Intelligent goods in intelligent transport systems

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EasyWay Viking
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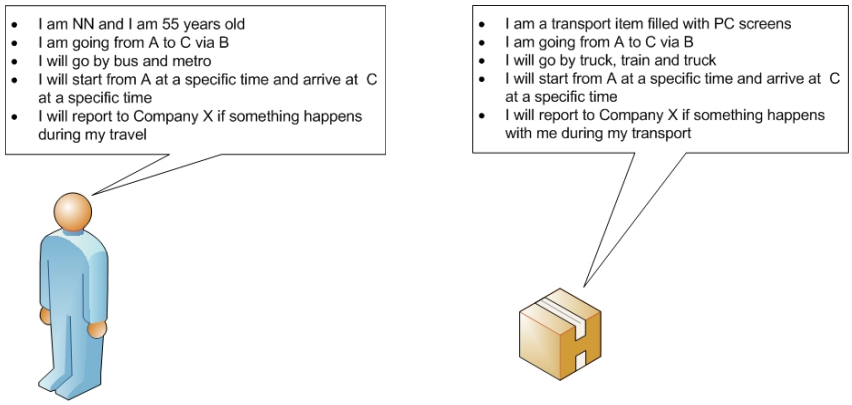
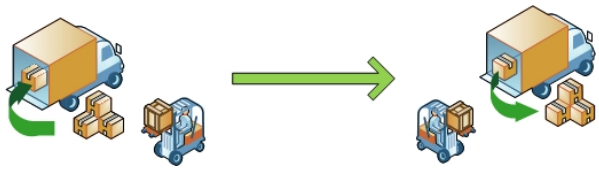
1. Intelligent goods in intelligent transport systems



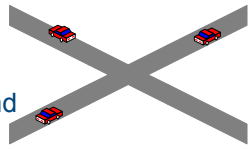
The Transport system for Intelligent goods

- *is a system that fulfils the requirements of the involved actors concerning an effective, secure, traceable and reliable transport*
- *is a system where the goods itself is an important carrier of information about itself, the final destination and events occurred during the transport*



A transport system consists of:

- Transport infrastructure (links and nodes)
- Equipment linked to the infrastructure, e.g. equipment for traffic management, monitoring and communication

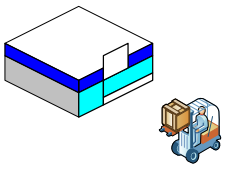


- Transport items (boxes, pallets containers etc)
- **Equipment linked to the transport item**

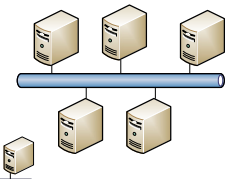
- Transport means (vehicles, trains, boats, planes)
- Equipment linked to the transport means, e.g. Driver support equipment, On-Board Equipment (e.g. for Electronic Fee Collection)

A transport system consists of (cont.):

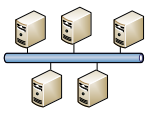
- Terminals with terminal areas
- Terminal equipment
  (equipment and resources for loading and unloading, equipment for communication and track and trace)

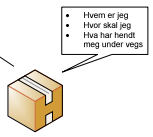


- Interoperable information systems



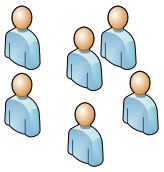
- Control and Decision support systems
  - Centralised
  - Decentralised

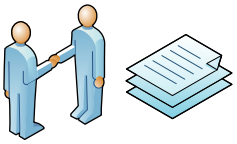




A transport system consists of (cont.):

- A defined set of roles and responsibilities
- A framework with commercial, functional and technical sets of rules

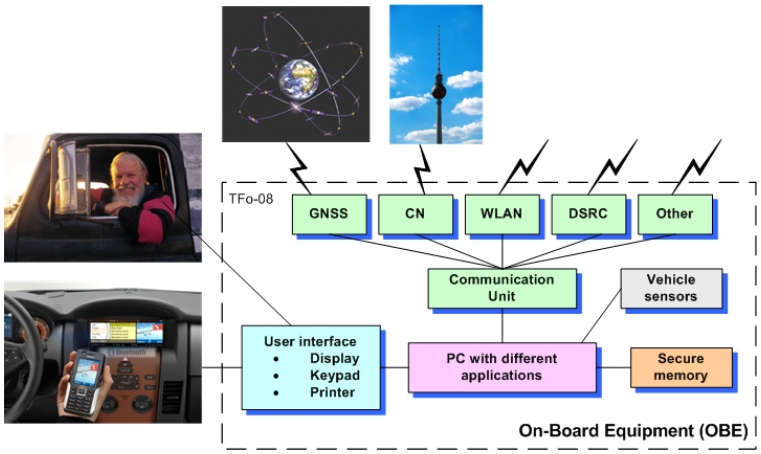




Where are the main R&D challenges today?

