iCargo

Intelligent Cargo in Efficient and Sustainable Global Logistics Operations

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SEVENTH FRAMEWORK PROGRAMME

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Semantic interoperability in logistics supply chains

Vision of the iCargo T2.3 working group

Wout Hofman (TNO)

Contents

- Vision and Goal of iCargo
- The challenges for (‘semantic’) interoperability
- The approach

Vision and Goal of iCargo

Five business level innovations

Overall goal: increased efficiency and sustainability by:

- Synchronization of vehicle movements and logistics operations across various modes and companies,
- Adapt to changing conditions through dynamic planning methods involving intelligent cargo, vehicle and infrastructure systems and
- Combination of services and resource capacity by information sharing amongst companies.

Business level innovations

1. Collaborative planning
2. Logistic chain composition based on services
3. Re-planning of logistic chains by the client
4. Optimization of the use of resources in the logistic chain by logistic service providers
5. Monitoring the environmental footprint

Vision and Goal of iCargo

Three technical innovations

IT innovations

Business (driven) vision

1

Technical vision

2

Interpretation of data

- Semantic interoperability
- Common Framework

Accessibility of data

- Seamless connectivity
- Controlled & secure access

Organisation of data

- Entity-centric approach
- Reduction of complexity

Overall goal: to increase information sharing by creating an open, dynamic logistics ecosystem for business collaboration with minimal implementation effort.

The challenges

This iCargo vision enables organizations to collaborate in a logistics business ecosystem: an ecosystem of organizations that compete or collaborate by offering or using logistic services and sharing information.

Interoperability challenges:

- The ecosystem is open: companies should be able to leave or join certain business collaborations effortlessly.
- It requires processes and information synchronization among companies.
- It should be easy to set-up new collaborations for new logistic service-offerings.
- Data should be shared amongst parties in a collaboration, e.g. about the environment footprint, exceptions, performance or future shipments (e.g. for collaborative planning).

The challenges
Semantic interoperability at all layers (1)

The semantic model is not just a data model or data structure. It facilitates interoperability on several levels:

