Integrate BPMN and Archimate Models using SpecIF

TdSE 2021

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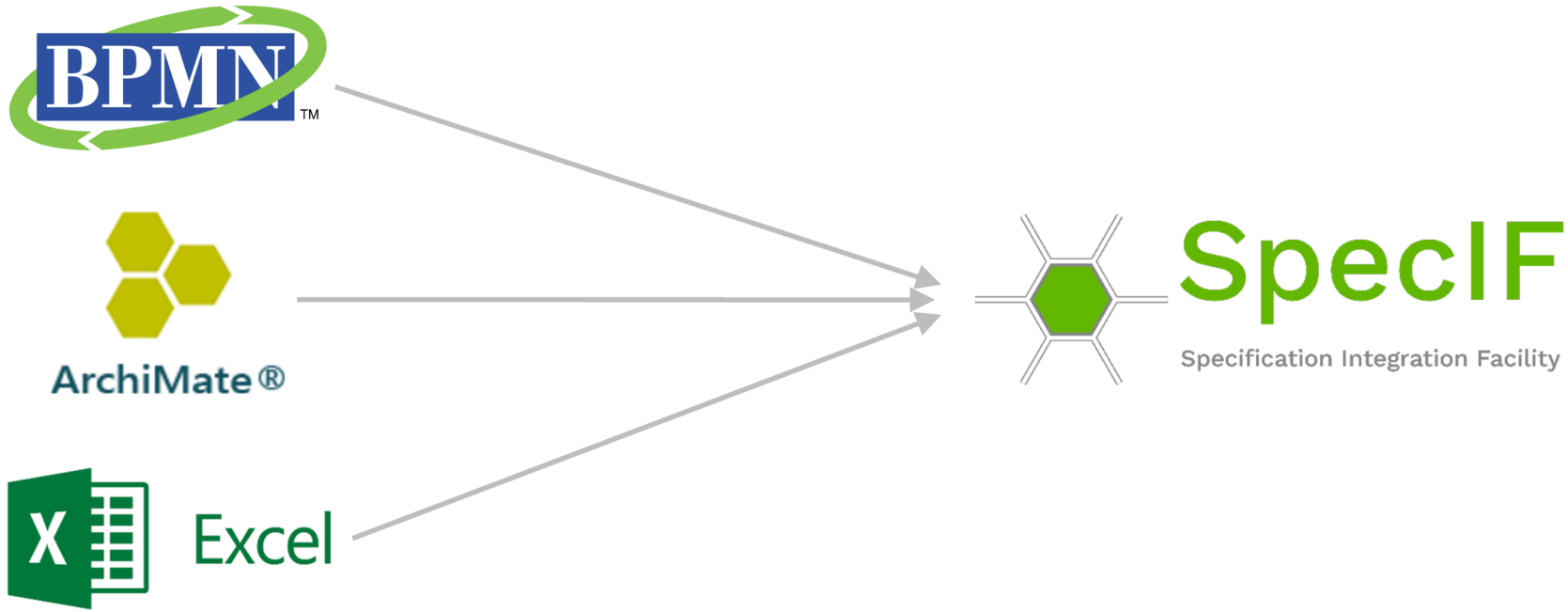
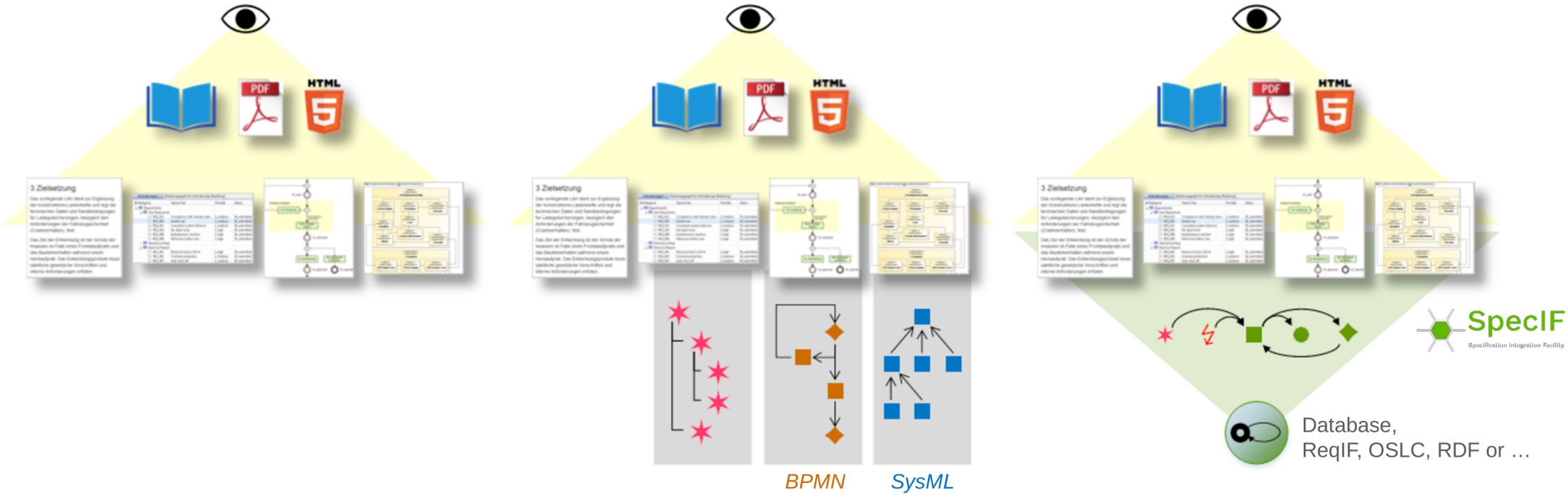


Basic Assumptions

- There will be always specialized tools for different purposes
- It is unwise to require collaborators to use certain tools or even a single tool
- Yet, there is an interest
  - to navigate, search and audit partial results in a *common context*
  - to exchange model information between organizations and tools

→ That‘s where SpecIF kicks in: Specification Integration Facility

The eye sees the same – behind the surface it gets interesting



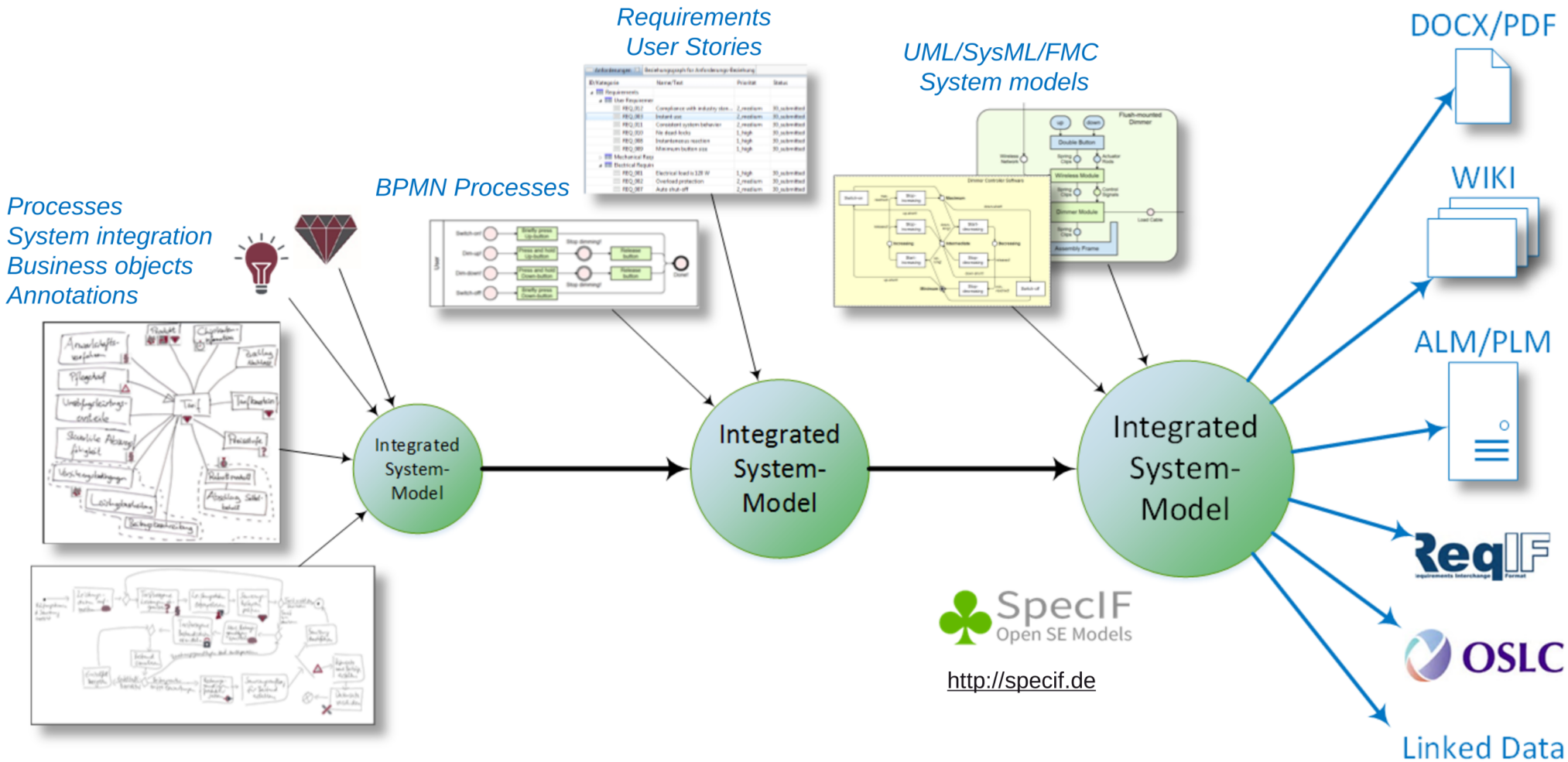
Creating the „Visible“ → Partial Modelling → Model Integration

- Text editing and image „drawing“
- Needs brain and discipline to build and keep consistent

- Text editing and modelling per method
- Tool support within the methods

- Text editing and modelling per method
- Elements in all views are interrelated by a semantic net

Add partial models step-by-step ...



