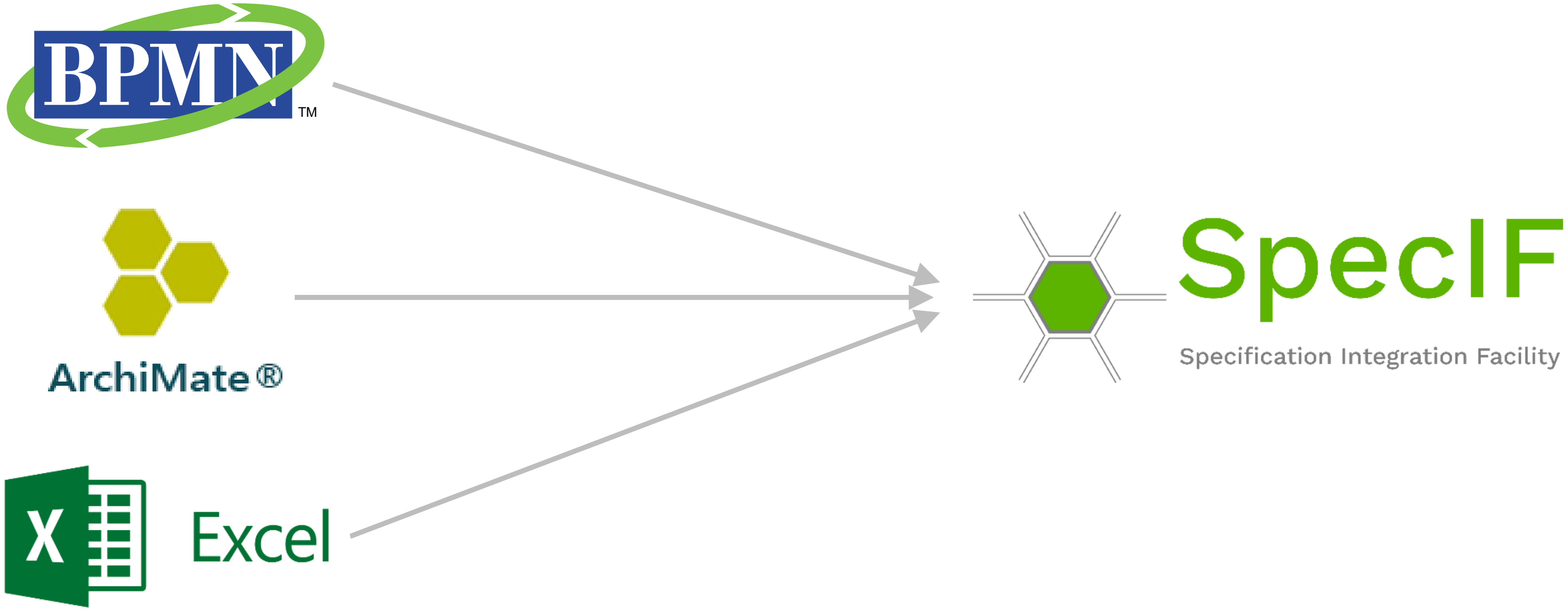
Integrate BPMN and Archimate Models using SpecIF