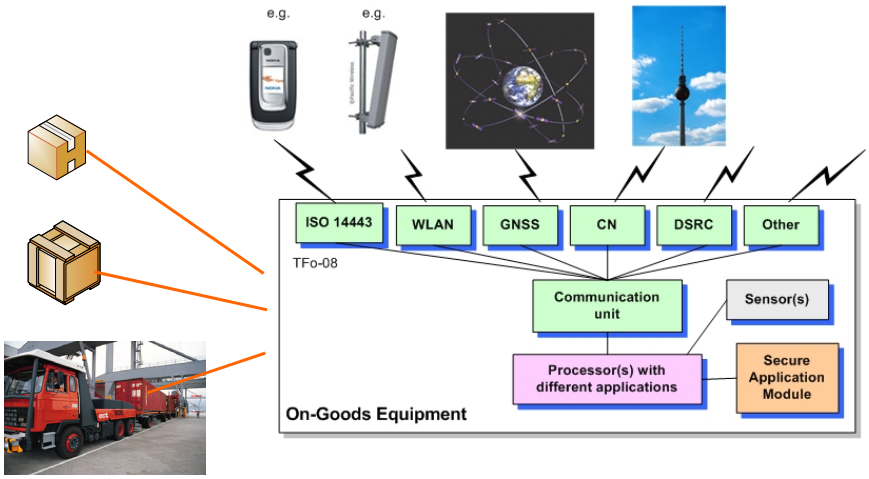
- **Equipment linked to the transport item (On-Goods Equipment)**
- **Equipment linked to the transport means (On-Board Equipment)**
- Interoperable information systems
- Control and decision support systems
- A defined set of roles and responsibilities
- A framework with commercial, functional and technical sets of rules

The future On-Board Equipment (OBE)

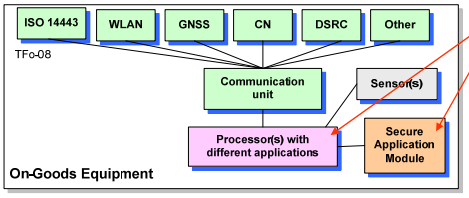


Simple On-Goods Equipment (OGE)

Advanced OGE



OGE function 1: Store data



- Data to be stored, for instance:
  - Electronic Product Code (EPC) data
  - Events
  - Limit values for alarms and events
  - Route data
  - Security keys
  - Specific transport item data
  - IP adresses

GS1 The global language of business

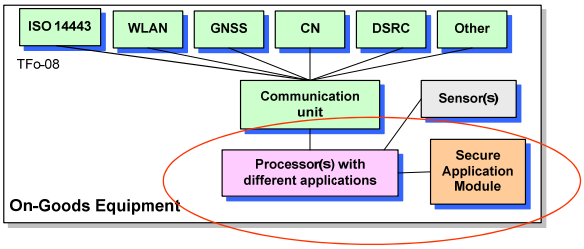
EPCglobal

ISO International Standardisation Organisation

cen European Standardisation Organisation

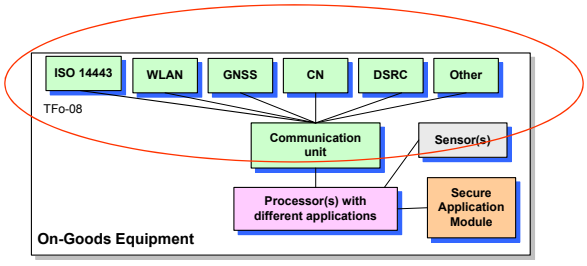
OGE function 2: Manage security

- Access control to data
- Authentication of external entities
- Certificates, e.g. Message Authentication Codes (MAC)
- Security monitoring