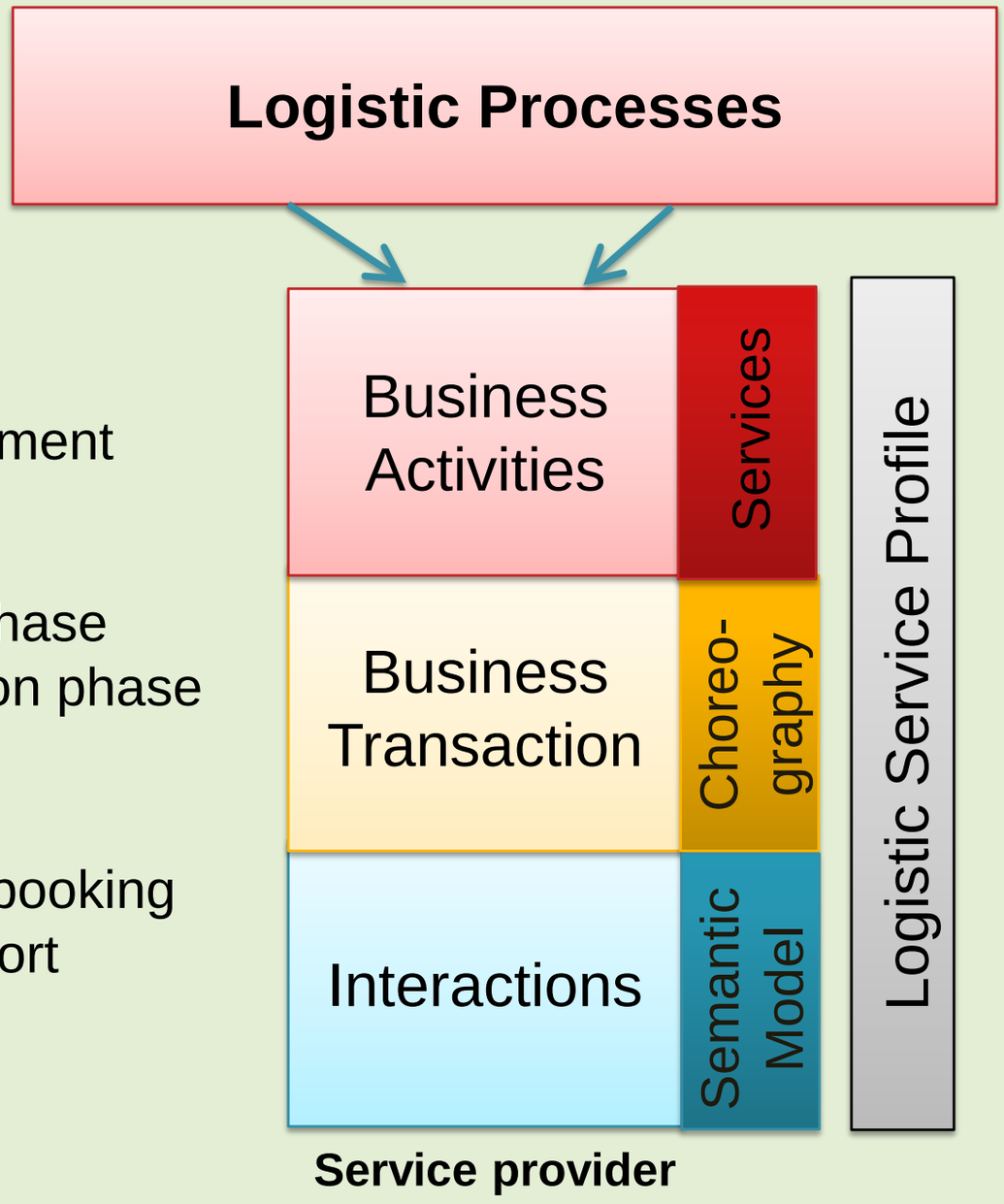
- ***Business activities*** **–** an organization can offer different logistic services according a classification of business activities.
  - Logistic services, offered or requested by a party, are an instance of a (generic) business activity, e.g. transport.
- ***Business transactions*** **–** information sharing to actually deliver a requested logistic service. A transaction includes for instance a booking and reporting phase.
  - A choreography is required to make sure the transactions take place in the right order, according to a pre-defined schema.
- ***Interactions*** **-** To implement transactions, one or more interactions are required between a customer and service provider.
  - The choreography of interactions for a business transaction requires a semantic model specifying the information that needs to be shared for actually delivering a requested logistic service.

The challenges
Semantic interoperability at all layers (2)

transport
trans-shipment
.....

