Port Net

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Quaderni
della Direzione generale
Reti infrastrutturali,
Logistica e Sistemi
di Mobilità

2

Proceedings of the Workshop on Multimodal Transport and ICT: Results and Recommendations

Regione Emilia-Romagna
Assessorato Mobilità e Trasporti

in collaborazione con

istituto sui trasporti
e la logistica
fondazione

Proceedings of the Workshop on Multimodal Transport and ICT: Results and Recommendations

INTERREG IIIC Project **Port-Net**
Promoting interregional co-operation of ports and multi-modal transport structures in the EU

NORTH East South West
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Note of the Editors

The last decade has been characterised by relevant changes in the area of transport and logistics. The debate about infrastructures, superstructures, services and optimisation of transport was one the key element for the improvement of competitiveness of Europe and for guarantying a adequate level of mobility both for freight and passengers. Europe's transport policy has been characterised by a general trend to liberalisation and harmonisation that is now producing the first interesting results, even if a great debate is growing about the role of public financing in transport and infrastructures (such as port). The problem is connected to the general impact of logistics and transport in any aspect of economy (from the impact on GDP to the number of operators involved in transport, to the usage of energy.

The total demand of energy in Europe is 31% related to transport, while 28% for industry and 41 for residential and services. This figure highlights the relevance of the sector both in terms of costs and in terms of impact in a generic supply chain or industrial chain, for which the costs related to the management of delocalization and virtual enterprises are becoming the focus of relevant reengineering initiatives. Another concrete data is the growth of transport in terms of demand and the low growth of rail transport.

The fast growth of freight transport contributes to growth and employment but also causes congestion, accidents, noise, pollution, increased reliance on imported fossil fuels, and energy loss. Infrastructure resources are limited and any disruption in the supply chain (i.e. energy) has necessarily a negative impact on the EU economy. Without adequate measures, the situation will continue worsening and increasingly undermine Europe's competitiveness and the environment that we all live in.

To overcome such problems, **Europe's transport system needs to be optimised by means of advanced logistics solutions**. Logistics can increase the efficiency of individual modes of transport and their combinations. As a result, fewer units of transport, such as vehicles, wagons and vessels should carry more freight. Impact on the environment will decrease accordingly. Rail and inland waterways need to be modernised. Air freight should be more closely integrated in the system. The positive development of short sea shipping should be accelerated. Deep-sea shipping and its hinterland connections need to be enhanced. Shifts to more environmentally friendly modes must be achieved where appropriate, especially on long distance, in urban areas and on congested corridors. At the same time each transport mode must be optimised. All modes must become more environmentally friendly, safer and more energy efficient. Finally, co-modality, i.e. the efficient use of different modes on their own and in combinations, will result in an optimal and sustainable utilisation of resources.

Logistics measures are indispensable for maintaining and increasing European competitiveness and prosperity in line with the renewed Lisbon agenda on growth and jobs. Europe needs to rise to its transport challenges by integrating logistics thinking in its transport policy. The approach should be market-oriented, include social and environmental dimensions, and create a win-win situation for all actors. To achieve these objectives, the present Communication examines whether and where the EU could offer added value to enhancing the development of freight transport logistics in Europe and the world. This work could lead to establishing a framework strategy for freight transport logistics. The challenge of the PORTNET project is to create a network of experts discussing and providing proposals for 3 main topics: the port and infrastructure financing, the cargo flows and the role of EDI and the port-people relationship. This publication reports about the results of the PORTNET working group WG3 that focused the EDI and cargo flows problems, trying to put together the need and requirements of ports, freight villages and intermodal nodes, without forgetting about the local realities in terms of industrial partnerships.

We would like to thank all the partners of the project and the steering committee members for their fruitful cooperation during last 2 years of a successful network based on concrete topics and a group of experts that expressed needs of the multimodal transport and launched innovative ideas.

Maurizio Campanai
and
Rino Rosini

Bologna, July 2007

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1

The Perspective of Transport and the Opportunities for Networking

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Port-Net is an Interreg IIIC network project with 20 partners from 12 European countries and Russia. While running from 2005 to 2007 Port-Net's objective is to identify and tackle the main challenges faced by European ports in order to create better operational structures and capacities and achieve the best possible regional integration of ports.

In the next 15 years European transport is expected to grow in line with the overall economy. Practically this means that in 2020 overall freight transport is forecasted to be up by 50% and passenger transport by 35% (see graph below). These expectations and forecasts are new in the sense that in 2001 the commission still announced its main policy target to decouple transport an economic growth (European Commission, 2001, White Paper European transport policy for 2010). But, in the mid term review of the white paper this target was already relaxed as the Commission recognised that transport will continue growing (European Commission, 2006, Keep Europe moving — Sustainable mobility for our continent).
In the mid term review in 2006 the Commission also changed its approach regarding modal shift. Since reality did not show up any shift from road to rail the realistic ambitions had been brought down to more realistic dimensions. Now, European transport policy concentrates on critical categories like long-distance, urban areas and congested corridors. Summarising this new trend, the current EC approach expects transport continuing to grow significantly and transport policy should focus on optimizing the transport mode in terms of safety, efficiency and environmental-friendliness.
Europe is going to respond to these challenges in certain ways. On the one hand, of course, physical infrastructure has to be provided. This is the main focus especially in the new member states and those areas of the community which are still underdeveloped in terms of transport infrastructure endowment.

Expected growth in freight transport activity by mode (2000 = 100)

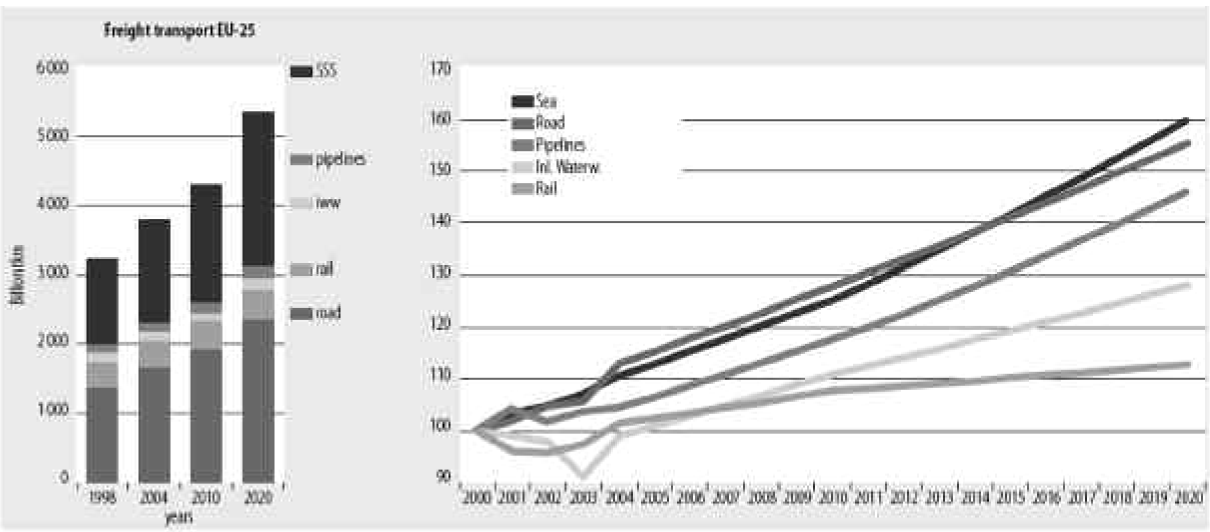

Fig. 1-1 Source: European Commission, Keep Europe moving — Sustainable mobility for our continent, 2006

On the other hand, many European countries are already endowed with high amounts of physical infrastructure, although they are facing simultaneously capacity problems and suffering more and more from congestion and pollution. This is especially true for mid-west countries around the Alps where due to environmental restrictions, high population density and limited fiscal capacities future investments in transport infrastructure will be limited. Therefore, if transport policy wants to meet demand also in the future, in these countries and regions rather intelligent solutions like improving productivity, capacity utilisation and an intensified use of intermodality modes have to be implemented. This is the basic idea of the EU Project “Port-Net” which concentrates on learning from other European experiences in order to improve the operational structures and administrations in ports as well as cooperating in searching for more intelligent organisation and capacity utilisation.
In order to reach these objectives, Port-Net tries to exploit the dissimilarities in European countries and regions according to history, culture and economic development guaranteeing a large variety of “best practice” examples in certain environments. To nearly any question in transport policy there is already an intelligent solutions somewhere in Europe allowing to reduce congestion and pollution and to improve efficiency. However, this is an ambitious target for an EU-project, but it indicates an important direction in which transport policy should move: Improving efficiency by learning from others experience as a first step before thinking about expanding physical capacity. As the name “Port-Net” indicates, most of the partners are located at the coast line, and the project concentrates mainly on challenges of ports. Although ports are, of course, only one aspect of transport policy, they are an important nodal point especially for transport according to international trade. Furthermore ports are usually a logistic area where transport switches between different modes.
Both characteristics indicate that intelligent solutions improving capacity, productivity and environmental friendliness should always have also a focus on the European ports. The Port-Net workshop “multimodality” in Bologna deals exactly with those challenges, which were described above as “intelligent solutions and improved productivity”. By presenting experiences and best practice examples from ports and logistic areas all over Europe as well as from certain projects this workshop contributes to a better understanding of the question in which direction certain transport modes, their investments and their common operation should move. By this workshop, among many others, Port-Net contributes to a dissemination of best practice knowledge among Europe.

2

Contractual Aspects in Intermodal Transport

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The lack of a widely acceptable international legal framework on the subject has resulted in individual governments and regional/subregional intergovernmental bodies taking the initiative of enacting legislation in order to overcome the uncertainties and problems which presently exist. Concerns have been expressed regarding the proliferation of individual and possibly divergent legal approaches which would add to already existing confusion and uncertainties pertaining to the legal regime of multimodal transport. A multimodal operation is made up of a number of unimodal stages of transport, such as sea, road, rail on air. Each of these is subject to a mandatory international convention or national law.

International conventions applicable to unimodal transportation include:

Transport by sea:

- International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading, 1924 (Hague Rules);
- Protocol to Amend the International Convention for the Unification of Certain Rules Relating to Bills of Lading 1924, (Hague/Visby Rules) 1968;
- Protocol Amending the International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading, 1924, as Amended by Protocol of 1968, 1979;
- United Nations Convention on the Carriage of Goods by sea, 1978 (Hamburg Rules).

Transport by road:

- Convention on the Contract for the International Carriage of Goods by Road (CMR) 1956.

Transport by rail:

- Uniform Rules Concerning the Contract for International carriage of Goods by Rail (CIM), Appendix B to the Convention Concerning International Carriage by Rail (COTIF), 1980;
- Protocol to amend CIM-COTIF, 1999.

Transport by air:

- The Hague Protocol, 1955;

- Montreal Protocol No.4, 1975;
- The Montreal Convention, 1999.

The problem which arise is the extent to which these mandatory conventions applicable to unimodal transportation would also influence contracts where more than one mode of transport is involved, bearing in mind that some of these unimodal conventions also extend their scope into multimodal transport. For example the CMR (article 2), CIM (article 2) and Montreal Conventions specifically include provisions dealing with transport of goods by more than one mode. In any event, in the absence of a uniform liability system for multimodal transport, the liability for each stage of transport is determined by the relevant unimodal convention or national laws which adopt varying approaches to issues such as the liability questions.

Thus, the greatest shortcomings of transport law are considered to be: "the vast differences between the rules governing the different transport modes. Different grounds of liability, different limitations of liability, different documents with a different legal value, different time bars. Where it may perhaps be said that this particularism did not constitute such a formidable problem when unimodal transport was still predominant, its drawbacks become glaringly obvious when attempts are made to combine different transport modes, and inevitably, their different legal regimes into a single transport operation governed by a single contract".
All of this premised, let's define what the multimodal transport is.
The most authoritative definition of the term "international multimodal transport" is provided in article 1 of the United Nations Convention on International Multimodal Transport of Goods 1980 which reads as follow:

- " International multimodal transport means the carriage of goods by at least two different modes of transport on the basis of a multimodal transport contract from a place in one country at which the goods are taken in charge by the multimodal transport operator to a place designated for delivery situated in a different country…"

This definition should be read in conjunction with the definition of the term "multimodal transport operator" (MTO) provided in article 1(2) of the MT Convention, which provides:

- "Multimodal transport operator means any person who on his own behalf or through another person acting on his behalf concludes a multimodal transport contract and who acts as a principal, not as an agent or on behalf of the consignor or of the carriers participating in the multimodal transport operations, and who assumes responsibility for the performance of the contract".

Thus, the main features of a multimodal transport are: the carriage of goods by two or more modes of transport, under one contract, one document and one responsible party (MTO) for the entire carriage.
The terms "combined transport" and "intermodal transport" are often used interchangeably to described the carriage of goods by two or more modes of transport.
The development of new transportation techniques, such as containerization and other means of unitization of goods in the 1960s, also introduced a significant need for modification of commercial and traditional legal approaches to transport.

Goods stowed in a container could be transported by different means of transport, such us ships, railway wagons, road vehicles or aircrafts, from the point of origin to the final place of destination, without being unpacked for sorting or verification when being transferred from one means of transport to another.
Gradually, more and more operators took responsibility for the whole transport to under one single transport contract. Shippers/consignees needed to pursue one single operator, in the event of loss of, or damage to, the goods involved in multimodal transport, who would be responsible for the overall transport, rather than against several unimodal carrier involved.
Although the Convention has not succeeded in attracting sufficient ratifications to enter into force, its provisions have significantly influenced the type of legislation enacted in a number of countries/regions.
The Convention applies to all contracts of multimodal transport between places in two States, if the place of

taking in charge or delivery of the goods as provided for in the multimodal transport contract is located in a contracting State (article 2).

The liability of the multimodal transport operator (MTO) for loss of, or damage to, goods as well as delay in delivery is based on the principle of “presumed fault or neglect”. That is to say that the MTO is liable if the occurrence which caused the loss, damage or delay in delivery took place while the goods were in his charge, unless the MTO proves that he, his servants or agents or any other person of whose services he makes use for the performance of the contract, took all measures that could reasonably be required to avoid the occurrence and its consequences. This provision is modelled on article 5 (1) of the Hamburg Rules.

In spite of various attempts to establish a uniform legal framework governing multimodal transport no such international regime is in force.

Pending the entry into force of the UN Convention on International Transport of Goods 1980, the UNCTAD’s Committee on Shipping, instructed the secretariat to elaborate model provisions for multimodal transport documents, in close collaboration with the competent commercial parties and international bodies, based on the Hague and Hague/Visby Rules as well as existing documents such as the FBL (FIATA Bill of Lading) of the International Federation of Freight Forwarders Association (FIATA) and the ICC Uniform Rules for a Combined Transport Document.

Following this resolution a joint UNCTAD/ICC working group was created to elaborate a new set of rules for multimodal transport documents. During a series of meeting the joint UNCTAD/ICC working group completed the preparation of the UNCRAD/ICC Rules for Multimodal Transport Documents in 1991. The Rules entered into force on 1 January 1992.

The UNCTAD/ICC Rules for Multimodal Transport Documents, which came into in January 1992, do not have the force of law. They are standard contract terms for incorporation into multimodal transport documents. The rules, being contractual in nature, will have no effect in the event of conflict with mandatory law.

The UNCTAD/ICC Rules for Multimodal Transport Documents have been incorporated in widely used multimodal transport documents such as the FIATA FBL 1992, and the “MULTIDOC 95” of the Baltic and International Maritime Council (BIMCO).

One on the key questions and possibly the single most important issue for debate is which type of liability system should be adopted in any possible international instruments to govern multimodal transport.

Essentially three opinions exist, namely uniform, network and modified liability system. For a better understanding the three opinions are presented in overview:

- In a **uniform liability system**, the same rules apply irrespective of the unimodal stage of transport during which loss, damage or delay occurs. There is no difference between cases where loss can or cannot be localized.

- In a **network liability system**, different rules apply depending on the unimodal stage of transport during which loss, damage or delay (hereafter loss) occurs.

- In a **modified liability system**, some rules apply irrespective of the unimodal stage of transport during which loss, damage or delay occurs, but the application of other rules depends on the unimodal stage of transport during which loss, damage or delay occurs.

Therefore, the liability of the multimodal transport operator for loss or damage to goods can differ depending on which stage of transport the loss has occurred. The question becomes even more complicated if the loss or damage cannot be localized, or the loss occurs gradually during the entire transport.

As in a network system, a carrier’s liability is primarily governed by rules applicable to the mode during which a loss occurs, concerns in relation to recourse actions, as set out above, do not arise for the contracting carrier.

However, the disadvantage of this approach, particularly for transport users, is that applicable liability rules, as well as incidence and extent of a carrier’s liability are not predictable, but vary from case to case, thus placing an extra burden on cargo-claimant in the form of increased insurance premiums and ultimately higher costs of claims recovery/administration. Any debate considering the adoption of a network system of liability would need to particularly focus on universally acceptable “fall-back” provisions on liability and limitation of liability for cases where loss cannot be localized.

A further central question in any debate about a possible international instrument governing multimodal transport is whether liability of the carrier (MTO) should, in principle, only arise in cases of fault or should be strict, i.e. arise irrespective of fault.

The note deals with some central issues for consideration in connection with the preparation of a new international instrument to govern liability arising from the carriage of goods. In 2002, an UNCITRAL Working Group on Transport Law had commenced its deliberations on a "Draft Instrument on Transport Law". The UNCTAD secretariat had prepared an analytical commentary of the Draft Instruments.

This note, which has been submitted to the UNCITRAL Working Group at its 14th session, is a complement to the earlier UNCTAD commentary and focuses on some central issues which arise for consideration by the Working Group namely (a) freedom of contract, in particular the issue of liability of the carrier for cargo loss, damage and delay. The ICC ad hoc Working group having reviewed the status of multimodal transport liability regimes concluded that the revision of the MT convention was not a feasible option and the harmonization of liability rules could be achieved through the incorporation of self-regulatory provisions into private contract. It therefore recommended further promotion of the UNCTAD/ICC Rules for Multimodal Transport Documents.

3

EDI and Cargo Flows in the Mediterranean Sea

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The cargo flows in the Mediterranean Sea are undergoing strong development. Recent developments of maritime transport have been characterised by an increase in shipping volumes and by the use of larger and more specialized vessels. In particular, the transport of oil and related products has increased tremendously. It is expected that a tenfold increase of the trade volume will occur within 20 years. Through EU-expansion a somewhat homogenous trading ground has been achieved, but disparities are still high which make trading in the region a somewhat difficult experience. The limited availability of resources and hindering as well as missing regulations lead to uneven trading grounds. The challenge for port and intermodal areas to cope with increasing cargo flows in these commodity areas is not only concerned with providing the appropriate super- and infra-structures but also to facilitate market mechanisms and supply chains of companies transporting their goods through the intermodal nodes.

Few industries are more exposed to the force of globalisation than logistics. As supply chains are stretched across oceans and continents, manufacturers and retailers are increasingly looking for logistics partners with international capabilities. This pressure "*to go global"* helps explain the wave of consolidation that has swept through the industry over the past two years, as logistics companies have raced to expand around the world. The world's top 10 freight forwarding companies command less than 4% of the global market. Markets are still fragmented and customers are pushing against local competition and towards consolidation of operators at local level together with a need of involving SMEs in the business. Infrastructure are a key aspect of the global logistic market together with economic, legislative aspects. Because goods are moving together with information for planning, monitoring, controlling, etc and the quality of information could represent one of the factors of success of a chain, a certain attention has been paid (and will be) in the area of ICT (Information and Communication Technologies), topics such as EDI (Electronic Data Interchange) and Interoperability are becoming important and strategic. To find a service, to identify a partner, to have information through the ICT tools such as Web Services, trying to avoid any useless duplication of effort for finding and managing an information.

3.1 Portnet Study on Freight Transport Logistics

This paper presents the results of a study whose objective has been to analyse the parallel or advanced electronic data interchange of cargo movements, especially for containers along the multi-modal transport chains related to: customer information, operation facilitation, security, multimodal tracking and tracing, and cost and time savings ("paperless port", "paperless terminal", and "paperless chain management"),

In modern transport chains, the goods are moving together with information, and the aspect of synchronisation of all operations during transport since the planning of a chain is relevant from the organisational point of view and the economic point of view of the entire transport chain. The involvement of customer to the access to the information that is improving, e.g.: services for tracking and tracing information are now provided by many operators. In this perspective, big operators are developing their own infrastructure and services, while small

and medium companies are going to have a big gap in terms of their capability to be involved with many different "legacy" software infrastructure with a negative impact in terms of costs and time (they have to use different systems for different customers since system interoperability has not reached a sufficient maturity).
The study identified added value technologies, standards and services in the area of EDI (Electronic Data Interchange), ICT (Information and Communication Technologies) and WEB/Internet applications that could be adopted in order to improve the efficiency and competitiveness of the multimodal transport chains, considering the needs of all the actors of the chain.
The Commission's approach focuses on logistics in freight transport and covers all modes of transport. The approach contains a vast variety of areas, such as pure modal logistics and multimodal logistics, and emphasises the need for optimum complementarily modes in an efficient and seamless European transport system that can provide the best possible services to transport users. Developing freight transport logistics is primarily a business-related activity and a task for industry.
Nevertheless, the authorities have a clear role to play in creating the appropriate framework conditions and keeping logistics on the political agenda. This framework approach concentrates on improving the preconditions that Europe can offer for logistics innovation and leaves the internal running of company logistics to the companies themselves. For the purposes of this study, even referring to the "Freight Transport Logistics in Europe", communication COM(2006) 336:

- '***Freight Transport Logistics***' covers the planning, organisation, management, control and execution of freight transport operations in the supply chain.

- '***Co-modality***' means the efficient use of transport modes operating on their own or in multimodal \ integration in the European transport system to reach an optimal and sustainable utilisation of resources.

- '***Multimodality***' is the carriage of goods by two or more modes of transport, irrespective of the types of freight, within a single transport chain.

- '***Third-party logistics***' means that an organisation uses external logistics providers that supply all or a considerable number of its logistical activities.

The focus of this study is the ICT architectures to allow the adoption of EDI in the area of freight transport logistics, trying to identify the new boundaries that are represented by e-logistics and virtual logistics services. .This report is an attempt to analyse the emerging scenario of EDI and ICT services, with a specific focus on the concept of a general architecture proving services to the freight transport community, including SMEs, that are an obstacle to the success of e-logistics initiatives in terms of their capability to invest in innovation and to improve their business processes. The study propose alternative scenarios providing general ICT and EDI in terms of definitions, models, level of adoption and future ICT models. The study will not answer specific questions about potential ICT and EDI solutions; it will provide other collected material for discussion about something that is continuously evolving and impossible to freeze, such as technology; anyway we would like to report about the capabilities to adopt models closely related to business and companies in order to be able to maximise the positive impact of technology.

3.2 The Approach and the Results

The study has been conducted according the following approach:

- Cargo flow data collection: review of statistics related to cargo flows from official web sites (port authorities) and consultancy company in the area of transport and logistics. In few cases, the Port Authorities have been contacted for the provision of the official data (if not available through web sites);

- Analysis and data gathering for cargo flows for determining the main evolution perspectives

- ❑ Analysis of the ICT projects at European level and the EDI applications: review of the projects funded by Euopean Community in the area of Innovation, cooperation and Interreg;
- ❑ Analysis and evaluation of ICT application and WEB site promoting ICT services;
- ❑ Analysis of the requirements of a modern and open ICT architecture for managing an multimodal supply chain;
- ❑ Definition of a new proposal for an EDI platform based on new emerging needs and technologies

3.3 Logistics and Intermodal/Multimodal Transport

Logistics has become one of the determining factors in European Community economic policy and Intermodal Logistics services belong to the most important instruments emphasised by this policy. Although there have been several improvements in the field of logistics centres and combined transport the intermodal logistics network can not be regarded as finished yet. An EU goods transport surveys – carried out among market players – resulted in the following limits in the field of intermodal transport:

- ❑ lack of solutions for European combined transport;
- ❑ intermodal transport technologies cannot be integrated into state-of-the-art logistic systems (due to long transmission time, lack of door-to-door transport services, strict timetables);
- ❑ lack of confidence for the services of combined transport modes (relatively low reliability, monitoring and safety);
- ❑ high costs of goods transmission and handling;
- ❑ difficulties in international and transit transport (incompatibility, lack of cooperation and connection points, too complex responsibility and contraction relations).

From the parameters above the most significant are the low degree of fitting into the logistic systems, the lack of Pan-European services, the un-clarified responsibilities, and only after these are high costs mentioned as a disadvantage.Beyond lots of obstacles and problems there are more and more tendencies helping intermodal transportation to expand and become stronger. The trends below are the most significant:

- ❑ environmental friendly strategies have become more and more popular as important parts of company strategies;
- ❑ due to solid expansion of procurement and concentration of production and storage, transport distances are growing in international transport;
- ❑ the supply systems based on hub & spoke and break-bulk technologies are capable to consolidate goods flows;
- ❑ most of transported goods – which are able – are unitised (most of them in containers);
- ❑ time losses in road transportation, the gradually introduced tolls and crowded transit corridors are l eading to decreased competitiveness of road transportation at mid- and long term period, which leads to the increase of interests in alternative transportation.

It is demanded from the logistic suppliers to take advantages of offered market opportunities with adequate intermodal strategy of service improvements. These are the transport integrators mentioned in the EU white paper who are able to transport the whole cargo door-to-door, and choose the most efficient and environmentally friendly way of transportation. The tasks of transport integrator include all the activities related to goods transportation: choosing the carrier, signing the contract, preparing the goods to transport, documentation, controlling the transportation procedures. Naturally, these are not to be done by the integrator itself: the integrator can use other service providers, but the integrator is responsible for the whole transportation process. It is also important, that the client should have contracted contact only to the integrator to have easier administration and to have a more attractive complex service.

When an integrator chooses or combines the transportation methods, he/she should do it neutrally, without previous commitment. The most important parameters are the efficiency ratio and the sustainability criteria. That means that the offered alternatives are valued not just by costs, discounts, elasticity, but by accuracy, availability and by environmental and social views (externalities). The comparison of the above mentioned parameters leads to the ultimate decision.

The analysis of service levels among potential integrators showed, that the most important working area is transportation, logistics, distribution, and storage.

In the near future the situation will probably be modified by the strengthening of value added services. From these the most important are the ***information-service*** supply elements – for example: real time tracking & tracing, EDI.

3.4 The modal shift and/or transport modes integration

The main objective of the last years has been the creation of a background guaranteeing optimum integration of the various transport modes in such a way as to offer continuous door-to-door services meeting customer needs and enabling the transport system to be used efficiently and profitably while promoting competition between the operators. The carriage of goods is tending towards the following: greater traffic intensity and a growing imbalance in the use of the various transport modes, road transport taking an increasing share of the market, while the railways' share is decreasing. Intermodality , which has been defined by the Commission as "a characteristic of a transport system whereby at least two different modes are used in an integrated manner in order to complete a door-to-door transport sequence". The resultant global approach enables the available transport capacity to be used more rationally. Intermodality or co-modality is not intended to impose a particular mode option, but enables better use to be made of the railways, inland waterways and transport by sea, which individually cannot provide a door-to-door service. Co-modality have been added to the other transport policies conducted by the European Union, more particularly with a view to:

- liberalising the transport market;
- developing the trans-European networks (TEN);
- promoting fair, efficient pricing;
- bringing the information society to the transport industry.

As things now stand the use of intermodal/multimodal goods transport faces a certain number of hurdles. A change of mode during a journey is more a change in system than a simple transhipment operation. The resultant friction costs have an impact on the competitiveness of intermodal/multimodal transport. These elements result in:

- higher prices (due to friction costs);
- longer journeys, more delays or less-reliable deadlines;
- lower availability of quality services;

- restrictions on the type of goods;
- a greater risk of cargo damage;
- more complex administrative procedures.

There are clear “inabilities” to interconnect the different modes at the following levels:
1) infrastructure and transport equipment:

- the lack of consistent networks and interconnections (missing infrastructure sections, for example), forces transfer costs onto the operators;
- each mode within the current system is financed and managed separately. The responsibility for strengthening the links between those modes is thus difficult to establish;
- the inability to operate between modes, such as differing railway signalling systems, causes problems;
- the differing sizes of load-carrying unit between one mode and another are not harmonised;

2) operations and infrastructure use, and in particular that of terminals:

- certain services such as vehicle identification or productive information systems are unavailable in i ntermodal situations;
- the various transport modes give unequal performance and service quality;
- commercial information and practices are not always coordinated among the various modes;
- terminals cannot always adapt to train and ship timetables that are operated round the clock, while the working hours of drivers and crews are not always suited to intermodal operations;
  the timetables for the various modes are not harmonised;

3) services and regulations aimed at the modes:

- the absence of harmonised electronic communication systems among the various operators within the intermodal sequence prevents adequate scheduling;
- where cargoes are damaged the responsibility is difficult to establish since the various transport modes involved are governed by different international conventions;
- administrative bottlenecks impair the competitiveness of intermodal transport.

Faced with this situation the European Commission advocated a certain number of approaches towards promoting multimodal/intermodal transport in Europe. The aim of integrated infrastructures and means of transport is to have a network of infrastructures and transfer points that is consistent at European level in order to ensure that the various modes can interoperate and interconnect.
In order to do this the Commission decided to boost the intermodal configuration of the TEN, to support the provision of logistical services that have added-value potential at the transfer points; to guide the process of harmonising the load-carrying units (dimensions and weights). Intermodality is a quality indicator of the level of integration between the different modes: more intermodality means more integration and complementarities between modes, which provides scope for a more efficient use of the transport system. The economic basis for intermodality is that transport modes which display favourable intrinsic economic and operational characteristics individually, can be

integrated into a door-to-door transport chain in order to improve the overall efficiency of the transport system. The integration between modes needs to take place at the levels of infrastructure and other hardware (e.g. loading units, vehicles, telecommunications), operations and services, as well as the regulatory conditions. Intermodality is not bound to certain modes. It is a trading and mobility issue in which rail, water, air and road are called on to contribute to the optimization of the whole, where they are supported by advanced information and communication services. On the level of transport operations new services, information and communication technologies will improve the utilisation of the existing capacities.
Intermodality clearly is not about forcing a specific modal split. However, by improving the connections between all modes of transport and integrating them into a single system, intermodality allows a better use to be made of rail, inland waterborne transport and short sea shipping which, by themselves, in many cases do not allow door-to-door delivery. Intermodality is, therefore, complementary to other EU transport policies such as liberalisation of transport markets, developing the TENs and the promotion of fair and efficient pricing.

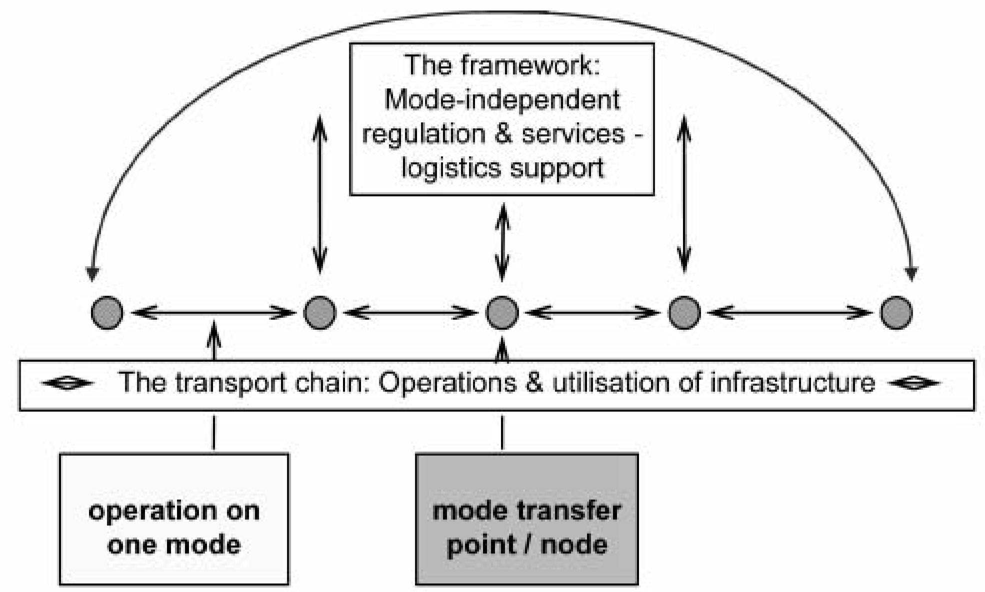


Fig. 3-1 The Intermodal Transport Chain

In Fig 3-1 it is highlighted the relevance of the single node (independently form the mode) and the framework regulations and services that are available in the market. Only through a specific integration of nodes, modes and services, the intermodal transport community could offer a realistic high level service.
Freight transport is a derived demand. It is therefore part of the economic process. The requirements of industrial processes have changed drastically during the past 10 years and can be characterised by global competition, shorter production processes and product-life-cycles and the need to cut costs. The use of just-in-time delivery, customised production and the concentration of supply- and distribution centres has led to a close interrelationship of production and distribution processes and transport, aimed at high service performance, reduced time-to-market and lower costs. At the same time, competition in global markets has increased the number of players and the geographic scope of the supply-and distribution chains.

3.5 The Ports in the context of Short Sea Shipping and Motorway of the Sea

A port is a regional gateway to international trade; it is the entry and exit point for a nation's imports and exports. These imports and exports-and transhipments and transit consignments-may be bulk goods, travelling in specially made vessels for such items as oil and petroleum, grain, sugar and chemicals. They may be fully containerised vessels or general cargo, i.e. part containerised or non containerised vessels, or they may be passenger vessels. A port may be a maritime gateway, a river, lake, road, rail or air gateway. Most ports are multi-modal in that they serve as the combined gateway for several forms of transport, most typically maritime, road and rail, often with a mix of bulk and containerised traffic. Transhipments implies that goods are received at a port and then repackaged for more convenient local transport to feeder ports or terminals, or to local distribution channels. Transit means that goods are received and then transported "as is" on to another port or terminal, often using road and rail links. The historical factors behind a port's success have revolved around location: proximity to the source of resources or manufactures being exported or the proximity to sources of consumption for imports. Proximity to international sea lanes and shipping routes and port efficiencies are increasingly important. Multimodal terminals and efficient land and internal transport are now influencing port locations to the point where the maritime point of entry may become of secondary importance.

A port is not a single entity; it comprises a community of many sub-industries and enterprises. For example, it serves the shipping, shipping agent and the "non vessel" operating common carrier communities. In addition to cargo carrying vessels there are tugs and lighters. Then there is the harbour side, wharves and berths and special facilities for handling the different types of cargo; storage and warehouse facilities, both pre and post Customs. The Port Authority, Customs and several Government departments such as Health, Agriculture, Fisheries, Consumer Protection, Transport, Military and Security usually have a presence at gateway ports. And then there are the organisations involved with storage and movement of goods, and logistics. These include stevedores, transport-road and rail-freight forwarders, warehouse operators, container terminal operators and storage yards, container repair operations, Customs Agents and the various branches of Customs.

Many of these organisations operate as separate entities so that there is traditionally a great deal of intra community business. Payments, transactions and business messages are exchanged between these businesses, using differing business systems and processes, different data bases and different methods of exchanging information. And this is a large part of the problem of port management, which has led to costly and inefficient ports, which in turn penalises national trade. Ports are key element of modern definition for freight transport: SSS or MoS.

SSS (Short sea shipping) refers to the movement of freight along coasts and inland waterways. Short sea shipping includes the movements of wet and dry bulk cargoes, containers and passengers around the coast (say from Lisbon to Rotterdam or from Ravenna to Catania) and the term is also often used to include inland barges (though this technically is inland transportation, carried out by a different type of vessel - not seagoing). Typical ship sizes range from 1000dwt (tonnes deadweight - ie the amount of cargo they carry) to 15000dwt with drafts ranging from around 3m to 6m. Typical cargoes include grain, fertilisers, steel, coal, salt, stone, scrap and minerals (all in bulk), oil products (such as diesel oil, kerosene, aviation spirit - all in bulk), containers and passengers (yes, even ferries are technically short sea ships).

In Europe, short sea shipping is at the forefront of the European Union's transportation policy. It currently accounts for roughly 40% of all freight moved in Europe. In the US, short sea shipping has yet to be utilized to the extent it is in Europe, but there is some development in the area. New York's Port Inland Distribution Network (PIDN), and the private company Osprey Line are the best examples.

The main advantages promoted for this type of shipping are alleviation of congestion, decrease of air pollution, and overall cost savings to the shipper and a government. Shipping goods by ship (one 4000dwt vessel is equivalent to 100-200 trucks) is far more efficient and cost-effective than road transport (though the goods, if bound inland, then have to delivered by truck) and is much less prone to theft and damage.

MoS (Motorway of the Sea) - In its Transport White Paper of September 2001, the Commission proposed the development of "Motorways of the Sea" as a "real competitive alternative to land transport." To help these lines develop, the White Paper states that European funds should be made available. These "motorways of the sea" should be part of the Trans-European network (TEN-T).

The “motorways of the sea” concept aims at introducing new intermodal maritime-based logistics chains in Europe, which should bring about a structural change in our transport organisation within the next years to come. These chains will be more sustainable, and should be commercially more efficient, than road-only transport. Motorways of the sea will thus improve access to markets throughout Europe, and bring relief to our over-stretched European road system. For this purpose, fuller use will have to be made not only of our maritime transport resources, but also of our potential in rail and inland waterway, as part of an integrated transport chain. This is the Community added-value of motorways of the sea.

General transport infrastructures are the main element for the success of these approaches, nevertheless the quality of information exchange among the different potential partners is considered one of the main success factors. EDI and ICT solutions are main technical operational support for the success of the approach.

The role of a Port Authorities is related to management of the port, with the multitude of different participants in the system, poses severe strains on the potential for efficiency in today’s ports. This is especially true in some regions, since they have many older and smaller operations than most international ports, more entrenched cultural differences and complex, local business practices.

The following describes a typical port operation from the perspective of the major activities that take place during import and export transactions. There are two distinct systems in the shore based shipping segment:

- The movement of cargo between the ship and the gate of the terminal, depot or wharf;
- The movement of the cargo between the customer (shipper/consignee) and the gate of the terminal, depot or wharf.
- The following illustrates the typical steps involved throughout the import and export cycles:
- Reporting the Ship; Ship’s Arrival
- Berthing the Ship
- Stevedoring the Ship (loading/unloading cargo)
- Clearing the Ship: Ship’s Departure
- Clearing the Cargo: Importer, Customs Agent
- Clearing the Cargo: Ships Agent or port community operators (Containers)
- Consigning the Cargo
- Road/Rail Transport: Import-Export

The context for port process reform is ideally set within a programme of overall trade process reform. The following are highlights of a model for trade process reform:

- to reform port processes; to automate processes; to introduce port management and control IT systems; to create a paperless port; to realign the roles of the Port Authority, the port community and port users.
- to upgrade Customs processes and IT systems in order to take advantage of electronic commerce and paperless customs operations;
- to implement electronic exchange of trade information between the port, Customs, trade professionals and the trader so that information is exchanged immediately and accurately;

- to reengineer Customs work practises to reflect the changing role of Customs from a “police” mentality to that of a trade facilitator and business partner
- to install container scanners within a Customs area outside the port gates, in order to scan sealed containers. Containers will remain sealed in all but the most extreme cases;
- to implement pre clearance as a result of exchanging electronic information before goods arrive;
- to implement pre and post event auditing, whereby trusted trading partners are able to declare origin and consignment details to the satisfaction of Customs and the relevant technical control agencies. As a result, the importer, and his goods, may be audited infrequently by a Customs investigation/audit unit on the importer’s premises instead of physical inspections at the port.
- to add the concept of “risk management” to the Customs IT clearance systems, so that the history of trading partners may be used to asses the risk of lost revenues and fraudulent information in advance of any declaration.
- to establish a Customs Training Institute in order to set new minimum standards of professionalism and competence within the Customs service and the trade professional. This institute will offer formal qualifications, without which trade professionals will be unable to submit information to Customs in the future.
- to overhaul the system of trade laws and regulations so that new legislation may be enacted to make possible the legal exchange of electronic information, electronic signatures, a reengineered IT based Customs and port environment, electronic payments and electronic funds transfer techniques.
- to establish a national trade process reengineering and IT/electronic commerce project management entity which will also provide the technology, expertise and the neutral and autonomous forum for cooperation between all of the participants in this major project.
- to establish a “one stop shop” where all remaining technical controls may be issued to traders, and paid for, within a single visit.
- to develop the IT systems of this “one stop shop” so that technical controls may ultimately be applied for and issued electronically, and so that risk management principles may be adopted by each of the technical control agencies.

3.6 Interports / Freight Villages

A Freight Village (FV) is a defined area within which all activities relating to transport, logistics and the distribution of goods, both for national and international transit, are carried out by various operators. These operators can either be owners or tenants of buildings and facilities (warehouses, break-bulk centres, storage areas, offices, car parks, etc...) which have been built there.
Also, in order to comply with free competition rules, a freight village must allow access to all companies involved in the activities set out above. A freight village must also be equipped with all the public facilities to carry out the above mentioned operations. If possible, it should also include public services for the staff and equipment of the users. In order to encourage ***intermodal transport*** for the handling of goods, a freight village must preferably be served by a ***multiplicity of transport modes*** (road, rail, deep sea, inland waterway, air). Finally, it is imperative that a freight village be run by a single body, either public or private”.
Freight Villages are key actors for the development of new services related to intermodal/multimodal transport.

3.7 Freight Integrators

The idea of Freight Integrators was first mentioned in the 'White Paper on the European Transport policy until 2010' and referred to them being organizers of intermodal full load transports. In accordance with the transport policy which aims to rebalance the modal shift and to increase the ecological friendly share of alternatives to road, the emergence of such Freight Integrators should be
supported. Against this background, this study aims to research comparable concepts and develop a definition for Freight Integrators as well as indicators for their identification. As a basis for further support, the current situation of freight integrating companies as well as their major problems were identified, together recommendations for measures to overcome the main barriers to the emergence of Freight Integrators.

Definition and freight integration concepts: to describe Freight Integrators, the definition was elaborated as follows: "Freight integrators are transport service providers who arrange full load, door-to-door transportation by selecting and combining without prejudice the most sustainable and efficient mode(s) of transportation."
The transport share of full loads, the main market of Freight Integrators, was estimated at about 477 billion1 tkm in Europe, corresponding to about one fifth of European transportation. More than half of these are actually effected by road, one third by short sea shipping and the rest mainly by rail.
Comparable concepts to Freight Integrators include freight forwarders, who lack a focus on intermodal transportation because they do not as a rule make the unprejudiced choices necessary by including sustainability as well as efficiency factors. Intermodal marketing companies are not deeply involved enough in the arrangement of transport. Integrators are active today in the parcel market but these have a strong focus on consolidation.

Identification of Freight Integrators: 10 indicators for the identification of Freight Integrators were identified:

1. Specialisation on full loads
2. Relevant market participation in the field of intermodal transports
3. Intermodal transports as a relevant business field within the company
4. Commitment to intermodality
5. Knowledge and experience
6. Supporting the idea of environmental sustainability
7. Economic substantiation of intermodality
8. Customer relationships
9. Co-operations and partners
10. Geographic spread as a EU-wide business

In the report "Study on Freight Integrators" To the Commission of the European Communities (Service Contract N° ETU/B2-7040B-S07.18491/2002) some problem areas were identified on the basis of interviews:

- Transported goods: Examples of goods for which it is currently a problem to transport intermodally. A lack of return freight is a special problem arising in intermodal transport.

- Containers: The availability of containers (as the preferred unit for intermodal transportation). The standardisation and adaptation to intermodal transport's current needs.

- Infrastructure: Infrastructure problems were mentioned concerning harbours, trimodal terminals and rail t racks.

- Rail: Service quality problems (reliability and journey time) and a lack of co-operation complicates international transports. Monopolistic structures of national railways are seen as the reason for high prices and the lack of a competitive approach.

- Water transport: Though considered as developing positively, short sea as well as inland waterway shipping is not widely seen as an possible transport mode to use.

- Education / staff: There is a lack of a European-wide vocational training system, especially regarding any emphasis intermodal transports which leads to knowledge often being focused on the road mode.

- Mentality / attitude: A lack of awareness of the possibilities of intermodal along with difficulties to get the necessary information make the decision to favour freight integration a difficult one. In general, intermodal transport has a bad image, it is regarded as complicated and not the normal mode of choice.

- Lack of incentives: Transport service providers do not see any reason why they should engage in intermodal transportation if they are not doing so at present. They are generally of the opinion that no profit can be earned in this field.

The overall main barriers are seen as the lack of incentives, the lack of information and qualifications, infrastructure problems, the bad image of intermodal transport as well as difficulties concerning liability and documentation.

3.8 Accessibility

One relevant aspect of intermodal transport chains is the accessibility level to the infrastructures. There are different views about accessibility: for people, for freights and goods, for vehicles (vessels, lorries, trains, planes). Accessibility is directly connected to the concept of: Multimodality, Intermodality and Co-modality and to concepts related to infrastructures (Roads, Railways, Ports, Freight villages, Transport Integrators), or other approaches such as MoS - Motorway of the Sea and SSS – Short Sea Shipping). It is necessary to face the problems of the accessibility of the wide, inter-provinces areas where exist a strong connection between the port or urban/suburban traffic and the freight traffic generated by intermodal and logistic centres, through the analysis, definition and implementation of strategies and actions directed to solve conflicts between the operational areas/gates of access of the intermodal centres and the external road network. It is possible to face these problems acting on the whole accessibility to transport and logistic services, intervening on two fundamental aspects:

Physical level, composed of infrastructures, technological devices and organisational aspects necessary to support the user of transport services in moving trough the network to join his destinations, both for the logistic freight transport and for passenger transport (with private or public vehicle). The objective is to make the transport network both for people and for goods efficient and integrated in order to reach the destinations easily.

- Infrastructures at local and European level

- Connections with main corridors

- Nodes (ports, freight villages, airports and railways)

- The concept of MoS (Motorway of the Sea)

Virtual level, that is the organisational/technological support necessary for obtaining transport services (logistics and for passengers) and to make integrated all the phases of the displacement to be done on the network. This level is relative to the working of the transport services and implies the whole differentiated accessibility for typology of users, services, served areas, etc.

- ICT support for accessibility

- Planning systems, tracking and tracing, simulation software, GIS,

- Interoperability among ICT systems at European level

- ❑ Access to value added ICT services

Since intermodal transport is more data-intensive than conventional transport, the role of ICT and EDI in transport is of crucial importance. The use of ICT is key to efficient and customer oriented transport services. Open and flexible information and decision support systems are changing the way transport is organized and managed and will enhance present and create future market opportunities. In addition the use of the information infrastructures and the development of additional specific capacities for intermodal operations will increase the attractiveness of the new approach. Intermodality does not aim or relate to a specific modal split, but addresses the integration of modes at three levels:

(1) infrastructure and transport means (“hardware”),
(2) operations and the use of infrastructure (especially terminals), and
(3) services and regulation (from a modal-based to a mode-independent framework).

3.9 Statistics about Cargo Flows

Basic information and statistics about container traffic have been found on the respective Port Authorities web site. From a methodological aspect, trade and transport data is compiled from various sources and put together as applicable. The study takes on quantitative data; this is a very complex task because inconsistencies can occur while combining different sets of data from various data sources. When inconsistencies occurred, national and regional statistic sources were given highest priority. In general, port figures are compared even if comparability is not completely given. This attempt as made in order to reach a certain understanding of regional differences in rather broad categories of products. On the other hand a difference needs be taken into account when looking at combined statistics at the national level. These are generally recorded with net figures not taking into account he dead weights of transporting vehicles or similar. But port statistics tend to add these figures.
This means that statistical figures of ports and those from national statistical bodies differ significantly. If different statistics are used at the level 2 analysis, this is mentioned. In general, a holistic approach in the analysis of cargo flows is taken. It is attempted to gather information as complete as possible.
The scope of the data collection is the identification of potential development of flows, main actors, main routes and the potential role of ICT in the described context.

