FInest – **F**uture **In**ternet **e**nabled optimi**s**ation of **t**ransport and logistics networks

D8.1

Requirements Analysis and Selection of Technology Baseline for Logistics Contract Manager

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Abstract

Modern transport and logistics processes are characterized by distributed inter-organization activities often spanning several countries and continents. Some of the major problems faced by the domain are: highly manual processes, lack of standards, legal and governmental regulations; limited visibility on T&L processes and critical events hampers business network efficiency and effectiveness, and closed logistic supply chains which hinders agile inter-organizational information exchange and collaboration and access for SMEs. FInest project aims at addressing those problems by developing a Future Internet enabled ICT platform to support and optimize the collaboration and integration within international transport and logistics business networks.

The FInest envisioned technical solution is divided in three major parts: (i) Front-end layer, which is related to user access issues; (ii) Back-end layer, associated with access to, and integration with, legacy systems, third party services and any Internet of Things (IoT) devices that may provide information during the transport lifecycle; and (iii) the Core Modules layer, which is composed of Business Collaboration Module (BCM), E-Contracting Module (ECM), Transport Planning Module (TPM), Event Processing Module (EPM).

This document focuses in the E-Contracting Module (ECM) and is submitted as specified in the FInest Description of Work (DoW) as part of deliverable D8.1 – "Requirements analysis and selection of technology baseline for logistics contract manager" – associated with Work Package 8 (WP8).

The objectives of WP8 are: Conduct a detailed analysis of the state-of-the-art techniques and solutions to select the technology baseline to build upon (task T8.1); Provide a conceptual design and detailed specification for the E-Contracting Logistics Module and its integration within the overall envisioned technical solution (task T8.2); Identify Generic Enablers required from the Core Platform to realize the E-Contracting Logistics Module, and clearly define the additional components ("domain-specific enablers") that need to be realized on top of this (task T.8.3); Develop a conceptual prototype for demonstrating the planned features (task T8.4). Define a detailed Implementation Plan for the follow-up project in Phase 2 (task T8.5).

The objectives of this document are:

a) identification of initial requirements for the Logistics Contract Manager (task 8.1);

b) selection of existing R&D results to build upon (task 8.1);

c) initial identification of the required Generic Enablers(task 8.3).

The first two objectives are addressed in detail by this document, once the following topics are here discussed: an overview of the current state of contracting related topics in T&L domain; an analysis the state-of-the-art related to contracting processes in ICT, and the identification of the technological baseline that can be exploited by the ECM module. The last objective is addressed in this deliverable but the details are part of D3.1. In addition, this document also introduces an initial high level architecture of the logistics contract manager, i.e., ECM, and an initial set of technical requirements for designing the ECM module.

Document History

Version	Date	Comments
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Acronyms

Acronym	Explanation
AEO	Authorized Economic Operator
ASEAN	Association of Southeast Asian Nations
ASW	ASEAN Single Window
BCM	Business Collaboration Module
CCS	Cargo Communication Services
CEFACT	Centre for Trade Facilitation and Electronic Business
CSI	Container Security Initiative
C-TPAT	Custom Trade Partnership Against Terrorism
DTA	German Data Exchange Format
Dy.z	Deliverable identified by the numbers “y” and “z”
ECM	E-Contracting Module
EDIFACT	Electronic Interchange for Administration, Commerce and Transport
ELM	Electronic Logistics Marketplace
ELM	Electronic Logistics Marketplace
EPM	Event Processing Module
ETA	Estimated Time to Arrive
FAST	Free and Secure Trade
GLN	Global Location Number
GS1	Global Standards One
GTIN	Global Trade Item Number
HLA	High Level Architecture
ICT	Information and Communication Technology
IMS	Inventory Management System
INCOTERMs	International Commercial Terms
IoT	Internet of Things
IRU	International Road Transport Union
KPI	Key Performance Indicator

Acronym	Explanation
ODETTE	Organisation for Data Exchange by Tele Transmission in Europe
OMS	Order Management System
PIP	Partner in Protection
QoS	Quality of Service
RFID	Radio Frequency Identification
SEDAS	German Standard Regulation of Uniform Data Exchange Systems
SLA	Service Level Agreement
SLO	Service Level Objects
SME	Small Medium Enterprise
SOA	Service Oriented Architecture
SSCC	Serial Shipping Container Code
SWIFT	Society for Worldwide Interbank Telecommunication
T&L	Transport and Logistics
TAPA	Transport Asset Protection Association
TEXO	THESEUS Research program
TPM	Transport Planning Module
UNECE	United Nations Economic Commission for Europe
USDL	Unified Service Description Language
V1.0	First draft
VDA	Association of the German Automobile Industry
WCO	World Customs Organisation
WMS	Warehouse Management System
WPx	Work Package identified by the number “x”
WS	Web Services
WSDL	Web Services Description Language
WSLA	Web Service Level Agreement
WSOL	Web Service Offerings Language
YMS	Yard Management System

1 Introduction

A Transport & Logistics (T&L) contract specifies all legal terms and conditions for the carriage of goods and Service Level Agreement (SLA) conditions such as: escalation processes for the occasions when problems arise, payment schedules and service level requirements. Unfortunately, all of this information is contained in a paper based document that is not generally available to the downstream individuals who are responsible for executing the contract. As consequence, executions of paper-based T&L contracts do not allow online/real-time and accurate check whether the SLAs of such contracts are maintained, which results in overcharges among parties of a contract and "post-mort" verification of contract violations.

In addition, the contracting process itself within the transport and logistics domain for complex international movement of goods is currently a manual and time consuming process. The process begins with the identification of a need to ship something. Needs identification is followed by partner identification (based on capacity or availability, for example) and qualification, partner bid development and bidding, bid evaluation and tentative partner selection. Once a tentative partner has been selected a contract is negotiated and agreed between various the contracting parties. All these steps until the actual agreement among the parties are typically executed by individuals interacting using emails, phone calls, datasheets and/or text documents. There are few initiatives trying to automate the contracting processing, like, for example, Electronic Logistics Marketplaces. However, these attempts are still far away from solving the extreme dependency of manual intervention.

There are at least another two other problems also associated to this extreme manual contracting phases. The first is associated with the fact that in most of the cases, the offers between the negotiating parties are exchanged though datasheets or text documents. The resulting problem is the lack of common representation of the SLAs attributes, and more specifically to service level requirements representation in T&L contracts. The second problem is related to the manual and individual-knowledge-dependent identification of potential partners. An individual responsible for verifying which are the available offers for establishing T&L business networks to support effective transport, will more likely to be aware of large enterprises offers or business capabilities. This individual-knowledge-dependent process prevents SMEs of having the chance to present their offers, and participate in complex international movements of goods.

In order to change the current situation on the contracting process in the T&L domain, Work Package 8 will design, specify and prototypically implement a Logistics Contract Manager (from now on called E-Contracting Module, ECM) to support logistics stakeholders in (semi)-automatically establishing and managing contracts.

1.1 Objectives and Scope of WP8

The concrete objectives of WP8 are:

- Conduct a detailed analysis of the state-of-the-art techniques and solutions to select the technology baseline to build upon (task T8.1)
- Provide a conceptual design and detailed specification for the E-Contracting Logistics Module and its integration within the overall envisioned technical solution (task T8.2).
- Identify Generic Enablers required from the Core Platform to realize the E-Contracting Logistics Module, and clearly define the additional components ("domain-specific enablers") that need to be realized on top of this (task T.8.3).
- Develop a conceptual prototype for demonstrating the planned features (task T8.4).
- Define a detailed Implementation Plan for the follow-up project in Phase 2 (task T8.5).

In order to achieve the objectives of WP8, we defined the scope of ECM as follows: (i) enable a semi-automated support for the contracting cycle, such as actions from selection of partners until the agreement of the contracts, and (ii) structure the electronic support to enable the runtime management of T&L contract executions.

The initial main envisioned features of the E-Contracting Module are listed below:

- Electronic model for representing the SLA attributes of T&L contracts (e.g., SLAs, pricing, escalation processes, etc.);
- Provide the support to enable future online monitoring of T&L contracts;
- On-line management and review of contracts with automatic notification of contract end dates and renegotiation time fences;
- Execution of semi-automated e-contracting selection (offering, bidding, choosing), establishment (negotiation and agreement), and management (support to re-contracting in case of deviations in the execution of established contracts);
- Integration of marketplaces to support (semi)-automated partner selection, bidding, and negotiation.

The aforementioned features of the ECM are not static set, instead, they will be constantly refined and whenever necessary updated.

1.2 Objectives of this Deliverable

This document focuses on the E-Contracting Module (ECM) and is submitted as specified in the FInest Description of Work (DoW) as the deliverable D8.1 – "Requirements analysis and selection of technology baseline for logistics contract manager" – associated with Work Package 8 (WP8).

The objectives of this document are:

- identification of initial requirements for the Logistics Contract Manager (associated with T8.1);
- selection of existing R&D results to build upon (associated with T8.1);

- and initial identification of the required Generic Enablers (associated with T8.3).

The first two objectives are addressed in this document in Sections 2 up to 7. The last objective is addressed in this deliverable in Section 8 but the details are part of Section 5 in D3.1.

1.3 Deliverable Organization

This deliverable is organized as follows.

Section 2 encloses information from the transport and logistics domain that is relevant for understanding how contracting processes occur in this domain. This section starts with an overview of terms and established issues related to T&L contracts. After this, it is presented a review on how the T&L domain address SLAs (Service Level Agreements) in terms of which are the common attributes considered and management issues. Finally, initiatives for approximating ICT and logistics services are described.

Based on the current situation in T&L domain, we present in Section 3 the requirements analysis necessary to support the definition of the E-Contracting Module. This section presents initially an analysis and definition of concepts associated with T&L contracts to be followed by the design of the ECM, and then it describes the initial set of requirements elicited.

Section 4 depicts the initial high level architecture of the ECM based on the elicited requirements. Besides the introduction of the elements of the high level architecture, this section also presents the mapping of the requirements to those elements.

Taking into account the requirements for the ECM, Section 5 depicts the state-of-the-art in E-contracting associated with ICT. An overview about ICT services and e-contracting is presented. In addition, service description languages are presented as well as SLA marketplaces platforms. The discussion about the potential technology baseline closes this section.

Section 6 presents the description of the GE request associated with SLA negotiation and management for non-ICT services attributes.

Finally, Section 7 describes the final remarks of the work developed within the period reported in this document. In addition, the next steps are also discussed in this section.

1.4 Relationship with Other Work Packages

WP1 ('Domain Characterization and Requirements Analysis') is concerned with the identification of business requirements in the Transport & logistics domain. Those requirements contribute to the overall design goals and rationale of the E-Contracting Module in WP8.

WP2 ('Use Case Specification') provides three use case scenarios for FInest project. Those scenarios serve as basis for the refinement of the business requirements identified in WP1, and serve as the demonstration, test, and evaluation scenarios for the prototypes associated with the technical WPs, such as WP8. In addition, WP2 will design to-be use case scenarios taking into account the modules developed in the technical WPs.

WP3 ('Solution Design and Technical Architecture') provides the overall design and architecture of the FInest platform. This means that the core technical modules, i.e., design of the solutions in WP5 – WP8, must follow the definitions of WP3 in order to be integrated in the FInest platform.

WP4 (‘Experimentation Environment’) is concerned with providing the experimental infrastructure for demonstrating the use cases scenarios described in WP2. During the demonstration process the elements required by the WP8 module will also need to be considered by the experimental infrastructure.

The technical WPs (WP5, WP6, and WP7; respectively, ‘Business Network Collaboration’, ‘Proactive Event Driven Monitoring’, ‘Transport Planning and Replanning’) are not isolated entities in the overall FInest platform. In this sense, WP8 is mainly associated with WP5 and WP7, because information about contracts must flow specially among the e-contracting, business collaboration and planning modules.

WP9 (‘FI PPP Alignment’) is responsible for the alignment of the FInest project with the FI PPP Program. In this sense, WP8 is related with WP9 in the sense that it helps on the identification of GEs associated with e-contracting aspects.

2 Current Contract-related Practices in T&L Domain

This section describes the current practices related with contracts in T&L domain. The information presented in this section is partially based on the experience and knowledge of the T&L domain specific partners of FInest project involved in WP8 activities and on a non-exhaustive review of literature.

The elaboration of the current situation in T&L domain is divided in four main parts.

- The first one gives a basic overview of topics that are related to contracts in the domain. This overview is important to contextualize some common terms and concepts associated to T&L contracts.
- The second part describes SLAs issues in the scope of the T&L domain.
- The third part describes the relationship of ICT systems and T&L domain.
- Finally, a summary of the major issues associated with current status in T&L contracts is provided in the fourth part of this section.

2.1 Overview on Logistics Topics Associated with Contracts

The objective of this section is to gather knowledge and explore the current processes and issues related to T&L contracts. During the development of the work in WP8, we performed interviews with the domain partners, and we could observe that there are many issues related to T&L contracts, like the characterization of the attributes of a T&L contract, legal terms and country regulations. In between, we identified the existence of standards associated with the execution of contracts.

In this section, therefore, we first describe the major stakeholders associated with the contracting processes. In a second moment, we describe some of the main standards in use for the execution of T&L services and, in turn, the execution of T&L contracts. Finally, we discuss in this section some examples of electronic documents employed during the execution of contracts.

2.1.1 Major Stakeholders

Transporting goods from seller to buyer usually involves several parties whose roles may be unclear to many external contemplators. In the following, an outline the basic functions of the most prominent actors in a transport chain is presented. The terms here presented are a summary of the work developed by WP1 (Domain Characterization and Requirements Analysis). For more details about the stakeholders one should look the D1.1 – '*Transport and Logistics Domain Analysis*'.

The **seller/shipper** and the **buyer/consignee** are the parties contracting with one another for the delivery of the goods [3;7]. The **shipper** is the party who contracts for the carriage of the goods. The **consignee** is the one that receive the goods [1;3].

A **freight forwarder** is a transport intermediary, offering different types of services like organizing transport, customs documentation, etc. In some cases, the freight forwarder can also act as a carrier [5].

A **carrier** is a party who owns the transport equipment and provides transport services. Examples of carriers are: shipping companies, airlines, railway companies, and truck companies [3;7].

Depending on the trade terms, either the seller or the buyer will usually take out goods transit insurance with a **cargo insurer.** Insurance Brokers are looking for insurance companies providing insuring contracts in order to cover the risks of liability of involved parties [3].

Another party to be considered in the transport process chain is the **customs authorities**. The customs authorities are crosschecking the cargo with the provided customs declaration and whether there is any violation of laws or other regulations or not [4;5].

2.1.2 Standards Associated with the Execution of T&L Contracts

For contracts in international trade and goods exchange several contractual terms have to be incorporated into the settlement of the agreement. To these belong the **Terms of Trade** [4;5] which are used in order to describe economic and legal delivery conditions and related rights and obligations. Likewise, **Price Escalation Clauses** [4] help to explicitly shape the contractual agreements on price determination whereas **Terms of Payment** regulate the method and maturity date of the receivable payment and its place of fulfilment, amongst others. Moreover, contracts in international trade, esp. in the transport and logistics domain, are subject to specific **Customs and Security Regulations** [4]. With respect to communication and information exchange, there exist several **Data Exchange and Communication Standards** [4; 6; 7; 8] in order to support smoother and seamless processes with a minimum number of media breaks and a maximum in speed and efficiency. For the work developed in WP8, the first 3 items associated with contracts (i.e., Terms of Trade, Price Escalation Clauses, and Terms of Payment) are os special interested, because they can provide insights on which are the attributes of SLAs that could be support by the E-Contracting module. Therefore, these 3 items are discussed below.

Terms of Trade

The large amount of customs of trade or trade terms customary in a certain region or within an industry all around the world lead to highly opaque situation and many misunderstandings and even legal suits in everyday business. In 1928, the International Chamber of Commerce decided to introduce the so-called International Commercial Terms (INCOTERMs) as universal contracting norm for the trade clauses usually used in international trade. Currently, the Incoterms 2010 – having entered into force as from January 1st, 2011 - apply. In order to be legally binding, the Incoterms have to be explicitly included in the purchasing agreement, i.e. the sales contract between shipper (exporter) and consignee (importer) [4].

The Incoterms consist of eleven individual terms and can be differentiated into maritime and non-maritime conditions, i.e. rules applying for sea and inland waterway transport, on the one hand, and rules for any mode of transport, on the other [4;5]. In the following, the Incoterms are shortly introduced: **EXW**: Ex Works (agreed place of loading); **FCA**: Free Carrier (agreed place of loading); **CPT**: Carriage Paid To (agreed place of destination); **CIP**: Carriage and Insurance Paid to (agreed place of destination); **DAT**: Delivered at Terminal; **DAP**: Delivered at Place

(agreed place of destination); **DDP**: Delivery Duty Paid (agreed place of destination); **FAS**: Free Along Side Ship (agreed port of departure); **FOB**: Free on Board (agreed port of departure); **CFR**: Cost and Freight (agreed port of destination); **CIF**: Cost and Freight (agreed port of destination). The detailed description of the INCOTERMs is presented in

Appendix A.