booking phase
cancellation phase
…

transport booking
status report
…

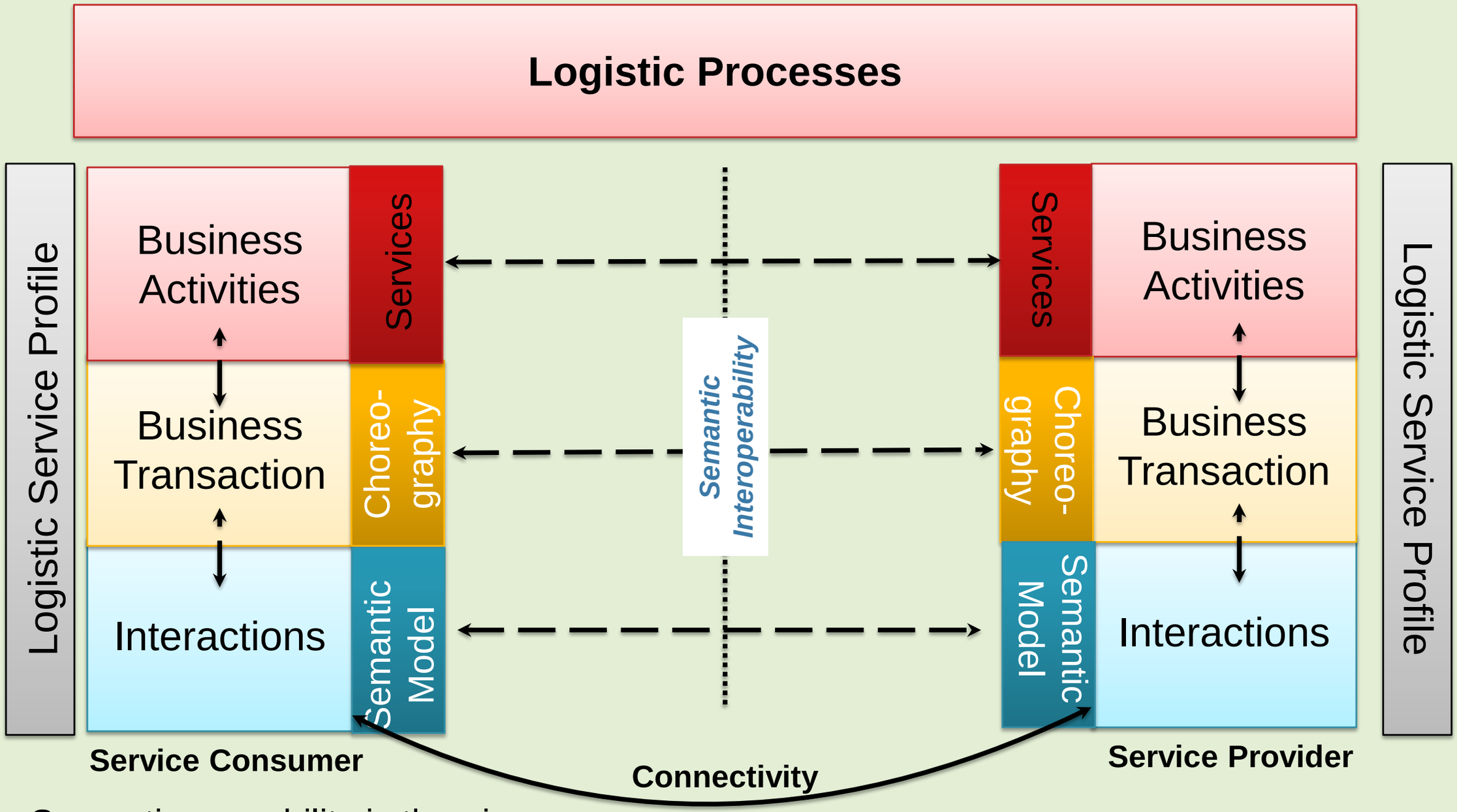


- The iCargo ontology is developed to support this layering

- The Logistic Service Profile of a Service Provider contains a (semantically supported) description for each of the layers

The challenges

Semantic interoperability at all layers (3)