OGE function 3: Communicate

- Communication with e.g.:
  - Positioning systems, e.g. GPS
  - Sensors
  - On-Board Equipment
  - Transport infrastructure equipment, e.g. Road-side Equipment (RSE)
  - Terminal equipment
- Several communication types and protocols e.g.
  - Communication Access for Land Mobiles (CALM)
  - Dedicated Short Range Communication (DSRC)
  - Near-field communication (NFC) based on ISO 14443
  - Radio frequency identification for item management (ISO 180000)
  - TC/IP
  - GSM

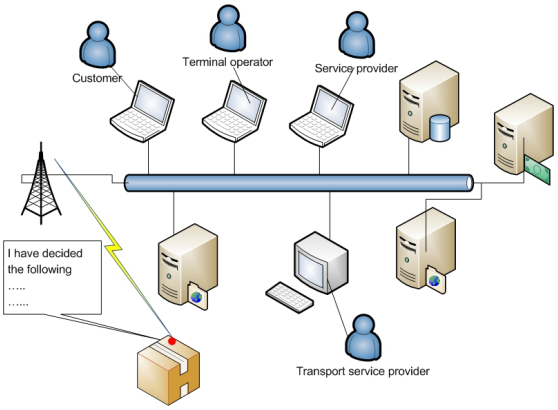


OGE function 4: Monitor the transport item

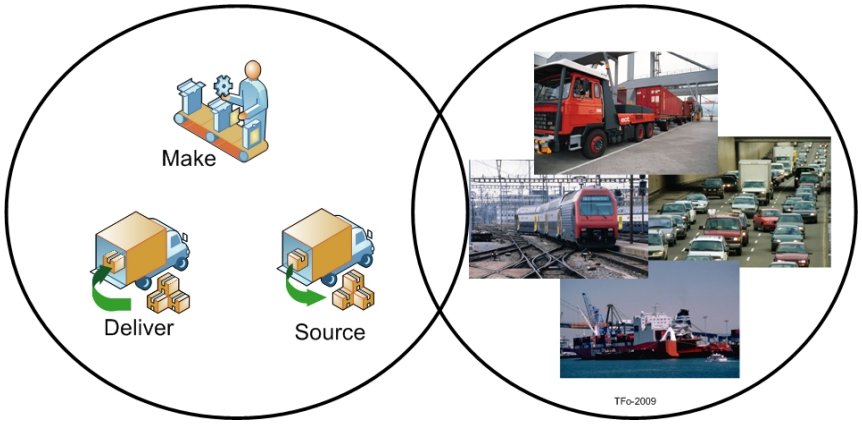
- Monitor the transport item by means of:
  - Integrated sensors
  - Connected sensors
  - External sensors
- Examples on parameters to monitor
  - Location and time
  - Temperature in relation
  - Humidity
  - Shocks
- Monitoring tasks, e.g.
  - Compare location and time with schedule
  - Compare measured parameters with limits
  - Log events in a log
  - Send alarm or messages for predefined events, e.g. temperature above limit or major delays

OGE function 5: Decision support

- Process the data collected in the monitoring process
- Make decisions based on predefined decision criteria



2. The intersection of the supply chain and transport domains



Supply Chain domain *Transport domain*

Main objectives of the paper

- To describe the intersection of the two domains to have a better understanding of the different terms and models used
- To achieve a common view on the upper level of the system architecture in both domains focusing on the main roles and responsibilities
- To be part of the deliveries from the R&D project INTRANS supported by the Research Council of Norway

Supply Chain domain *Transport domain* *Supply Chain domain*

Methodology applied

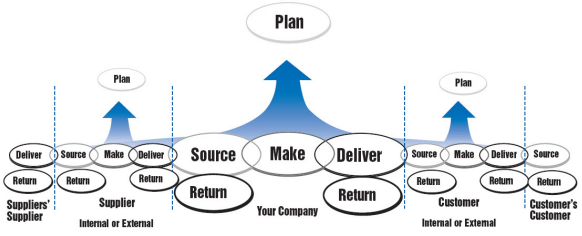
- What are the models available and suitable within the Supply Chain Management domain?
  - Should be
    - Technology independent
    - Internationally applied
    - Stable and continuously maintained
    - Based on international or de facto standards
- What are the models available and suitable within the Transport domain?
  - Should be
    - Technology independent
    - Multimodal
    - Cover transport of goods
    - Stable and continuously maintained
    - Based on international or de facto standards
- How can these models be compared and linked/connected together?
- How can this linking or connecting build a bridge between the two domains?