Price Escalation Clauses

Price Escalation Clauses allow the flexible determination of procurement and sales prices in international trading transactions and serve as contractual protection against the risk of currency rates and inflation. Especially in connection with long lead times for manufacturing or delivery, agreements on follow-up orders or constant deliveries, inflation-based price fluctuation or general currency uncertainty and changes in currency exchange rates may lead to a relatively strong position of an exporter. Basically, there exist four types of Price Escalation Clauses which namely are Exchange Rate Clauses, Unilateral Clauses, Time-based Price Clauses and Price Clauses based on Price Changes [4].

The Exchange Rate Clauses refer to currency uncertainty and fix a certain currency rate as a base of the price of the good, e.g. a CIF price of 1.00 EUR = 7.75 NOK. Unilateral Clauses work vice versa since a price representing a minimal value is being determined in order to protect oneself against unfavourable currency rate developments [4]. Time-based Price Clauses bear considerable uncertainties for importers since they would have to suffer from inflation and currency uncertainty as well as those uncertainties having occurred after the conclusion of the contract [4]. Price Clauses based on Price Changes refer to changes of external elementary values influencing the price of the good, such as costs of material and labour transportation, energy and living [4].

Terms of Payment

The Terms of Payment can be distinguished along the time pattern of the payment conditions, i.e. between short-term and long-term conditions. The Terms of Payment usually applied in international trade are:

- Cash In Advance (CIA)
- Down Payment
- Cash On Delivery (COD)
- Consignment Sale
- Payment Against Invoice
- Open Account
- Documents Against Payment - Documentary Collection (D/P Collection)
- Documents Against Acceptance - Documentary Collection (D/A Collection)
- Documents Against Payment of Letter of Credit (D/P Credit)
- Documents Against Acceptance of Letter of Credit (D/A Credit)

A detailed description of each one of the aforementioned terms is presented in

Appendix A.

2.1.3 Electronic Documents

In order to better support the execution of T&L contracts and services, some initiatives for employing electronic documents have been developed. This section presents two of those initiatives.

Single Window

The main idea of the Single Window Concept is to increase the efficient exchange of information between traders, concerned public authorities and governments in an international (cross-border) trading environment [10] where large volumes of information and documents have to be prepared and submitted to fulfil all import, export, and transit-related regulatory requirements. The Single Window concept aims to facilitate these time-consuming processes and procedures and describes a system that enables traders to submit all required documents only once at a single entry point, bringing meaningful gains to all parties involved in cross-border trade: availability and handling of information, simplified information flows as well as greater harmonisation and sharing of the relevant data across governmental systems. Examples of Single Window systems are described below, and further ones are depicted in Appendix B.

Swedish Single Window system

The present Swedish Single Window system, known as "The Virtual Customs Office" (VCO), allows the submission, by electronic means, of customs declarations and of applications for import and export licenses, for licenses for strategic products and for both the import and export licences. It can further be integrated into the business system of traders and can then automatically update changes in exchange rates, tariff codes and duty rates. The Single Window also includes all trade-related regulations and can provide traders with automated updates on changes via Internet and/or SMS-services.

Import and export declarations can be processed both via Internet and EDIFACT. All services are pooled on a single VCO web page, currently more than 150 e-services are available. The information and procedures on the VCO support ten different languages.

The system currently involves the Swedish Customs (lead agency), the Swedish Board of Agriculture, the National Board of Trade, the National Inspectorate of Strategic Products, the Police, the National Tax Administration and Statistics Sweden.

A customer using the electronic customs declaration will get a reply within 90 seconds. Should the processing take longer, the trader will have the option of receiving frequent updates on the progress of the transaction via SMS and e-mail. Feedback from traders has shown that 80 % found the virtual customs office saved time, 54 % directly saved money, 72 % experienced increased flexibility and 65 % found that the quality and speed of the service had improved.

The Customs have simultaneously been able to cut costs, increase the efficiency of internal procedures and relocate resources to core activities. [18]

The Port of Hamburg as an Example for Maritime Single Window Systems

In a maritime centric environment for example there are two Single Window concepts that focus on ship clearance, cargo clearance and port clearance services: The Port Single Window (PSW)

that provides local information about the vessel to the authorities on a port level and the Port Community System (PCS) that serves as an exchange platform for messages in port environment and integrates procedures, rules, standards and ICT solutions in order to support automatic data and document exchange related to the port authorities' clearance of ships and cargo upon arrival, stay and departure. In many cases, a PSW is also titled as a PCS.

The main objectives of these systems are a more efficient communication between ship and shore, early exchange of information to allow authorities sufficient time to assess the required information, improved efficiency of reporting activities, port operations and separation of responsibilities of reporting to authorities and commercial reporting. [13]

The Port of Hamburg, for example, claims itself as a "paperless port" and offers a Single Window Port Community System called DAKOSY where all companies and authorities involved in the export, import and transit processes can handle their transport processes rapidly and with electronic assistance by using B2B services and applications of this platform. For all import- and export-relevant transport and (transit) processes as well as all documents necessary for processing the transport (e.g., transport orders, customs applications, harbour orders, bills of lading) the Port of Hamburg provides a special Export Message Platform (EMP) and Import Message Platform (IMP) where the documents are transferred in internationally standardized message formats [14].

Figure 1 - Port Communication System Port of Hamburg [14]

The European Single Window Concept

At the end of 2010 the European Port Community Systems Association (EPCSA) was formed to move forward with an European 'Single Window' concept. The association will provide expert opinion on proposed new regulation and contribute to the harmonisation and coordination of reporting formalities, processes and procedures. Therefore a detailed whitepaper is being developed that demonstrates the role, benefits and objectives of Port Community Systems and the possibilities of an economic area comparable to other influential free trade zones around the world [15].

Way-Bill

A waybill ("consignment note") is a document that provides details and instructions about: the shipment of a consignment of goods, like the names and addresses of the sender and recipient; a description of the goods; the number of packages and their weight; the point of origin of the consignment, its destination, the transport route and the amount charged for carriage. The primarily actors associated with way-bills are described below.

- The sender is the shipper of the consignment also often the transport buyer.
- The recipient is the receiver of the consignment.
- The carrier is responsible for providing the transport service for the consignment.

Each actor gets a copy of the document, which is in turn, a proof of collection at the sender perspective and a proof of delivery at the recipient perspective. The proof itself is characterized by the stamp and signature of sender, carrier and consignee. A copy of the waybill should by law follow the goods during transport.

Depending on the method of transport a waybill is also called sea waybill or BOL (Bill of Lading), air waybill, road consignment note or CMR (*Convention relative au contrat de transport international de marchandises par route*) document, rail consignment note or CIM (Contract for International Carriage of Goods by Rail) document.

The need for online solutions dealing with electronic consignment notes has been discussed in various research works within the last ten years. There are also many companies and research programs that have already developed concrete solutions in order to make use of more efficiency, safety and security by electronic consignment notes. Examples of Way-Bill systems are described below.

Electronic consignment notes (e-CMR)

Discussions about the electronic consignment note for international road transport started in 1997 in order to provide a faster and more efficient transfer of information. In May 2008, seven countries signed the United Nations Economic Commission for Europe (UNECE) protocol to establish a legal framework and standards for electronic consignment notes (e-CMR) in international road transport. The e-CMR protocol is part of the CMR agreement - the standard regulation for goods transport contracts - that was established in 1956 and has currently 53 contracting parties. It is hoped that all of them will adhere to the e-CMR protocol [67]. In order to force the development and dissemination of electronic communication in contracts of carriage, an "Additional Protocol to the Convention on the Contract for the International Carriage of Goods by Road (CMR) concerning the Electronic Consignment Note" has been promoted lately (7 March 2011) [68].

The e-CMR contains the same particulars as its paper counterpart. In order do to combat fraud, the original form of the note must be preserved to show the original particulars. The e-CMR protocol provides requirements to ensure efficiency, safety and security, for example authentication by means of a reliable electronic signature that is linked to the document and an assurance that the electronic consignment note retains its integrity. [69] The contracting parties must also agree to certain procedures concerning the method of issuance and delivery of the e-CMR. [70]

Electronic air waybill

In December 2010 the global logistics service provider Logwin signed an agreement with Lufthansa Cargo AG to conclude freight contracts with Lufthansa Cargo AG and handle transportation exclusively on the basis of an electronic Air Waybill.

The development of concepts and the standards for the electronic Air Waybill are driven by the International Transport Association (IATA), whose specifications regulate every detail of the processes covering the "Carriage of Cargo using Electronic Data Interchange" [71]. The diagram in Figure 2 shows the mechanism of an e-Air Waybill:

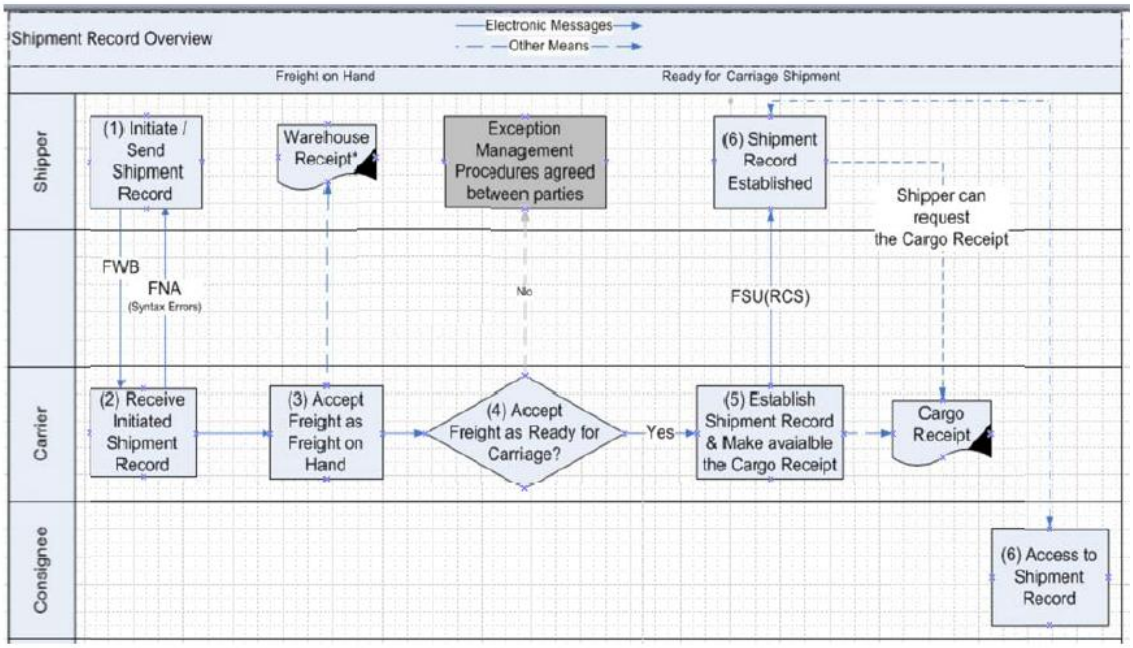

Figure 2 - E-Air Waybill Mechanism [71]

The agreement permits the parties to conclude cargo contracts by Electronic Data Interchange (EDI) and ensures that they are legally bound by such contracts. The specification also requires confidentiality and protection of all data. In addition, the parties must agree to accept testing and certification procedures that ensure the technical implementation meets the integrity and security standards that are detailed in the agreement.

Electronic bill of lading (E-BOL)

The U.S. General Services Administration (GSA) provides an electronic Bill of Lading (BOL) in the context of a whole "Transportation Management Services Solution" (TMSS) that is "the first comprehensive online freight and household goods transportation management system designed exclusively for Federal civilian agencies" [73]. Companies specialized in the generation of E-BOL, provide an interface where the bill is filled out, checked, modified and printed online. Additionally, digital signatures of concerned persons, when required, can be attached to the electronic bill.

Based on the aforementioned, it is possible to summarize some main capabilities offered by current solutions associated with electronic way-bill documents: (i) electronic signature linked to the document; (ii) confidentiality and protection of all data; (iii) exception management procedures; (iv) test and certification procedures; (iv) interfaces for generation of electronic bills; (v) digital signature of concerned persons.

2.2 SLA in T&L Services

SLA comprises quality objectives for various parts of the logistics service and the agreement terms. The T&L SLA usually includes six different sections: (i) introduction and purpose, (ii) services to be delivered, (iii) performance tracking and monitoring, (iv) problem management, (v) fees and expenses, and (vi) customer duties and responsibilities. The introduction and purpose part includes the information on parties signing the agreement and the objectives of the agreement. The specific services that will be delivered are described in detail in services to be delivered section of the SLA. The performance tracking and monitoring are usually measured and evaluated in fixed time intervals such as annual or bi-annual evaluations between the customer and the logistics service provider. The attributes that are used to define QoS for the logistics operations and their specified levels are listed in Section 2.2.1. The problem management part explains the courses of action when problems occur in the logistics processes that are subject to the agreement. The fee and expense section outlines the financial obligations of the logistics service provider in the case of deviation from the agreed values of the attributes listed in SLA. The last section specifies the duties and responsibilities of the customer.

The next two subsections provide an overview on QoS attributes associated with T&L services and SLA management issues in such domain.

2.2.1 QoS Attributes in Logistics

The quality of service in the logistics sector tries to understand the attributes for customer satisfaction from the perspective of the differences between customer perceptions and the actual service. The research on service quality focused on the use of five dimensional structure including tangibles, responsiveness, empathy, reliability, and assurance (Parasiraman, et al., 1985). The nature of this structure is based on perception and therefore it is hard to quantify precisely. A quantitative approach to analyze the Quality of Service is essential in order to increase the competitiveness of the logistics sector in creating value to different organizations participating in the transportation chain.

The following quantitative attributes are considered as indicators of logistics service quality: information quality, ordering procedures, timeliness, order accuracy, order quality, order condition, order discrepancy handling, and personal contact quality. These quantitative attributes are discussed briefly below, while

Table 1 presents some example of SLOs in T&L contracts:

Information Quality: Information quality is used to measure the correspondence between the needs of organizations and the degree of information exchange between organizations. There are many criteria regarding the characteristics of quality information; these are measured by accuracy, frequency, credibility, and availability of forecast.

Ordering Procedures: Ordering procedures refer to how efficient and effective are the procedures followed by the logistics service provider are when taking orders. In order to increase the effectiveness of ordering procedures investment in automatic replenishment and other IT capabilities are required.

Timeliness: Timeliness refers to whether the logistics processes are realized on promised times. This does not include the delivery time to customers only but also pickup from the origin and also loading and unloading times at different transportation nodes of the entire chain.

Order Accuracy: Order accuracy is a measure to indicate the difference between customer order and the delivery to customer. If the type, quantity and quality of delivery is different than the customer order, then the order accuracy is low.

Order Quality: Order quality refers to how well the service provider commits itself to maintain a promised service delivery on schedule with predetermined quality specifications (for example, including timeliness and order accuracy).

Order Condition: Order condition refers to whether the packaging and the product itself is damaged or not upon delivery to the customer.

Order Discrepancy Handling: Order discrepancy handling is the ability of logistics service provider to address the problems related to orders after their delivery to final destination.

Personal Contact Quality: The skill set of the employees of the firm in charge of distribution and ordering, and their ability to foster customer relationships.

Vehicle suitability: The match between the customer order and the vehicle is important. The vehicle should be suitable to the requested transport order.

Table 1 - Examples of quality of service attributes in logistics SLAs

Attribute	Description
Delivery Time	The defined transport schedule for a particular order. Usually measured in hours or days.
Delivery Reliability	It refers to the fraction of deliveries are that completed on schedule (measured in %).
Delivery Accuracy	It refers to the fraction of the deliveries that are made to the correct delivery address and signed by personnel assigned to receive the delivery (measured in %).
Invoice Quality	Invoice quality refers to the correctness of the shipping addresses and the items/services listed in the invoice (measured in %).
Information Quality	It refers to the availability of information to the customer in the SLA including the tracking and tracing the shipments (measured in %).
Service Inquiry	The elapsed time between the inquiry by the customer and responsible contact personnel by the service provider (measured in minutes).
Consignment Inquiry	The time that it takes to answer a service inquiry related to consignment (measured in hours).
Invoice Inquiry	The time that it takes to answer an inquiry related to invoice (measured in hours or days).
Complaint Inquiry	The time that it takes to answer an inquiry related to complaint by the customer (measured in hours or days).