Five Principles of Model Integration

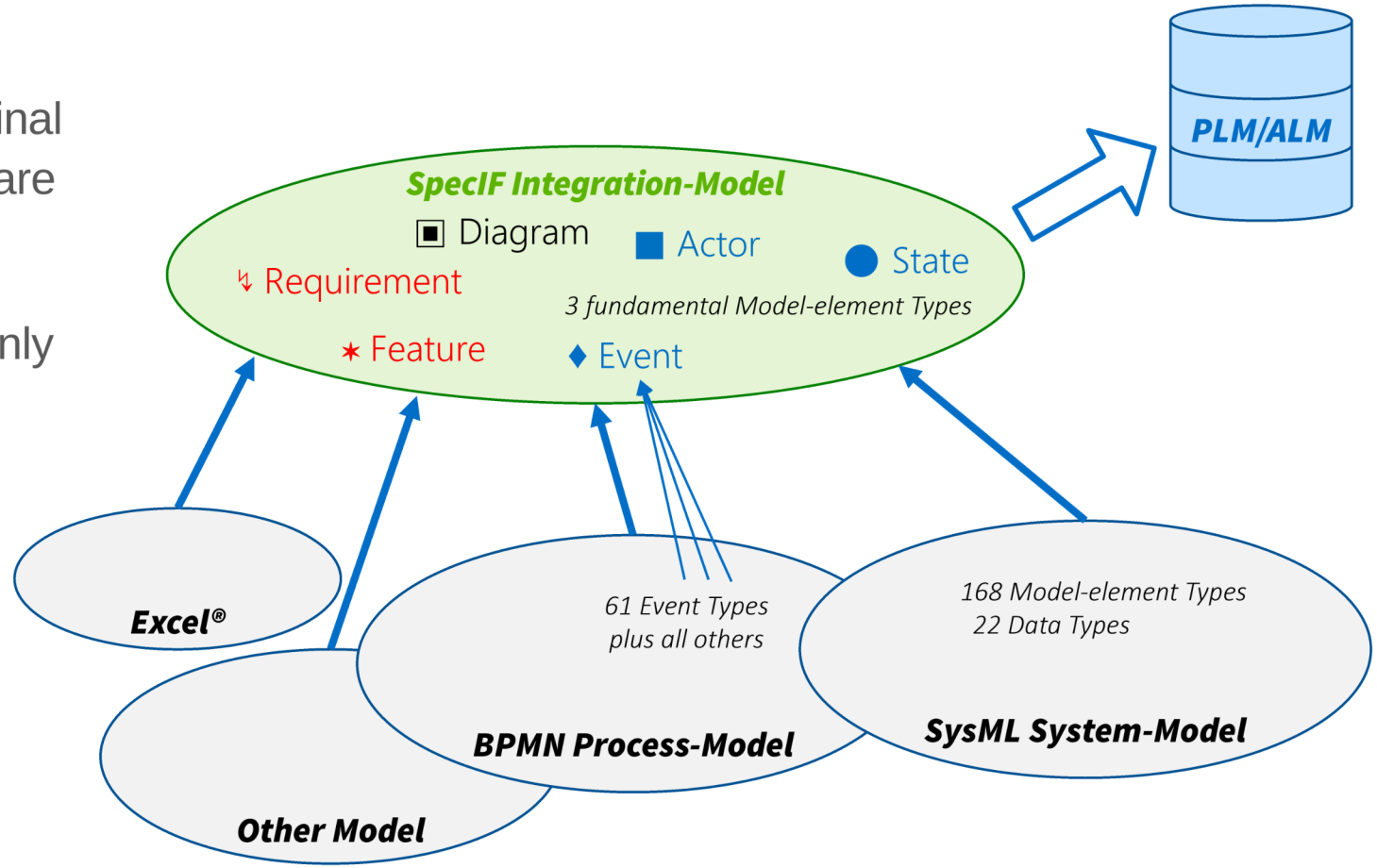
1. Separate View and Model
2. Abstract Model Element Types
3. Use a Vocabulary
4. Share Model Elements between Views
5. Interrelate Model Elements to build a semantic net

Find a Useful Abstraction Level

- Model-Integration: Cannot match original model-element types, because there are too many.
- Configuration Management: Should only handle a few artefact types.

→ Map to 3 fundamental model-element types ■ Actor, ● State and ♦ Event being common to *all* notations.

(see Fundamental Modelling Concepts by S.Wendt)



Use a Vocabulary

- Add meaning to terms
- Agree on terms and meaning
- Meaning is conveyed with the terms
- Can be translated to
  - national languages
  - special terminology in a given field

→ Use and contribute to the SpecIF System Engineering Vocabulary

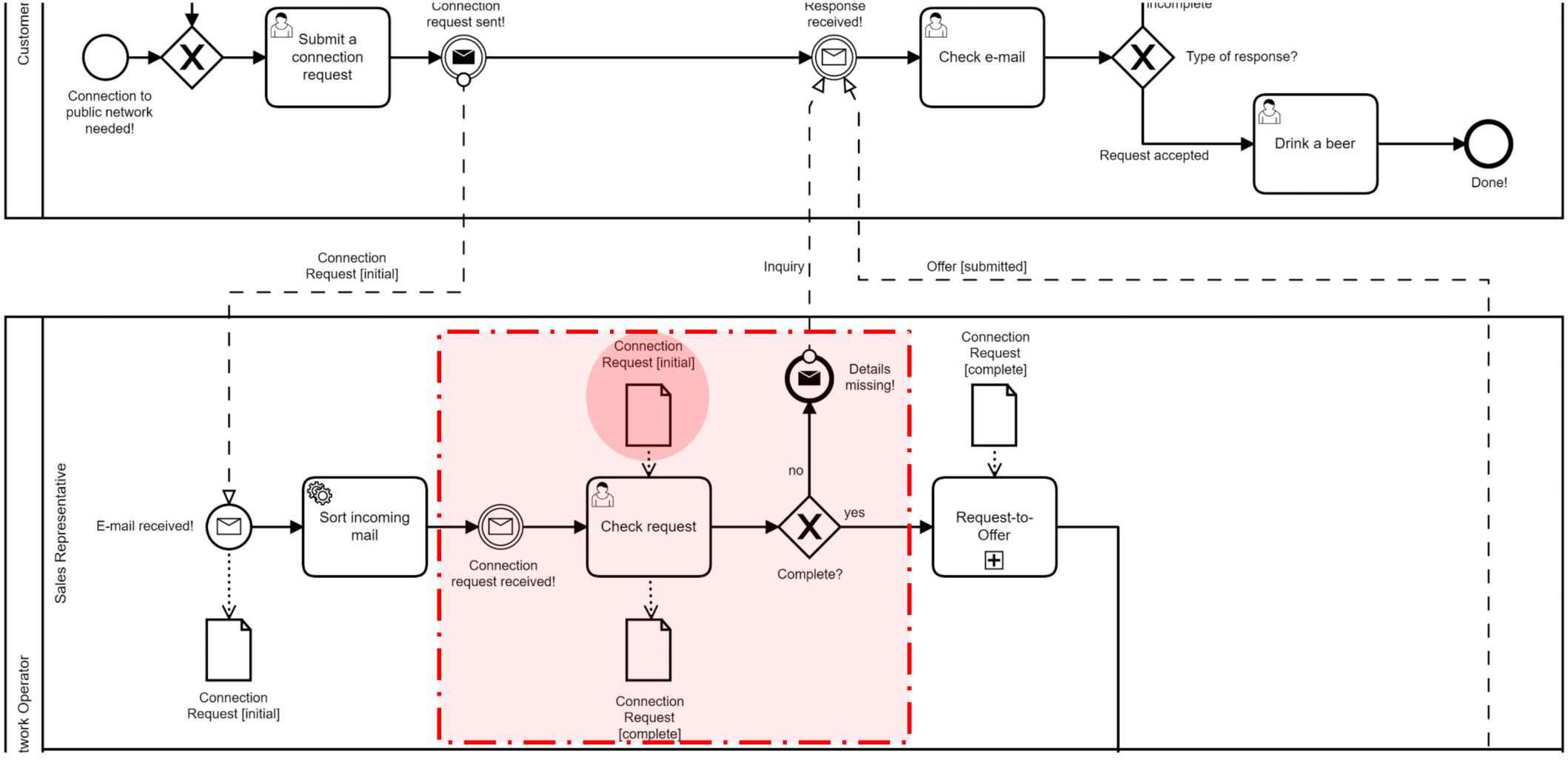
Resource Class Names
- FMC:Actor
- IREB:Requirement