TdSE 2021

Oskar von Dungern, Dr.-Ing., enso managers GmbH

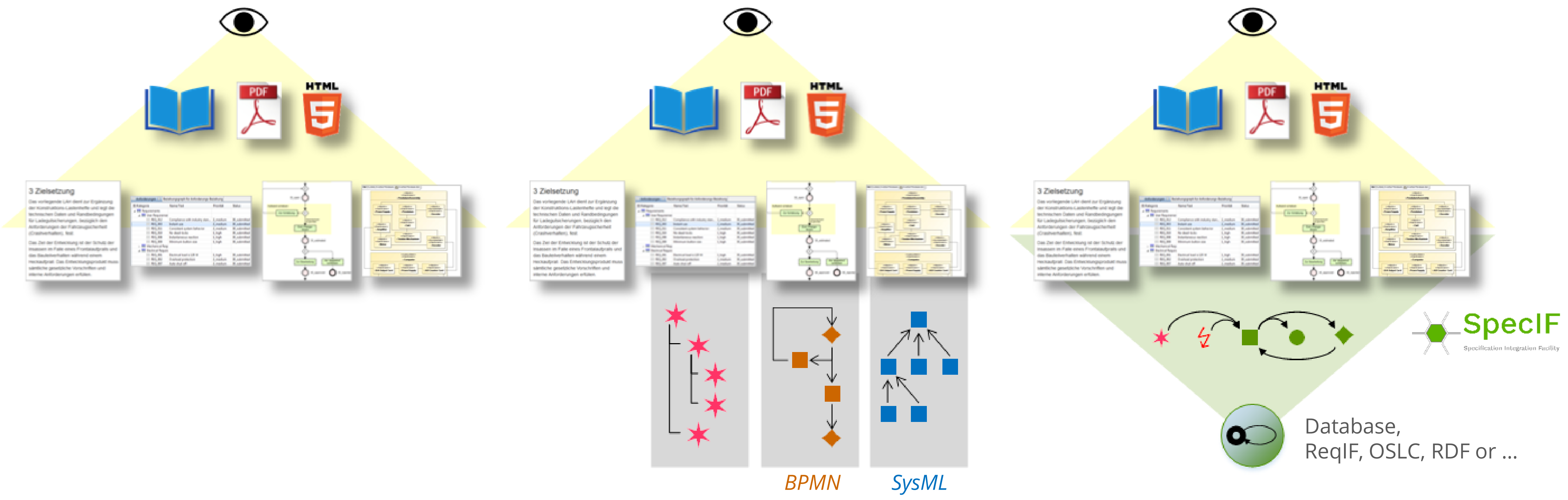


Basic Assumptions

- 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



Database,
ReqIF, OSLC, RDF or …

Creating the „Visible“

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

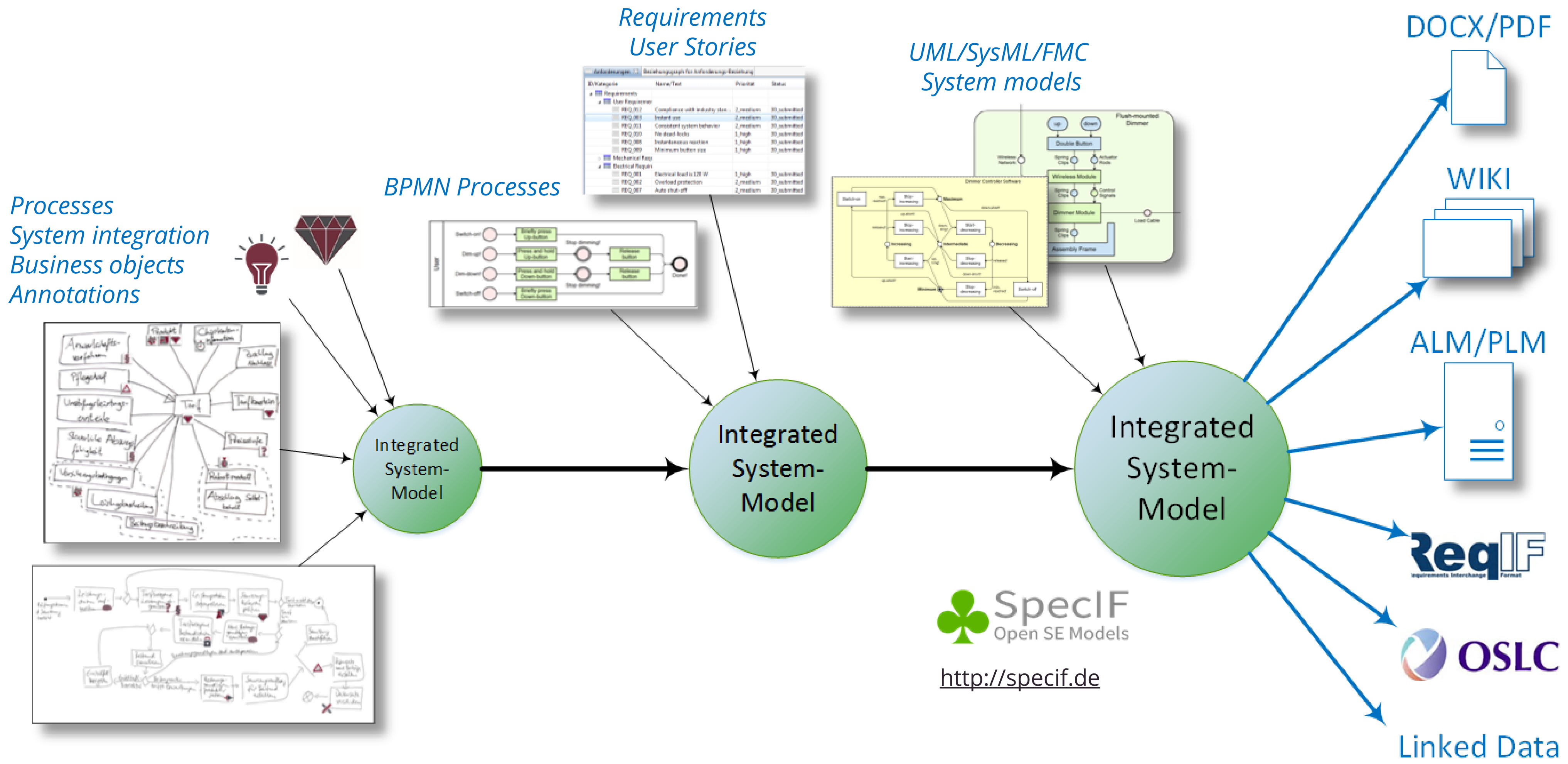
Partial Modelling

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

Model Integration

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

Add partial models step-by-step …



Processes
System integration
Business objects
Annotations

BPMN Processes

Requirements
User Stories

UML/SysML/FMC
System models

Integrated System-Model

Integrated System-Model

Integrated System-Model

DOCX/PDF

WIKI

ALM/PLM

ReqIF

OSLC

Linked Data

SpecIF Open SE Models

http://specif.de

Five Principles of Model Integration

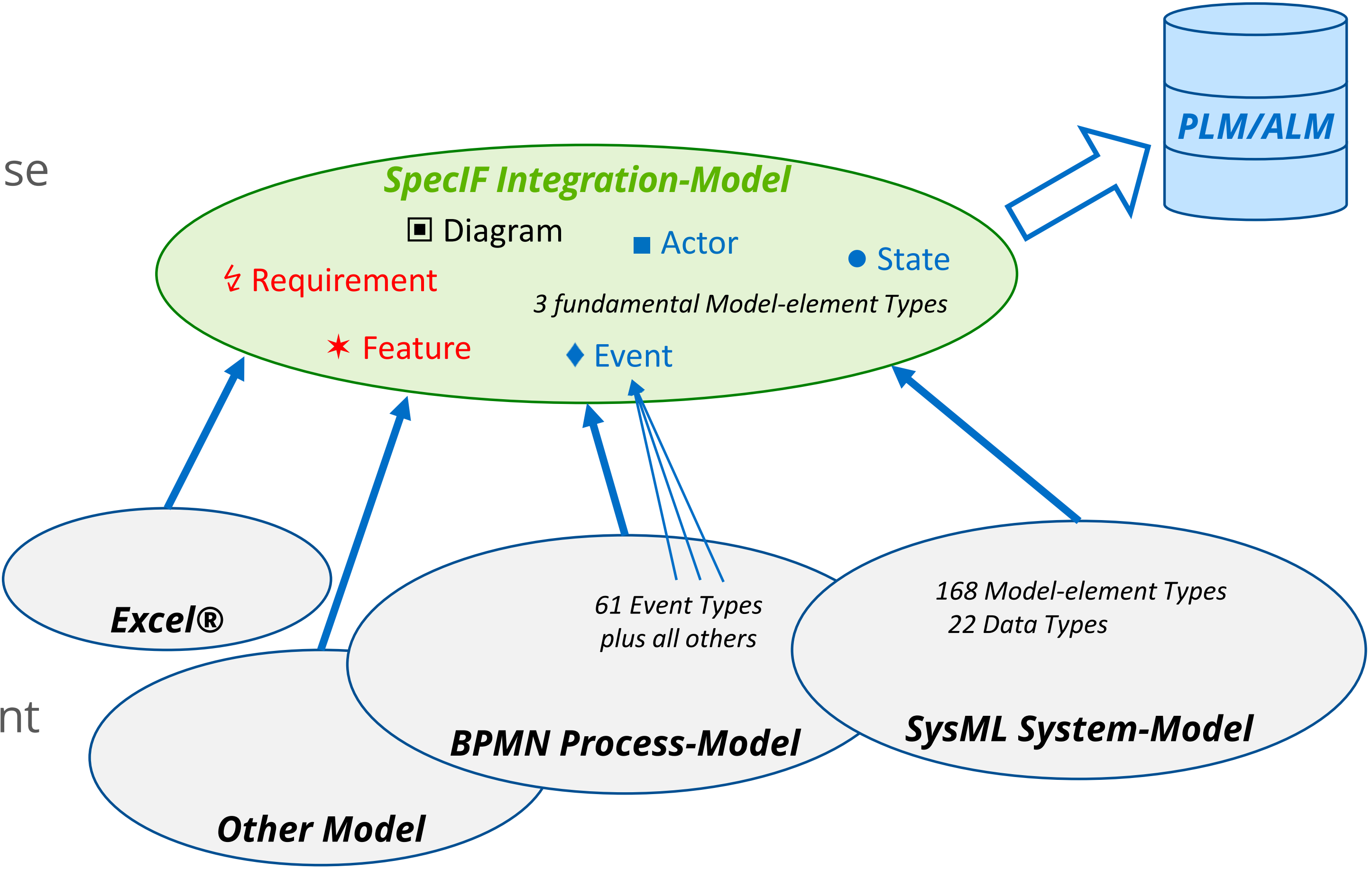
1. Separate View and Model
2. Abstract Model Element Types
3. Use a Vocabulary
4. Share Model Elements between Views
5. Interrelate Model Elements to build a semantic net