One example of a model applied for measuring and understanding current supply chain conditions, quality of service, and performance is the SCOR model (http://supply-chain.org/). It can help supply chain managers (such as the ones in charge of executing a transport and logistics service) evaluate cost/ performance tradeoffs, develop strategies for meeting new customer expectations, and respond to domestic and global market growth.

The SCOR model identifies five core supply chain performance attributes: Reliability, Responsiveness, Agility, Costs, and Asset Management. Consideration of these attributes makes it possible to compare an organization that strategically chooses to be the low-cost provider against an organization that chooses to compete on reliability and performance.

- **The Reliability** attribute addresses the ability to perform tasks as expected. Reliability focuses on the predictability of the outcome of a process. Typical metrics for the reliability attribute include: on-time, the right quantity, the right quality. The SCOR KPI (level 1 metric) is Perfect Order Fulfillment. Reliability is a customer-focused attribute.
- **The Responsiveness** attribute describes the speed at which tasks are performed. Examples include cycle-time metrics. The SCOR KPI is Order Fulfillment Cycle Time. Responsiveness is a customer-focused attribute.
- **The Agility** attribute describes the ability to respond to external influences and the ability to change. External influences include: Non-forecasted increases or decreases in demand; suppliers or partners going out of business; natural disasters; acts of (cyber) terrorism; availability of financial tools (the economy); or labor issues. The SCOR KPIs include Flexibility and Adaptability. Agility is a customer-focused attribute.
- **The Cost** attribute describes the cost of operating the process. It includes labor costs, material costs, and transportation costs. The SCOR KPIs include Cost of Goods Sold and Supply Chain Management Cost. These two indicators cover all supply chain spend. Cost is an internally-focused attribute.
- **The Asset Management Efficiency** ("Assets") attribute describes the ability to efficiently utilize assets. Asset management strategies in a supply chain include attributes like capacity, utilization, fleet management, inventory reduction and in-sourcing vs. outsourcing. Metrics include: inventory days of supply and capacity utilization. The SCOR KPIs include: Cash-to-Cash Cycle Time and Return on Fixed Assets. Asset Management Efficiency is an internally-focused attribute.

Performance data can be collected in a number of ways. For example, the service provider may complete worksheets and job reports or feedback from customers might be sought actively in the form of comments on worksheets, complaints and customer surveys. Once the organisation has collected these data they should be used to complete a score-sheet at regular intervals. This should be undertaken for a sample of the services delivered by each service provider based on KPIs. These will be given in the SLA and contract and will provide a basis for measuring performance in a way that involves both the customer and service provider.

2.2.2 SLA Management

A service specification is a document that quantifies the minimum acceptable (technical) standard of service required by the customer and will generally form a part of the contract with the service provider. The extent of detail in the specification will depend on the importance and complexity of the service or asset item. Service specifications and SLAs are formal documents that together should set out the following.

- Customer's expectations of the quality, performance and value of the services to be provided in a clear and unequivocal manner.
- Minimum acceptable standards of the service and the customer requirements that have to be met.
- Output or performance-oriented measures, concentrating on what is to be provided as opposed to how.
- Agreement between the customer and service provider for providing a range and target level of services.

Updating service specifications and SLAs

Service specifications should not be regarded as fixed statements of service requirements, but as a basis for continual improvement as circumstances and customer requirements change. Experience will reveal how better results and improved value can be achieved by a change in specification. Service providers should be involved in the process of updating and improving service specifications and SLAs in order to draw upon their experience of actually providing the service. These actions will ensure that the organisation is able to determine if the specified service was obtained and so draw lessons for the future. At all times, it is essential that the requirements set out in the service specifications and SLAs should be reflected in the contracts with service providers.

Quality assurance systems

If client organisations are to receive a satisfactory level of service, not only they but also their service providers must have good quality assurance (QA) systems in place. Service providers' QA systems should form an integral part of their service provision. To add value, service providers have to adopt QA to enhance service provision through a reduction in errors and reworking. Thus, a quality approach can save money. Clients should therefore consider QA systems of bidders during the assessment of bids.

Quality assurance systems generally consist of a policy statement, a quality manual and a work practice manual. The policy statement is the organisation's explicit commitment to a quality-assured system covering its services. The quality manual provides a detailed interpretation of the way in which each of the quality standards is to be met within the context of the operations of the business. The work practice manual explains the detailed procedures that must be followed in order to comply with the QA system.

For a system to be effective, it needs to be applied as work is being done. Thus, for example, logs and reviews should not be completed retrospectively. Contract documents should incorporate quality-of-service criteria and stipulate that payments will depend on the provider meeting these criteria. These contractual provisions should assure the quality of services or products of service providers. The issue of penalties and incentives relating to performance standards should be considered following performance reviews.

Involving stakeholders

Identified stakeholders should be involved in specifying their requirements and the level of performance that will be acceptable. This means:

- involving stakeholders, as far as practicable, in identifying their requirements (for example, through the use of questionnaire surveys and in contributing to the drafting of service specifications and SLAs);
- controlling stakeholder input and changes once the specification has been agreed; and
- prioritisation by stakeholders of their requirements.

Organisations may find that they are defining and specifying their requirements for the first time. In such cases, there is a risk that they might unknowingly specify a higher level of service than was received in the past and that, consequently, bids may be higher than forecast. Value management, a technique for ensuring that real needs are addressed, can be used to guard against over-specification, whilst allowing standards to be raised over time.

Electronic systems supporting SLA management

Supply chain service providers do normally have integrated information system enabling a broad information flow both internal and between companies. Enterprise resource planning (ERP) systems integrates internal and external management information across an entire organization, embracing finance/accounting, manufacturing, sales and service, customer relationship management, etc. ERP facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders.

Service Level Agreement metrics are in most cases implemented as an integrated part of ERP systems. A broad range of data within the ERP systems supports measurement and reporting of SLA metrics as an integrated part of Business Intelligent and Performance Management modules of the systems. However, it is still a manual process to gather information about those SLAs and insert those metrics into such modules.

2.3 ICT Relationship with T&L Services and Contracts

It is of special interest for this section to understand and reveal how ICT systems are currently being used in the T&L domain, so that we can have a good background of how this on-going integration between ICT and T&L services can enable and/or improve the establishment of electronic contracting processes. To achieve this goal this section is divided into two parts.

First we discuss the concept of servitisation of logistics systems, and as it will be explained, servitisation is not only related to the use of Web services (ICT services), but also to the fact of exposing logistics activities as services that can be completely outsourced. The employment of Web services for building logistics systems, as it will be discussed, contribute to the servitisation of logistics systems.

In the second part of this section, we present concepts and some examples of Electronic Logistics Marketplaces (ELM) systems, which are related to contracting processes such as, automation of selection of partners. The description of example of ELM requires the discussion of the types of logistics services, and the types of collaborations, which are also addressed in the second part of this section.

2.3.1 Servitisation of Logistics Systems

While transport consist of the physical movement of goods from one point of origin to a point of destination, **logistics** is a supply-chain-management function that "plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements"[76] [77].

Transport and logistics activities are services which can be conducted in-house or outsourced. When performed by third parties, their degree of servizitation has evolved considerably from the simple shipment of load-units to the complete management of door-to-door transport networks.

Servitization of logistics services correspond to the development of value added logistics and more sophisticated logistics systems [78]. In fact, services like freight forwarding and transportation have become so well-known by customers and standardized, that these services have been productized [78].

Value-creation and competitive advantage are now sought by logistics suppliers through higher service integration with customers' processes and the delivery of integrated solutions [78]. The diagram below illustrates this shift in strategy of transport and logistics services suppliers which require a significant adjustment of capabilities.

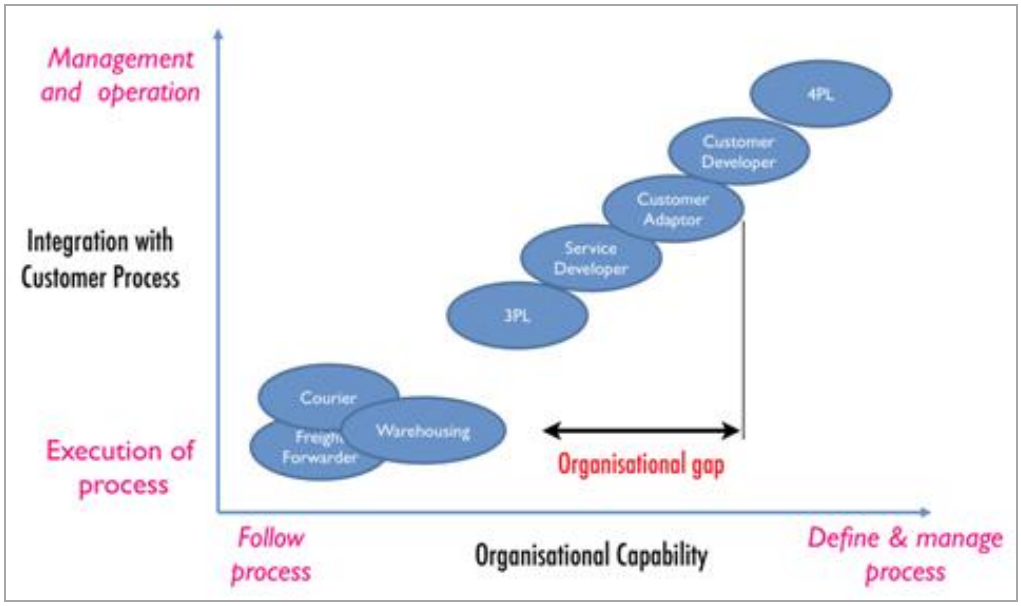

Figure 3 – Servitization in the Logistics Sector (Source: Frank, 2010 [78])

Gould [77] underlines that, while the primary services often contracted are inbound and outbound transportation, cross-docking, warehousing, freight bill auditing/ payment, and freight consolidation and distribution, value-creation now lies in capable information technology and integrated solutions.

ICT services for Transport and Logistics

ICT services have proven to be crucial services for supporting transport and logistics businesses. They increase the possibility to implement radical and more efficient solutions, thus being the most important type of servitization that Transport and Logistics Systems have been exposed to.

Transport logistics activities like distribution network design, cargo tracking and tracing, warehousing, shipment notice, etc. are typical activities that have benefited greatly of the introduction of Information Technology support in transport and logistics services, allowing timely and systematic information transfer among actors in the logistics chain [79].

The contributions of IT applications include [79], [80]:

- Improving information sharing and processing by replacing paper-based information, manual processing and one-to-one communication.
- Reduction of waste in operations and time normally necessary for coordinating activities.
- Improving coordination of business processes among partners, as some operation- and process adaptation is necessary for enabling the IT integration of firms.
- Facilitating collaboration, through real-time data transfer and automated communication

Examples of common IT applications used to support logistics activities are EDI (electronic data interchange), LIS (logistics information systems), RFID (Radio Frequency identification), all enabling electronic sharing of standardized data [79].

Further, logistics systems can be grouped in several categories [77]:

- Inventory Management Systems [IMS]: ensuring the availability of products by linking customer demands, product reservation, and al location processes.
- Order Management Systems [OMS]: providing real-time visibility into the entire order lifecycle, ensuring against lost, delayed, or corrupted orders.
- Warehouse Management Systems [WMS]: providing real time information on inventory (status and location), and optimization of pick-up/put away operations based on real-time information.
- Transportation Management Systems [TMS]: focusing on freight movements and physical distribution. TMS help companies to:
    - determine the best routing and transportation mode for their products
    - select carriers based on service levels and rates,
    - create a delivery schedule,
    - optimize the total shipping costs against service and delivery constraints.
    - monitor transport execution, by automatically sending shipping notices, manifests, carrier information to all interested parties, and receiving requests for updates about the status of shipments.
    - monitor and initiate freight payments
- Yard Management System [YMS]: extending the warehouse beyond the physical four walls of the plant by controlling the activities of trailers on the dock and in the yard to the point of scheduling both inbound and outbound trucks.

Service Oriented Architecture / Web services- for more Interoperability

The distribution of information in and across companies, and across a whole set of information systems, creates a need to integrate applications. More specifically, the information exchange among distinct and heterogeneous data bases needs to be supported by systems enabling integration and communication among software [82].

Benaissa et al. [82] have identified four different approaches to application integration:

- The Manual Approach: very commonly used, this simple but expensive approach consists of printing reports/ratios to seize them again manually in other application.
- The Import/Export Approach: although not suitable for real time data transfers, and requiring modification of data for ensuring readability, this approach consists of data being exported by an operator or software, transferred, and imported in another application.
- The access approach to the primitive data structures: This approach exploits the possibility for the databases to accede to the data structures, and allows real time access to data. Still, any modification of the data structure requires an update of the other applications to sustain compatibility.

- The API Approach: an application programming interface enables the sharing of functionalities and data among the applications

Service Oriented Architectures (SOA) are artifacts of the abovementioned API approach. SOAs provide tools that can operate across data platforms and standards. A typical industry standard used to support SOA is web services [81]. Web services are "web based distributed software components that provide information to applications rather than to humans through an application-oriented interface" [85]. Real time access to data is enabled while guaranteeing data integrity [82].

The interacting software services that are connected through SOA sharing the followings attributes [85]:

- Individually useful or able to be combined, and their functionality reused
- Able to communicate, exchange messages
- Self-contained or depending on other services or databases.

Examples of application of SOA and Web services in the Transport and Logistics sector are given below.

- *Intelligent cargo* - The research project EURIDICE [83] (European Inter-Disciplinary Research On Intelligent Cargo For Efficient, Safe And Environment-Friendly Logistics) focuses on the development of intelligent solutions for the transport sector. The project has developed a information-services platform centered on the individual cargo item, and on its interaction with the surrounding environment and the user. The EURIDICE architecture is schematized in the figure below.

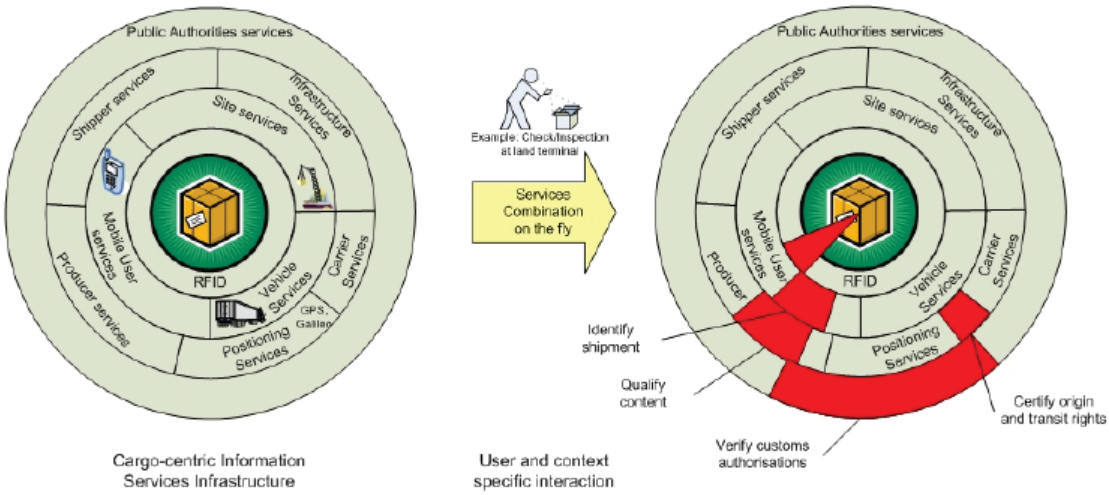

Figure 4 – EURIDICE Cargo-centric information services infrastructure (Source: Project EURIDICE [83])

- *Shared Intermodal Container Information System*- The project INTEGRITY [84] has developed a Shared Intermodal Container Information System allowing authorized companies or authorities to access information of selected consignments (planning and status). The system takes account of new EU customs regulations (e-customs procedures) and the development of container security technologies (container security devices, RFID, e-seals).

2.3.2 Electronic Logistics Marketplaces (ELM)

According to Bakos [26] an electronic marketplace is defined as a place where buyers and sellers are supported in the exchange of information about price and product offerings by electronic means.

In detail, electronic marketplaces offer three main functions: Matching buyers and sellers, supporting the exchange of information, goods, services and payments that are associated with market transactions and providing institutional infrastructure, such as legal and regulatory framework.

In transport and logistics, Electronic Logistic marketplaces (ELM) act as intermediaries between shippers and carriers to support the exchange of logistics services. The functionalities of an ELM range from basic load bidding services and consignment tracking and tracing, to complex offerings that encompass not only transport transactions but also complete order fulfilment services.