Statement Class Names
- IREB:satisfiedBy
- oslc_rm:refinedBy

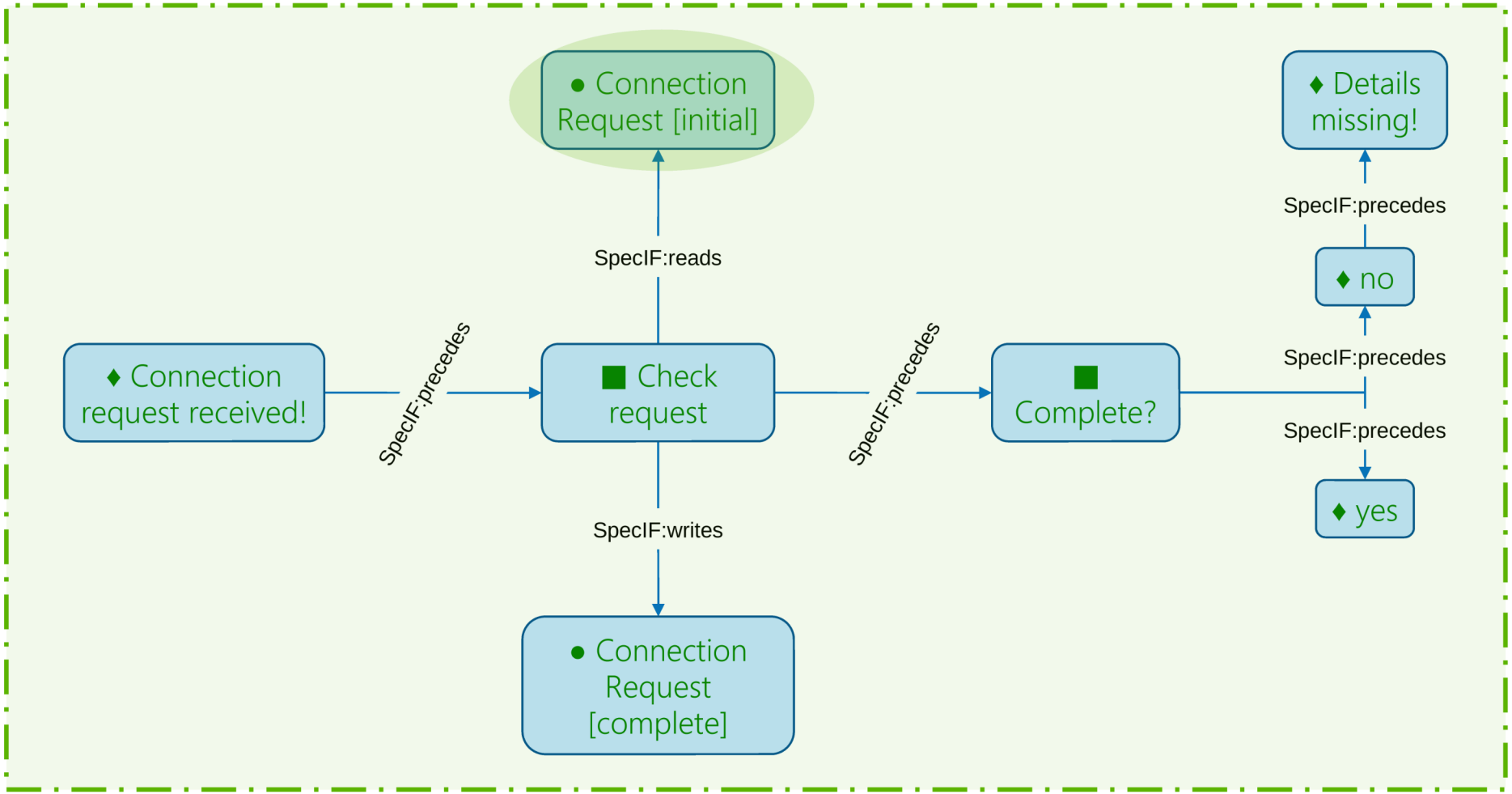
Property Names
- dcterms:title
- SpecIF:Priority

Property Values
- SpecIF:priorityHigh

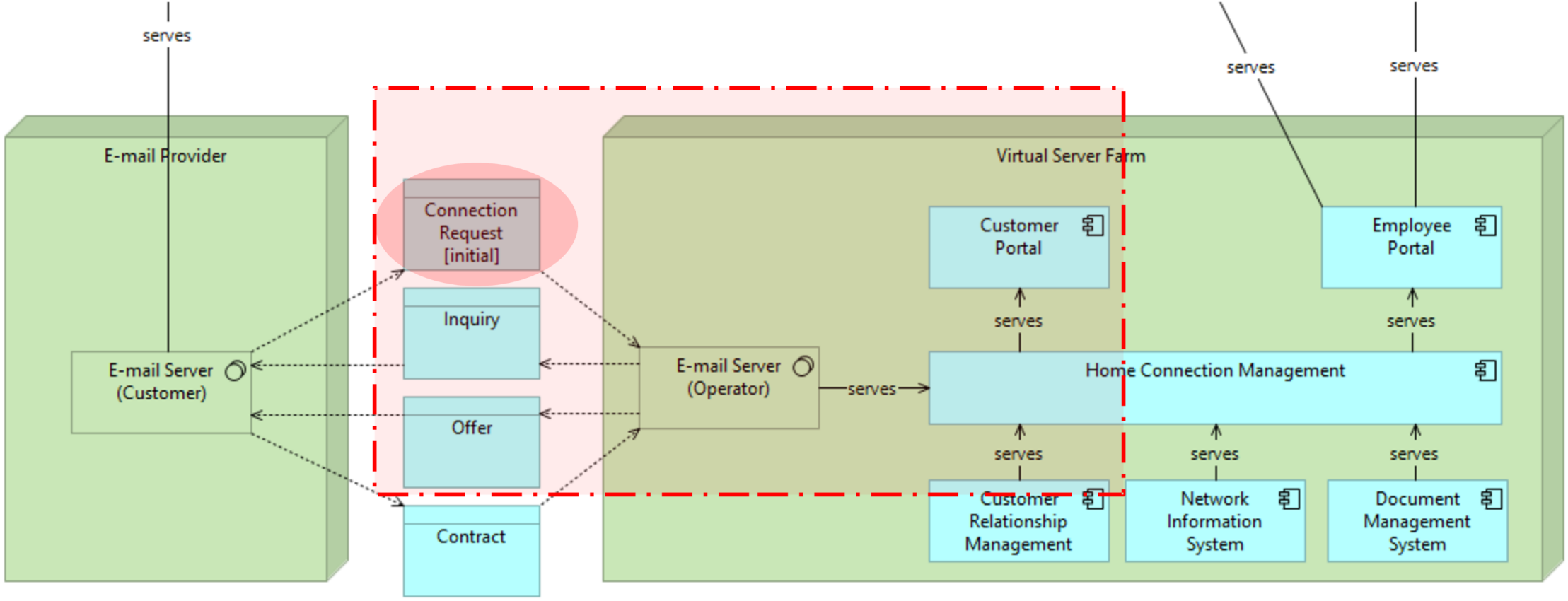
Telephone Connection Request – Business Process (BPMN)