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

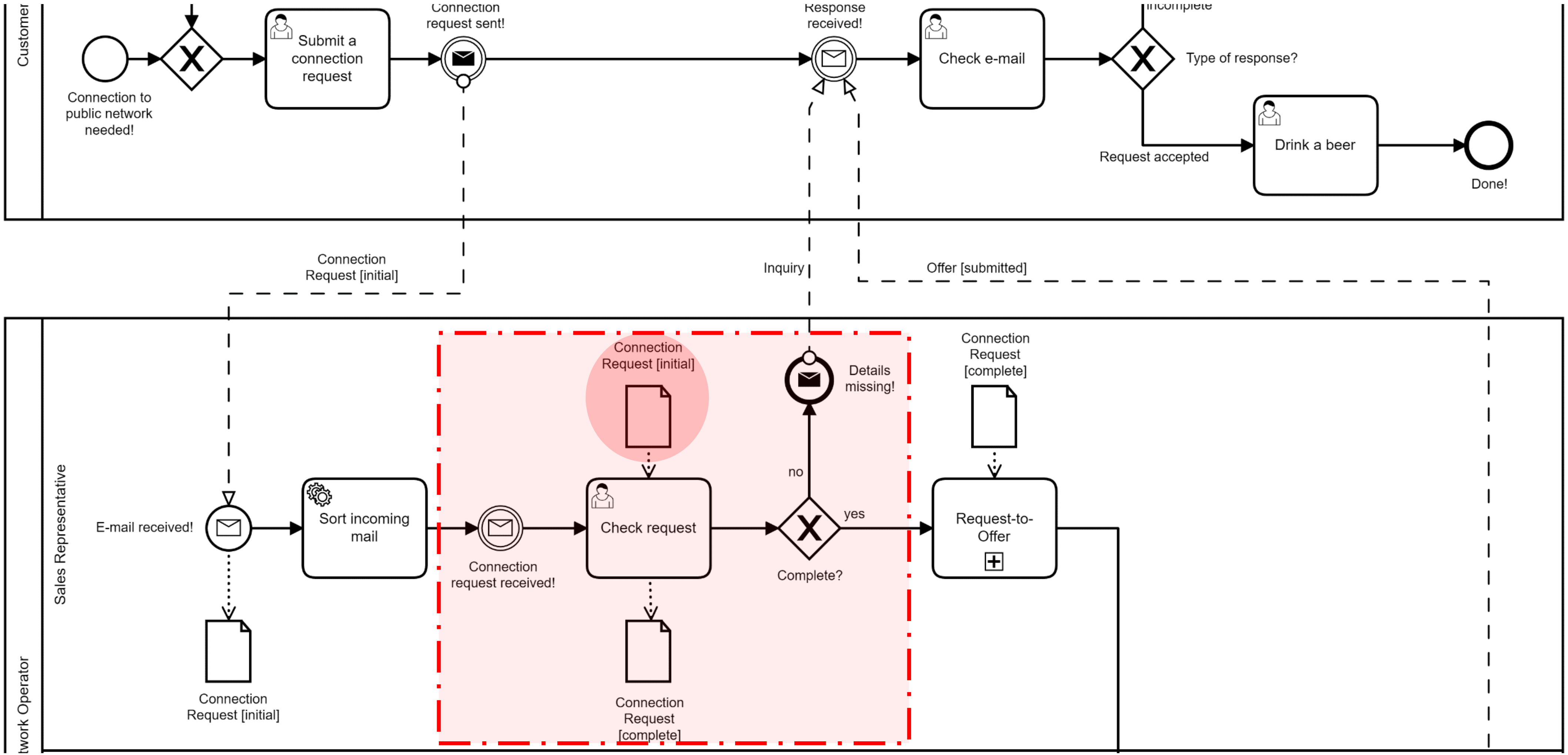
Property Names

- dcterms:title
- SpecIF:Priority

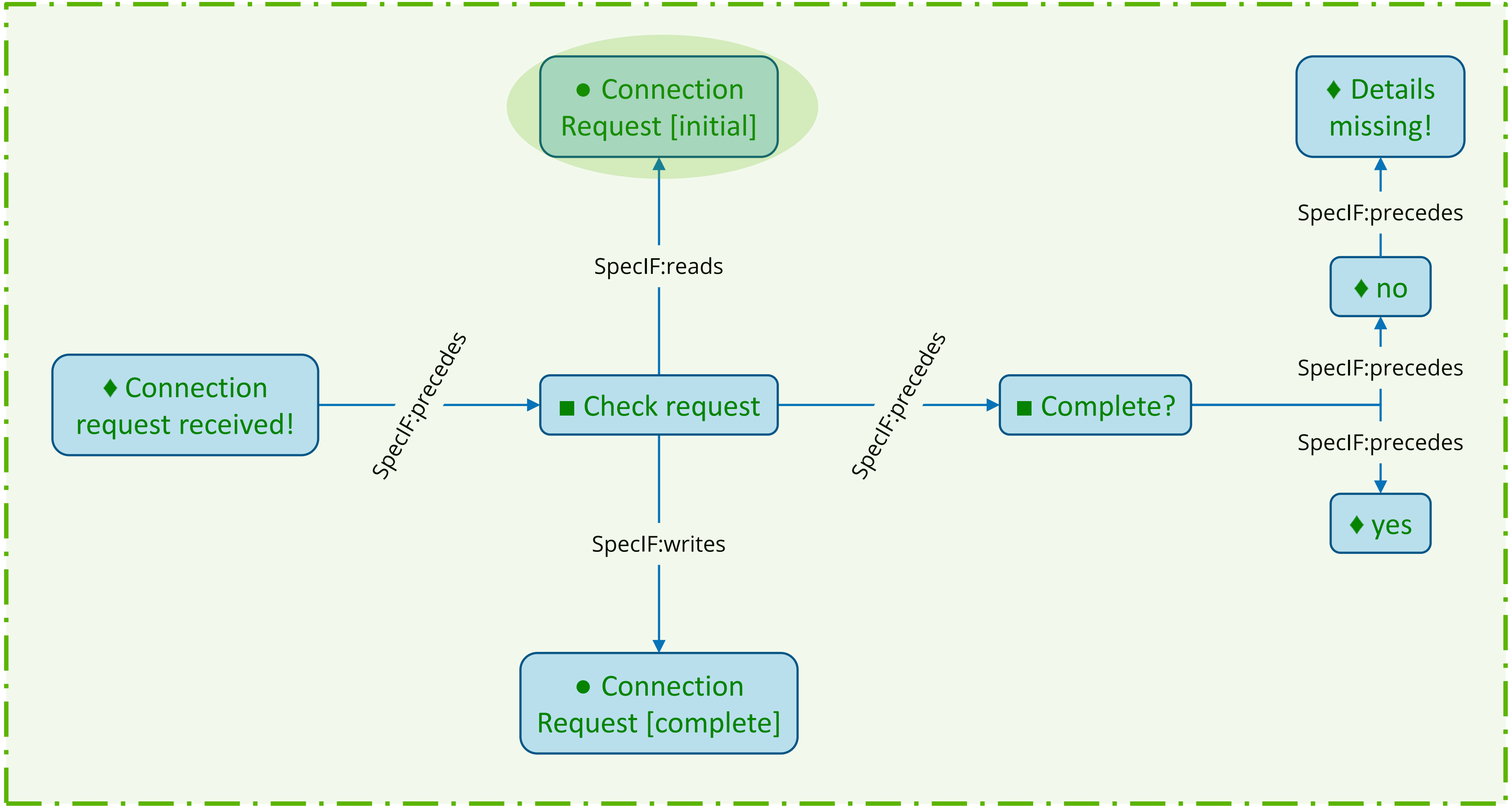
Property Values

- SpecIF:priorityHigh

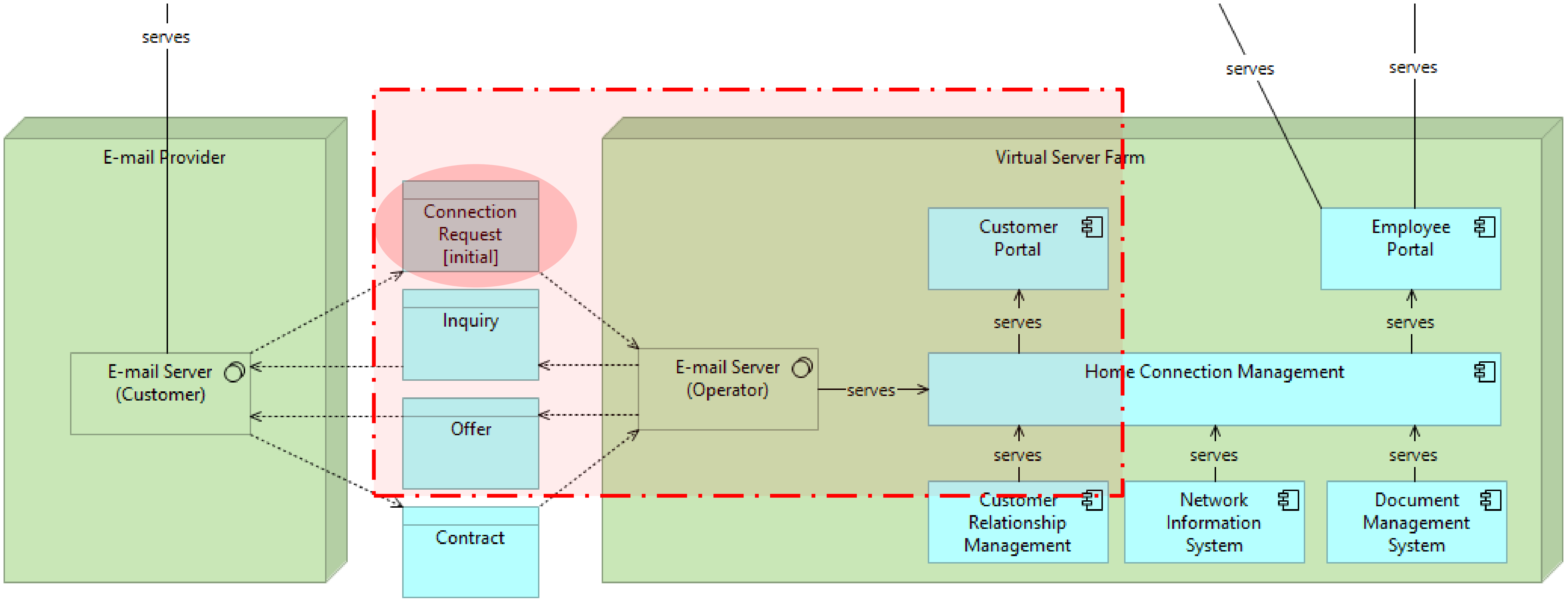
Telephone Connection Request – Business Process (BPMN)