While the traditional way of communicating between shipper and carrier is rather fragmented due to different communication channels, an ELM allows the connection of a number of shippers and carriers using a single interface. In the first place, this results in lower costs due to better inter-organization information connectivity and a less time-consuming process. Furthermore, the electronic way of communication provides real time visibility and flexible partnership configuration as well as lower search costs, reduced transaction costs, wider accessibility of a large base of buyers or suppliers, business processes automation, improvement in service quality and reduction of inventory cost [27,28].

According to Skjøtt-Larsen et al. [29] two types of ELMs have emerged since the late 1990s: open and closed ELMs. Open ELMs focus on routine logistic service and the selection and identification of potential partners and allow shippers and carriers to use their services with no barriers to entry, for example an on-line freight exchange for the spot trading of transport services. By contrast, closed ELMs are concerned with transport planning and execution where the transport rate, in most cases, is already pre-defined through a contract [27], like in standard or custom logistic services. Closed ELMs evolved due to the increasing need for companies, and particularly shippers, to retain their linkages with preferred business partners, aiming not for a large volume of transactions, but based on relational lines emphasizing the extent of services [30] and a long-term collaboration.

Following sections outline examples for ELM according to the different types of collaboration. In order to reach these examples, we first describe types of logistics services, the types of collaboration according to the type of logistics services, and finally we present the examples of ELM for each type of collaboration.

Customisation and Complexity of Logistics Services

Kallio et al. [24] and Bask [25] identified three levels of customisation and complexity in logistic services:

(1) Routine. This type of service describes the transportation of goods by a single mode of transport and without providing any other additional services. The procurement of service is based on volume provision and price selection. Routine services require reactive provision and execution and assume a centralised and open market with bidding and pricing systems.

(2) Standard. In contrast to routine logistic services this type of service may provide some degree of customization, for example the provision of different specialist transport based on a special mode of transport or different vehicles. This type of service is often found in private marketplaces, using authority and other procedural coordination processes instead of a pricing mechanism.

(3) Customized. This type of service is characterized by a fully-customized offering and sometimes even includes the total order-to-delivery process. Customized service requires proactive provision and execution. The ownership is held by a consortium group that shares a high level of information and joint activities. The participating parties need to streamline their logistics activities to have complete visibility of real time information for decision-making, and build flexible system configuration and connectivity with different business partners.

Types of Logistics Collaboration

The different types of logistic services have essential influence on the type of logistics collaboration between shippers and carriers. Generally it can be stated that the lower the collaboration level is, the more standardized the inter-activity is and the less customized the logistics service and the higher the collaboration level is, the more confidential the shared information is. In order to clarify the different aspects of collaboration for each type of logistic service, the following section differentiates between cooperation, coordination and synergy.

- The type of collaboration in routine services can be described as *cooperation*: Shippers as well as carriers keep their own authority and independency, while collaborating at an operational level with a short term horizon, a low level of trust and no shared goals and information. On the one hand, the agreement between the parties is governed by definitive contracts that are characterized by formal agreements and on the other hand by complete contracts, which specify every contingency of transactions.
- The type of collaboration in standard logistic services can be referred to as *coordination*: Though the partners keep their individual authority and independency, they collaborate by planning together within a midterm horizon, a moderate level of trust and shared goals and information. The partnership is governed both by definitive contracts as well as by relational contracts. Relational contracts are characterized by informal agreements and unwritten codes of conduct.
- The type of collaboration in custom services can be described as *synergy*: The partners collaborate together within a long term horizon, a high level of trust and common goals. Structural savings are accomplished by restructuring the organizations and comprehensive planning. The partnership is primarily governed by relational contracts.

Examples of ELM that Support Cooperation

In general, an ELM that supports cooperation – the lowest level of collaboration – is practically a platform for information communication in the form of bulletin service or private community board where the members can search for similar partners and form a buying group.

For example, Nestevo (www.nestevo.com) assists cooperating shippers in getting more favorable rates. Therefore the platform collects and synchronizes multiple shipper's information and identifies sets of lanes through scheduling truckload movements in order to submit them to a carrier as a bundle, rather than individually.

There are also ELMs that focus on the cooperative fulfilment – including payment, order tracking and tracing and performance appraisal - in order to keep transaction risks low and

assure high quality [31]. For example, NTE (www.nte.com) provides an ELM that offers transportation management services and also takes financial responsibility.

Another example for an ELM that supports loosely coupled cooperation is a platform that provides information about shippers and carriers while avoiding open market negotiation. This information is offered in form of an e-catalogue where shippers and carriers include pre-negotiated terms. The main idea is to minimize the risk when dealing with a new partner. 3Plex (www.3plex.org) for example, offers shippers to set up their own private exchanges with their carrier private e-catalogue.

Examples of ELM that Support Coordination

In order to support coordination between the logistic partners, an ELM has to master the complexity of calculating a collaborative logistics network of multiple parties. This requires expertise on the one hand, and on the other hand particularly the ability to master loads of shipment data and the ability to harmonize the needs of service provider and consumer.

The platform One Network Enterprises (www.onenetwork.com) for example concentrates on coordination between shippers. It supports the members with the identification of "routes with less asset repositioning for their transportation needs" as well as the possibility to manage their transportation activities [31].

An example for the coordination between carriers is the online air-cargo load-matching site Logistics.com (www.logistics.com) that brings different carriers from different logistics markets together in a single shipment. The goal is to create a seamless multimodal transportation service by coordinating carriers in different transportation industries like sea, air or vehicle transportation.

A typical example for an ELM supporting coordination between shippers and carries is an on-line freight exchange for the spot trading of transport: On the one side shippers or freight forwarders advertise freight that must be transported and on the other side carriers or freight haulers looking for load and companies offering cargo capacities can search for these transport requests. Generally these platforms are either open or closed subscription-based online systems with a small charge for using the advertising and searching functionality.

For example, the company "TransCore Freight Solutions" provides a Spot Freight Exchange with "matchmaking service that enables manufacturers or their intermediaries to find carriers with excess capacity on the equipment and routes that best suit their immediate needs" [32]. The platform (presented in Figure 5) provides functionalities like order management, load planning, route & loading instructions, carrier selection, carrier qualification, rate negotiation, pick-up, monitoring & delivery, invoice management and evaluation:

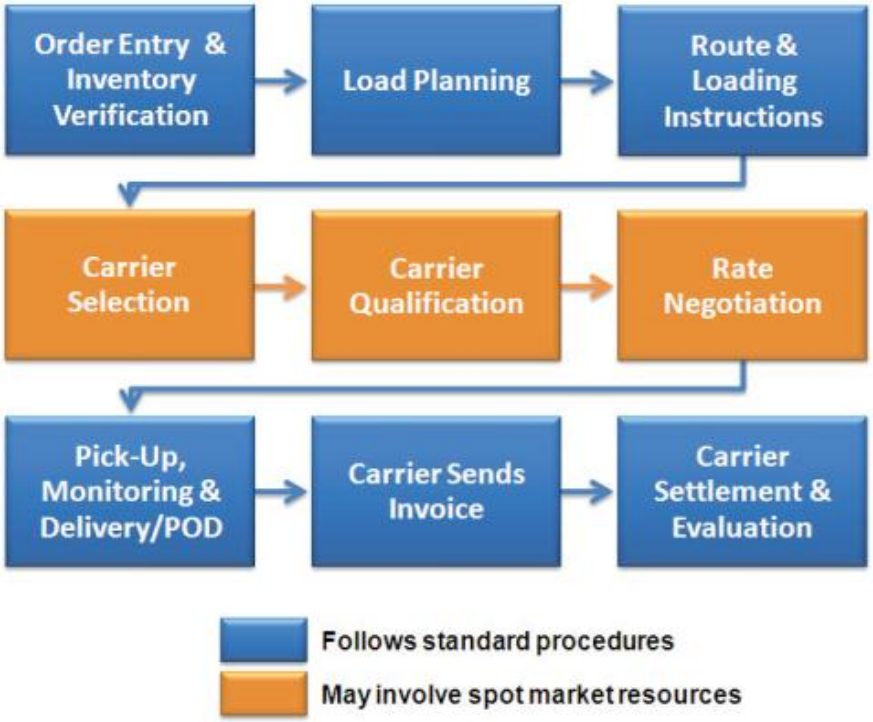

Figure 5 - TransCore Freight Exchange service [32]

Another example for freight exchange is "CARGOTRANS" that is the leading online EU Freight and Vehicle exchange based on e-mail communication [33].

Examples of ELM that Support Synergy

Generally, synergy collaboration in logistics networking is not supported very well by ELMs based on a standardized platform because of the complex rules and customized systems that are involved [31]. Another reason is that synergy demands high security and trustworthy in information exchange. In practice, this type of collaboration is often supported by private networks.

2.4 Summary

One of the first issues that we could identify - based on the analysis of the current situation in T&L - is the lack of a clear separation among contracting, planning of a T&L process, and the actual execution of the a T&L process based on an agreed contract. In addition, there is not a clear line dividing logistics collaboration infrastructures and systems, from T&L contracting infrastructures. For example, ELM can serve as collaboration hubs as well as, places for selection of partners. Summing up to the aforementioned, there are numerous standards that are already employed in the execution of contracted T&L services, and the existence of SOA-based systems to facilitate the exchange of information.

However, we observe a gap when it comes to the online, runtime, (semi)-automated establishment and negotiation of contracts and the electronic support to check contract SLAs. The standards described in Section 2.1.2 and electronic documents presented in Section 2.1.3

are related to the execution of contracted T&L services, but they do not apply for the processes of selecting parties and creating in an electronic way the contract itself. The offline use of T&L contracts is confirmed in Section 2.2, where we identified that the evaluation of SLA contracts is a process executed typically in a large interval of time, e.g., annually. Even, the support provided by ELM does not seem to be associated with the creation of online T&L contracts. In contrast, it is related to the online integration of information (i.e., offers and bids) from the T&L parties involved in such ELM. Finally, a detailed analysis of the T&L domain in regards to contracting processes is performed in the next section.

3 Domain Analysis Related to Contracts

The FInest E-Contracting Module (ECM) is being designed to address the highly manual nature of transport and logistics contracting and the problem of providing support to enabling downstream transparency to contracted SLA conditions by exploiting solutions from e-contracting [34, 35].

In summary, the lifecycle of T&L contracts can be divided into two major parts: the contracting and the execution. The first one is related to the definition of the contract document itself, while the second is related to the information inside the contract document that is necessary to be checked during the execution of a T&L process agreed in the respective contract.

It is part of the scope and objective of the E-Contracting Module in WP8 to enable a semi-automated support for the contracting cycle, such as actions from selection of partners until the agreement of the contracts. Therefore, it is out of the scope and objective of WP8 to support actions related to the execution of T&L contracts, such as, active monitoring of SLA violations.

The initial main envisioned features of the E-Contracting Module are listed below [36]:

- Electronic model for representing the SLA attributes of T&L contracts (e.g., SLAs, pricing, escalation processes, etc.);
- Provide the support to enable future online monitoring of T&L contracts;
- On-line management and review of contracts with automatic notification of contract end dates and renegotiation time fences;
- Execution of semi-automated e-contracting selection (offering, bidding, choosing), establishment (negotiation and agreement), and management (support to re-contracting in case of deviations in the execution of established contracts);
- Integration of marketplaces to support (semi)-automated partner selection, bidding, and negotiation.

One important factor for the accomplishment of the aforementioned features is the aligning of the knowledge associated with contract establishment and management from the T&L domain to the one related to ICT. Therefore, based on discussions and interviews conducted with the domain specific partners of WP8, we clarified some important concepts and issues associated with the notion of T&L contracts. This section summarizes the knowledge retrieved from the domain specific partners and specifies the basic concepts for contract establishment and management in the E-Contracting Module.

3.1 Contract Types

The first important concept is related to the essence of the contract. In general, contracts are composed of two parts:

a) the “Terms and Conditions”, which contains the issues related to legal aspects and regulations, and

b) the Service Level Agreement (SLA), also known in the T&L domain as Key Performance Indicators (KPIs), can be described as the attributes that describe the features of the contract (*e.g.*, the amount of containers that will be used by the consignee during the period of the contract, the period of the contract itself, etc.).

Based on the knowledge gathered from the domain specific partners and the analysis of the domain, we realized that there are no strict boarders between what we called in WP8 the "Term and Conditions" and the SLA part of the contract. Indeed, in some cases they are understood as the same content. However, we tried to create this distinction in WP8 so that we can focus on the contract issues that are not directly related to laws and regulations. Therefore, the focus of the ECM is to support electronic establishment and management of the SLA part of the contract, .i.e, issues related to laws and regulations are out of the scope of this WP.

This decision is based on the fact that despite the importance of legal aspects of the contract, they are not the first issues to be faced when providing support to enabling downstream transparency to contracted SLA conditions. First of all it is necessary to understand which attributes – or according to the ICT terms, Service Level Objects (SLO) – characterize the contract. Therefore, the ECM focuses in the SLA part of T&L contracts.

We also need to clarify some discussions about the similarities and/or differences between SLA and KPIs concepts. During the work in WP8, we have gathered different opinions about the similarities and differences between the aforementioned concepts. In some cases, SLA and KPIs were considered synonymous, whereas others consider the former to define the service to be delivered and the later to specify the performance indicators of a T&L service. In fact, both concepts are important to be analysed because they could provide the necessary SLOs to turn the paper-based contracts into electronic contracts. At this stage of the work in WP8 we are not exhausting the discussion of those concepts, but we became aware of their importance. As for the simplicity of the rest of the domain analysis, in this document, we decided to follow the trend of opinions that consider both SLAs and KPIs as synonymous.

After understanding the parts that constitute T&L domain contracts, the next steps is to realize which kind of contracts are typically used. Once again, based on the experience of the domain specific partners, we were able to identify four types of contracts to be supported by the E-Contracting Module: blanket, capacity-based, tariff/time-based, and spot market. Figure 6 illustrates the data model of these types of contracts.

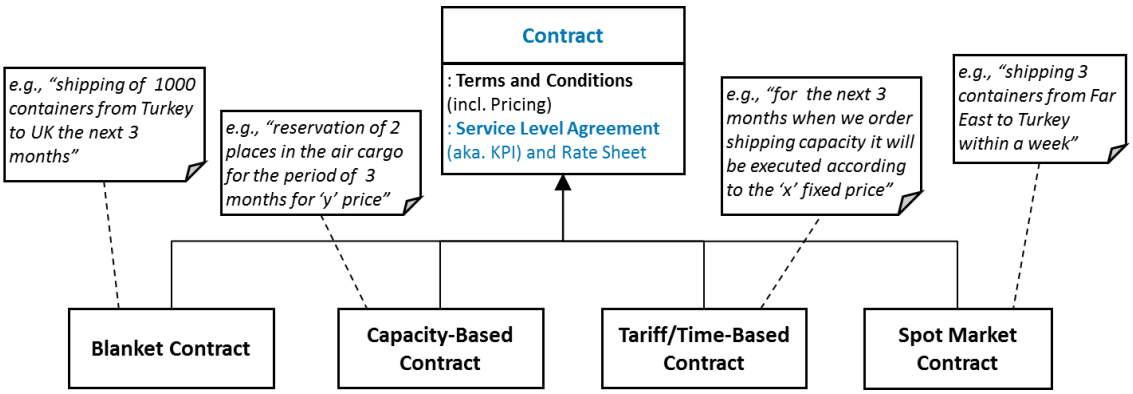

Figure 6 - Types of contracts

A **blanket contract** defines the long term relationship that it establishes among the parties of such T&L contract. For example, as expressed in Figure 6, the blanket contracts defines that for the next 3 months the consignee will ship 1000 containers from the Turkey to the UK. This means that the consignee can send at once the 1000 containers, or send 100 containers, 10 times

during the period of 3 months. For both cases, the contract among the consignee and the T&L provider will be the same. According to the expertise of domain specific partners of WP8, blanket contracts are typically established among parties that very often use each other services, normally these parties are large enterprises, and can be reviewed / renegotiated within 6 months.

The **capacity-based contract** is related to the reservation of a fixed transport and logistics service provider capacity for a fixed period of time and price. An example of such type of contract is depicted in Figure 6, where a reservation of 2 places in the air cargo is reserved for a consignee during the period of 3 months for the fixed price of 'y'. In essence, this means that the consignee is committed to pay for the reserved space independently whether the total amount of space is fully used or not.

In the case of **tariff/time-based contracts** the consignee and the logistics service provider agree that during the period of time of the contract the price of a shipment among them will be fixed. Nevertheless, the consignee is not obliged to actually reserve or request any shipment and the logistics service provider is not obliged to have the availability of capacity when the consignee requests the shipment. Figure 6 presents an example of this kind of contract. In this example, a consignee and a logistics service provider agree that during a period of 3 months the price for a shipment will be fixed in the value of 'x', and nothing is established regarding the total amount of shipment request by the consignee during this period or the guarantee of availability capacity offered by logistics service provider at the moment that a shipment is requested.