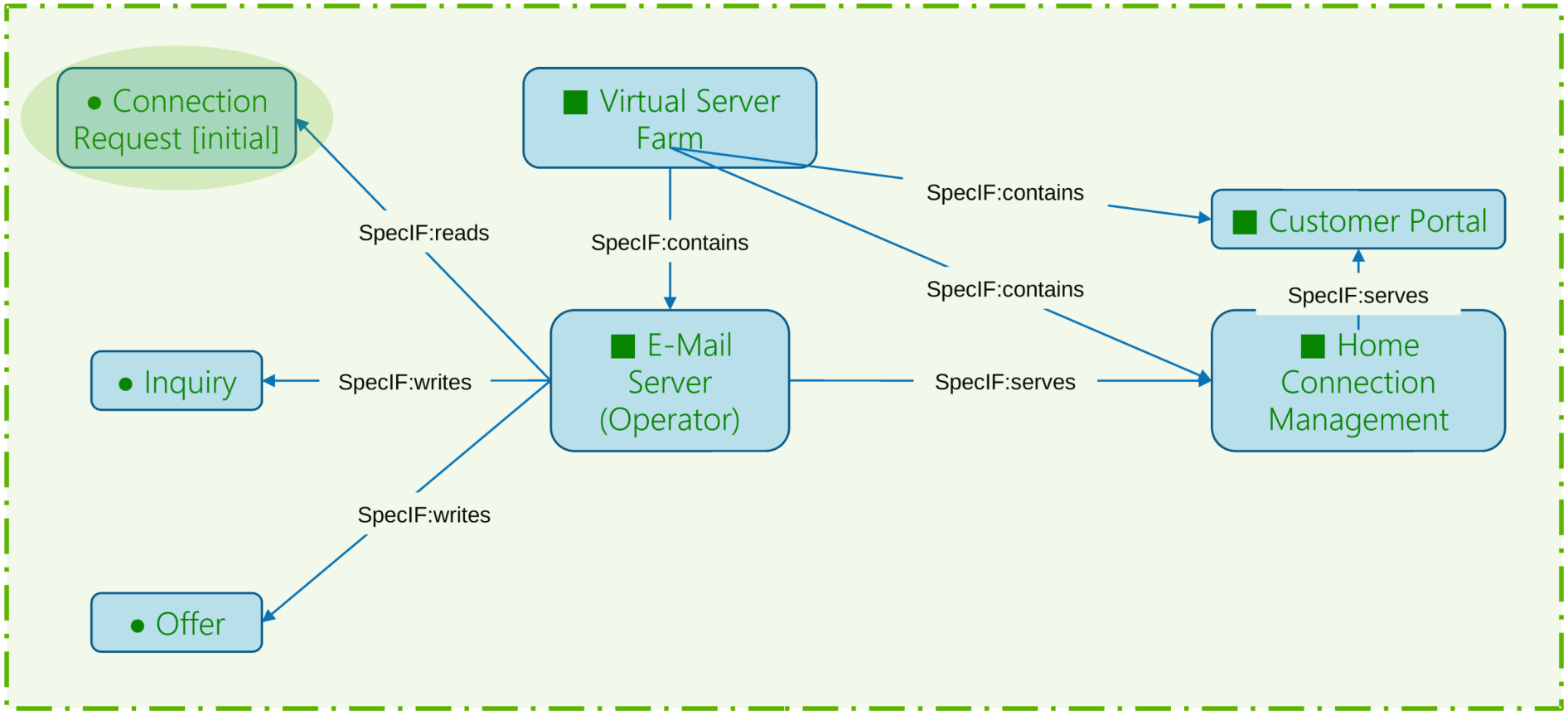
BPMN → SpecIF Transformation



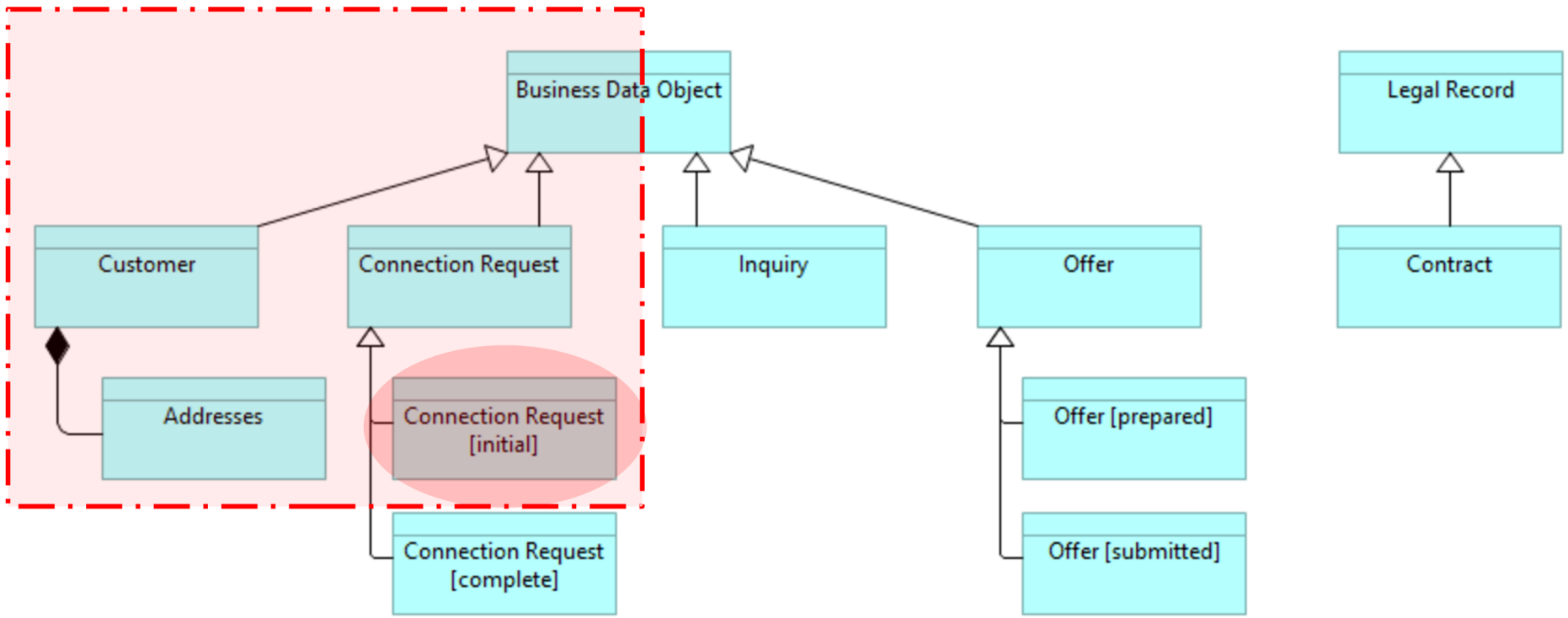
Telephone Connection Request – Application Landscape (Archimate)