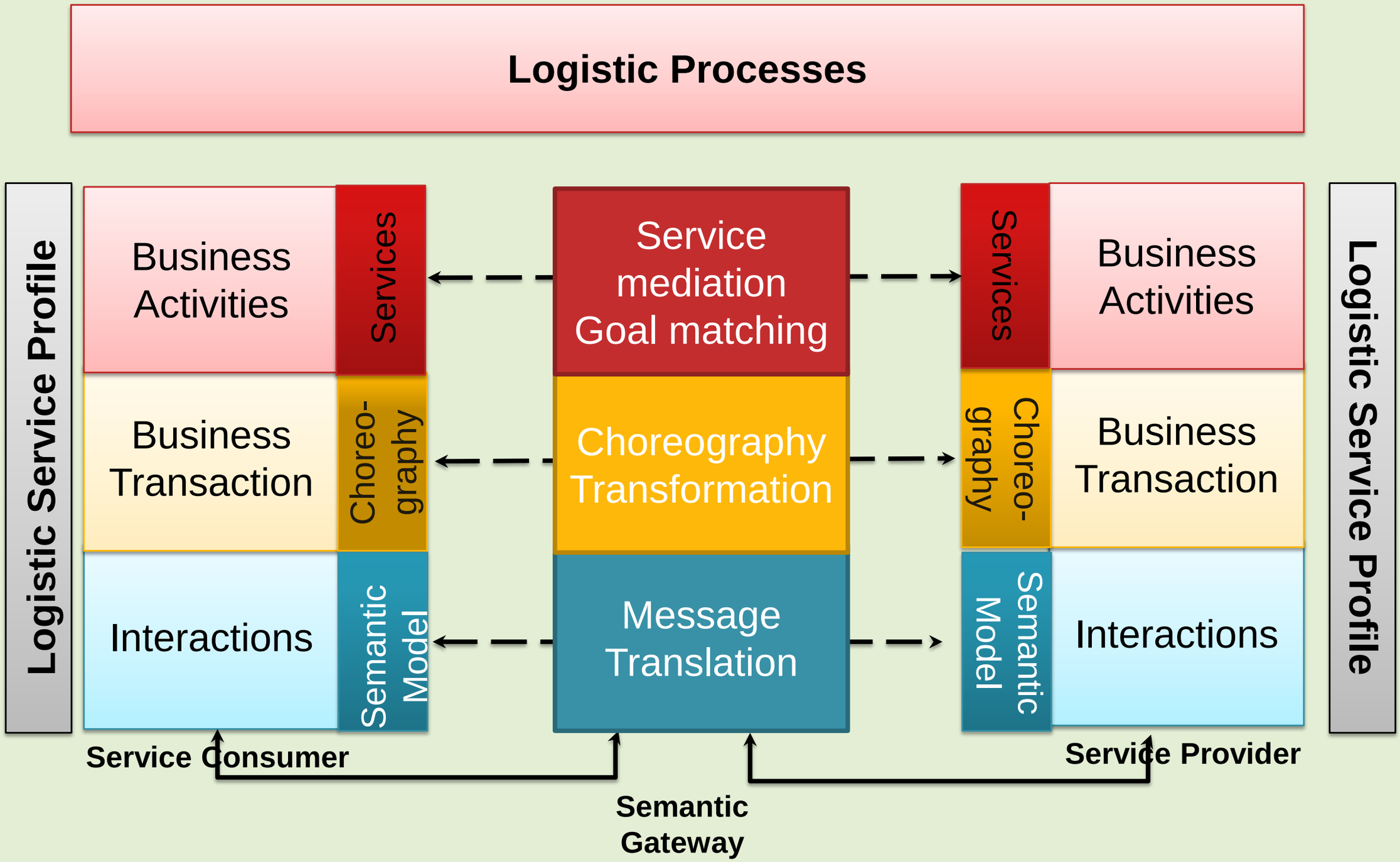


Semantic operability is the aim

- horizontally: at each of the layers
- between the layers of a specific provider

The challenges

Semantic interoperability at all layers (4)



The approach
Support of various types of interfaces

In essence, there are three interfaces towards the outside world, to:

- Expose the logistic services offered by a party:
  - Provide information about possible logistic services
  - Execute business services according to pre-defined business activities.
- Share data related to logistic services, including:
  - Status information, related to the execution of logistic services
  - Entity centric information, related to specific entities involved in a logistic chain (e.g. container information, shipment data, capacity data)
- Expose business data to selected parties by means of linked open data.

The approach
Basic requirements

The realization of semantic interoperability requires the development and implementation of:

- *a well-defined semantic model for the logistics domain*

  This well-defined semantic model for the logistics domain should be developed from the perspective of supporting semantic interoperability between stakeholders on the various levels of interaction, i.e. the levels of business activities, business transactions and interactions.

