Towards a Dynamic Infrastructure for Playing with Systems of Systems

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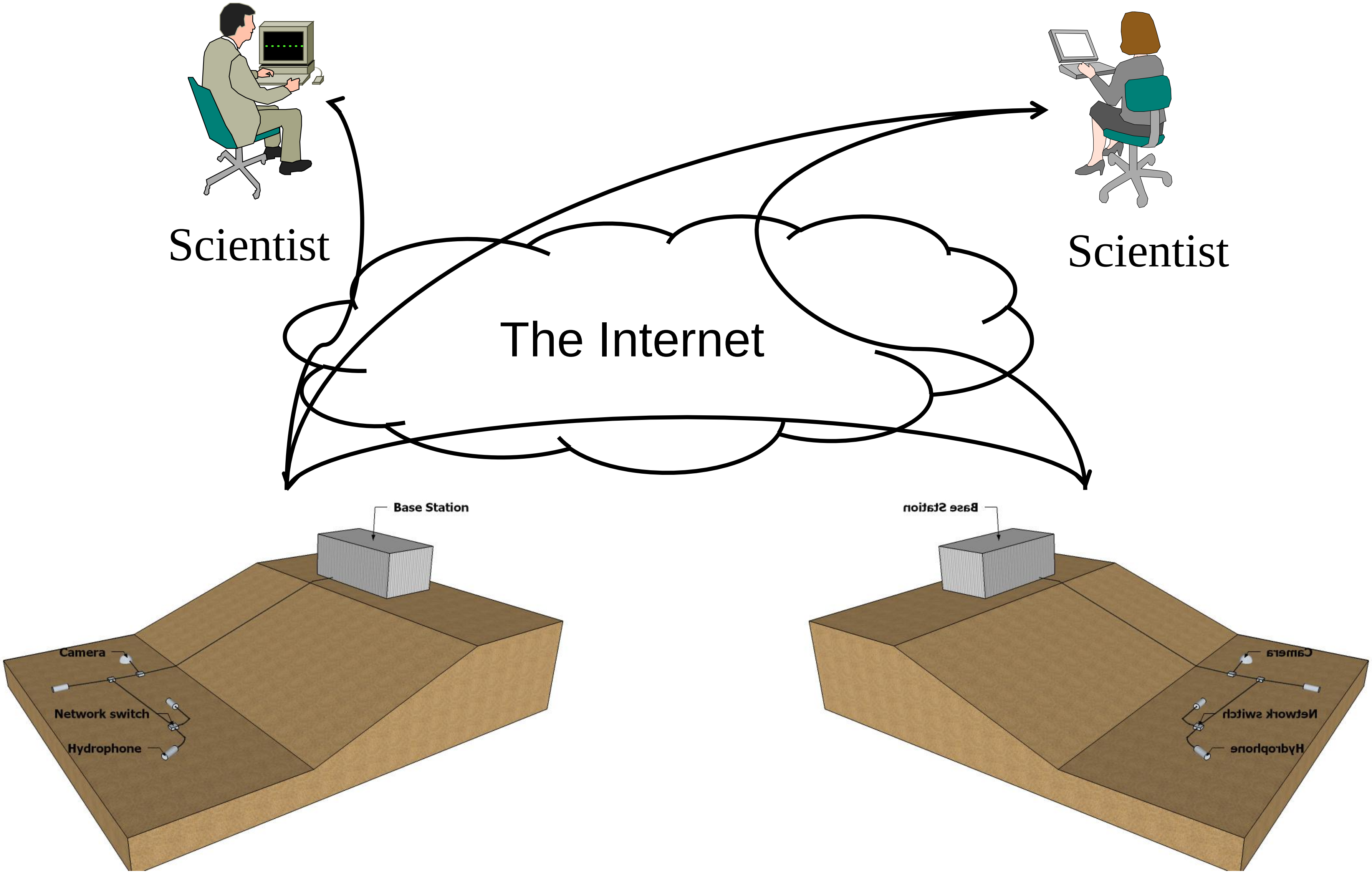
Seafloor Observatory