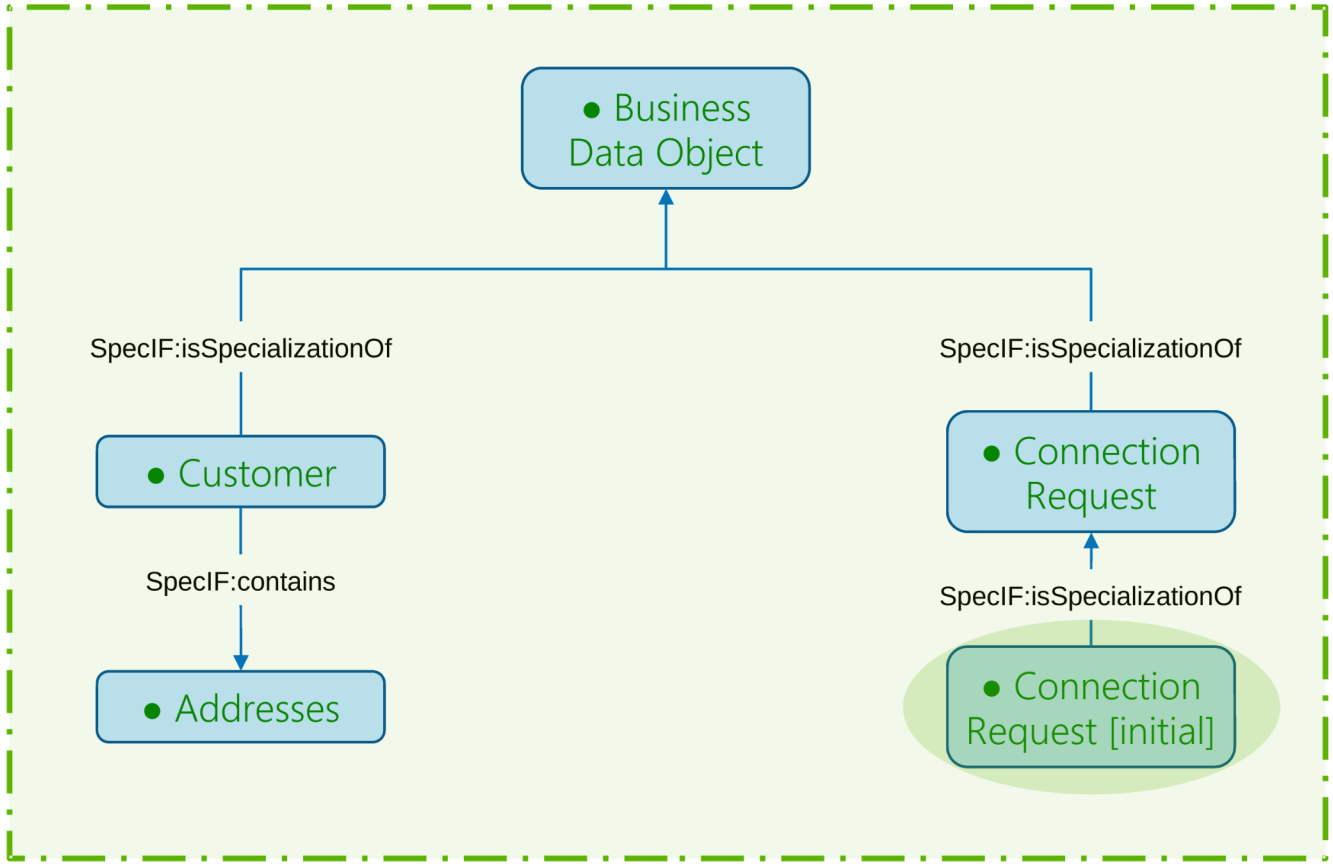
Archimate → SpecIF Transformation



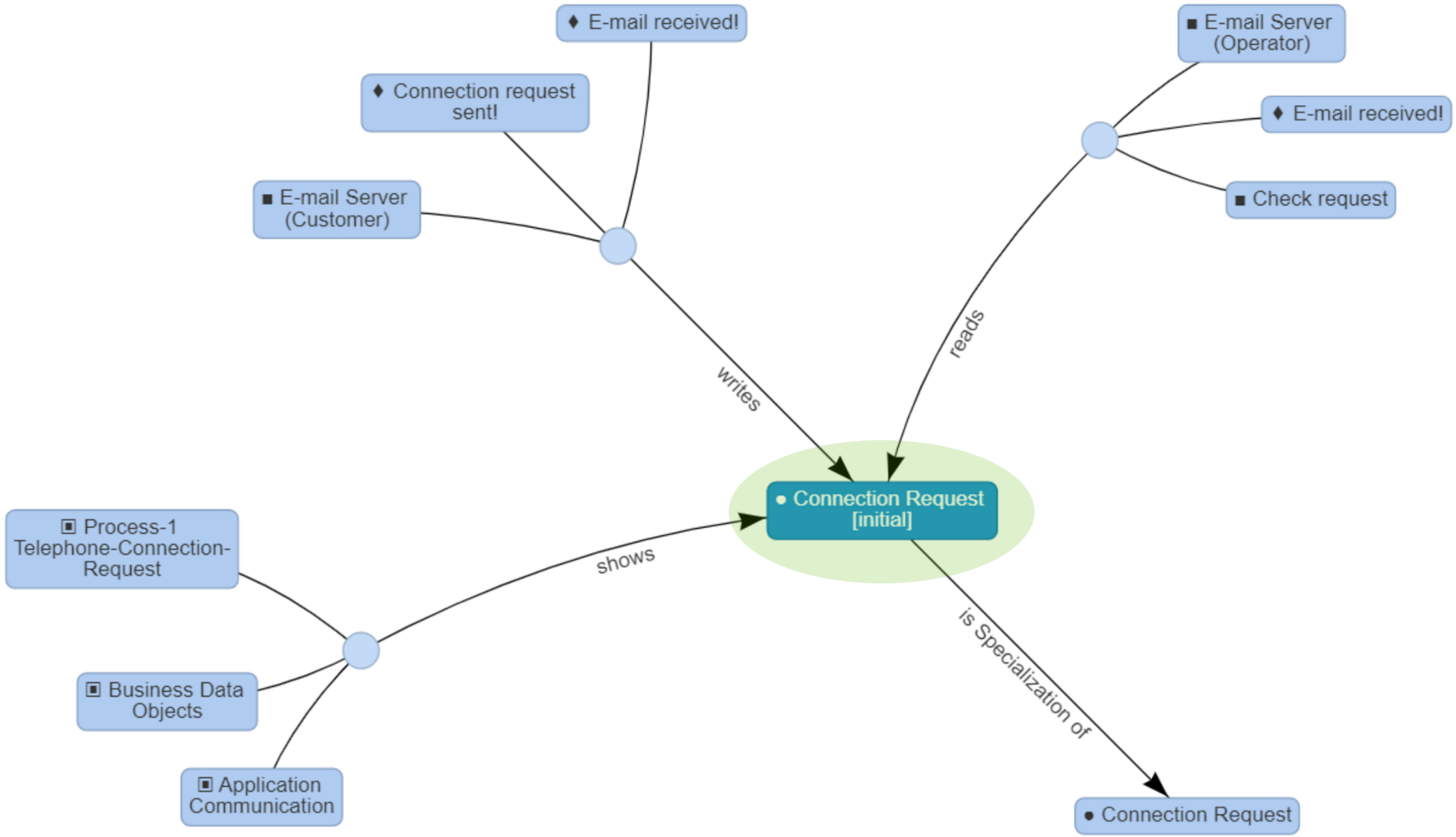
Telephone Connection Request – Class Diagram (Archimate, UML, ..)



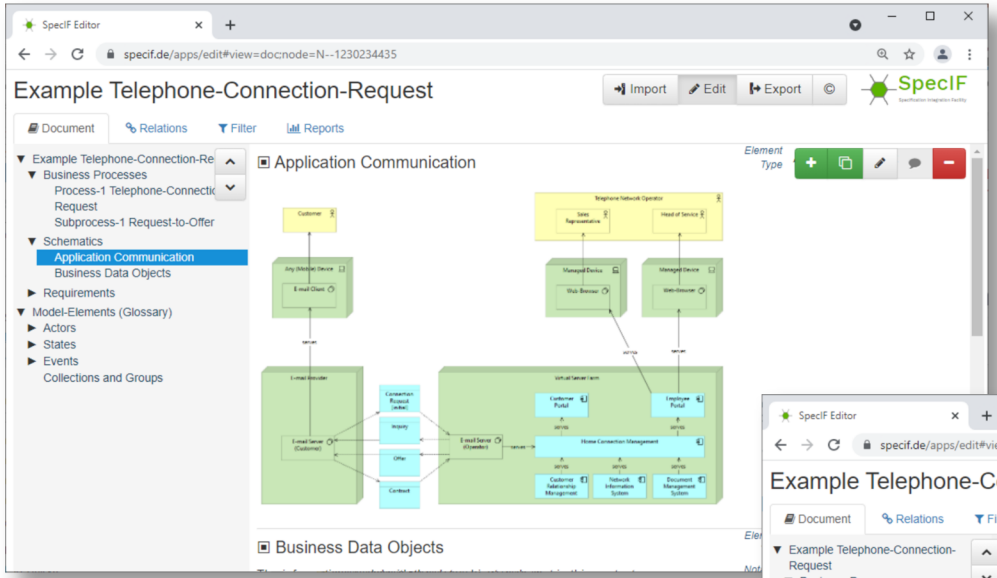
Class Diagram → SpecIF Transformation



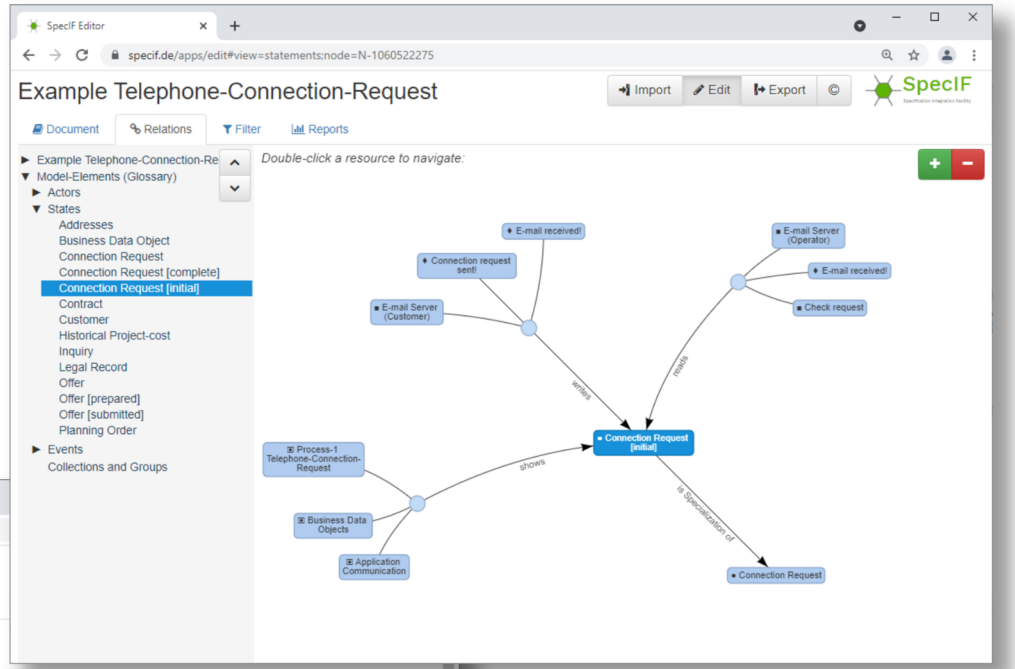
All relations combined → Semantics of a Model-Element



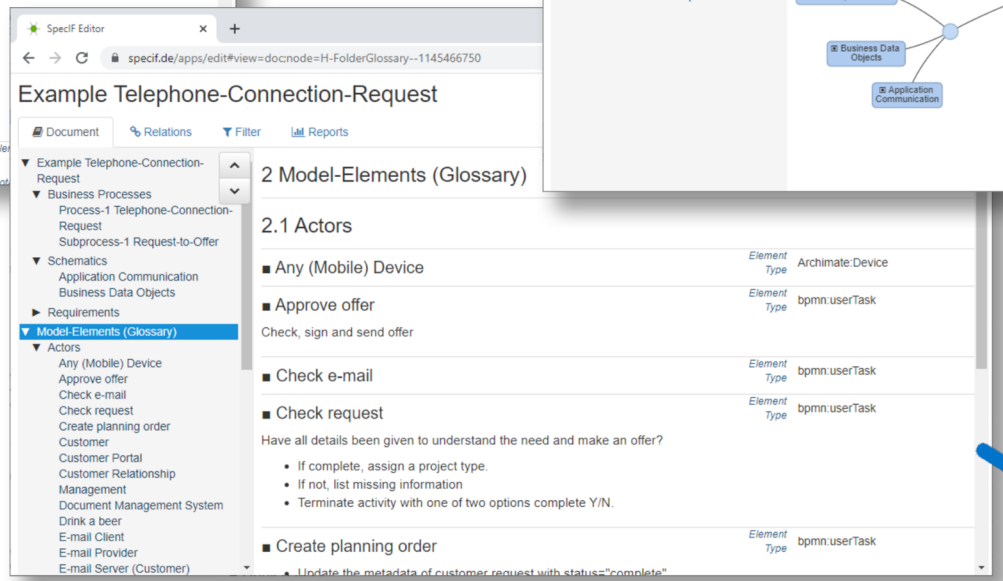
Navigate, search and audit in a common context