3.9.1 Container ports in the world

The following table shows the major ports at world level; from the available data, it is clearly stated that the first Mediterranean port has a traffic that could not be comparable with the main ports in China or Baltic Sea.

Major Container Ports (in Teu x 1000)

PORTS	1995	2000	2001	2002	2003	2006	2000-2006
Hong Kong	12.600	18.098	17.900	18.600	20.450	23.548	30%
Singapore	11.860	17.087	15.520	16.800	18.410	24.800	45%
Shanghai:	1.196	5.560	6.334	8.610	11.280	21.720	291%
Shenzen:	-	3.993	5.076	7.613	10.650	18.469	363%
Busan:	4.500	7.540	8.072	9.436	10.370	12.030	60%
Kaoshiung:	5.230	7.426	7.540	8.493	8.840	9.775	32%
Rotterdam:	4.800	6.268	6.102	6.515	7.143	9.690	55%
Los Angeles:	2.560	4.998	5.183	6.105	7.200	8.470	69%
Amburgo:	2.980	4.248	4.689	5.374	6.138	8.862	109%
Anversa:	2.330	4.082	4.218	4.777	5.445	7.019	72%
Gioia Tauro:	16	2.652	2.488	2.896	3.081	2.938	11%
Genova:	615	1.501	1.526	1.531	1.606	1.657	10%
La Spezia:	695	910	975	975	1.007	1.025	13%
Livorno:	424	520	521	536	592	659	27%

Tab. 3-1 Major Container Ports at world level

The following table is showing the 10 container shipping companies in terms of TEU capacity. All the figures are related to 2006; it has to be highlighted that each company (or aggregation) announced relevant investments in terms of new containers and new and bigger ships.

Company	TEU capacity	Market Share	Number of ships
A.P. Moller-Maersk Group	1,665,272	18.2%	549
Mediterranean Shipping Company S.A.	865,89	8.6%	299
CMA CGM	507,954	5.6%	256
Evergreen Marine Corporation	477,911	5.2%	153
Hapag-Lloyd	412,344	4.5%	140
China Shipping Container Lines	346,493	3.8%	111
American President Lines	331,437	3.6%	99
Hanjin-Senator	328,794	3.6%	145
COSCO	322,326	3.5%	118
NYK Line	302,213	3.3%	105

Tab. 3-2 Top 10 container shipping companies (TEU capacity 2006)

It is relevant to note that the consistent investments in vary large vessels will provide an added capabilities of TEU transport and at the same time will permit the adoption of the actual vessels for other specialised traffic such as more specific and distributed feeder traffic.The following table shows the best performance in term of improvement of container traffic considering ports at world level.. Many of the large % of growth are related to recent opening or improvement of terminal container, while it has to be highlighted the growth in absolute terms of of Bremerhaven and the Black Sea ports that is showing a clear interest in consolidation of specific areas for deep sea traffic.

2006: TEU traffic best performance

Ports	2005	2006	Diff. in TEU	Var. %
Amsterdam	65.844	300.000	234.156	355,60%
Sines	50.994	121.956	70.962	139,20%
Rauma	120.234	168.952	48.718	40,50%
Costanza	768.099	1.075.000	306.901	40,00%
kotka 3	66.667	461.876	95.209	26,00%
Taranto	716.000	892.300	176.300	24,62%
Ancona	62.449	76.496	14.047	22,49%
Napoli	369.855	444.982	75.127	20,31%
koper/Capodistria	179.745	218.970	39.225	21,82%
Tallin	127.585	152.399	24.814	19,40%
Bremerhaven	3.735.574	4.449.624	71.050	19,10%
Zeebrugge	1.196.000	1.408.000	212.000	17,73%
Black Sea Ports (Costanza, Llijcevsk, Novorossik	1.509.000	1.953.000	444.000	29,42

Tab. 3-3 Best performance (TEU management in port)

Looking at Mediterranean level, it could be highlighted the relevance of the port of Algeciras that since 2005 is the first port in the Mediterranean sea in terms of container traffic.

The collected data highlights the role of Mediterranean ports are managing a traffic that is relevant at world level (more than 23 mil. TEUs) but the traffic is fragmented and distributed in the territory, representing it a strong and weak point: there are more opportunities to reach the final origin/destination of goods and at the same time there is not the possibility to make adequate investments for the improvements of port and infrastructure facilities.

2006 in Mediterranean Sea and Black Sea

Porto	2005	2006	diff. TEU	Var. %
Algeciras:	3.179.614	3.497.575	317.961	10%
Barcellona:	2.071.481	2.317.368	245.887	12%
Valencia:	2.409.821	2.612.139	202.318	8%
Marsiglia:	908.000	941.400	33.400	4%
Gioia Tauro:	3.161.981	2.938.176	-223.805	-7%
Genova:	1.624.964	1.657.113	32.149	2%
Livorno	661.216	657.600	-3.616	-1%
la Spezia:	1.024.455	1.137.000	112.545	11%
Cagliari:	631.435	690.392	58.957	9%
Trieste:	198.319	220.661	22.342	11%
Taranto	716.000	892.300	176.300	25%
Ancona	62.449	76.496	14.047	22%
Napoli	369.855	444.982	75.127	20%
Salerno	414.345	359.707	-54.638	-13%
koper/Capodistria	179.745	218.970	39.225	22%
Pireo	1.395.000	1.255.500	-139.500	-10%
Damietta	1.130.000	1.243.000	113.000	10%
Malta Free Port	1.400.000	1.450.000	50.000	4%
Izmir	784.000	823.200	39.200	5%
Ambarli (Istambul)	1.118.000	1.173.900	55.900	5%
Thessaloniki	365.925	342.727	-23.198	-6%

tab. 3-4 Best Performance in Mediterranean Sea

The difficulties are related both to geographical constraints for which it is impossible to expand some of the ports and competition; e.g.: in the north Adriatic sea there are 4 ports (3 of which Italian) that are in competition since years without any possibility to define a real and concrete strategy for cooperation and sspecialization.
Other ports in the Med Area will be developed; it was declared that a contract was concluded with the government of Egypt to (re-)develop port facilities at Eastern Port Said. Included is the building of a new box terminal in addition to the state-controlled Port Said Container & Cargo Handling facility and APM Terminal-operated Suez Canal Container Terminal (source: DYNALINERS 28/2006 weekly news summary, analysis and commentary on *liner shipping*). The development of an international competitive market will probably suggest specialisation policy in Mediterranean countries.

3.9.2 Italian Ports

Looking at Italian ports, it could be notices that there the best performance have been done in transhipment ports, while other ports have relevant loss of traffic, mainly because of the crisis of the industrial districts in Italy in last decade and because of the inland connections that are considered an obstacle to the development od MoS and SSS initiatives.
In this perspective even important ports, such as Gioia Tauro, are loosing traffic because of the difficulties in improving the capabilities of the terminals.

Italian Ports (TEU)	2000	2001	2002	2004	2005	2006	2000-06	2005-06
Gioia Tauro*:	2.652.000	2.488.000	2.896.835	3.261.034	3.161.000	2.938.200	11%	-7%
Genova:	1.500.632	1.527.000	1.531.252	1.628.594	1.624.964	1.657.113	10%	2%
La Spezia:	909.962	975.000	975.005	1.040.438	1.024.200	1.133.700	25%	11%
Taranto*:	3.400	186.000	471.570	763.318	716.900	892.300	NA	24%
Livorno:	501.339	502.000	546.882	638.586	657.600	658.400	31%	0%
Napoli:	396.562	430.000	446.000	347.537	445.000	373.100	-6%	-16%
Salerno:	275.963	321.000	375.000	412.000	358.000	418.200	52%	17%
Cagliari-*Sarroch:	21.631	26.000	47.000	501.194	659.100	726.100	NA	10%
Venezia:	218.023	246.000	262.667	291.000	293.000	316.641	45%	8%
Ravenna:	181.387	151.000	161.000	169.432	168.600	162.052	-11%	-4%
Trieste:	206.134	201.000	185.301	174.729	201.300	220.310	7%	9%
Ancona:	83.934	90.000	94.315	85.969	73.900	64.200	-24%	-13%
Savona:	36.905	50.000	54.796	83.891	219.900	231.500	527%	5%
Civitavecchia:	12.617	16.000	35.000	36.301	32.800	33.500	166%	2%
Bari:	1.373	2.000	13.000	20.000	10.008	49	-96%	-100%
Palermo:	17.128	15.000	10.000	24.040	27.500	13.700	-20%	-50%
Trapani:	17.357	20.000	17.000	10000	9.900	8.900	-49%	-10%
Brindisi:	6.922	6.000	1.235	3.815	2000	0 -	100%	-100%
Catania:	12.851	11.000	12.984	11.751	14.700	13.900	8%	-5%
Marina di Carrara:	10.635	9.000	10.000	7.917	6.200	4.500	-58%	-27%

Tab. 3-5 TEU in Italian Ports

Lack of sufficient berth and channel depths is a determining cause of the stagnation, if not fall of box throughput in our country's ports, Assologistica, the association of Italian terminal operators posed.

3.9.3 Other Traffic in Mediterranean Ports

The following table reports about the statistics in terms of TEU and Tonns for major Mediterranean Sea.
The following table is demonstrating that many ports are not focusing the investments in container terminal and container traffic. The Port of Ravenna is decreasing the traffic in terms of TEUs and is improving the total amount of goods about 6-7% per year in solid and liquid bulks. The traffic in Marseille is characterised by oil.

PORT	Container (TEU)	Solid Bulks	Liquid bulks	Ro-ro/gen Cargo	In container	Total/ Tonn
Rijeka	94.390	3.199.707	5.877.906		1.572.997	10.650.610
Piraeus	1.349.512	191.000	21.000	711.472	13.363.513	14.286.985
La Spezia	1.133.700	1.529.000	3.055.000	851.000	11.000.000	16.435.000
Thessaloniki	343.727	3.765.517	8.519.412	1.150.000	3.506.043	16.940.972
Napoli	444.982	4.000.000	6.000.000	8.500.000	3.600.000	22.100.000
Ravenna	162.052	17.869.276	4.838.358	240.875	935.664	23.884.173
Gioia Tauro	2.757.137	131.233	469.927		24.312.760	24.913.920
Livorno	657.592	1.186.571	8.508.475	9.695.046	9.735.170	29.125.262
Cagliari	687.657	10.100.948	26.033.123			36.134.071
Barcellona	2.318.239	4.107.582	10.536.375 9.	189.575	22.572.587	46.406.119
Genova	1.657.113	6.797.321	21.640.834	9.198.618	16.546.974 54.	183.747
Algeciras	3.179.000	4.000.000	21.939.000	16.584.000	25.000.000	67.523.000
Malta	32.818	1.305.472	7.558.563	156.070	819.512	9.839.617
Marseille	916.000	16.190.000	67.466.000	7.090.000	9.320.000	100.066.000

Tab. 3-6 Traffic in Mediterranean Sea

3.9.4 Multimodal transport

Analysing the available data about freight villages and interports in the Mediterranean area, it is not easy to find useful data for analysing the future development. A study on “Infrastructure Capacity Reserves For Combined Transport By 2015” prepared for International Union of Railways Combined Transport Group (UIC-GTC) reported about the growth rate for combined transport 200/2015.

Country	All modes	Rail	Road	CT 2015
Austria	2.4	2.7	2.5	3.2
Belgium	2.5	11.6	2.8	3.5
Czech Republic	1.6	-0,9	2.4	2.9
Denmark	2.0	1.5	2.0	2.5
Estonia	3.1	2.2	7.0	3.6
Finland	1.6	2.8	1.2	3.3
France	2.0	2.6	2.2	3.1
Germany	2.3	1.8	2.5	3.5
Hungary	2.5	0.9	3.0	3.5
Italy	2.3	3.5	2.2	4.0
Luxembourg	2.7	2.2	2.9	3.5
Netherlands	2.6	4.0	2.3	4.5
Norway	3.0	2.1	3.1	3.6
Poland	2.2	-2,7	4.5	5.0
Portugal	2.9	5.3	2.5	5.8
Spain	3.3	4.6	3.2	5.1
Sweden	3.2	2.2	3.8	4.3
Switzerland	2.6	2.1	2.8	3.5
UK	2.6	3.1	2.5	3.0

Tab. 3-7 Prognosis of average annual growth rates of tonne-kms 2000/2015 (%)

The following table reports about the rate of employment of the intermodal terminals in Europe focusing on the 2002 handling capacity.

Country	Transport Area	N. of terminals	Transhipment volume in 2002 Totale	National	International	2002 handling capacity	Rate of employment
AT	Graz	1	50.000	9.000	41.000	130.000	38%
	Villach	1	51.289	6.668	44.621	70.000	73%
	Wels	1	102.815	33.929	68.886	132.000	78%
	Wien	2	152.115	42.394	109.721	175.000	87%
BE	Antwerpen	4	356.700	161.700	195.000	610.000	58%
	Genk	2	57.842	2.889	54.953	69.000	84%
	Zeebrugge	1	126.693	120.000	365.000	35%	
CH	Basel	2	155.274	67.527	87.746	195.000	80%
	Praha	2	148.600	9.600	139.000	250.000	59%
DE	Bremen/Bremerhave	2	542.000	337.200	204.800	760.000	71%
	Duisburg	2	107.500	53.500	54.000	208.000	52%
	Hamburg	5	969.231	582.066	271.165	1.200.000	81%
	Koeln	1	265.745	72.466	193.279	237.000	112%
	Luebeck	1	42.500	0	42.500	140.000	30%
	Muenchen	1	200.000	144.000	56.000	320.000	63%
	Neuss	1	75.092	9.847	65.245	140.000	54%
	Nurenberg	2	118.800	63.800	55.000	150.000	79%
	Mannheim/Ludwigsh	2	260.752	129.910	130.842	254.000	103%
DK	Taulov	1	75.000	25.000	50.000	80.000	94%
ES	Barcelona	3	163.000	87.000	76.000	314.000	52%
	Madrid	1	100.000	80.000	20.000	192.000	52%
	Valencia	2	105.000	43.000	92.000	240.000	44%
FR	Le Havre	2	108.946	95.500	13.446	34.000	(a)
	Paris	6	176.282	110.837	65.445	658.000	27%
HU	Budapest	2	140.000		140.000	210.000	67%
IT	Bologna	1	93.585	49.600	44.000	220.000	43%
	Milano	9	488.002	81.462	406.540	801.000	61%
	Novara	3	182.625	750	181.875	315.000	58%
	Verona	2	223.796	1.043	222.753	329.000	68%
NL	Rotterdam	2	516.000	125.000	391.000	600.000	86%
PL	Gliwice	1	30.000		30.000	30.000	100%
	Poznan	1	27.000		27.000	25.000	108%
	Warszawa	1	40.000		40.000	60.000	67%
SI	Ljubljana	1	58.300	11.100	47.200	100.000	58%
All transport areas			**6.310.484**	**2.436.787**	**3.781.018**	**9.613.000**	**66%**

Tab. 3-8 Transhipment Volume and Capacity [in LU] and Rate of Employment [in %] by Selected Terminal Area

Note: Rate of employment calculated on 100% nominal capacity & full substitution between terminals of an area. (**a**) No valid calculation since capacity only regards terminal, volume includes quayside, too.

The following table reports about the expected flows in 2015 related to the intermodal nodes in the list.

Country	Transport Area	Transhipment volume in 2002 National	International	2015/2002 international traffic	2015 total volume
AT	Graz	9.000	41.000	212%	137.000
	Villach	6.668	44.621	157%	121.000
	Wels	33.929	68.886	114%	181.000
	Wien	42.394	109.721	119%	282.000
BE	Antwerpen	161.700	195.000	132%	614.000
	Genk	2.889	54.953	168%	150.000
	Zeebrugge		120.000	155%	306.000
CH	Basel	67.527	87.746	94%	238.000
CZ	Praha	9.600	139.000	100%	288.000
DE	Bremen/Bremerhaven	139%	813.000	337.200	204.800
	Duisburg	53.500	54.000	108%	166.000
	Hamburg	582.066	271.165	136%	1.222.000
	Koeln	72.466	193.279	130%	517.000
	Luebeck	0	42.500	138%	101.000
	Muenchen	144.000	56.000	149%	283.000
	Neuss	9.847	65.245	109%	146.000
	Nurnberg	63.800	55.000	138%	195.000
	Mannheim/Ludwigshafen	139%	443.000	129.910	130.842
DK	Taulov	25.000	50.000	109%	130.000
ES	Barcelona	87.000	76.000	189%	307.000
	Madrid	80.000	20.000	200%	140.000
	Valencia	43.000	92.000	166%	288.000
FR	Le Havre	95.500	13.446	132%	127.000
	Paris	110.837	65.445	144%	270.000
HU	Budapest		140.000	88%	263.000
IT	Bologna	49.600	44.000	140%	155.000
	Milano	81.462	406.540	158%	1.130.000
	Novara	750	181.875	162%	478.000
	Verona	1.043	222.753	147%	551.000
NL	Rotterdam	125.000	391.000	122%	993.000
PL	Gliwice		30.000	90%	57.000
	Poznan		27.000	98%	53.000
	Warszawa		40.000	97%	79.000
SI	Ljubljana	11.100	47.200	60%	87.000
All transport areas		**2.499.787**	**3.850.711**	**138%**	**11.540.00**

Tab. 3-9 Determination of Transhipment Volume [in LU] by 2015

The terminal capacity bottlenecks (gaps) by transport area by 2015 that have been envisaged by the study is reported in the following table

Country	Transport Area	Capacity 2015	Total volume	Rate of employment	Probable capacity gap 2015
AT	Graz	130.000	137.000	105%	33.000
	Villach	110.000	121.000	110%	33.000
	Wels	132.000	181.000	137%	75.400
	Wien	300.000	282.000	94%	42.000
BE	Antwerpen	940.000	614.000	65%	
	Genk	122.000	150.000	123%	52.400
	Zeebrugge	365.000	306.000	84%	14.000
CH	Basel	390.000	238.000	61%	
CZ	Praha	200.000	288.000	144%	128.000
DE	Bremen/Bremerhaven	1.060.000	813.000	77%	
	Duisburg	318.000	166.000	52%	
	Hamburg	1.200.000	1.222.000	102%	262.000
	Koeln	300.000	517.000	172%	277.000
	Luebeck	140.000	101.000	72%	
	Muenchen	320.000	283.000	88%	27.000
	Neuss	140.000	146.000	104%	34.000
	Nurenberg	320.000	195.000	61%	
	Mannheim/Ludwigsha	346.000	443.000	128%	166.200
DK	Taulov	120.000	130.000	108%	34.000
ES	Barcelona	348.000	307.000	88%	28.600
	Madrid	192.000	140.000	73%	
	Valencia	236.000	288.000	122%	99.200
FR	Le Havre	39.000	127.000	(a)	(a)
	Paris	658.000	270.000	41%	
HU	Budapest	300.000	263.000	88%	23.000
IT	Bologna	235.000	155.000	66%	
	Milano	1.057.925	1.130.000	107%	283.660
	Novara	805.000	478.000	59%	
	Verona	780.000	551.000	71%	
NL	Rotterdam	1.400.000	993.000	71%	
PL	Gliwice	32.000	57.000	178%	31.400
	Poznan	65.000	53.000	82%	1.000
	Warszawa	60.000	79.000	132%	31.000
SI	Ljubljana	150.000	87.000	58%	
Total terminals		**13.271.925**	**11.184.000**	**84%**	

Tab. 3-10: Determination of expected “Need” by Terminal Area by 2015

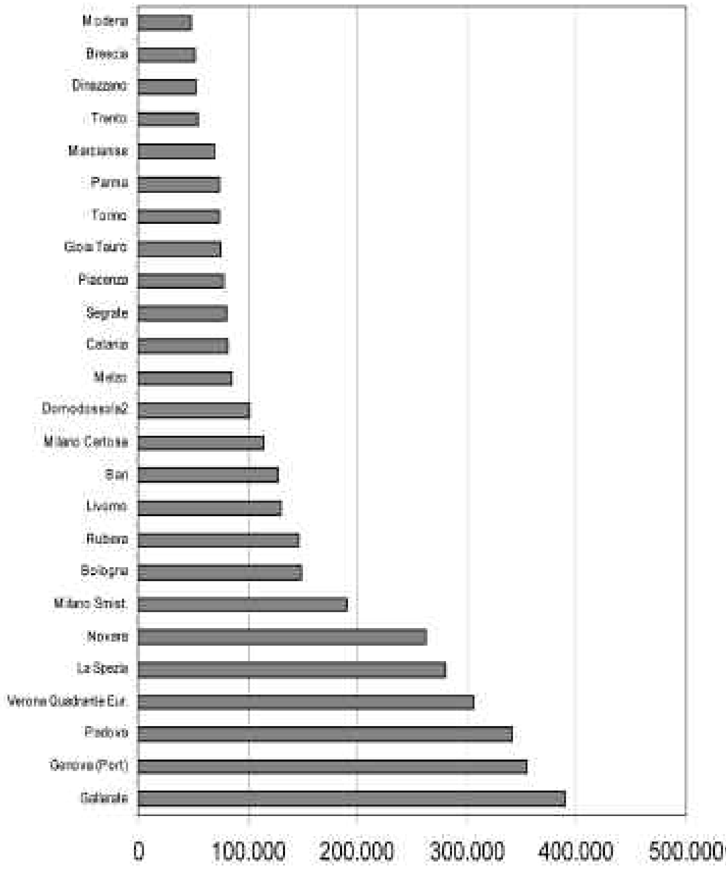
The following table reports about the Top 25 transport areas by 2015 for international CT

N° Transport area	Export (1,000 t)		Import (1,000 t)		Growth rate	
	2002	2015	2002	2015	2015/2002 p.a.	
1 Milano	4.402	11.477	4.908	12.566	158%	7,60%
2 Rotterdam	3.176	6.960	3.450	7.717	122%	6,30%
3 Ko?ln	3.338	7.811	2.184	4.870	130%	6,60%
4 Verona	2.123	5.225	2.642	6.522	147%	7,20%
5 Antwerpen	2.574	6.355	2.283	4.934	132%	6,70%
6 Hamburg	2.384	6.335	2.241	4.585	136%	6,80%
7 Novara	1.677	4.382	2.238	5.862	162%	7,70%
8 Praha	1.141	2.277	1.288	2.580	100%	5,50%
9 Mannheim/Ludwigshafe	1.279	3.070	646	1.521	138%	6,90%
10 Zeebru?gge	953	2.441	730	1.849	155%	7,50%
11 Paris	830	2.004	759	1.866	144%	7,10%
12 Basel	982	1.923	978	1.863	93%	5,20%
13 Barcelona	517	1.460	662	2.047	197%	8,70%
14 Valencia	558	1.328	587	1.714	166%	7,80%
15 Genk	663	1.769	449	1.217	169%	7,90%
16 Nurenberg	602	1.436	551	1.297	137%	6,90%
17 Neuss	710	1.500	529	1.084	109%	5,80%
18 Bremen/Bremerhaven	623	1.643	463	874	132%	6,70%
19 Roma	301	781	586	1.519	159%	7,60%
20 Munchen	479	1.200	395	989	151%	7,30%
21 Duisburg	605	1.275	440	894	108%	5,80%
22 Wien	311	678	623	1.370	119%	6,20%
23 Wels	379	795	495	1.073	114%	6,00%
24 Budapest	408	749	553	1.051	87%	4,90%
25 Ljubljana	466	736	518	840	60%	3,70%
Subtotal 1.-25. (~72%)	31.480	75.609	31.196	72.706	137%	6,90%
Other transport areas	12.391	28.017	12.549	28.794	126%	6,50%
Total volume	43.870	103.626	43.744	101.499	134%	6,80%

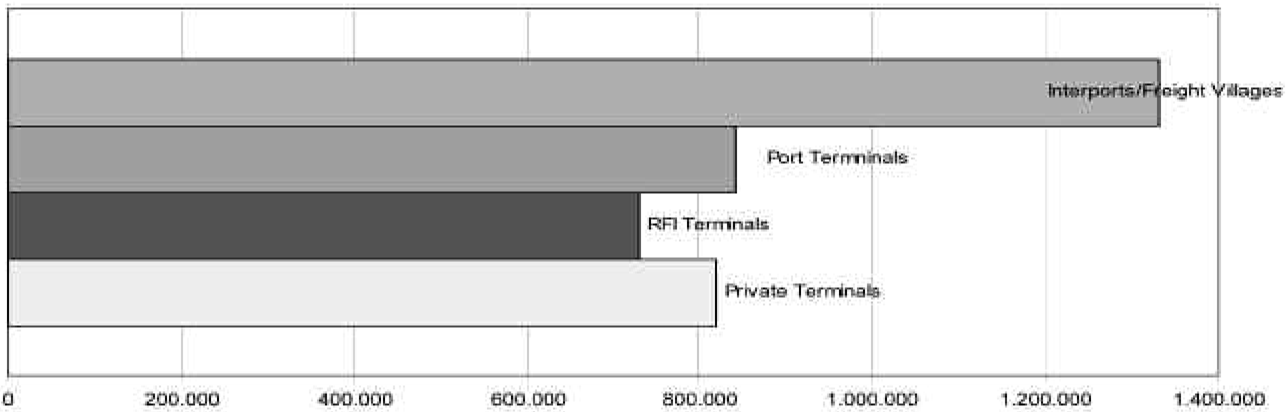
Tab. 3-11 Top 25 transport areas by 2015 for international CT

Analysing the terminals in Italy, it is possible to note that Freight villages are the main actors of the traffic at Italian level and that in the management of terminal, the private area is present with a large percentage of the traffic.

Terminal	TEU
Modena	49.000
Brescia	52.000
Dinazzano	53.000
Trento	54.000
Marcianise	70.000
Torino	74.000
Parma	74.000
Gioia Tauro	76.000
Piacenza	78.000
Segrate	80.000
Catania	81.000
Melzo	85.000
Domodossola2	102.000
Milano Certosa	115.000
Bari	128.000
Livorno	130.000
Rubiera	146.000
Bologna	149.000
Milano Smist.	190.000
Novara	263.000
La Spezia	280.000
Verona Quadrante Eur.	306.000
Padova	342.000
Genova (Port)	355.000
Gallarate	390.000



Tab. 3-2 Capability in Italian Terminal



Tab. 3-3 The Distribution of Traffic in Italy

According the strategic view on Intermodal and Combined traffic, the DIOMIS project (Developing Infrastructure Use and Operating Models for Intermodal Shift) developed by International Union of Railways (UIC) seeks to improve the competitiveness of international rail freight transport and encourage a shift of traffic from other modes – the roads especially – to rail. To this end, it must help identify ways and means of decongesting the network of rail infrastructure and terminals and make them more attractive to shippers for international transport operations.
A key question addressed by DIOMIS is how to absorb the anticipated growth in combined transport volumes in the years ahead, on a rail network shared between different types of traffic and already highly saturated. The Capacity Reserves Study published in 2004 had focused exclusively on the development of international combined transport on the 2015 horizon, with domestic combined transport then viewed as a constant. The analysis of domestic combined transport was carried out for several countries, namely Austria, Belgium, France, Germany, Italy and Poland. The study findings show that by 2015 the congestion zones will not only be denser but also more numerous.
In Germany, for example, the most revealing corridor is Hamburg-Frankfurt, with congestion levels increasing from 41% to 68% by 2015.

In Italy too the Bologna-Florence corridor by 2015 will have reached record congestion levels following the anticipated growth in domestic combined transport.

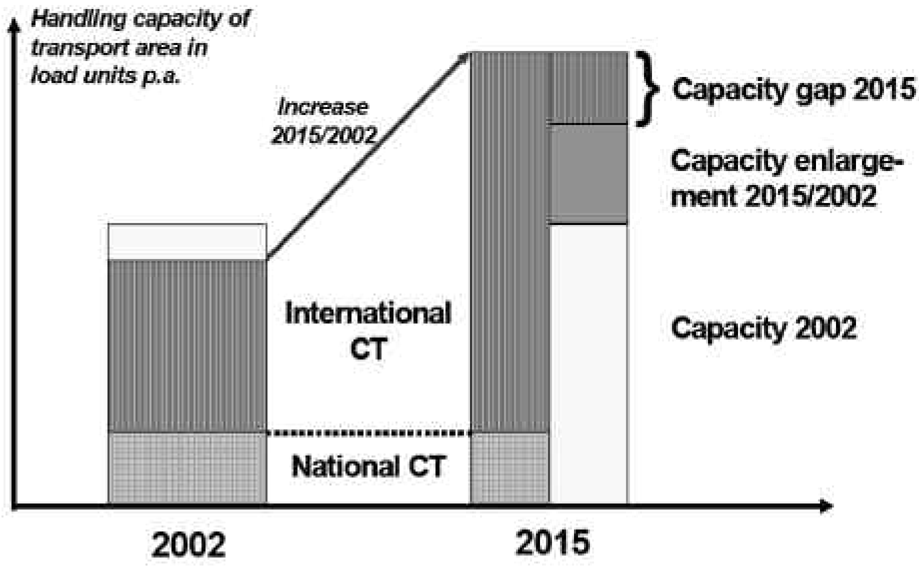


Fig. 3-4 The DIOMIS view about Capacity Gap in Capacity

On the basis of discussions held with combined-transport operators, DIOMIS has produced a report listing best practices in terms of the management of existing capacity. These best practices are analysed against 3 three criteria: How easy are they to implement? Are they transposable to other operators? What is their impact on existing capacities?
DIOMIS has therefore dedicated a module to this question and the report addresses the following aspects:

- growth forecasts for (domestic and international) combined transport
- market structure : players and customers
- marker shares per segment
- salient developments during the period reviewed (for information : it is planned to update this report every two years).

3.10 ICT and EDI Architecture Framework at European Level

Guaranteeing the freedom of movement to people and goods is a priority for the economic and social development of any country. Nevertheless, the increasing of transport demand, which has characterised the last decades has had the effect of progressively limiting this freedom: people have paid a heavy cost in terms of quality of life, safety and pollution. The risk we are running today is that the continuously increasing transport demand will make this cost no longer sustainable.

The challenge we now face is to protect this freedom, while safeguarding at the same time environment and the transport users' need for safety and efficiency. The experiences of other Countries show that this objective cannot be achieved by merely building new infrastructures, but it is necessary to think Transport in a new way. An answer is given by the application of informatics and communications methods and technologies to transport. It has allowed to develop systems able to face the problems of mobility and transport in an "intelligent" way ; this discipline is also called Intelligent Transport Systems (ITS), that I related to the design and development of systems for:

- Traffic and Mobility Management
- Public Transport Management
- User Information
- Advanced Vehicle Control
- Emergencies Management
- Fleet and Goods Transport Management

Many ITS projects have been developed within the TEMPO framework, which was a multi-annual program spanning the period 2001 to 2006. TEMPO designed as a way to promote a harmonized and synchronized deployment of ITS systems and services on the trans-European road network (TERN), and to contribute to convergence between national/regional planning and the overall implementation of the Information Society in the road transport field in Europe.

The many trials performed both in Italy and abroad show that ITS can bring significant benefits as regards environment, efficiency, productivity and, first of all, Transport Safety. They allow to launch new markets for components, systems and services. They are then bound to play a more and more key role in the present and future development of the National Transport System.

Following the idea of the general architecture, in the following chapters, it has been analysed the general ITS framework (ACTIF, ARTIST and FRAME), the initiative/projects funded at European level and then the general proposal for a new concept of ICT architecture for multimodal and co-modal trans-national chains. Within the TEMPO framework, seven Euro-Regional project have been supported - Fig 3.5.

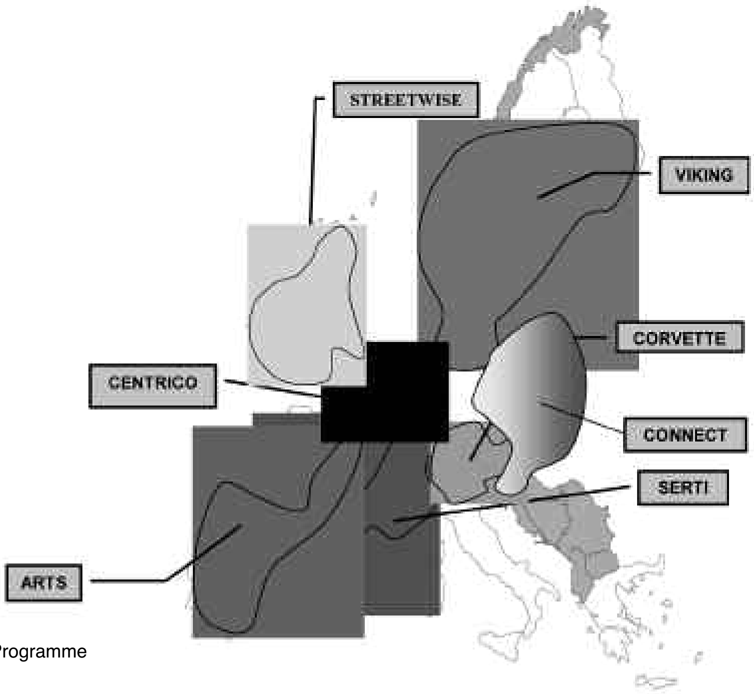


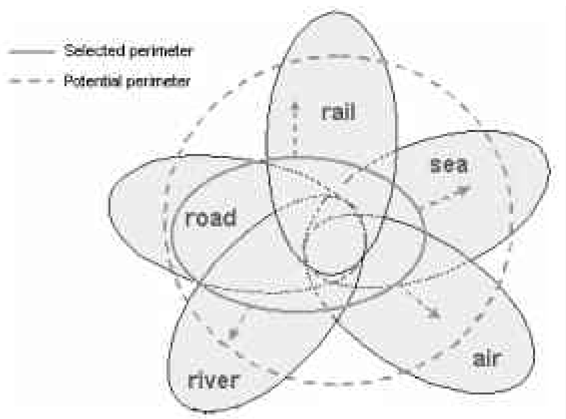
Fig. 3-5 The TEMPO Programme

3.11 The ITS Frameworks and Architectures

In the following chapters, three main ITS frameworks are described, representing the general approach that each country adopted in order to promote an open framework to create an interoperable application baseline at national level and be able for interoperability at wider level. Similar initiative have been developed in USA, Japan, CANADA and Australia

3.11.1 ACTIF

ACTIF was answering the world of transport calls for more advanced new technologies in order to offer more diversified services and to answer the important needs for safety and sustainable mobility: optimization of the traffic fluidity, law enforcement, traveller information, ticketing, emergency management, freight and fleet management, etc. These technologies rely on complex information systems whose upgradeability and durability must be guaranteed.
Moreover, the inter-modality issue brings the actors of different means of transport to work together. These evolutions in the world of transport require a new approach in project piloting and management in order to avoid the deployment of systems that are not compatible and difficult to upgrade. The upstream management and organization of transport systems is therefore an essential key to interoperability and durability of the systems and investments. It is vital to provide the contracting authorities, and generally-speaking the participants of a project, with a method, a model and simple tools enabling quick and efficient thinking. Aware of these stakes, the Ministry of Public Works, together with the actors of the world of transport, has launched a project whose aim is to encourage interoperability of transport systems via an approach of urbanization and architecture of the information systems. This is how ACTIF was born (Aide à la Conception de systems de Transports Interopérables en France – Assistance for design of interoperable transport in France). Today, ACTIF is already used for the urbanisation approach of the travel management system in Grenoble, of the Road traffic speed enforcement project (automatic radars), of the SDIR (Road traffic information masterplan), etc. Other countries around the world, aware of the interoperability issue on the efficiency of their transport networks, have equipped themselves with similar tools: the USA, Canada, Japan, Australia, Italy, etc.
ACTIF works closely on these different projects in order to make the most of the foreign experiences and to enable the improvement and coordination of methods, models and tools, namely concerning cross-border transport. There is thus a real partnership with the European architecture FRAME.
The ACTIF model is structured into 9 functional domains which model, through a common vocabulary and grammar, the functions and information exchanged between functions of transport systems. This model was the subject of an important consultation and stems from the experience of partners of different sectors. It allows one to gain in efficiency in the modelling and analysis of transport systems. (see http://www.its-actif.org/gb/index_actif.asp)
Each model offers a simplified representation of the working logic of different sectors and interfaces to ensure, between them and their environment.
The modelled objects are characterized by: the collection, treatment and spreading of information, to be done
external partners with whom information must be exchanged
information exchange with external partners and between functions
the data stock enabling to save information the norms and standards applicable to each object



The model is accessible on the ACTIF website through several diagrams:

- Functional views which present the functions, the exchanged messages and the interfaces to be guaranteed (namely with the other means of transport).

- Organized views, which enable to tackle more easily the functional model and the interfaces between sectors. These groupings correspond to locations of functions on physical organisations or systems (Management and operating centre, vehicle, etc.).

- Thematic views which present all the functions, messages, norms and recommendations for a given process

A set of documents describes the general logic of modelling and the application of each logic to each profession, and the possible use of the model.

3.11.2 ARTIST

ARTIST is the Answer to the need for a common ITS language. Promoting the development and the diffusion of ITS on a National level, requires the definition of a strategic Framework Architecture providing the guidelines to make the different ITS applications integrated, interoperable and able to dialogue through a common language. For this reason, in September 2001, the Italian Ministry of Infrastructure and Transport promoted the ARTIST (ARchitettura Telematica Italiana per il Sistema dei Trasporti) Project aimed at defining the National ITS Architecture. The ARTIST Project derives from the National Plan for Transport and Logistics (PGTL) and it aims at outlining the National Framework Architecture for the deployment of ITS in Italy, at large scale and in a multi/intermodal context from the present until the year 2010. The first phase of the Project, concluded in January 2003, provided the first Version of the ARTIST Architecture. On the basis of the stated User Needs, ARTIST defines:

- the necessary services for users

- the functional, logical and physical relationships among systems

- information flows

- organisational relationships among the different users (Public and Private Institutions) involved in the development and management of ITS.

ARTIST allows then to identify the stakeholders and the strategies to be adopted in the whole process of collection, processing and data management, which are fundamental for ITS operation.
From ARTIST recommendations can be derived for any new legal and technical standards required to ensure the development of innovative solutions that are compatible with the existing situation and able to exploit the opportunities offered by technological advances. The objective is to encourage the interoperability among Transport modes and telematic services, at National and European level.
ARTIST is then the approach to be followed for the development and realisation of the new telematic systems moving people and goods.

ARTIST MAIN ELEMENTS: ARTIST is composed of seven main elements mirroring the phases in which the Project was structured.
Survey of the current development of ITS Systems
User needs
Logical Architecture
Physical Architecture
Organisational Architecture
The Navigation Tool
Glossary

3.11.3 FRAME

FRAME, the European ITS Framework Architecture was created in order to provide guidelines and a common approach to the planning, development and implementation of ITS throughout Europe. It focuses mainly on road-based ITS applications and covers eight major functional areas. The benefits of having an ITS Architecture and how to go about creating one are explained in the brochure ‘Planning a Modern Transport System’. Version 1.0 was created by the KAREN Project (Keystone Architecture Required for European Networks) and issued in October 2000. It was the result of an effort to create a minimum stable framework necessary for the deployment of working and workable ITS within the European Union until at least 2010. The Architecture focuses mainly on road-based applications. It is planned to extend it in the future to include intermodal interfaces.
Version 1.1 was issued in March 2002 by the FRAME Projects. It consists of an update of the previous version and corrects a number of inconsistencies found in Version 1.0. For details of the changes made see the Update Notes (D10) in the LIBRARY. Version 2.0 was issued in August 2004 by the FRAME Projects. It is an upgrade of the previous version which takes into account the use of the Selection Tool. For details of the changes made see the Update Notes (D11) in the LIBRARY. Note that this document also includes details of all Update Request and Problem Reports submitted by users. Version 3.0 was issued in November 2004 and incorporates further improvements based on the Update Requests and Problem Reports submitted by users of the ITS Framework Architecture. For details of the changes made see Update Notes (D12) in the LIBRARY. The following are the FUNCTIONAL AREAS covered by the European ITS Framework Architecture:

- Electronic Payment Facilities
- Safety and Emergency Facilities
- Traffic Management
- Public Transport Operations
- Advanced Driver Assistance Systems (ADAS)
- Traveller Journery Assistance
- Support for Law Enforcement
- Freight and Fleet Operations

In a global economy, the importance of the smooth mobility of people and goods cannot be underestimated. In the European Union, the increasing difficulty of guaranteeing this mobility is a growing threat to economic efficiency.

3.12 ICT and EDI Initiatives at European Level

In the past years, many R&D and cooperation projects, proposed by transnational consortia and partially founded by EU, have been developed in the area of EDI and ICT applied to transport and logistics. In this section, an analysis of the projects, the results have been selected and described.
The selection have been made according the relevance of the objectives and the interest for the results in terms of Multimodality and EDI.

PROJECT ACRONYM	PROJECT TITLE
ARTEMIS	Advanced Road Transport Electronic Management Information Systems
BOPCOM	Baltic Open Port Communication
CESAR	Co-Operative European System For Advanced Information Redistribution
COMETA	Commercial vehicle Electronic and Telematic Architectur
D2D	Demonstration of an integrated management and communication system for door-to-door intermodal freight transport operations
EFFORTS	Effective Operations in Ports
Freightwise	Management Framework for Intelligent Intermodal Transport
GILDANET	Global Integrated transport Logistic DAta NETwork
INFOLOG	Intermodal Information Link for Improved Logistics
INTACT	Integrated Telematics for Advanced Communication in Transport
INTERBALTIC	Baltic Sea Intermodality
INTERPORT	Integrating Waterborne Transport in the Logistics Chain
KAREN	Keystone Architecture Required for European Networks
LOBSTER	Location Based Services cluster
MATAARI	Improvement of Accessibility to Transport and Logistic Services among Urban Areas and Intermodal Centres
PLATFORM	Computer controlled freight platforms for a time-tabled rail transport system
POSEIDON	European Project On Integrated VTS, Sea Environment and Interactive Data Online Network
PRECISE IT	Precise Automatic Location System for the Management of ITUs and Vehicles inside Intermodal Terminals
PROMIT	Promoting Innovative Intermodal Freight Transport
PROSIT	Promotion of Short Sea Shipping and Inland Waterway Transport by use of modern Telematics
RETRACK	Reorganization of Transport network by advanced Rail freight Concept
SITS	Simple Intermodal Tracking and Tracing Solutions
THEMIS	Thematic Network in Optimising the Management of Intermodal (Freight) Transport Services
TRACAR	Traffic And Cargo supervision system
TRIM	Transport Reference Information Model
WATERMAN	Waterborne Traffic And Transport Management - Technical Secretariat

Projects' short description

ARTEMIS: ARTEMIS proposes to develop an improved emission model for road transport based on a harmonised methodology for national and regional inventories and forecasts. Starting points are two well-known models (COPERT, HANDBOOK EMISSION FACTORS) which will be merged. The model development will be accompanied by a thematic network with representatives of the EU, the member states and other stakeholders. The model will include also new emission measurements of passenger cars, LDV and HDV which will be provided by other projects within the 5th Framework Programme. ARTEMIS will perform complementary data collection of traffic characteristics in EU and non-EU countries and analyse driving behaviour in different European cities. The new emission model will be validated by street tunnel measurements and will be applied for different scenarios. The model will be distributed as a software tool to be used by different user groups.

BOPCOM: Open platform in the Baltic sea and comparable areas for co-operation in telematics and logistics of small and medium ports concerning the application fields of cargo booking, dangerous goods, vessel movement, combined freight traffic terminal, localization of units, costums cooperation, statistics, berth allocation, hinterland Transport. - Interconnectivity of individual systems of e.g. single users, companies, authorities and local or regional communities (called Lopcom) - Confidential handling of information controlled by the individual users - Common data handling so far as reasonable e.g. concerning dictionaries, vessel information, dangerous goods, statistics, etc - Interconnectivity of different technical und organizational standards and networking services - Establishment of services and consultancy in adaptation or development of individual systems in local areas as well as dissemination of existing and new solutions to all parties interested in the solutions

CESAR: The overall objective of CESAR is the improvement of intermodal transport performances and quality, with a further view to attracting more transport volume for intermodal transport and increasing efficiency of transport in the European Union. The main step to generate this quality improvement is by way of an intermodal transport information system. CESAR will establish the basis of a common standard interface for information and data exchange and distribution between combined transport operators and their clients, mainly road hauliers and freight forwarders. As a kernel of such a European standard information system, major operators of the two main alpine North-South routes in Europe will link their information systems, as far as operator - to – client information flow is concerned, and develop, in close conjunction with the other actors in European intermodal transport, a basis for standard communication for this type of information flow and interaction. A co-operative approach was chosen as an efficient way of enabling the initial three partners to increase the performance of their different information systems while still allowing them to keep their decentralized structure, which responds to a number of national or specific user requirements. The results achieved will undergo a test run on the Gotthard and Brenner axis and a co-ordination and acceptance procedure with the other actors in European intermodal transport. Finally, the results will be disseminated in such a way as to foster acceptance and to bring forward European standardization.

COMETA: In the coming years, the kind of tasks assigned to drivers and dispatchers will be dramatically affected by the introduction of new information and communication technologies. This introduction carries a number of risks such as problems of interoperability, problems of ergonomics and spiralling costs. The COMETA project has been initiated to answer these concerns by defining and designing modular associations of various on-board functions based on clear interfaces with the global transport environment. This has resulted in an on-board information system architecture. The main objective of COMETA was to develop a modular system architecture for on-board freight, fleet and cargo management systems based on clear interfaces that can be standardized. Having explored and identified the possibility of integrating all on-board elements related to the driver/operator function through an open data interchange system, COMETA has also taken the results of other relevant projects like KAREN (overall system architecture), FLEETMAP standardizing the communication between home base and vehicle) and national projects concerning mobile EDI into account.

D2D - The market for logistics management systems is developing rapidly. Globalization, lead-time reduction, customer orientation and outsourcing are some major changes contributing to the focus and interest into logistics management. Integration of the supply chain has become an important way for the industry to gain competitive advantages. As a result, the role of logistics providers is changing both with respect to contents and complexity. New firms from different fields are entering the market competing with the traditional transport and warehousing companies. Assessing the market for logistics IT systems is a major challenge, since the terminology and descriptions of the functionality of the applications have not yet reached global standardization. The next generation of logistics management system: the European Commission has the long-term objective to reduce road transport to help combat traffic congestion, pollution, and road accidents. Alternatives to road and land transport are rail, inland waterways (barges), and ocean transport. One of the initiatives to solve these problems is the door-to-door

(D2D) project. Five existing logistics chains have been chosen to demonstrate that the technology works. The chains cover intermodal logistics processes for cars, farming equipments, metal products and general cargo.