- *the support of communities*

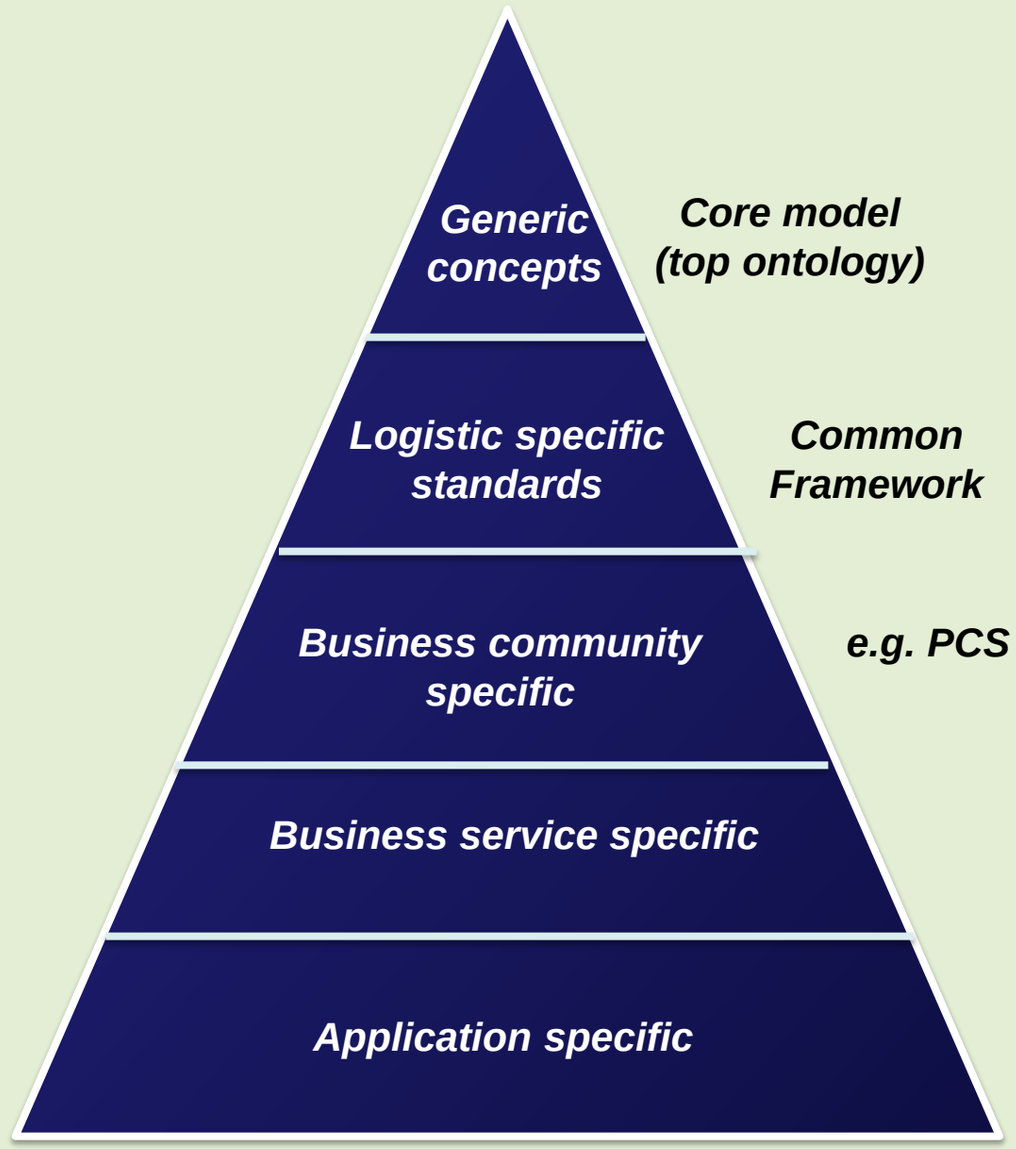
  To meet a high level of dynamics in logistics value chains with ever changing collaborations of stakeholders, the (dynamic) configuration of business communities is required. A community can be a group of collaborating organizations operating in a particular port, a group of suppliers to a specific large shipper, or any other group of cooperating organizations.

- *services to implement semantic interoperability*

  These encompass the supporting tools to define semantic models and to activate and configure the stakeholder's infrastructure for semantic operability.