In the opposite side, there are the **spot market contracts** which represent a short relationship among T&L partners. For instance, a spot market can define that three containers should be transported from Far East to Turkey within a week (as illustrated in Figure 6). Some very important differences from the previous contracts and spot market ones are the conditions of the offered/contracted T&L services (e.g., pricing). In blanket contracts it is possible to negotiate better conditions, once the relationship among the parties will be longer and probably involve a greater number of T&L services executions. In contrast, spot market contracts are isolated and punctual relationship among parties, and for this reason, the contract conditions are normally not so attractive. A logistics provider would use the spot market when there are no better options among their long term contract partners (e.g., the ones related to blanket, capacity-based, and tariff/time-based contracts).

Understanding the existence of the aforementioned types of contracts and the relationship among them is very important for the definition of semi-automatic processes for e-contracting. Moreover, we realize that the aforementioned types of contracts are not the only possible ones and that there might exits other types. Nevertheless, at the current stage of work in WP8, we believe to have identified the ordinary types of contracts fitting into the business activities of the domain specific partners of FInest project.

3.2 Contracting Phases and Steps

During the process of recognizing the existence of different types of contracts, we also identified different phases and steps related to such contracts. We realized that there is not well established process for contracting, and that this process depends a lot on the type of service, type of contract, and the size of the business of the T&L provider. We could also identify that in some cases the term booking is also used instead of the term contracting. Despite all the variants associated with contracting processes, we tried to identify a set of actions that are typically executed in order to reach an agreement that constitutes a T&L contract.

According to the analysis of the information retrieved from domain specific partners of WP8, we identified that there are at least three main phases related to the lifecycle of T&L contracts,

and six major steps to be executed in those phases. Figure 7 illustrates the identified phases and steps, and highlights the scope in which WP8 will develop the E-Contracting Module.

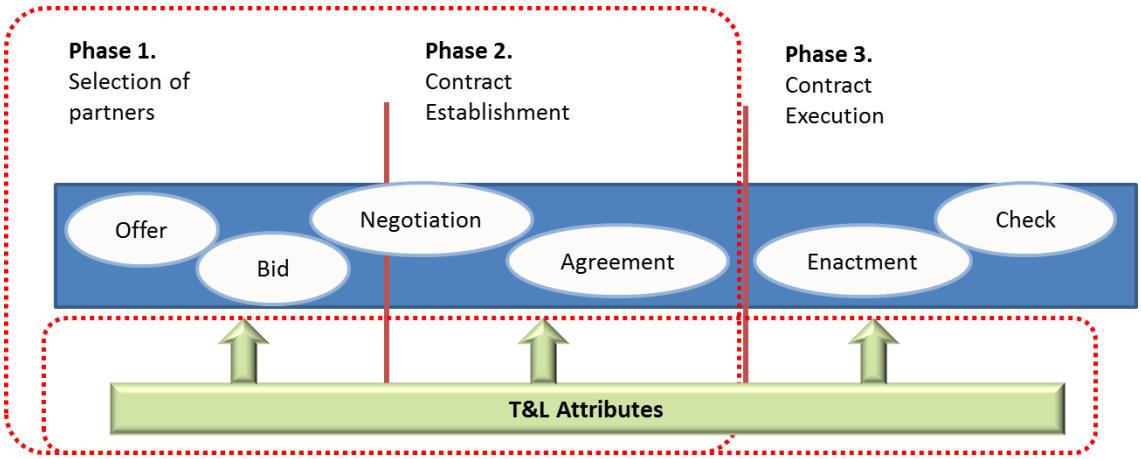

Figure 7 – E-Contracting phases

The **Phase 1** is associated with the selection of partners that will be part of a contract. This phase comprehends initial contacts among parties of a T&L service, where the steps of offering services and bidding for the best offers take place. After this initial contact, there is the **Phase 2** which consists of the actual establishment of a contract. In fact depending on the type of contract that is supposed to be established, different steps need to be followed (as it will be explained in the sequence). At the end of the Phase 2, the contract is actually agreed among the parties and the document is created. Finally, the **Phase 3** is associated with the execution of the terms and services agreed in the contract. For example, a shipment of 1000 containers from Turkey to UK (as illustrated in Figure 6) represents one execution of the blanket contract established among the parties of this T&L process. During the contract execution phase, the following steps are executed: enactment (for example, providing the documents for crossing country borders) and check (i.e., monitor the T&L processes and compare if they are following the SLAs established in the contract).

As illustrated by the red dotted areas in Figure 7, the E-Contracting Module to be developed by WP8 is focused on the partner selection (Phase 1) and contract establishment (Phase 2) phases and their respective steps. It is also responsibility of WP8 to identify the T&L attributes associated with the SLAs so that they can be represented in an electronic form, and enable semi-automatic execution of the steps in the partner selection and contract establishment.

In addition, the differentiation of steps according to different types of contracts, is another relevant issue for enabling semi-automatic execution of those steps. Based on the knowledge acquired from the domain specific partners, we could identify at least two different types of processes associated with the types of contracts, as illustrated in Figure 8.

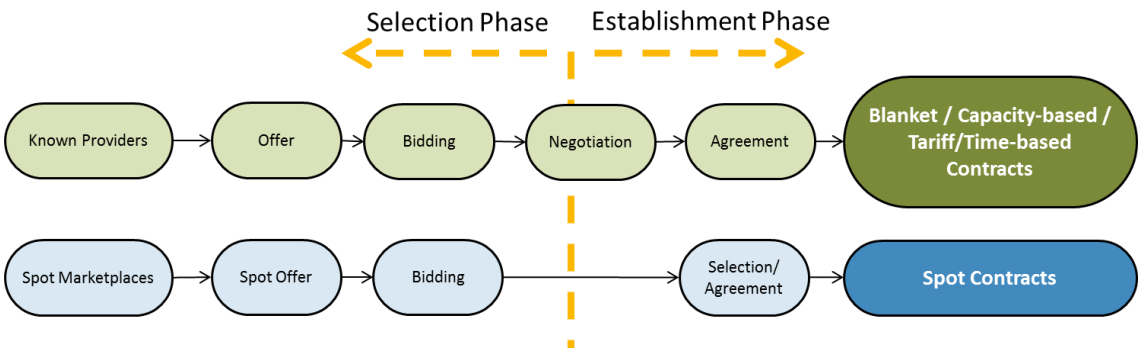

Figure 8 – Selection and establishment steps according to the type of the contract

In the case of blanket, capacity-based, and tariff/time-based contracts, the selection phase typically occurs among known transport & logistics providers, and it encloses the offer and bidding steps followed by the negotiation and agreement steps from the establishment phase. However, in the case of the spot contracts, the selection phase typically occurs in spot marketplaces, where the partners are not known in advance. Because of the short term character of spot contracts, there is not a negotiation phase among the partners. The best bidding fitting the offer is selected and the contract is agreed among the parties.

The difference on the steps to be followed in order to establish the different types of contracts need to be understood in order to realize which are the technical requirements that need to be considered in the definition of the E-Contracting Module.

3.3 Relationship among Contracts, Electronic Documents, and Contract Phases

As discussed in Section 2.1, there are already standards and initiatives of using electronic documents in the T&L domain. Therefore, the objective of this section is to clarify how already established T&L electronic documents are related to the contracting phases and related to the E-Contracting Module. Figure 9, illustrates the e-contracting phases (selection, establishment, and execution) and the different types of information and data models related to the T&L contract.

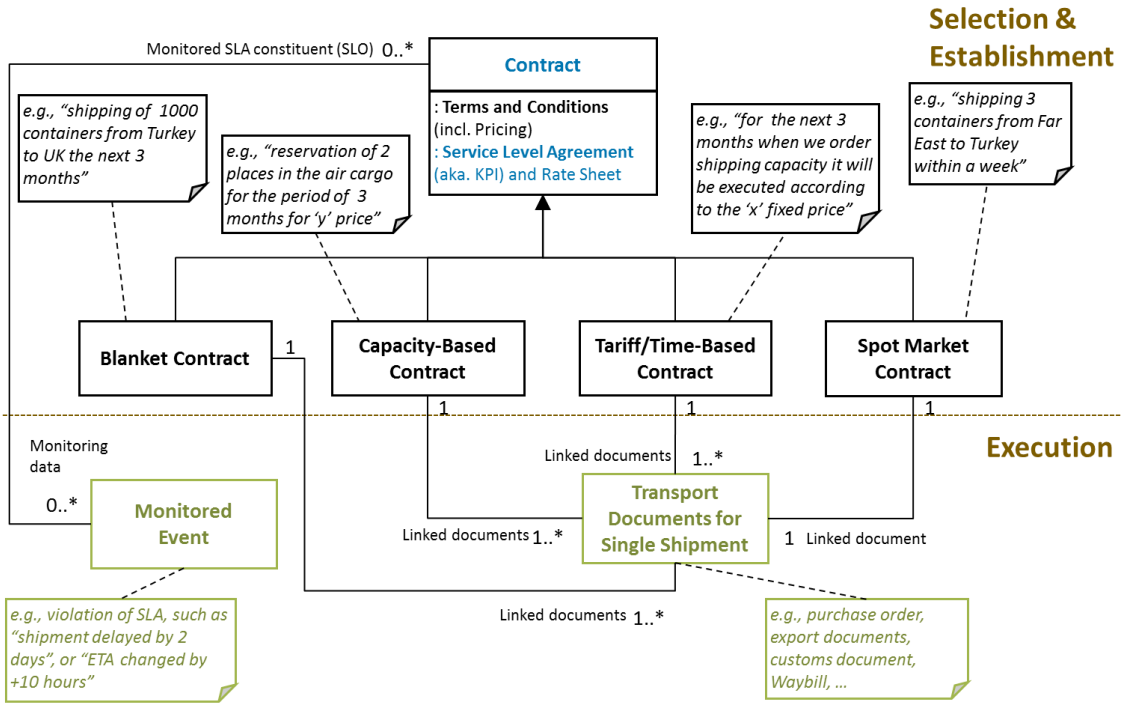

Figure 9 – Relationship of contracts, electronic documents and contract phases

During the selection and establishment phases, the information and data model of interest are related to the contract as a document, *i.e.*, the concern is to represent the SLAs of the contract and define which kind of transport documents are necessary to execute the T&L process. However, it is not part of those phases to be actually aware of the content of such documents and their actual existence. In fact, the process of gathering the documents and monitoring events associated with a contract are part of the execution phase, as illustrated in Figure 9.

For example, Waybill – an electronic document used in T&L processes – is one of the documents that should follow the shipment during the execution of a T&L process and it is not related to the selection and establishment phases. This means that the definition of waybill document depends on the information of the contract, but a waybill is not part of the contract itself, instead it is part of a T&L process that is associated with a contract.

Observing this difference, we defined that the design of the E-Contracting Module is focused on the issues related to the selection and establishment phases, as mentioned before. The main reason for excluding the issues related to the execution phase is related to the fact that there already exist many standards defining the structure of documents and interactions used during the execution of T&L processes, i.e., the execution of an already established T&L contract. Examples of such standards are: EDIFCAT and INCOTERMs. However, this situation changes when we analyse the selection and establishment phases, and as motivated in the introduction of this document, these two phases still a very manual process that can be improved by the employment of cloud-based ICT technologies.

4 Initial Technical Requirements

Together, the domain analysis of T&L contracts and the review of the state of the art in the T&L domain and in the ICT area provided the necessary insights so that we could define the initial set of technical requirements that are needed for the definition of electronic contracting processes in the T&L domain.

The list of the identified technical requirements is depicted in Table 2. We use the following main fields to describe the technical requirements: name, description, and rationale. The last one draws the arguments to justify the inclusion of such technical requirement in our initial list.

Table 2 - List of technical requirements for E-Contracting Module

Tec. Req. ID	Name	Description	Rationale
TR.1	T&L Service Level Objects model	There must be models to support the description of SLO composing the SLA part of electronic T&L contracts.	ICT SLA management platforms and models consider solely ICT service attributes (e.g., delay, MTBF). Considering the T&L domain, most of the focus is directed to models that can represent the semantic of T&L services. However, it is missing manners to expose T&L contracts in an electronic version based on the mapping of the T&L attributes (or KPIs) of contracts into SLO objects that could be manipulated in an electronic manner by ICT SLA management platforms.
TR.2	Explicit differentiation of contract types	There must be the proper support to electronically represent each type of T&L contracts.	Different types of relationships and collaboration among T&L parties require different representation of the terms and SLAs of those relationships.
TR.3	Electronic storage of SLA part of T&L contracts	There must databases supporting the storage of information associated with each type of T&L contract.	In addition, to enable the electronic binding among T&L parties, and the servitisation of some parts of the T&L service execution, it is also necessary to electronically store the established contracts to enable the online check of established SLAs among the T&L parties.
TR.4	Support the creation of the SLA part of T&L contracts.	The creation of the different types of contracts demands distinguished steps in order to finalize their establishment. Therefore, there must be different interfaces and processes to support each type of the contract establishment.	It is necessary to create mechanisms to help on the definition of electronic online contracts, instead of static documents like text or sheets. The electronic platforms, like marketplaces, provide ICT support during the selection phase of parties, but in general do not provide the ICT support for the other steps associated with contracts.

Tec. Req. ID	Name	Description	Rationale
TR.5	Contract information retrieval support	There must be mechanisms to allow searches and reports of information associated to the established and stored contracts.	Currently, there is no automated and sophisticated solution for retrieving complex information from contracts during the execution of those.
TR.6	Access rights for the users.	Only authorized users (human/software) must have access to the creation of contracts and extraction of data associated with established contracts.	There are primitive solutions to provide collaboration and SLA management infrastructures for T&L services. However, those platforms are typically composed of closed and known partners. A cloud-based platform implies a more open environment and therefore it is necessary to provide the proper access rights to the users of this platform.
TR.7	Integration support to Spot Marketplaces	There must be mechanisms to guarantee the access to spot marketplaces among parties establishing spot market contracts.	The establishment of spot contracts is based on T&L parties with short time relationship and according to the domain, spot marketplaces are the usual mechanism used to provide this binding process for this kind of relationship among the T&L parties.
TR.8	Semi-automated support for selection of known parties	There must be provided electronic support for offer, bid, and selection of parties during the process of establishing long-term contracts, like blanket, capacity-based, and tariff-time-based contracts.	Currently the first steps on the establishment of long-term contracts are extremely dependent on human intervention through email, phone call, and manual analysis.
TR.9	Filtering mechanisms for contract selection	There must be provided (semi)-automated mechanisms that reduce the amount of matches between offers and bids in order to support an agile (semi)-automated selection of potential partners.	Although there are initiatives for integrating the system information of different T&L parties, the selection of possible partners still a manual process which reduces the agility on the contract establishment, and it is prone to the bias of the person selecting the partners (which can reduce the participation of SME).
TR.10	Access to T&L information systems	The marketplace must be feed with information on offers and bids that are coming from T&L parties connected to the marketplace.	In order to enable a dynamic and global market it is necessary to provide the proper ways of exposing information from the T&L parties systems.

It is important to remark that the set of requirements presented in the Table 2, is an initial attempt of representing the needs of establishing electronic and online versions of T&L contracts. This set is not closed, and as far as the work is developed in WP8 this set will be refined.

5 Initial High Level Architecture (HLA)

Based on the initial technical requirements, we defined a high level architecture of the E-Contracting Module, as illustrated in Figure 10.