EFFORTS - Increasing globalization i.e. world-wide distribution of production and consumption results in continuous increase of trade and transport. In container transport e.g. the growth estimation for the next 5 years is about three times the GDP growth, i.e. about 9% p.a. The port sector handles more than 90% of the Union's trade with third countries and approximately 30% of intra-EU traffic, as well as over 200 million passengers every year. Even if competition between and within ports is increasing, there are areas common for almost all EU-ports where improvements are feasible on a pre-competitive level to benefit from technological opportunities in order to strengthen the ports position within the European intermodal environment. Improved port efficiency will contribute to the integration of modes and services into a single system. The market trend is towards capital concentration, specialisation and vertical integration. The provision of port services is gradually being transferred from the public to the private sector in order to increase efficiency and reduce public expenditure on port labour costs. The FP-6 DG Research Integrated Project "Effective Operations in Ports (EFFORTS)" will improve both, the competitiveness of European port operations and the quality of the ports labour conditions and market, being a prominent one in coastal regions. Commencing 1st May 2006 and lasting for 36 months EFFORTS, research and development will focus on three scopes of application.
Navigation in Ports, i.e. to allow for safe and efficient port approach and berthing in the view of vessel sizes are growing faster than port infrastructure can currently follow. Based on high accurate digital chart data (Harbour ECDIS) operations of vessels and tugs will allow improved use of available manoeuvring space, continuous monitoring of operations and increased automation of processes. Additionally prognostic traffic management of increasing feeder vessel operations will allow for improved planning of port and terminal resources on a regional level.
Ports and Environment, aiming at integration of ships into the land-based systems to handle wastes and pollutants in order to avoid dumping in European coastal waters. Availability of shore-based reception facilities need to be agreed on an European level and operated within a network including the monitoring of the whole process from ships provisions to waste. Dredging is not only a very costly operation but also generates problems how to treat polluted sediments and where to dump it, a problem where EFFORTS will contribute to already ongoing activities in order to accelerate European solutions rather than local experiments. EFFORTS will also cater for a harmonized neighbourhood between port industrial areas and residential areas by eliminating or at least minimizing annoyances from all kind of emissions.
Port Organisation and Infrastructure, where as a first step a system analysis will provide a comprehensive picture of related port processes and architectures in order to appropriately allocate project activities, elucidate interdependencies, provide a common understanding on a European level and to allow identification of potential synergies. Development of tools and methodologies for improvement of port operations, infrastructure and systems will then follow also including a risk assessment framework and investigations into opportunities for artificial offshore port structures to solve the shortage of land for port extensions and new ports.
EFFORTS primary users are the ports, it is therefore part of the project strategy to have ports (Dublin, Le Havre and Gijón) leading the three activity areas. It is the purpose of an "integrated project (IP)" to achieve a more significant innovation impact than through individual small projects.

FREIGHTWISE - FREIGHTWISE is being developed by a consortium of 55 partners in 14 European countries with a budget of €13 million, €7.9 million of which is being contributed by the EU. As the EU undergoes expansion and the continent battles overcrowding in its transport infrastructure, FREIGHTWISE will allow the Commission to formulate future strategies that support intelligent intermodal freight transport solutions. Intermodal transport – i.e. one transport using a combination of modes – has been deemed crucial in encouraging the use of more sustainable modes of transport such as rail, short sea shipping and inland waterways. Peter Schmutzler, Managing Director of BMT Transport Solutions GmbH, said: "Intermodal transport represents the future of the European transport infrastructure but there are many commercial, technical and organisational obstacles to overcome before transport services can be combined into an efficient transport chain." "Rapidly changing business and administrative practices demand a high level of flexibility from the transport industry both in terms of the services offered and the management systems." The FREIGHTWISE research project will lead to the production of a virtual transport network and a stakeholder framework that will provide a blueprint for managing the interaction between co-operating organisations region wide. The virtual transport network allows users to assess the available transport services for a specific transport chain by running the relevant operational and commercial information through FREIGHTWISE. This will facilitate the integration of transport services across Europe and foster closer co-operation among stakeholders while preserving commercial integrity and confidentiality requirements. The stakeholder framework takes the principle of co-operation even further by setting out business guidelines to support the management of intermodal transport chains across the range of companies and institutional actors (e.g., customs or port authorities) involved. This stakeholder framework will facilitate the definition of contractual terms and liabilities and appropriate information management processes such as reporting rules or confidentiality and security aspects. Another output is integrated reference architecture to support the modelling of business processes and information flows and facilitate the design of interoperable transport management systems. The conceptual work in FREIGHTWISE will be strongly informed by nine FREIGHTWISE business cases covering various transport scenarios and geographic areas. The business cases will provide realistic requirements for the FREIGHTWISE reference architecture, and in some cases also serve as a test bed for re-engineering solutions based on it.

GILDANET - The GILDANET project proposed to transform the existing ICT infrastructures into a working system based on reference architecture for the logistics at European level in full coherence with the user's needs and the emerging standards for mastering the business processes, using advanced ICT solutions. To meet the above objectives, a variety of actors have been considered, together with a targeted set of test cases (pilot actions focused on real, specific and demanding logistic chains). The main objectives of the project were related to enhance existing ICT-solutions with capabilities to cooperatively support transnational transport chains. Specifically, efforts will be made to build upon the recommendations and deliverables of international standardization bodies such as UN/CEFACT, OASIS and ebXML. The project built pilot systems, interconnecting ICT-solutions among themselves and with legacy applications of other public/private actors (e.g. Custom, public administrations, companies) to support specific transport chains, such as perishable goods, automotive and reversed logistics of container. Moreover, a specific attention has been paid to define appropriate business models and to establish a level playing field for SME‘s and global players.

INFOLOG: The goal to be achieved by INFOLOG is to demonstrate how the efficiency of intermodal transport based on waterborne, road and rail transport as a core can be improved through better information and communication possibilities. Hence INFOLOG addresses one of the most critical issues for successful intermodal transport chains. Better means of generating and accessing information is the key to achieving the necessary amount of control and flexibility needed to compete with door-to-door transport by truck. The project set out to meet the objective by developing a Transport Chain Management System (TCMS) based on concrete requirements from shippers, forwarders, shipping agents, carriers and terminal operators/ports. The TCMS has been designed with a modular structure making it generic enough to be used from supervision of simple transport services to automatic message handling in complex logistics solutions. The TCMS makes it possible to adapt step-by-step the handling of more difficult transport chains with an increasing number of players, restrictions and options, thus easily responding to actual needs and to a growing understanding of the possibilities of using modern information technology in intermodal freight transport solutions.

INTERBALTIC: The InterBaltic project is initiated by the CPMR Baltic Sea Commission and seconded by the Baltic Development Forum based on the assumption that there will be a huge increase in transportation and logistics related to the Baltic sea region. This situation will affect business development and living conditions in general, and thus the call for important political decisions. The main focus of the project will be to develop practical actions in a partnership between the public and private sector based on a common strategic platform. The project complies with TEN, Motorways of the Sea, The Northern Dimension and national/supranational politics and objectives. The project consists of 4 Work Packages (WP) which will:

- ❑ design common strategies and prerequisites for actions based on existent information and analyses
- ❑ build an ICT framework for intermodal transport planning in the region
- ❑ bring strategies and plans onto concrete actions based on groups of key products

The project involves 43 partners from all the countries in the region, except Belarus. But project activities will also include this country and other non-partners. Also, there are three partners from Russia and they can participate according to Tacis programme conditions. A ”High Level Group” will secure mutual understanding and political acceptance.

INTACT: INTACT tackled the issue of the lack of freight transport activities integration. This issue has been tackled in a two-track approach: a generic track developing a conceptual information model and a specific track with four pilot demonstrations. Both tracks run in parallel and are interdependent. The generic track resulted in a generic system architecture consisting of a unified data model of a road freight transport company, with all parties, business functions and information flows modelled into it. This should allow any transport company manager or IT provider to recognise the processes in the transport company and help them formulate their user needs and integrate their telematics systems. The specific track built and implemented interfaces between various applications at four test sites across Europe. By means of these test site demonstrators, the generic model has been validated.

INTERPORT: The aim of INTERPORT is to implement and test an automatic equipment identification system for handling vehicle and container movement in ports in accordance with the information exchanged electronically between transport partners. The project will incorporate modern technology for electronic identification and remote reading into an integrated system. It will also consider standardisation - a crucial issue for ports, as these are a common location for different transport means. INTERPORT will deliver identification systems specifications adapted to different modes of transport, a manual for implementation of systems, and a cost-benefit analysis for their possible marketing.

KAREN: The KAREN Project (Keystone Architecture Required for European Networks) spanned two years from 1st April 1998. It was the European ITS system architecture effort, requested by the High Level Group on road transport telematics, approved by the European Council of Ministers, and funded by DGXIII as part of the 4th Framework Programme. KAREN has realized a minimum stable framework necessary for the deployment of working and workable ITS solutions within the European Union until at least 2010.

LOBSTER: Location based services in mobile cellular networks open new horizons for the provision of innovative lucrative value added services. Interest in the industry for LCS (Location based services) is huge. These build on various positioning techniques such as localisation at the level of the cell, triangulation based on measurements of the uplink or the downlink channels and satellite navigation. Current efforts aim at defining the best cost effective easy to implement hybridised solutions delivering a reliable location service with an homogenous performance in all environments (including urban and in-door). Innovative IP based techniques in UMTS networks facilitating the introduction of location aware applications in the context of UMTS are also being studied. The practical implementation of privacy provisions, the availability of open platforms, the derivation of adequate business models, roaming issues are immediate concerns at service and technical levels. These need to be resolved in order to guarantee commitment towards exploitation and pan-European deployment. (http://cordis.europa.eu/ist/ka4/mobile/proclu/c/lobster.htm).

MATAARI: This project wants to face the problems of the accessibility of the wide, inter-provinces areas where exist a strong connection between the urban/suburban traffic and the freight traffic generated by intermodal and logistic centres, through the analysis, definition and implementation of strategies and actions directed to solve conflicts between the operational areas/gates of access of the intermodal centres and the external road network. The proposal aims to foster the aggregation and coordination of different bodies existing on the territory and to promote a real improvement of the whole accessibility to transport networks and logistic services aiming to the mobility sustainability in the whole wide area.
MATAARI, thus wants to face these problems acting on the whole accessibility to transport and logistic services, intervening on two fundamental aspects:

- ❑ Physical level, composed of infrastructures, technological devices and organisational aspects necessary to support the user of transport services in moving trough the network to join his destinations, both for the logistic freight transport and for passenger transport (with private or public vehicle). The objective is to make the transport network both for people and for goods efficient and integrated in order to reach the destinations easily.

- Virtual level, that is the organisational/technological support necessary for obtaining transport services (logistic and for passengers) and to make integrated all the phases of the displacement to be done on the network. This level is relative to the working of the transport services and implies the whole differentiated accessibility for typology of users, services, served areas, etc.

PLATFORM: PLATFORM's main objective is to implement a more cost-effective way to manage freight traffic flows through the enhancement of terminal management and the integration of existing telematic systems. Such an approach is expected to make rail transport competitive for long- and even medium-distance transport providing a substantial reduction of road-based transport. PLATFORM implemented a simulation environment for the assessment of impacts produced by the adoption of different technologies and management policies to enhance terminal performances. The simulation environment has been used to analyse how to make combined transport competitive for long- and even medium-distance and thus lead to a substantial reduction of road-based transport. PLATFORM produced a set of appropriate methodologies (including guidelines) and technical tools (agent-based scheduling and simulation) that make the simulation environment attractive for both end-users and intermediate users concerned with the project.

POSEIDON: From 1996 to early 1999, the POSEIDON project analysed, defined and specified the scope of VTMIS (Vessel Traffic Management and Information Services) for achieving interoperability and interconnectivity of VTS (Vessel Traffic Services), and improving the safety and the efficiency of maritime vessel traffic at European level. The project proposed VTMIS system architecture, developed tools and applied advanced technologies for demonstrating VTMIS functions at five test sites in Europe. Major outcomes of the project are already considered as marketable products and make up part of the portfolio of solutions offered by major European industries. The products developed the evaluation results and the recommendations for standards concluded at the end of the projects create a solid basis for the authorities, the industry and the users of the European maritime community for implementing VTMIS.

PRECISE IT: PRECISE IT intends to contribute to the optimisation of intermodal terminal operations, addressing those operational problems that can be recognised as being related to the position of ITUs and/or vehicles on the terminal. The optimisation of the activities associated with intermodal terminal operations and the consequent reduction of operative costs are vital issues for increasing the competitiveness of the intermodal transport of freight. In many intermodal terminals additional costs, time delays and quality deficiencies are often due to the wrong positioning of ITUs and to the inefficient management of personnel and vehicles dedicated to the moving of ITUs. One of the prerequisite conditions for improving the overall efficiency of the terminal operations is to have automatic provision of real-time, error-free information about the position of all stocked ITUs and moving vehicles inside the terminal.

PROMIT: PROMIT is a Coordination Action funded by the European Commission, under the 6th Framework Programme, with main objectives to contribute to a faster improvement and implementation of Intermodal freight transport technologies and procedures, and to help Promoting Innovative Intermodal Freight Transport and modal shift by creating awareness on innovations, best practices and intermodal transport opportunities for potential users as well as politicians and research community. This is the official web site of the project PROMIT, where you can

- find information about the project goals and methodologies;
- download PROMIT outputs;
- be informed about the latest news and announcements of the project's events;
- find information about the PROMIT team;
- participate to a dedicated discussion forum for the exchange of ideas, views and information about intermodal freight transport;
- find connections with interesting links in the area of intermodal transport;

PROSIT: PROSIT is attempting to achieve several goals: to support an intermodal brokerage for linking and tuning the demand and supply side in transport including short sea shipping and inland waterway transport; to improve quality and reliability of short sea shipping and inland waterway transport and its integration into intermodal transport chains; to establish a monitoring system for the entire transport chain, after sales service (reporting deviations, activating fallback solutions) and by doing so assist in guaranteeing the quality and reliability required for the sustainable acceptance of short sea shipping and inland waterway transport on the market.

SITS: The SITS project was set up to demonstrate the feasibility of an inexpensive and user-friendly cargo tracking and tracing (T&T) solution. The project, having acknowledged the need for a technology independent positioning of the cargo, has developed a concept which relies on an open access to T&T information. A fundamental aspect behind this concept concerns the distinction of the roles between the parties acting in the intermodal transport chain. It is obvious that SITS has paid its full attention to the T&T of the cargo position and status. However, the project has acknowledged that an effective T&T solution must be supported by the required reference information, i.e. the data coming from the transport booking and transport chain planning and design. That is why the Consignor and the Forwarder have been enriched with their respective functionalities and the interchange terminals and the vehicles with tools for the provision of the necessary T&T data. Of course, all parties perform the T&T of the consignments along the transport chain.

RETRACK: The main objective of the RETRACK project is to develop, demonstrate and implement an innovative and market-tested rail freight service along an East-West trans-European corridor. This axis will be composed of a backbone corridor connecting Rotterdam with the Black Sea seaport Constanza in Romania, as shown on the map below. Subsequently, this business plan is extended to service of the Bratislava-Budapest logistical hub located at the new Central European industrial cluster which covers Poland, Czech Republic, Slovakia, Hungary, and Austria. New service lines connecting Bratislava-Budapest with Nordic and Baltic states will be opened, followed by establishment of south-east corridor section linking this new European powerhouse with important trade partners in Black Sea region such as Turkey and Ukraine.
The RETRACK rail freight service will connect traditional Member States (the Netherlands, Germany, Greece and Scandinavia) with new EU Entrants (Poland, Czech Republic, Slovakia, Hungary and Lithuania), the Candidate Countries (Romania, Bulgaria and Turkey), with important EU trade partners (Ukraine and Russia), and overseas production centers in South-eastern Asia. This will be effectuated by a business project offering high-quality of rail intermodal service applying the latest rail transport techniques, information and communication technologies, and logistics solutions for safe and secure transfer of goods in trans-European corridors. This business solution will be developed using research on new service offerings followed by the testing, improvement and validation of results of operational pilots.
The rail freight ventures in the RETRACK project operating through European Bulls consortium are all new entrants into rail freight supply. They exploit business opportunities created by rail liberalisation and the ongoing work on removal of operational, institutional and technical fragmentation between the national railway systems through standardisation of infrastructure, IT systems and rolling stock (e.g., TSI and TSI-TAF) carried out by the EIFF, ERRAC and the European Railway Agency. The RETRACK project will demonstrate how several market-driven rail operations can be integrated with strategic port hubs that provide access to large goods repositories for balanced intermodal freight transfer along the corridors studied.
By including new rail entrepreneurs who invest their proprietary managerial and financial resources in establishment of new rail ventures offering high-quality/customised rail services targeted at the until-now-truck-served market segments, the RETRACK team provides the ultimate evidence that the new EC railway policy is gaining ground in Europe. Furthermore, the RETRACK project shall demonstrate, using the market-growth knowledge, how business expansion of new rail entrepreneurs can be supported through field-validation of new service concepts which, when incorporated into new business and management models may be transferred into stable service offerings. Recognition of the above is critical for bridging the imbalance between the motorised freight conveyance and rail intermodal transport; without heavy risk-taking by the new rail entrepreneurs, any sizable freight transfer from motorised haulage to rail intermodal transportation won't take place. Likewise, without intensification of intra-rail competition, any significant reduction in negative socio-environmental externalities won't be achieved. Higher level of intra-rail competition will subsequently stimulate the inter-modal road and rail rivalry, improving thereby rail service quality, the competitive position of rail operators in international freight market, and the volumes of freight carried by intermodal rail operations.
Although the new railway legislation has radically changed the rail business environment, the degrees of

transformation vary considerably from country to country and some political and administrative interventions for market opening and non-discriminatory treatment of new rail entrants still need to be implemented. In this connection, the RETRACK project will detect both the opportunities and the barriers that foster/hinder seamless freight flow along the corridors studied. Next, it will devise strategies for better exploitation of opportunities through removal of existing barriers, and propose how these measures may be used by rail entrepreneurs to develop new service concepts. Subsequently, the RETRACK team will evaluate how this corridor-driven market expansion may foster economic growth and improve the socio-environmental conditions in industrial production regions emerging in the newly extended Europe.
The project will support the Commission's aspirations to induce a sustainable modal shift of freight traffic from road to rail to achieve a market share of 15% by 2020. This aspiration is also supported by the European Rail Research Advisory Council's (ERRAC) declared aim of bolstering rail's market share of freight to a similar level.

SITS: According to the scope and objectives of the SITS project, the main focus of the work was therefore to "propose a concept for an inexpensive, user friendly, cargo Tracking and Tracing solution that is applicable at National and International level and focused on shippers needs".
Besides this overall objective, SITS was to investigate a number of other secondary issues, that can be summarised as follows:

- illustrate the opportunities for integration of TRACING AND TRACKING solutions in the operation of Freight Transport with emphasis on intermodal transport;
- devise a generic and commonly agreed Framework to include T&T information in today's transport information systems;
- fill in possible gaps, especially on technical and organisational interfaces;
- clarify and illustrate the pros and cons of the solutions and perform a comprehensive evaluation of a potential European wide T&T system;
- develop implementation strategies by assessing critical success factors;
- demonstrate a viable Tracing and Tracking solution; and
- make recommendations for public or collective (public private partnership) actions to remove barriers and/or stimulate the development of T & T solutions.

THEMIS: THEMIS' area of work has been defined as the planning and operational functions of freight transport within the future European ITS. THEMIS will attempt to define the position of European Freight Transport within the Intelligent Transport Systems (ITS) infrastructure that is being developed, by utilising technologies and applying innovative logistics concepts in order to contribute to a rebalancing and integration of the different transport modes into intermodal transport chains. Of the various ITS applications and areas of development, THEMIS is focusing, by way of priority, into the relation and integration of the new, ITS-based, Traffic Management Systems (TMS) with the Freight Transport Management systems operation (FTMS). From 2001 to autumn 2004, the task of promoting the Framework Architecture and providing practical assistance to users was carried out by FRAME-NET and FRAME-S. They provided various forms of support: a) seminars and training workshops; b) international meetings and events, c) brochures, reports and technical documents. The FRAME projects (FRamework Architecture Made for Europe) were funded by the European Commission as part of the 5th Framework Programme of the Information Society Technologies (IST) Directorate. They were a follow-on to the KAREN project (1998-2000) which developed the first version of the European ITS Framework Architecture. Thematic Network on Intelligent freight Transport Systems (http://www.frame-online.net)

TRACAR: The overall objective of the Tracar project is to establish a common telematics system/standard for the identification, positioning and management of cargo in a multi-modal set up (cargo in terminals, on road, railway, sea and inland waterways), including the handling of freight documents. The project builds on existing, but upgraded, low frequency Tag/Transponder technology and other established technologies i.e. radio-, tele-, and satellite technology. These technologies will become integrated and enhanced. The development of the system should lead to an attractive low-cost system, which should bring cargo back to the railways (with all the advantages this implies), become attractive for the SME user group and increase the EU's competitiveness in the world market for cargo transport.

TRIM: The establishment of TRIM is a step towards improving the information flows in multimodal freight transport. The lack of integration between the information systems along the transport chain causes many problems and extra costs, and there exists a large potential for improving the present situation.
Current information systems in the transport chain can not communicate with each other because of lack of a common ”language”. TRIM will improve this situation by defining a common language, which can be implemented as standard messages between the information systems. Better communication between the information systems will increase the reuse of data. Practical experiences have shown that each information element is manually controlled and registered about 12 times for a typical transport. Reuse of data can result in large benefits. Data should only be registered once, and should be reused by all actors which need this data.
TRIM is based on the data needs from several European Union projects in the freight transport sector, and is recently supported by the D2D project. TRIM is also supported and adopted by ARKTRANS, the Norwegian system framework architecture for multimodal freight and passenger transport. Physical Data Models and schemas for most of the popular DBMS´s can be generated on request. The scope of TRIM includes the information needs for all actors along the transport chain, from consignor to consignee. The transport chain covers international freight transport by road, waterway and railway.

WATERMAN: The thematic network on Waterborne Traffic Management and Information Services, is a further and crucial step in the expected implementation of IT applications in practice aimed at: - Improving navigational safety and protection of the environment. - Optimising control and use of resources, cargo flows and infrastructures through the integration of information related to transport logistics. The WATERMAN approach is a systematic method and tool to collect, present and analyse “state of-the-art” information, user requirements and priorities to give guidelines and recommendations for further development within a defined domain. All information is linked together in a database by using a framework as a guide.
The following table shows the web link of the reported projects:
Many of the listed projects produced very interesting results in terms of new ICT applications. Almost the totality

PROJECT ACRONYM	**WebLink**
ARTEMIS	http://cordis.europa.eu/telematics/tap_transport/research/projects/artemis.html
BOPCOM	http://www.isl.org/projects/project.php?proj_num=3180&proj_sub_num=&lang=en
CESAR	http://www.cesar-online.com/
COMETA	http://www.cometa-project.com/
D2D	http://www.d2d.no/
EFFORTS	http://www.efforts-project.org
FREIGHTWISE	http://www.freightwise.info/
GILDANET	http://www.gildanet.net/
INFOLOG	http://www.bmt-ts.com/
INTACT	http://cordis.europa.eu/telematics/tap_transport/research/projects/intact.html
INTERBALTIC	http://www.interbaltic.net/
INTERPORT	http://www.bmt-ts.com/
KAREN	http://cordis.europa.eu/telematics/tap_transport/research/projects/karen.html
LOBSTER	http://cordis.europa.eu/ist/ka4/mobile/proclu/c/lobster.htm
MATAARI	http://www.mataari.ema.fr/
PLATFORM	http://www.idsia.ch/platform/
POSEIDON	http://hermes.civil.auth.gr/poseidon/poseidon.html
PRECISE IT	http://cordis.europa.eu/transport/src/precise.htm
PROMIT	http://www.promit-project.net/
PROSIT	http://www.maritime.deslab.naval.ntua.gr/research/projects.asp?id=prosit
RETRACK	http://www.retrack.eu/
SITS	http://www.phys.uu.nl/~durr/TransportStuff/sits/
THEMIS	http://hermes.civil.auth.gr/themis/co-operation.htm
TRACAR	http://cordis.europa.eu/telematics/tap_transport/research/projects/tracar.html
TRIM	http://www.sintef.no/static/td/projects/trim/
WATERMAN	http://www.waterman-ts.net/

Tab. 3-12 WEB link for the EDI-ICT projects

of the solutions have been proposed in the market without any specific impact on the customers that are avoiding any investments in terms of new solutions for the transnational management of freight transport. The main constraints that is identified and pointed out by potential customer is the “low” interoperability” among different ICT systems. This s specially true for SMEs that want to work with different operators and that often are obliged to choose the customer and its related ICT system in order to be able to work in the specific chain. The aspect of interoperability in ICT solutions is one of the main driver towards e-logistic applications.

3.13 EDI for Multimodal Transport Chain Management

3.13.1 The relevance of standardisation

The first attempts at standardising electronic communications at a messaging level, for the purpose of being machine-readable, were a set of standards for Electronic Data Interchange. Around 1980, TRADACOMMS were largely developed in the UK and conformed to the UN GTDI syntax. (It is fair to mention that some other standards, such as ODETTE for the automotive industry, was also developed to this syntax.) Meanwhile, in the US, the ANSI organisation developed X.12 as its set of EDI standards. The two standards, while not dissimilar in their structure, were nonetheless quite incompatible.

In 1986, the new UN/EDIFACT standard was launched, adopting the best aspects of the earlier standards. Since then, most new EDI communities have used standards based on the EDIFACT structure and syntax. While EDIFACT is quite easy to parse for a computer, it is quite something else to determine the actual semantic meaning of the data extracted. “Account Holder Identification” might mean one thing to a bank and quite something different to a life insurer, say. Therefore, in practice it has become necessary to issue so called Message Implementation Guidelines, or MIGs, for each message in each industry wishing to use that message. These MIGs give a precise definition of how each data element is to be interpreted, and sometimes also further restrict or specify the implementation of the message (for example, one industry might decide only to allow a maximum of 99 line items but to make two references mandatory for each line item). Although the EDI standards were originally designed for use over Value Added Networks, there is increasing use of “Web EDI”, i.e. the interchange of EDI formatted messages using Internet messaging protocols, principally SMTP (the e-mail protocol) or HTTP (the Web protocol), though sometimes FTP (the file exchange protocol) is also used.

3.13.2 EDI and Traffic Information

Recent advances in ICT systems have opened the way for the delivery of personalised real-time traffic information to drivers. A number of initiatives have been developed to enable the exchange of real-time traffic data between government agencies and commercial service providers. The existing systems and standards work quite well for exchanging data that is centrally maintained, such as that collected by national Traffic Information Centres or TICs. However, currently it is difficult to make use of information that is distributed across multiple agencies. In this area it is relevant the potential for using XML (eXtensible Markup Language) as a means of enabling multiple-agency data exchange. Although this appears limited, a key aim of the research was to ensure that the system implemented could easily be extended to any other transportation-related data source. The goal was to develop a full XML-based web application using open-source tools.
Concepts applied in the project include data fusion, transformation and vector mapping. The primary basis for the application is Cocoon2, which provides server tools to deploy XML based applications.

3.13.3 eXtensible Markup Language, XML for Data Exchange

Currently most information on the Internet is presented using HyperText Markup Language (HTML). It is difficult to cost-effectively automate the processing of large amounts of HTML coded material, because the HTML combines both data content and formatting instructions. For this reason, the Internet has not been a particularly attractive mechanism for automated information exchange between computer systems. XML differs from HTML in that it separates data and formatting instructions. As a result it is being adopted universally as a means of automatically publishing, storing and exchanging data on the Internet.
XML describes data in a human readable format with no indication of how the data is to be displayed. Because the data is structured it can easily be searched, aggregated, transformed or interpreted by other systems. It is a

database-neutral and device-neutral format – data marked up in XML can be targeted to different devices using Extensible Style Language (XSL) stylesheets. Essentially the XSL allow formatting information (font size, sort/select instructions etceteras) to be applied to raw XML data prior to transmission. This approach allows for a “write once, publish many” approach to communication (web, mobile, audio, etcetera). XML supports multiple platforms and multiple languages, plus multiple major vendors are developing XML support tools for Java, C++, SQL etcetera.

XML is one of the newer technologies in the world of information interchange, but it now plays a central role in data management, transformation, and exchange.

Since its introduction to industry in the late 1990s, XML has achieved widespread support and adoption among all the leading software tools, server, and database vendors. As importantly, XML has become the lingua franca for data by lowering the cost of processing, searching, and re-using information. XML provides a standardized, self-describing means for expressing information in a way that is readable by humans and easily verified, transformed, and published.

This allows both information workers and automated applications to better find and use the information they need. In addition, data can be transmitted to remote services anywhere on the Internet using XML-based Web services to take advantage of the new ubiquity of connected software applications.

The openness of XML allows it to be exchanged between virtually any hardware, software, or operating system. Simply put, XML opens the door for information interchange without restriction.

XML and XML-based technologies such as XML Schema, XSL (eXtensible Stylesheet Language), WSDL (Web Services Description Language), SOAP (Simple Object Access Protocol), etc., are all open standards that can be used in conjunction with any programming language or platform. This is to say that XML technologies can be used on and between any combination of database, application run-time, and operating system – a characteristic that’s essential for integration with heterogeneous systems. Though XML provides much of the basis for B2B information exchange over the Internet today, it was not designed to replace all existing EDI and database technologies. Rather, the flexibility and openness of XML allow it to co-exist with and complement non-XML data formats and technologies.

Because of its built-in interoperability, XML gives organizations the ability to leverage existing investments while adopting a powerful new technology, and, at the same time, it actually increases the usefulness of those existing systems by adding the flexibility required for real-time data exchange across departmental and geographic boundaries and through system and programmatic constraints. However, XML in and of itself is not a data integration panacea. Successfully integrating XML with other data formats requires the development of applications that integrate system interfaces and map between data structures.

Developing Data Integration Applications

Data integration frameworks and applications offer the potential to unify business data while capitalizing on the particular strengths of relational databases, EDI, and XML systems that have made them staples of modern business.

Businesses have the option of choosing a middleware or server-based data integration platform, but these solutions are proprietary and often extremely expensive. In addition, off-the-shelf point products offer a quick solution for very specialized integration scenarios, but lack the flexibility necessitated by the pace at which business and technology requirements evolve today. A third and more viable option is building customized data integration applications that are cost effective, flexible enough to adapt to changes, and don’t force businesses to be locked in to a particular software vendor.

Depending on an organization’s specific needs, customized applications can be created to, for example, store XML or EDI data in a relational database, convert database or EDI data to XML for use in advanced Web services or content management applications, transform an XML file to conform to another XML format to enable an e-business transaction, or simply process data from one or more databases to conform to the structure or naming conventions of one or more other databases.

Despite their advantages over other solutions, customized data integration applications are often extremely complex, and developing them can be complicated, expensive, and time consuming. For an application to be effective, developers must understand the underlying theory and implementation intricacies of each data format, which is no small feat. Moreovr, the different run time characteristics of the primary business applications the data stores support, and the data model design choices that make those applications effective, play a considerable role in defining the integration opportunities and constraints.

An enormous amount of enterprise application code is tied up in data access, verification, and management. Data processing functions are required to transform source data to the target format. Many services-oriented applications require multi-step mappings that merge multiple structures into a logical model. Writing the hundreds or thousands of lines of infrastructure code required to procedurally perform intricate operations or merge the XML payloads of multiple Web services before updating one or more relational databases, for example, is not merely tedious – it is cost prohibitive, inflexible, and error prone. Further, no matter the shape the job market, few firms will find it easy to justify, attract and retain enough of the highly skilled developers who could routinely take on such challenges.
Developers need an affordable tool that simplifies away as much complexity as possible and enables them to easily define mappings that account for the unique aspects of each integration scenario. Only that increase in productivity can allow an enterprise data integration project to achieve the kind of success business demands.

3.14 Central or Decentralised EDI Model ?

Fig. 3-7 – Different Levels of Centralisation for B2B Integration: shows different approaches for the integration of businesses:

- *"Classic" EDI*: two partners cooperate just by sending EDI messages forth and back. They use a proprietary VAN provider and proprietary adapter components.
- *EDI based on XML*: standards-based document formats are supported. They are represented as XML documents, and data transfer is organised via standard protocols.
- *Marketplace, Hub*: This solution centralises the message transfer between two partners. It helps mapping product codes, and provides – if required – additional application functions like an auction module, or a reporting engine.
- *Portal with unilateral Web interface*: This architecture allows to integrate small partners which use the Web interface for order entry and tracking. The large partner remains integrated using a messaging interface.
- *Portal with bilateral Web interface*: For SMEs on both sides, this is a suitable solution, since all application logic is centralised inside the portal. For the following, we assume only large sides, i.e., the last two approaches are iirrelevant.

At the same time, out of the many possible configurations for B2B integration, it is possible to identify the following

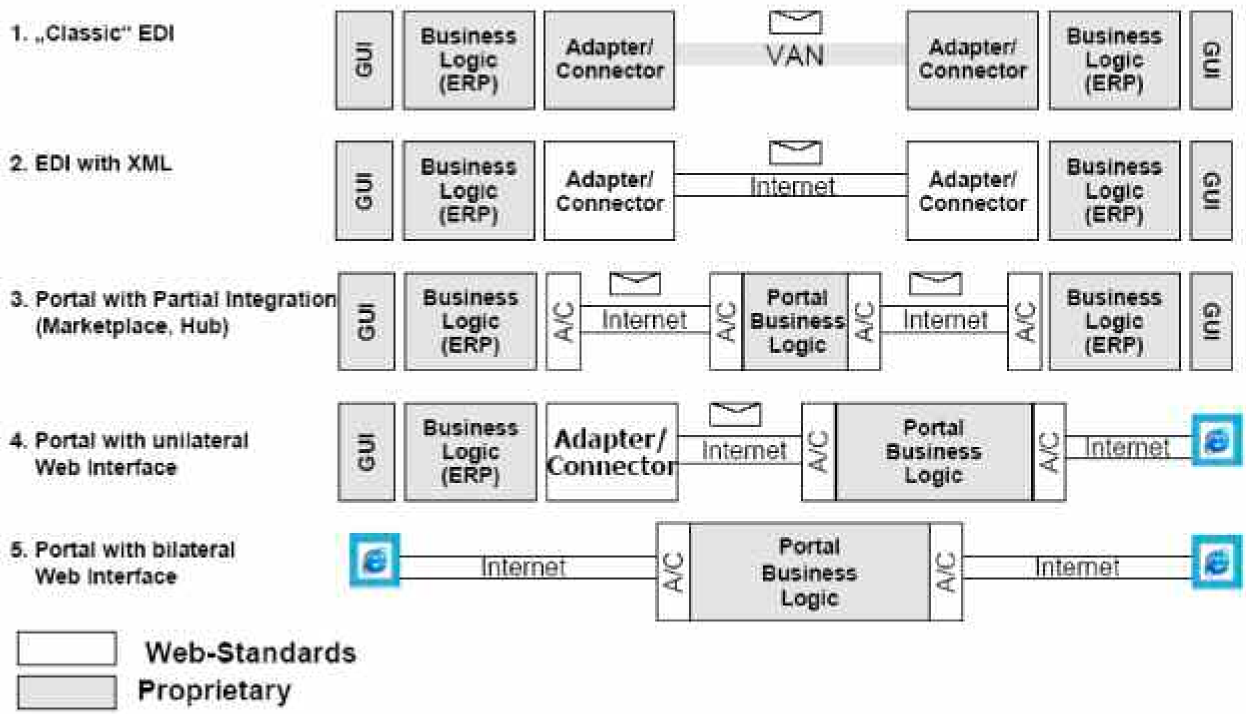


Fig. 3-7 – Different Levels of Centralisation for B2B Integration:

three basic models:
Model 1: “Spaghetti Communication”. This is the situation that we usually find in many industries. There is neither an agreed format for documents used alongside the supply chain nor a software or protocol agreement. If a document is to be transferred, it needs to be converted from the internal ERP format into the receiver’s format on a bilateral basis, since there is no document standard. In the worst case, high agreement overhead is also given for the agreement of processes and business rules – here we find another lack of integration. Finally, the communication takes place across very different software solutions: If the receiver software encounters an error, does the sender understand the error code? Many interoperability gaps need to be bridged – this is a cost intensive process and in many times prohibitive.

Model 2: “Central Hub”. The value proposition of a central hub is in shielding the participant from the heterogeneity of the partners: The protocol “spoken” between the partner and the hub is the partner’s proprietary one. It is the hub who maps both documents and protocols to the opposite partners’. Therefore, switching costs for a partner are reduced: Only the one connection to the hub needs to be established. However, internally, many peer-to-peer transformations need to be done, i.e., the effort remains the same although now done by internal staff of the hub provider. Due to the higher internal coherence of the hub provider’s software, this effort should be less than if every partner does it locally.

Model 3: “Concerted Action”. This model assumes a standardisation of processes, document types and communication software and follows the decentralised peer-to-peer model. For these reasons, the number of converters is the same like in the hub-model, because each partner needs to process only one format, thanks to the standardisation. Also the per connection effort is minimal since configuration and testing of the communication protocol is not required – all partners use the same software and if this has been configured successfully between two peers, it will also work between others.
From the decision_making point of view there are some more background information to have:

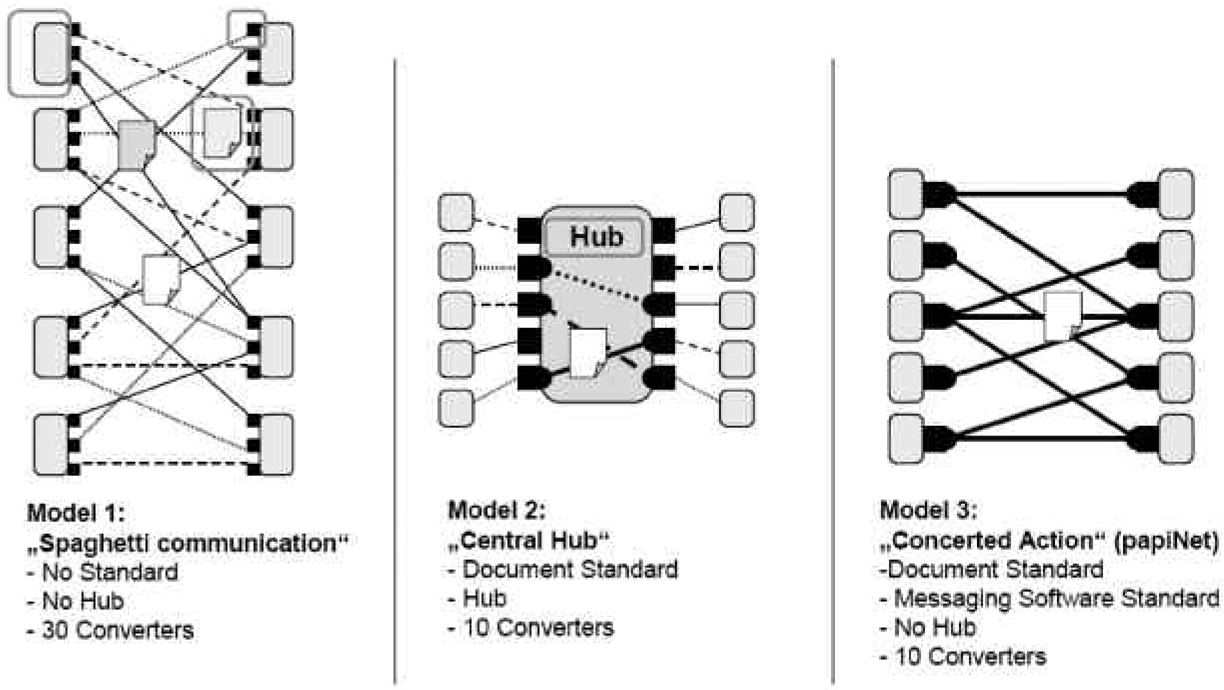


Fig. 3-8 Comparison of three Integration Models

If partners intend to integrate across different software products, interoperability problems usually appear in the following areas as well: Public Key Infrastructure (PKI), message envelope formats, envelope semantics (error codes, transaction types, guarantees provided by the receiver, etc.)

- The transformation of documents between two formats is much more complicated in practise than expected: What if the sender's document doesn't provide information that is required by the receiver? Usually, this cannot be created and mixed-in by the hub. Example: The sender doesn't support loading information as a part of a purchase order. This, however, is needed by the receiver to organise an appropriate transport vehicle. This information can only be agreed on by both parties on a bilateral basis, a hub doesn't help very much here…
- If an error occurs while transferring a message, there are three organisations involved the may be responsible for that incident. In practice, complexity is much lower if the two partners communicate directly without an intermediate.
- What if the transferred documents are encrypted? In this case, the hub-side transformation is not possible at all since access to content data elements is not possible.

Finally, many marketplace participants don't want to disclose the sensitive data that is enclosed in the messages transferred. Quantities, prices, discounts, payment conditions are usually negotiated on an individual basis and no two partners (customer plus supplier) would like to disclose this to the hub operator. However, today most marketplace operators claim for the IPR1 of aggregated information that is derived from the messages.

3.15 Cost Drivers in EDI and ICT Projects

The complexity of a project related to EDI and ICT generates some difficulties in the evaluation of the impact in terms of organisation and costs. There are many drivers that leads to decisions about the adoption of new applications and solutions. The main cost drivers are reported in the following list:

Adaptation Costs: This cost factor can vary very much, it depends on the skills and complexity of each partner's ERP system but also on the complexity of the document formats. Further, it depends on the complexity of processes: E.g., placing and cancelling orders is much simpler than processing order amendments or other flavours of order documents. In practise, adaptation costs are between some person-days and several person months, sometimes even up to the magnitude of a person years. Since adaptation costs depend very much on the individual business and IT infrastructure of each partner, they should be considered as a constant cost factor that cannot be influenced by the chosen B2B integration model

License costs: This depends on the complexity and functionality of the B2B messaging software. Depending on the number of installations (and/or licenses) per partner this may vary between 5.000 Euro and 150.000 Euro or more.

Document Type Conversion Costs. This factor scales with the number of document formats that are to be supported to communicate with business partners. The costs are mainly customisation efforts for the mapping between the internal document format and the "wire format". In practise this effort is ca. 10-20 person days for the agreement of the format, map definition, and testing of the connection.

Connection Set-up Costs. Independent of the document format is the communication protocol between two partners. If this is not standardised, programming and testing effort is high and always required for each new connection, at least for each new connection that bridges between the own system and a not yet support system on the opposite side. For the following quantification, we assume connection set-up costs at the level of another 10-20 person days.

Third-Party Transaction Costs. This factor is usually not relevant in the case of peer-to-peer communication via public Internet (at most a few cents per message). Transaction costs therefore only occur in the hub case. We assume that the yearly amount charged by the hub provider is higher than the direct technical integration costs between both sides (in case of a third-party hub, also its profit and marketing effort needs to be covered).

PKI Integration Costs. Usually, there exists no agreed PKI for a network of trading partners, and even if, third party Trust Centres charge fees for the issued certificates. Apart from this, there exists no harmonised policy for issuing certificates. Also the software integration between EDI and PKI components required high skills.. However, although most industries appreciate authentication and encryption the currently don't use it due to prohibitive integration costs. For this reason, we do not include this factor in the calculation. It should also be kept in mind that the activities behind these tasks include overheads like meetings, travelling and administration.

3.16 Basic Functional Model for an MTCMS

3.16.1 The Essence of e_logistics

When we consider a transport chain, time, speed and accuracy of transactions, information flow and distribution processes are essential for industries that deal with short shelf-life and product life cycles, particularly consumer packaged goods, food and beverage and high-tech markets. The transport sector has surely witnessed the recent development of ICT solutions. Although built using the state-of-the-art technology, the available EDI and ICT systems and services attempting to support planning, operational and controlling activities within the context of intermodal transport chains seems not able to support the demanding requirements of transnational intermodal transport chains, nor are they – restricted in scope and reach as they are - providing attractive business propositions for the ICT services suppliers and (potential) users. A specific effort has been made to define a common approach and propose solutions for managing all the logistics capabilities for dealing with the complexities involved in the business processes.

A modern system's mission is to support companies to bridge the gap in the e_logistics area. The essence of e_logistics is related to the concepts of a global business community where enterprises of any size, anywhere can:

- Find each other electronically
- Conduct business through the exchange of electronic based messages using standard message structures
- According to standard business process sequences with clear business semantics
- According to standard or mutually agreed trading partner agreements
- Using commercial off-the-shelf purchased business applications

The e_logistics approach is still related to large companies that can create an "ad hoc" environment in which all the business partners are included. In this case, a SME (Small Medium Enterprise) can only adopt the system provided by the chain leader and have to accept the business process supported.

To enable SMEs to be partner in multimodal transport chains, it is necessary to work at level of standards, open architectures, best practices and full adoption of the WEB as the environment to have low costs and easy access to services.

At European level, the e_logistics platforms should moreover be defined according to the European evolving

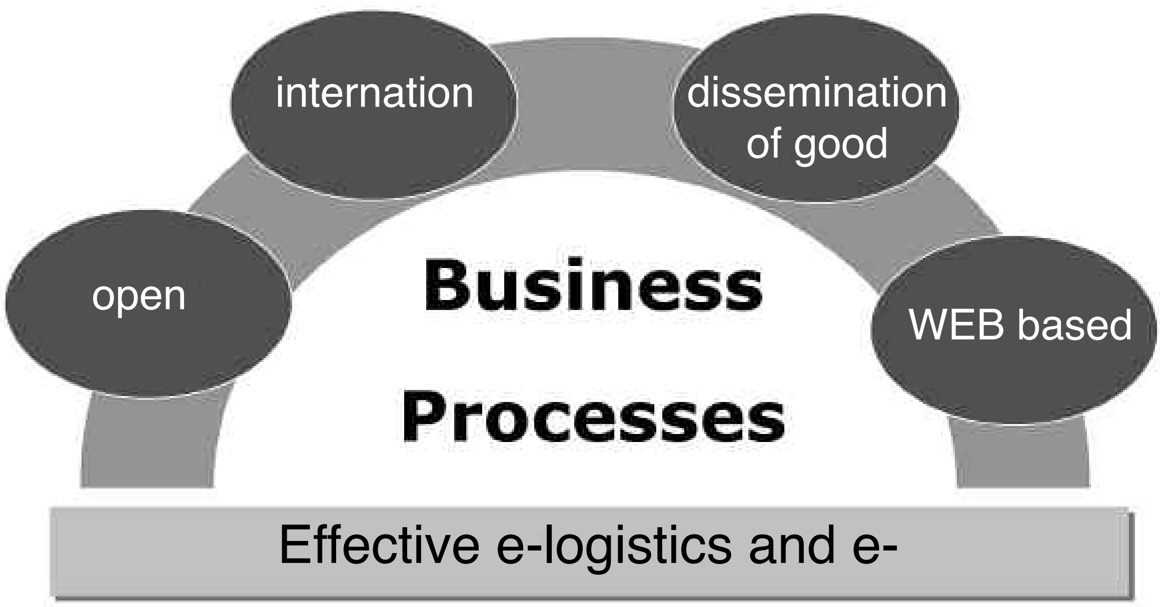


Fig. 3-9 The attention to Business Processes

context, trying to contribute to the European vision of the Sevilla submit and the i2010 initiatives.
The Sevilla submit (2002) that endorsed two important political initiatives:

- the "e-Europe 2005 initiative" aiming at providing a favourable environment to boost productivity, modernise public services, create jobs, in order to make Europe the most competitive and dynamic knowledge based economy. Within this approach, it has to be focused the interactive public services (e-government), the concept of accessible for all, and the idea of interoperability and multiple platforms.
- The "better regulation", according to which to give technical answers to a process that need a strong effort fro reviewing the legislation affecting e-business both at European level, as well as at international level.

SME's involved in multimodal transport (co-modality) supply chain and their adoption of e-logistics through:

- support to international business by enabling ***interoperability*** in ICT systems (booking, tracking and tracing, invoicing, etc.) and definition of standard cooperation processes;
- reduction of costs and times connected to communication flows and data interchange (with the adoption of international standards);
- reduction of the technological gap between SME's and the main operators
- efficient and effective cooperation between all the actors involved along the Supply Chain
- strong cultural change toward information sharing and cooperation through the use of state of the art technologies.

3.16.2 The Different perspective of a modern platform

A new proposal should be developed involving two main perspectives:

- *the business perspective*: to enhance the capability of the companies to model the business cooperation processes, based on the need of creating a common understanding of electronic business messages and workflow. The focus of the project was to deal with the definition of appropriate business models and how to establish a level playing field for SME's and global players can work together using state of the art technology;
- *the technological perspective*: to adopt and enhance existing ICT-solutions with capabilities to cooperatively support transnational and multimodal transport chains. Specifically, to build solutions upon the recommendations of international standardization bodies such as UN/CEFACT, OASIS and ebXML and with all the functionalities capable to support well defined business models.

