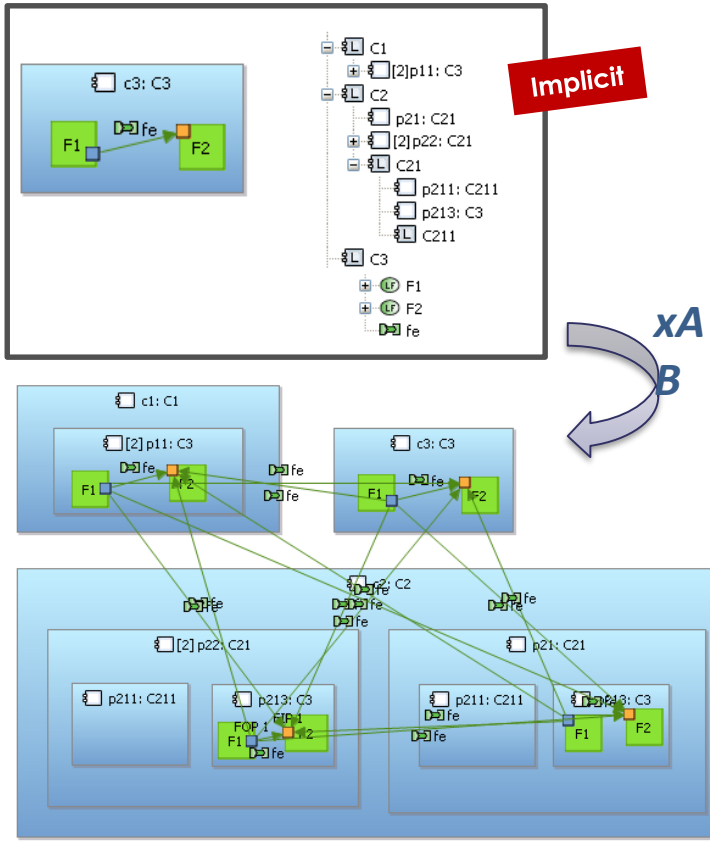
# 4 years ago: Explicit & implicit, semi-failure

- Allocation of two Functions to the Component C3

- On a xAB diagram,
  - Functions appear as many times as C3 appear, but all the green boxes are representing the same model elements (8 Functions boxes displayed but only 2 Functions in the model)
  - Exchanges are « multiplied » even though they are not meaningful

- **In Arcadia, distinguishing the different occurrences / execution / instances of Functions is most of the time mandatory.**

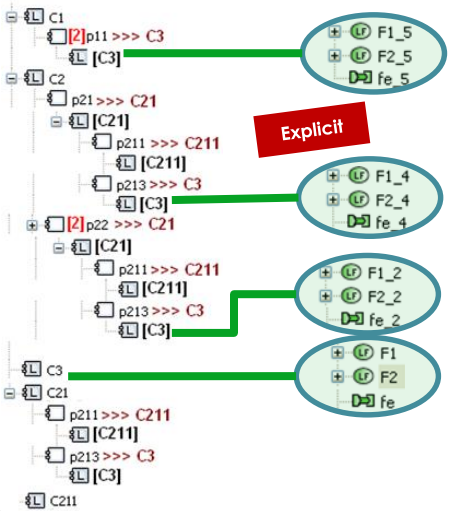
  ➔ **Explicit modeling is likely to be preferred.**

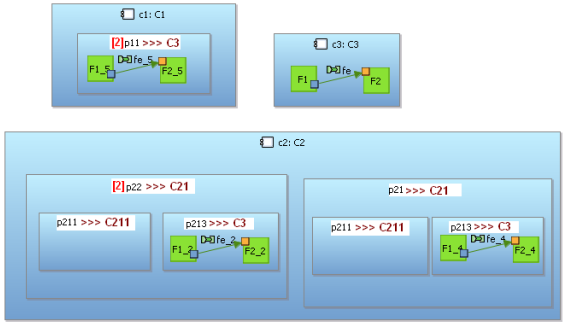


# 4 years ago: Explicit & implicit, semi-failure

- When distinguishing the different executions / occurences of Functions is necessary, modeling explicitely is required.