Available models

Supply-Chain Council

SCOR - Supply Chain Operations Reference Model

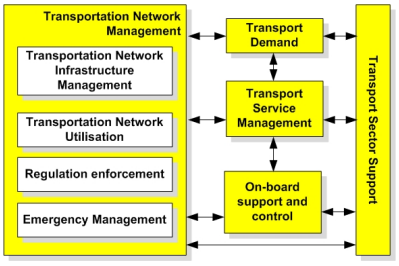
www.supply-chain.org/



ARKTRANS

Norwegian multimodal framework for intelligent transport systems

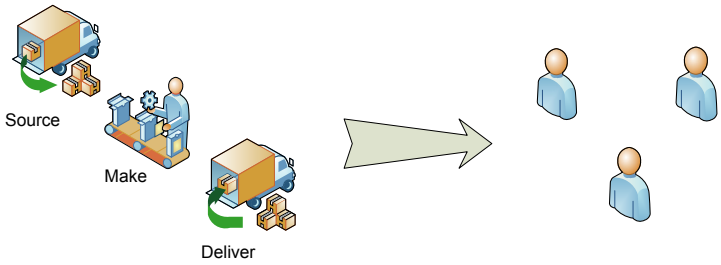
www.arktrans.no



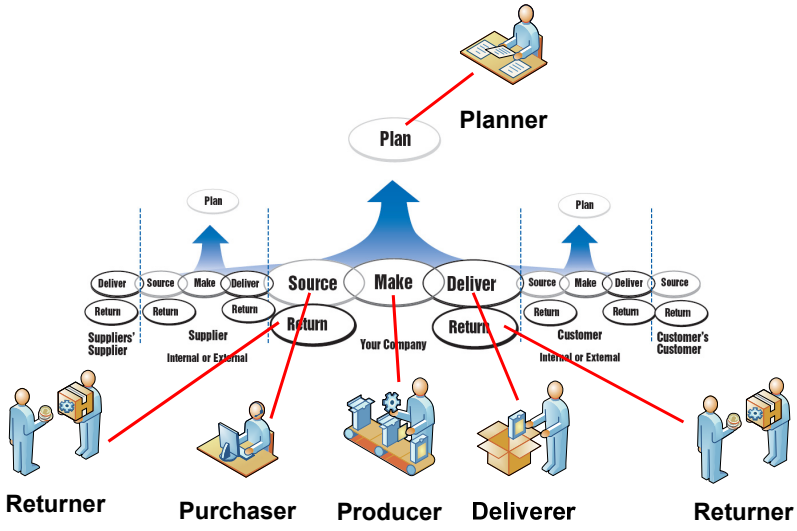
How can these models be compared?

- SCOR is a process-oriented model
- ARKTRANS is both a roles and responsibilities model, a functional model and an information model
- Solution: Transform SCOR on level 1 and 2 to a roles and responsibilities model

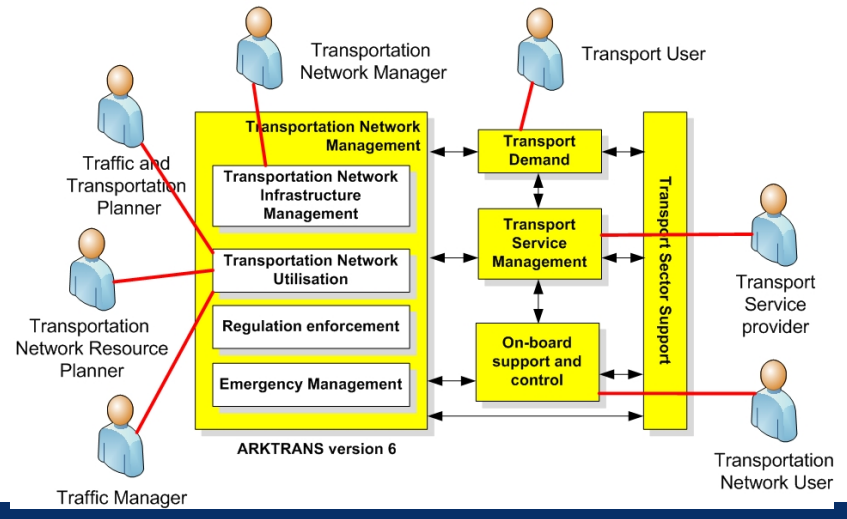
From a process-oriented model to a roles and responsibilities model