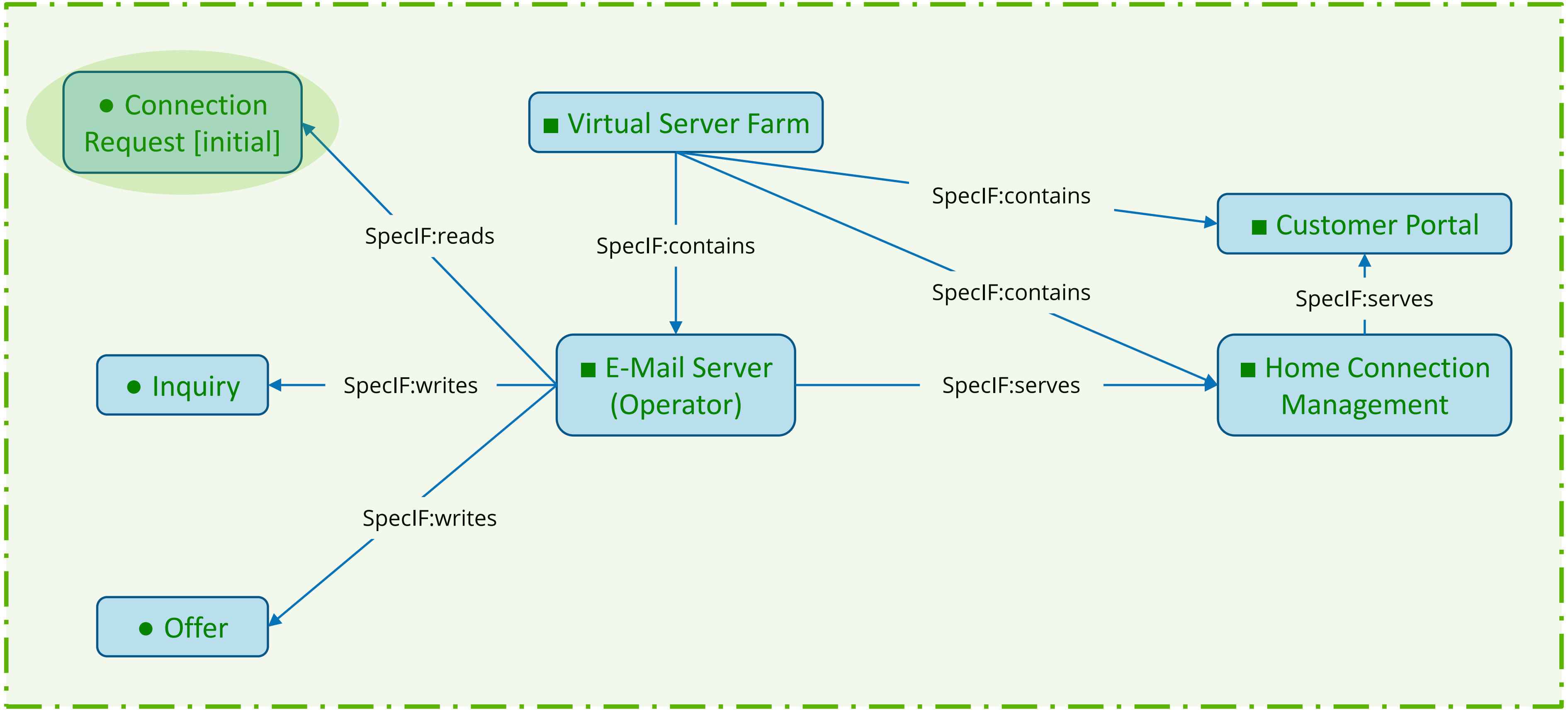
BPMN → SpecIF Transformation



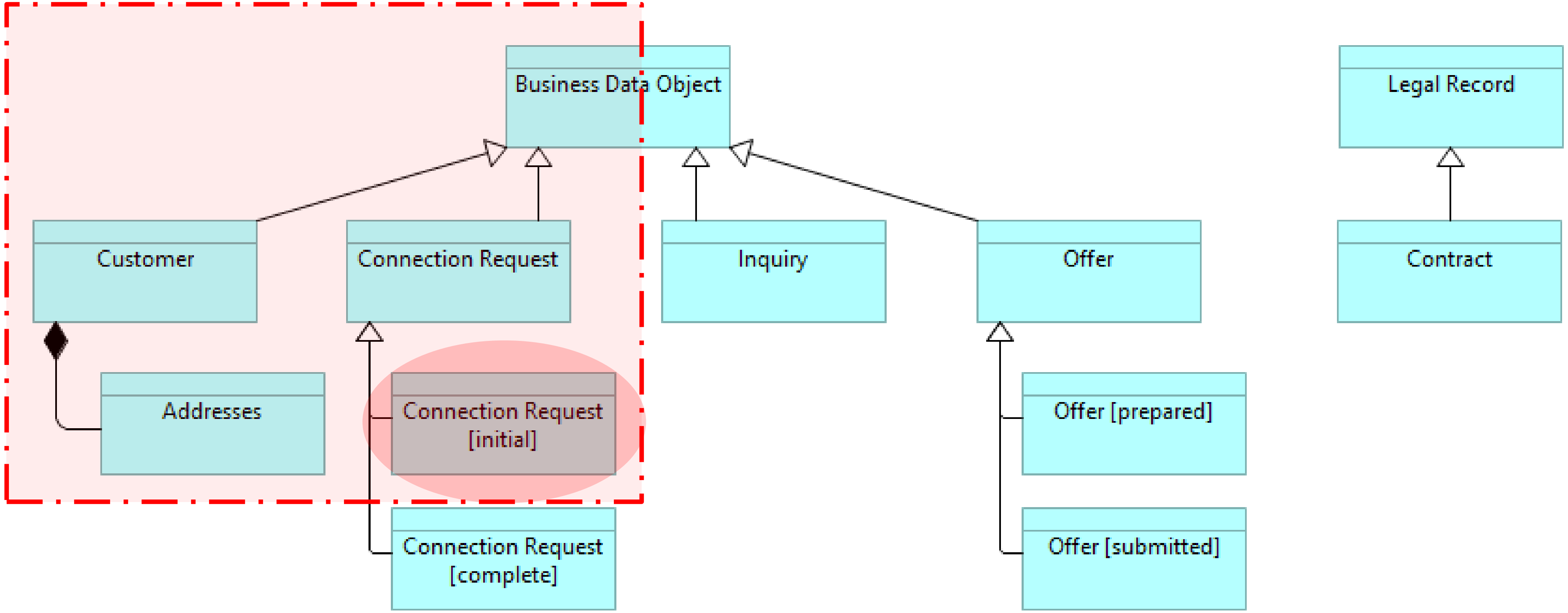
Telephone Connection Request
– Application Landscape (Archimate)



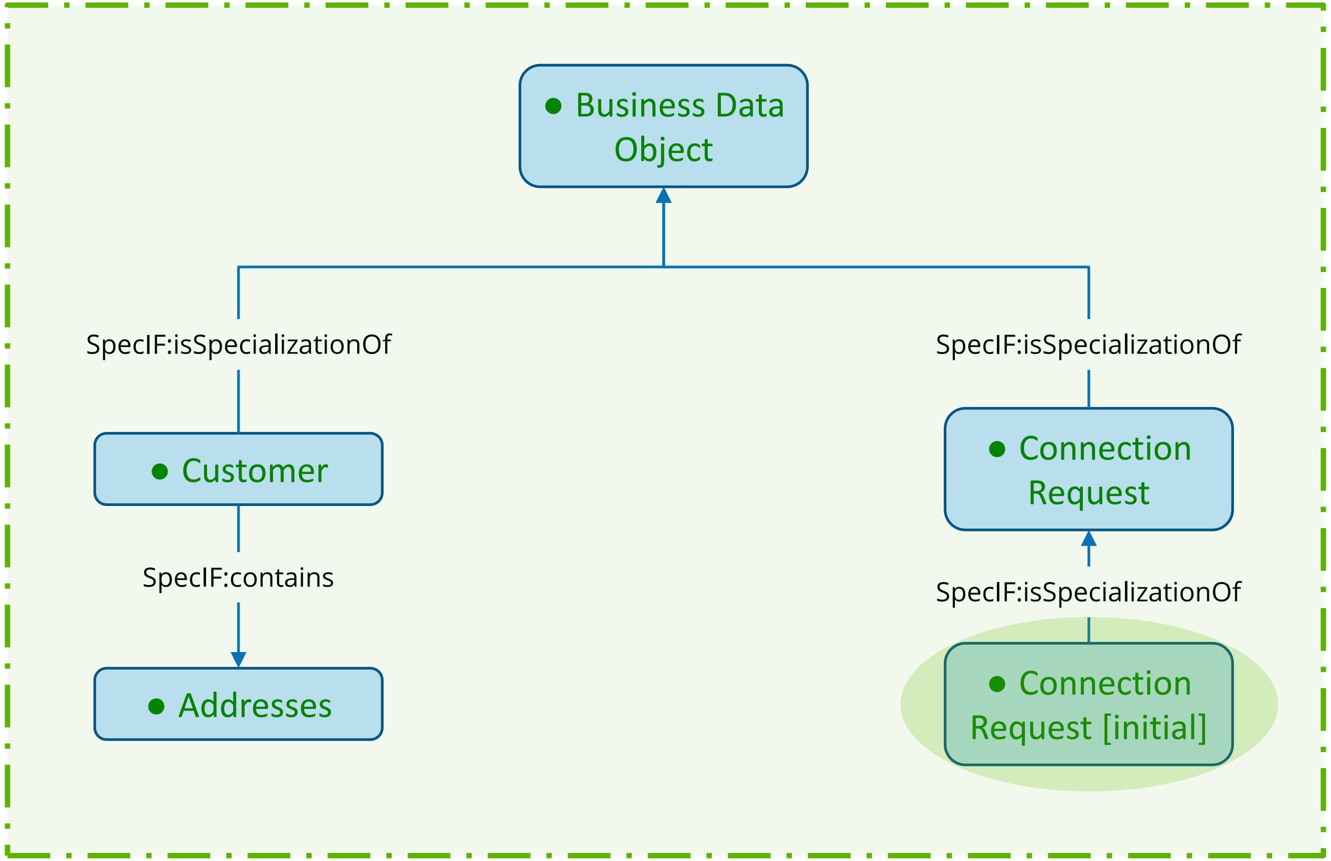
Archimate → SpecIF Transformation



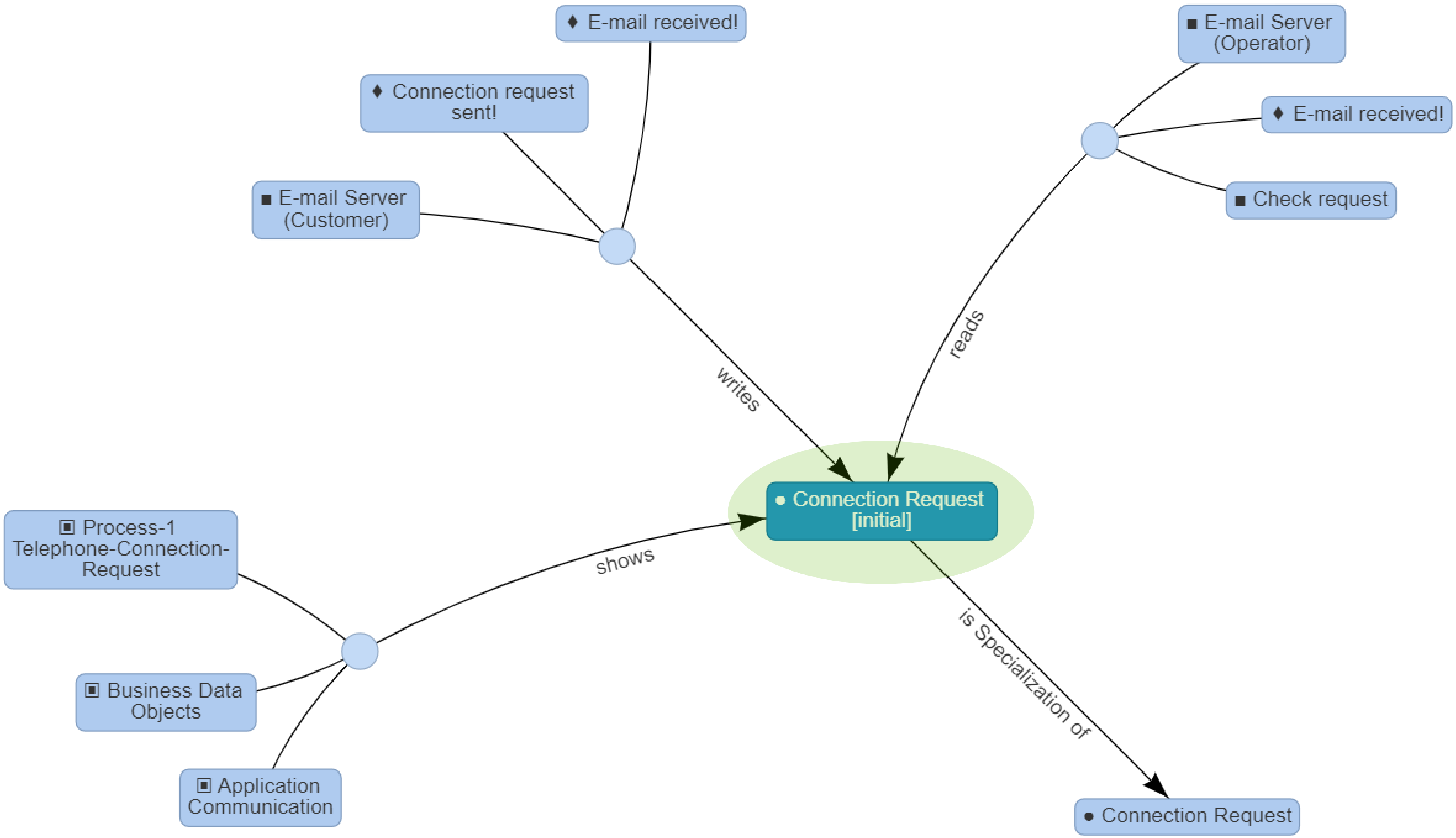
Telephone Connection Request – Class Diagram (Archimate, UML, ..)