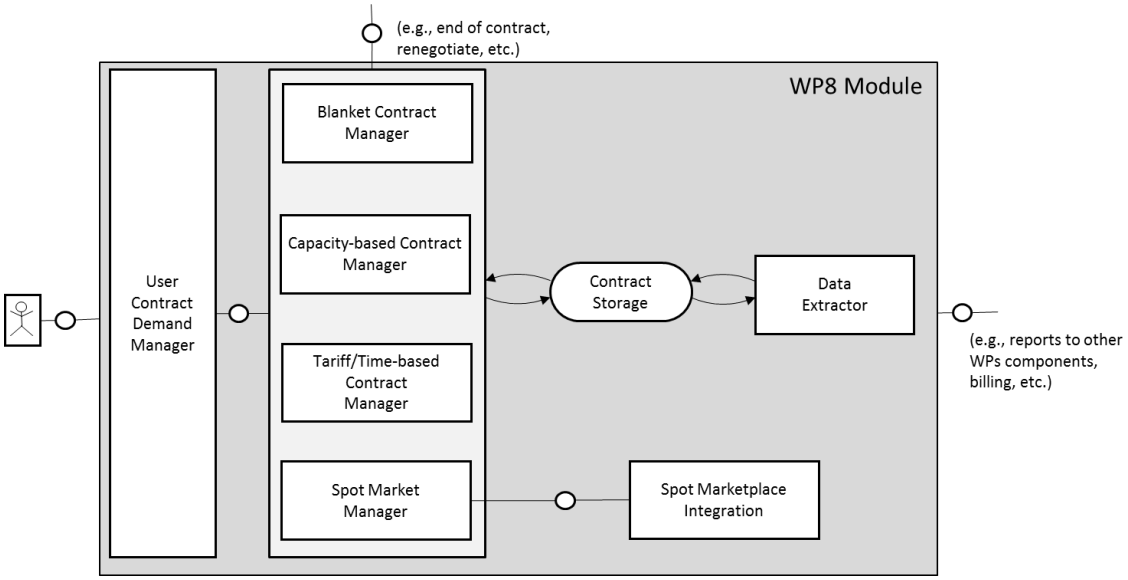

Figure 10 – High Level Architecture of E-Contracting Module

The key architectural elements planned for the ECM include:

- ***Contract Storage*** – Data repository for all established transport and logistics contracts, including a set of contract primitives, such as general attributes that characterize transport and logistics contracts.
- ***User Contract Demand Manager*** – Single interface where actors (human or electronic) interact with the ECM and inform it of the type of contract (e.g., blanket, spot, etc.) to be negotiated and established.
- ***Blanket, Capacity-based, and Tariff-Time-based Contract Managers*** – Elements responsible for assembling the electronic form of each respective type of contract (i.e., blanket, capacity-based, and tariff/time-based contracts), selection of partners (via an auctioning or other process, according to the attributes of each type of contract) and electronic SLA part of the contract creation and storage.
- ***Spot Market Contract Manager*** – Element responsible for selecting qualified bidding partners for a spot contract, developing the spot contract and establishing the spot contract.
- ***Spot Marketplace Integration*** – Integration with infrastructures for executing an auction process (offering, biding, selecting, etc.). We do not need necessarily to define

and create an entire marketplace support, but we need to provide the easy integration from the ECM and the already existent logistics marketplaces.

- ***Data Extractor*** – Element responsible for generating information about/from contracts for other external modules (such as the Business Collaboration Module (BCM) from WP5, and Transport Planning Module (TPM) from WP7).

There is a direct connection among the technical requirements described in Section 4 and the elements of the high level architecture, as summarized in Table 3 and further described as follows.

Table 3 - Association of technical requirements with ECM elements

E-Contracting Module Elements	TR.1	TR.2	TR.3	TR.4	TR.5	TR.6	TR.7	TR.8	TR.9	TR.10
Contract Repository	x	x	x		x	x				
User Contract Demand Manager	x	x		x		x				x
Blanket Contract Manager	x	x				x		x	x	X
Capacity-based Contract Manager	x	x				x		x	x	x
Tariff-Time-based Contract Manager	x	x				x		x	x	x
Spot Market Contract Manager	x	x				x	x		x	x
Spot Marketplace Integration	x					x	x		x	x
Data Extractor	x	x			x	x				

The *Contract Repository* element is associated with the: T&L service level objects models (TR.1), explicit differentiation of contract types (TR.2), electronic storage of SLA part of T&L contracts (TR.3), contract information retrieval (TR.5), and access rights for users (TR.6). All those requirements are directly or indirectly related to the creation of a repository to store information about the contracts.

The *User Contract Demand Manager* element is associated with: T&L service level objects models (TR.1), explicit differentiation of contract types (TR.2), wizard UI to guide the creation of the SLA part of T&L contracts (TR.4), access rights for users (TR.6), and access to T&L information systems (TR.10). To enable users to interact with the envisioned E-Contracting Module it is necessary to consider the joint development of these technical requirements.

The *Blanket Contract Manager, Capacity-based Contract Manager, and Tariff/Time-based Contract Manager* elements are associated with: T&L service level objects models (TR.1), explicit differentiation of contract types (TR.2), access rights for users (TR.6), extended marketplaces for blanket contracts (TR.8), filtering mechanisms for contract selection (TR.9),

and access to T&L information systems (TR.10). As described in Section **Error! Reference source not found.**, there are different types of contracts that observe different steps for their establishment. The combination of the aforementioned technical requirements enables the design of the contract managers that can observe the specificities of each type of contract associated with such managers.

The *Spot Market Contract Manager* element is associated with: T&L service level objects models (TR.1), explicit differentiation of contract types (TR.2), access rights for users (TR.6), spot marketplaces support (TR.7), filtering mechanisms for contract selection (TR.9), and access to T&L information systems (TR.10). As well as the aforementioned element, it is necessary to handle the features of spot contracts, and therefore we believe that observing these technical requirements it is possible to provide the proper support for spot contracts.

The *Spot Marketplace Integration* element is associated with: T&L service level objects models (TR.1), access rights for users (TR.6), spot marketplaces support (TR.7), filtering mechanisms for contract selection (TR.9), and access to T&L information systems (TR.10). We believe that it is possible to integrate in the proposed already developed marketplaces, so that instead of developing all the functionalities of the necessary marketplaces for blanket and spot contracts, this element will be able to integrate existent functionalities and incorporate the missing ones.

The *Data Extractor* element is associated with the: T&L service level objects models (TR.1), explicit differentiation of contract types (TR.2), contract information retrieval (TR.5), and access rights for users (TR.6). All those requirements are directly or indirectly related to the support for providing contract information for further elements of the Finest Platform.

This connection among the technical requirements and the elements of the initial high level architecture will serve as the basis for the design refinement of the E-contracting module in the next steps.

6 E-Contracting in the ICT Domain

The objective of this section is to present the support for e-contracting related to ICT services which are not related to T&L domain. In this context, ICT services are related to software and not to actual real life services like the ones in the T&L domain (e.g., transporting a good from 'A' to 'B'). Contracting a ICT service means that the functionalities of a software will be used for a period of time according to SLAs.

First we introduce an overview of ICT services regarding the typical phases in an e-contracting process, and later we discuss some of the groups of Service Level Objects (SLOs) associated with Quality of Service (QoS) attributes typically used in ICT Service Level Agreements (SLAs). In the second part of this section, we describe some main SLA description languages, since one of the objectives of WP8 is to represent the SLAs attributes of T&L contracts in an electronic manner. The third part of this section discusses some examples of SLA marketplaces platforms.

6.1 Overview on ICT Services

As discussed in Section 3.2, there are different phases and steps that need to be executed in order to establish T&L contracts. In this section, we explore how the lifecycle of e-contracting in ICT services is perceived. In addition, we also describe which major groups of SLOs are associated with SLAs in ICT contracts, and we establish how those groups of SLOs can or cannot be used in the context of T&L domain. The objective is to identify which groups of the ICT SLOs could be relevant for representing and/or complementing the T&L SLOs. The conclusions of the analysis of the content of this section will be presented in Section 7.

6.1.1 Contracting Phases

The lifecycle of an electronic contract is defined by three activities, namely the contract definition, contract establishment and contract enactment. [37] The contract definition refers to the establishment of a model for the definition of contract terms and usually involves the definition of a contract template that is instantiated in an actual domain-dependant contract between the participating parties. This instantiation is done in the contract establishment activity that may also include the selection of the contract partner depending on the offered set of providers, functional requirements, matchmaking of QoS attributes and the negotiation of the contract terms between the collaborating parties. The concrete contract execution is done in the contract enactment activity that is in line with the monitoring of the satisfaction concerning the fulfilment of the QoS guarantees between service consumer and provider [38].

The contracting phases described in this section refer to a framework presented by M. Comuzzi and B. Pernici that concerns the automation of the contract establishment activity and involves the phases matchmaking, provider selection and SLA configuration.

The matchmaking phase starts when a service request is received. In this phase, the providers of services in the requested category are filtered depending on the match of non-negotiable QoS dimensions, negotiable QoS-dimensions and price. The candidates for selection are based on the service offers that fulfil the requirements on non-negotiable QoS dimensions and at least cover partially the requirements on negotiable QoS dimensions. Additionally, the price L of a service

that is associated to the minimum quality profile must not exceed the declared budget B of the service requestor: $L \leq B$.

During the provider selection phase, the providers filtered in the matchmaking phase are ranked by a bidding function that maximizes the requirement coverage while still maintaining the price L below the allowed provider's declared budget B. Services that only partially cover the requirements are penalized with the help of a utility function. The goal is to select the provider of the best fitting service offer associated to the lowest bid. The difference between the declared budget B and the price L is referred to as extra budget EB = B-L. With the end of this phase all non-negotiable parts of the agreement should be closed.

The actual negotiation takes place in the agreement configuration phase where the selected provider's service offer is configured to adjust the negotiable part of the contract according to the service requestor's requirements. In contrast to non-negotiable QoS dimensions, negotiable QoS dimensions can be modified at runtime. This means that for each negotiable QoS dimension a single QoS value is selected. The agreement phase starts with the evaluation of the extra budget EB that was determined in the selection phase. If EB = 0, no more budget is left for the configuration of the negotiable part of the selected service and the service requestor must stay with the minimum quality SLA. As a result, this phase only takes place if EB > 0. The main question of the agreement configuration phase is how to spend the available extra budget on the configuration of negotiable parameters in order to increase the quality of the service, assuming that the service requestor is willing to fully spend the extra budget. Therefore, the framework proposes a vertical strategy that concentrates on increasing the level of the negotiable QoS dimension with the highest priority as well as an horizontal strategy that should be used when the service requestor relies on a general set of preferences, that means a sufficiently good service instead of having severe constraints on a specific QoS dimension. As a result of the agreement phase the SLA is closed concerning negotiable as well as non-negotiable QoS parameters and the final price is fixed.

6.1.2 Service Quality Attributes related to ICT Domain

The Quality of a Service (QoS), in the scope of Internet of Services (IoS), regards to the set of attributes that characterize the ability of a service to satisfy a state or requirements in an end-to-end fashion. In IoS scenario, the quality attributes of a service are essential for the negotiation and establishment of contracts among service providers and requesters. The resultant document of such negotiation is the SLA (Service Level Agreement). Thus, SLA documents are composed of a set of service quality attributes and the metrics that will be used as quality constrains among the service provider and requester. The analysis of the literature reveals a vast list of different quality attributes that can be used to establish an SLA. This list was categorized and summarized in the S-Cube Quality Reference Model (QRM) [39]. In this section, we review in a high level of abstraction the S-Cube QRM, and the details of the attributes can be found in Appendix C.

Performance - The Performance of a system is characterizes how well a service performs and is measured by response time, throughput and transaction time.

Dependability - Dependability of a computing system is the ability to deliver service that can justifiably be trusted [40], mainly with regard to availability, reliability, failure semantics and robustness [39]

Failure Semantics - Failure semantics describe the circumstances of faults that can occur in a system as well as the way and possibilities of a service to react on these failures.

Robustness/Flexibility - The capability of a service to react in an acceptable way when an anomalous or unexpected situation occurs or when the context changes.

Recoverability/Survivability - Recoverability and Survivability refer to the capability of a service to keep and re-establish its functionality in presence of faults, attacks or accidents.

Security - Regarding the provision of services over the public Internet the rising concerns about security make this category of quality attributes particularly important. Depending on the type of service request the provider may apply different types and levels of security.

Data-related - Data-related service quality is relevant when services not only accept input parameters but when they process input data or return output data. The quality attributes that characterize this data are based on traditional attributes that characterize information related quality like accuracy or timeliness [41] with regard to deviation and validity.

Configuration-related quality - This group of quality attributes describes the way a service is configured in order to offer its functionality.

Network and Infrastructure-related - Despite being neglected by the first research proposals, network and infrastructure-related attributes are now becoming important attributes on the negotiation of SLAs. Changes on normal behaviour of the network (e.g., network disruption) and infrastructure (e.g., picks of CPU or memory usage) may impact other quality attributes (e.g., availability of a service). Below, we describe some examples of network and infrastructure-related attributes and in the sequence we analyze the importance of them in face of the business requirements related to E-contracting.

Quality of Use Context - Based on the context of a service it can be necessary that a service becomes adaptive, that means it has the ability to change its configuration, behaviour or appearance. Based on the definition given by [42] the context refers to any information about a service, the user, the physical and run-time environment as well as the network. The quality of context information depends for example on the way the service is provided, the required time or the level of detail. For the adaptability of a service it is important to know about the context and its quality in order to decide whether, when and how to adapt.

Cost - In order to select a service according to the QoS that fits not only the user's requirements but also the budget, the costs are an important attribute computed either from all atomic cost attributes listed below or just from the fixed costs.

Others - Beside the quality groups and attributes listed above there are even more attributes like usability, comprehensibility, standards, learnability, effectiveness, satisfaction, resolution, probability of correctness, etc that can affect the portability and inter-operability of a service.

6.2 Service Level Agreement Description Languages

Different service consumers often have different requirements on the same web service. Some consumers need high availability and others are totally fine if the service is (e.g.) available once a day. The reason for these differences is the different contexts and environments in which the service will be used. However, it is necessary to offer web services in different variants consumers can choose from. With Service Level Agreement (SLA) description languages those web service variants are described as service levels. A service level describes for example they describe the quality of service (QoS) and the price of a service variant. In addition to the service levels SLA description languages describe how SLAs are negotiate, how they are monitored and what happens if violations occur. In this section the some SLA description languages and service description languages with SLA support are described.

6.2.1 USDL

Unified Service Description Language[1] (USDL) is a description language for web services, which is used to attach additional information to web services descriptions in order to add those in a uniform way. USDL is divided into several modules which are optional to be used for each service, but dependencies between single packages do exist [43]. Relevant modules for WP8 are **Legal**, **Pricing** and **Service Level**. Because of dependencies between single modules additional modules are required [43]. Those are **Foundation**, **Service** and **Participants**.

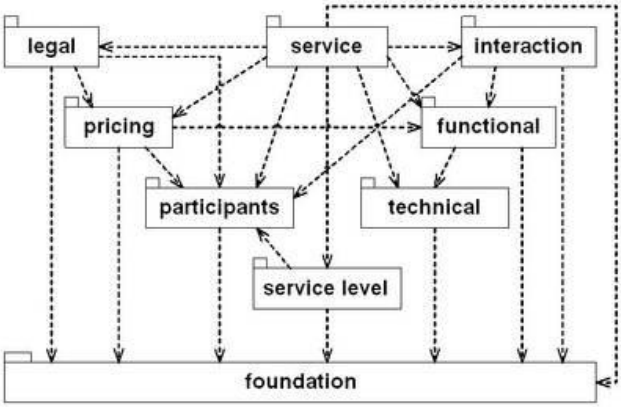

Figure 11 - Packages comprising the USDL model and their dependencies [44]

USDL is capable of describing web services in a much brighter and uniform way than it would be possible with other available description languages. This includes the description of:

- licenses information related to the copyrightable elements of a service including information about requirements, restrictions and granted usage rights (Legal Module) [45]
- licensors and authors of service (Participants Module) [46]
- modular service pricing structures (Pricing Module) [47]
- services, service bundles, service variants and service dependencies (Service Module) [48]

[1] http://www.internet-of-services.com/index.php?id=264

- service level profiles related to a service or service bundle with several different service levels to choose from (Service Level Module) [49]
- service level specifications with several attributes, e.g. constants or metrics, necessary for Quality of Service definitions and SLA monitoring (Service Level Module) [49]

In the FI-WARE project a GE will be developed which enables and supports the usage of USDL in the FI PPP Core Platform. FI-WARE also plans to use USDL other GEs like SLA and Service Repository.

Remarks:

- The Foundation Module contains (among others) classes which are used in multiple packages. [43]
- The Legal Module so far only supports licenses and copy rights according to German law. A version for US jurisdiction is in the works [43]. If licenses and copy rights according to additional country laws are necessary (what we expect to be the case) then those laws need to be implemented as well.

6.2.2 WS-Agreement

WS-Agreement is a part of the WS-* standards with focus on Service Level Agreement for web services. It is used for technical formulation and negotiation of SLAs [51]. While the WS-Agreement specification provides a structure for SLA documents, it does not specify which aspects of a service are described and how [50].

WS-Agreement describes the process of how agreements will be established and which documents are necessary for this. The establishing process is mainly fixed in structure:

1. The agreement initiator (can either be the service provider or the service consumer) will send an agreement request to the agreement provider.
2. The agreement provider will send an agreement template back
3. The agreement initiator will create an agreement and will send it as an offer to the agreement provider.
4. The agreement provider either accepts or rejects the agreement.