Transforming from processes to roles



Roles in the ARKTRANS framework

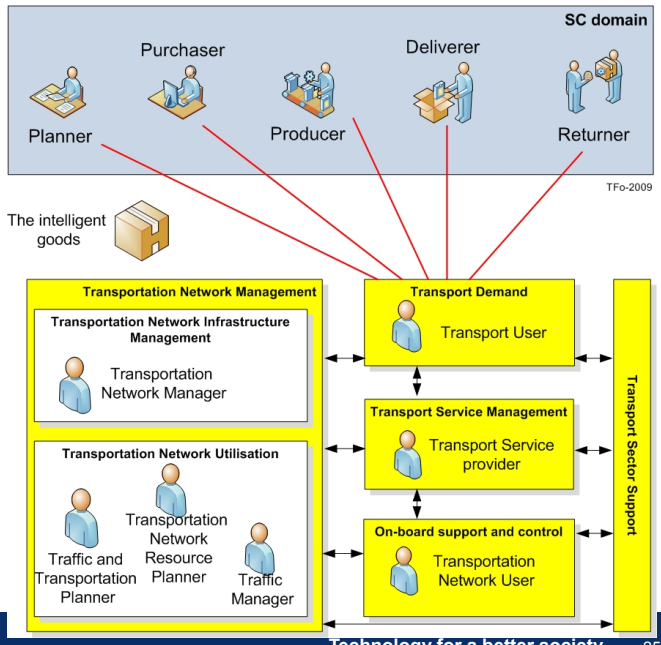


Mapping the SCOR and ARKTRANS roles

Example:

Supply Chain (SC)		*Transport systems*	
Role	**Transport related SC responsibilities**	**Matching ARKTRANS responsibilities**	**Role**
 Deliverer	• Implement the delivery transport plans • Determine delivery date, consolidate orders and build loads • Route shipments and select transport service providers (carriers) and rate shipments • Pack product, load product and generate shipping documents • Ship product • Receive and verify product by customer	• Defining the transport demands and requirements including the object, e.g. the cargo item, to be transported • Transport planning and re-planning (finding the best transport alternative, i.e. the best transport services) • Transport follow up, e.g. track and trace an object in the transport system	 Transport User

Intersection between SC domain and transport domain



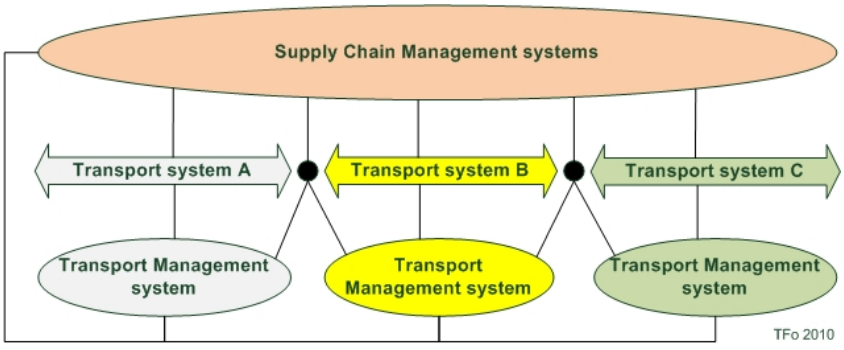
3. The integration of control systems for the supply chain and transport domains

Overview of the paper

Main objective : - to propose a way forward to link and integrate the SC and transport domain for the benefit of the stakeholders in both domains concerning a more effective, secure and reliable transport of goods