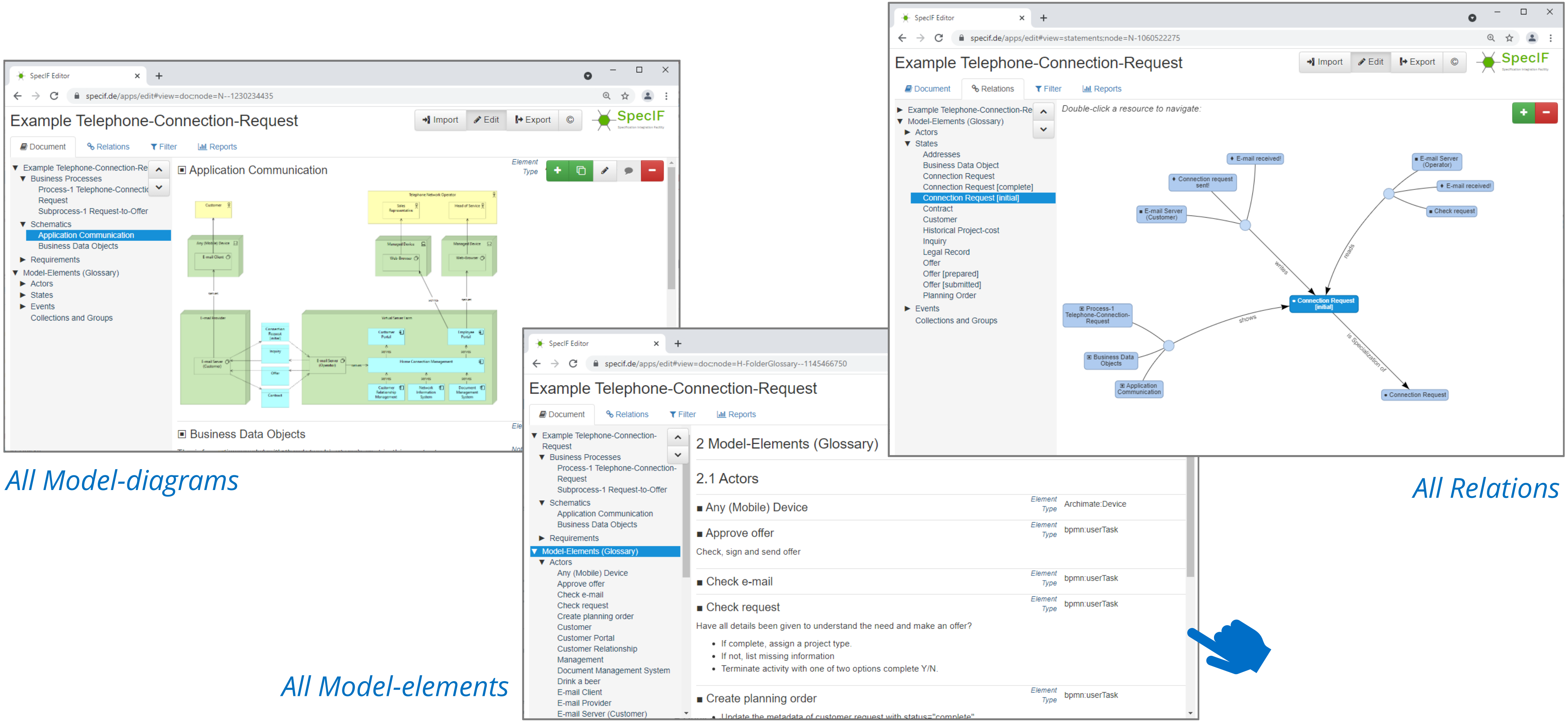
Class Diagram → SpecIF Transformation


● Business Data Object
SpecIF:isSpecializationOf
SpecIF:isSpecializationOf
● Customer
● Connection Request
SpecIF:contains
SpecIF:isSpecializationOf
● Addresses
● Connection Request [initial]

All relations combined → Semantics of a Model-Element


♦ E-mail received!
♦ Connection request sent!
■ E-mail Server (Customer)
writes
■ E-mail Server (Operator)
♦ E-mail received!
■ Check request
reads
● Connection Request [initial]
▣ Process-1 Telephone-Connection-Request
▣ Business Data Objects
▣ Application Communication
shows
is Specialization of
● Connection Request

Navigate, search and audit in a common context



Example Telephone-Connection-Request

- Example Telephone-Connection-Re
  - Business Processes
    - Process-1 Telephone-Connection-Request
    - Subprocess-1 Request-to-Offer
  - Schematics
    - Application Communication
    - Business Data Objects
  - Requirements
- Model-Elements (Glossary)
  - Actors
  - States
  - Events
  - Collections and Groups

▣ Application Communication

▣ Business Data Objects

All Model-diagrams

Example Telephone-Connection-Request

- Example Telephone-Connection-Re
- Model-Elements (Glossary)
  - Actors
  - States
    - Addresses
    - Business Data Object
    - Connection Request
    - Connection Request [complete]
    - Connection Request [initial]
    - Contract
    - Customer
    - Historical Project-cost
    - Inquiry
    - Legal Record
    - Offer
    - Offer [prepared]
    - Offer [submitted]
    - Planning Order
  - Events
  - Collections and Groups

All Relations

Example Telephone-Connection-Request

- Example Telephone-Connection-Request
  - Business Processes
    - Process-1 Telephone-Connection-Request
    - Subprocess-1 Request-to-Offer
  - Schematics
    - Application Communication
    - Business Data Objects
  - Requirements
- Model-Elements (Glossary)
  - Actors
    - Any (Mobile) Device
    - Approve offer
    - Check e-mail
    - Check request
    - Create planning order
    - Customer
    - Customer Portal
    - Customer Relationship Management
    - Document Management System
    - Drink a beer
    - E-mail Client
    - E-mail Provider
    - E-mail Server (Customer)

2 Model-Elements (Glossary)

2.1 Actors

■ Any (Mobile) Device — Element Type: Archimate:Device

■ Approve offer — Element Type: bpmn:userTask

Check, sign and send offer

■ Check e-mail — Element Type: bpmn:userTask

■ Check request — Element Type: bpmn:userTask

Have all details been given to understand the need and make an offer?

- If complete, assign a project type.
- If not, list missing information
- Terminate activity with one of two options complete Y/N.