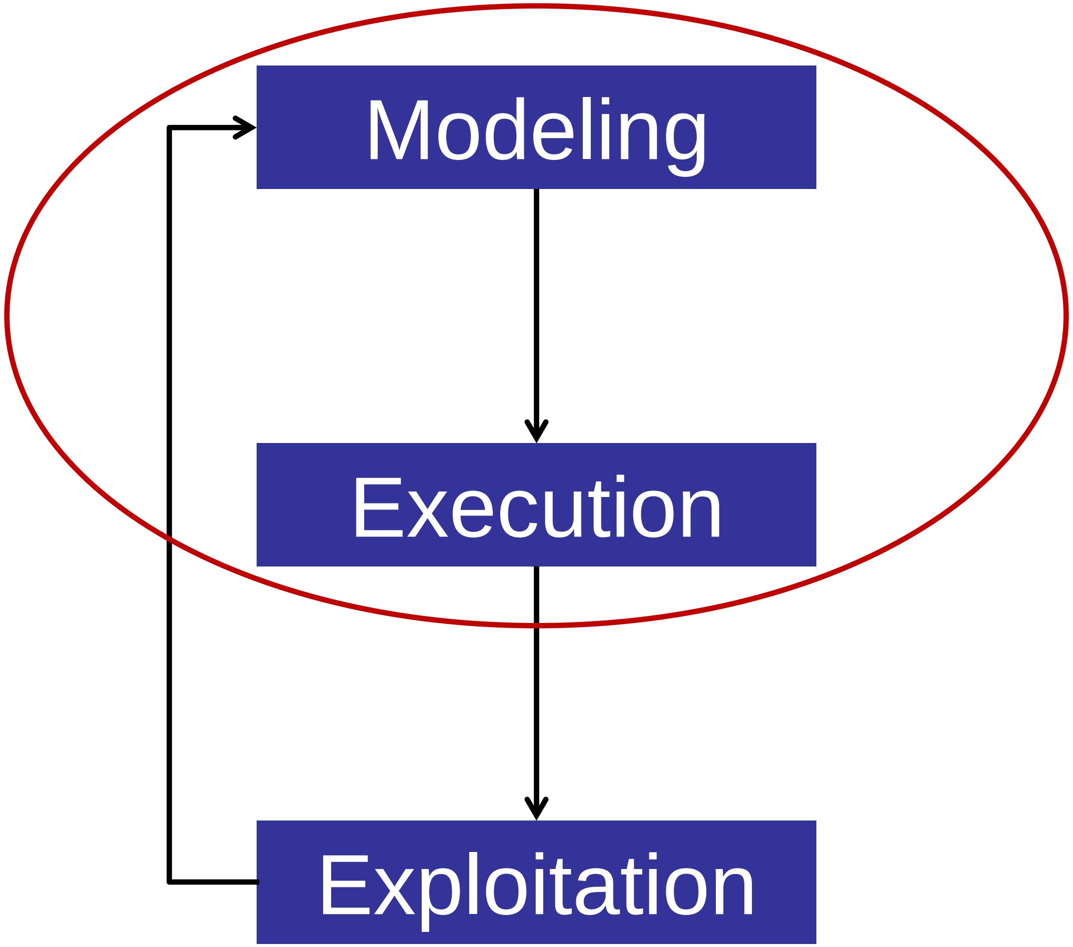


Scientist

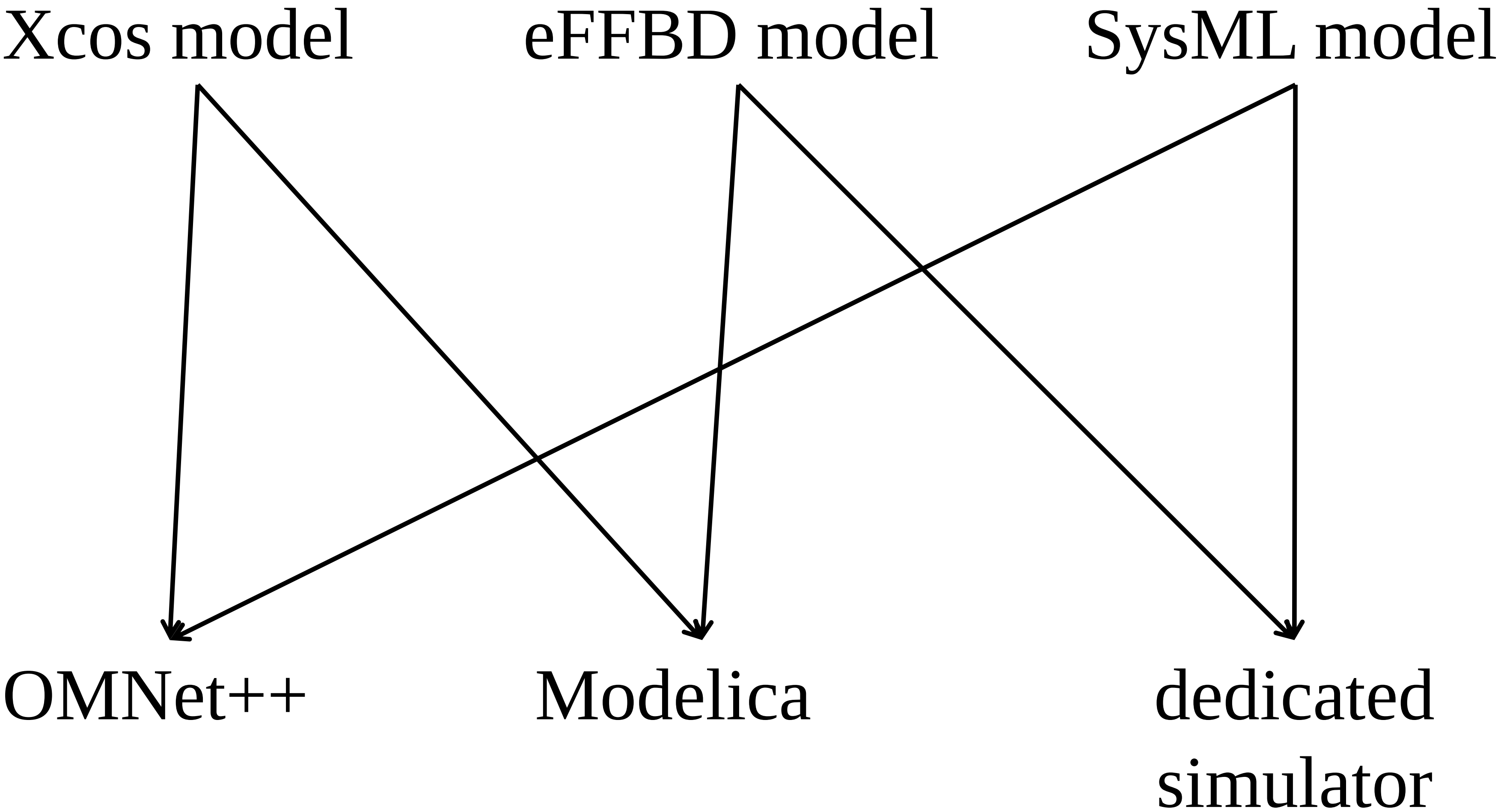
Scientist

The Internet

Simulation Process



From Model To Simulation



Xcos model