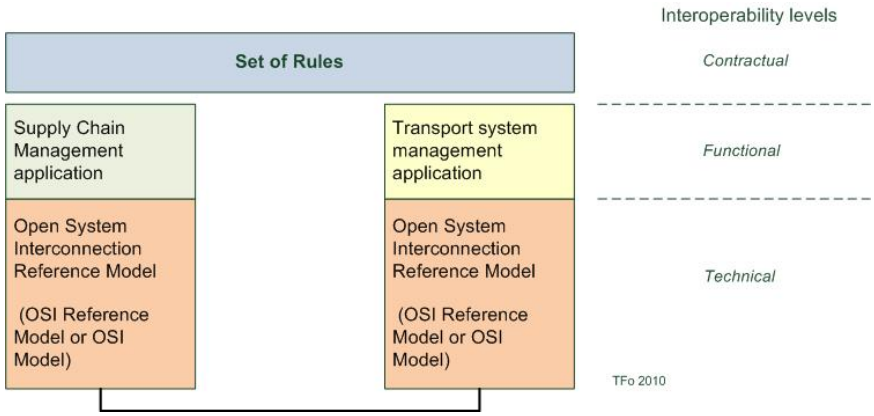
- Describes some of the results up till now of the research project INTRANS supported by the Research Council of Norway.
- Focuses on the results related to the integration of control systems in the Supply Chain domain and the transport domain.
- Looks upon the integration from an interoperability point of view and describes the three different types of interoperability, Contractual, Functional and Technical interoperability, providing complete interoperability.
- Describes how complete interoperability can be achieved by a common role model for the two domains, a common set of core functions for the two domains and a common information architecture.
- Introduces the intelligent goods as a crucial link between the two domains as well as playing an important role in the decision taking in the SC domain and the monitoring and management of transport in the transport domain.

The Challenge



How may the different actors in the SC and transport domain benefit from a better integration of the two domains by sharing the information infrastructure and the information itself?

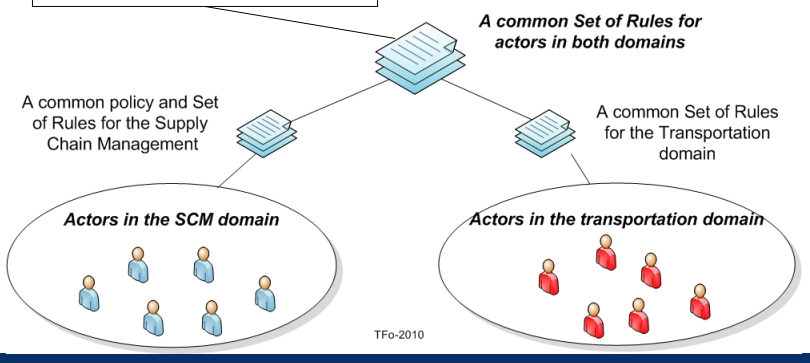
One possible answer



- through contractual, functional and technical interoperability

Contractual interoperability

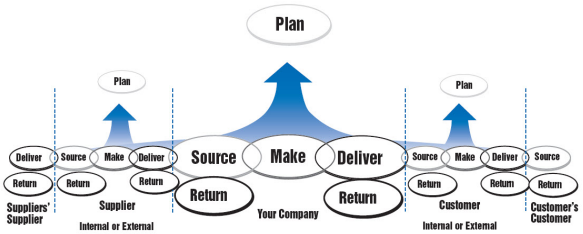
- Governing rules
- Commercial rules
- Functional rules
- Technical rules



Merging two models to one common

SCOR - Supply Chain Operations Reference Model

www.supply-chain.org/



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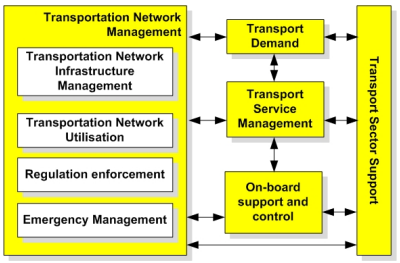
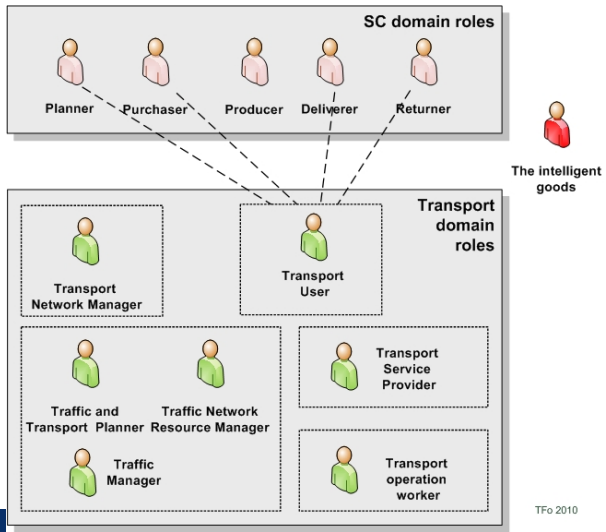
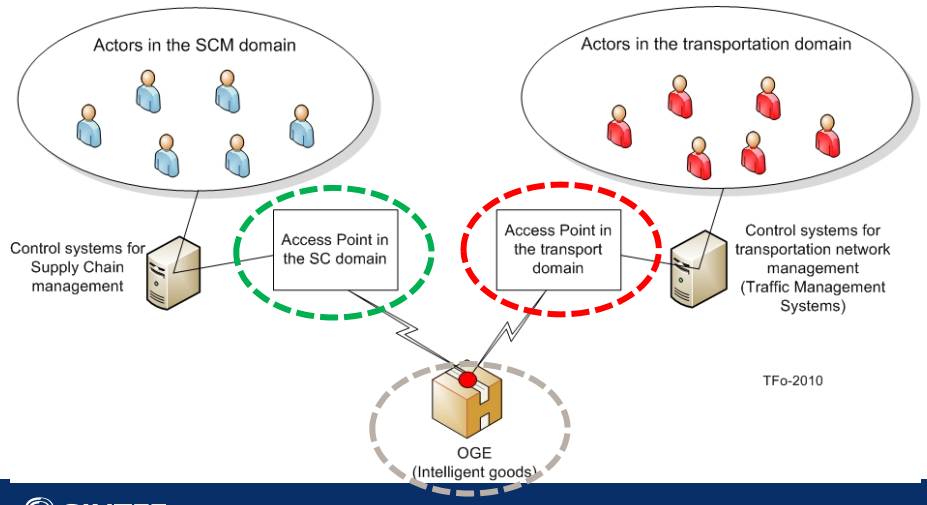