■ Create planning order — Element Type: bpmn:userTask

- Update the metadata of customer request with status="complete"

All Model-elements

SpecIF Goals and Benefits

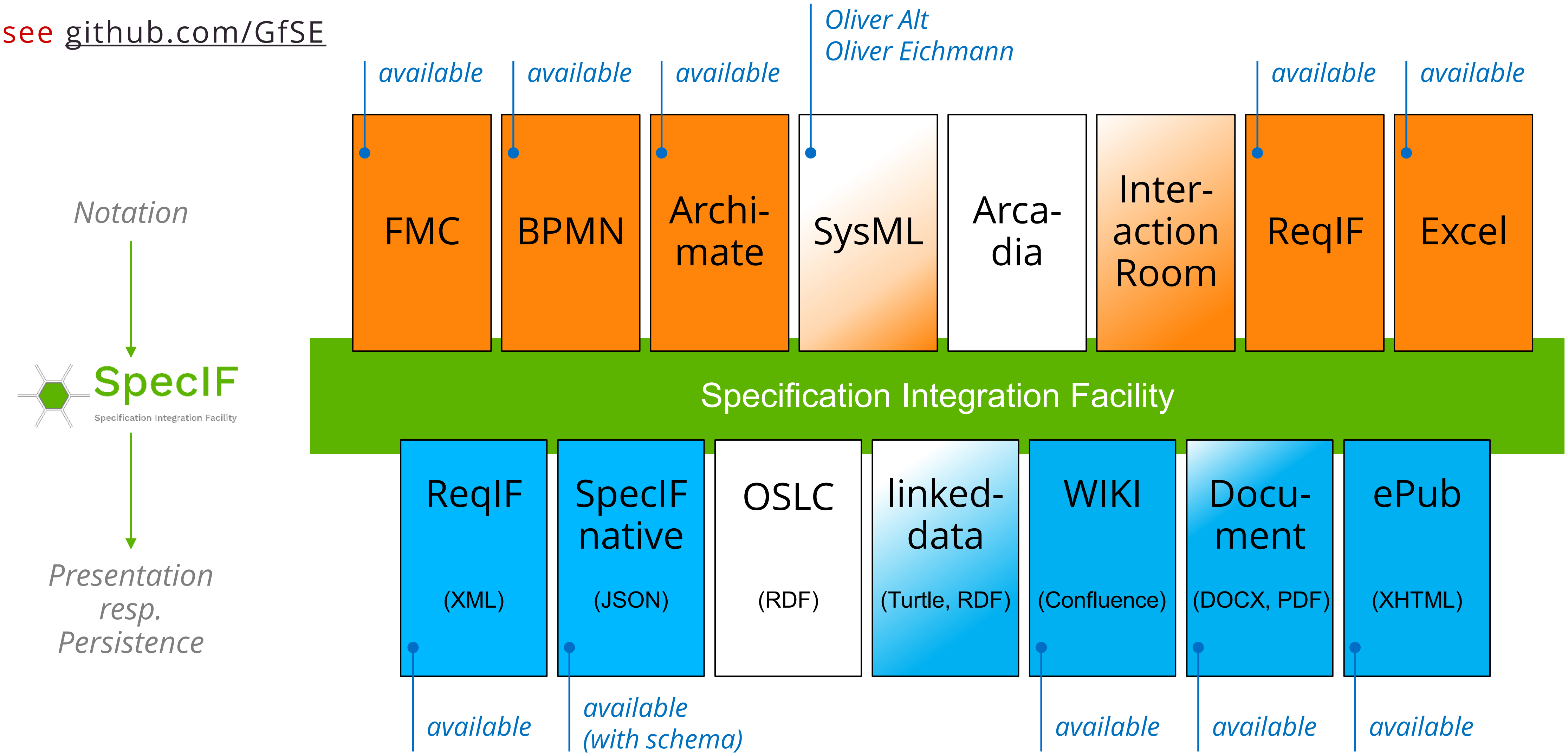
- Exchange model-based specifications between organizations and tools.
- Combine texts and models from different tools.
- Navigate, search and audit in a common context.
- Manage the product lifecycle from birth to death („end-to-end“):
  - Reference for all engineering-disciplines
  - Combining methods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

What is different ?

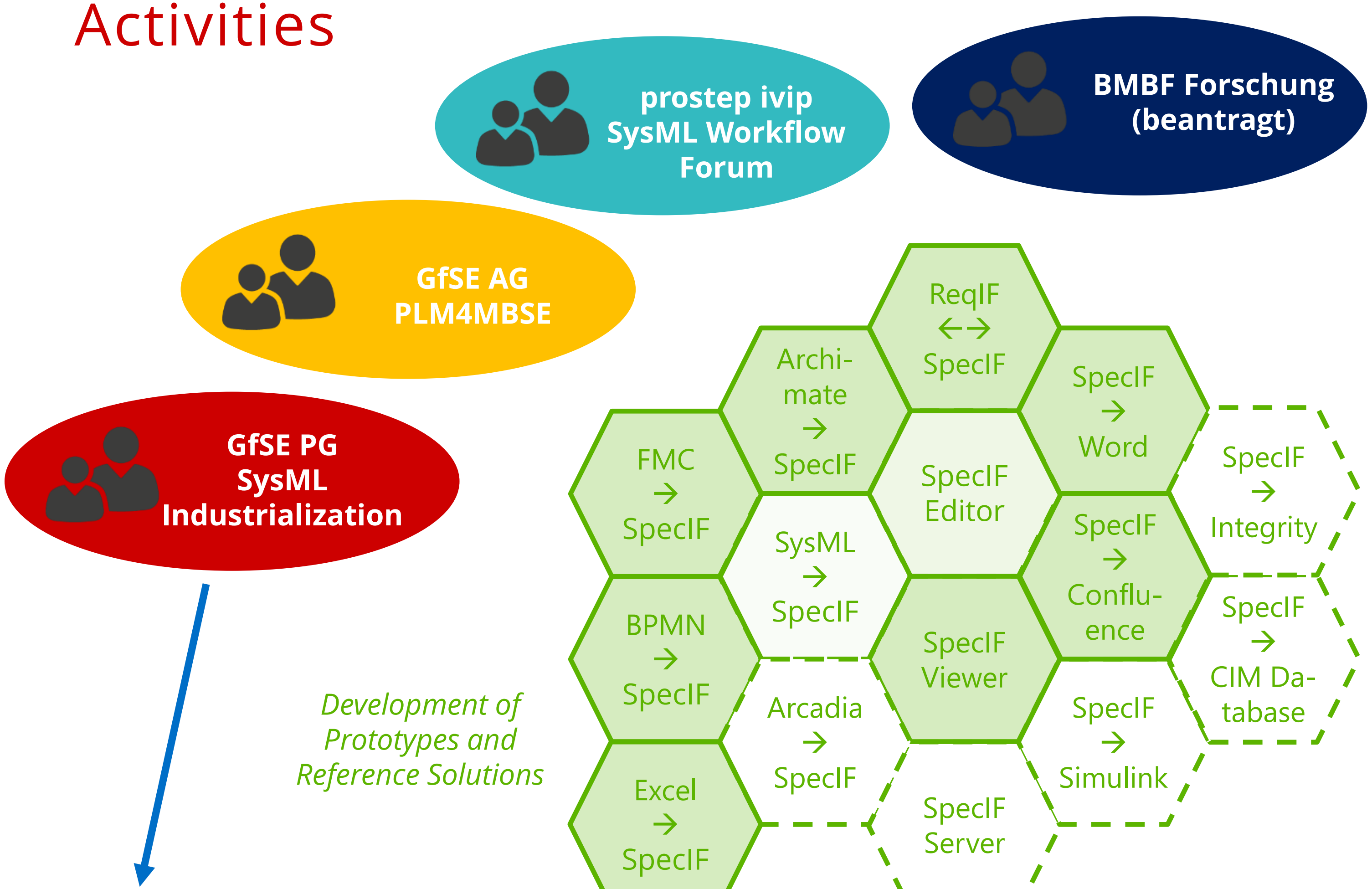
1. SpecIF builds on known notations and technical formats; doesn‘t replace any.
2. Conveys meaning through defined vocabulary and simple predicate logic.
3. SpecIF works because it uses *few* fundamental model-element types.
4. SpecIF is a semantic net („graph-data“) with typed nodes and edges.
5. Graph 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

ReqIF ↔ SpecIF

Archi-mate → SpecIF

SpecIF → Word

FMC → SpecIF

SpecIF Editor

SpecIF → Integrity

SysML → SpecIF

SpecIF → Conflu-ence

BPMN → SpecIF

SpecIF Viewer

SpecIF → CIM Da-tabase

Arcadia → SpecIF

SpecIF → Simulink

Excel → SpecIF

SpecIF Server

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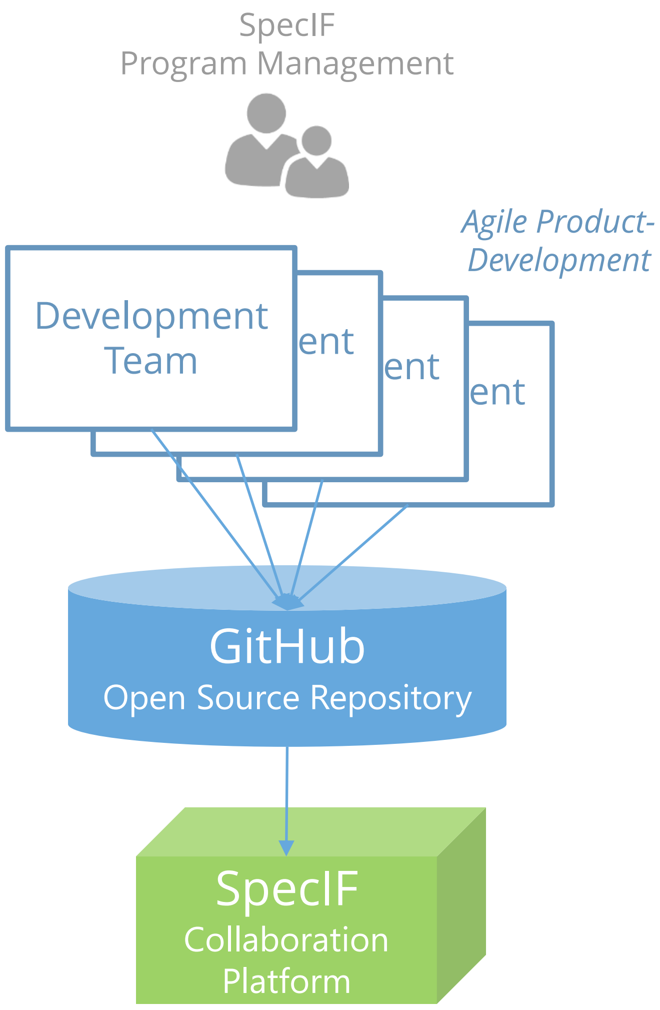
Plan



SpecIF Program Management

Agile Product-Development

Development Team

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GitHub

Open Source Repository

SpecIF Collaboration Platform

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.