eFFBD model

SysML model

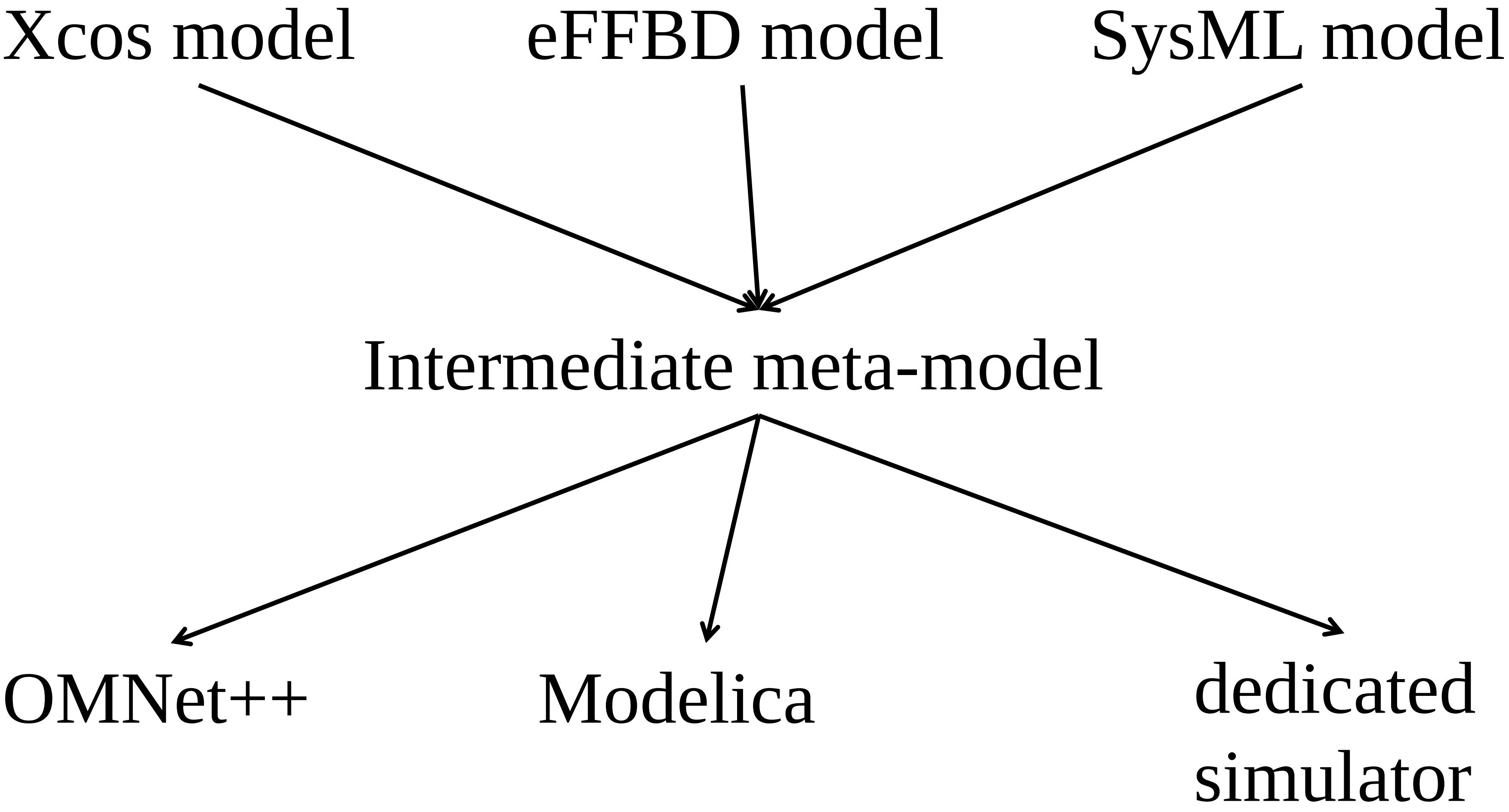
OMNet++

Modelica

dedicated simulator

Adaptation and extensibility

Through an Intermediate Representation



Xcos model

eFFBD model

SysML model

Intermediate meta-model

OMNet++

Modelica

dedicated simulator

Challenges

- How to combine several models independently from the input order?