- **The proposed solution is to exploit the local specialization mechanism**
  - Functions are duplicated & allocated to local specializing components
  - When reusing a Component through a Part, local Functions are automatically created





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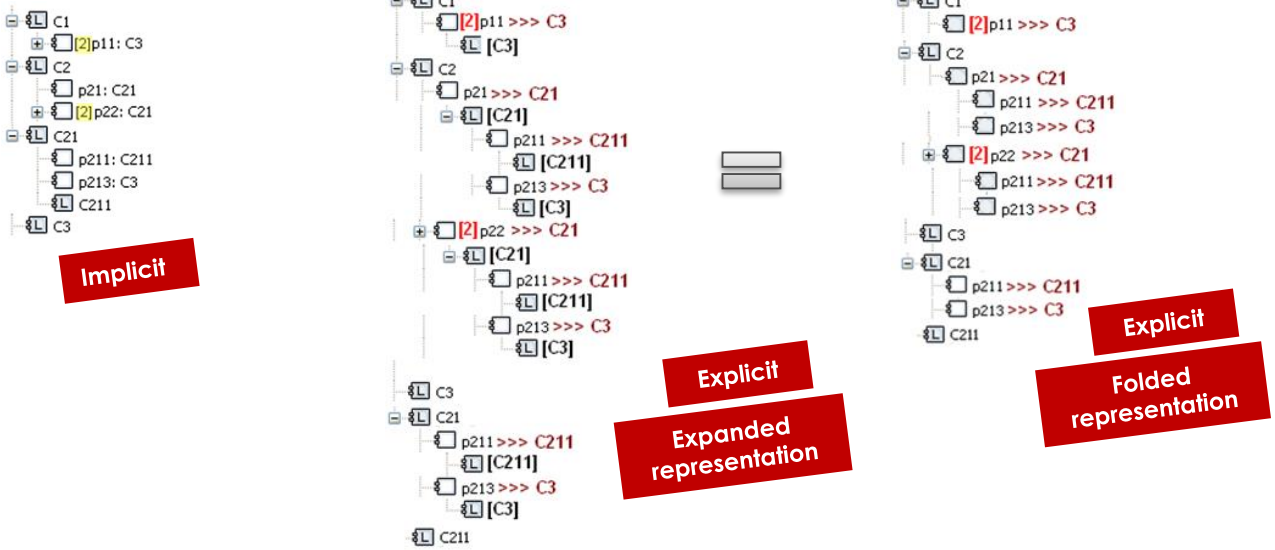
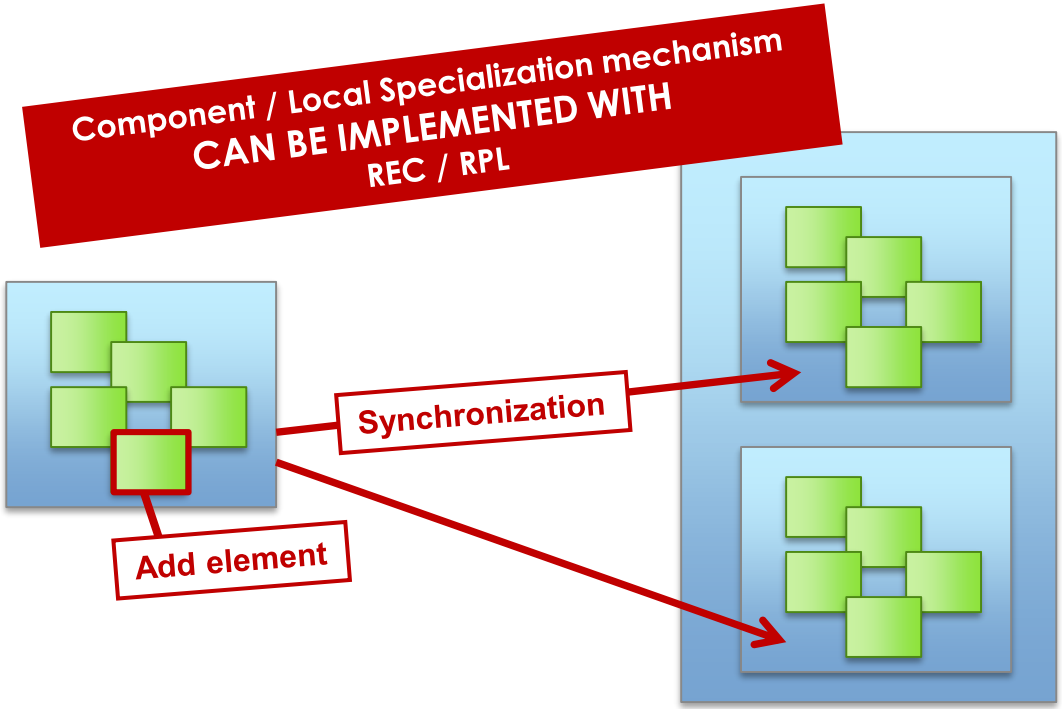
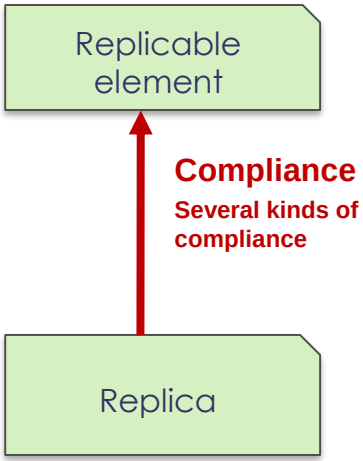