[2] Knöpfel, A.; Gröne, B.; Tabeling, P.: Fundamental Modelling Concepts – Effective Communication of IT Systems. ISBN-13: 978-0-470-02710-3. John Wiley&Sons, Chichester, 2005.

[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.

[10] Dungern, O.v.: Von Anforderungslisten zu vernetzten Produktmodellen – am Beispiel der Gebäudeautomation. REConf, Unterschleißheim, März 2016.

[11] Dungern, O.v.: Semantic Model Integration for System Specification. TdSE Tag des Systems Engineering der GfSE, Herzogenaurach, October 2016.

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

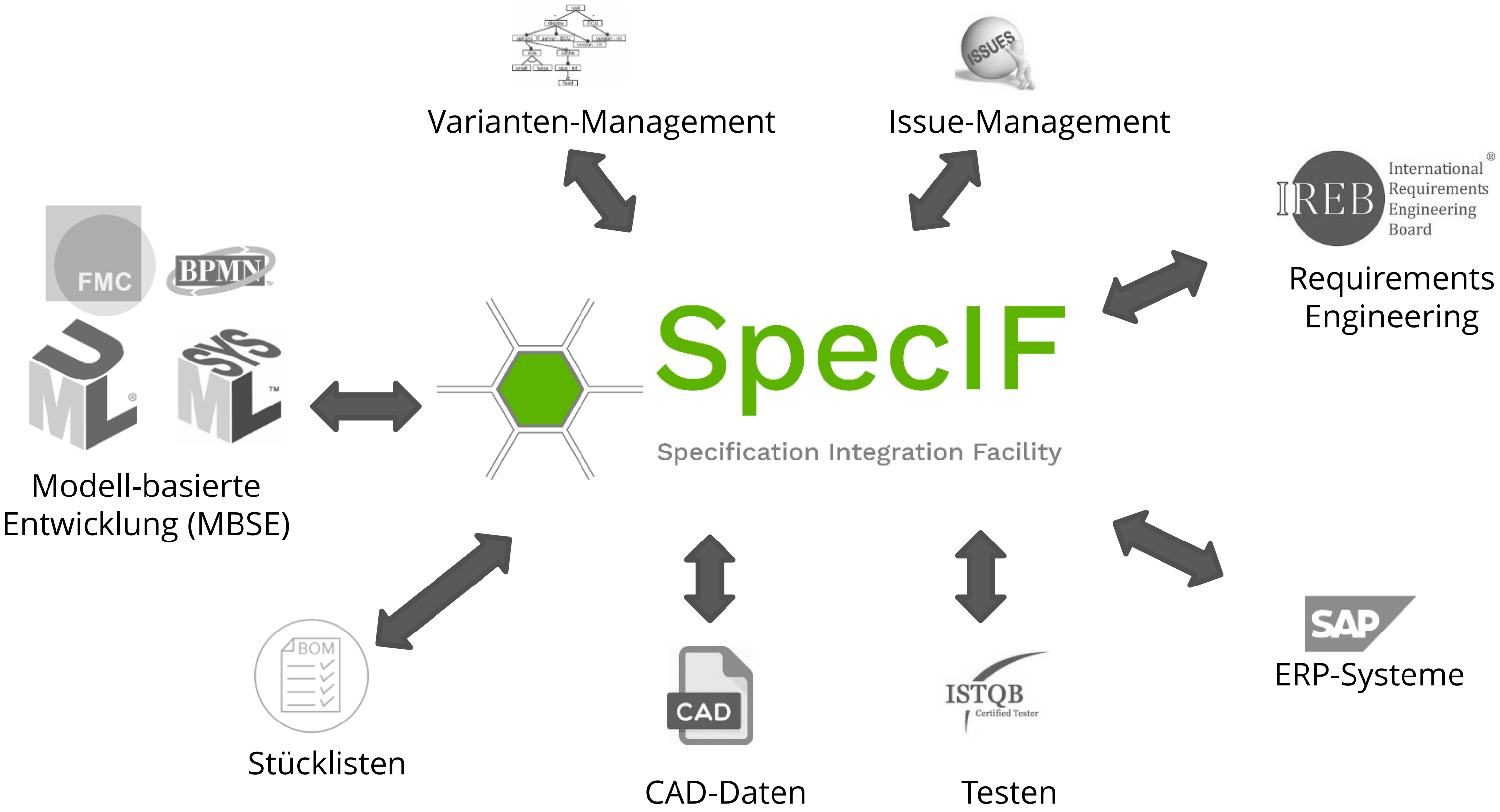
[13] Mochine, P.; Sünnetcioglu, A.; Dungern, O.v.; Stark, R.: SysML-Modelle maschinell verstehen und verknüpfen. TdSE Tag des Systems Engineering der GfSE, Paderborn, Oktober 2017.

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

[15] Dungern, O.v.: Model-Integration with SpecIF. ProSTEP ivip e.V. SysML-Workflow-Forum November 2019.

Interessant ?

od@enso-managers.de
oliver.alt@mdd4all.de



Details for further discussion

What is SpecIF ?

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

SpecIF
Open SE Models

- 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“

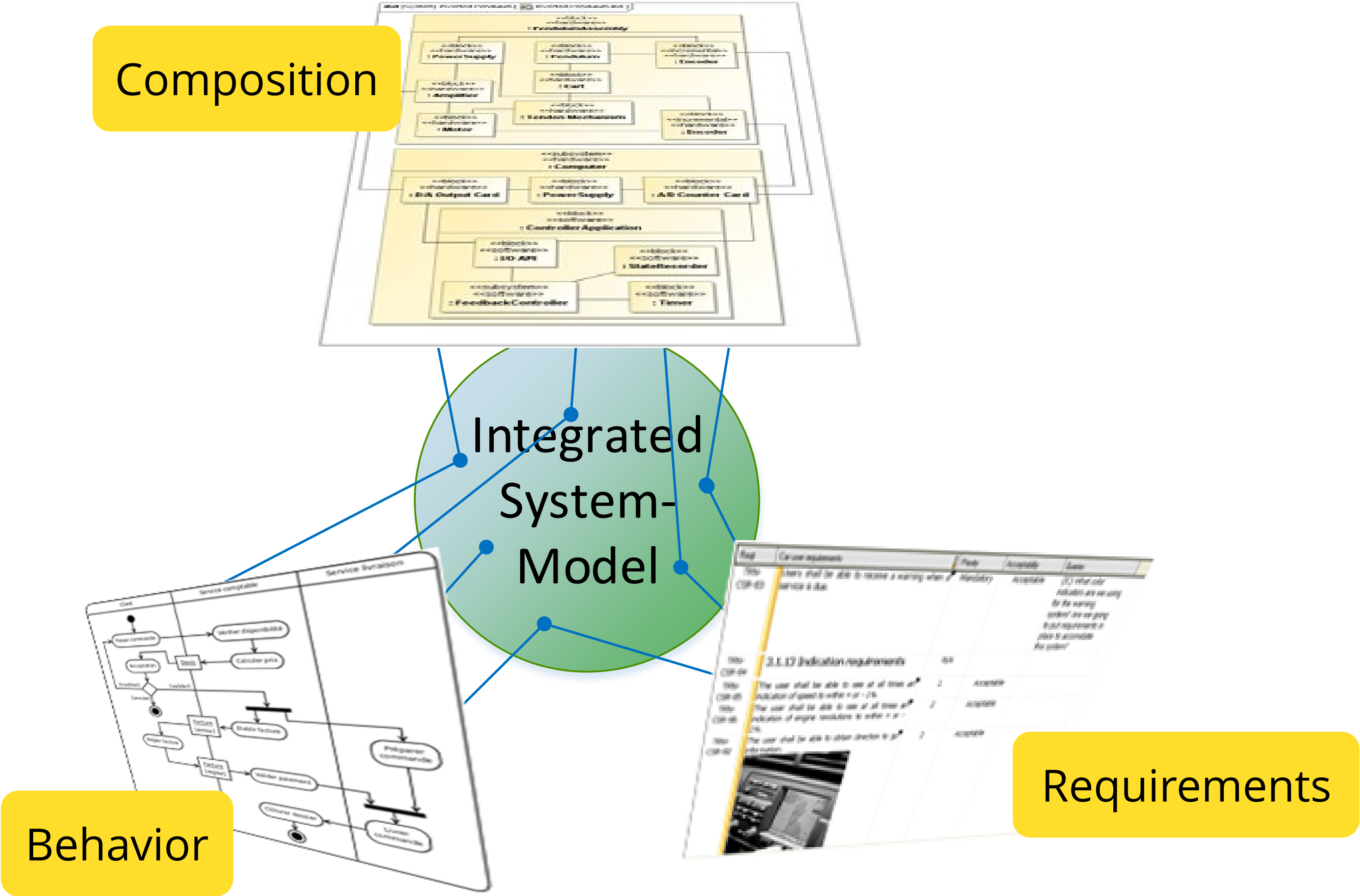
→ SpecIF carries both the „Visible“ and the „Meaning“