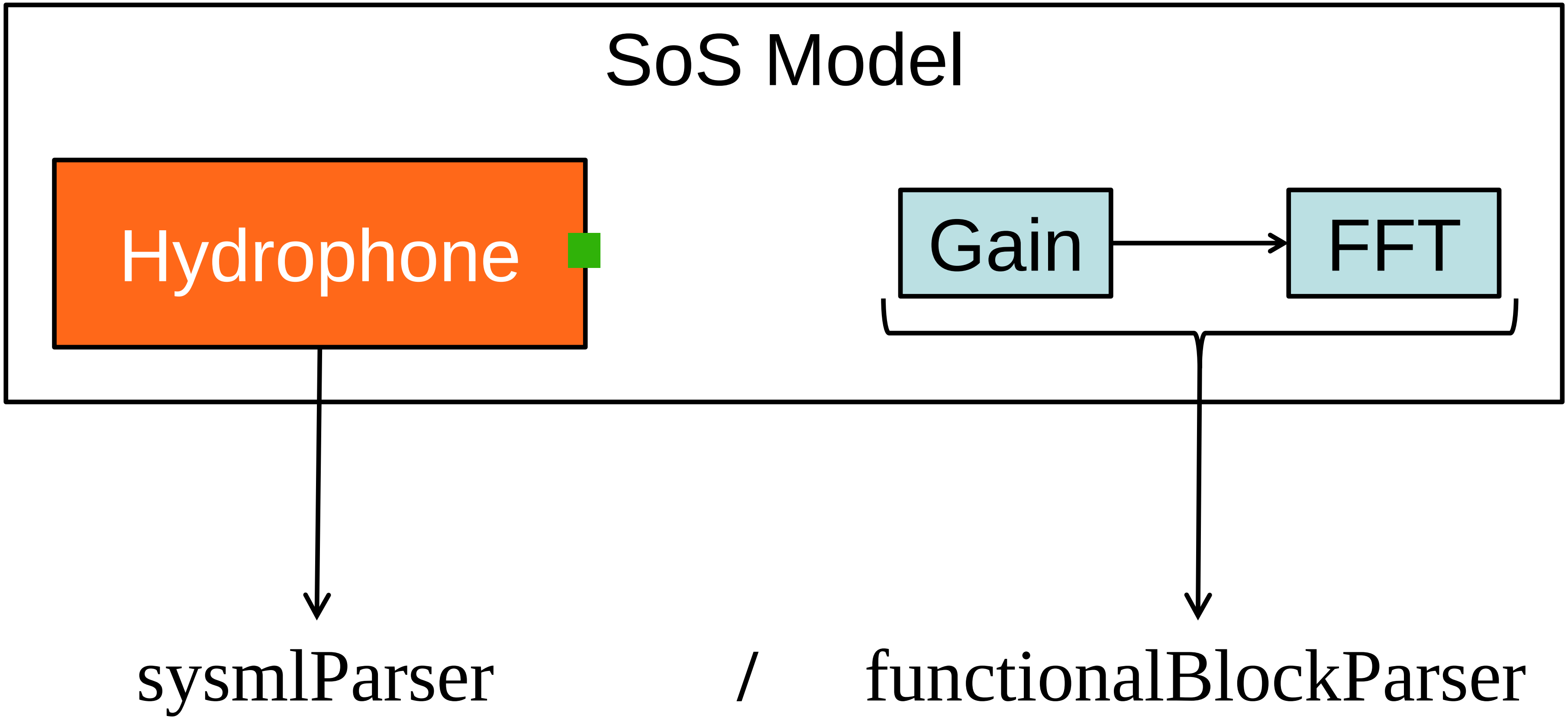
- How to extend tooling to support evolving input and output formalisms?

Parser Combinators

- **1 formalism = 1 model analyzer = 1 parser**
- **PetitParser (Grammar and Parser as Objects):**
  - ➔Associating one predicate (syntactic condition) with multiple actions.
  - ➔Using combinator operators such as sequence, choice or ordered choice.

How to use parser combinators in SoS modeling?