## Both implicit and explicit mode should be provided

- Be able to configure a default mode for part creation [implicit/explicit]
- When using implicit part, provide a way to make local specialization on demand (for example, when local valuation of a Property is needed)
- Additional request: The local specialization mechanism should be available for Classes as well

# Replication





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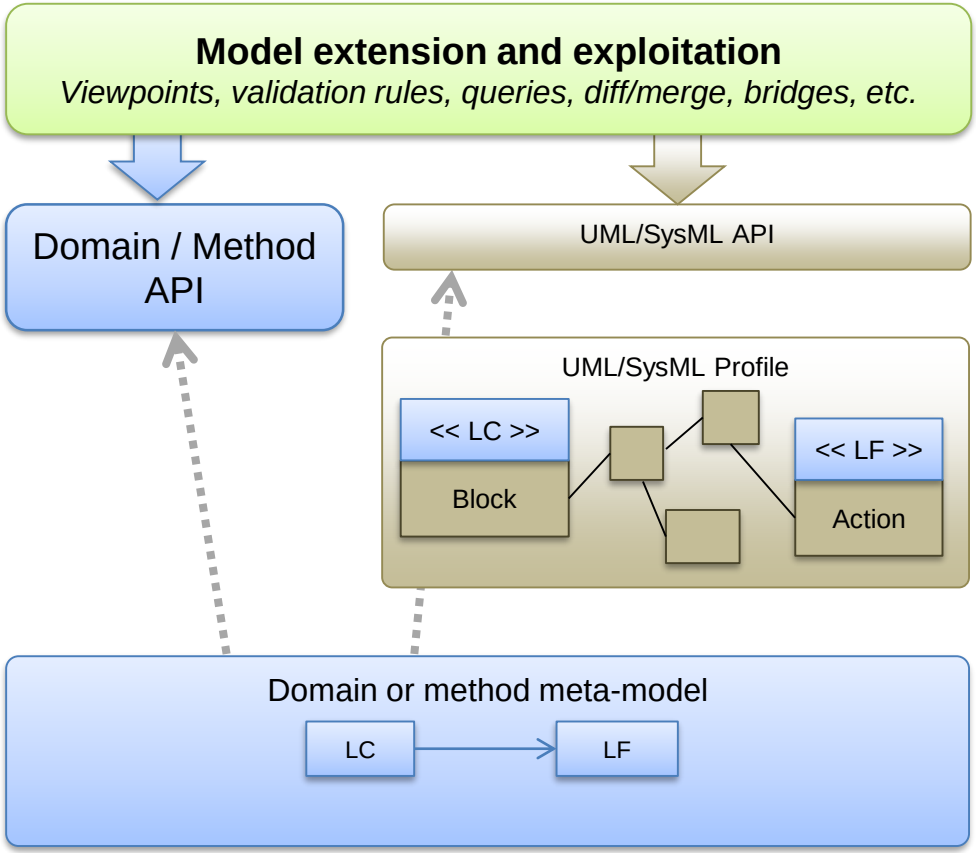
# Tooling and API Perspective

*<< Give me all the Logical Components and their lists of Functions >>*




*<< Give me all the Blocks with « LC » stereotype and their lists of Actions with « LF » stereotypes >>*





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