Upon the two main perspective, a new world wide community of operators could develop pilot projects, interconnecting ICT solutions among themselves and with legacy applications of other public/private actors to support specific transport chain, such as perishable goods, automotive and reversed logistics of container;

3.16.3 The General Functional Model

The basic system in the management of multimodal transnational supply chains is constituted by a system for planning, managing and monitoring the chain through different modes and different nodes.
The solution presented in this specification is a synthesis of advanced proposal from different projects and commercial initiatives. The main sources of information are 2 co-funded European projects that represents the most advanced proposal in terms of architecture and potential involvement of different users: GILDANET (www.gildanet.net) and D2D (www.d2d.no).
Both systems can be considered best practices of an integrated approach to Multimodal Transport Chain Management Systems (MTCMS). They are unique in their approach to manage logistics as a collection of configurable processes and operators.
Multiple operators' activities are not managed as individual files, but as services in a coherent process. This enables proper planning and enhanced visibility in the entire supply chain. The following Fig 3-10 shows the complexity of such a system because of the integration of all the business proceses implemented by a company involved in one of the roles in the supply chian management (freight forwarder, transporter, logistic nodes, terminal operator, etc)
The basic idea is the provision of a global access to the ICT services for each user, which has to pay its own specific

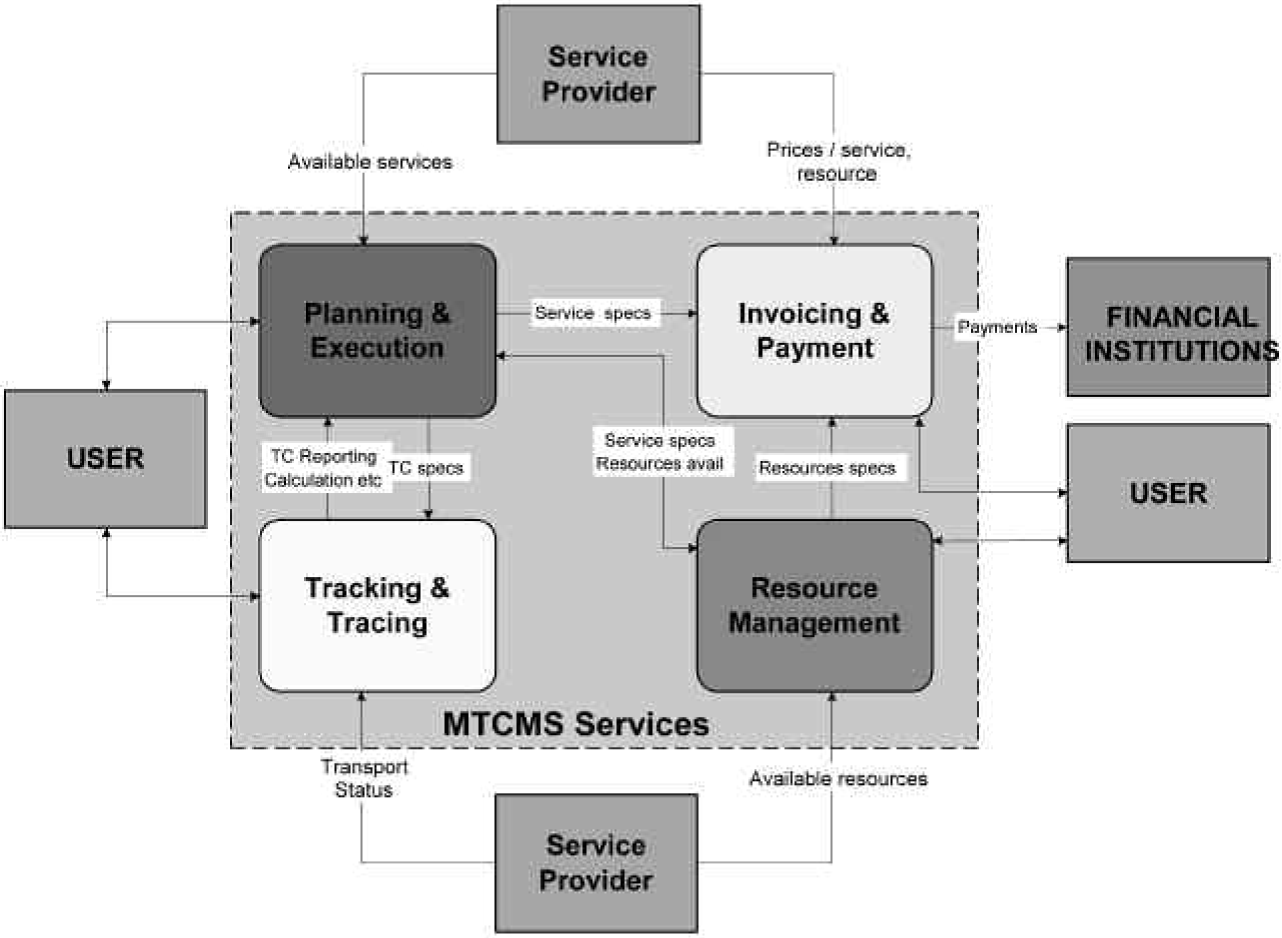


Fig. 3-10 Basic Functional Model for a MTCMS

role in the business process. The following figure represents the generic processes that can be represented at high level for a generic user in the transport chain.

Process Architecture: The platform should support a process architecture that includes generic capabilities to plan and execute logistics processes based on the framework. New logistics processes should not require new software development: This can be achieved by merely configuring the generic tool.

Information Architecture In order to facilitate such a high level configuration potential, the core of the system

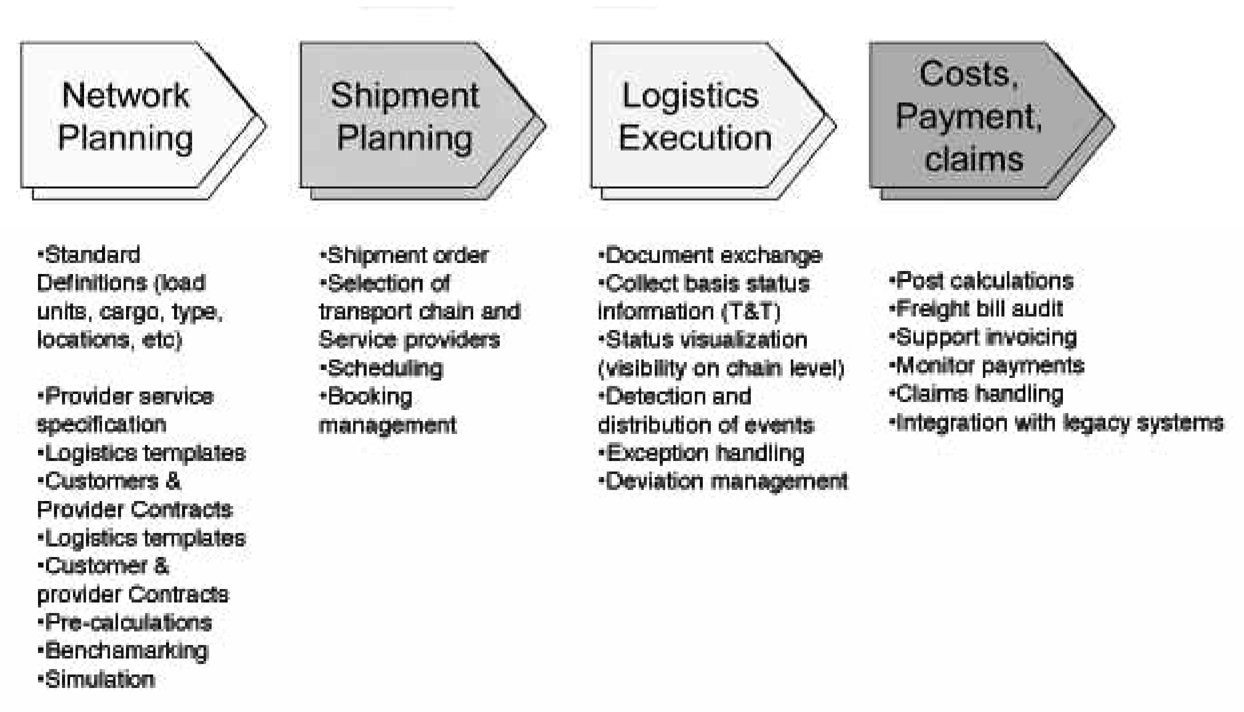


Fig. 3-11 - Main process to be managed

should be an integrated logistics database that was the result of participations in leading European R&D activities. An overview of the “D2D” and “Gildanet” data model is presented in the figure below:

3.16.4 The General Technical Architecture

Fig. 3-12 Information Architecture (standard data model)

A general model for integrating the different components of a generic information system for Multimodal chains is reported in the following. The main module are represented by

- MTCPS – Multimodal Transport Chain Planning System, and
- MTCMS – Multimodal Transport Chain Monitoring System,

Each of this module could be linked with different applications working for different modes: Rail, Road, Sea and with different systems for terminal management (port, freight villages). Moreover, the visualization of the results could be provided through different visualization approaches (geographical, graphical and textual)
Fig 3-13 shows the generic proposed model in which all the different actors of a multimodal chain can share

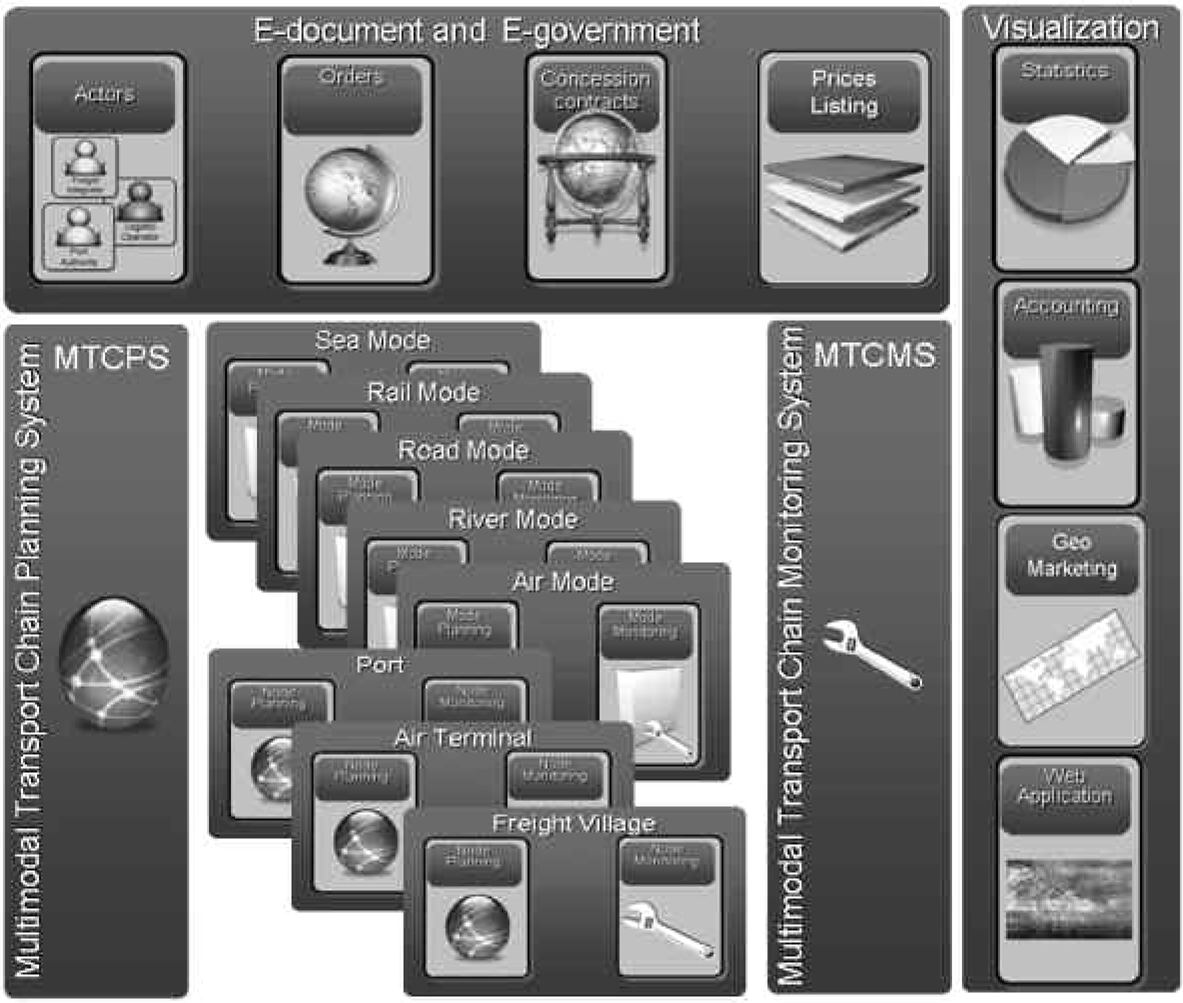


Fig. 3-13 Model for a MTCMS, where MTCPS is the Multimodal Transport Chain Planning System and MTCMS is Multimodal Transport Chain Monitoring System

information or adopt specific applications provided by third parties. The main technical requirements of the system is the high level of interoperability among different applications that could be guaranteed by the adoption of a SOA (Service Oriented Applications) approach.

3.16.5 FTMS - Freight Transport Monitoring System

An FTMS will gather information about the movement of cargo through a position data network utilising a number of different sensors. This will ensure that information is available in the appropriate formats in all transport chains. The system will be used for monitoring the actual transport operations and to provide feedback if the schedules are not adhered to. The FTMS system will be designed to be a European global commercial service that will be able to provide status information to number of subscribers, that is, by many TCMS installations and other systems used for intermodal transport chain management.

By being generic, the FTMS should be envisioned as a service that could be used by anyone transporting cargo in the physical infrastructure monitored by the FTMS. The FTMS should also be an open system and should have the capability of receiving status information from a number of sensor technologies:

Automatic Equipment Identification

Position sensors for cargo

Load units an transport means

reliable estimates of arrival times through integration with traffic management systems for road, rail, inland waterways and short sea shipping.

Technical and organisational solutions for integrating and interfacing systems and services along the intermodal chain will be developed by reusing results and experiences from the previous EU-sponsored projects. The goal is to develop and demonstrate solutions that are open and flexible enough to meet the various needs of different supply chains, but at the same time are sufficiently standardised to allow robust and reliable technical solutions needing a minimum of customisation.

It is further an objective to make use of emerging "smart" technologies both in terms of ICT and equipment, which promise to improve the efficiency of the intermodal transport chain through automation of processes. However, any system setting out to provide a "European solution" must be able to integrate new technologies with sate-of-the-art solutions if the desired integration shall be achieved. A mix must be possible in order to create a basis for the co-ordination between the operators involved. An assessment of the identified alternatives will lead to the formulation of a relevant framework to guide the system architecture work for a novel FTMS. Special reference will be made to the SITS project, since it has targeted similar principles. This project concept enables all tracking and tracing solutions currently on the market, together with those being developed but near completion, to work together so they can provide data to the T&T system, even when the tracking and tracing systems involved are technically different and are operated by competing organisations. The key to achieve this level of interoperability is the T&T published interface, whereby any system complying to that interface, can provide data to any T&T compliant Information Provider's System. This is achieved regardless whether the system operator is a major transport company acting as an Information Provider, an entrepreneurial Broker offering services to many shippers or a telecommunications company taking advantage and building upon its Internet and Web hosting facilities. Strong aspects behind the concept as developed are:

- Its interoperability - interfacing of various new technologies;
- The use of open standardised technology (XML);
- The fact that the T&T concept build on previous (RTD) projects;
- Its relatively low cost and accessibility by SME's using Internet as the basic IT infrastructure and multiple ways of exchanging information;
- The visibility of the total supply chain.

3.16.6 TCMS - Transport Chain Management System

Transport Chain Management System, will be provided with transport status information by the FTMS, and is to be used for managing multimodal door-to-door transport operations. The main functions of the TCMS comprises are:

- Organise and initiate transport
- Monitor and control operations
- Visualise the transport status (including position of cargo, ETA, etc.)
- Exchange product- and transport documentation (product certificates, quotations, proof of delivery, invoicing information, etc.)

The TCMS has to be designed to manage single- or multimodal transport chains. TCMS provides computer support to companies that offer Door-to-Door transport services to its clients, i.e. a "One-Stop-Shop". TCMS handles all types of information related to managing such operations efficiently and handles all type of documents that are necessary to perform the transport and to evaluate the performance over time. This means that the TCMS database handles any type of document related to the transport that LCL would like to include (claims form is one example). The TCMS concept and system will be modified to comply with the requirements for door-to-door management in the transport chains that have been demonstrated in the D2D project.

3.16.7 The ports and the paperless port

ICT in a Port Environment: Ports need to deal with a wide range of disparate activities: the movement of ships, passengers, cargo and containers, the loading and unloading of ships and containers and Customs and technical control agencies' activities, among others. And then there are the human resources to consider, in addition to physical resources such as anchorages, channels, lighters, tugs, berths, warehouses and storage space; all have to be allocated and managed. The management of a port involves efficient deployment and utilisation of all these resources, the flow of payments between port users and the provision of timely, readable and accurate management information.
The most successful applications of IT to port management have the potential to yield the following:

Accurate scheduling of ships arrivals and departures leading to reduced turnaround times, reducing congestion, contention for resources and costs.	Savings in operating costs; reduced costs to shippers and traders. Reduced time for availability of goods.
Better utilization of all port's assets, equipment, fixtures and fittings through enhanced ability to schedule and balance use of key resources within constraints of commercial imperatives and user requirements.	Reduction in capital requirements; improvements in return on existing investments.
Reductions in time to deliver cargo resulting from improved communications between all of the parties concerned with port usage and import and export.	Reduction in costs to trader and to consumer and export clients, leading to growth in trade.
Accurate transaction information; integrated ICT systems between all participants in the trade process.	Reduction in personnel, time, costs and paper in administration.
Higher throughput of cargo and increased utilisation of port facilities.	Increased volume of containers, general and bulk cargo, and passengers handled with known resources.
Increased security and Customs efficiency as a consequence of container track and trace systems.	Lower Customs costs; increased Customs revenue; reduced cargo losses; reduced problems in identification; reduction in 'unofficial taxes"
Better integration into national information sharing and IT strategies. Adoption of international standards.	Reduced costs and time of double handling and correction of information, especially for national statistics, revenue reporting, etc.

3.17 E_PORTS (PAPERLESS PORTS)

The general idea of a paperless port is based on the concept of a software entity managing all the activities in the port.

Fig. 3-14 The generic framework of a Port Community System

Access to services	Directory of services and functionality to access them
Bookings (Sea)	Bookings for maritime services for carriers and/or liner agents
Shipping instructions (Sea)	Bill of Lading request for carriers and/or liner agents
Vessel Operation (Port)	Port Authority single desk for berthing request and authorizations
Cargo Documentation (Port	Cargo Manifests' Hazardous Materials and Customs Declarations from liner agents and shippers
Cargo Operations (Port)	Instructions to terminal to load/unload vessel
Inland Logistics (Land)	Planning, contracting and management of inland transport
Integrated Track & Trace	Integrated solution for freight monitoring: sea-port-land
Reporting & Quality Contro	Information analysis and reporting for to seal of quality
Integration with National Customs System	Single access point to the National Customs Clearance System

Target Users

- Carriers / Maritime Agents
- Freight Forwarders
- Land Carriers
- Container Depots
- Terminal Operators

3.17.1 Expected benefits for the different target users

Port Authorities

- Integration and modernization of operations:
- Communications front-end for the port authority facilitating the automation of internal functions
- Single point of access for Port Authority
- services: The Port Community views the PCS as a “single administrative window” for all the relationships with the Port Authority and other public bodies (Customs, Harbormaster, etc.)

Port Community

- Easy access to integrated logistics information: sea, port and land
- Provides monitoring information and historical data, and authorizes access to other agents involved in the process
- Superior customer service quality
- The availability of quality, real-time information delivered by the system enables forwarders to improve their customer services
- Unification of access to and communication with shipping companies
- Offers one-stop shopping for integrated, unified communication and information with shipping companies and sea aggregators INTTRA and GTNexus
- Capture of new freight and increased customer loyalty
- Improves competitiveness in all port services
- Improve information quality reducing errors and retyping of data at all levels in the port
- Basic e-port services
- The basic e-port services that could be considered th core system for a modern port are reported below:

Access to services

Functionality

- Secure, online one-stop shopping for all services Benefits

Benefits

- High usability – integrates Windows application and web services
- All services are a click away
- Search, statistics, charts, etc available

Sea services: Bookings

Functionality

- Allows for bookings and confirmation with carriers

Benefits

- Integrated with carriers
- Increases control for processing information and documentation and reduces errors
- Speeds up subsequent preparation of Shipping Instructions
- Minimizes response times
- Provides secure transaction

Sea services: Shipping instructions

Functionality

- Helps process freight statements and bill of lading with carriers, so major carriers worldwide as well as small to midsized regional carriers

Benefits

- Integrated with carriers
- Increases control of processing information and documentation and reduces errors
- Homogenizes shipments to any carrier
- Provides monitoring information
- Reduces costs by optimizing processes

Port services: Vessel operation

Functionality

- Berth request by liners
- Single desk through Port Authority
- Multiple Administration Authorization

Benefits

- Online information of vessel status for all agents
- Speed up Administrative procedures
- Single point of contact to reach port authority, maritime authority, police, immigration, etc.

Port services: Cargo documentation

Functionality

- Hazardous materials management
- Management of manifests
- Management and request for instructions with customs declaration and customs status of containers

Benefits

- Provides monitoring information to all agents involved
- Facilitates relationship with Port Authority as single point of contact for DG and cargo manifests
- Provides online information about container status and paperless customs

Port services: Cargo Operations

Functionality

- Management of instructions to terminal
- Confirmation of container movements from terminals

Benefits

- Online monitoring of container & cargo status
- Single point of entry for all port terminals

Land services: Inland Logistics

Functionality

- Management of inland transport operations: transport orders, accept and delivery orders,etc.

Benefits

- Generates documents independently
- Automatically generates accept and delivery orders
- Provides multiple containers per transport order
- Provides monitoring information
- Can be used for road, rail and inland waters transports

Integrated track and trace

Functionality

- Provides monitoring information about shipments across entire logistics chain: current freight status, transhipments, transportation used, process documents, etc.

Benefits

- Increases process efficiency and information
- Can be integrated with management systems
- Can mail notice of events
- Authorizes access to information to other agents involved in process

Communication at Port Level

Functionality

- Provides information about processes in the port (planning, queues, process documents, etc.)
- Multichannel communication (Internet, mobile phones, Video TV in the port)

Benefits

- Increases process efficiency and information
- Integrated with management systems
- Easy notice of events

Integration with National Customs System: valenciaportpcs.net is a key entry point to the Customs paperless clearance system

Functionality

- Establishes a single administrative window for loading and discharge manifests and single administrative documents for customs declarations.
- Import and export paperless clearance
- EU New Control Transit System (NCTS)

Benefits / Aims

- Simplification and costs reduction in customs formalities.
- Improves customs controls (security, taxes, …)
- Electronic data interchanges among customs for any procedure.
- Single desk and unique recognition among Member States.

A Port Community System should cover business and operating transactions for *sea*, *port* and *land* operations constituting another step forward in the evolution of port information systems towards multimodal transport system.

- *Sea*: sending and confirming documentary procedures about transactions and confirming booking and shipping instructions (to obtain B/Ls).
- *Port*: the electronic processes involved in port of call requests, dangerous goods declarations and pre-loading cargo manifests and summary declarations.
- *Land*: processing haulage orders, cargo acceptance and delivery orders, and rail loading orders.
- *Other general services*, developed to provide users with integral track and trace information about the status of goods in transit and to ensure quality control.

In order to improve the operations of all Port Community operators, the following interfaces and mechanisms should be developed in terms of services and information:

Customer application: This innovative application enables users to manage and carry out any service available in valenciaportpcs.net in a simple, intuitive manner:

- Transaction and information services
- Operational and handling enquiries
- Handling utilities and applications

Electronic messaging: via electronic messaging services, agents can integrate their handling application with services by using standard communication interfaces between systems.
In addition, information and enquiry services can be accessed in the private area of this web page from any internet-enabled computer (goods track and trace, quality control, enquiries and information about port operations, etc).
All services have been developed using modern architecture able to grow and adapt to meet users' requirements whilst complying with secure information guarantees.
All developments should be based on the latest standard solutions (more than latest technology) to facilitate user integration as easily and quickly as possible:
Service-oriented architecture enabling new services and functions to be added easily for all concerned. Development based on accepted programming standards (web services, XML, .NET, "no touch deployment",...) and security (HTTPS, transaction control, ...) that make it easier to integrate users' applications with access to the valenciaportpcs.net services from any system, all of which ensures the integrity of both communications and transactions. Supported by the latest generation servers enabling a high volume of operational transactions to be handled in record time. The platform should guarantee the security of the information it handles, ensuring absolute confidentiality about user data and implementing encryption mechanisms into communications.

3.18 An Example of an e_Logistic Platform: GILDANET

GILDANET is an initiative that developed a pilot architecture for the management of a complex transnational multimodal chain. As for many project GILDANET (www.gildanet.net) has tangible results related to the adoption of new architectures for multimodal transnational chain planning and monitoring:

- a proven method for defining new business process collaboration agreement, based on standard approaches such as ebXML
- an ICT communication platform enabling transnational chains to adopt e_documents (GIPO)
- an ICT application platform providing services to transnational chains (GIAP)
- pilot applications: chain planning, chain monitoring, fleet management, tracking and tracing modules, e_document applications.
- a validation of the Gildanet approach in real transnational chains.

GILDANET deals with some relevant topics of international multi-modal transport, which relate to both material flow and information flow:
the needs for tracking and tracing are different for trading companies compared to transport companies (delivery batch vs. transport equipment, means of transport)
key reference numbers used by trading companies are different from those used in transport companies (goods identification numbers vs. container/truck/trailer/wagon numbers)

- there are gaps in information flows (e.g. when railway mode of transport ends the party that prepares road waybill does not have any previous documents such as railway consignment note. Therefore it is not possible to pass on key reference numbers.)
- the more players there are during the delivery chain the more difficult it is to pass on key references (goods identification numbers, means of transport identification) through entire delivery chain
- there is no international or multi-modal tracking and tracing system available
- there is a need for better tools for better delivery planning (i.e. estimated time of delivery)
- there is a need for better tools for exception reporting

The project offered other "intangible and promising results":

- the interest of private companies in the technical solutions
- the interest of public bodies for the adoption of standard languages and format

- the interest of operators and stakeholders of logistics for accessing real-time data
- the interest of large companies for having an infrastructure for e_logistic.

3.18.1 EDI and ICT Context in GILDANET

Although many operators in transport and logistics have had tracking and tracing systems in place, these only cover the individual needs of the operator; now, with supply chains becoming more and more complex, involving many carriers and multiple transport modes, there is a much higher demand for an across the board system. Gildanet focuses on interoperability, open interfaces, and standardization in order to allow seamless tracking and tracing across the entire logistics and transportation chain. With its open and scalable system architecture, a small trucking company could adopt the Gildanet services just as easily as a large national or international carrier.

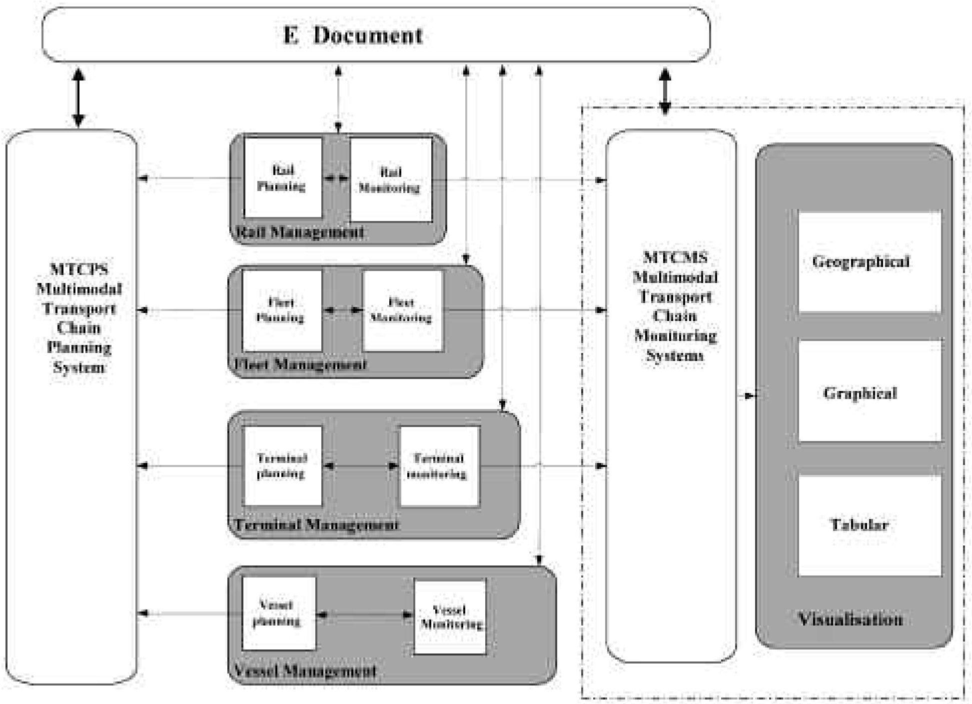


Fig. 3-15 Gildanet Model for a MTCMS

The GILDANET architecture is an attempt to address the demands of international multimodal supply chains, whose critical areas are described in the preceding chapter. The GILDANET architecture adheres to the principles layed out in the ebXML framework, and is consequently predicated on the concept of interoperability between otherwise heterogeneous and incompatible information systems. Interoperability is achieved through the consistent deployment of the following technologies and methods:

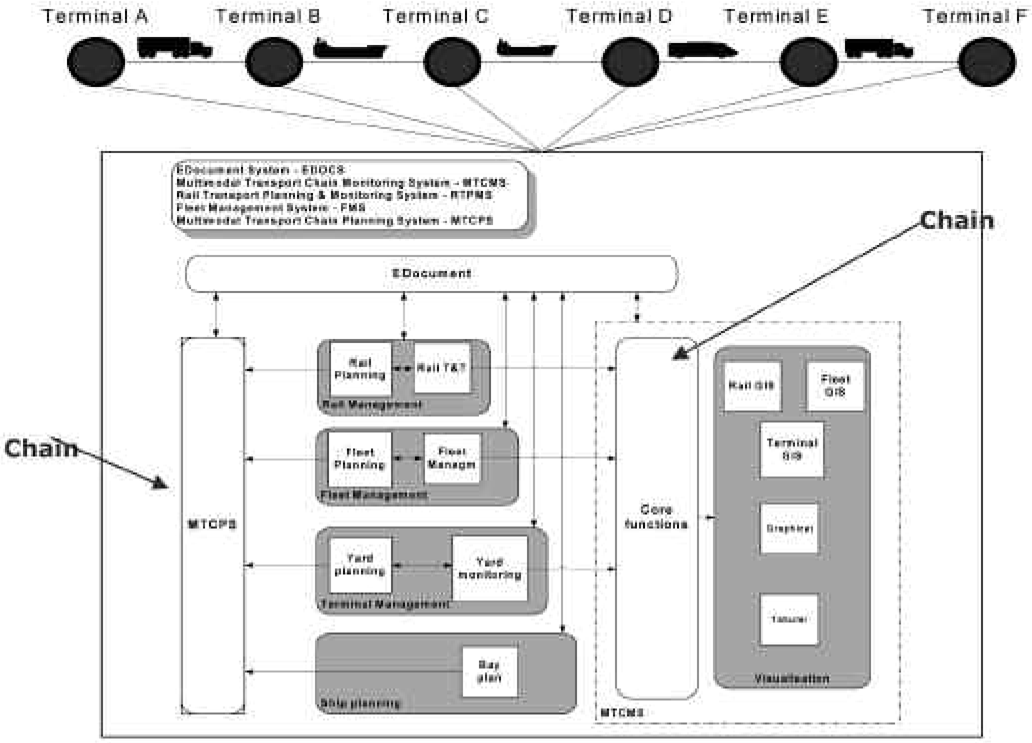


Fig. 3-15 Gildanet Model for a MTCMS

Collaboration-Protocol Profile and Agreement Specification (CPP & CPA)
The CPP - in essence a structured standardized XML document - describes the specific capabilities that a Trading Partner supports as well as the Service Interface requirements that need to be met in order to exchange business documents with that Trading Partner. The CPP contains essential information about the Trading Partner including, but not limited to: contact information, industry classification, supported Business Processes, Interface requirements and Messaging Service requirements. CPP's may also contain security and other implementation specific details. CPP's may be registered in a registry but need not be. Two trading partners prepared to enter a business relationship (i.e. e freight forwarder with a transporter) negotiate a CPA using their respective CPP's. The resulting CPA will be the intersection of the CPP's. Based on the CPA (a copy of which will be stored in each trading partners system) the trading partners modify their MSI software layer.

BPSS Business Process Specification Schema
To be understood by an application, a Business Process has to be expressible in XML syntax. A means to be followed by GILDANET is the expression of the characteristics of these business processes using the ebXML Business Process Specification Schema (BPSS). Using the BPSS user may thus create a Business Process Specification that contains only the information required to configure ebXML compliant software. A Business Process Specification is in essence the machine interpretable run time business process specification needed for an ebXML Business Service Interface. The Business Process Specification is therefore incorporated with or referenced by ebXML trading partner Collaboration Protocol Profiles (CPP) and Collaboration Protocol Agreements (CPA). Each CPP declares its support for one or more Roles within the Business Process Specification. Within these CPP profiles and CPA agreements are then added further technical parameters resulting in a full specification of the run-time software at each trading partner.

3.18.2 UMM Business Process Models

Business process models describe interoperable business processes that allow business partners to collaborate. Business process models for e-business must be turned into software components that collaborate on behalf of the business partners. The objective of this specification is to ensure interoperability between two Parties even though they may procure application software and run-time support software from different vendors. The CPP defines a Party's Message-exchange capabilities and the Business Collaborations that it supports. The CPA defines the way two Parties will interact in performing the chosen Business Collaborations. Both Parties use identical copies of the CPA to configure their run-time systems. This assures that they are compatibly configured to exchange Messages whether or not they have obtained their run-time systems from the same vendor. The configuration process may be automated by means of a suitable tool that reads the CPA and performs the configuration process.

The exchange of information between two Parties requires each Party to know the other Party's supported Business Collaborations, the other Party's role in the Business Collaboration, and the technology details about how the other Party sends and receives Messages. In some cases, it is necessary for the two Parties to reach agreement on some of the details.

The supply chain as a collaborative process: The need to work closely with other organizations is rapidly gaining acceptance. Although some organizations may find it challenging to meaningfully buy into the idea of collaborating with customers, suppliers, and even competitors, many are quickly adopting changes to accomplish this objective. Considering the imperative on creating value for the end-user customer or consumer, the need for collaborative relationships cannot be overstated. With consistent delivery of products having been identified as an ongoing objective for many firms, excellence in logistics has taken its place as a core business priority. In addition to the flows of product, the principles underlying Collaborative Logistics will help significantly to improve flows of information, assets, documents, and capital. In essence, the benefits of collaboration occur when companies work together for mutual benefit. As collaborative efforts gain momentum, and as Collaborative Logistics is recognized as a strategic priority, participating members will be well-positioned to reinforce their core competencies.

With the Internet's capacity to connect individuals and networks, a huge barrier to collaboration has been removed. Much of the remaining barriers are psychological, and those who are not willing to transcend outmoded practices will be left behind as the rest of the world joins together for mutual benefit.

3.18.3 ebXML Registry Implementation

The electronic business extensible markup language, better known as ebXML, aims to allow companies of any size to conduct business electronically via the Internet. The ebXML Framework consists of loosely coupled specifications for conducting e-Business - like UMM, BPSS, CPP and others. We are using UMM as a method to define business collaborations models for B2B in the GILDANET context. The business collaboration models represent the Business Operational View .

The results of the UMM analysis will provide insight into the processes of the domain, the business documents and transmitted information between the actors, and the choreography of the B2B e-commerce. GILDANET is using the business process specification schema (BPSS) to define the choreography of ebXML business processes. Such Business Process and Information Models are stored and made available through an ebXML Registry. The ebXML Registry serves as a central repository that enables businesses to share information. The ebXML Registry Services specification defines it as "a set of services that enable sharing of information between interested parties for the purpose of enabling business process integration between such parties based on the ebXML specifications." So, in addition to being a directory of content, it's a storage mechanism. Essentially, it's a place where people can locate, store, and retrieve objects with the intention of performing B2B transactions.

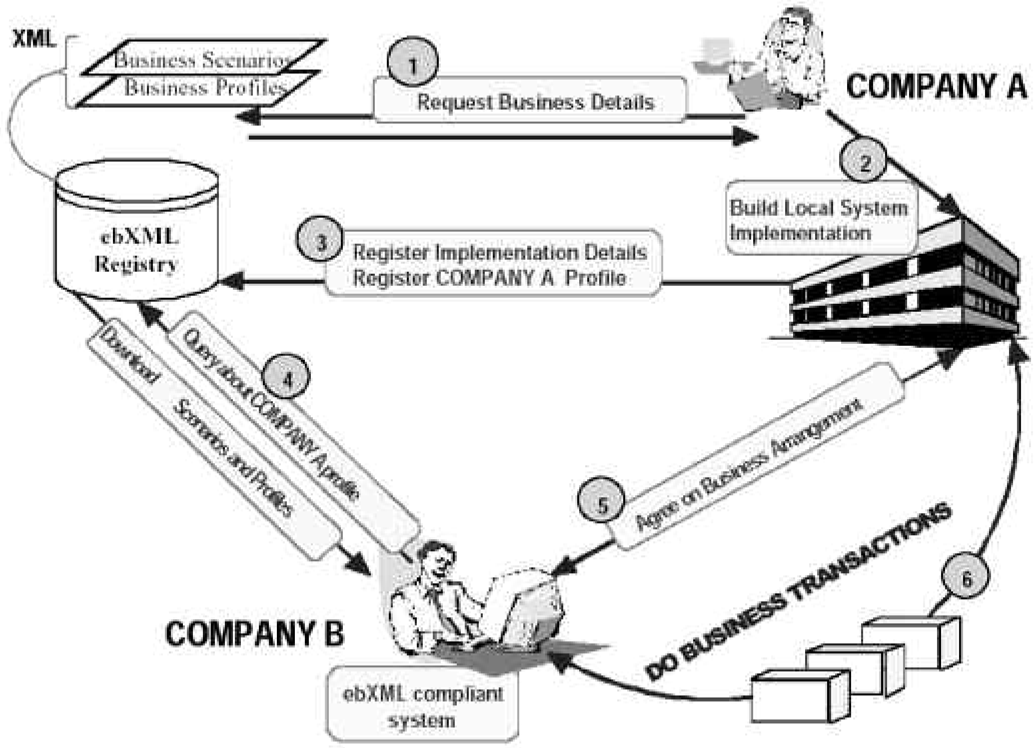


Fig. 3-17 A high level overview of the interaction of two companies conducing e-business using ebXML

Fig. 3-17 A high level overview of the interaction of two companies conducing e-business using ebXML" (www.ebxml.org) shows a high - level use case scenario for two Trading Partners, first configuring and then engaging in a simple business transaction and interchange (www.ebxml.org). This model is provided as an example of the process and steps that may be required to configure and deploy ebXML Applications and related architecture components. These components can be implemented in an incremental manner. The ebXML specifications are not limited to this simple model, provided here as quick introduction to the concepts. The conceptual overview is described by the following concepts and underlying architecture:

- A standard mechanism for describing a Business Process and its associated information model.
- A mechanism for registering and storing Business Process and Information Meta Models so they can be shared and reused.

Discovery of information about each participant including:

- The Business Processes they support.
- The Business Service Interfaces they offer in support of the Business Process.
- The Business Messages that are exchanged between their respective Business Service Interfaces.
- The technical configuration of the supported transport, security and encoding protocols.
- A mechanism for registering the aforementioned information so that it may be discovered and retrieved.
- A mechanism for describing the execution of a mutually agreed upon business arrangement which can be derived from information provided by each participant from item 3 above. (Collaboration Protocol Agreement CPA)
- A standardized business Messaging Service framework that enables interoperable, secure and reliable exchange of Messages between Trading Partners.

- A mechanism for configuration of the respective Messaging Services to engage in the agreed upon Business Process in accordance with the constraints defined in the business arrangement.

Company A has become aware of an ebXML Registry that is accessible on the Internet (Figure 3-17, step 1). Company A, after reviewing the contents of the ebXML Registry, decides to build and deploy its own ebXML compliant application (Figure 3-17, step 2). Custom software development is not a necessary prerequisite for ebXML participation. ebXML compliant applications and components may also be commercially available as shrink-wrapped solutions.

Company A then submits its own Business Profile information (including implementation details and reference links) to the ebXML Registry (Figure 3-17, step 3). The business profile submitted to the ebXML Registry describes the company s ebXML capabilities and constraints, as well as its supported business scenarios. These business scenarios are XML versions of the Business Processes and associated information bundles (e.g. a sales tax calculation) in which the company is able to engage. After receiving verification that the format and usage of a business scenario is correct, an acknowledgment is sent to Company A (Figure 3-17, step 3).

Company B discovers the business scenarios supported by Company A in the ebXML Registry (Figure 3-17, step 4). Company B sends a request to Company A stating that they would like to engage in a business scenario using ebXML (Figure 3-17, step 5). Company B acquires an ebXML compliant shrink-wrapped application.

Before engaging in the scenario Company B submits a proposed business arrangement directly to Company A's ebXML compliant software Interface. The proposed business arrangement outlines the mutually agreed upon business scenarios and specific agreements. The business arrangement also contains information pertaining to the messaging requirements for transactions to take place, contingency plans, and security- related requirements (Figure 3-17, step 5). Company A then accepts the business agreement. Company A and B are now ready to engage in eBusiness using ebXML (Figure 3-17, step 6).

The Registry provides a stable store where information submitted by a Submitting Organization is made persistent. Such information is used to facilitate ebXML-based Business to Business (B2B) partnerships and transactions. Submitted content may be XML schemata and documents, process descriptions, Core Components, context descriptions, UML models, information about parties and even software components. A Registry is a component that maintains an interface to metadata for a registered item – a previously submitted content. Access to an ebXML Registry is provided through Interfaces (APIs) exposed by Registry Services.

The Registry Information Model provides a blueprint or high-level schema for the ebXML Registry. Its primary value is for implementers of ebXML Registries. It provides these implementers with information on the type of metadata that is stored in the Registry as well as the relationships among metadata Classes.

3.18.4 Tracking & Tracing in GILDANET

In GILDANET an architecture based on the EPCglobal (Electronic Product Code) model has been developed to make possible the exchange of information about objects collected by means of a number of ways and technologies.

The numbering scheme Like the bar-coded numbers of a Universal Product Code (UPC), an EPC identifies a product and its manufacturer. But an EPC also includes a serial number that uniquely identifies the item to which the RFID tag is attached. The EPC has a header, which tells an RFID reader whether the tag is a 64-bit or a 96-bit EPC, and three sets of data, which identify the manufacturer, the product and the item 's unique serial number. By separating the EPC data into partitions, RFID readers can search for items with a particular manufacturer code or product code.

The middleware: This is the software that enables data exchange between an RFID reader — or network of readers — and the business information systems, such as enterprise resource planning applications. The middleware differs from most enterprise middleware in that it uses a distributed architecture and is organized in a hierarchy that manages the flow of data.

The Object Name Service (ONS) This provides a way for business information systems to match the EPC to information about the associated item. The ONS is an automated networking service that points computers to information about a product associated with an EPC. It's based on the Domain Name Service (DNS), which points computers to Web sites on the Internet.

Companies will need to maintain ONS servers locally, so they can quickly retrieve stored information as the need

arises. To enable this, the ONS has two layers. The first layer, called the root ONS, is the authoritative directory of manufacturers that may have product information available on the EPC Network.
The second layer, called the local ONS, is the directory of products for that particular manufacturer. This layer handles queries directed to the manufacturer. So when a tag is read, Savant middleware would go to the root ONS to get the network location of the local ONS for that manufacturer. The ONS then directs the middleware to a specific server where data about that item is stored. The Savant can retrieve that information and forward it to an organization's supply chain applications.
The Information Services (EPCIS): Formerly called Physical Markup Language (PML) servers, EPCIS — a system that stores, hosts and provides access to EPC-number-specific product information across the Internet — enable organizations to exchange data with their trading partners based on EPCs. Product information will be stored in PML, a variant of XML.
The EPC Discovery Service: This network service is designed to allow a company to identify every reader that has read a particular EPC tag, anywhere in the world. It's designed for track and trace and other applications that are critical to achieving a return on investment in EPC technology.
When a particular item's information is added to a manufacturer's EPCIS, the knowledge that this data exists in the company 's EPCIS is passed to the EPC Discovery Service. When the item leaves the manufacturer's facility and arrives at the next point in the chain, this information is automatically registered with the receiving company's EPCIS and the EPC Discovery Service. When track-and-trace information is required for an item*, the Discovery Service provides a list of each EPCIS that contains information about that item. Then each EPCIS can be queried so the information can be aggregated into the complete chain of custody*.

3.18.5 T&T in the contecxt of Multimodal Transport Chain Monitoring

The Multimodal Transport Chain Monitoring System (MTCMS) provides the functionality for Tracking and Tracing cargo in the intermodal freight transport chain. In that context the system not only allows its users to monitor transport order throughout the transport chain, but it is also capable of performing calculations for possible deviations from scheduled plans. The information for these calculations can derive from various sources, such as external Transport Chain Planning Systems. In case the system notices deviations that exceed certain limits it is capable of creating respective alert messages in order to notify all interested parties involved in the freight transport chain. Moreover, in order to be secure the system must ensure that only authorized users will access its functionality and data, thus apply additional security mechanisms. Finally, since it interacts with the GildaNET platform and must disseminate any calculated information to the rest of the actors of the freight transport chain, it provides a number of interfaces to be used in that scope.
In order to be secure the system must ensure that only authorized users will access its functionality and data. Finally, since it interacts with the GildaNET platform and must disseminate any available information to the rest of the systems, it provides a number of interfaces to be used in that scope.
The Hierarchical Model presents the functionality of the MTCMS decomposed at the appropriate modules. The Hierarchical Model is nothing more that a tree of functions and processes introducing the modules involved to the functionalities and services of the system. The functionality of the MTCMS can be divided in three areas:

- F.1 Validation: The first area has the responsibility to validate and parse all incoming information, received from various parties of the intermodal transport chain, as well as to assess the impact that potential delays and incidents have on predefined schedules of the transport chain activities.
- F.2 Short term Forecasting: The second area calculates all available ETA and ETD, as well as forecasts delays on specific parts (nodes) of the transport chain that may affect the transport progress of the chain.
- F.3 Administration: The third area has an administrative (internal) role within the MTCMS. Its main purpose is to authenticate users that wish to handle incoming messages, perform any required actions on the local DB such as updating and maintenance, etc.