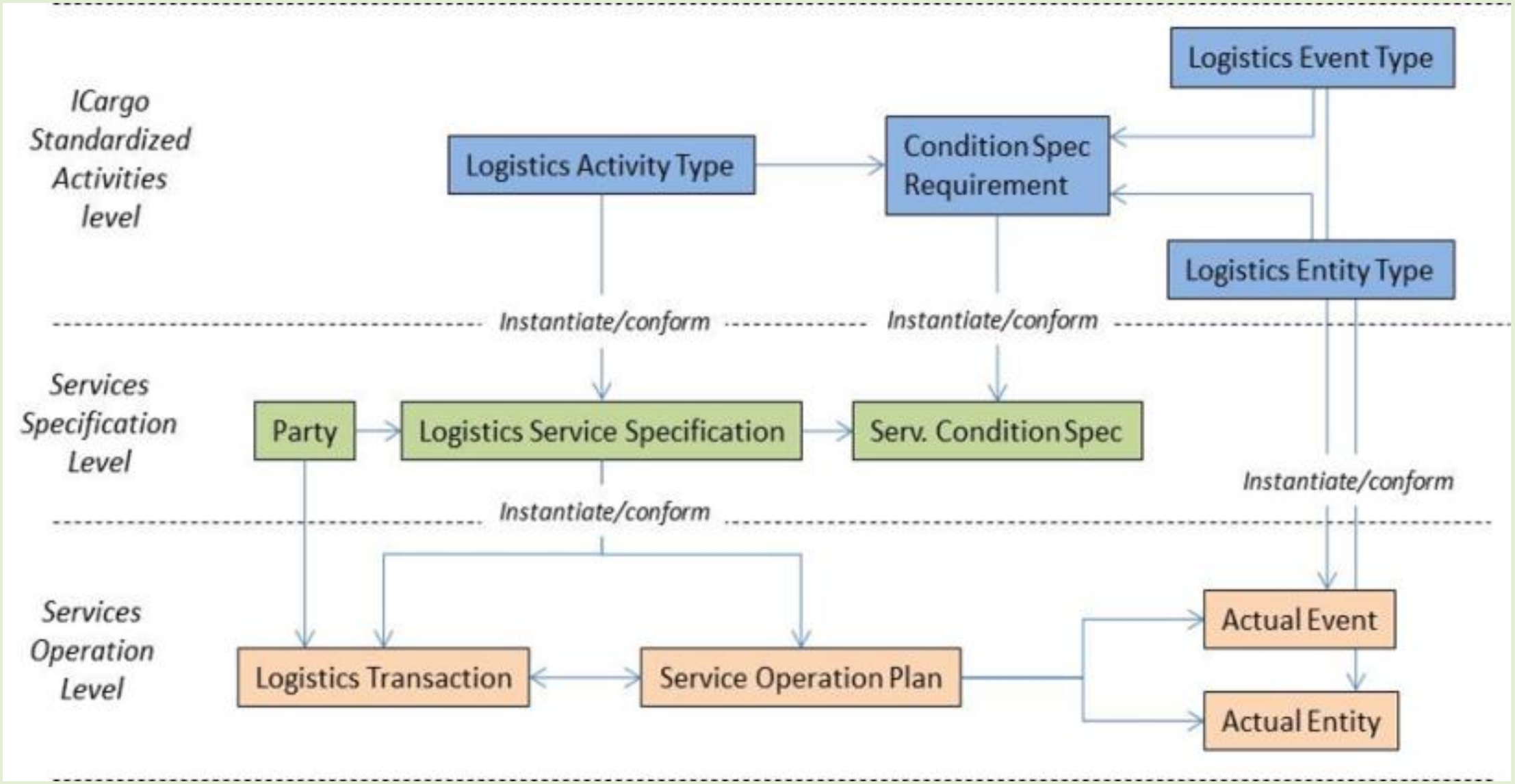
The approach
Support of various types of interfaces

- *No 'one semantic model fits all'*
  - It is desirable to re-use existing models and specify extensions of them.
  - Multiple semantic models might be in-use, that need to be connected in order to provide the semantic interoperability within a community.
  - A layered semantic model is used
- *The role of ontologies in relation to the semantic model*
  - Networked ontologies can be used to implement the semantic model.
  - To support these various levels, the semantic model must not only be able to define 'static' concepts (such as a resource, location, activity, …), but also the dynamic behaviour, i.e. business activities and business transactions to be performed (e.g. using BPMN, BPEL, ….)