WS-Agreement contains a schema for specifying an agreement and for specifying an agreement template. The three documents involved in the process (agreement offer, agreement template and agreement) are XML documents. [50][51]

6.2.3 Web Service Level Agreement (WSLA)

The Web Service Level Agreement (WSLA) language was one of the first approaches to describe SLA and developed by IBM [52][53]. WSLA supports the creation of Service Levels as well as the negotiation and the monitoring of SLAs. WSLA is based on XML and is defined as a XML Schema. Both, service provider and customer can use WSLA to describe their need or offer [53]. A WSLA Document contains not only information about the service and the service level parameters, but also information regarding relevant SLA parties like provider, customer and third party monitoring service provider. Additionally guarantees for achievement of pre-

defined measures are included in a document. However, the WSLA development has stopped to push the WS-Agreement (section 6.2.2) instead [52].

6.2.4 SLAng

Like WSLA (section 6.2.3) SLAng was one of the initial languages to describe SLAs[54]. SLAng is based on a bundle approach which means that, several agreements are bundle in a so called SLA contract which contains, for example, information on relevant parties (service provider, service customer and trusted third parties), their locations and digital signatures. Beside that the service levels are described with focus on the quality of service (QoS) and contractual statements like time of validity. Like WSLA also the further SLAng development has been stopped [54][55].

6.2.5 Web Service Offerings Language (WSOL)

Web Service Offerings Language (WSOL) does not describe SLAs like the other introduced languages but different pre-configured service levels for one specific web service. WSOL has been developed as an extension of WSDL [56]. WSOL enables a service provider to pre-configure several service level configurations, called web service offerings, which are fixed for a service customer. This is a very simple and inflexible way of realizing SLA because a customer can only choose one of the offers instead of having SLAs associated with the overall composition of services. If the customer needs a different configuration there is no way of creating it. An agreement is simply realized by selecting a service offer [56][57].

6.2.6 Rule-Based Service Level Agreements (RBSLA)

Rule-Based Service Level Agreements (RBSLA) is an additional SLA description language which includes the definition of rules to minimize the need of human interactions in the agreement process [58][59]. RBSLA is a SLA specific extension of RuleML, which is a XML-based language for describing rules. It enables the description of established SLAs and their monitoring via rules. The rules are executed using a rule engine which receives the description document. As a result, the SLA monitoring can be executed automatically. However, RBSLA does, like WSOL (section 6.2.5), not support the agreement process in any way [58][59].

6.3 SLA Marketplace Platforms

On the internet thousands or possibly millions of web services are available which makes it very difficult to find the right service with a suitable quality level and a good price. SLA management platforms often provide an initial or single point of access to find offered web services and additionally support functionalities related to the management of the SLA attributes. For example, they can monitor the performance of the response time of services and thus determine whether violations on SLA attributes related to response time on accessing such services occurred. SLA management platforms need to support SLA description languages so that SLAs can be negotiated and described in ICT terms that could be later managed by the platform. Due to the fact that SLA management platforms can assume the role of access points for offered and demanded services, they also can be explored as marketplaces for ICT services. In this section different SLA management platforms and marketplaces are introduced.

6.3.1 TEXO

The Theseus project was a research project on semantic technologies and initiated and founded by the German Federal Ministry for Education and Research. TEXO was one of the use cases of Theseus with focus on the Internet of Services (IoS). The aim of it was to provide an infrastructure for supporting the design, creation and hosting of web services [60][61]. Relevant for FInest, and especially for Work Package 8, is the developed service marketplace. TEXO aims at providing the infrastructure for [60]:

- Customizing and personalizing web services
- Involving communities into the optimization of web services
- Seamless customization and integration of services into the using environments

To achieve those, an architecture is provided which supports the service development, service execution and SLA (lifecycle) management, among others. The architecture contains three different main components with different responsibilities [61]:

1. The *ISE Development Environment* consists of a couple of design time tools and provides functionality for [61]:
    - Designing services
    - Describing services
    - Composite services including SLA creation and SLA negotiation for those
2. The *Service Management Platform* (Service Marketplace) is a single point of access for offering or purchasing services and enables (among others) [61]:
    - Offering of services
    - Searching for services
    - SLA negotiation
    - SLA monitoring
    - Billing

    On the marketplace the offered services are described using USDL (section 6.2.1) and support for selection of service level attributes exist. On the TEXO marketplace not only web services can be traded but also real-life services.
3. The *Tradable Service Runtime* is the runtime infrastructure of the architecture and can exist in several instances. It provides functionality for [61]:
    - Service execution
    - Monitoring from the providers point of view

Important for the composition of web services is the dependency management. If a service consumer wants to compose several services, he or she needs a SLA for each of them first and afterwards also a SLA for the composed service (at least if it will be offered again) [61].

6.3.2 SLA@SOI

The EU FP7 project SLA@SOI has lead to several results like a SLA management framework and a suite for e-contracting [62]. The projects vision was to provide "a business-ready service-oriented infrastructure empowering the service economy in a flexible and dependable way" [63]. The main innovations of the SLA@SOI project with focus on SLA management are:

1. A *SLA Management Framework* which provides [62]:
    - Standards for SLA specification
    - Standards for SLA negotiation
    - SLA management functionality including planning, optimization and provisioning
    - SLA monitoring functionality
    - SLA accounting functionality
2. Adaptive *SLA-aware Infrastructures* which provides [63]:
    - Different virtualization technologies accessible through standardized interfaces
    - SLA enforcement using advanced technologies on infrastructure level
3. The *Business Management Suite for e-Contracting* covers the handling of the complete service delivery (business) lifecycle [62].

6.3.3 GridEcon Marketplace

GridEcon was an EU FP6 project which also developed an marketplace on which web services can be offered and sold. One of the project objectives was to "design markets for services at various levels of service provisioning, from basic utility services to web services where buyers can express preferences for quality and reliability" [64]. The marketplace does primarily focus on renting of computing resources (computing time) which are accessible as web service. The project aim was to enable that "all spare bandwidth, storage and computational resources are purchasable on demand by anybody from anybody" [65].

6.3.4 StrikeIron Marketplace

StrikeIron[2] is a productive and established marketplace for web services. StrikeIron is not only the intermediate but also the service provider; however, web services from different providers are available as well [66]. On the StrikeIron marketplace web services are offered which are described using WSDL. Different service levels per web service are supported but not directly via the website – the customer has to call a hotline for this information, as well as, for pricing information. This means that SLA is not proper supported on this marketplace. Additionally, the marketplace data seems to be very static and there is no native way of adding new web service offerings.

[2] http://www.strikeiron.com

7 Analysis of Potential Technology Baseline

For each one of the main topics discussed in Section 6, we present a discussion of the potential technology baselines that are considered to be used in WP8 for the design and prototypically development of the E-Contracting Module.

- The framework for e-contracting phases (selection, negotiation, enactment) presented in Section 6.1.1 is very similar to the phases identified in the analyses of T&L contracts (selection, establishment, execution). Therefore, we believe that this framework represents a good base line to develop the e-contracting phases and steps required by the ECM.
- Regarding the analysis of the ICT QoS attributes and SLOs, we came to the conclusion that most of them are not completely aligned with the T&L services because their focus is to describe and characterize electronic and virtual services, and not T&L services connected to real life. For example, network and infrastructure related attributes are not important at all in an SLA for T&L domain. It is really not relevant if it takes 2s or 1 minute to access the ICT services of a partner, because this is not decisive for the accomplishment of a T&L service. However, we can get inspired by some of these groups of ICT SLOs in order to define the T&L SLOs. For example, the dependability group of SLOs could be translated to the needs of T&L domain. In this example, reliability would not be associated with the capability to access the ICT service of a logistics service provider, rather than it would be related to the capacity that the logistics service provider has of delivering the shipment always within the agreed period of time.
- USDL is a modularized description language for web services, which is capable of describing service levels and SLAs. WS-Agreement also focuses on SLAs and describes a mainly fixed negotiation process. The development of the early approaches WSLA and SLAng has stopped years ago; therefore, they are not relevant anymore. WSOL is a related description language which focuses on static variants of the same web service and does not allow the negotiation of SLAs. Hence, this language is not relevant. RBSLA is a SLA description language which enables, beside the description of SLAs, additional descriptions of rules for SLA monitoring, but it does not support the negotiation process itself. In the FInest project USDL is the best candidate for being used as the technology baseline for electronic representation of the T&L contracts because of two reasons. First, it has the capability of representing not only ICT attributes but also, pricing, participants, etc. Second, FI-WARE project will provide a GE to handle USDL documents and, this way, FInest could benefit from a common baseline for the service representation.
- In TEXO some interesting components with focus on SLA management have been developed, the most important for FInest is the TEXO marketplace which is based on USDL and also enables the trading of real-life services. The SLA@SOI also provided useful SLA-related results but without a marketplace. Additionally, two web service marketplaces have been introduced. The GridEcon is a research prototype like the TEXO Marketplace and enables everyone to offer web services but those are not universal, instead they always focused on computing resources like CPU time. Finally the StrikeIrom marketplace has been described which is a productive marketplace but without real support for SLA negotiation. Based on the aforementioned, we believe that TEXO is a potential technology to be used by WP8 in order to support the technical requirements identified so far for the design of the E-contracting Module.

8 Generic Enablers

Currently, most SLAs and contract of non-ICT business tend to employ a paper-based approach for storing their SLAs and Contracts. One of the important aspect for the E-contracting Module (ECM) is the capability to represent and store the SLA attributes of contracts in an electronic way. Therefore, one key generic enabler for WP8 is the capacity of storing of SLAs and contracts and mechanisms to retrieve information from those SLAs and contracts.

In fact, not only the ECM module developed within FInest project but Future Internet business applications executing over the FI-WARE platform will need such storage place for their SLAs and contracts and associated retrieval information mechanisms. Moreover, the retrieval mechanisms should allow the search and retrieval of individual attributes of SLAs and contracts.

Future Internet applications based on FI-WARE platform could make use of the electronic storage of SLA and contracts, in order to enable the runtime and online verification of the execution of the contracted non-ICT services and achieve agile detection of deviations and violation of agreed business contracts.

Therefore, we identified the need for a **Generic Enabler for SLA & Contracts storage and retrieval.**

The detail description of such request is available in this web page http://www.finest-ppp.eu/index.php/project-results/generic-enablers, and it is structured according to the FI-WARE template for requesting GEs.

9 Conclusions and Roadmap

This document encloses a detailed analysis of current situation on T&L domain and ICT systems associated with e-contracting processes. A requirements analysis of the domain was performed and as a result an initial set of technical requirements of the design of the E-Contracting Module. We also identified the potential technology baseline to be used for the refinement of the design and the prototypically implementation of the ECM. In addition, an initial high level architecture for the ECM was also presented and associated with the technical requirements. Finally, due to the experienced gather during the execution of the work in this WP, we could identify the need for a GE related to the SLA negotiation and management of SLO attributes not related to ICT, but able to support actions related to non-ICT attributes.

Based on the aforementioned, we are able to assure the accomplishment of the objectives of the deliverable D8.1, which were: (i) identification of initial requirements for the Logistics Contract Manager (associated with T8.1); selection of existing R&D results to build upon (associated with T8.1); and initial identification of the required Generic Enablers (associated with T8.3). In fact, we achieved more than the initial objectives of this document, once we also provided an initial high level architecture for the E-Contracting Module.

The roadmap for the next achievements in the development of the ECM in WP8 includes:

- Refine the technical requirements (specialization into functional and technical requirements);
- Refine the high level architecture and define the Conceptual Design of the ECM;
- Identify the relevant set of SLA attributes for each type of T&L contract;
- Identify the need of differentiation between SLA attributes of T&L contracts and QoS attributes that should be part of the offers and bids (e.g., during the execution of auctions) in selection and establishment phases of the contract;
- Map the identified SLA attributes (and if necessary the QoS attributes) to the USDL model;
- Identify which kind attributes in each contract type are negotiable or not;
- Refine the request for the non-ICT SLA negotiation and management engine and look for further possible GE requests.

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Appendix A

This appendix presents a detailed description of some of the standards used in T&L that are somehow associated with contracts and their execution.

Terms of Trade - Detailed description of INCOTERMs

EXW: Ex Works (agreed place of loading)
When the goods are loaded on the transport unit of the buyer, the transfer of costs and risk is prior to the loading. The seller has fulfilled his obligation to deliver as soon as the goods are export worthy packed with marks and numbers and ready for sending, at the agreed place and the seller has informed the buyer accordingly. EXW is both a maritime and a non-maritime condition.

FCA: Free Carrier (agreed place of loading)
The seller arranges goods with invoice, packaging, export license, customs formalities when exporting and costs up to delivery of the goods to the carrier (the transport company), as stipulated by the buyer and in accordance with the mode of transport. The seller delivers the cleared goods and transfers them to the carrier appointed by the buyer, in the location or place agreed on. If no exact place has been agreed on, the seller may select where within the stipulated location or area liability is transferred.
FCA is a non-maritime condition.

CPT: Carriage Paid To (agreed place of destination)
This term means that the seller will pay all freight costs all they to the foreign port and that the buyer assumes all risk of loss beyond the loading port. The transfer of costs occurs when the goods have been delivered to the agreed destination. The transfer of risk already occurs at the time that the goods are offered for carriage to put in the care of the (first) carrier as in FCA. With FCL, this usually means the plant or on the property of the seller after loading and with LCL usually after delivery of the goods to the carrier nominated by the seller itself. The seller has fulfilled his obligation to deliver when the goods are under the custody of the carrier that was nominated and named by the seller. This means for FCL usually when the goods are loaded in the outgoing means of transport in the factory or in the field of the seller. For an LCL is this usually the moment that the seller has delivered the goods at the designated consolidation warehouse.
CPT is a non-maritime condition.

CIP: Carriage and Insurance Paid to (agreed place of destination)
The transfer of costs occurs when the goods have been delivered to the agreed destination. The transfer of risk occurs at the time that the goods are offered for carriage to put in the care of the (first) carrier as in FCA and CPT. The seller has fulfilled his obligation to deliver when the

goods are under the custody of the (first) carrier that was nominated and named by the seller. This means for FCL usually when the goods are loaded in the outgoing means of transport in the factory or in the field of the seller. For an LCL is this usually the moment that the seller has delivered the goods at the designated consolidation warehouse. The insured value of goods is normally 110% of invoice value.
CIP is a non-maritime condition.

DAT: Delivered at Terminal.
The vendor delivers in the agreed terminal in said port or place of destination. The seller takes all risks till delivery into the terminal en is responsible for unloading the goods and export Custom Clearance. The consignee is responsible for Custom Clearance at imports. A terminal can be every place such as the wharf, warehouse, container-, road-, rail- or air terminal.
DAT applies for any mode of transport is thus both a maritime and a non-maritime condition.

DAP: Delivered at Place (agreed place of destination)
The transfer of costs and risk occurs when the goods are not cleared and unloaded from the arriving means of transport, and available to the buyer at the agreed place of destination. The seller has fulfilled his obligation to deliver as soon as the goods are not cleared and unloaded from the arriving means of transport, are available at the agreed place of destination.
DAP replaces the former (Incoterms 2000) conditions DAF, DES and DDU and is a non-maritime condition.

DDP: Delivery Duty Paid (agreed place of destination)
The transfer of costs and risk takes place after the goods custom cleared and duties paid, but not discharged, made available to the buyer at the named place of destination. The seller has fulfilled his obligation to deliver when the goods are custom cleared and import taxes are paid, not unloaded at the disposal of the buyer at the named place of destination.
DDP is a non-maritime condition.

FAS: Free Along Side Ship (agreed port of departure)
The transfer off costs and risk occur at the time the goods are delivered alongside the vessel that is nominated by the buyer, so before loading. So, the seller must arrange for delivery, and assume all risks, up to the ocean carrier at a port and has fulfilled his obligation at that moment that he delivers the goods alongside the (by the purchaser) nominated and named vessel in the port of departure. Alongside i.e. alongside the waterfront, such as a barge or alongside on the tray of the shipping port by truck.
FAS is a maritime condition.

FOB: Free on Board (agreed port of departure)
The transfer off costs will occur after placing the goods on board of the ship in the port of departure or after the goods are loaded. The transfer of risks also takes place at that time, in other words, the critical point of costs is equal to the critical point of risk transfer. The ship's

rail, traditionally a symbolic barrier between the seller and buyer, has been abolished. The seller has fulfilled his obligation to deliver when the goods are placed/loaded on board of the (by the buyer) nominated and named vessel at the port of departure.
FOB is a maritime condition.

CFR: Cost and Freight (agreed port of destination)
The transfer of costs will occur after placing the goods on board of the ship in the port of departure or after the goods are loaded. The transfer of risks also takes place at that time, in other words, the critical point of costs is equal to the critical point of risk transfer, just like FOB. The ship's rail, traditionally a symbolic barrier between the seller and buyer, has been abolished. The seller has fulfilled his obligation to deliver when the goods are placed / loaded on board of the (by the seller) nominated and named vessel at the port of departure.
CFR is a maritime condition.