3.18.6 Delivery Planning

The Delivery planning process is essential in the way that it initiates the lifecycle of the truck deliveries as they are being managed through the Fleet Management Application. Its main function is the allocation of available resources such as trucks, and terminals to the inserted delivery requests so that deliveries are created and forwarded to the next phase.
Delivery requests represent groups of product deliveries that have to be transported from an origin point to a

destination point. An origin point is usually a warehouse, which belongs either to the transport company that manages the deliveries or to the client itself. The destination point is most of the times the End Customer's premises. The destination point can also be the transport company's warehouse, but as far as the FMA application is concerned, this is also regarded as End Customer. There can even be scenarios that a whole transport chain can be set up where each leg's destination node is the origin node of the next leg. The FMA can handle the truck delivery transport chain as a series of interconnected origin–destination legs. The following figure illustrates all the possible types of delivery scenarios:

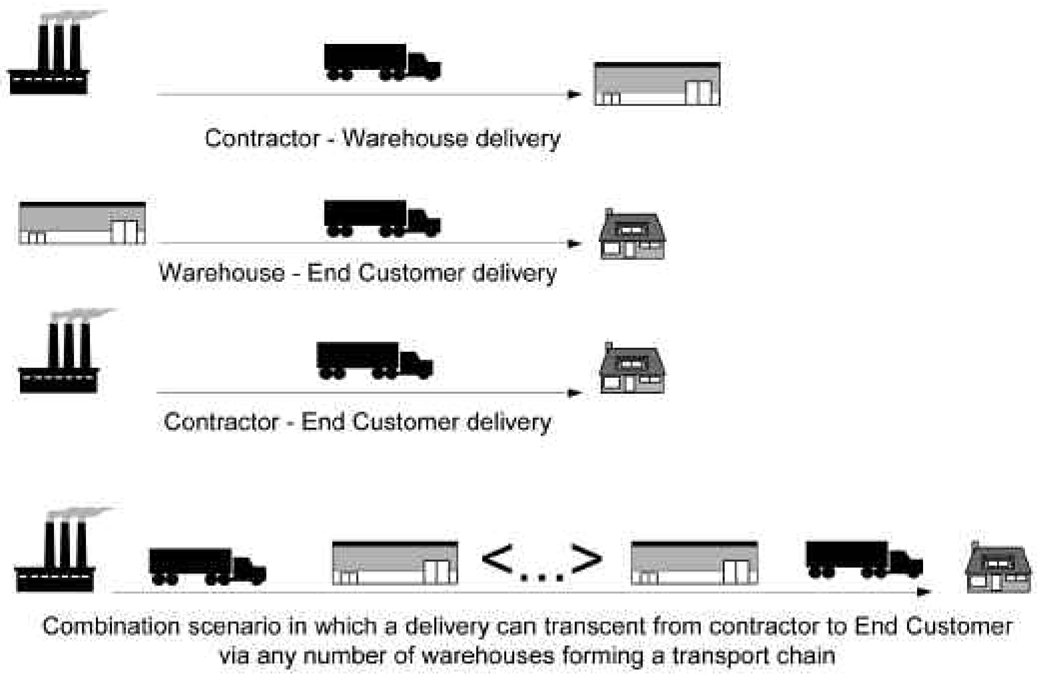


Fig. 3-18 Combination of Scenarios for delivery

3.18.7 Delivery Execution

The "Delivery Execution" functional area is responsible for the effective transportation of goods from origin to destination by registering each shift in delivery status to the appropriate tables into the database. Delivery execution stages are performed in an asynchronous manner so that other systems such as the Monitoring may intervene and request status information for one, or a group of deliveries before they finish their execution process. The phases from which a distribution can pass are:

Receipt: The driver goes to a place of origin in order to load the freight.

Delivery: The driver goes to a place of destination with freights that he has already loaded in order to deliver them**.**

Cancellation/Invalidation: The distribution is cancelled and the server receives a pre-selected justification message that it hasn't been processed.

The sequence of Receipt/Delivery phases must be strictly kept. There is no case to deliver without receipt, or to accomplish a distribution without the delivery taking place. «Exceptions» are the cases that the place of origin or destination is a transport company's warehouses and the distribution has marked with check status (POD Level 0). In that particular case, only the one of two phases is executed.

The Delivery Execution functional area interacts with various types of actors. This section is primarily designed to receive validated deliveries from the planning phase. Upon reception from planning, deliveries can be scheduled for execution according to their priority level. This allows for time-critical deliveries to be sent upon to the mobile terminals applications for execution regardless of any other possible deliveries waiting in queue. The possible levels of priority a delivery may have are the following:

Low **Priority:** Sent delivery only if no other deliveries are waiting in queue.
Normal Priority: This is the default level of priority. It means to put the delivery into a queue and wait to be executed on a "First come, First served" basis.
High Priority: This always puts the delivery to the top of the queue so that it is the next one to be sent to the corresponding mobile terminal application. In the case that multiple High Priority deliveries are sent to the queue, the one sent last, will be the first one to be sent to the mobile terminal application for execution.
The administrator user can log into the system any time and intervene at will with the scheduling of the deliveries in queue.
Delivery requests, which have been promoted into full deliveries by their association with a truck, are marked accordingly and wait to be executed. Execution takes place on a mobile terminal application, which is controlled by a truck driver. The mobile application pulls pending deliveries from the delivery queue waiting on the server and stores them locally for execution. According to the checking level of each delivery, the mobile application sends back to the execution control one or more confirmation messages for every shift in delivery execution phase. The database is then notified with the updated statuses for these deliveries so that other systems or functional areas may query the current phase of them via the corresponding web services.
Apart from the input received from the planning area, the delivery execution area is designed to receive input from external systems via the use of specific web services. This serves as a bypass method for MISs that are already equipped with a routing system. The respective external system may request its allocated trucks from a web service setup in Planning area, and perform the routing and matching internally. Afterwards it can send these pre-processed deliveries directly to execution via web services so that they are scheduled and sent to the mobile terminals directly.
The delivery execution is not regarded complete and closed until another distinct actor comes in and provides his input. This actor is the end customer. When the end customer receives the goods from the truck, he is required to log into the system and provide feedback about the quality of services, the actual quantity of the goods delivered or the reason the quantity of goods delivered is not the one expected. Once the end customer submits the confirmation info, the delivery is marked executed and its details are moved for archiving in the data warehouse system. Regarding the delivery, a notification message is sent towards the monitoring subsystem, which is used to push the delivery details to external systems subscribed to the FMA Monitoring service.
Order Monitoring: The Order Monitoring Functional Area serves as the interface of the FMA application with the outside world, so that users or external systems have a clear view of each status and phase of inserted deliveries. The order monitoring area provides the set of functions and rules for retrieving information about the two specific entities managed by the FMA application. The entities are:
Delivery Requests monitoring: Provides monitoring information to users and external systems about their submitted Request Deliveries. Information may contain the delivery's details, cargo amounts etc.
Truck Deliveries monitoring: Provides monitoring information to users and external systems about the status of deliveries. Information may contain all the aforementioned details found in a delivery request, plus the associated truck, the current phase etc. All actors requiring monitoring information from the FMA system must be first validated at the GIPO platform. Once they are provided with a valid session token, they can log into the respective services to monitor and observe the progress of their submitted deliveries. There are mainly three access methods providing monitoring information about the status of deliveries. These are:
Thin Client Access: This is the typical access method for a user of the system. The user logs into the GIPO platform to receive a valid Session ID, and then his browser is redirected to the specific monitoring page to retrieve information about his delivery.
M2M Interface: This is the federated approach for providing information about a delivery in a way that can be processed and presented externally of GILDANET. This web service interface can deliver monitoring information upon request to external systems in XML format so that they can easily extract and process that information for their own data consumers.
E-Mail: This method corresponds to the push notification subscription service supported by the Order Monitoring functional area. Validated users may submit their email addresses to the FMA subscription service so that once one of their deliveries has finished execution, an email is sent to them in order to get notified about the completion of deliveries at the shortest possible amount of time. The triggering for the dispatch of the notification email comes from the Delivery Execution functional area at the time when the End Customer confirms the delivery of the transported goods.

Naturally, the access to the delivery information provided by the Order Monitoring is not context-free. Each validated user is associated with an access level. The access level, provided by the GIPO platform, dictates to the system what deliveries an actor has rights to access and what he hasn't. When a client performs a request on the Monitoring system for a specific delivery, the respective module, contacts the GIPO platform and validates the client's access level with the one provided by the platform.

If the client does indeed have sufficient rights to access that piece of information, the corresponding module fetches all related info from the database.

Administration: The Administration Functional Area serves the purpose of providing the means and functions to manage the FMA's data resources via a specific, thin client interface. Apart from managing the database entries for the main data structures of the system, the Administrator can log into the FMA as a super user with access that transcends the context of any normal user allowing him to perform tasks over all data stored in the database. As with every actor in the FMA system, the administrator has first to log into the GIPO platform before he gains access to the administrative functions. The thin client interface provides managerial services to the main resources available to the system. The administrative functions are:

1. Clients **Administration:** The clients administration function is used for registering clients and their companies to the system. A client account has to be associated with a specific set of companies before it is able to access the planning and monitoring functions. Since the FMA's user accounts are stored in the GIPO platform's internal database, the clients administration function retrieves the list of clients to be associated with registered companies through the use of a related interface (web service).
2. Truck Terminals **Administration:** The truck terminals administrative function is responsible for the management of truck resources. Trucks can be added or removed from the system, so that deliveries can be assigned to them. Trucks must also be associated with a client account, so that users can relate deliveries to their own managed pool of trucks for deliveries.

   The administrator has also an interface to eliminate deliveries for a specified truck In the cases that a truck breaks down and cannot fulfil its scheduled deliveries, the administrator is able through this function to eliminate all its related deliveries, allowing for redirection and rescheduling.

   Apart from managing the resources available to the users of the system, the administrator has also the privilege to log into the GIPO platform in the regular user context and gain access to the delivery planning and delivery monitoring functional areas. His advantage is that he is not restricted by the rules imposed to the normal users, therefore he can plan deliveries for every company, with any truck, as well as monitor any activity of any truck without restriction imposed by the associated company.

3.18.8 Rail transport planning and monitoring System in GIldanet

The Rail Transport Planning And Monitoring System provides the functionality for managing shipment actions throughout the transport chain. The functionality contain actions such as train composition and trip planning, reports regarding trains' schedules, as well as dynamic calculation such as ETA and total trip durations. In order to be secure the system must ensure that only authorized users will access its functionality and data. Finally, since it interacts with the GildaNET platform and must disseminate any available information to the rest of the GILDANET integrated platform systems, it provides a number of interfaces to be used in that scope.

System Functions: The system consists of the following modules:

F.1 Access Rights Validation

F.2 Transport Chain Management

F.3 Information Dissemination

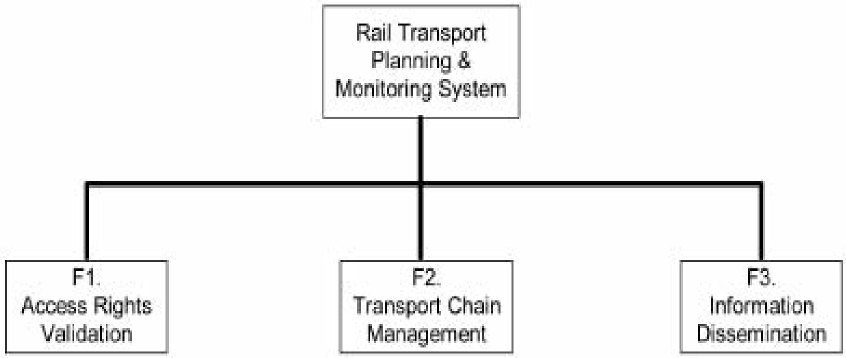


Fig. 3-19 Functional Analysis of the Rail Transport Planning And Monitoring System

F.1 Access Rights Validation This module aims at guaranteeing access to the system and available information only to authorized users. Security measures preventing unauthorized access to the platform and specific information sets having been applied in two levels:

- The first one concerns the control of the access to the system's environment;
- The second level concerns the access to specific information sets.

F.2 Transport Chain Management: The main purpose of this module is to calculate dynamic elements concerning the shipment's progress. Some characteristic elements are:

- Train composition and trip planning
- Regular updates regarding ETA for trains / cargo
- Updates regarding train / cargo status
- Deviation Report with regard to the predefined trains' schedule
- Total trip duration

The data required in order to calculate such elements is retrieved from the local database, where all incoming messages sent by the various parties are stored. Since the authorized parties constantly update the system, such information is dynamically calculated and updated on a continuous basis. For example, the basic data needed for the calculation of ETA is included in the status messages sent from the various nodal points of the transport chain. Each time such a message arrives the ETA in the next node of the transport chain is updated automatically.

F.3 Information Dissemination: The main purpose of this module is to provide the necessary interfaces in order to disseminate all the available information to the rest of the systems of the platform. Such information can be:

- Cargo and wagon monitoring information;
- Physical and administrative cargo management information.

The required input for the above is deriving either from incoming messages or from several internal calculations performed by the system. The transmission of information by the system can be performed only if the customer is an authorized user of the platform. For this reason, the module is interfaced with module F.1.

3.19 Conclusions

The PORTNET Study about EDI and Cargo Flows in the Mediterranean Sea reports about the flows of freight, mainly containers, in the Mediterranean Sea.

The fragmentation of ports, freight villages and interports is the weak and strong point of the logistic community in the Mediterranean area. The lack of infrastructures is not the key element in the perspective of a growth of traffic in terms of container, while the lack of communication could help an improvement of the communication among different operators for an improvement of the global efficiency of a complex transport chain.

Information Management and EDI systems in freight transport is an outstanding issue for the efficiency of transport intermodality at transnational level. Technology innovation enables new opportunities, BUT the logistic chains should define and adopt new efficient business models together with the main intermodal nodes.

The ***e_logistics*** is the silver bullet for companies and public administration because it could offer key advantages if it is the result of an integration of a business processes reengineering. The companies should be ready to change the organisation and follow the growth of IT capabilities and e_business applications could have a positive impact on SMEs adopting the new EDI technologies. There are many different EDI and ICT solutions already available in the market and many of them have been developed for a specific user with a specific business process.

There is a concrete need to have a more complex ICT baseline in which to have SMEs and big operators playing their own role in an electronic way (e-logistics).

This element of interoperability among different ICT applications and systems seems to be the first issue speaking about competitiveness of a transport chain in which dofferent actors have to share information, to send/receive documents and to reuse all kind of data the system could manage except commercial data (related to the specific company).

The study highlighted the relevance of a generic ICT model in order to disseminate the relevance and impact of standardised interfaces among different ICT systems without any specific impact on the final users.

The adoption of standards, such as XML and ebXML, could help the adoption of ICT solutions; at the same time, it could be relevant to speak about the impact of ICT in the business processes to understand and to make clear the benefit for each company in a very long transport chain.

The success of ICT is based on the adoption of the same standard by all the actors of the chain; it will happen only if there will not be the necessity to invest money for changing the actual systems and if all the information available could be reused in the future. The Study proposes a generic framework to be promoted towards final users and technology providers with the attempt to explain the benefits for all the actors in adopting such a model.

In the Appendix of the study (see www.port-net.net) , a subset of available services has been analysed with the scope to demonstrate that there are ICT services available and ready for specific usage, while there is a lot of work to do for a common open platform in the area of multimodal supply chain management.

4

The Rail and Road Freight Transport in the Co-Modality Approach

Andrea Campagna[1] and Francesco Filippi[2]

The EU transport policy has the objective to improve transport systems in terms of performances, environmental impact, safety. In particular, co-modality is foreseen to be the proper solution to optimize each mode and the use in combination. Road and rail freight transport efficiency can be improved. The increase of capacity and the use of Information and Communication Technology can reduce operational costs, improve safety, improve the service quality and allow modal shift from road to rail.

Keywords: road freight transport, rail freight transport, ICT, co-modality.

4.1 Objectives

The present paper intends to illustrate some of the current practicable improvements to road and rail freight transport, trying to identify how these modes can be more efficient. Pros and cons of each of them will be analysed, and finally the possibility of application of the EU co-modal approach will be investigated.
After the necessary background focusing on the current trends in the EU freight transport, the paper introduces respectively some possible improvements in the road and in the rail freight transport based on experiences in Europe and in America.
Finally the road and rail freight transport will be analysed within the co-modality approach, in order to also identify the possibility of modal shift, from road to rail, in conjunction with the optimization of each mode.

4.2 Background

The 2006 mid-term review of the White Paper (2001) of the European Union on transport confirmed the rapid development of the EU transport policy over the past 15 years. Nevertheless the EU confirms its main objective to provide Europeans with efficient, effective transportation systems that offer a high level of mobility to people and goods throughout the Union; are environmental friendly, and ensure energy security; increase the efficiency and sustainability of the growing transport sector [1].
The growth of goods transport within the EU, at a rate of 2.8% per year, was broadly in line with economic growth, which was 2.3% on average in the period 1995-2004. Overall, goods transport grew by 28% during the period 1995-2004, with transport by road growing by 35%. Rail freight transport in those Member States that have opened up the rail market early showed a bigger increase compared to the other countries. Overall, rail freight transport grew by 6% in 1995-2004. For the period between 2000 and 2020, forecasts establish that freight transport is expected to grow at 50% for the whole period. Although a major contributor to growth, transport also involves a cost to society. Its environmental cost is estimated at 1.1% of GDP. This includes emissions and safety of transport. Efforts are required to face these impacts while achieving the goals of meeting growing mobility needs. Tools for an overall sustainable transport approach are needed. The following evident aspects have emerged in the recent years:

- the road sector has experimented benefits from the internal market;

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- the need to disconnect mobility from its negative side effects is a priority to be faced by means of policy tools;
- the need of infrastructures to alleviate environmental pressure on specific corridors is clear;
- the potential for technology to make transport more environmentally friendly has to be enhanced;
- the shift to more environmentally friendly modes must be achieved, while ensuring the optimization of each transport mode.

Consequently, the following expectations can be stated:

- the rail transport will probably benefit from the internal market, due to the EU policies which will enhance the efficiency of the mode, making it more competitive on longer routes;
- transport policies will be developed to achieve clean and efficient transport systems through the optimization of each mode's own potential;
- a new approach to make an optimal and sustainable use of resources has to be adopted; this is co-modality, the efficient use of different modes on their own and in combination [1].

4.3 Improvements in the road freight transport

The largest share of intra-EU transport is carried by road, which accounts for 44% of freight transport. Demand factors, such as a reduction in heavy bulk transport and the increasing importance of door-to-door and just-in-time service, undoubtedly contributed to the strong sustained growth of road transport [1].
A key strategic element to improve the road freight transport efficiency may be the increase of dimensions (size and weight) of vehicles. This can also meet the needs of an intelligent logistics, also contributing to shift freight from roads to other modes. In this context, some issues have to be considered as reported in the following sections.

4.3.1 The US truck size and weight (TS&W) projects

The research on truck sizes and weights has been carried on for several years in the US. As an example, a TS&W project ended in 2005 in Minnesota [2] studied the effects of an increment in the dimensions and weights of trucks. Some of the key findings of the US project, relevant to the European situation, are the following:

- There is greater surplus brake capacity for vehicles with more axles.
- Adding axles to a truck can reduce the impact on road pavement.
- Lack of consistency among states creates barriers to cross-border freight movement.
- There needs to be increased flexibility of weight limits and vehicle configurations to allow greater payloads.
- There are concerns about the infrastructure impacts (local roads and bridges), and about safety (increase of crash rates and severity).
- Technology enhancements can improve the safety performance of heavy trucks.

Finally, the main benefits of the increment of dimensions and weight of heavy trucks are:

- Increased payloads and fewer truck trips will lower transport costs significantly.
- Additional axles and fewer truck trips will result in less pavement wear.
- A modest increase in bridge postings and future design costs will be necessary.

Proposed trucks have slightly higher crash rates but, given fewer overall truck miles (due to increased payloads) than would be experienced otherwise under existing weight limits, safety would improve slightly.

4.4 The research in Europe on truck dimensions

Past European studies, also based on the US longer experience, have demonstrated that increasing the legal maximum weight of trucks enables companies to consolidate loads and thus reduce the amounts of vehicle movements required to distribute a given quantity of freight.
Under certain conditions, this can yeld both economic and environmental benefits. In UK during 2003, 44tonne trucks travelled 22% of their laden-kms with loads constrained only by weight. This suggests that remains some potential for consolidating loads in even heavier vehicles, particularly in those industrial sectors producing and distributing dense products such as coal, drinks, petroleum products and timber [3]. The maximum authorized

dimensions that are allowed for national and international traffic and the maximum weights and dimensions that are allowed for certain vehicles in international traffic were prescribed in the EU Council Directive 96/53/EC of May 25th 1996.
Articulated vehicles, composed of a tractor and a semi-trailer, are dominant in international traffic within the EU. Their regular loading capacity, of about 85 m^3 and 26 tonnes is provided by a 13.6 metre long semi-trailer.
Also road trains, consisting of a lorry and a trailer, are used. The loading capacity of the road train combination is dependent on the type of trailer used and the length of the draw bar between the cargo units. In general the maximum loading capacity for a road train is 26 tonnes in weight. The maximum loading capacity in volume is approximately 96 m^3. If the cargo consists of a 40-foot ISO container the total weight of the semi-trailer combination may be 44 tonnes in international transports. Some European countries have positively experienced for years Longer and Heavier Vehicle Combinations (LHV). The most common combination for national transports in Sweden, Finland and Norway are road trains. The trailers combined with load-carrying lorries in these road trains have different lengths and axle configurations. For international transports the same vehicles are used as in the rest of Europe. The system practised in Sweden and Finland since 1997 is based on the CEN standardized 7.82-metre long unit load carrier and the 13.6-metre long semi-trailer being the longest single vehicle allowed in EU. The maximum length of this “module” combination is 25.25 metres. This module is also called Euro Modular System (see).

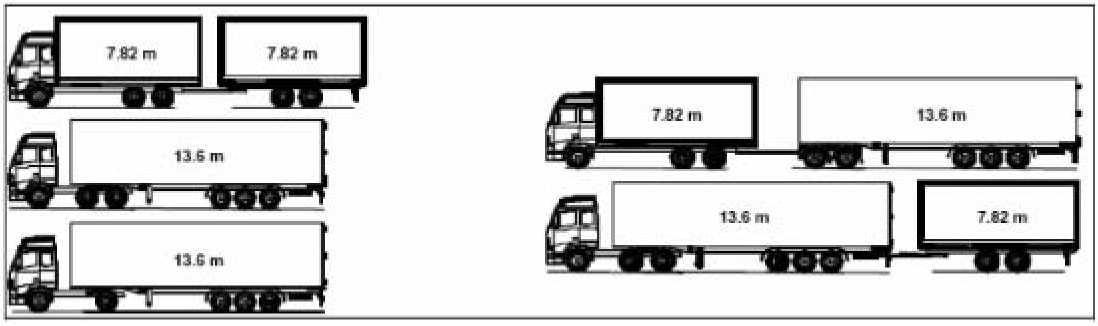

Fig. 4-1 The Euro Modular System (on the right) and the Europe directive module vehicles (on the left).

Source: Volvo.

All cargo units in the system are well adapted for combined transport on rail (20 and 40-foot containers) in either as single vehicles or as separate load carrier units. The modular combination is built on existing vehicles and load carriers available in large quantities on the European continent. It has been estimated that if all EU member states adopt the Euro Modular System they would be able to decrease the number of cross-border long-haul trucks by a third, and thus decrease emissions by some 15-20% [4]. According to Swedish government estimates, emissions from heavy-duty vehicles would have increased by 700,000 tons of CO_2 and 12,000 tons of NO_x if Sweden had reduced its 24 metre vehicles for the European standard 18.75m when it entered the European Union in 1995. Recently, LHVs have been experimented in the Netherlands in the period starting the middle of 2004 until November 2006. The experiment [5] allowed to use 60 ton and 25,25 metres LHV in The Netherlands, which are longer and heavier than presently allowed (50 ton and 18,75 m). The main results of the study, limited to The Netherlands, are:

- A certain percentage (up to 30%) of 20 tons vehicles can be replaced by LHVs, which are used for longer and heavier transport more than for longer transport.
- The introduction of LHV’s causes only a limited modal shift.

There is no reason to assume that a LHV has a higher safety risk compared with a regular vehicle combination. Since LHVs reduce the number of mileages, the traffic safety can increase.

- The use of LHVs reduces the number of rides and thereby the total mileages of inland road transport. As a result the fuel consumption of LHVs is lower, compared to regular trucks in case they transport an equal amount of freight. This leads to a small decrease of emissions in exhaust gases and noise.

- The use of LHVs can reduce congestion by 0,7 to 1,4%.
- The total cost reduce in road transport will amount to 1,8 to 3,4%.

With regard to logistics, participants are able to fit in LHVs. Big changes in logistics planning are not required.

- For these reasons, the optimization of road freight transport can be achieved by means of the increase of dimensions of trucks, which also allows to consolidate certain types of freight, improving logistics. This optimisation process can be highly supported by technology, in order to achieve intelligent logistics practice.

4.5 Road Freight Transport and Technology

Information Technology systems can help companies to improve the efficiency of transport and logistics operations and increase profitability. Six key areas can be identified in which IT can lead to effective performance management (see Fig. 42 The six key areas in which IT can lead to effective performance management).

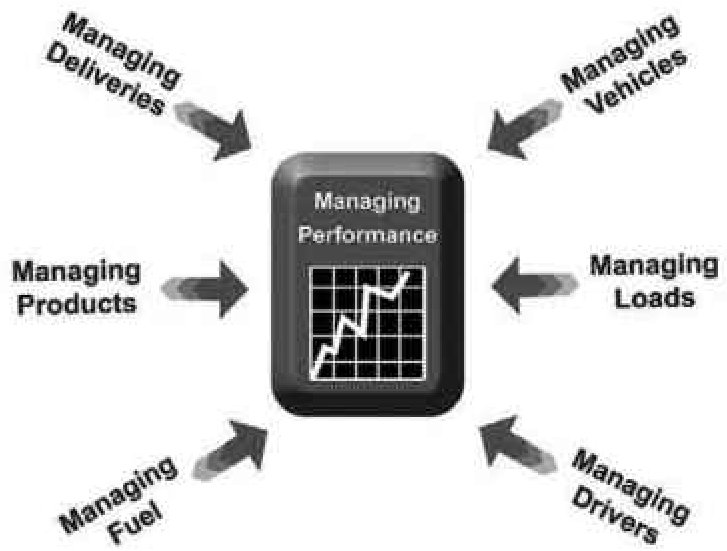

Fig. 4-2 The six key areas in which IT can lead to effective performance management. Source [6].

These six areas are described as follows with an example of related technologies [6].

Managing Deliveries. Planning deliveries can be an extremely complicated task, even for small transport operations, and IT is used by companies to utilise vehicles more productively and reduce administration costs. Example applications: *Paperless Manifest/POD Systems, Online Freight Exchanges, Traffic Information Systems, Simple Journey Planning Tools, Computerised Vehicle Routing and Scheduling Systems*.

Managing Vehicles. The IT systems available for managing vehicles are often referred to collectively as telematics. Telematics can help to track assets, allow to communicate with drivers and better manage delivery paperwork and vehicle maintenance, and provide information on the performance of vehicles and drivers. Appropriate use of telematics can lead to significant improvements in fleet productivity and efficiency, and reduce fleet mileage, costs and fuel consumption. Telematics can also reduce the environmental impact of truck operations and improve safety. Example applications: *In-cab Communication Systems, Vehicle Tracking Systems, Satellite Navigation Systems, Vehicle Diagnostics Systems*.

Managing Loads. The load carried by a vehicle gives rise to a need for information across a range of different areas. Trailer tracking, temperature control, load weighing and load and vehicle security systems can help protect assets and loads and ensure legal compliance. Example applications: *Trailer Tracking Systems, Telematics-based Temperature Control Monitoring Systems, Vehicle Weighing Systems, Security Systems*.

Managing Drivers. The best vehicle technology in the world is limited if the driver - the person who can really make a difference to service delivery and fuel consumption - is not properly managed. By managing drivers effectively and productively, improvements in the efficiency can be achieved. IT systems can also help you to comply with drivers' hours regulations. Example applications: *Driver Information Systems, Digital Tachographs and Hours Compliance Tools.*

Managing Fuel. A fuel management programme can be extremely beneficial as it will enable effective monitoring of fuel and reduce the amount of fuel a company uses, not only saving money but also reducing the effects on the environment. Example application: Fuel Recording Systems.

Managing Products. More efficient product management can improve the movement of goods into and out of warehouses and ensure better movement of raw materials and goods between suppliers and end-users. This can help reduce inventories, order errors and the need for return, as well as more general administration and handling requirements. Example applications: Warehouse Management Systems, Voice Picking Systems, Product Scanning and Tracking Systems - Radio Frequency Identification (RFID), Supply Chain Planning and Management Systems.

4.5.1 Improvements in the rail freight transport

A re-balancing of the rail freight transport is required by the European policy, in order to face the growing road congestion, the dependency from oil, and the transport safety. The opportunity to take advantage of the continental dimension of Europe is compromised by the difficulty of railways to quickly respond to current needs. European railways have focussed their attention on always greater costs, mainly dependent on their organization, and not on service quality. Customers require integration with the other transport modes and with logistics services in order to have a seamless transport service. Railways are also congested, as road, and passenger transport is prioritized on freight. Application of ICT is not diffused, most of operations are hand-made. Border crossing remains a problem in terms of costs and time.

Nevertheless, the European Commission has recently stated [1] that the rail freight transport decrease has stopped since 2001, while in some countries it has registered a growth. Other positive indicators are the increase in productivity and a more efficient use of transport capacity. In order to compete with the other transport modes, railways have to considerably reduce tariffs, improve reliability of delivery times, improve cars availability, and make ad hoc investments in infrastructures.

4.5.2 Reduction of tariffs

A considerable reduction of tariffs can be possible, if we compare the railway systems tariff of some OECD countries, as depicted in.

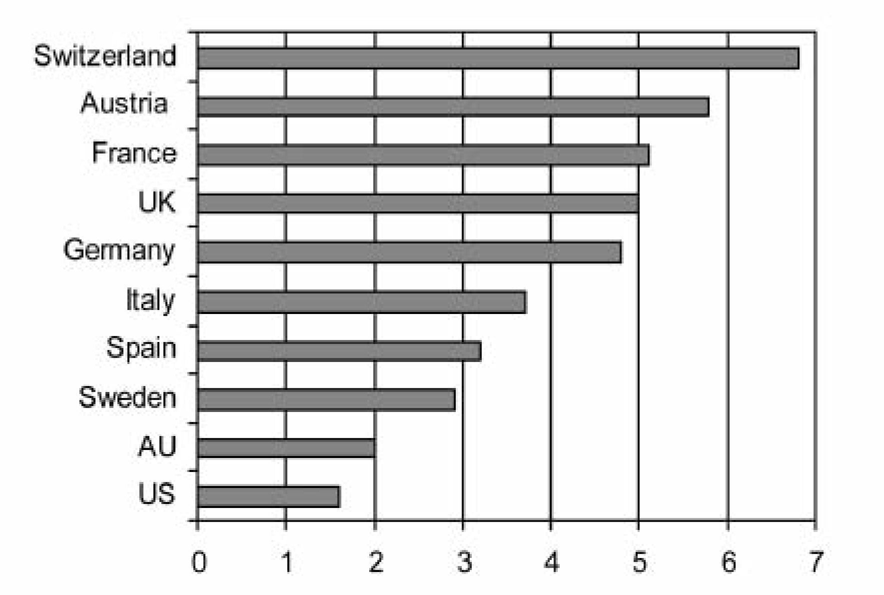

Fig. 4-3 Railway tariffs in some OECD countries ($/100 per tonn-km).Source [7].

These tariffs show very diversified costs. European rail companies have delayed restructuring processes, use of technology, reduction of personnel, and the development of a customer oriented culture, leveraging their condition of monopolist and the support of government.

4.6 Railways and Technology

The European Commission has started the process of deregulation and competition in the rail transport. Effects are delayed by many rail companies, which are trying to maintain their privilege and avoid the competition of new private operators.

Technology can help in two key sectors of the rail system:

- Train operation, traction and rolling stocks.
- Train control and ICT application.

The first sector is more traditional but not least important for research and developments in the rail system. The increase of work productivity can be achieved by the increase of the transport capacities. This is true for all the transport modes. Long, heavy and high-volume trains greatly reduce costs, as is already evident in the American railways. The increase of the length of trains allows to reduce frequencies or to increase transport capacity.

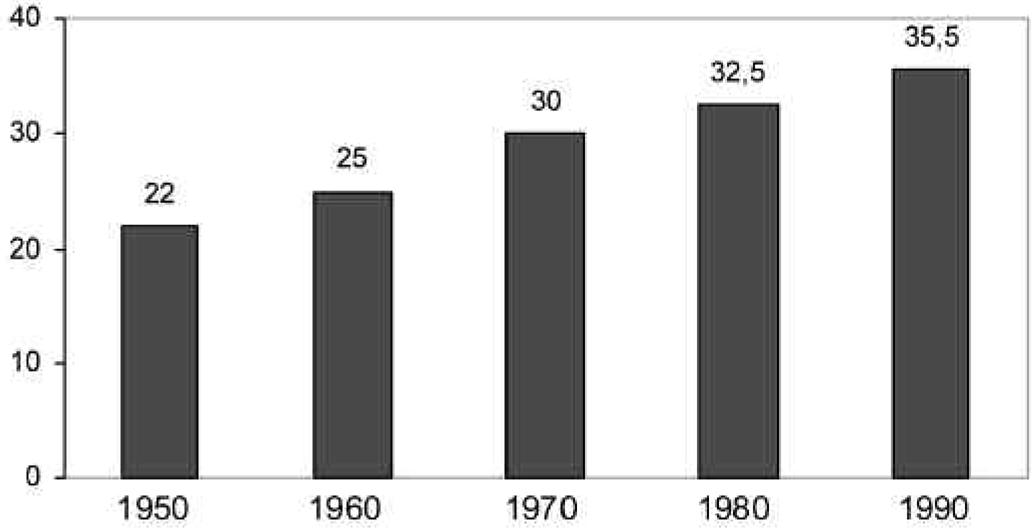

Fig. 4-4 Increase of load (tons) / axle in US railways. Source [8].

The load per axle in the European railways is between 22 tonn, as in US during 50s (see) and 25 tonn, as in US during 60s.

Today the European railways have the best performance in Sweden (see), where tariffs are the lowest and iron minerals are transported with trains with 52 cars and 30 tonnes per axle, serving the Malmbanan track. The increase of the load per axle implies higher investments in the rail infrastructure, and higher maintenance costs. Nevertheless these costs can be mitigated if cars with better suspensions and tracks with more endurable materials are used. The economic result is widely positive. It is important that the increase of the load per axle comes with the increase of the payload/tare ratio. In the US railways this ratio increased from 2.7 with 25 tonnes to 3.7 with 35.5 tonnes [8]. The main benefits of the HAL (Heavy Axel Load) system, with the same load, are [9]:

- lower number of trains and train-kms;
- lower consumptions, due to the better payload/tare ratio;
- higher productivity of the insfrastructure, of the rolling stocks and of the workers.

To increase load on trains, also volumes increased in north-american railways, with the use of double-stack vagons (see Fig. 45 Double-deck train in the US).

The use of HAL and double-stack vagons allowes to achieve loads of 10.000 – 20.000 tonnes using up to 5 coupled locomotives, with traction power of 30.000 Hp. By example, an efficient train has 4 locomotives with a total traction power of 15.000 Hp, carries 320 TEUs and is 1.500m long, weigthing 6.000 tonnes.

Fig. 4-5 Double-deck train in the US

The second sector in which technology can help is ICT systems and applications. The Advanced Train Control System is probably the most relevant example of such system, due to its efficiency in safety and in tracks capacity. In general, the use of sensors, wireless and digital communication integrated systems, and onboard computer systems allows considerable improvements in rail operations. These are the basic elements for ICT platforms with innovative applications [10]. The objectives are:

- safety and security;
- increase of capacity;
- increase of productivity;
- improvement of quality;
- performance indicators measurement and cost control;
- reduction of consumptions;
- increase of earnings;
- risk management.

The main systems are illustrated in . The information flows are represented in red and can be supported by traditional systems as the Internet, mobile phones and satellites, in order to communicate with customers. The internal communication is provided by copper cables, optical fibre cables, microwaves, UHF and VHF, Wi-Fi, Wi-Max, NDGPS and the future Galileo system.
The control system is the same both for tracks and trains. Europe is actually separating these two parts of the rail system, thus creating a disadvantage for the integrated application of advanced technological solutions.

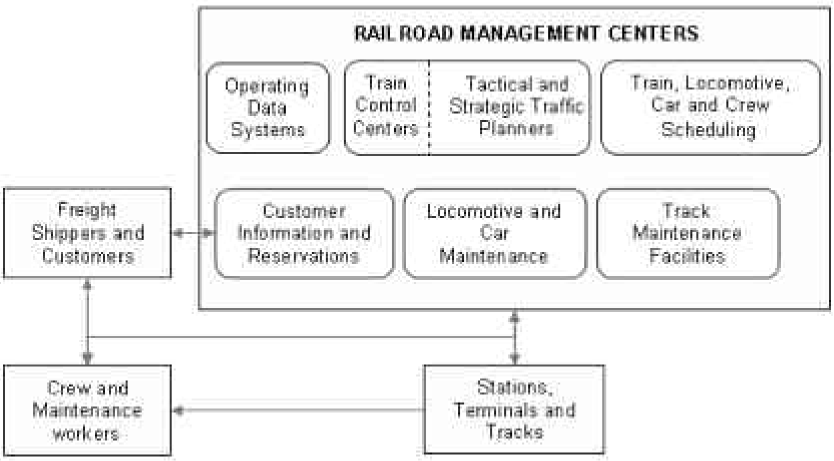

Fig. 4-6 Main components of the ICT system.Source [10].

4.7 Co-modal road-rail freight transport scenario

The above sections illustrated some practicable improvements to road and rail freight transport. These improvements are coherent with the EU transport policy and with the new co-modality approach recently introduced. We can infact consider what follows:

- A greater capacity in road and rail freight transport reduces total costs, can increase transport safety and reduce the environmental impact.
- The use of LHVs can benefit the modal shift from road to rail, allowing to carry 20 and 40-foot ISO containers, which are commonly used in rail transport.
- The use of IT is a key element for achieving co-modality, by improving performances of trucks and trains.

Finally, a possible co-modal scenario is depicted in Fig. 47 Possible co-modal scenario. We consider by example a transport chain from the supplier of raw materials to the manufacturer. These materials can be dense products, for which it is possible to reach high consolidation factors, and which are generally transported by rail [3]. Road transport can be managed with LHVs using 20-foot and 40-foot ISO containers which can be easily loaded on trains. All the transport chain is supported by IT.

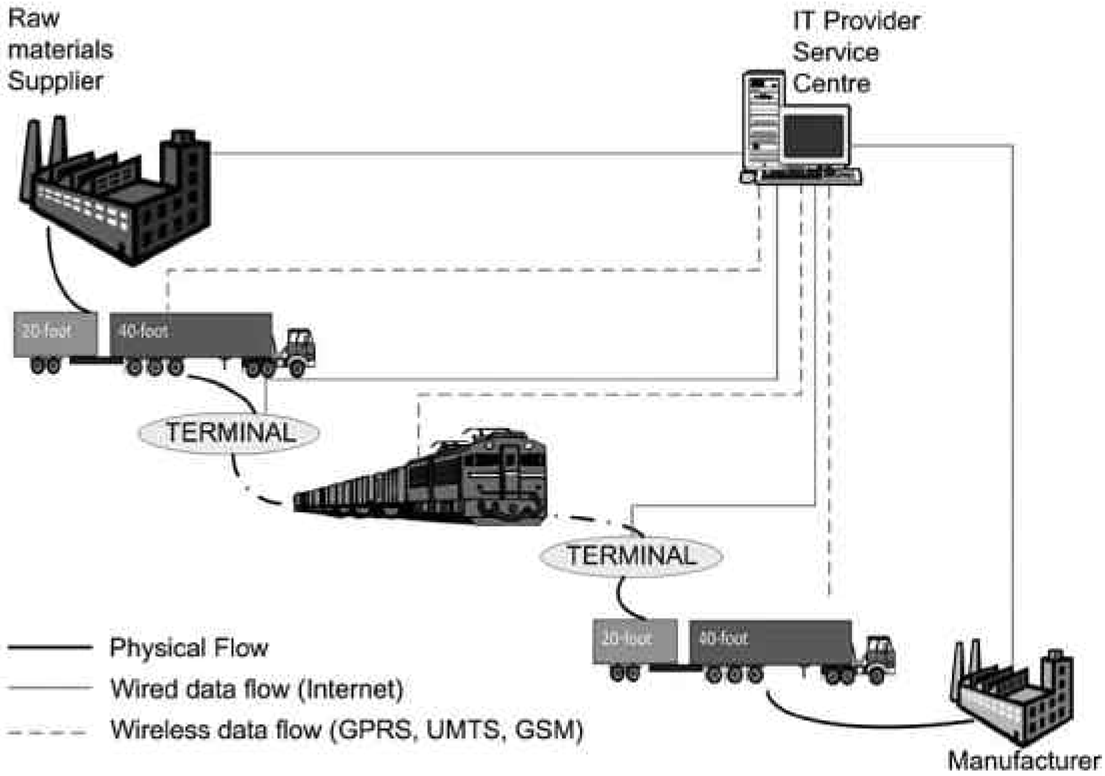

Fig. 4-7 Possible co-modal scenario.

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5

Actions Towards Enhancing the Control of Operations in Ports

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The strong growth of containerised cargo combined with the increased pressure to comply with international security and safety requirements has overloaded manual procedures and practices used to control operations in ports and revealed how inadequate they were. This situation has encouraged inefficient control procedures to be shelved and be replaced by other methods in which technological solutions play a key role in identifying areas of improvement.

This paper presents the main outcomes achieved by Valenciaport through three EU Interreg IIIB MEDOCC projects in which the Port Authority of Valencia and the Valenciaport Foundation have participated: SESTANTE (Telematic tools for the safety and documental efficiency of port and airport logistic chains), MATAARI (Improvement of accessibility to transport and logistic services among urban areas and intermodal centres) and MADAMA (Risk management systems for dangerous goods transport in the Mediterranean Region).
Containers, which first crossed the Atlantic in 1966, had taken over 50% of the general cargo by 1995 and are expected to carry 70% of the cargo by 2010. Globalisation and the China effect have spectacularly increased the east-west containerised traffic volumes. To attend this demand the fleet capacity and vessel size has also been increased with 13,000 TEU vessels on the horizon and more than eight million cellular slots distributed among more than 3,500 containerships in 2006. This strong growth of containerised cargo has been combined with an increasing pressure to comply with international security and safety requirements in ports. Ports, as main international trade point nodes in the European economy, have an important role in implementing solutions that can marry security and safety concerns (as the need of our society to be protected against dangerous or harmful products and the necessity to better integrate security aspects into customs procedures) and trade facilitation.

5.1 SESTANTE Project: Towards a Single Window in ports

SESTANTE project allowed the Port Authority of Valencia to take advantage of its experience in implementing Single Windows in Ports with the support of Information Technologies. This experience started at the beginning of the 90s and has included different administrative requirements in the movement of goods in ports: customs procedures, dangerous goods declarations and vessel formalities. All these initiatives had never been possible without the joint cooperation among Customs, Maritime Authorities, Port Authorities and other governmental agencies.
This kind of approximation in simplifying procedures with the administration is very well aligned with the current policies and initiatives within the European Union and at international level. In fact a specific Recommendation and guidelines on establishing a Single Window was published in 2005 by the UN/CEFACT[3].
During the first phase of the SESTANTE project the data interchanges related to the reporting formalities for ships arriving in and/or departing from ports, the notification of dangerous goods entering or departing from ports and on board vessels and the loading/discharge container manifests were identified as critical points in the administrative procedures and documental flows within the maritime transport chain. This data interchanges were directly related with the three Single Windows (Cargo Declarations, Dangerous Goods and Vessel Port Formalities) established in the Spanish Port System.

3 United Nations Centre for Trade Facilitation and Electronic Business

In order to understand the environment in which the implementation of these three single windows have succeeded in Valenciaport, a briefly presentation of the different Administrations involved in these processes are given bellow.

5.1.1 The Spanish Port System: Port Authorities and the Ports of Estate Public Entity

The state-owned Port System in Spain consists of 44 General Interest Ports, managed by 28 Port Authorities, with the Public Entity “Puertos del Estado” responsible for coordination and efficiency control. Puertos del Estado depends on the Spanish Ministry for Transport and Public Works and is charged with the execution of the Government’s port policy. The legislation provides the Spanish port system with the necessary instruments to improve its competitive position in an open, global market, setting up extended self-management faculties for the Port Authorities, which must be run on commercial business criteria. Within this framework, the General Interest Ports are intended to respond to the ‘landlord’ model, whereby the Port Authority does no more than provide the port land and infrastructure and regulate the use of this public property, whereas the port services are essentially provided by private sector operators under an authorization or concession regime.

Fig. 5-1 Map of Spanish Port Authorities. Source: Puertos del Estado

5.1.2 Main directorate of the Merchant Marine

The Main Directorate of the Merchant Marine is the Maritime Authority. It is a public entity which also depends on the Spanish Ministry for Transport and Public Works and charged with the execution of the Government’s maritime policy, with the following functions:

General legislation of maritime navigation and civil Spanish fleet.

Legislation and execution of pollution prevention, security and technical and radioelectric control and inspections.

Granting of authorisations and concessions of maritime navigation services and tax related issues. This directorate also manages SASEMAR, an organism responsible of search, maritime rescue and pollution prevention in the territorial waters of Spain and the Harbour Master Offices in charge of the following functions, among others:

- ❑ Ship’s clearance
- ❑ Application of different normative concerning maritime navigation
- ❑ Arrival and departure vessel authorisations to/from Spanish territorial waters.
- ❑ Vessel and on board cargo inspections (specially in the case where dangerous goods are involved)
- ❑ Vessel waste disposal control.
- ❑ Vessel anchorage zones management and control.
- ❑ The closing of the port when maritime security risks exist.
- ❑ Pilotage and tugboat service supervision.

5.1.3.The Customs Department

The Customs Department is a public organism dependant on the State Agency of the Tributary Administration (AEAT) in charge, among other functions, of:

- ❑ the management and inspection of the tributes and burdens that fall on the outer traffic,

- the control of legitimate trade,
- the direction and coordination of the fight against customs fraud, and
- elaboration of information, analysis and statistics of the data of foreign trade.

5.2 Single administrative window for summary declarations

Within this context, the first experience of the Port Authority of Valencia in the creation of Single Windows started at the beginning of 90s when this entity, jointly with the Port Authority of Barcelona, started a series of conversations with the Customs Department. The aim of these conversations was the creation of a project which allowed the electronic transmission of summary declarations in import processes between both entities, with the objective of improving their control and management activities.

On the one hand, Port Authorities require this type of information in order to improve their invoicing systems as they depend on the information contained in these documents. On the other hand, the interest of Customs in receiving this type of information resided in facilitating the proceedings to the different operators but, at the same time, maintaining its control over the entrance of goods within the Community Customs territory and fulfilling the requirements established in the Community Customs Code. These conversations laid the foundations for the creation of the COMPAS system, which allowed the electronic transmission of the summary declarations as well as the customs declarations by means of EDIFACT messages. The agreements taken during these meetings allowed to the creation of a pilot project in the Port Authorities of Valencia and Barcelona which demonstrated the viability and convenience of this type of systems. The specifications of the messages involved in the electronic transmission and the systems were developed and became operative in 1992 in the Port Authority of Valencia. At this moment, Customs' systems were not yet completely prepared for the electronic reception of the declarations. So the Port Authority prepared specific interfaces to the Customs office in Valencia in order that they could use the received information immediately. This experience demonstrated to be extremely beneficial for both organizations. Consequently, and after a period of tests of around two years and when the systems of the Tributary Agency were adapted, a ministerial order in 1995 was issued by which the model of summary declaration for the marine traffic settled down fulfilling article 43 of the Community Customs Code (2913/92) which establishes that the merchandise presented in customs will have to be object of a summary declaration. Additionally it was developed the possibility of its presentation and acceptance by electronic means (EDI) by using standardized messages as stipulated in regulation 2454/93.