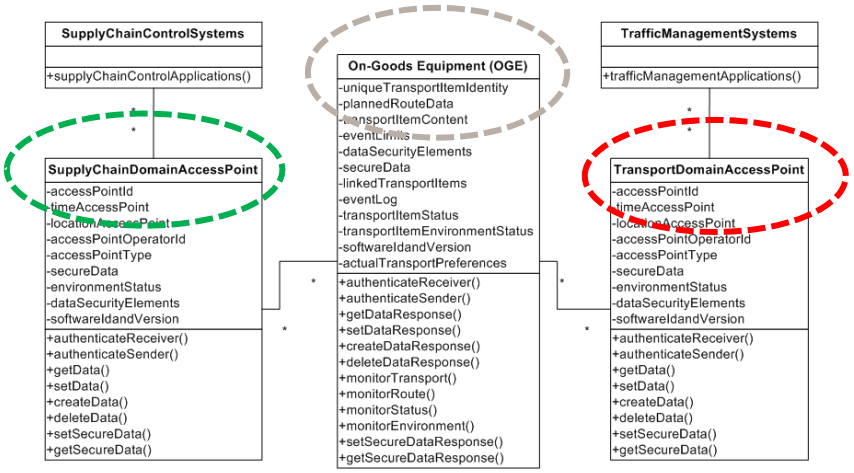
One common role model as bases for allocation of functions



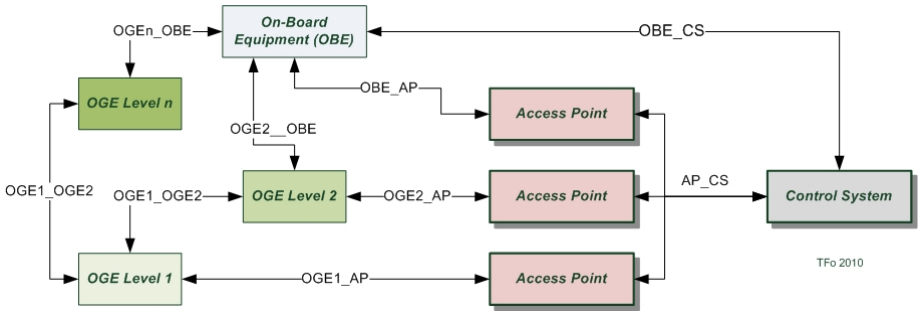
The crucial role of the Intelligent goods and the On-Goods Equipment



Functional interoperability



Technical interoperability



Conclusions and findings

- Transport domain
  - Improved statistics for transport of goods
  - Improved monitoring of traffic, e.g. specific types of goods
  - Improved management of traffic including incident handling
- SC domain
  - Improved statistics gives better basis for planning
  - Improved product deliveries, and product receptions
  - Improved monitoring of transport status, transport item (goods/product) and track and trace

Thank you for your attention!

Questions?