Combine Formalism Specific Parsers



SoS Model

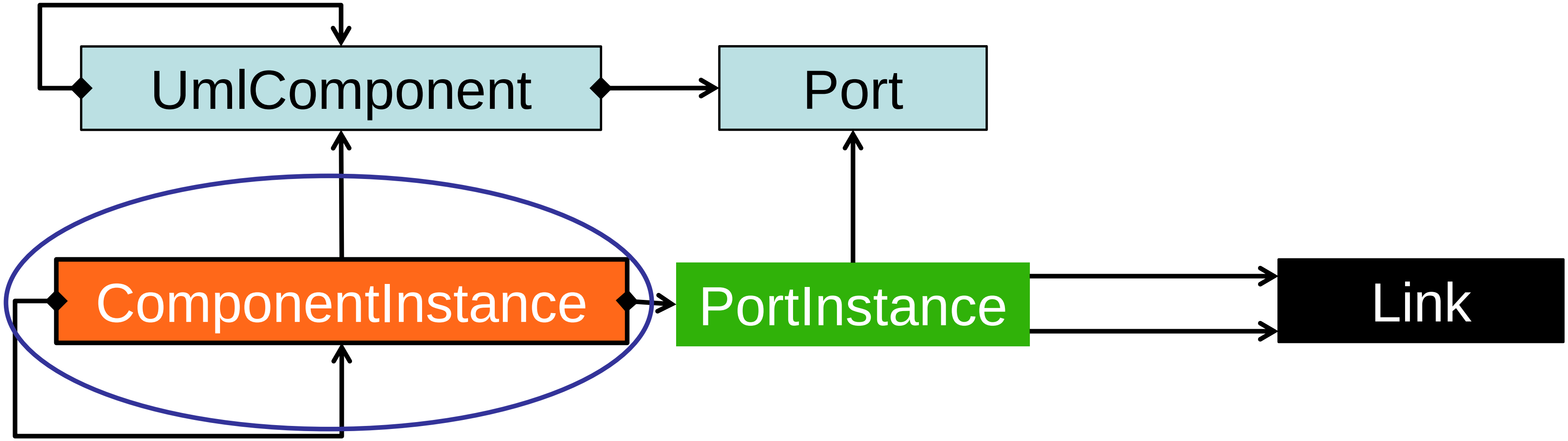
Hydrophone

Gain

FFT

sysmlParser / functionalBlockParser

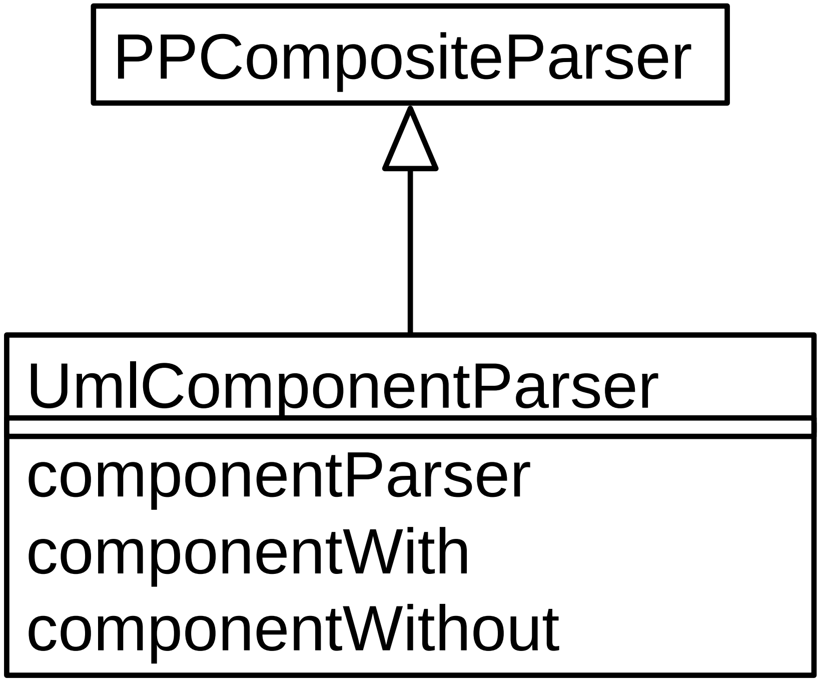
Combine Context-Specific Parsers



Distinguish cases:

- components with subcomponents
- components without subcomponents

Writing Parsers



PPCompositeParser

UmlComponentParser

componentParser
componentWith
componentWithout

Writing parsers

- **componentWith**

  Predicate

  ```
  ^[:instance | instance isComponent and: [instance
  hasSubcomponents]] asPredicateParser.
  ```