Additionally, this order established the channels of collaboration between the State Agency of the Tributary Administration and the Ports of the State Public Entity. By this way a single window was created in the port enclosures for the reception of summary declaration that would have effects in both Administrations. In synthesis, Ports of the State act as a collaborating entity of the Tributary Agency, in charge of the reception of the summary declarations, presented as well in paper as through EDI and committing itself to its immediate electronic transmission to the Customs.

This procedure was modified subsequently in 1998 to incorporate some new normative amendments and in 2001 by which the cargo manifest could also be presented by electronic means. The cargo manifest is the declaration that allows controlling the effective departure by sea of the goods from the customs territory of the Community. It also allows the control of transhipments. These controls help Customs to fulfill its obligation in customs monitoring. By this new amendment operators were forced to present this declaration to the Port Authority and to the Customs, being able to be present it by electronic means (

Also, taking advantage of the benefits that supposes the computerization of the management of these declarations (summary declaration and cargo manifests), a simplified system of declaration of transhipments was settled down.

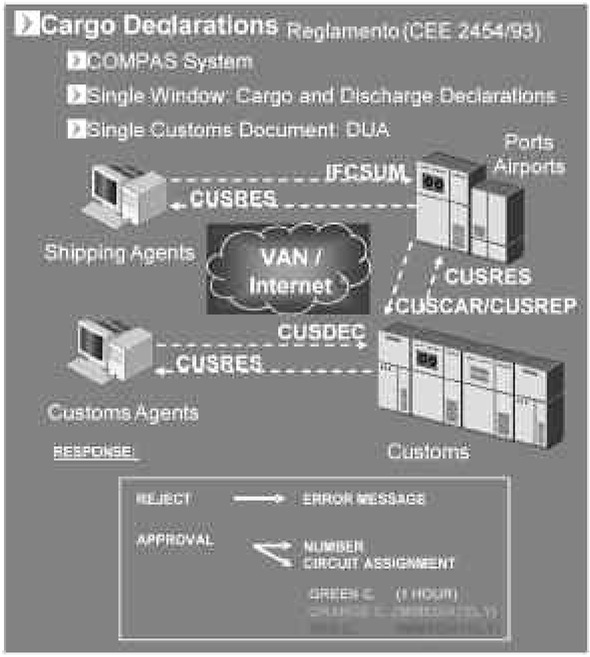

Fig. 5-2 COMPAS System message scenario

The COMPAS system was created to facilitate import, export and transit operations to the operators. The system establishes the possibility of transmission of the information by means of EDIFACT messages in the following cases:

- Summary declarations and cargo manifests: These declarations are presented by the person who has introduced the goods in the customs territory of the Community, by the person who was in charge of the transport of the goods after their introduction and before their declaration, or by the person who acts in name of them. The Port Authority assumes the responsibility of receiving such declarations through a single window system and establishes maximum periods for their presentation, based on the vessel arrival or departure. A pre-declaration mechanism is also established to accelerate procedures. In this case, when the port pilot service confirms the arrival of a vessel, the Port Authority notifies Customs, so the cargo declaration is activated and all related customs documents are cleared. Such mechanisms allow that the goods imported could be retired in less than an hour after the arrival of the vessel.
  When arriving an electronic declaration, the Port Authority checks the correctness of the information based on established controls jointly defined by Customs and Port Authorities. If the message is not compliant an error message is submitted to the agent and the message is not relayed to Customs. If the message is compliant it is relayed to Customs, which accepts or rejects the declaration based on its own controls and submits a response to the Port Authority. Finally the Port Authority notifies the agent the response. It is interesting to mention that although electronic transmission is allowed, agents are obliged to present these declarations under request of any of these administrations. However, this is not usually the case.
- Single Administrative Documents (SAD), used in import, export and expedition of transit across all EU, are also allowed to be presented by electronic means to the Customs Department. This possibility gives operators greater agility and facilitates the fulfilment of its tributary obligations. The telematic transmission is made through Internet, with the only requirement to be in possession of a User Certificate (electronic signature) granted by the National Factory of Currency and Stamps, organization also in charge of the manufacturing of currency, national identity documents and passports. This entity is recognised by law as an authorised certificate authority.

In conclusion, the COMPAS system is well aligned with the dispositions recommended by the Commission in its communication on the creation of a simple and paperless environment for Customs and Trade and the e-Customs initiative.

5.3 Single Administrative Window for Dangerous Goods

This project started in 1994 in collaboration with the Maritime Authority, Ports of the State and other port authorities. The objective of this initiative was the improvement of the notification, consolidation, acceptance and/or authorization of the arrival and departure of dangerous goods in the port enclosures according to two effective norms: a national norm concerning the admission, manipulation and storage of dangerous goods in ports (RD 145/1989) and the HAZMAT European directive (93/75/CEE) on the minimum requirements for vessels bound for or leaving Community ports and carrying dangerous or polluting goods. Both norms require the proceeding of declaration in front of two organizations: Port Authority and Maritime Authority. This is due to the competences of each one in the control and protection against disasters in which dangerous goods are involved. By this way, Port Authority has control competence within the port enclosure and the Maritime Authority has control competence within territorial waters. This situation forced the responsible agents (generally the maritime agent or the vessel consignee) to declare the same dangerous goods declarations in each one of the Administrations.
In consequence, the presentation and acceptance of the declarations of dangerous goods by electronic means and the use of a single window towards both Administrations were also established, being the Port Authority the responsible entity of receiving such declarations and relying them to the Maritime Authority. As in the previous case a set of EDIFACT messages were defined and communications established to the Maritime Authority, including SASEMAR (Rescue and Maritime Security) and the national coordination centre on dangerous goods as stipulated in the HAZMAT Directive.
The electronic proceedings of dangerous goods was quite similar than the one established for summary declarations. The particularities established in this procedure were because an explicit acceptance of both Administrations was required. The Port Authority must authorise or deny the arrival or departure of dangerous goods in the port enclosure and the Harbour Master Office must submit a favourable report on this matter. When both acceptances have taken place, a response is submitted to the agent. Finally, it is interesting to mention that although this procedure allows the presentation of dangerous goods declarations by electronic means, the national legislation related to this procedure has not yet been modified. For this reason the electronic transmission is allowed as a means to accelerate the management of the transport, but periodically, agents must present and sign these declarations on paper to fulfil this legislation. Single Administrative Window for Port Formalities (Call Requests and Electronic Port Clearance).
Taking advantage of the close cooperation established between the Maritime and Port Authorities, another project started for the creation of a single window in 1995 for the request of berths, anchorages and services for vessels in ports, as well as for the ship's clearance. Like in the previous case, this management requires the joint proceeding of these two organizations due to the competences of each one for the authorization of the entrance and exit of a ship. Thus, Maritime Authority is responsible of authorizing the arrival and departure of a ship in territorial waters and Port Authority is responsible of authorizing the arrival and departure of a vessel within the sheltered waters of the port. Both authorisations are required. Like in the previous case, this situation forced to the vessel agents to present the requests of arrival and departure in each one of the Administrations. By means of the creation of a unique window that allowed the electronic presentation of the call in the port, this proceeding was simplified to a great extent. Again messages were defined and communications established between both Administrations, being the Port Authority in charge of receiving these requests from agents.
Although this procedure was operative in Valenciaport since 1996, it was not until the year 2000 when the Ports of State Entity and the General Directorate of Merchant Marine published the regulation about ship's clearance. This regulation specified the mandatory documents and data required and opened the possibility of being presented and managed by electronic means. This procedure was modified just before the beginning of SESTANTE on the basis of the approval of a new legislation. This new legislation includes an integrated procedure of call and establishes the channels of collaboration between the Port and Maritime Administration, officially opening administrative one stop shops for the reception of a unique document of call, which has effect for both administrations. Additionally, the dispositions established in the 2002/6/CE directive on reporting formalities for ships arriving in and/or departing from ports of the Member States of the Community and the ISPS code are also being considered.

Common aspects in the creation of single Windows: the Valenciaport experience. Based on the experiences presented before, there are common aspects in the creation of single administrative windows that should be considered:

A **strong commitment and a clear will** to create single window services is required by the Administrations that take part in this process. The creation of this mechanism as an instrument to simplify proceedings requires the establishment of channels of collaboration among these Administrations and the reception of documents must have effects in each Administration. Additionally, single windows require a modification of the current procedures and of the information systems. This collaboration must also last in time to coordinate the necessary changes that legislation amendments or technology evolution could impose. This firm commitment in the creation of one stop shops can be motivated by mutual interest in the consecution of this simplification or be determined by a legislation that establishes this requirement.

A pilot experience that demonstrates the viability and convenience of single windows is required in the case that this creation does not come determined by legislation. Sometimes during this experience, some agreed procedures between Administrations could arise that require changes in legislation. Nevertheless and during these intermediate periods, these proceedings can continue offering advantages in the application of this single windows. This has been the case in the admission, manipulation and storage of dangerous goods in Valenciaport.

The amendment of **legislation** is often required. Once demonstrated the advantages of the single window and in order to obtain legal basis and support in these interchanges it is probable that some legislation shall be amended. However, it is more and more common that the effective legislation is already perfectly adapted to this type of approaches and that this process does not suppose a delay in the implantation of single windows. In the opposite case, this adaptation could imply an important delay in its effective adoption.

Interoperability is a critical aspect in the effective adoption of single windows. Spanish Port Authorities found that, although single windows were widely adopted in ports, there were some minor differences in the messages and telematic procedures that caused a lack of interoperability among ports. This situation was not good for operators who usually worked in different ports as they had to adapt his systems for each specific port. In order to solve this problem, a Proceeding Harmonization Group (GAP) was created in 2000. This group formed by several Port Authorities, Ports of the State and companies that exploit Port Community Systems had the objective of harmonizing the different interfaces at a national level. This objective has been widely obtained by achieving interoperability in all the single windows established in ports. The group has also worked in the creation of other single windows and in the alignment with other European initiatives (as for example with PROTECT).

User adoption is an important issue in consolidating telematic procedures. The electronic transmission of documents offers significant advantages to Administrations and declaring agents. However its use often implies the change of internal procedures and inversions on technology that could delay the adoption of such systems. For this reason, the Port Authority of Valencia was committed from the early stages of single windows development in involving end users in using telematic procedures. Some actions that have been taken are:

- ❑ A discount in port taxes (up to 3%) if telematic procedures are used in presenting declarations.
- ❑ A well defined approval process is established between the Port Authority and declaring agents whereby the validity of the applications used and the correct use of the system is checked.

Finally, a set of applications have been developed and distributed to declaring agents that help in the introduction, the management of data and documents, and its electronic transmission to the Port Authority. These applications are not intrusive within the usual management applications of the companies and are widely used by the port community. Taking advantage of the necessary changes imposed by legislation in the single window interfaces for port formalities and dangerous goods, the Port Authority modernised these applications by using last technologies, like XML, and taking into consideration all aspects about interoperability on a European scope. This action was developed within the SESTANTE project.

5.4 Pilot projects developed in SESTANTE.

The reporting formalities for ships arriving in and/or departing from ports and the notification of dangerous goods entering or departing from ports and on board vessels were extensively dealt during the application developments for the Valenciaport SESTANTE pilot. All these applications were developed using the interoperability requirements established in SESTANTE and considering all existing applicable normative and best practices available among the European Union. The most relevant ones were:

1. IMO FAL Convention for the simplification and facilitation of the international maritime traffic: This convention has been adopted as an EU Directive (2002/6/CE). Furthermore, during its session in 2002, this convention agreed that electronic data interchanges should be the sole mode for reporting all formalities through a “Total Electronic Clearance of Ships and Cargoes”.
2. Directive on Maritime Transport Management and Information System (2002/59/CE) which establishes the requirements for the presentation of dangerous goods declarations on board for vessels.
3. Proved message scenarios for the electronic transmission of dangerous goods declarations and formalities for ships arriving in and/or departing from ports as the scenario used by Protect for dangerous goods or the scenario used by the Spanish Port Authorities for port formalities.

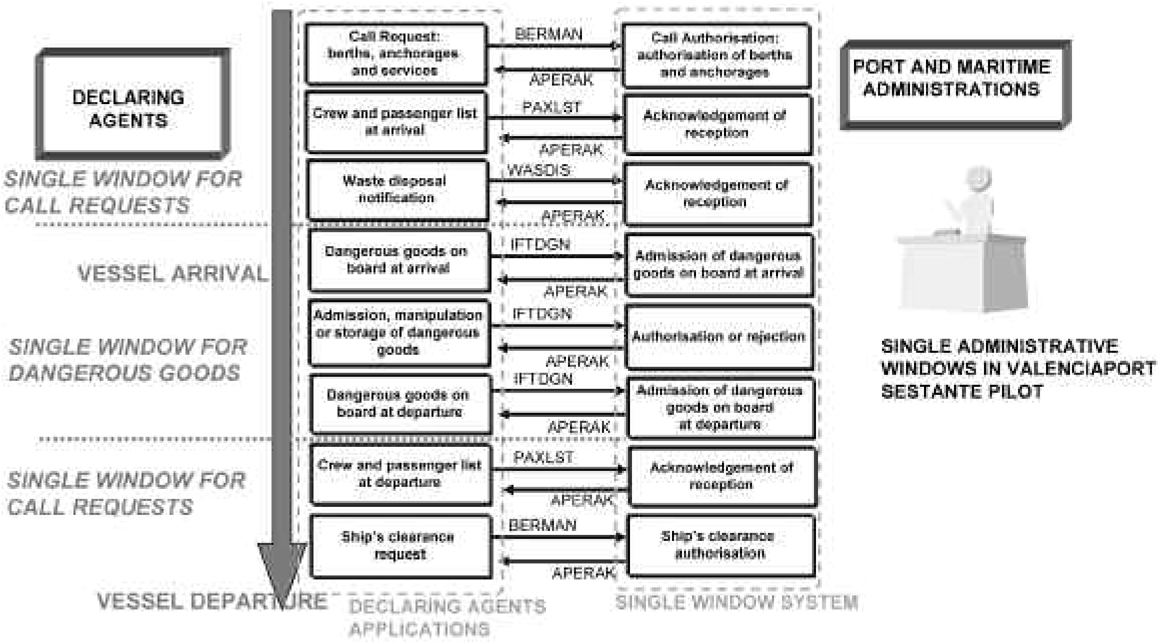

Fig. 5-3 Scenario of Valenciaport SESTANTE pilot applications

The following diagrams show all the actors, procedures and regulations involved in the Single Windows of services offered by SESTANTE as well as the particular information flows that Valenciaport SESTANTE pilot applications are covering:

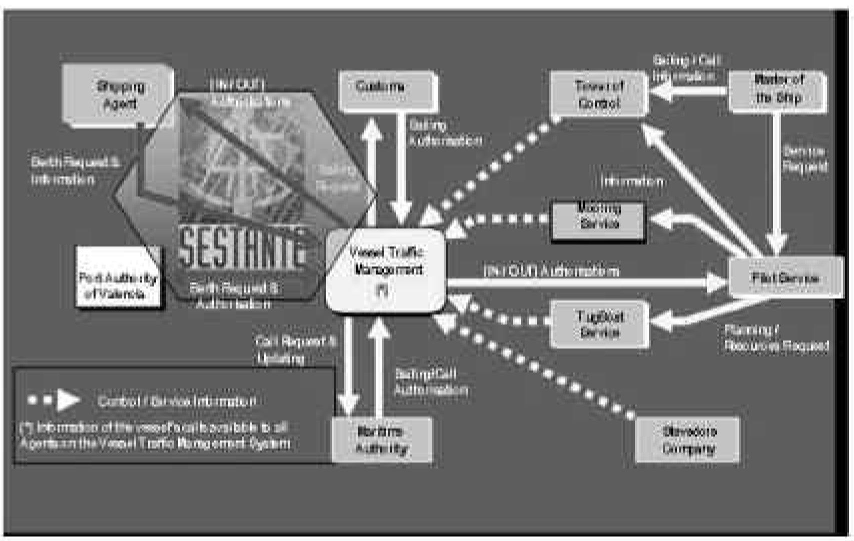

Fig. 5-4 Single Window for reporting formalities for ships arriving in and/or departing from ports

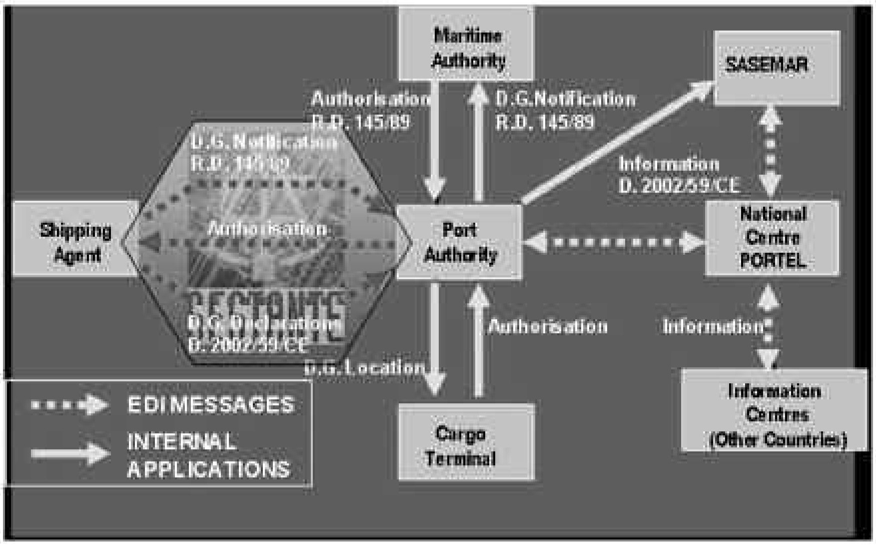

Fig. 5-5 Single Window for on board dangerous goods notifications and dangerous goods movement notifications within port premises

Valenciaport SESTANTE pilot project aimed to demonstrate the viability of implementing Single Windows in ports that improve the relationships between agents in the logistics chain and the different administrations involved in the flow of goods. The creation of such Single Windows allows the optimisation of the procedures and information flows required for the appropriate transport of goods complying with all the formalities required by administrations to guarantee safety, control and coordination among EU ports.

5.5 MADAMA: Risk management systems for dangerous goods transport in the Mediterranean Region

After the finalisation of the SESTANTE pilot project, the Port Authority of Valencia has carried several adjustments of this pilot system and also has adapted its internal system and the rest of interfaces to the rest of governmental entities and operators. The SESTANTE system has been fully integrated in the port community system valenciaportpcs.net. Finally, on 7th may 2007 these services have successfully started its real operation and are being used by all the shipping agents in the Valenciaport port community. The setting off of these services is being supported by the MADAMA Interreg IIIB MEDOCC project through the delivering of several training seminars. MADAMA project aims to understand and harmonize actions needed to control the dangerous goods transport chain and improve the security and risk control and management by the use of ICT tools in order to obtain a sustainable mobility and better environment in the Mediterranean Area. This project is currently under development with the following specific objectives:

- To create the conditions for a relevant modal shift on dangerous goods from roads to train and short sea shipping, through a cooperative approach based on the definition of new policies and the application of innovative risk management solutions.
- To face the process of dangerous goods transport and logistics in terms of methodologies, organizational procedures and innovative tools.
- To support the cooperation among all the private and public parties involved in the logistics chain of dangerous goods transport.
- To promote the exchange of experiences and transfer of expertise from different regions in managing the whole dangerous goods transport chain and using ICT defined solutions.
- To organize education/training courses for the technicians of the involved companies and authorities.

Risk management means the systematic application of management policies, procedures, and practices to the tasks of analyzing, evaluating, controlling and communicating about risk issues. Risk assessment and management is acquiring a high level of interest by public entities in different domains (customs, maritime and port authorities, etc.). However, to be efficient, risk management techniques require the availability of certain cargo, transport and operational data at an early moment (wherever possible before the arrival or departure of the goods) and their transmission or availability to customs, port authorities, maritime authorities and other agencies responsible for its control through electronic means using a single channel of communication.

Within the context of dangerous goods transport, the availability of the required data through electronic means has been enhanced in the Port of Valencia through the SESTANTE applications. However, more operational data is required to accurately control the flow of dangerous goods in the port. To this end an electronic channel of communication has been established between the Port of Valencia and the different cargo/container terminals. This link allows the port authority to warn the terminals about the risks associated with each particular dangerous goods and give particular instructions to reduce these risks to safety levels. By the other hand, cargo/container terminals report all the internal and external movements of dangerous goods in their premises to the port authority for its subsequent control with the aid of a GIS (Geographic Information System). This risk management system is named ESTRABON.

Finally, to allow other involved public entities to execute its activities concerning dangerous goods transport, the information about dangerous goods is transmitted properly to other parties as the Maritime Authority, SASEMAR and the National Coordination Centre of Dangerous Goods (Portel).

This overall system allows the Port Authority of Valencia to perform an accurate risk management about dangerous goods movements as well as provide critical information for the emergency plan procedures in case of incidents.

5.6 MATAARI: Actions in support of the eCustoms initiative

The European Commission published on 2003 a Communication[4] towards a simple and paperless environment for Customs and Trade. This document responded to the Council's request to draw up an action plan for:

the simplification and rationalisation of customs regulations and procedures,

and the use of efficient working methods such as information technology, risk analysis and advanced auditing systems.

This document stated clearly that the use of information technology tools combined with modern risk-management techniques were the adequate response to better integrate security aspects into customs procedures in order to deal with security concerns but, at the same time, maintaining and improving trade facilitation.

Since this communication was published in 2003 a lot of implementation actions are under development following the "Electronic Customs Multi-Annual Strategic Plan"[5]. The staged approach towards implementation of eCustoms is schematised in the multi-annual strategic plan through the following picture:

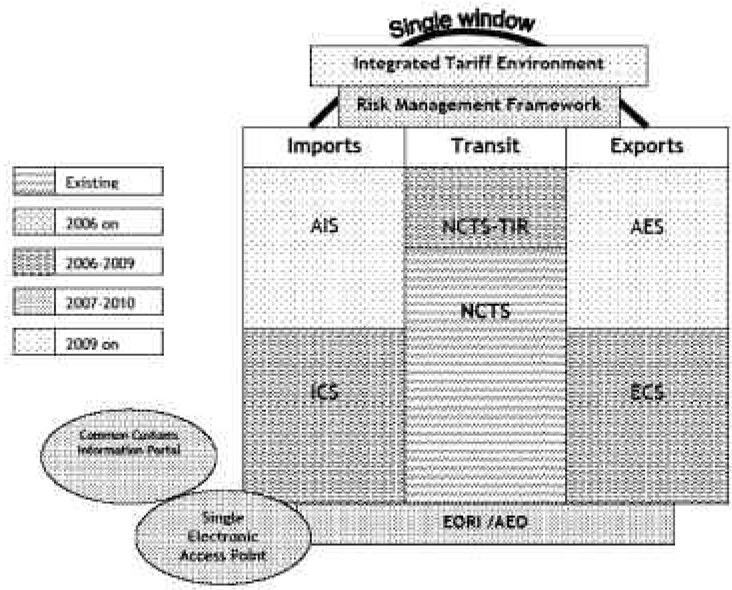

Fig. 5-6 Electronic customs vision in a diagrammatic form. Source "Electronic Customs Multi-Annual Strategic Plan"

[4] COM(2003) 452 Final

[5] Electronic Customs Multi-Annual Strategic Plan (MASP Rev. 7). TAXUD/477/2004 Rev.7. September 2006

The eCustoms system will be based on the following premises:

- Based on electronic data interchanges among Customs of different Member States.
- Customs declarations will be able to be presented in any Member State by the economic operator independently of the location of goods.
- The payments will be performed in the place where the economic operator is established.
- Risk analysis will be executed automatically based on European and national criteria.
- The registers of national economic operators will be valid for all Member States.
- There will be a single access point for all economic operators.
- Customs systems will follow an integrated architecture.
- There will be a Single Window and a unique recognition.

As stated in the multi-annual strategic plan the development of the eCustoms initiative is divided in four stages:

- Stage 1: Work in the field of risk management and creation of the foundation for an electronic customs declaration environment by adding ICS (Import Control System), ECS (Export Control System) and NTCS-TIR (New Computerised Transit System-International Road Transport).
- Stage 2: Work in the EORI (Economic Operators' Registration and Identification System), AEO (Authorised Economic Operator), Common Customs Information Portal and Single Electronic Access Point.
- Stage 3: Work in the AES (Automated Export System), AIS (Automated Import System), and the Integrated Tariff Enviroment.
- Stage 4: Work in the Single Window project.

Taking into account the overall context of the eCustoms initiative presented above, the Port Authority of Valencia is collaborating with the Customs Office of Valencia in enhancing the control of cargo flows through the port of Valencia by a process re-engineering integral plan. The general idea behind this collaboration is to give support to existing processes used by the national customs system but also develop new enhancement projects based on the valenciaportpcs.net port community system whereas there is not any solution at national level. As stated before the collaboration between the Port Authority of Valencia and Customs started in the 80s. During this time, the following projects have been completed:

- Projects in the framework of Single Windows:
  - Summary discharge declaration and its electronic submission.
  - Loading manifest and its electronic submission.
  - Automatic transhipment
  - Amendments of the summary discharge declaration and its integral management.
  - Paperless customs release of containers in import operations (LSP-import)
  - Paperless customs release of non-containerised cargo in import operations (SIGRA)
  - Electronic phytosanitary inspection certificate (SIFI)
- Control enhancements projects:
  - Introduction of barcodes in the paperless customs release of containers in import operations.
  - Introduction of barcodes in the paperless customs release of non-containerised cargo in import operations.

However there are still several on-going collaboration projects under development based on the valenciaportpcs.net port community system:

- Control enhancement projects:
  - Contingency procedure for the paperless customs release of containers in import operations.
  - Control enhancements of container export operations by the cross-border police.
- Projects for the integral control management of the port customs area:
  - Import container release system in container terminals
  - Paperless customs release of containers in export operations (LSP-export)

During the execution of the MATAARI project, a clear improvement in accessibility of the transport in the port (one of the main targets in this project) was to enhance the control of import containers by the cross-border police.

Customs controls affect directly in the mobility of container transport through the port. In particular, it is the

responsibility of customs and the cross-border police to assure that full cargo containers do not leave the port premises without the appropriate customs authorisations. To this end several customs check points are located outside the terminals where all the trucks transporting full containers coming from the terminal shall be verified and if not allowed to exit shall return back to the terminal. On the other hand, the new configuration of the road accesses in the Port of Valencia designed for the America's Cup event jointly with the setting up of a new container terminal has lead to the Customs Office in Valencia to move the customs check points from the different port terminal gates to the single port area gate to optimize the use of human resources for inspection and control. The effectiveness of this situation in accessibility to the port is highly dependant of very low percentage of returns to terminal due to unauthorized departure from the port. If this situation is not achieved unauthorized trucks shall come back to terminal blocking the port gate and causing important delays or even collapsing the port.
Customs check points are, thus, a critical pace for the mobility inside the port. One important aspect to guarantee the effective flow of trucks in these locations is the availability of the application used for a paperless verification of the departure authorization through the use of barcodes printed in the container receipts submitted by container terminals. This application, included in the national customs system and in use for some years, has been determinant to simplify and accelerate this procedure. However, it shall be taken into account that the application is network dependant and it may be the case that, for different reasons, the connection with the customs data centre may be not available. To solve this situation, which can collapse the way out of the port, a contingency plan has jointly been defined with Customs and the Port Authority and a disconnected application that will be fed by authorization data has been developed to guarantee the service in Valenciaport.
The adopted technical solution is the electronic notification of container departure authorizations through CUSRES EDIFACT messages. These messages are being used to feed up a disconnected database for the contingency plan as well as to distribute the authorizations to the container terminals. Container terminals will use this information for unblocking containers to leave the port. The successful deployment of this solution has taken into account the requirements and restrictions established by Customs and Tributary Computer Department which is submitting this information and the different Terminal Operation Systems (TOS) that are in place in the Valenciaport container terminals. It has also required some changes in the current working procedures.

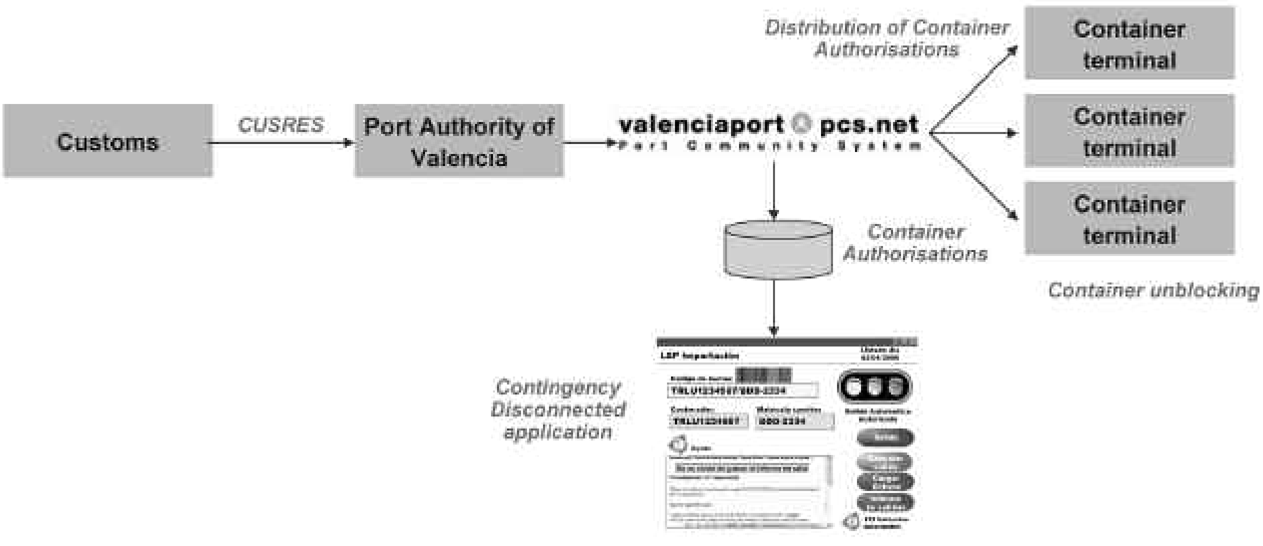

Fig. 5-7 System for contingency procedure of paperless import procedure

Fig 5-7 represents the system for contingency procedure of paperless import custom container release (semaphore application) and import container release systems at terminals.
The main outcomes achieved during the pilot setup have been:

- A modification in the message that the Tributary Computer Department sends to the port authorities for receiving electronically the release authorizations of import containers. This modification was made through a request for amendment sent on april 2006.

- A contingency plan for the customs paperless import release of containers and the construction of the "semaphore application" for these purposes.
- The definition of a message for the notification of customs authorizations to container terminals.
- The analysis, design and development of a system for distributing the authorizations received by the Tributary Computer Department to the container terminals.
- A thorough test plan and debugging of received customs authorizations to achieve a maximum level of success.
- And finally the establishment of a common procedure for notification of customs authorizations for import containers.

The MATAARI project has additionally developed the following studies and pilot projects to enhance the control of operations in the Port of Valencia:

- Dynamic model for port internal traffic simulation: This simulation model will allow evaluating the impact of the different control points in the traffic behaviour.
- Evaluation of a system to assess the road access quality through RFID tags installed on trucks: The objective of this system has been to determine the quality of the accessibility to the port premises starting by a data acquisition at the container terminal gates for measuring potential congestions.

Conceptual design of a system for monitoring security and accessibility: Following the mandatory application of the regulation on enhancing ship and port facility security (ISPS code) and other different safety measures (as the compliance of dangerous goods regulations) in Valenciaport, the Port Authority of Valencia is going a step forward to improve the safety and security of the port area by enhancing different systems oriented to a better management and control of the traffic generated inside the port area. This study is aligned with the EU Directive on enhancing port security.

The work started in MATAARI in collaboration with the Port Authority of Valencia and the Customs Office of Valencia will continue with a subsequent research and development of a prototype to simplify the current customs procedures by the establishment of a paperless export authorization system, a simplification in the presentation of the maritime export manifest and the use of current commercial and operative electronic data interchanges submitted by the economic operators (concretely carrier agents and container terminals).

The objective of this system will be to automatically assign the maritime transport used for the departure of goods to the associated authorised export declarations before and after the execution of this operation allowing to improve the control performed in the export operations by customs and, at the same time, reducing the associated logistics costs and maximising the efficiency of container terminal loading operations. This is one of the targets of the ECS (Export Control System) in the eCustoms initiative. Currently these controls are performed manually by the cross-border police and customs based on cross-checking paper copies of the loading container lists and authorised export SADs (Single Administrative Documents). This system will be based on the port community system valenciaportpcs.net used by the transport business community and controlling authorities to plan, execute, monitor and control containers movements.

5.7 Conclusions

In conclusion, the actions that are being taken at the Port of Valencia towards enhancing the control of container operations at ports are oriented to reduce logistics costs and to maximise the efficiency, safety and security of the whole supply chain in global and European intermodal container shipment by improving the following topics: using technologies to enable a continuous monitoring and control of containers and the customs status of cargo, taking advantage of communication systems and platforms (valenciaportpcs.net) used by the transport business community and controlling authorities, and

defining supportive innovative procedures and processes in ports and terminals with the aim to establish seamless and high capacity container transport flows in the European global supply chains.

6

The Experience of the STIL Project: ICT for Multimodal Transport

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Abstract: The aim of this paper is presenting a research initiative aimed at empowering the SMEs that lead or participate in production and distribution processes in their ability to design, plan and operate efficient interlinked logistic networks. The intention is to study, implement and experiment models and services that can enable manufacturing companies and logistic operators to easily build or participate in logistic networks, with special attention to SMEs. Such logistic networks include procurement, transportation, production and distribution processes, from the supplier of raw materials to the end customer.
Keywords: logistics, eServices, digital ecosystems.

6.1 Introduction

The globalisation of markets and growing customer demands are compelling companies to form supply chains (or networks) to coordinate and control flows of materials, information and money. They evolve when activities are outsourced or the need arises to cooperate with other companies and to optimise processes among the companies in the chain.
It is the aim of this paper to present a technological approach, based on an infrastructure for eServices development and with an extensive use of sectoral/regional ontologies, which allows to substantially reduce cost and time of software application development for managing logistic networks. This is of paramount importance for SMEs, which need to interact with other organisations (most of which are SMEs in turn) all over the world by minimising cultural and linguistic barriers. Internet is the enabling infrastructure, but interactions cannot be effectively automated without a sound work on ontologies and mappings, to make humans (and systems) understand each other. The ICT solutions developed in the frame of the STIL project, based on a neat Service Oriented Architecture, is reported as a living example of the proposed technological approach.
The paper is organised into six main chapter. Chapter 2 sketches the addressed operational scenario. Chapter 3 focuses on the related informational problems. Chapter 4 proposes samples of target business cases. Chapter 5 presents the technological requirements derived from them. Chapter 6 describes the semantic interoperability approach. Finally, Chapter 7 depicts the architecture of the ICT platform the STIL project has developed as an implementation example of the proposed technological infrastructure.

6.2 Operational scenario

Logistic networks include procurement, transportation, production and distribution processes from the supplier of raw materials to the end customer. Companies in supply chains have to perform operational, tactical and strategic planning tasks. Depending on the nature of the task and the form of network organization, these tasks are handled locally or globally. There has been little research so far on the of logistic network modelling, design, planning, operation and control.
In order to plan or coordinate activities spanning more than one company, the members of the network have to share information. If all the necessary information is shared between the members of the network, companies

planning locally (for themselves) can include common objectives in their planning. This also enables a central institution or company to plan globally. This institution or company can be the focal company of the network or a neutral entity like a third party logistics provider:

- Global planning by the focal company. This is the most common form of organising planning tasks in a supply chain. Often, one company emerges as the focal company and is more powerful because of its size, know-how, resources or position with respect to the customer.
- Global planning by an external company. Network planning and control is not necessarily one of the focal company core competences. It can be outsourced to a third party logistics provider or a software service provider. Either one would be a neutral entity within the network and but might lack the necessary know-how in some fields.
- Local planning with global information exchange. Planning can be done by work groups made of experts from the participating companies. The teams or committees can be formed for an unlimited or limited amount of time. Participants can vary or remain the same over time. The teams can be led by the focal company or an external entity.

Operational planning tasks include production, distribution and transportation planning as well as order promising. Tactical planning tasks are demand and requirements planning. Especially important for organizing a logistic network is the design (strategic planning) of the network and methods of information exchange. Companies can use these structures as the basis for collaborative planning. This form of collaboration depends on factors like trust and reliability of the participants. Depending on their importance, different members of a logistic network can be classified as partners, co-producers, suppliers or operators.

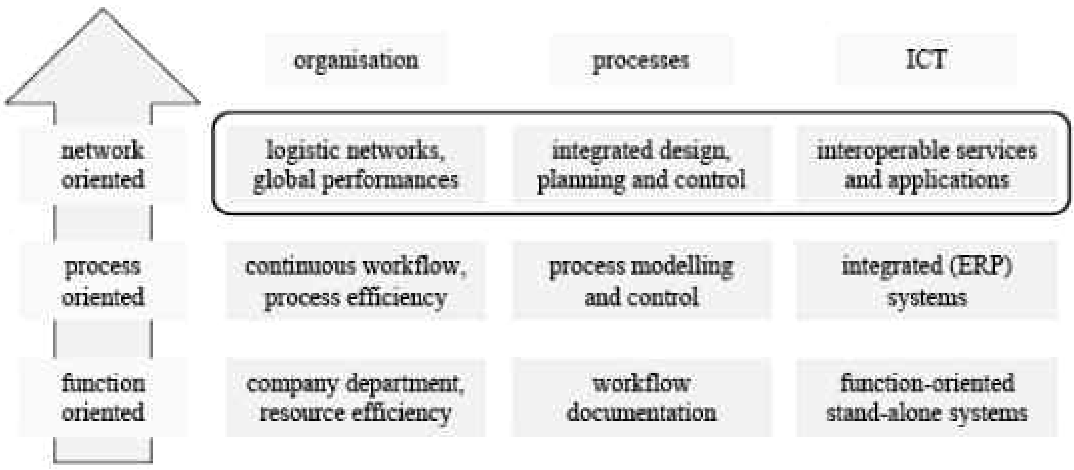

Fig. 6-1 Strategic planning of information exchange

Heterogeneous system landscapes with different process logic and diverse legal linkages, and different interface protocols and formats, lead to inadequate information and long throughput times. This has negative effects on the quality of decisions and then on value creation. Further, the optimum of the supply network can not be reached. The integration of organisation, processes and ICT, and their networking orientation (as sketched in the above figure) is the main challenge for all the solutions.

Once oriented to networking and accepted the corresponding organisational models, the resulting business ecosystems calls for well-funded methods for managing its complexity and dynamically building logistic networks that overlap and intersect each other:

- Leading companies use long-term agreements to constitute constellations of candidate partners and suppliers, then they set up dynamically the single logistic network to satisfy a specific need by selecting partners and negotiating with them.
- A subcontracting company or operator could play subordinate roles in one, two or more logistic networks and, at the same time, could have its own network(s) to manage as leading company.

- Because of its finite capacity, the participation of a company or operator in a certain distributed process usually reduces the possibility to take part in other competing processes.
- Transports, warehousing and other logistic functions are sometimes performed directly by the leading company or its subcontractors, in which case they play the role of logistic operators, or assigned to independent logistic operators.
- In turn, logistic operators are used to subcontract some logistic function to other operators and also pre- and post-production activities (e.g. quality control, assembly, packaging) to manufacturing partners.

6.3 Informational problem

A number of RTD objectives have been set with respect to the complex material and information flows reported in the next figure:

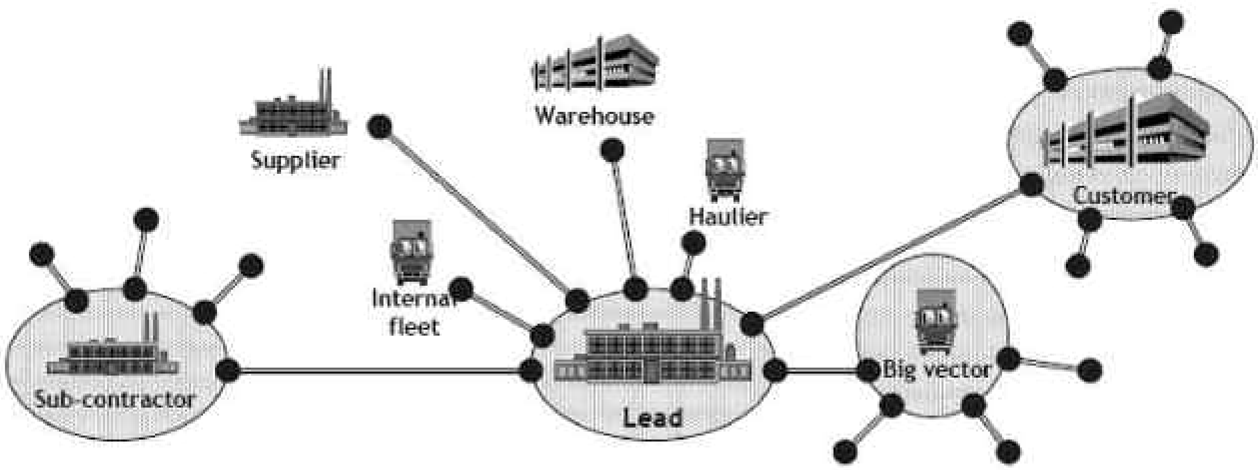

Fig. 6- 2 Logistic network design

Logistic network design. The single target SME must be driven by advanced models and methods to go through its business processes, revise them to include productive and logistic activities, introduce flexibility in form of alternative paths and choices, associate every activity to the internal or external resources that can execute it, and refine the resulting picture by simulation until it meets the established requirements.

- Logistic network planning. The single target SME must be driven by advanced models and methods to define its own planning criteria and rules, dynamically update capacity and status of the candidate suppliers and partners, acquire orders and perform a distributed planning of the implied activities, negotiate supply conditions with the selected partners, and react to possible exceptions by re-planning.
- Logistic network operation. The single target SME must be driven by advanced models and methods to monitor the workflow progress in the ongoing distributed processes and undertake the needed operation and correction actions and, at the same time, to increase its autonomy and human capability to take decisions and cope efficiently with the fast changing requirements in the network.
- Model integration. This objective is to tune and harmonise the three organisational models above, so as to obtain the best for the whole out of the optimum from each part. In particular, a sectoral ontology is required to define and map concepts and terms between partners and their legacy systems, and new business models help understanding the benefits of the proposed approach.
- Technological support. In this area the objective is exploiting the very recent findings on interoperability and web services to create an easy and open infrastructure for communication and information exchange between legacy systems and for accessing as services the ICT tools that will be developed to realise the functions identified by the scientific work on new organisational models.

Main innovation are expected and can measured with respect to three aspects:

- Leading company/operator viewpoint. Existing organisational models for logistics networks in manufacturing companies have no real alternative paths and choices in order to cope with the fast changing requirements in the network. With the proposed approach the population of candidate suppliers can be dramatically extended, network planning is optimised and business progress management is finally based on explicit rules.
- Supplier company/operator viewpoint. Entities playing subordinated roles in logistic networks are critical rings of the chain since their interest is normally disregarded. Many experiences show that the main obstacle to the introduction of the virtual enterprise paradigm is not coming from the leading entity but to the difficulties met by supplier companies. The proposed solution adopts a win-win approach by assuring similar benefits to leading and subordinated entities. In particular, specific network interlink models and regulations are assured to those entities playing also a leading role.
- Interoperability of systems and services. A further problem still to be solved concerns, on the technological side, the need for logistic network nodes to exchange data and access repositories and services independently of the legacy systems they have. Recent findings on interoperability and semantic web enable access to and connection between software systems in form of web services. An innovative solution must apply and adapt these brand new techniques to the complex case of dynamic logistic networks for supporting the proposed models and methods.

6.4 Target business cases

Going deeper into the classification of logistic networks, we can identify two main categories representing the target business cases since they share (at least partially) some basic requirements on network design, planning and operation:

- Networks of SME producers and external service providers (advice, engineering, logistics). They are characterised by high complexity and aimed at gaining stronger positions in the evolving market by meeting strict customer needs, coordinating the manufacturing process, including warehousing and transports as critical phases of the global distributed processes, sharing capacities and knowledge, and integrating (interoperating) the respective ICT infrastructures.
- Networks of SME logistic operators that collaborate to gain a better market power compared to the big players. They are of medium complexity and aim at exchanging information about the capacities that every partner can made available to the network, as well as at using intelligent ICT tools to coordinate and optimise the contributions coming from the different partners.

Either categories are well represented by the following real life business cases.

6.4.1 Spanish business case: Electronic Industry

Logistics and supply chain management activities are becoming more and more important for the European electronic industry, as decentralization and global distribution of products is affecting the working system in the companies. The necessity of reduction of costs as a result of the presence of Asian and East Countries in the market has caused the improvement of distribution systems and the use of better logistic applications in order to facilitate the control and management for the components and final products.

Logistics managers know how vital it is to keep things moving. Failure to deliver products on time, in the proper quantities, and to the right place carries very real consequences: assembly lines halt, shelves lie empty, perishable goods grow stale, and the window of business opportunity slams shut.

The new market opportunities appearing as a consequence of the globalisation process and e-Business practices are of relevant importance. In this new scenario alliances of competence between companies are not more fixed and precisely defined. Some examples: (i) companies that are competing today for an order from one specific customer can be forced to cooperate tomorrow to satisfy the requirements from another customer and at the day-after (or simultaneously) they will compete again for the order of a third party. (ii) A manufacturing company could be simultaneously part of the supplier network of two or more (competing) electronic assembly companies. (iii) One assembly company can be central company of the supply chain for one order from a customer, and can be at the same time one intermediate node within the same network for another order from the same or a different customer. This complex problematic requires powerful models and tools for dynamic design and planning of

logistics and supply chain networks.
In addition, Directive 2002/96/EC on waste electrical and electronic equipment forces these companies to control the location of each manufactured products during the entire life cycle (from design to the end of its days). In many cases logistic matters are considered as an individual problem for each company but the development of an integral system useful for all companies will be an important improvement for them.

6.4.2 German business case: Forestry and Wood Processing Industry

Forestry and wood processing industry is subject to enormous economic pressures. Timber production and processing is a complex process with many parties involved and completely different tasks. When looking at the present situation new concepts and technologies are needed to optimise the logistics chain from the forest to the factory for all actors. Apart from the demand for cost effectiveness and optimisation, special significance is also attached to environmental protection to ensure management protects resources on a long-term basis. Latest information and communication technologies are an important driver to reach the envisaged objective of optimising the logistic chains.
The wood processing industry is characterized by a vast number of actors of different sizes with diverse tasks and individual objectives within the logistic chain. Many complex coordination tasks are carried out along the logistic chain with the necessity of networked information exchange: starting by fostering the wood to harvesting the timber; transport and handling from the forest to the processing companies, utilisation of timber products and their disposal. The main problems are missing transparency and inconsistent information flows, inadequate qualification of the workforce and deadheads.
The involved companies are all subject to strong competition and need to reduce their costs in the areas of processing and transporting timber. This requires stronger technical and organisational linkages between the involved organisations, simplification of interfaces and the application of qualified technical systems for navigating and routing in the forest.