All Model-diagrams



All Relations



All Model-elements

SpecIF Goals and Benefits

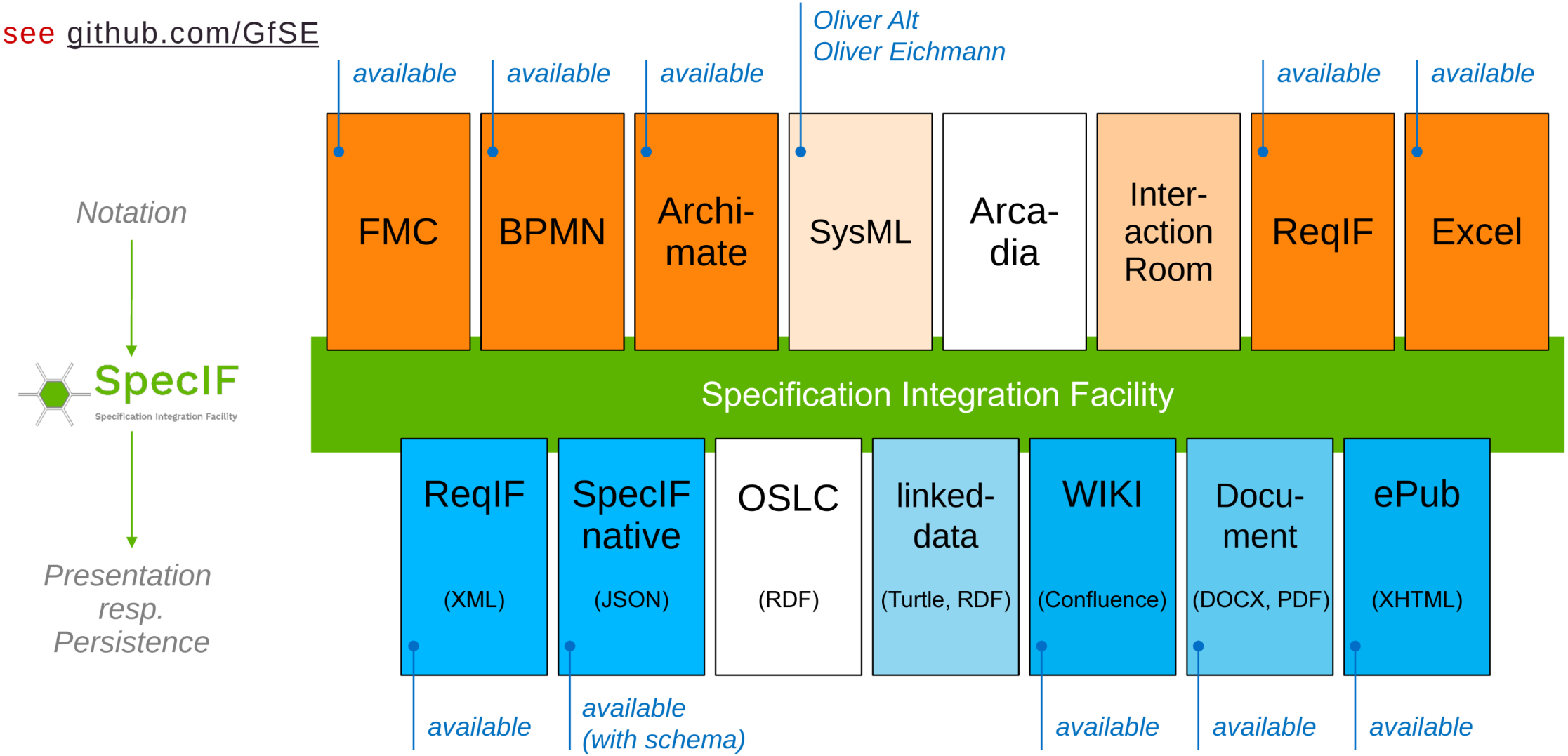
- Exchange model-based specifications between organizations and tools.
- Combine texts and models from different tools.
- Navigate, search and audit in a common context.
- Manage the product lifecycle from birth to death („end-to-end“):
  - Reference for all engineering-disciplines
  - Combining methods
  - Technology-neutral
  - Vendor-neutral
  - Schema-conforming
  - Standard-conforming
  - Open and cooperative

What is different ?

1. SpecIF builds on known notations and technical formats; doesn‘t replace any.
2. Conveys meaning through defined vocabulary and simple predicate logic.
3. SpecIF works because it uses *few* fundamental model-element types.
4. SpecIF is a semantic net („graph-data“) with typed nodes and edges.
5. Graph data is highly scalable – searching is ultra-fast.
6. Dynamic data-model – strict meta-model with schema and constraint checker.
7. Users drive open-source development – don‘t expect product vendors to invest; time-to-production 7 years → 1 year.

Status ...

see github.com/GfSE



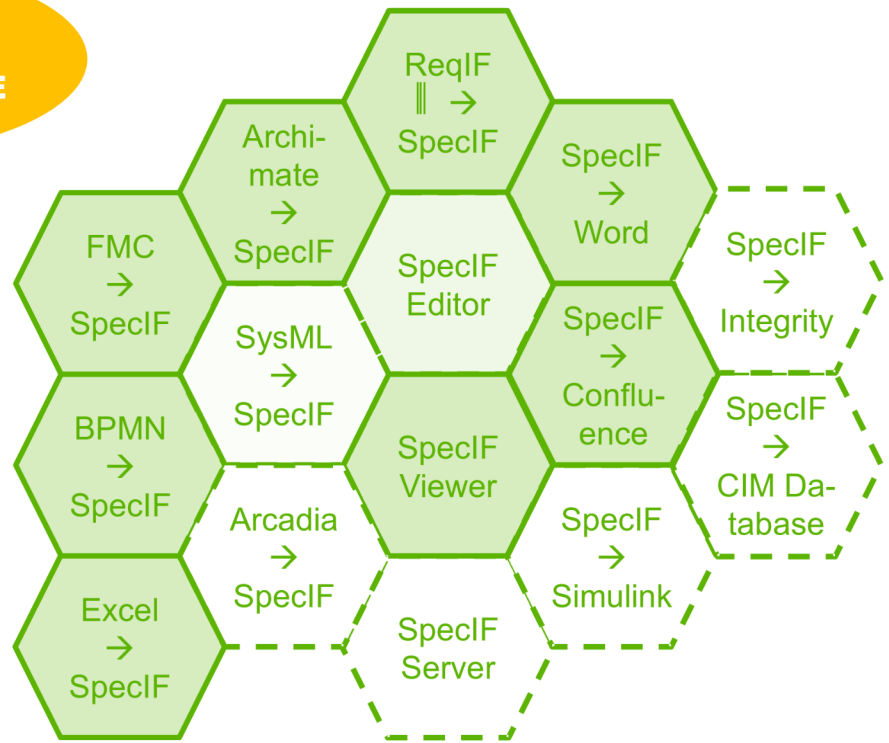
Activities

prostep ivip SysML Workflow Forum

BMBF Forschung (beantragt)

GfSE AG PLM4MBSE

GfSE PG SysML Industrialization



Development of Prototypes and Reference Solutions

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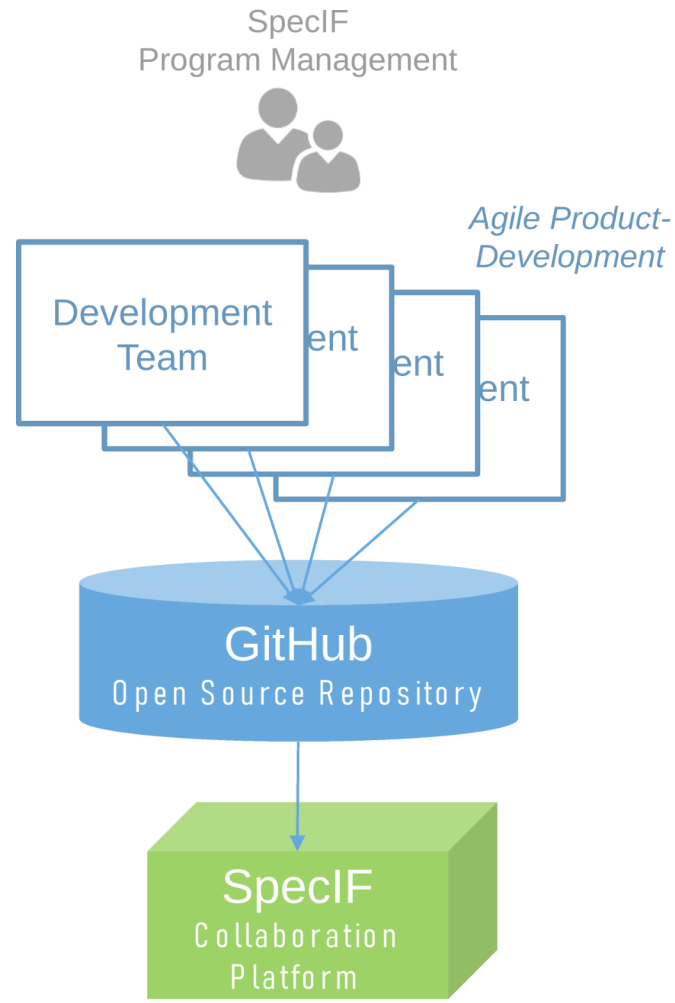
FKS Institut für Flugzeug-Kabinensysteme

Plan



Resources

- SpecIF Home
- SpecIF Schema and Tools on GitHub (Open Source, Apache License)
  → Use the GitHub Ticket System for questions, proposals and requests
- Hosted SpecIF Schema and Consistency-check (CORS-enabled, watch for new releases)
- SpecIF Viewer und Editor
- Examples:
  - Telephone Connection Request (Notation BPMN+Archimate+XSLX)
  - System Engineering Collaboration (Notation Archimate)
  - Dimmer (Notation FMC)
  - Small Autonomous Vehicle (Notation: SysML)
- SpecIF Vocabulary

Literature

[1] Wendt, S.: Ein grundlegender Begriffsrahmen für das Wissensmanagement im Software-Engineering. In Proceedings „Knowtech“ Dresden 2001.