  Parser

- **componentWithout**

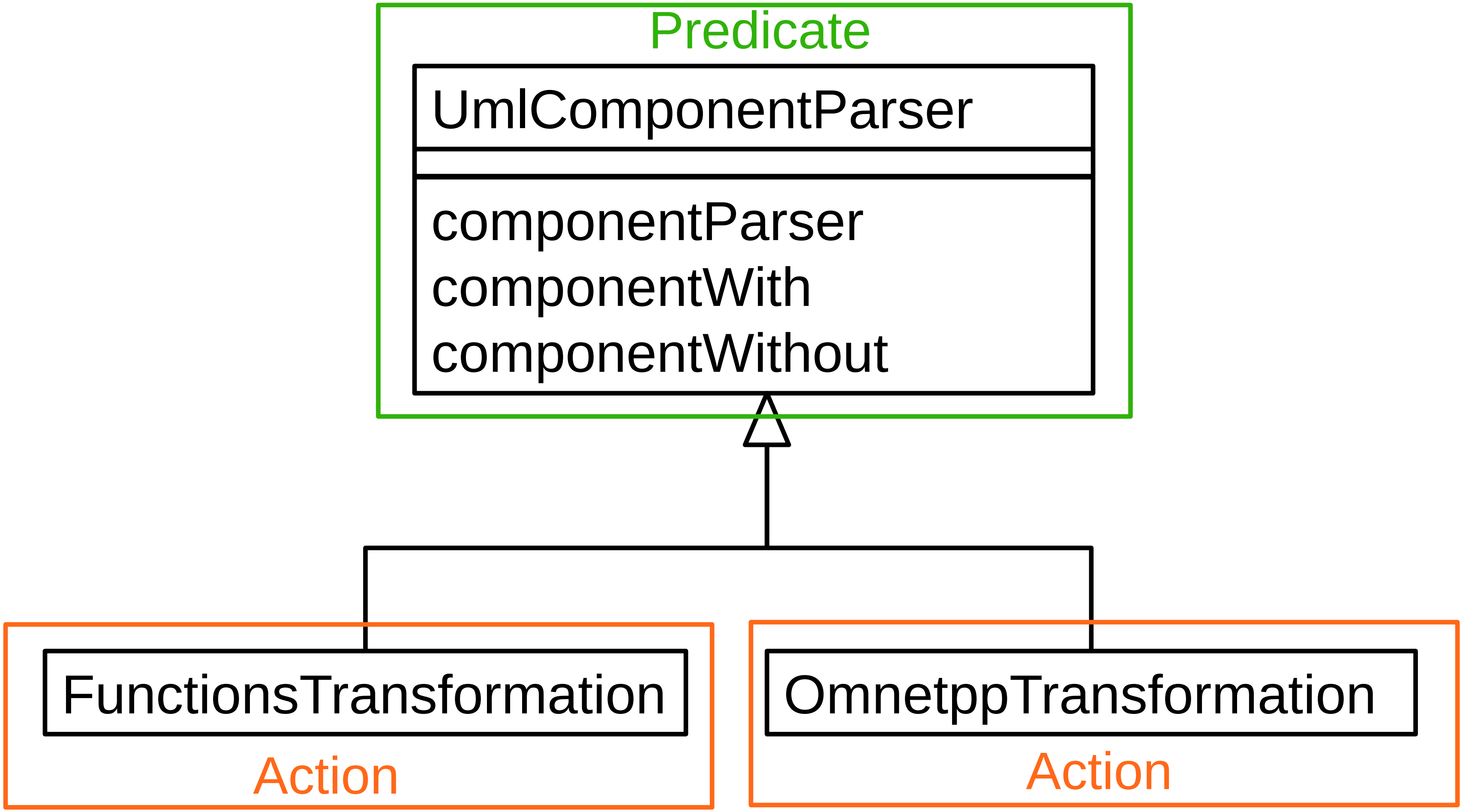
  ```
  ^[:instance | instance isComponent and: [instance
  hasSubcomponents not]] asPredicateParser.
  ```

- **componentParser**

  ```
  ^(componentWith / componentWithout).
  ```

  Composition

Associating Predicate and Actions



Parameterize parsing according to desired transformation action

Associating Predicate and Actions

- **FunctionsTransformation>>componentWith**

Predicate

```
^super componentWith ifTrueDo: [:instance |
    LogicalFunctionGroup from: instance].
```

Action

- **OmnetppTransformation>>componentWith**

```
^super componentWith ifTrueDo: [:instance |
    OmnettppComposite from: instance].
```

Conclusion

- **SoS design and analyzes need adaptative and extensible modeling tooling.**

- **Parser combinators provide an efficient support based on:**
  - Several output formalisms → one predicate / n-actions
  - Several input formalisms → Combinator operators.

- **Approach to be extended to an industrial use case.**

Thank you for your attention