6.4.3 Italian business case: Cooperative Logistic Operator

Short-range operators, spread all over Europe, offer transportation activities and other logistic services in a number of sectors such as building and construction, manufacturing and food. Now imagine a cluster of logistic micro-enterprises joining together to achieve a better presence on the market and reduce overheads. It can be organised into more branches (one for each industrial district served), and in addition it has relationships, at different levels of dynamics, with some tens of external companies like medium-long range transportation companies and warehousing service providers.
Each branch plans and monitors autonomously the work of a subset of associated companies, while invoices and payments are managed in a centralised way. Work assignments are made on an “equal right” basis, with the objective of assuring a balanced income and workload to each associated micro-company over a monthly period.
At the time being such clusters are seldom using ICT support tools, with the exception of the invoicing and financial department. The reason is that the current offer of mission assignment and monitoring tools is much more oriented to single medium-size logistic operator, able to adapt their way of working to the software application.

6.4.4 Hungarian business case: International Logistic Operator

After the enlargement of the EU a number of medium-sized logistics operators based in the New Member states started broadening their transportation services to the Western and Central European countries. These all-round logistics activities include warehousing services. Now these companies are focusing on value added services in the supply chain process and provides logistic consultancy services to its clients. The goal of these services is creating logistic scenarios to the clients, that could reduce the costs of the logistic processes, with an average saving of 10 percent.
Clients usually outsource the whole logistic processes, meaning that they require “house-to-house” logistic services. In this case, the logistic processes have to be divided into many sub-processes or tasks, of which part of the services are outsourced in turn to third parties all over Europe. The main issue of these processes are: always searching and selecting the proper partner for elementary tasks, total control and optimisation of the processes, and assuring the quality (time and cost pressure).

6.5 Technology requirements

The main requirement from electronics companies are the following: (i) have a global solution allowing the companies to manage their products from the design until the end of its utile days, (ii) reduce costs in order to be a more competitive company in an global market, (iii) use new technologies for tracking procedures (RFID) and storage systems for the control of components and final products, (iv) develop an integral logistic system for companies applied to different kind of companies.
For the wood industry, the internal factors impacting on the logistics chain include: technologies and means of transport and shipping, processing technologies, information technologies (mobile equipment, RFID, etc.), safety systems, freight attributes, storage times, training and qualification requirements, special client requirements (delivery timeframe, moisture content of wood, etc.). The external factors with an impact on the logistics chain include: regional and cluster development and influence of politics and local government, ecological aspects such as legal regulations, standards and requirements (transportation, environmental protection, nature conservation), contingencies (weather, catastrophes, consequences of management), sustainability and utilization strategies (development and implementation of a holistic sustainability indicator system).
The requirements coming from logistic operators can be summarised as follows:

- *Design support*: having a simple but effective way to evaluate to which extent the available resources (fleet, warehousing) fits different customer demand configurations.
- Order management. The clients of the logistic operators sending orders mainly use their ERP system interfaces. Orders are usually complex, calling for breakdown to elementary tasks and assignment to different. Clients can require new and unusual services or extra-capacity which has to be solved by the logistic operator by finding new competent partners and involving them into the process.
- Planning and workflow. Critical issues are: maintaining an integrated view of the customer order status together with the missions assigned to the internal and external resources to fulfil it and managing in real-time mission confirmation from the assignee, taking advantage of mobile technologies.
- Interoperability. A strict requirement refers to automate as much as possible communications with customers (order acquisition and progress), with associated companied (missions assigned and executed, exceptions) and with external partners (requests of extra capacity, negotiation of detailed supply conditions).

6.6 Semantic interoperability

Software tools have been developed in the last years to support supply chain planning and management. However their introduction has been much slower than expected, especially at SMEs, as: (i) benefits are addressed to one of the actors while the others are disregarded; (ii) adoption of new ICT solutions produces technological and semantic interoperability problems with legacy systems; (iii) each network is supported as a closed world and info exchange between networks through the shared nodes is not considered. The proposed approach puts much attention to exploiting recent findings in the interoperability and semantic web field, in particular by the SEWASIE [1], SEEMseed [2], STIL [3], DBE [4] and SEAMLESS [5] projects.
The aim is developing and delivering an ontology-based solution to exchange data between different technologies and database schemas, as well as the identified model support tools in form of web services that can be easily accessed and linked to legacy systems without the need to invest in new ICT infrastructures.

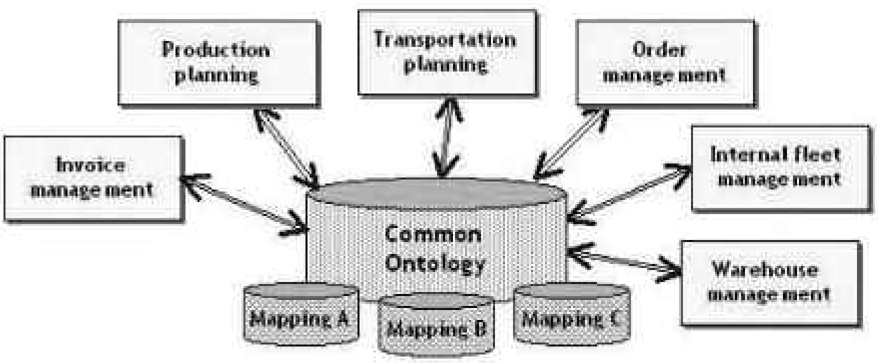

Fig. 6-3 Common ontology

The specific contribution is to enhance the state-of-the-art in the adaptation of such techniques to a real and challenging case constituted by the management of complex interlinked logistic networks.
On top of this open infrastructure a set of software components and services are designed and developed for implementing the needed support functions to network design, planning and operation models. The software component will be conceived to be provided as electronically available services (eServices) for the logistic network. The work is based on the detected user requirements and takes into account the existing solutions and technology platforms for providing advanced ICT tools and services to the end users.
Finally, the interoperability of the implemented eServices is checked against other open infrastructures, such as those developed and experimented by the SEEMseed, Digital Business Ecosystem or STIL projects, each of which implementing autonomously a similar development approach based on open source, web services and open specifications (XML, BPEL, WSDL and so on).
This further level of interoperability will ensure the possibility to a number of software developers, no matter if involved in any open infrastructure development, to study and realise added value applications and services, cheap and easy to integrate, that can enhance dramatically the level of ICT adoption at all the SMEs involved as logistic network actors.
At the time being some experiences of re-engineering “monolithic” web-based applications to obtain autonomous building blocks, on which basis new applications can be built, have been carried out and the results are very encouraging. It is estimated that having available 10-15 basic eServices (distance calculation, route computation, order import from the buyer legacy systems, mission export to the logistic operator legacy system, price comparison and so on), the software coding time required to obtain an application ready for use is reduced of the 35-40%.

6.7 The STIL architecture

The STIL project (ICT tools for interoperability in enterprise networks: digital integrated logistics) is a project funded by the Telematic Plan of the Emilia-Romagna region, lasted two years and completed in February 2007. The main outcome of the STIL project is an ICT platform, validated in a number of real life operational scenarios, whose application components are built on a message-based Service Oriented Infrastructure. The platform is made of nine independent modules, each provided with specific functionality able to satisfy the needs of a particular actor of the exchange of logistic services scenario.
The modules are able to communicate with each other and exchange the information needed by each actor according to the role played in the different operational scenarios. The studied interactions are those represented in the following figure (red colour), most of which have been implemented for demonstration and validation purpose.
The modules highlighted in green are actual web services, and constitute the main operational tools of the STIL user profiles. The modules highlighted in yellow represent existing information systems, fully independent of STIL, on top of which it is possible to build a “web service layer” (in green) to enable their communication potential with the STIL web services.
Thus, every company provided with its own information system is pot in condition to open it to the rest of the world and use the STIL messages to exchange information with other involved actors. As an example, a manufacturing company with a legacy system can export transportation orders and send them to a logistic service provider or to a broker through a proper STIL message.
The main actors involved in the logistic service exchange scenario are:

- *User company*: this is the manufacturing and distribution company willing to buy logistic services, both transportations and warehousing.
- *Logistic provider*: this is the transportation service provider, providing the good picking and delivery services.
- *Warehouse* / Logistic Platform: this is the company offering housing & handling services to the user companies (or to the logistic providers).
- *Broker*: This is an independent actor behaving as mediator between logistic services requesters and providers. Its main task is matching demand and offer of logistic and warehousing services, trying to optimise times and costs.

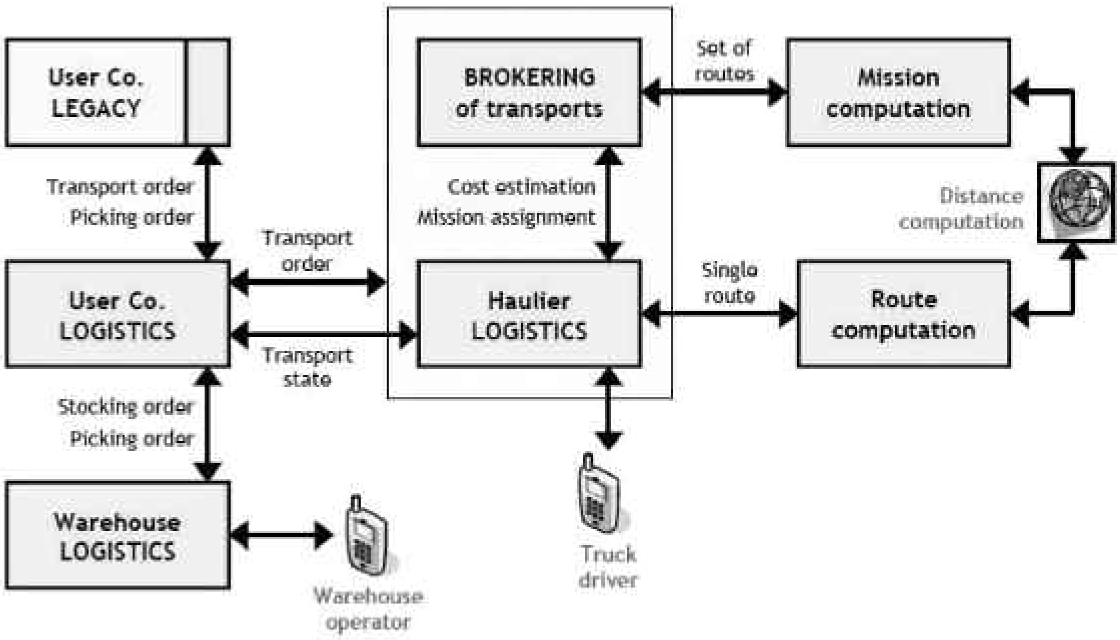

Fig. 6-4 Interaction devices

The figure shows that some interaction devices can be mobile in nature, as they fit well the needs of some user profiles. In the STIL context the two actors intended as provided with mobile technology are the truck driver and the warehouse operator:

- The truck driver can use a palm-top computer to get in real time the assigned transportation mission, and to signal its geographic position and communicate the performed loading and unloading operations and the possible exceptions occurred.
- The warehouse operator is likely provided with a device to read the bar codes on the packages to handle, and can communicate to the logistic platform legacy system the entry, location and exit of every single package.

Other STIL web services are those aimed at supporting transport planning, through route computation and optimisation. They can be used by every other STIL service able to compose the request message and handle the answer message.

- Route planning: This module supports the broker in finding the best transportation solution satisfying a set of transportation orders coming from the user. The service allows grouping compatible orders together, for load and route optimisation
- Fleet planning: This module is used by the logistic service provider to pan its own fleet. It allows computing transportation solutions taking into account the status (shifts and allocations) of every single truck of the fleet and the travel costs.

The large number of interactions between web services studied within the project allows reducing a large quantity of data exchanges, then overcoming the obstacles arising from the different implementation technologies, data syntaxes and semantics. In fact, independently of the business logic of each application, a new actor can enter the STIL world provided that it is able to produce and interpret the SOAP messages, validated with respect to the schema defined in the domain ontology. In addition, every STIL service fits both cohesion and de-coupling requirements, as it contains all and only the functionality needed by a given actor. Thanks to the communication ability granted by the use of the web service technology and the STIL ontology, the services can be composed in different patterns to meet the requirements of real world actors, playing more then one role in the operational context (e.g. logistic provider providing also warehousing services, user company provided with an internal fleet, and the like).

6.8 Conclusion

The paper summarises the research activities carried out by a European-wide group, and materialised in Italy by the completion of the STIL project, aimed at substantially increasing the adoption of new ICT solutions and the satisfaction level of companies participating in interlinked logistic networks.
After the first generation of Internet-based and mobile-based stand alone applications, it is time to study a new generation of pan-European and world-wide logistic services starting from the actual needs of the different user categories. The work is full in line with the objectives of the i2010 initiative.

Acknowledgements

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[5] See www.seamless-eu.org

7

Bologna Freight Village: IT Automation for Railways

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*** Interporto di Bologna, ** Exitech srl**

The Bologna Freight Village (BFV) consists of an integrated system of logistics, rail and road infrastructures designed for the transport of freight and directly connected to the national railway line and motorway system. The BFV covers an area of 2,000,000 sqm, 650,000 sqm of which house the Italian Railways facilities.

7.1 Introduction

The complexity of the Freight Village as a system has required in the past and continues to require a strong commitment in identifying and developing IT solution for meliorating logistic processes. In order to identifies which aspects are relevant for the improvement of the quality of service the first step has been the evaluation of the processes in terms of operators that are on the field, data exchanged, and the modeling of processes that also if not implemented yet should improve the global process. On the basis of the analysis performed and on some practical consideration and interests of BFV management company, some pilot project have been started in order to cover the needs that are mainly focused on simplifying railways management in terms of shunting operation, wagon management, quality of service and statistic information. In this work the processes of BFV are analyzed and described and a report on the pilot projects that have been activated is reported with a main focus to shunting automation and GPS monitoring of locomotive in order to obtain statistic for meliorating QOS, for a optimizing time and train planning and for monitoring locomotive position in order to avoid safety problems both in terms of speed excess and contemporary operation in the same zone.

7.2 Freight Village Process analysis

It is evident that all freight villages that have railways facilities inside have similar problem and similar process in a general sense; moreover the same set of general operators are present. The main process that have should be considered common to several freight villages are:

- Empty Container Management: that is the process of holding empty container for future uses on behalf of companies that uses freight village;
- Booking: that is the process that involve the management of booking operation both for empty and not empty container in order to have a faster access to the facilities (i.e. railways or hold for loading/unloading);
- Train Arrival: that is the process that starts when a train arrive at the station and it is necessary to split it among different track in the terminal. This process involve also shunting operations;
- Train Handling for unloading: that is the process that activates when a train arrives and it is necessary to unload it;
- Train Handling for loading: that is the process that manages all the operations that are performed before train departure for loading wagons;
- Train Departure: that is the complex process that compose a train that have to leave the terminal. This process include also shunting operations;

A certain number of operators (say companies that works in the freight village) are usually present, and several times the same company cover more than one role; in any case the main roles identified are:

- RO: Railway Operator
- TO: Terminal Operator
- SO: Shunting Operator

- MTO: Multimodal Transport Operator
- TMC: Track Management Company

It is also evident that this common background can differentiate when a single process is analyzed in deep for several reason among those we can identify:

- Different roles are covered by different company with a different approach;
- The same company can cover more than one role, and the set of roles covered are not always equal;
- Different level of automation in infrastructure and document management are present;

In this work we will cover the aspects that are strictly related to BFV for which the following flow of data and operations are represented.

7.2.1 Train Arrival

In the Train arrival process the following operators are involved:

- RO: Railway Operator
- TO: Terminal Operator
- SO: Shunting Operator
- MTO: Multimodal Transport Operator

The main technology to be adopted in order to simplify and automate the shunting process consists in the adoption of a mobile device that receive the shunting operations to be performed. On the basis of the operations that are really performed the wagon positioning is updated.

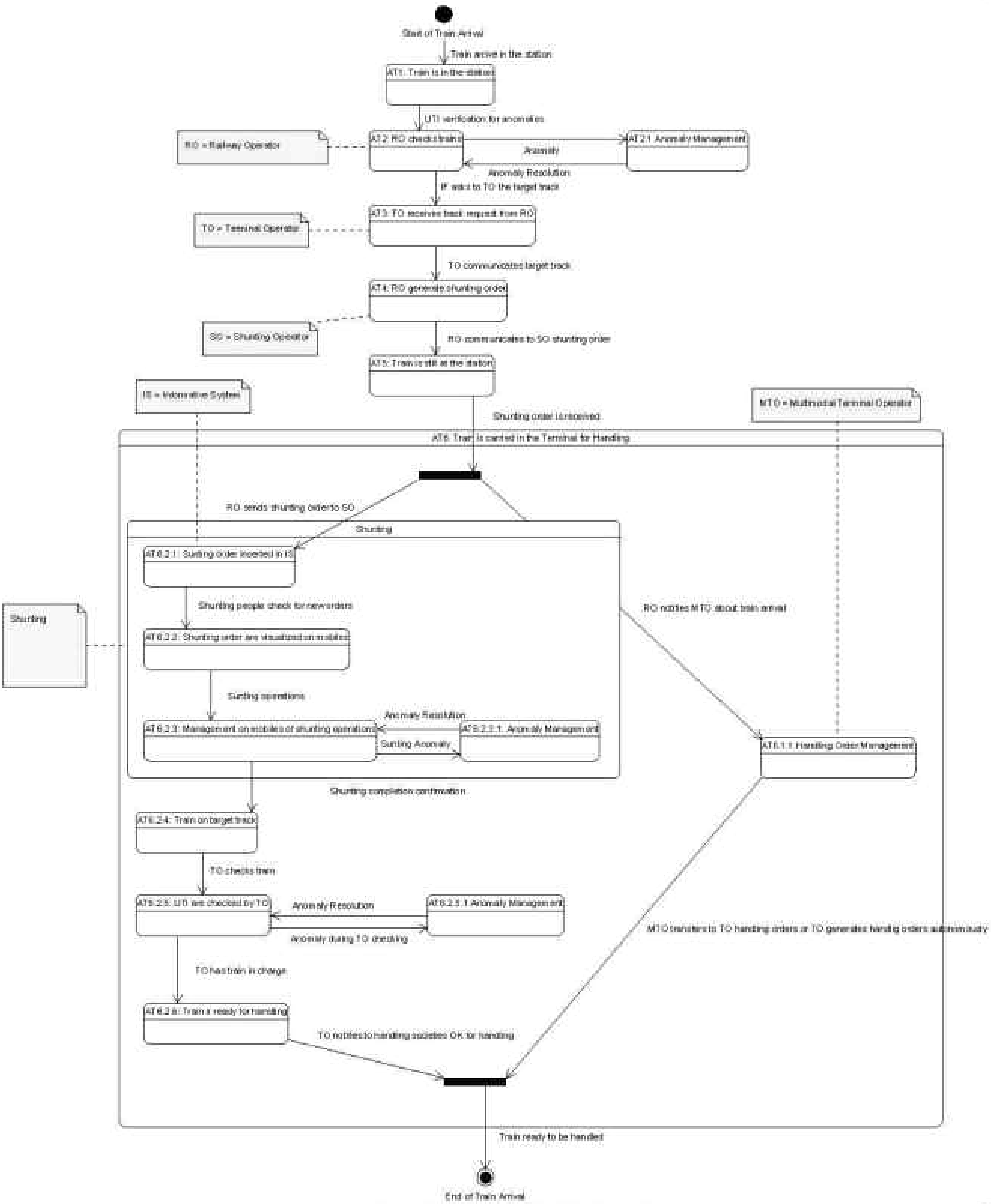


Fig. 7-1 Train arrival process

7.3 TRAIN HANDLING FOR UNLOADING

In the Train handling for unloading process the following operators are involved:

- TO: Terminal Operator
- SO: Shunting Operator
- MTO: Multimodal Transport Operator

From the technological point of view there is quite nothing to add apart the possibility to automate communication among TO, SO and MTOs, in order to have an electronic format for data exchange common to all the operators.

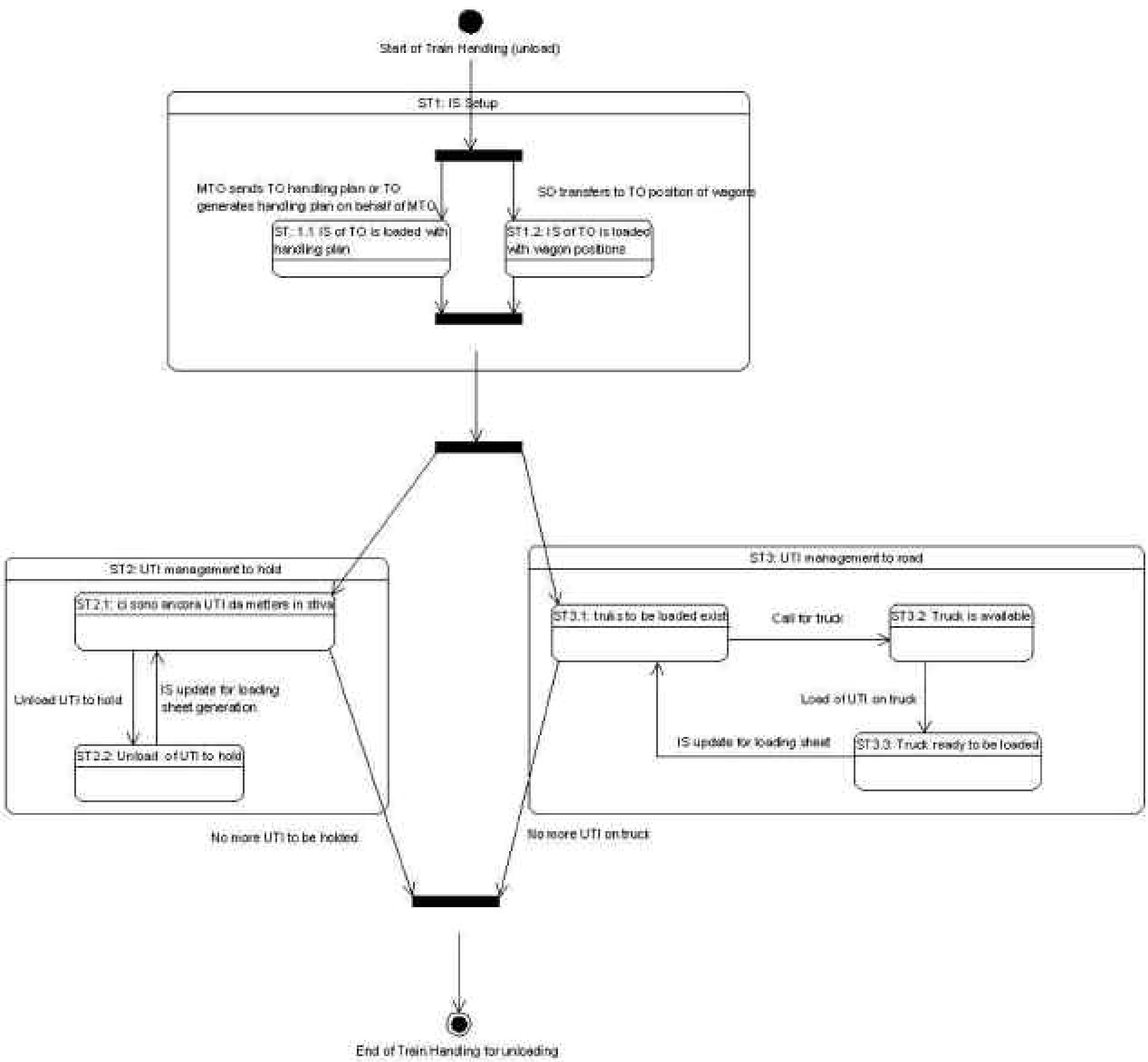


Fig. 7-2 Train handling for unloading process

7.3.1 Booking process

Booking process involves only TO and MTOs, since this process is a simple communication of MTO booking data to the TO. This process can be specialized for different type of booking such as:

- ❑ Booking for empty containers
- ❑ Booking for train load
- ❑ Booking for train unload

In any case the main technological aspects are focused on the TO informative system that must be able to receive data from the different informative systems of MTOs.

This can be done by implementing open web services at the TO site or by creating custom import module one for each MTO.

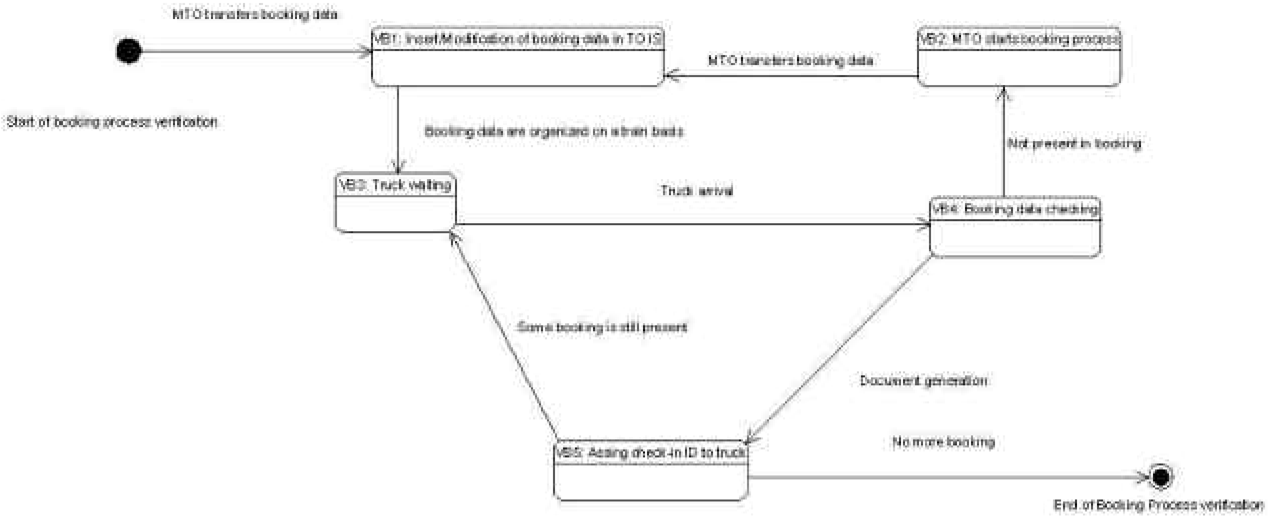


Fig. 7-3 Booking Process

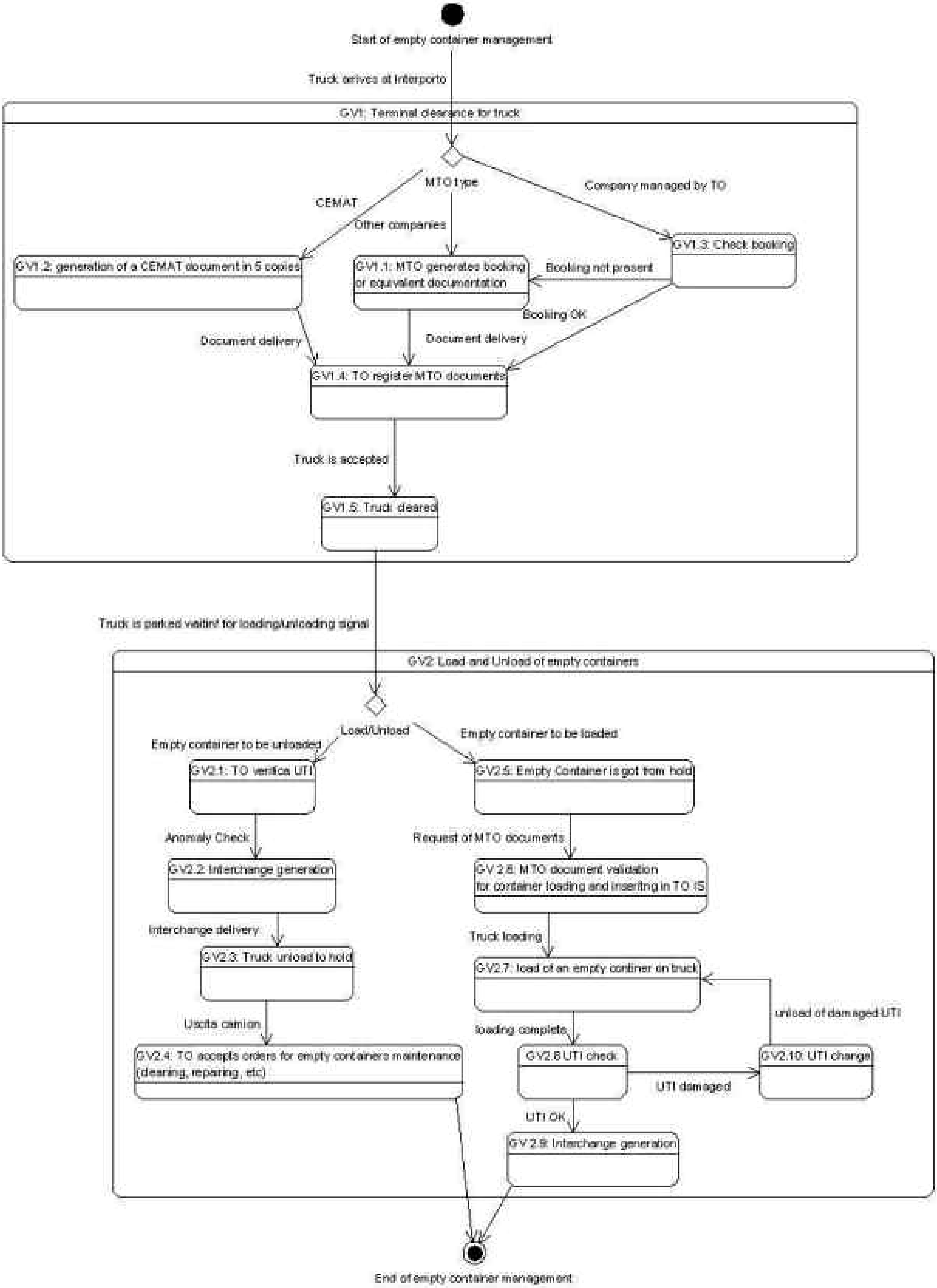
7.3.2 Empty Container Management

In the empty container management process the following operators are involved:

TO: Terminal Operator

MTO: Multimodal Transport Operator

This process is very important in each freight village since allows transport operator to use the outward or return journey of a truck to leave an empty container or to get a previously left one in order to optimize truck travel. The process is complex and implies the adoption of a booking process to save time. Over this process several other processes related to the freight village services can be created, such as cleaning and repairing of empty containers.

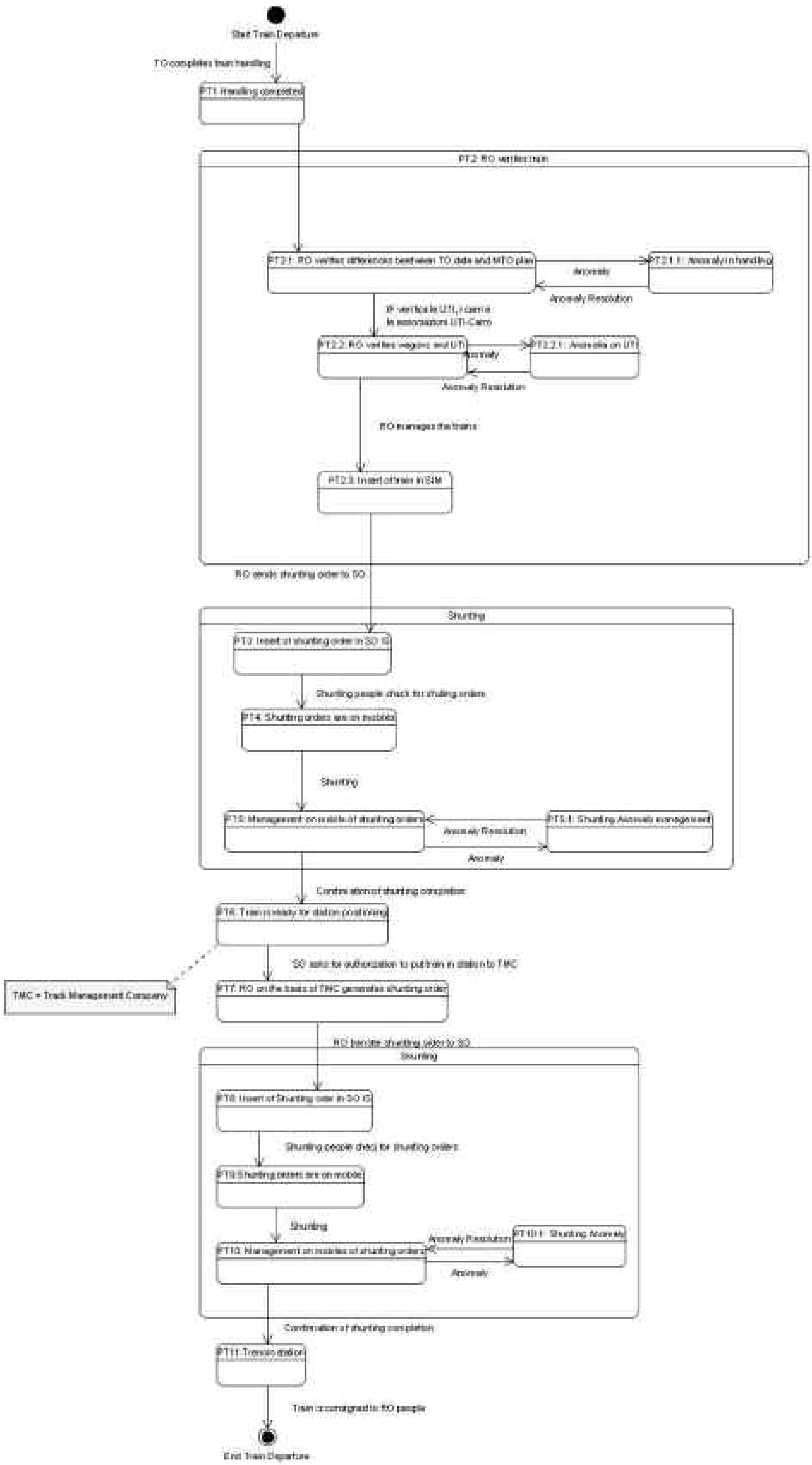

Start of empty container management
Truck arrives at Interporto
GV1: Terminal clearance for truck
MTO type
CEMAT
Other companies
Company managed by TO
GV1.2: generation of a CEMAT document in 5 copies
GV1.1: MTO generates booking or equivalent documentation
Booking not present
GV1.3: Check booking
Booking OK
Document delivery
Document delivery
GV1.4: TO register MTO documents
Truck is accepted
GV1.5: Truck cleared
Truck is parked waitinf for loading/unloading signal
GV2: Load and Unload of empty containers
Load/Unload
Empty container to be unloaded
Empty container to be loaded
GV2.1: TO verifica UTI
GV2.5: Empty Container is got from hold
Anomaly Check
Request of MTO documents
GV2.2: Interchange generation
GV 2.6: MTO document validation for container loading and inserting in TO IS
Interchange delivery
Truck loading
GV2.3: Truck unload to hold
GV2.7: load of an empty continer on truck
unload of damaged UTI
Uscita camion
loading complete
GV2.4: TO accepts orders for empty containers maintenance (cleaning, repairing, etc)
GV2.8 UTI check
UTI damaged
GV2.10: UTI change
UTI OK
GV 2.9: Interchange generation
End of empty container management

7.3.3 Train Handling for loading

In the Train handling for loading process the following operators are involved:

- TO: Terminal Operator
- SO: Shunting Operator
- MTO: Multimodal Transport Operator

As already stated for the unloading process, from the technological point of view there is quite nothing to add apart the possibility to automate communication among TO, SO and MTOs, in order to have an electronic format for data exchange common to all the operators.



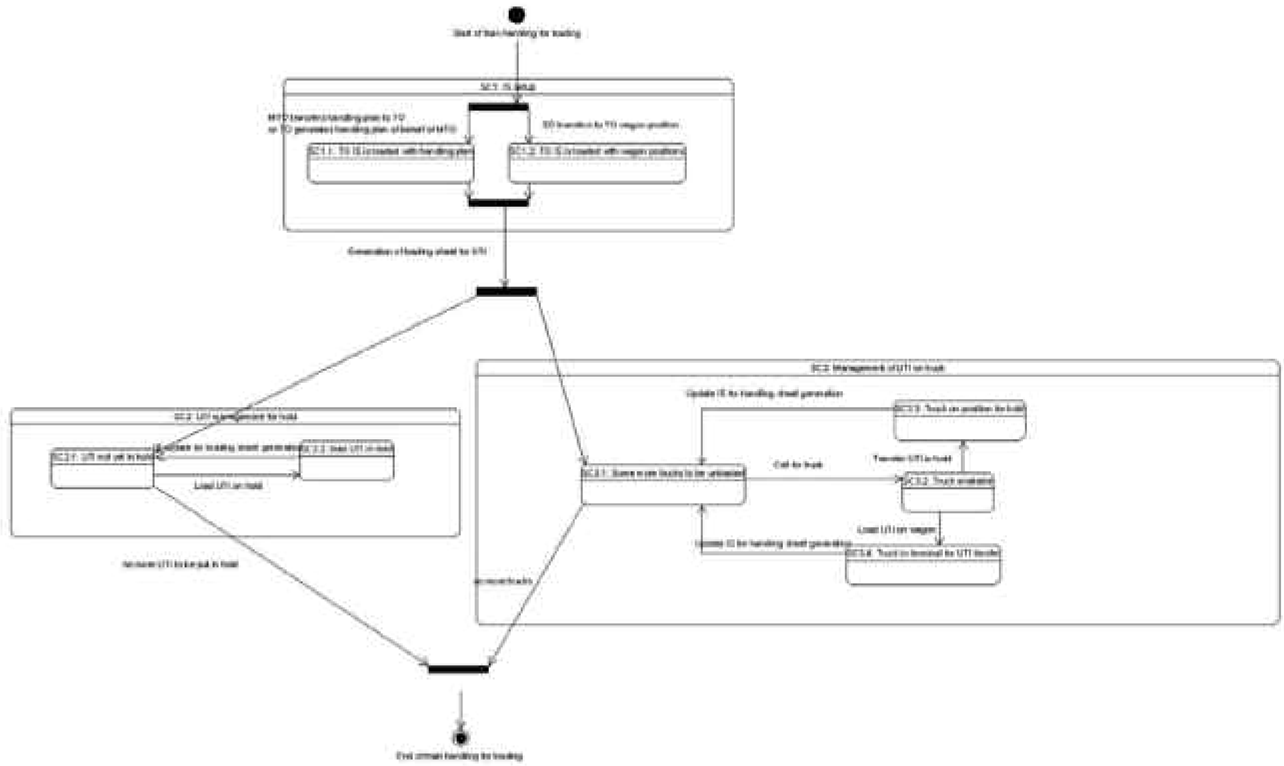


Fig. 7-4 Train handling for loading process

7.3.4 Train Departure

In the Train departure process the following operators are involved:

- RO: Railway Operator
- TO: Terminal Operator
- SO: Shunting Operator
- MTO: Multimodal Transport Operator
- TMC: Track Management Company

Also in this case, the main technology to be adopted in order to simplify and automate the shunting process consists in the adoption of a mobile device that receive the shunting operations to be performed. On the basis of the operations that are really performed the wagon positioning is updated. Another important automation process that is mainly involved in train composition (but that can also be applied to train arrival consists in the automatic generation of the sequence of shunting operation that optimize the number of operation (and therefore the time for train composition) on the basis of several different parameters such as terminal topographic information, priority of train composition, etc.

7.3.5 Shunting Automation

Shunting Automation architecture

Shunting process is a quite complex activity to be performed in a general sense especially when more that one train has to be composed in the same time slot or some complex activity have to be performed to create a train for the wagons that can be present in different tracks.

Information technology can give a great aid in this phase at least from two points of view:

- Management of information directly on the field with mobile devices connected with GPRS technology or Wi-Fi technology;
- Application of Artificial Intelligence algorithms to find the best solution taking into account bound and human behavior.

The process of shunting automation can be well described by the following diagram:

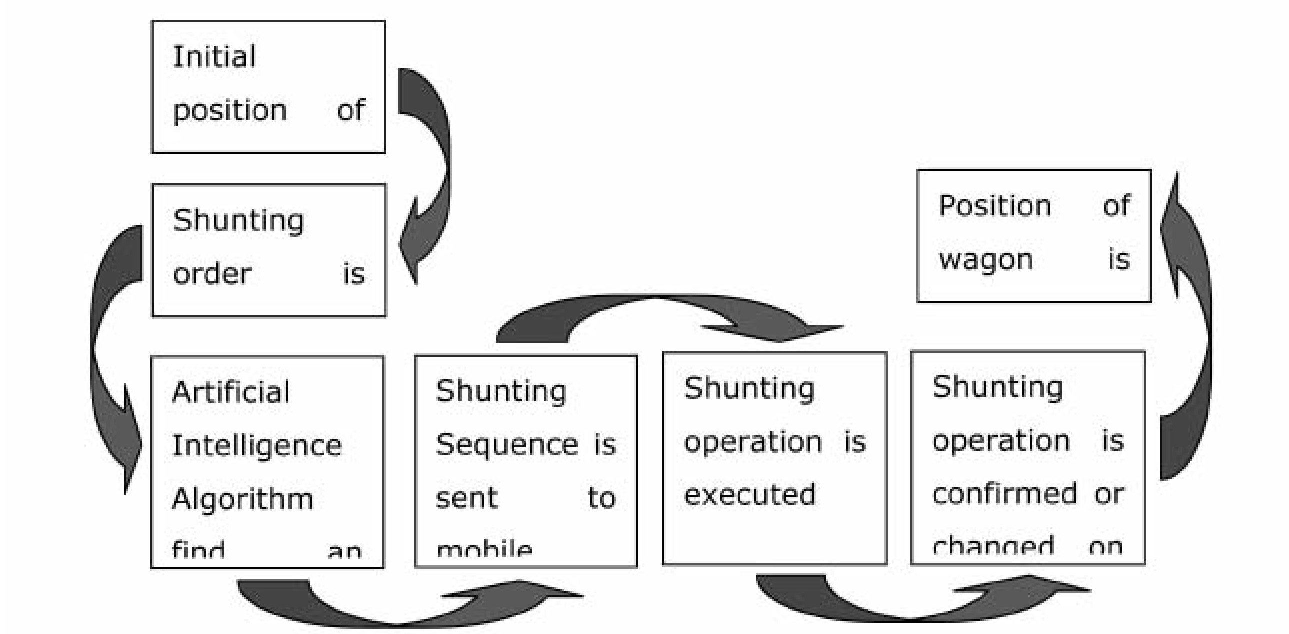


Fig. 7-5 The shunting process

The technological architecture uses the previously described flow to implement a real infrastructure in BVF based on mobiles that can be employed easily by shunting people, GPRS or Wi- Fi connection to exchange data and a monitoring station to issue orders, plan modification, view updated situation and so on.
The deployment on the field of the system can be described by the following picture, where the main interaction are depicted.

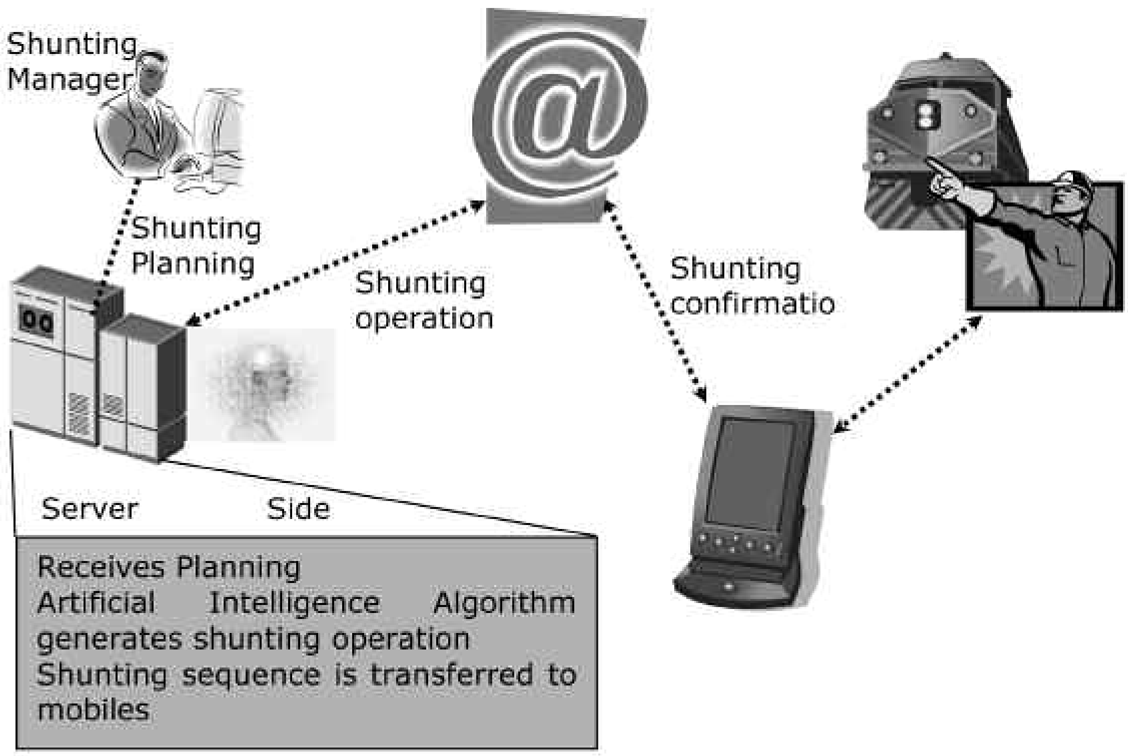


Fig. 7-6 The shunting ICT architecture

Shunting automation has to consider at least the following requirements:

- Generate shunting operation in situation where more than one train has to be composed;
- Allow to set up priorities for trains;
- Minimize the number of shunting operation;
- Consider current way in which shunting is performed;
- Consider shunting among different terminals inside the same freight village.

7.3.6 Advantages of Shunting Automation

Shunting automation allows to reduce the number of movement that each locomotive have to perform for completing a shunting order reducing composition time and fuel consumption. Moreover if the complete process is implemented the position of each wagon inside BFV will be monitored in real time with the information that can be associated to that wagon (type, length, weight, if it is empty, braking, etc).

People that manages shunting can have in each instant a snapshot of the real situation of the tracks with the associated wagons, allowing an easier management of the shunting process and having a clear view of what is happening in case of problems.

GPS positioning of locomotive

GPS Monitoring architecture

The architecture of the GPS monitoring system is quite complex and require several interactions among its different parts.

A GPS receiver connected to a GPRS equipment have to be placed on the locomotive. At a predefined time interval raw data related to locomotive positioning, speed, quality of signal, etc are sent to a BFV server that collects and elaborates these data. After an elaboration that allows the system to rebuild a-posteriori the paths followed by each locomotive and to set predefined statistics in order to improve the speed at which statistics are elaborated. The following figure shows the general architecture of the system.