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[3] Kaufmann, U., Pfenning, M.: 10 Theses about MBSE and PLM.

[4] Object Management Group: Systems Modeling Language (OMG SysML™), Version 1.3, June 2012.

[5] Object Management Group: Requirements Interchange Format (ReqIF).

[6] Open Services for Lifecycle Collaboration (OSLC).

[7] Specification Integration Facility (SpecIF).

[8] Dungern, O.v.: Semantic Model-Integration for System Specification – Meaningful, Consistent and Viable, 7.Grazer Symposium Virtuelles Fahrzeug, Graz, Mai 2014.

[9] Dungern, O.v.: Integration von Systemmodellen mit fünf fundamentalen Elementtypen. TdSE Tag des Systems Engineering der GfSE, Ulm, November 2015.

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[12] Uphoff, F.: Konzept und prototypische Implementierung der Modellintegration der Interaction-Room-Methode in die Specification Integration Facility, Kamp-Lintfort, März 2017.

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[14] Alt, O.: SpecIF - Die kommende vielschichtige Datenquelle für Spezifikationsdaten. Fachgruppentreffen GI-RE, Nürnberg, November 2018.

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Interessant ?

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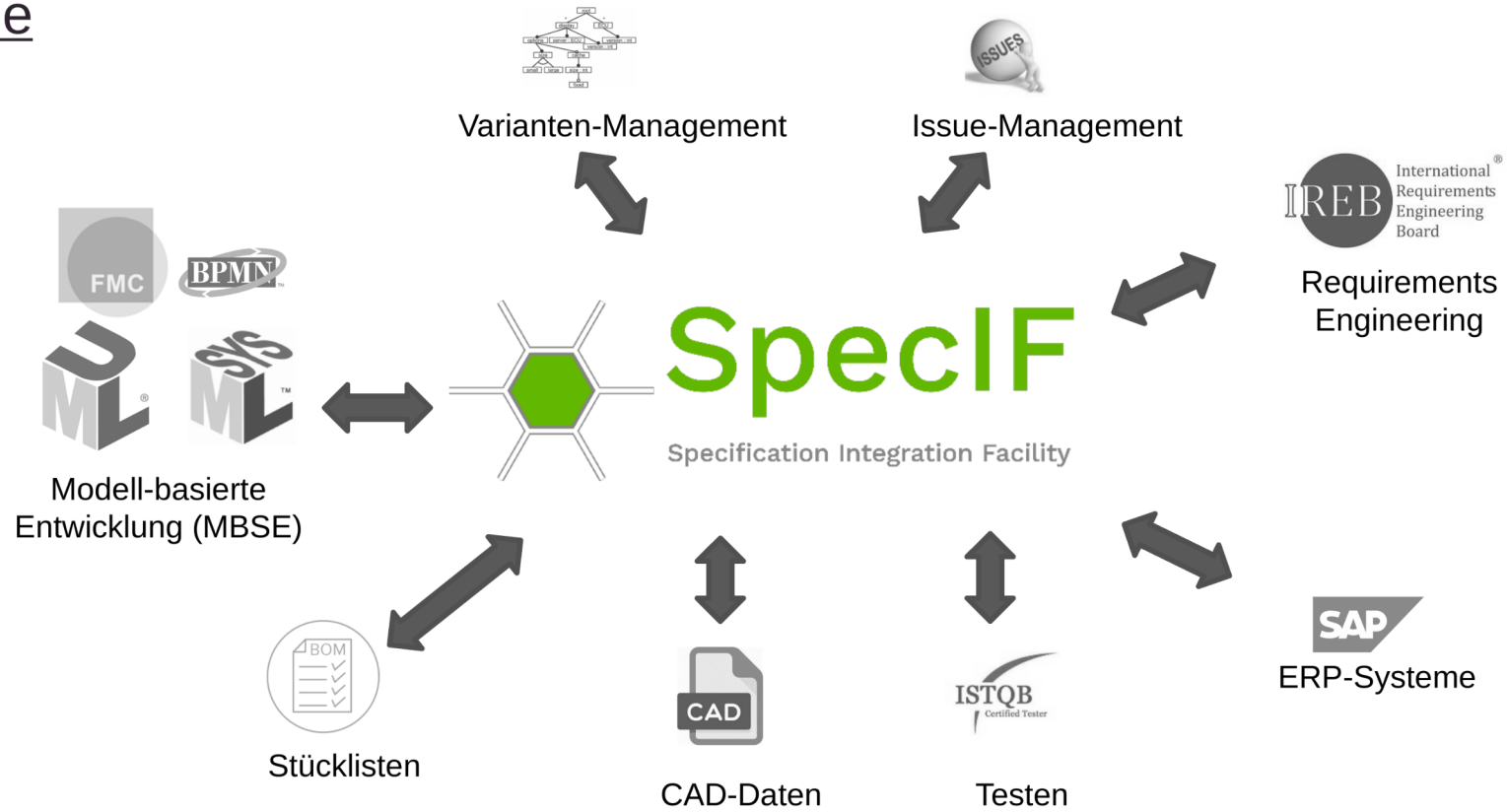


Details for further discussion

What is SpecIF ?

- „**Spec**ification **I**ntegration **F**acility“, a GfSE initiative

- SpecIF adds **conventions to convey meaning**
  using known technical formats such as ReqIF or OSLC.

  1. Vocabulary for Objects,
     Relations and Attributes

     „Requirement“, „Actor“, „State“, „Event“ …
     „satisfies“, „reads“, „contains“, „triggers“, …

  2. Logic Assertions
     („First-order predicate logic“)

     „A Component *satisfies* a Requirement“
     „An Event *triggers* an Activity“

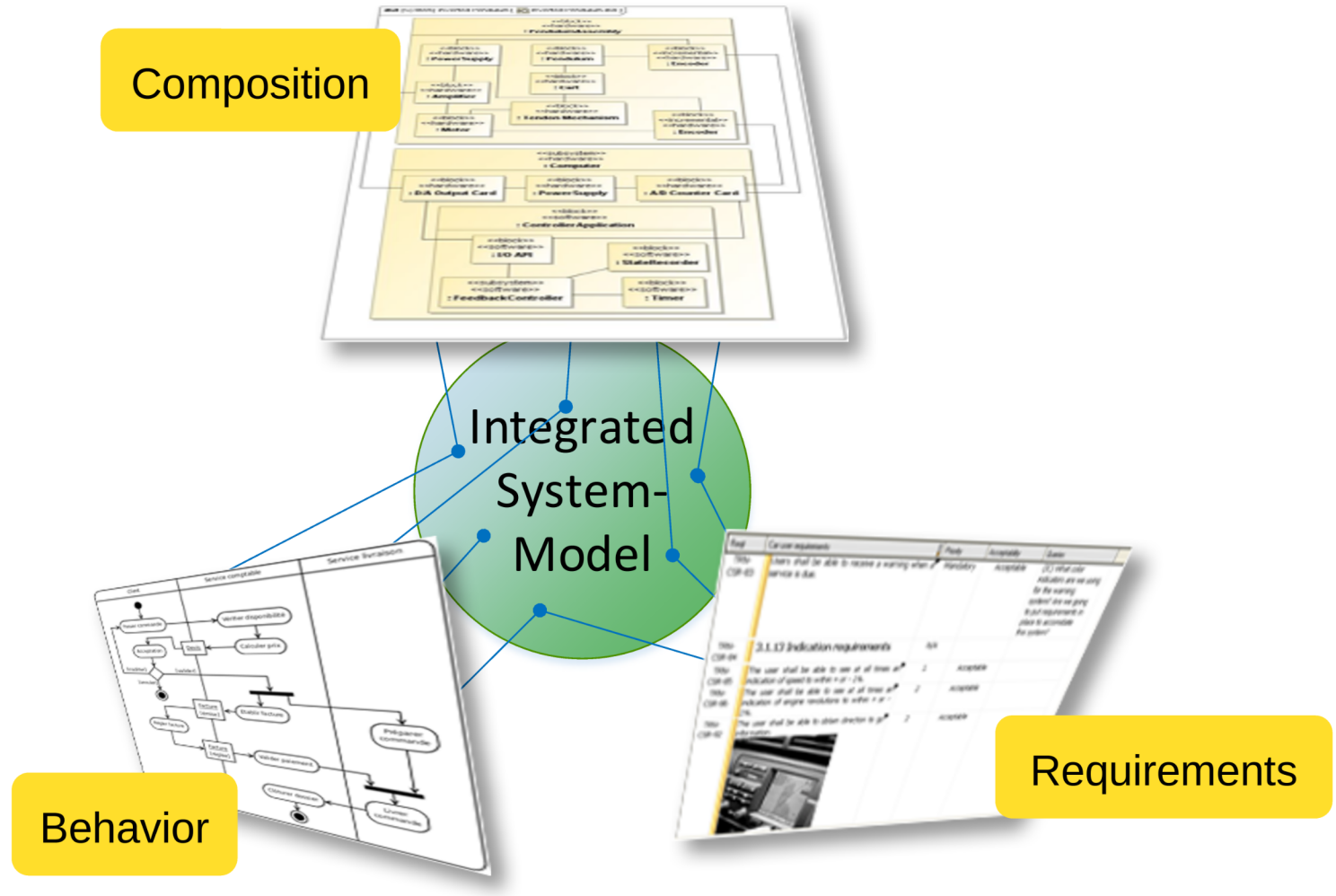
→ SpecIF carries both the „Visible“ and the „Meaning“

Purpose: Model Integration

- Search, navigate and audit partial engineering results in a common context
- Interrelate information elements of disparate sources to create a common view
- Find inconsistencies and gaps between different views
- Use-Cases:
  - Localize requirements on a BoM: Which components are affected when changing a requirement (or vice versa)?
  - When a use-case mentions a data-object, which system components and interfaces are involved?
  - Interrelate system structures with process models: Which activities are affected when modifying a system component (or vice versa)?
  - Associate a FMI simulation-routine with a SysML system component (block)
  - Collect and compare information about an element from different sources.