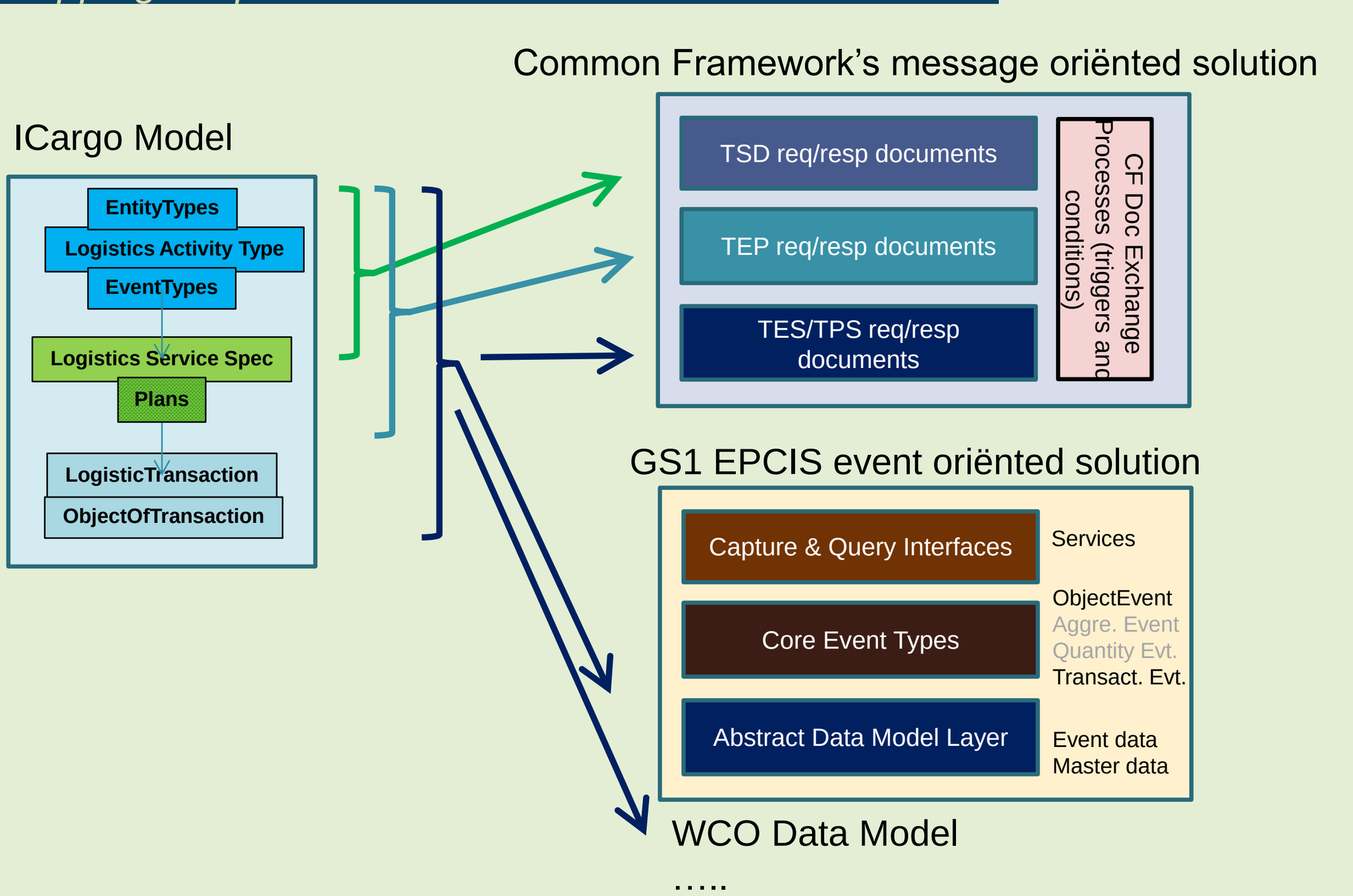
The approach
ICargo domain model - overview

The ICargo Model Description Levels



The approach

Mapping to specific interaction standards



Contributors

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Questions

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