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



What‘s Needed to Integrate System-Models with Requirements

• Import FMC (ARCWAY Cockpit)	available
• Import SysML	→ O. Alt (EA), O. Eichmann (Cameo)
• Import BPMN-XML	available
• Import Archimate/Open-Exchange	model-elements and relations: yes, diagrams manually
• Import ReqIF	
• Import Arcadia (Capella)	
• Import XLSX, XLS, CSV	available
• Model-Integration per „Adopt“	available
• SpecIF Server	→ O. Alt (.Net Core), O. v. Dungern (Node.js)
• Export ReqIF	available
• Export ePub	available
• Export OOXML (MS Word)	available (early version)

All model diagram types (notations) consist of three fundamental model-element types*

		▣ **Diagram Type (Notation)**				
	Model-element Type	BPMN Business-process	State-machine	System-composition	Organisation Chart	UML Classes
■	**Actor**	X	(X)	X	X	
●	**State**	X	X	X		X
◆	**Event**	X	X			

* Prof. Dr. Siegfried Wendt, Founding Director of the Hasso-Plattner-Institute, Potsdam: Fundamental Modelling Concepts

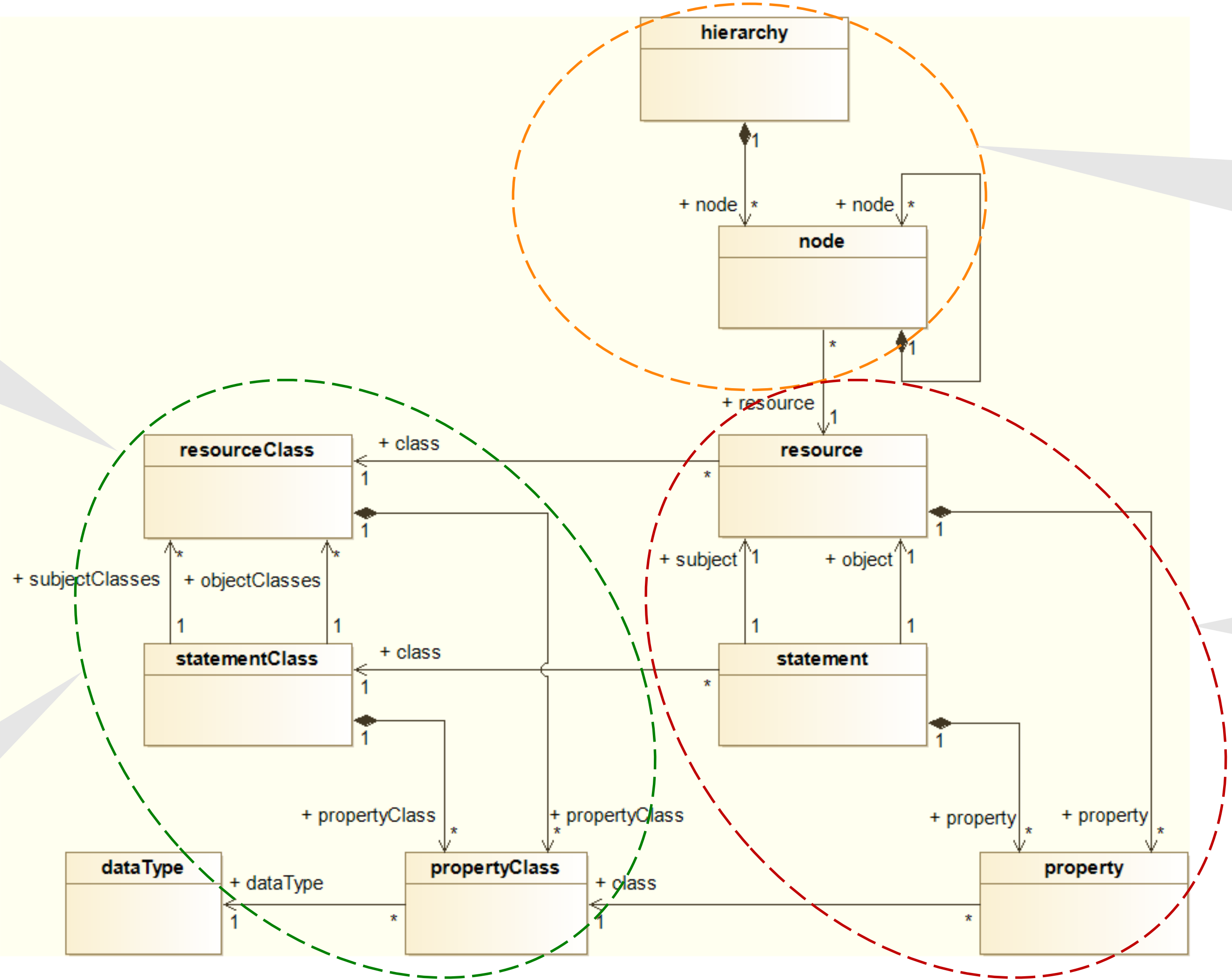
A complete specification needs also ‚feature‘ and ‚requirement‘

	▣ **Diagram Type (Notation)**					
Model-element Type	BPMN Business-process	State-machine	System-composition	Organi-sation Chart	UML Classes	Document Outline
■ **Actor**	X	(X)	X	X		X
● **State**	X	X	X		X	X
◆ **Event**	X	X				X
✶ **Feature**						X
↯ **Requirement**						X

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

SpecIF model with Resource- and Statement-Classes

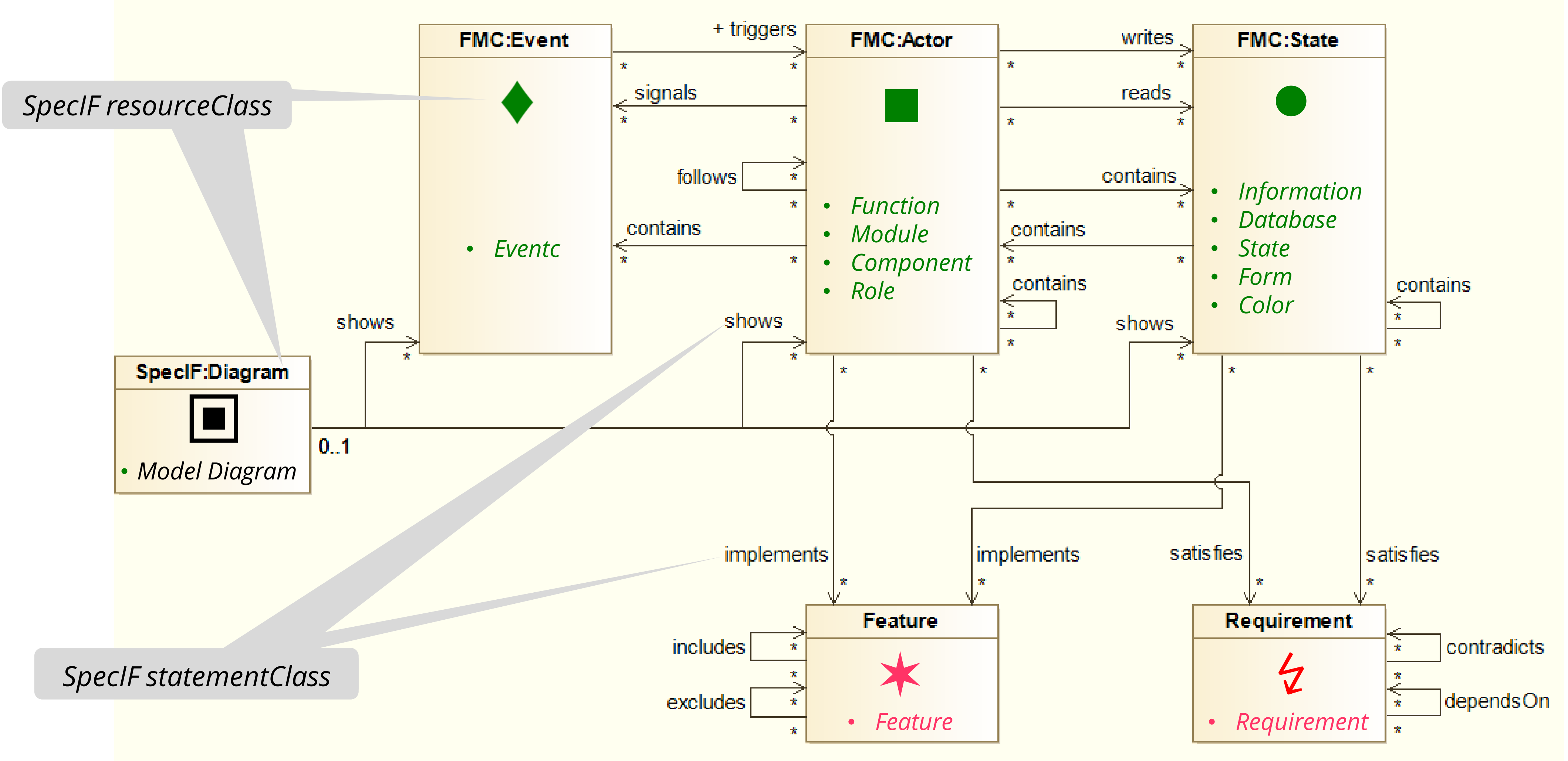
The classes can be defined at runtime („dynamic model“)



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

SpecIF data (payload) with Resources and Statements

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