Consolidate model elements from different diagrams

- Key to success is the abstraction using 5 fundamental model element types
- Impossible with 162 model element types in SysML and almost as many in BPMN
- Even within SysML the current tools fail to properly consolidate model elements from different model views



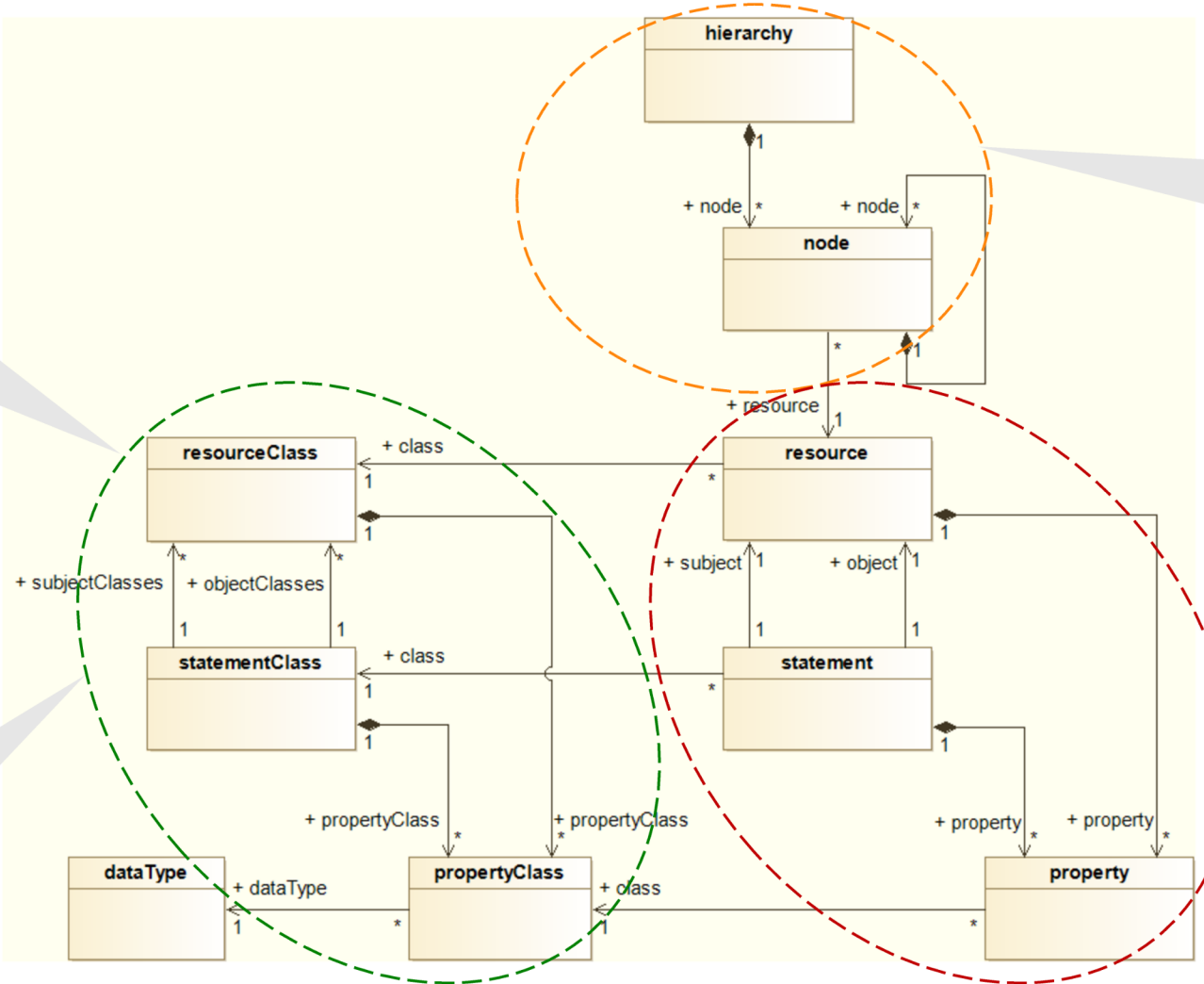
A SpecIF data set contains both the the types („model“) and the instances („data“ = „payload“)

Hierarchical ordering of Resources (e.g. for convenient reading)

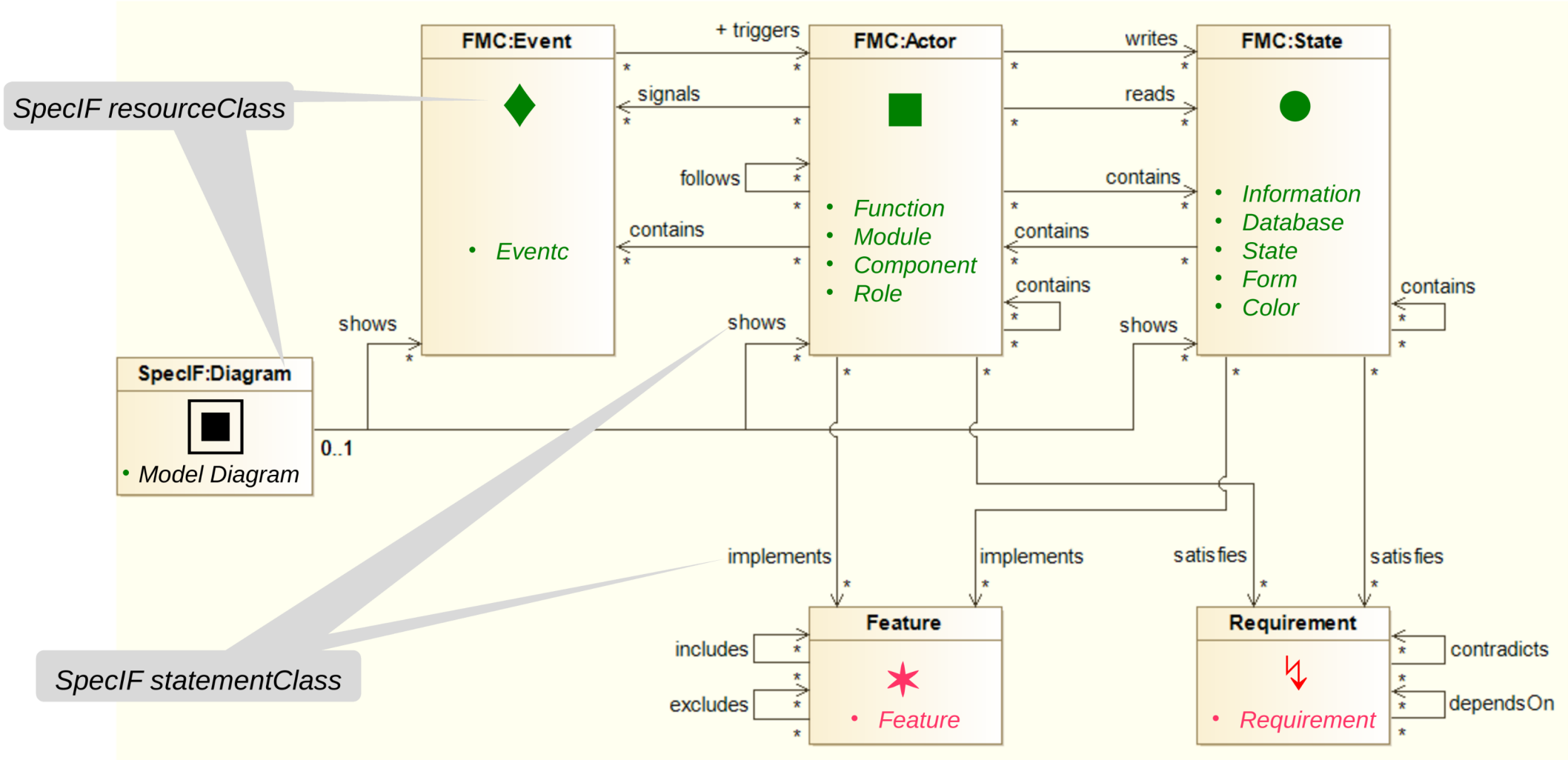
SpecIF model with Resource- and Statement-Classes

SpecIF data (payload) with Resources and Statements

The classes can be defined at runtime („dynamic model“)



The SpecIF Integration Model with 5 Fundamental Model-element Types



Simple Model-Integration „Adopt“

- Adopt existing model-element types, if they are equivalent
- Add new diagrams (views)
- Adopt existing model-elements having the same title
- Add new statements
- Build new glossary of model-elements, sorted by fundamental type