CIF: Cost and Freight (agreed port of destination)
The transfer of costs will occur after placing the goods on board of the ship in the port of departure or after the goods are loaded. The transfer of risks also takes place at that time, in other words, the critical point of costs is equal to the critical point of risk transfer. The seller has fulfilled his obligation to deliver when the goods are loaded / placed on board of the (by the seller) nominated and named vessel at the port of departure. The insured value of goods is normally 110% of invoice value.
CIF is a maritime condition.

According to the obligation area of the exporter there exist four categories of Incoterms:
- the ‘E terms’: Pick-up / Departure Clause like EXW
- the ‘F terms’: Main Carriage Unpaid like FCA, FAS, FOB
- the ‘C terms’: Main Carriage Paid like CPT, CIP, CFR, CIF
- the ‘D terms’: Arrival / Destination Clause like DAT, DAP, DDP

Apart from the differentiation according to the applicability on the different modes of transport and the exporter’s obligation volume, the Incoterms can be differentiated along the different responsibilities of buyer. Likewise, a differentiation between the various terms can be executed based on the heterogeneous characteristics of risk and cost transition.

Terms of Payment

The major Terms of Payment are introduced and elaborated as follows:

Cash in Advance
The Cash in Advance or Advance Payment method allows the buyer to pay cash in advance to the seller. Paying in advance is said to give the greatest protection for the seller and puts the risk on the buyer, but the payment does not guarantee the shipment or delivery of the goods from the seller. Therefore, the buyer will rarely pay cash in advance prior to receiving an

assurance that the goods will be shipped and that the quality and quantity of the goods ordered will be delivered.

Open Account

An open account transaction means that the goods are manufactured and delivered before payment is necessary. The method provides great flexibility and in many countries sales are likely to be made on an open-account basis if the manufacturer has been dealing with the buyer over a long period of time and has established a secure working relationship.

The open account method is a preferred method of payment for the importer since it places the risk on the exporter/seller. This method cannot be used safely unless the buyer is creditworthy and the country of destination is politically and economically stable. However, in certain instances it might be possible to discount open accounts receivable with a factoring company or other financial institution.

Consignment Sale

With consignment sales, the seller does not receive payment until the importer sells or resells the goods. The product stays with the importer until all the terms of the sale have been satisfied. In the consignment method, the importer is called the consignee and he/she is responsible for paying for the goods when they are sold. Consignment sales are very risky and there is no control available to the exporter. Obtaining sales proceeds or return of the merchandise if it is not sold can be difficult.

On Consignment payment method is useful if the consignee is reliable, has a good credit history, stems from a country with a high economic and political stability or is the branch office of the main company.

Draft or Documentary Collection

The Draft or Documentary Collection method is employed when either the cash in advance method is not acceptable to the buyer or the open account method is not acceptable to the seller. With the Draft or Documentary Collection Method, the seller/exporter ships the goods and draws a draft or bill of exchange on the buyer/importer through an intermediary bank. The draft is an unconditional order to make a payment in accordance with certain terms. The documents needed are specified before the title for the goods is transferred.

With four parties involved in the documentary collection method, i.e. the buyer, collecting/presenting bank (buyer's bank), the seller and the remitting bank (seller's bank), the documentary collection method takes place in four main steps: The seller sends the draft to the remitting bank whereupon the remitting bank sends the draft to the collecting bank. Then, the collection bank, in its intermediary role, makes the documents available to the buyer who, after having examined the documents, can pay immediately (sight draft), pay at a future date (time draft) or refuse to pay for the draft.

When the draft is paid, the title documents are released to the buyer so he/she can obtain possession of the goods. As the title to the goods is not transferred until the draft is paid or accepted, both the buyer and seller are protected. However, nothing prevents the buyer from refusing a draft for payment.

Two types of drafts are to be presented here:

Sight Drafts:

If the exporter and importer have agreed that payment should be made immediately upon receipt of the draft and/or shipping documents by the buyer's bank, the draft is said to be

drawn at sight. A sight draft is an order signed by the seller instructing the buyer to pay a specified amount to the seller upon presentation of the draft.

Time Drafts:

If the seller has provided credit terms to the buyer which allow the merchandise to be released before payment is received; it is called a time draft. The exporter will need a written promise from the buyer that payment will be made at a specified future date. When a bank receives time drafts, the bank is requested to deliver the documents only when the buyer has accepted. The buyer's acceptance of the draft is his/her agreement to pay at an agreed upon future date.

Letter of Credit

A Letter of Credit is a legally binding document that a buyer can request from his bank in order to guarantee that the payment for goods will be transferred to the seller in case the related terms and conditions are satisfied by presenting the necessary shipping documents confirming the shipment of goods within a given time frame. Basically, a letter of credit gives the seller reassurance that he will receive the payment for the goods.

For many years, the Letter of Credit has played an important role in international trade and continues to do so in global trade today. With the various alternative payment methods available to buyers and sellers of goods or services nowadays, the Letter of Credit is still the most common payment method since the seller usually will not ship without a bank's assurance of payment. While this is a major factor, the Letter of Credit offers other advantages for the buyer and seller, too. It is often used in international trade to eliminate risks such as unfamiliarity with the foreign country, customs, or political instability. For any company entering the international market, the Letter of Credit is thus an important payment mechanism that needs to be understood.

When preparing a shipment covered under a letter of credit, it is important to closely follow the instructions in the letter of credit. The letter of credit will explain exactly how to prepare the draft and the commercial invoice, what documents to prepare and attach to the draft for payment, and by what specified deadline to ship the goods by the seller and to present the documents for payment. Accuracy is extremely important.

All Letters of Credit are issued in either a "revocable" or an "irrevocable" form and “confirmed" or "unconfirmed".

Revocable Letter of Credit

The term revocable indicates that the credit is not a legally binding undertaking and can be changed or withdrawn at any time without the permission or even knowledge of the beneficiary. However, it does not assure payment. When the seller does not need a guarantee other than the buyer's reputation, a letter of credit serves no purpose unless it is used as a suitable means of exchanging documents and payment. Unless stated otherwise all credits are revocable.

Irrevocable Letter of Credit

With this type of credit the buyer's bank has given an irrevocable promise to pay the seller, on his/her proof of compliance with the set terms and conditions of the Letter of Credit, and the bank cannot change this without the authorization of the exporter. The buyer has no responsibility to agree to changes to the Letter of Credit. In case the Letter of Credit includes conditions that are inconsistent with the sales/purchase agreement, then this is a subject to be settled between the buyer and seller whereas the bank has no responsibility to involve itself with the particulars of the agreement.

Appendix B

Over the last years, various Single Window Systems have been developed and introduced to support different intermodal transport activities: cargo reporting activities that reference import and export, ship and vessel clearance and port clearance. The implementations often represent the same solution but the implementation varies from country to country depending on legal, political and organisational issues [19]. To ensure the compatibility between these systems it is necessary to make use of international standards that improve simplification and harmonization of cross-border data exchange. Therefore the concept is promoted by a framework of world organisations like the United Nations Economic Commission for Europe (UNECE) and its Centre for Trade Facilitation and Electronic Business (UN/CEFACT), World Customs Organisation (WCO), SITPRO Limited of the United Kingdom and the Association of Southeast Asian Nations (ASEAN). The framework provides and emphasizes the use of guidelines, case studies, recommendations and standards for the development and implementation of Single Window systems.

Both governmental as well as business entities can benefit from the implementation of a Single Window as single entry point for the exchange of standardized information and documents. Governments benefit from increased integrity and transparency of information, faster and more accurate validation and distribution of information, enhanced security end efficiency in trading procedures through systematic data collection, correct and often increased revenue yield as well as improved trader compliance due to up-to-date information and in case of payment systems also rapid and accurate payment for duties and other charges. Trading partners mainly benefit from easier and faster document preparation and processing and therefore faster clearance and release times. This results in a more efficient supply chain and cutting costs through reducing delays, leading to appreciable gains in productivity and competitiveness. If the Single Windows serves as single-point access to updated information on current trade rules, regulations and compliance requirements, it also encourages greater trader compliance and lowers administrative cost. The successful introduction and implementation of a Single Window concept based on ICT depends on its legal and technical cross-border interoperability. The necessary capabilities are described below by the means of the ASEAN (Association of Southeast Asian Nations) Single Window.

The ASEAN Single Window (ASW), once operational, will be one of the key elements in the ASEAN Member States efforts to create an integrated economic community by 2015 and to enhance both regional and global trade and development. The ASEAN States have outlined an ambitious and leading-edge approach to achieve these goals through the use of the ASEAN Single Window and doing this using modern Information and Communications Technologies (e.g., electronic commerce modalities): One of the key areas of legal and technical concern in the Single Window for national and international operations is related to information sharing with focus on privacy and data protection, authorized access to data, integrity of the data being processed by the Single Window and the accuracy of the data. Therefore, confidentiality, integrity, availability and privacy of information and data are fundamental to protect the information assets of government, business and private parties. Based on the work of the United Nations Commission on International Trade Law (UNCITRAL) the paper lists following legal issues as implications for the Single Window: Authentication and cross-border recognition of electronic signatures, liability and standards of conduct for information service providers, electronic invoicing and legal issues related to supply chains in electronics, transfer of rights in tangible goods (e-Documents of Title) and other rights through electronic communications, protection of intellectual property rights. The ASW will provide standardized business processes

of processing (receipt, processing and provision of information and data; communication, dissemination, cross-border exchange of information and data; and mutual recognition of completeness of provided and processed information). The trade data system will contain large amounts of sensitive information that requires protection, including personally identifiable information (PII), trade-sensitive, business confidential, law enforcement and information related to national security [19].

Appendix C

This appendix presents in detail the list of ICT Service Level Objects based on the QRM of S-Cube project.

SLO Group	Attributes
Performance	Response time – The amount of time needed to complete a service request from the user's point of view.
	Throughput – The number of service requests that are completed over a time period
	Transaction time: The time it takes a service to process one complete transaction.
Dependability	Availability – The degree of availability of the service for a client. The availability is specified as relative to a maximum availability of 24 hours, seven days a week.
	Reliability – The capability of a service to process its required functions under specific conditions for a stated period of time to maintain its service quality.
	Continuous availability - probability with which a client can make use of a service an infinite number of times during a particular time period and under the on condition that the service doesn't fail and retains all state information during this time period.
	Scalability – The possibility to increase the computing capacity of a system and therefore the ability to process more operations or transactions in a given period.
	Capacity – The maximum number of concurrent requests that a service can handle.
	Accessibility – The capability of a service to serve its requests. In particular, the main question is whether all clients can access the service. E.g., when a service can only handle a specific amount of bookings at a given time and the service reaches its threshold, it is not accessible any more for other clients.
	Accuracy - The error rate produced by a service in reference to the expected results. A lower error rate means a higher accuracy.
	Failure semantics – As failure semantics cover multiple aspects of a system's capability to handle failures this quality attribute is described below separately.
	Robustness/ Flexibility - The capability of a service to react in an acceptable way in an unforeseen case. Robustness and flexibility are described below separately.
Failure Semantics	Operation semantics - The way requests are handled in case of failures.

SLO Group	Attributes
	Failure masking - the type of failures a system is exposed to, especially between a server and its client so that a client can detect and react in an adequate way on these failures.
	Failure tolerance – The capability of a service to continue providing its functionality to its clients in case of failures.
	Compensation - Actions that must be initiated to undo the effects of a service invocation when using stateful services. E.g., if a customer orders by mistake a shipping capacity for a wrong day, then compensation includes to give the customer credit and to take back the order.
	Exception handling - Internal activities that are executed during the run-time of a service in case of failures. E.g., when a booking process is finished and the database where the booking data is stored is not available, a service might swap to another database to use it for persistency.
Robustness/Flexibility	Adaptibility – In case of context change a service should be able to dynamically modify its state and behaviour. The context can cover user preferences, device and network characteristics, available user peripherals, user location and status (e.g. activity, mood), natural environment characteristics and service and content descriptions.
	Repairability – The ability of a system to run repair actions in unexpected or anomalous situations.
	Self-healability: The capability of a broken service to a) recognize automatically that it is not working correctly and b) to restore itself to its normal state.
Recoverability/Survivability	Resistance – The capability of a service to repel to attacks and therefore to fullfill its mission.
	Recognition/ Observability/ Diagnosability – “The capability of a system and its monitors to exhibit different observables for different anticipated faulty situations.”[S-Cube Ref]
	Recovery - The ability of a service to restore its functionality and to recover to full service in case of faults, attacks or accidents.
Security	Safety - The certainty that the users and the environment of a system are not affected by catastrophic consequences.
	Authorization - The access of a subject to a service based on applicable access control information. Authorization is mostly processed is in the context of authentication: First, the subject authenticates and secondly it is authorized to perform different actions.
	Authentication - The process of confirming and verifying a subject identity.

SLO Group	Attributes
	Confidentiality – The authorized disclosure of information that means the message content or the request parameter is not leaked to unauthorized parties. E.g., the exchange of legal transport documents like waybill must be kept confidential.
	Integrity -The correctness of information. Integrity means that the message content or the request parameter is not changed during transmission and refers to the absence of improper and not allowed alterations including accidental or malicious alternation or removal and addition of information.
	Accountability – The state of being accountable refers to the liability to be called on to render an account and the responsibility when not performing as expected.
	Tracebility and Auditability - "Capability of the service to be monitored and to generate in a reliable and secure way events producing an audit trail from which a sequence of events can be reconstructed and examined. Security events could include authentication events, policy enforcement decisions, and others. The resulting audit trail may be used to detect attacks, confirm compliance with policy, deter abuse, or other purpose." [S-Cube Ref]
	Data encryption - The algorithms that are used to protect data from malicious access. It also refers the advantages and disadvantages of different algorithms and therefore to their efficiency.
	Non-repudation - The correct identification of the service consumer, provider and involved actions of each party. E.g., the exchange of legal documents referring to governmental regulations where the authenticity of the sender must be confirmed, for example tax receipts.
Data-related	Data timeliness – Describes that information arrives at a given time and not tool late
	Data reliability – Refers to the trustworthiness of data. Primarily the provider is accountable of the data reliability.
	Data accuracy – Represents the level of agreement between data value and a reference value that is assumed to be correct.
	Data completeness – Identifies the level of required and present data values in a given attribute or set of attributes, referring to temporal as well as spatial aspect of data quality
	Data validity - Based on the requirements of validation criteria the data validity identifies whether data values satisfy the required acceptable values.
	Data Policy - Represents the validity of data returned by a service in case of failures or anomalous events. Therefore, the data policy is associated with entities such as return values or arguments.

SLO Group	Attributes
	Data integrity - Specifies the validity of data that can be compromised by errors caused by the user, the system or the software as well as attacks, data modification, transmission errors, hardware malfunctions or viruses.
Configuration-related quality	Stability/ Change cycle – Measures the frequency of change regarding the interface or implementation of a service.
	Completeness – A measure to express the difference between a specified set of features and the implemented set of features.
	Reputation - Measures the provider's trustworthiness and depends mainly on end users experience of using the service of the provider
	Level of Service - The type of QoS commitment that is provided by an application, for example guaranteed service or best-effort service
Network and Infrastructure-related	Bandwidth - Identifies the average of all packet samples gathered by probing the network layer during intervals of length T.
	Network delay - The interval in milliseconds spent to transmit data between the provider and the requester. This interval includes all network packets transmitted in order to finalize the request-response operation.
	Delay variation (Jitter) – It is the variation on the intervals between each packet arrival time. This interval occurs due to the variable transmission delay over the network.
	Packet-loss – Average of all lost packets during in interval of time T. This information can be acquired by probing the network layer.
	Service failure - This attribute describes how a service can detail with failures. Examples of possible actions are: halt indefinitely, restart in defined an initial state, or rollback to a previous checkpoint.
	Guaranteed messaging requirements - This attribute describes the ability of the service to ensure the order and the persistence of the messages.
	Security-level – Identifies in which level security is ensured, for example, in the transport level or in the message level.
Quality of Use Context	Precision – Specifies the boundaries regarding how exact the provided context information match the reality.
	Resolution – Describes the granularity of information and can either be expressed as spatial resolution or temporal.
	Probability of correctness - Refers to the confidence of the source in the context and describes whether an instance of context accurately represents the corresponding real world situation the time it was determined.

SLO Group	Attributes
	Up-to-dateness/freshness - Identifies how old information is and is generally specified by adding a timestamp to the context information.
	Trust-worthiness - Describes the probability that information is correct. In contrast to the probability of correctness the term trust-worthiness enables the context provider to rate the quality of the actor from which the context provider originally received the context information.
	Coverage - Refers to the amount of potentially covered context information.
Cost	Cost model - The set of functions that calculates the cost of a service.
	Fixed costs - Costs that are only accounted once when accessing a service.
	Variable costs - Costs that vary during the provision of a service. They are added to the fixed costs.