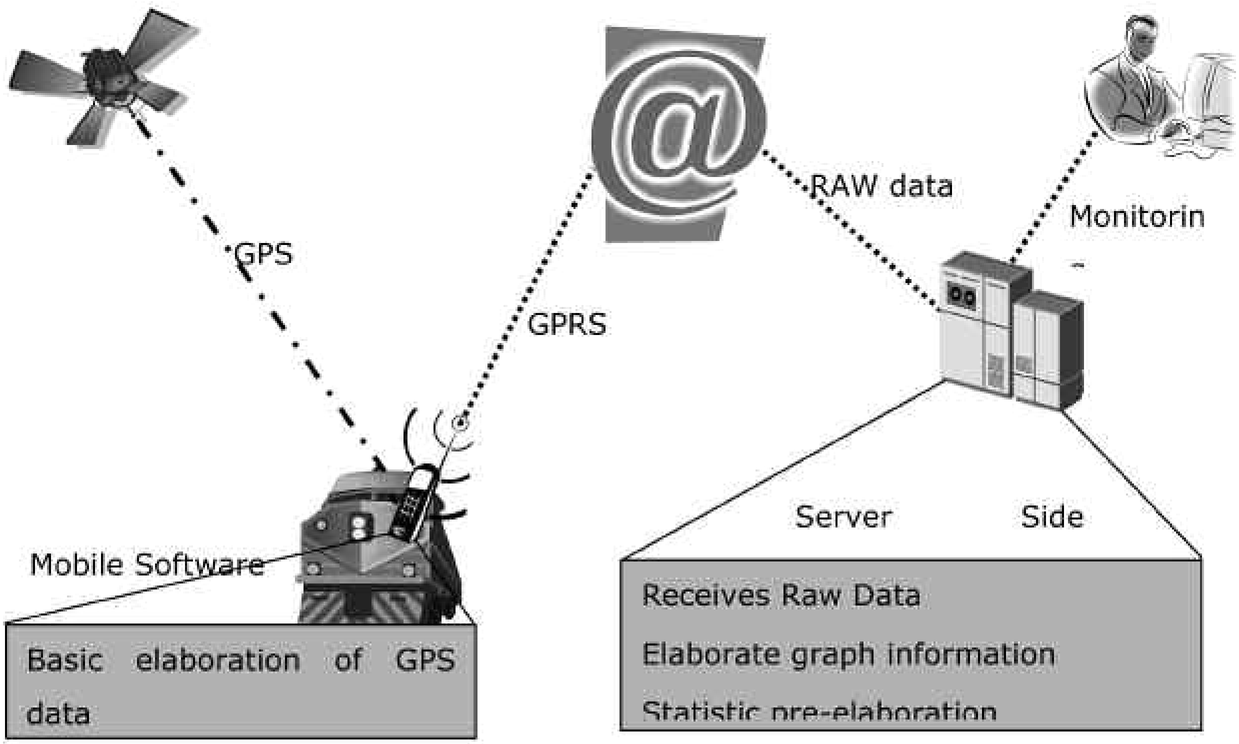


Fig. 7-7 General Architecture of the System

From the server side, the BFV railway terminal is represented as a graph where each node represent a zone and each arc the path for connecting the zones.
An example of such representation is reported in the following picture. It is not a real representation of BFV that is more and more complex neither a representation of the real connection among the different terminals that really exists in BFV.

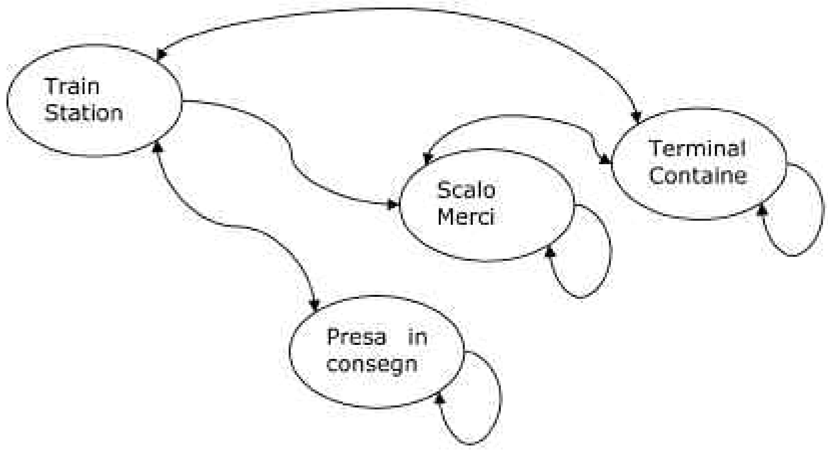
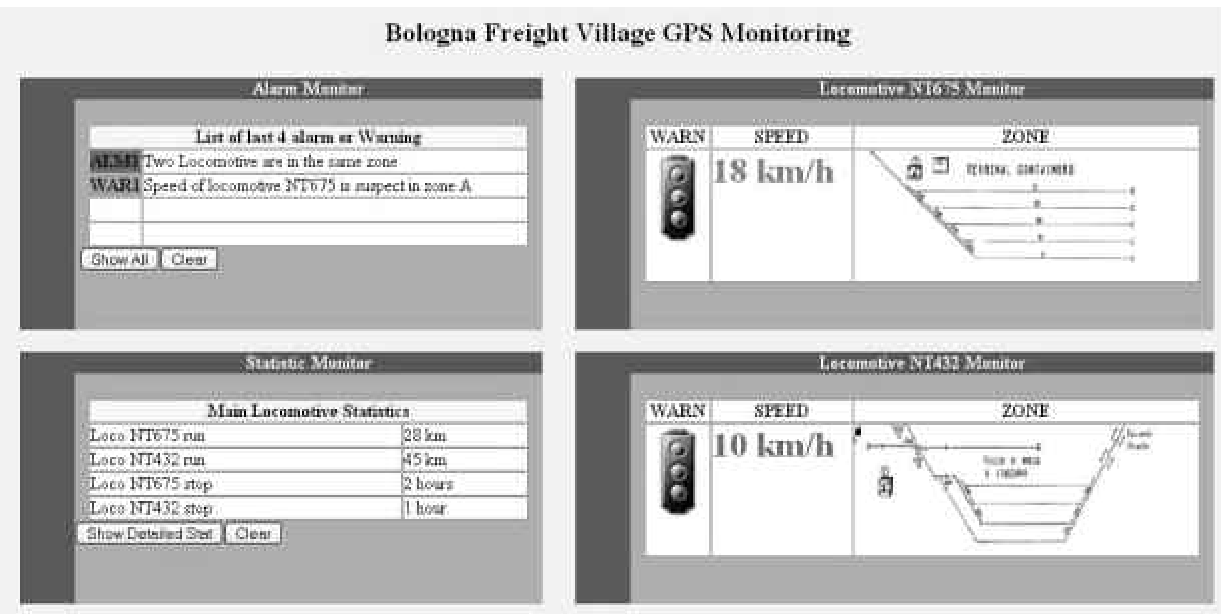


Fig. 7-8 Graph representing zones

7.3.7 Advantages of GPS monitoring

Monitoring of locomotive from with a GPS system will allow to the company that manages BFV to have a real time monitoring system for security reasons that monitors is a locomotive is exceeding the speed limit for a certain zone or if two locomotive are operative in the same zone.
The following pictures evidence two typical situation when an atypical speed is detected for a locomotive, and a situation where two locomotives are in the same terminal zone.



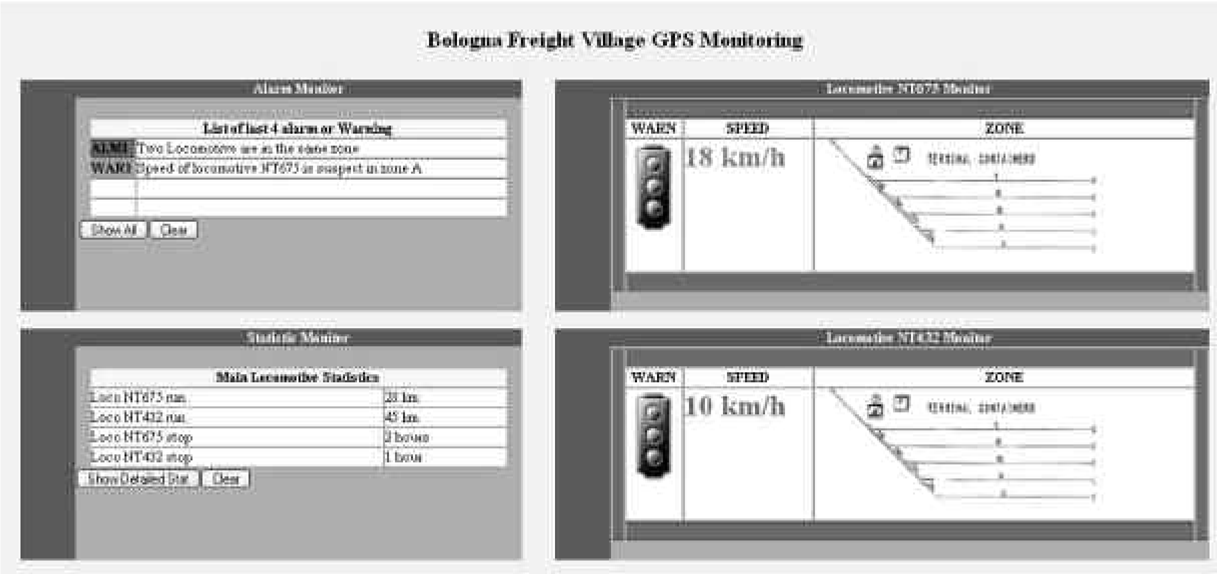


Fig. 7-9 GPS Monitoring system

Moreover the collection of raw GPS data and the evaluation of such data allows to extract statistics that can be relevant for short term planning and also for medium-long term planning.
Short term planning can be improved by monitoring in several weeks how the turns of shunting people can be reorganized on the basis of the real activity of the locomotive.
Medium and long term planning is improved by analyzing the time slot of inactivity of locomotive that allows the freight village to organize new trains or to accept new trains.

7.4 Conclusion

The work performed has allowed to obtain several important results can that improve the operations inside BFV.
Among all the results obtained the key points that can be enlightened are:

- A complete map of the process that involve railway and road terminals has been completed;
- Comprehensive identification of relationship among BVF actors has been carried out;
- Identification of key processes to be improved or at least managed in a better way;
- Identification of some test projects to improve special activities mainly related to railway terminals;
- Implementation (at the moment they are running projects) of these project in the BVF test plant.

All these activity will give to BFV an outstanding knowledge of its processes and an important startup of the technological infrastructure needed to optimize IT process in the large sense.

8

EDI and Cargo Flows in the North and Baltic Sea Region - an Analysis for Potential Logistical Services

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8.1 Introduction

The cargo flows in North and Baltic Sea are undergoing strong development. Recent developments of maritime transport in the NSR/BSR have been characterised by an increase in shipping volumes and by the use of larger and more specialized vessels. In particular the transport of oil and related products has increased tremendously in the BSR. In 2005, 17% of the world trade is handled only in the BSR and 30% of EU-Exports go through the BSR. It is expected that a tenfold increase of the trade volume will occur within 20 years.[6]

Especially the Baltic Rim functions as a platform for East-West trade but the integration of the Baltic Rim countries into a homogeneous trading area depends on its logistical networks. Nevertheless, through EU-expansion a somewhat homogenous trading ground has been achieved (excluding Russia), but disparities are still high which make trading in the region a somewhat difficult experience. The limited availability of resources and hindering as well as missing regulations lead to uneven trading grounds. But, for the implementation of sufficient networks the growth of the Baltic and Russian markets has become a driving force. Through these market demands and the intense trade between Germany and Scandinavia, the BSR is seen as one of the most thriving regions of the world. Trade with crude oil and refined oil products has been the major part of total trade volumes, especially from Russia and the Baltic states. Oils and other bulk commodities dominate the trade, but are outweighed by high value products groups in terms of transported value. Here, vehicles, machinery and electrical appliances dominate the high value trade while forest and plastic products develop sustained growth rates. Special attention should also be given to the tremendous growth in areas of pharmaceutical products. The challenge for port areas to cope with increasing cargo flows in these commodity areas is not only concerned with providing the appropriate super- and infrastructure but also to facilitate market mechanisms and supply chains of companies transporting their goods through ports.

8.2 “Value Added Services” strengthen logistics

The following tries to clarify the ports position in this regard looking at supply chains in general and related logistical services. Relating to this the conclusion of six industry case studies is given later on.

8.2.1 Added Value Potential

Ports have always been the culminating location of cargo flows from one point to the other. In a world of increased sourcing of goods from disperse locations and globalized production processes, the function of ports as logistical hubs has been developed further. Nowadays, the transport and handling of goods goes beyond the traditional functions of a port. In general, one can say that “logistics is the process of planning, implementing and controlling the efficient, effective flow and storage of raw materials, in-process inventory, finished goods, services and related information from point of origin to point of consumption (including inbound, outbound, internal and external movements) for the purpose of conforming to customer requirements.”[7] This has not only led to a different perspective on logistical activities but has also raised the expectations of producing companies shipping their goods on the standards provided by LSPs, especially ports. Ports are increasingly looked at as a specialized LSP.

6 Antola, Kivikari 2004

7 Coyle, Bardi, Novack 1999

Implied in the definition is that the logistical process provides a systematical framework for decision making that integrates transportation, inventory levels, warehousing space, materials handling systems, packaging and other related activities that encompass appropriate trade-offs involving costs and services. Another definition of logistics says that logistics involves the efficient and effective management of inventory, whether in motion or in rest, to satisfy customer requirements and organisational objects. An important aspect of the later definition is that the transportation service is recognised as inventory in motion; therefore, the true cost is more than the actual rate charged by the transportation company.[8]

The foundation for the development of any kind of value added service is the implementation of certain kinds of logistical processes. These in return bear the potential for the incorporation of services that go beyond the traditional comprehension of logistical services and add value to the handled products. The following logistical categories provide a framework for the categorization and the question is where to derive additional services from: Transport, Warehousing, Materials handling and packaging, Order handling and customer service, Prognoses, Production planning, Purchasing and materials management, Other activities.

Especially the last category provides room for activities that go far beyond the traditional handling of goods. And in this area, development tendencies towards individualized services for more intense integration of the supply chain are strong.

Value added services in this area can be divided into the following categories in order to relate their functionality for certain industry-specific supply chains:[9] Packaging, Specialist or niche services, Localizing and customizing, Time reliable services, Assembly, Repacking, Refurbishment, Installation a*nd instruction, Quality control and testing of products, Packaging return services, Product training on customer's premises, Bonded exhibition, Cargo related services.*

These different possibilities in implementing services provide a wide range of ways for servicing even in port areas. Besides these areas of new business possibilities, the following logistical trends could be observed for the last decades in the BSR:[10]

- Restructuring of logistical systems by spatial concentration of production; through reduction in plant numbers, or increased plant specialization ('focused production'); spatial concentration of inventory
- Realignment of supply chains by wider geographical sourcing of supplies, wider distribution of finished products and concentration of international trade to hub ports
- Rescheduling of product flow by adoption of Quick Response and ECR (Efficient Consumer Response) in retail distribution and concentration of international trade to hub ports
- Changes in management of transport resources by improvement in transport's relative cost/performance, increased use of outside transport / distribution contractors, changes in vehicle size regulations and in handling systems and combination of transport modes towards intermodal transport chains
- Changes in product configuration/design by increase in complexity and sophistication of product.

The observed logistical trends are assumed to have the following effects on transport:

- Increase of the average transport distance
- Concentration of flows on links and nodes
- Optimisation in use of transport resources

Despite the optimisation in use of transport resources, these logistical trends lead to a strong overall growth in transport activity which was referenced in the previous chapters. On the other hand, these tendencies show that the shipping companies have changed their activities in logistics and have tried to fit these to their individual needs in globalized sourcing activities. In general, industries operate with differing supply chains and differentiated needs for logistical services and they also have differentiated views on outsourcing logistical services. But an additional strong tendency has been observed: outsourcing of logistical activities has become a major concern of many companies across different industries in order to focus on their respective core activities and remain competitive. Over the last years, this has led to a growing market for specialized logistical services.[11]

8 ibid.

9 Rushton 2001, p. 62-63.

10 Baltic 21 2004b, Bowersox et al. 2002, Buchholz 2002, Coyle et al 1999, Hoffmann 2004, Panayides 2006, Song et al. 2001

11 Klaus, Kille 2006

Competitiveness is a key phrase, often stated in regards to logistical activities. And it has been putting pressure on the transport sector. Large potentials for improvement have been realised in many companies' supply chains. In case of the automotive industry, 35% of the companies' innovations result from supply chain improvements. Further more, automotive companies like the Toyota Motor Company of Japan implement supply chains with 60% of the company's innovations.[12]
However, an improved supply chain of one company is not necessarily applicable to another company with different needs. And certainly, standard logistical activities that were used in previous years are also not as efficient and not as fast enough for individual companies' needs.
So, any kind of logistical service and especially the provision of VAS must be specifically rated according to the companies needs. And furthermore, an overall needed for VAS can not be identified in general because every company has outsourced – if it does at all – different parts of supply chain. Different potentials for VAS can therefore be found in each industry where supply chains are generally similar.
However, there are certain kinds of services that add value that are applicable everywhere and are not industry- or company-specific.

8.2.2 The Logistics Industry and Supply Chains

Rapid changes in the business environment have created new obstacles for companies to keep their business functions competitive for an increasingly globalized market. This is the case for OEM companies and even more so for companies in the logistics business. They need to look beyond traditional ways of doing business and envision themselves to accomplish new, formerly unknown, tasks. Over the last few years the potential for logistics management has grown as an enabler to arrive at a better understanding of logistical chains and improved competitiveness. The development of logistical management has been sped up by an increasing focus of collaboration within chains of added value. Furthermore improved decision-making capabilities through financial-, warehousing- and inventory management concepts have led to a growth in importance of logistical activities.
Trying to identify potentials for added value in northern Europe, the tendencies in the European logistics market need to be looked at. As a clear relationship between the demand for freight transport and economic growth can be established, it still has to be kept in mind that the freight transport volume outweighs the amount of goods produced and imported because of the fact that cargo is handled numerous times within multi-modal transport chains.
The situation in Europe has changed from one in which many plants and distribution centres were working exclusively for one national market. With ongoing economic integration, one European plant or one European distribution centre/hub may cater for the entire EU market. This is true for many companies located in Europe. The larger ones, however, tend to build on regional distribution centres in order to handle the amounts of goods more efficiently.
Distribution centres that incorporate different logistical functions currently are the focal point of logistical activities. This function can especially be filled by port areas due to their strength in intermodal changes of transport. In order to provide for further developments, the logistical centre in a port should be open to external logistical companies. As the primary function of a port is the transhipment of goods, ports must also offer their customers the required combination of facilities, quality and price of services.
The whole phenomenon of restructuring logistical processes can be combined in the mentioned activity of logistical management. This oversees and integrates value added chains and is the main focus for developing any new value added services. This should also be the focus of LSPs operating in a port area in order to provide the best possible service for the customer.

8.2.2.1 Cargo Flows and Supply Chains

Supply Chain Differentiation

A further aspect is the differentiation of supply chains according to industries. Each industry has a different level of complexity regarding its structure of supply and complexity of the final product. In general, a differentiation can be made between production systems of (a) raw materials, (b) semi-finished products and (c) manufactured

12 Coia 2003

goods. The level of complexity of the final product is rising from (a) to (c). The level of supply chain links on the other hand is different in each case. Raw materials are bulk goods with generally close connections from the point of extraction to the point of processing or intermodal change for long-distance transport. These connections are extremely cost related.
The transport chain for semi-finished goods is rather complex by comparison. Depending on the kind of product, more or less transport relations are to be followed between different processing steps of the whole production process. As long as the producing company is vertically integrated in terms of corporate structure and location logistical activities will be few. If the company or corporate structure is vertically disintegrated, logistical activities will be much more.
Finished goods have a fairly simple transport chain. In most cases it runs from the company finishing the product to wholesale and then to retail. Nevertheless, reality never reaches this simplicity. Products can always go along different paths and can be further serviced through their logistical life cycle.
These broad categories of supply chains can also be found in evaluated region. Especially in the BSR, liquid bulk goods like mineral oils or dry bulk like fertilizers are transported in large quantities. They follow the described transport chain of raw materials with the closest relations to the markets of destination due to the high volumes that directly cost related. They are transported with special vessels and are in need of specialized terminal facilities. Semi-finished and manufactured goods are transported in different ways. In the current development towards increasing containerization, more and more goods of this category are handled this way. Especially in the BSR the RoRo trailer traffic is also very important in this respect.
It shows that logistical demands are different depending on the stage of the production process of a product.

Supply Chains and VAS

In many cases, logistical services – especially VAS – have not only something to do with the stage that the product is in but also with the location where the product is currently placed. Depending on the value that is added, it is related to the stage reached in the supply chain or transport chain. Some logistical services can only be performed at certain locations. In most cases these are distribution hubs or traffic nodes where goods flows move together. These hubs or nodes are strategically placed at a specific location that provides advantages in transportation costs and efficiency. But there are also services that can only be performed at certain locations because means of transport restrict the transport chain. Services like pre-delivery inspections can only be performed close to the destination market; otherwise an additional long transportation process would make the service obsolete.
That is why VAS should and have to function as part of a supply/production chain. For a third party LSP this puts the question if integration into the chain is possible.
Besides the question of strategical and spatial implementation of VAS, products are not always accessible to perform services with in a way that value is added. If for instance products are shipped through a port in a container, they are not necessarily predestined for VAS because any additional unloading of the container would add extra costs. Therefore it can be concluded that containerized cargo flows can only be serviced with VAS before the location of storing the container and after unloading its content for further distribution or manufacturing. This leads to the question if it is cost efficient to provide VAS in a port area where the container is only transhipped. In a location where the point of added value can incorporate several value chains it might, however, be possible to achieve scale effects by combined value addition.

Supply Chain Collaboration

The mentioned developments also point to the need for developing new collaborative forms of logistical activities within such chains. The integration of supply chains is more and more expected to grow from supply-based concept to a model that relates several equally important companies in one supply chain, distributing the whole production and transportation process over many players.[13] However, this is not yet implemented in many cases. But in the coming years, more and more semi-finished goods are expected to be shipped. The automotive and

[13] Wildemann 2004a

electronics industries are the most developed in this regard, engaging more and more companies that supply completely finished modules that only need to be built into the final product.
This concept potentially opens up new possibilities for LSPs in regards to the integration of value added services. These new forms of collaboration will then develop as an essential part for competitiveness with trust based network relations between OEM companies, their suppliers and LSPs.
This model is in favour of ongoing developments towards more and more individualized mass production. This requires focusing on core competencies and has led to outsourcing activities in many supply chains that are followed by necessary collaborations. Prominent examples from the automotive industry are Volkswagen Logistics and Volvo Logistics that have taken all logistical activities of OEM and are working as a collaborative partner in the supply chains.
The benefit of supply chain collaboration will then be the ease of implementing VAS into the supply chain of a company network as it is a goal of this company network to share in the production process regardless if the servicing company is a manufacturing company or a LSP.

LSPs
Nonetheless, the LSP plays a crucial role in the integration process of the supply chain. It is the linking factor between the manufacturing companies. They are the shaping entities of the cargo flows in a region. The shipping company is generally not concerned about the way that its goods are going as much as the transportation and handling process is fast and cost competitive. But the LSP is as it is its business capital.
Currently tendencies have developed several forms of LSPs. They all focus on a different aspect of logistics in a supply chain and play different roles in the NSR and BSR
The first have already existed for a long time and can be best described as the traditional business of a LSP. However, even 1PLs are experiencing new tasks in the face of globalizing plant networks. For instance, even though Volvo Logistics is a 3PL that offers all kinds of additional services it mainly handles the cargo flows between the Swedish and Belgian plants of Volvo. But in general LSP are providing more and more additional services and it can be observed that all major LSPs have outgrown stages of 2PL and are offering a variety of services to suit the needs of their customers. 4PLs are a special case and it is doubted if it even exists. But a group of LSP has developed that are experienced enough to offer specialized supply chain management without any actual handling and servicing of goods.
The logistical processes have continuously become more and more complex and OEM companies and their globally sourced suppliers are not capable of handling these. They have become even more complex due to increased possibilities to intervene in the production process either by the manufacturer or the final customer with information technology.
So, the integration of the transportation processes and related supply chains is affecting the logistics industry as well as ports. But one question remains: Where do port logistics fit in? Is a port even capable of providing additional services?

8.2.2.2 Potential for Contract Logistics
But are we talking about a business area that generally provides potential for growth in the future – even for port areas? Do logistical activities that are individualized for certain companies' supply chains offer potential? Part of an answer to this question is found in contract logistics. Contract logistics describe the granting of long-term logistical contracts to logistical service providers. This include

- the integration of several logistical functions into one complex package of services (including not only transport, storage or order processing),
- the individual design of logistical services developed for the needs of the shipping company and
- long-term contract security (at least one year contracts between service provider and the shipping company in written form in contrast to transaction-based business connections).

Therefore contract logistics do not include standardized services like the handling of bulk or general cargo. This differentiation is especially important as it helps to identify added value within logistical chains.
Service providers in this sector are generally classified as 3PLs. This term relates to the position of the service provider in the logistical chain between the shipping company and the customer, supplier or manufacturer and sees logistical activities in one sense as a complex package of tasks.

The logistical industry has identified the concept of contract logistics as a business area with a lot of growth potential for the logistical service industry. It is frequently referred as “logistical solutions” and logistical service providers are offering services with this term.
A provision of so called solutions describes best the situation in the logistical industry. A large part of logistical activities of shipping companies is very much industry- and company-specific and in most cases largely integrated with the core activities of these companies that it is only feasible to design individualized and integrated logistical services with long-term contracts which can be outsourced. Since the 1980 chances through this model are increasingly realised and taken advantage of. Major players pioneering in this area in Germany include FIEGE and RHENUS and on an international level EXEL and RYDER.
For a study on the German logistical service market a potential evaluation of the contract logistics market was conducted in 2005.[14] As the German market has a substantial impact on northern Europe, lines of development in the whole region can be drawn from here. This evaluation gives an overview on the possibilities of the logistics market in relation to certain industries. The largest potential for contract logistics is estimated in the car manufacturing industry followed by food production and mechanical engineering. After these there seems to be a large potential within logistical chains for wholesale companies. Due to the fact that products must have achieved a final manufacturing status when they arrive at a wholesale company to be sold to end customers or further processing companies, a whole logistical chain must have been gone through.
In the following these figures will be looked at as a foundation for the development of value added services. The realisation of these potentials will then be focused on. For the whole German economy currently outsourced activities account for about 15.6 billion €. This relates to the frequently quoted estimate that the implemented European contract logistics market accounts for roughly 40 billion €.[15]

8.2.3 Port Developments

Ports in the NSR and BSR have experienced a continuous growth over the last decades. Growth rates between 5-15% per year were achieved, especially in the area of container cargo. This puts a lot of pressure on port capacity and infrastructure. Shipping consultants expect a shortage in these areas due to the tremendous growth in container traffic especially in Southeast Asia, Middle East, South America and Eastern Europe.[16] This may halt the flow of global supply chains. However, container traffic growth has slowed and supply is expected to overshoot demand. But the handling of cargo will be difficult because of insufficient capacities.
Despite all the possibilities that differentiated logistical services might offer, the main focus of port development will practically be the expansion of capacity in the years to come. Therefore, it will be a matter of competition if this development is accompanied by individualized logistical services.
Regional differences can also be identified between NSR and BSR. North Sea ports are dominated by deep-sea transport from overseas and the transhipment of goods via short sea shipping while the Baltic Sea is favoured for short sea shipping of goods. BSR ports also show an internal differentiation in regard to their main focus. As the Russian market has been one of the driving forces for goods turnover of many of the BSR ports especially in the Baltic States, development of Russian seaports will lead to transhipment changes for the Baltic States.
Like with all logistical activities, ports also face a changed perception of logistical services and port activities. As mentioned before, global sourcing and focusing on core competencies has led to diversified approaches of a growing logistical market to offer individualized solutions. Providing VAS is a powerful way for ports to build a sustainable competitive advantage and act according to this development. Shipping companies and port customers are becoming increasingly demanding. Customers now tend to look at VAS as an integral part of their supply chain. As a result, ports must attempt to satisfy these needs by offering differentiated services. This poses a particular challenge for port management. Studies show that the most successful ports are those that not only have a productivity advantage in cargo-handling services, but that also offer value-added services. Thus, there are several available options for ports to choose from, as shown in the simple matrix in the figure below.

14 Klaus, Kille 2006

15 Klaus, Kille 2006, p. 121; Transport Intelligence 2003, p.32

16 *PORTNET – Proceedings of Workshop on Multimodal Transport*

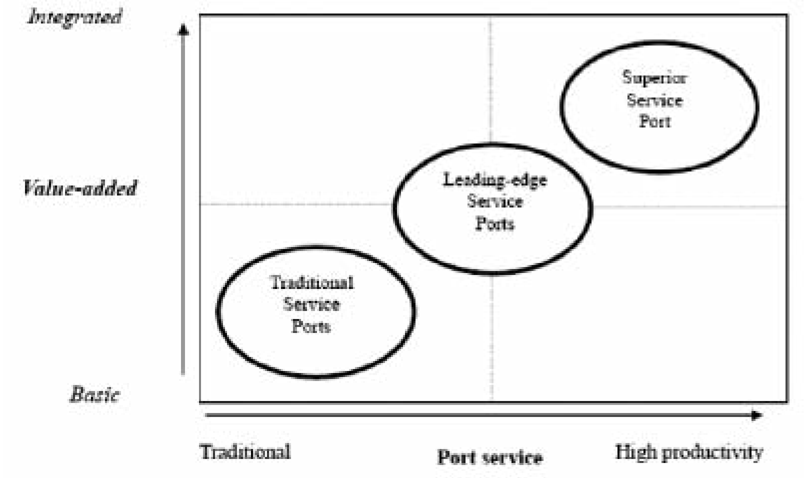

Fig. 8- 1Matrix of competitive advantage for ports (United Nations 2002)

The ports providing traditional services in the bottom left hand corner of the matrix are indistinguishable from their competitors. The only option for such ports is to move to the right side of the matrix, towards productivity-advantage leadership, or to move upwards, towards value-added service leadership. There continues to be a need for ports to provide basic, traditional cargo-handling functions, and that there continue to be many customers for such services. Perhaps it is for this reason that many ports in developing countries still concentrate on improving their productivity with regard to traditional port functions. It remains, so to say, the core competency of the port.

However, it is evident that, in the future, there will be fewer ports that prosper only in this area. Rather, we will see the dominance of superior service leaders that possess both a productivity advantage and an advantage through VAS. In between traditional and superior services, ports are the leading-edge service ports. These are the ports that are on their way to becoming superior service ports.

A number of ports have responded to this trend by focusing on VAS as a means of gaining a competitive edge. In this context, VAS refers to the process of developing relationships with customers through the provision of an augmented offer, which may encompass many aspects of added value activities.

Ports can experience synergistic benefits from the logistics centres to provide VAS. It is advantageous for a port to incorporate a specialized distribution centre as well, since the logistics centre can attract cargo that can be shipped through the port. There is a positive correlation between cargo flows at the logistics centre and the number of ships calling at the port. In other words, the cargo attracts the ships, and the ships attract the cargo. The port benefits by generating increased revenue and creating jobs. The port can profit not only from the logistics centre itself, but also from the increased flow of cargo through the port. Thus, an ideal port should provide a diverse range of services that are highly integrated. As such, there is a need to seriously consider the increasing importance of ports in logistics management.

8.3 Industries as Investment Targets

8.3.1 Automotive Logistics as an Investment Target

As logistics play an important role in the supply and distribution chain of automotive OEM and the automotive industry supplies a currently growing market, automotive logistics in port areas provide substantial potential for opportunities implementing additional logistical services. However, certain questions need to be raised before setting up any kind of service:

- Does the port fit into the supply/distribution chain? How does the spatial location of the port relate to the plant locations or supplier plants?
- Is the pricing of the used relations competitive? Do the relations of locations provide for competitive pricing? And do additional services by private companies and/or by the port authority lead to a competitive advantage for the port area compared to other port areas?

In general several findings need to be considered that frequently determine the debate about automotive logistics in the industry.

- Port must be close to plant or provide efficient hinterland connection.
- Ports are seen to provide for the last. Ports that can transfer vehicles to and from feeder vessels, barge and rail will be most successful.
- Vehicle handling in ports is driven through the commitment of one OEM.
- Space availability and appropriate berths are competitive assets.
- Provision of PDI (and other value added services) depends only on efficiency, space, costs and knowledge about handling vehicles.

For the whole world another problem is currently arising. Due to increasing demands and absorbing capacities of new and used cars from growing economies like Russia and China, ocean carrier companies also have to deal with increasing capacity shortages. On the one hand capacity shortages could be dealt with by incorporating new industrial areas for vehicle handling into port areas. However, this is extremely limited in most ports. On the other hand, port areas also need to handle the increasing turnover in containers and bulk.

Furniture Logistics as an Investment Target

As for a company like IKEA, furniture logistics is a constantly changing environment. The company tries to achieve the lowest cost possible for its products and therefore changes its logistical processes regularly to adapt to the market. On the one hand this provides for new LSPs to enter the market but it also lacks some continuity. On the other hand the furniture industry is a rather stable industry with product life cycles that range from 3 to 20 years. Through this the necessary continuity is achieved to develop mutually trusting contracts.

However, the potential for value added services is limited. In general, the products are finished by the time they leave the production plant. So there is only little room for direct value addition depending on the type of product. But services around the product can be offered by the LSP. Depending on the needs of the manufacturing company, this can range from simple packaging and labelling to the appropriate delivery of resources needed for the production process. And there is also growing need for distribution centres which are serving a larger area of retail stores.

8.3.2 Pulp, Paper and Forest Products Logistics as an Investment Target

The pulp, paper and forest industry is a heavily integrated industry with very much closed supply chains. However, especially ports function as hubs where cargo flows are consolidated and intermodal changes happen. That is why port areas should be the central focus for the implementation of services for the industry. VAS, however, are limited in their extent that they can provide added value to the product.

Additionally, cargo flows of the industry are currently being changed to consolidate flows for the internal BSR and external Europe trade. This will focus especially pulp and paper cargo flows on central hubs which are ports in this case. Fig shows the proposed consolidated RoRo services.

8.3.3 Electronics Logistics as an Investment Target

Electronics logistics provide much potential for additional services. The supply chain of electronics companies has increased in size over the last years and has developed much like the automotive supply chain with a variety of suppliers from different parts of the world. To incorporate this variety it is not only necessary to implement an appropriate SCM but also to develop SCC and to improve the competitiveness of the whole supply chain by distributing the value addition process over the whole chain.

The mentioned VAS possibilities are ways in which port areas can participate as well. In general these are not part of the traditional port services. But due to the fact that many parts, modules and finished products are arriving from the Far East where production is much cheaper, the final assembly, configuration, set up or further consolidation and distribution can be done on European premises.

Investments in such areas need to be undertaken in close cooperation to the shipping companies (LSP and OEM) and can not be implemented by themselves as the value addition process along the supply chain is too individualized with each product. The electronics industry is therefore in need of individualized concepts for adding value to and distributing their products.

8.3.4 Machinery Logistics as an Investment Target

Machinery logistics is a diverse field with many different possible activities due to the differentiated product

structure. However, much of the value added process is done by the OEM companies themselves. This leaves only small room for VAS.
Relating to the SME structure, consolidation centres and warehousing facilities are possible for networks of SME companies. But this will only be feasible if the needs of the companies can be combined and the willingness of them to cooperate is at hand. Fierce competition on the market makes this questionable.

8.3.5 Pharmacy Logistics as an Investment Target

Pharmaceutical products put a lot of demands on LSPs but the demand on the European markets is growing at high rates. Therefore, the industry is in need of handling the increase. In the case of outsourcing of logistical activities in order to focus on core competencies, most pharmaceutical companies have done so or are in the process of doing so. In addition to that, services like the picking & packing, nationalising and customer specific distribution (for hospitals) can be implemented by an LSP.
Port areas however are only predestined for a location of these services if they are located close to a major market to operate efficient express delivery or if the location can compete in costs with other sites.

8.4 Conclusion

The globalisation of supply, production and related transport chains as well as a wider geographical sourcing of supplies has led to increased transport. Especially the BSR is experiencing high growth in terms of traded value, traded quantities in tons and higher vessel traffic that evidences not only the growth of western European economies but especially the increasing demands of the markets in Russia, Poland and the Baltic States.
On the other hand average transport distances are increasing and the logistical trends lead to concentration of flows on hubs and nodes which in turn lead to the need of an optimised use of transport resources. Further concentration trends in industries, in trade and in transport operations strengthen the large ports, while many small ports face serious underemployment if they do not focus on their inherent strengths in special business areas that are serving the needs of the surrounding regional industry.
The importance of effective handling routines and specialization in specific commodities has led to strategic co-operation or merging of ports to help handle the growing trade flows and the competitiveness on the ports market. In general, trade flows in the NSR and BSR exhibit a dominance of certain product groups in terms of transported tons which are mineral oil and dry bulk commodities like building materials and fertilizers. In terms of transported value, vehicles, machinery, electronics and pharmaceutical products show the highest importance overall.
These areas of high value products proved to be industries with different aspects concerning the implementation of logistical processes and services that would lead to added value for the specified product. Even for port areas the potential varies in each industry. While automotive logistics show high potential to offer additional services in areas like pre-delivery inspection or customizing, other industries like machinery do not yet open up their production process in such a way as to let third party service providers cooperate in the process of value addition if it even possible. In general, much seems to be dependent on the individual use of logistical solution for a manufacturing company and if a LSP and a manufacturing company reach a form of contract that is mutually in its business. If a port should be integrated in this process, some additional factors need to be considered:

- ❑ Does the port fit into the supply chain of the specific product?
- ❑ Can the port provide the appropriate space and facilities?
- ❑ Do the hinterland connections and the infrastructure meet the efficiency needs?
- ❑ Is the port authority willing to organise a cooperative interaction between the OEM, the LSP and itself?

These questions can not be considered overall as each case provides a different situation and each company – even in the same industry – might have completely different needs.
However, the perception of ports as traditional handling facilities as changed. Simple stevedoring and transporting of cargo does not keep ports in competition nowadays. More and more companies are seeking for complete logistical solutions from one hand. Therefore, port authorities need to raise the question where their port is fitting it.
Two scenarios might be applicable for future activities of ports. The scenarios provide an outlook from the apparent need to offer more than traditional turnover procedures. This can also provide opportunities to attract new cargo flows and to be integrated into chains of collaborative companies that are part of a production chain.

- ❑ Port operators act as integrated service providers with the provision of logistical solutions that meet the needs of companies from different industries. A specialization on specialized services for a few industries can underline its competitiveness. This follows the concept of different levels of logistics service provision:

- 3PLs: Provision of additional logistical services, i.e. value added; the port actually carries out all traditional handling services but combines them with contract logistics, VAS, etc.
- 4PLs: Provision of integrating logistical services; the port oversees logistical activities as a SCM in addition to its traditional handling services
- Port authorities facilitate partnerships with LSPs; build specialized connections to relevant actors within industries and industry specific logistical services in order to expand the functions of the port but without engaging the traditional port operators in logistical activities beyond their scope and rather cooperate with specialized service providers

These scenarios can also be combined as can be seen in some cases. Both scenarios can be found in the BSR. But ports need to clarify their position regarding logistical services and try to bridge the gap between the need for complete logistical solutions and traditional port services. Otherwise cargo flows of companies will simple move another way. A way that is more cost competitive and efficient in use for the companies logistical needs.

It can be concluded from this that new investments highly depend on the supply chain strategies by individual companies. Even though cargo is flowing along a certain path and is moving along the shortest path in most cases, cost competitiveness is the determining factor which leads to transport chains that are not able to use the nearest port because a certain service is not offered.

To build up new partnerships to companies and LSPs, ports also need to build on their inherent, historically given strength. Today, much of the current competitiveness of a port is determined by its specialization in an area that has been the focus of business for a while. This should be developed further. But industries change and new forms of supply chain collaboration need to be considered to attract new cargo to the ports; for example, cargo that has previously not been transported via vessels or cargo from other regions.

This study highlighted the major lines of development in the NSR and BSR and gave an overview of potentials in the strongest growing industries in the region. Potentials for these, it was said, could not be generalized. But the individual port and LSP was seen as in charge of attracting and keeping the relevant cargo flows for the port through the implementation of appropriate services.

For further reading and reference, the full study is accessible at
http://www.port-net.net/studies/pdf_s/study_03_4.pdf

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9

Acronyms and Definitions

9.1 Acronyms and Abbreviations

AD	Applicable Document
AEI	Automatic Equipment Identification
AOC	Airline Operating Company
ATC	Air Traffic Control
ATIS	Advanced Traveller Information Systems
ATM	Air Transport Management
ATMS	Advanced Traffic Management Systems
B2B	Business-to-Business
B2C	Business-to-Customer
BSR	Baltic Sea Region
C2C	Customer-to-Customer
CAS	Controlled Access Service
CAT	Category
CCS	Cargo Community System
CORBA	COMMON OBJECT REQUEST BROKER ARCHITECTURE
CPDLC	Controller Pilot Data Link Communication
CS	Commercial Service
DB	Database
DGPS	Differential GPS
DoD	Department of Defense (US)
DoT	Department of Transport (US)
e.g.	*exempli gratia* (for example)
EC	European Commission
EDI	Electronic Data Interchange
EDIFACT	Electronic Data Interchange For Administration, Commerce and Transportation
EFDCN	European Freight Data Communications Network
EGNOS	European Geostationary Navigation Overlay Service
EMSAT	European Mobile Satellite System
ESA	European Space Agency
est.	estimate
ESTB	EGNOS System Test Bed
EU	European Union
EUROSTAT	European Statistical Body
FAA	Federal Aviation Authority
FDI	Foreign Direct Investment
FM	Fleet Management
FOC	Full Operational Capability
FTMS	Freight Transport Management Systems
GALA	GALileo Architecture definition
GDP	Gross Domestic Product
GEO	Geostationary Satellite
GIP	GIFTS Integrated operational Platform
GIS	Geographical Information System
GLONASS	Global Navigation Satellite System
GMRD	Galileo Mission Requirement Document

GNSS	Global Navigation Satellite System
GOC	Galileo Operating Company
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communication
GSRD	Galileo System Requirement Document
HDV	Heavy-Duty Vehicle
HLD	High Level Definition Document
HW	Hardware
i.e.	*id est* (that is)
IATA	International Air Transport Association
ibid.	ibidem
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IMO	International Maritime Organisation
INMARSAT	International Maritime Satellite
IST	Information Society Technology
ITS	Intelligent Transport Systems
JIS	Just-in-sequence
JIT	Just-in-time
JPO	JOINT PROGRAM OFFICE
JU	Joint Undertaking
Km	Kilometre
l.	left
LAAS	Local Area Augmentation System
LDV	Lock Data Views
LIF	Location Interoperability Forum
LORAN	Long Range Navigation
LSP	Logistics Service Provider
mil.	million
NA	Not Applicable
NACE	Nomenclature générale des activités économiques
NPV	Net Present Value
NRS	Navigation Related Communication Service
NSR	North Sea Region
NUTS	Nomenclature des unites territoriales statistiques
OBC	ON-BOARD COMPUTERS
OEM	Original Equipment Manufacturer
OS	Open Service
PFI	Private Finance Initiative
PPP	Public Private Partnership
PRS	Public Regulated Service
r.	right
RD	Reference Document
RF	Radio Frequency
RNSS	Radio-Navigation Satellite Service
RoRo	Roll-on Roll-off
SC	Supply Chain
SCC	Supply Chain Collaboration
SCM	Supply Chain Management
SME	Small and Medium-Sized Enterprises
SMI	Supplier Managed Inventory
SMS	Short Message System

SOA	Service Oriented Architecture
SOL	Safety of Life Service
SP	Service Provider
SSS	Short Sea Shipping
S-UMTS	Satellite - Universal Mobile Telecommunication System
SW	Software
T&T	Tracking and Tracing
t.	tons
TCO	Transport Centre Operator
TDMA	Time Division Multiple Access
TEU	Twenty-foot-Equivalent-Unit (6 meter container)
TLC	Telecommunications
TMO	Transport Mode Operator
TMS	Traffic Management Systems
UML	UNIFIED MODELLING LANGUAGE
UMTS	Universal Mobile Telecommunication System
USDOT	U. S. Department of Transportation
VAS	Value Added Service(s)
VAT	Value Added Tax
VTMIS	Vessel Traffic Management and Information Services
VTS	Vessel Traffic Services
WP	Work-Package
XML	eXtensible Markup Language

9.2 Definitions

Term	Definition
Agent	A person or organization authorized to act for or on behalf of another person or organization.
Automatic Identification System	Automatic Identification System (AIS) , according to IMO-standard, is a term for radio transponders which provide identification and additional data.
Application	A set of objects that provides an environment for processing Application Service Layer information flows.
Application Programming Interface (API)	A set of inter-layer service requests and service response messages, message formats, and the rules for message exchange between hierarchical clients and servers. API messages may be executed locally by the server, or the server may rely on remote resources to provide a response to the client.
Architecture	The organisational structure and associated behaviour of a system. An architecture can be recursively decomposed into parts that interact through interfaces, relationships that connect parts, and constraints for assembling parts. Parts that interact through interfaces include classes, components and subsystems.
Arrival notice	See Delivery notice
Business process modelling	Business process modelling (BPM) is an activity, which depicts the current state of a business entity and the desired future state. The popular supporting techniques include Unified Modelling Language (UML), model-driven architecture, and service-oriented architecture. (Source: Wikipedia)
Cargo	Goods transported or to be transported.
Cargo identity	Unique designation for the physical units of a goods item. It is often carried on a goods label, e.g. carrying a bar-code, affixed to the units.
Cargo Community System	Cargo Community System is an integrated series of procedures, rules, standards, and ICT tools supports the automatic exchange of data, information and documents related to the handling, storage and transport of cargo.
Cargo monitoring	Recording of data related to the cargo status, e.g. position, humidity, temperature.
Carrier	The party undertaking transport of goods from one point to another
Combined transport	The movement of goods in one and the same loading unit which uses more than one mode of transport without handling the goods themselves in changing modes.
Communication link	A technical system that allows voice and/or data communication between individuals or systems at different locations, or mobile.
Conditional access	A means of allowing system users to access only those services that are authorized for them.
Consignee	The party such as mentioned in the transport document by whom the goods, cargo or containers are to be received and accepted.
Consignment	A goods item or collection of goods items (to be) transported from one or many dispatch locations to one or many delivery locations for one consignor to one consignee under the terms of one contract of carriage.
Consignee/Consignor	The Consignor is at the start of the transport chain and the Consignee is at the end. i.e. the first actor involved in the transport chain is the Consignor and the Consignee is the last
Consignor/Shipper	An individual or organisation that prepares a bill of lading by which a carrier is directed to transport goods from one location to another.
Connector	Connector is a connecting point determined by an interface of activities between suppliers and customers/users.
Consolidation	the grouping together of smaller consignments of goods into a large consignment

	for carriage as a larger unit in order to obtain a reduced rate.
Containerization	Containerization is a system of intermodal freight transport cargo transport using standard ISO containers (known as Shipping Containers or Isotainers) that can be loaded and sealed intact onto container ships, railroad cars, planes, and trucks.
Contract	A legally binding agreement between two parties in which the specific titles, rights, commitments and obligations of both parties are defined.
CORBA	COMMON OBJECT REQUEST BROKER ARCHITECTURE is the object request broker component of the object management architecture and is the communications heart of the standard. It provides an infrastructure allowing objects to communicate, independent of the specific platforms and techniques used to implement the addressed objects. The objects request broker component will guarantee portability and interoperability of objects over a network of the heterogeneous system.
Customer identification	Customer identification determines the customer and includes accepting the inquiries, providing response to the customer, activities to analyze and to understand the customer's business as well as the customers' requirements.
Customs	Customs will give the Customs clearance of the goods once they have been identified and all Customs tariffs have been paid (Customs' Agent bears the Customs tariffs). It is mandatory that every single item of cargo obtains Customs clearance in order to be able to leave the port in an import/export operation. Customs' Agent The Customs' Agent is in charge of the Customs clearance of the goods. He will request Customs clearance from Customs and will bear the Customs tariffs. He will charge the Forwarder the Customs tariffs and commission.
Delivery notice	A message ending a logistical activity by stating the result, e.g. "cargo delivered at destination requested"
Delivery date (requested)	Date on which buyer requests goods to be delivered
Delivery notice	A message ending a logistical activity by stating the result, e.g. "cargo delivered at destination requested"
Delivery time/date (actual)	Date/time on which goods or consignment are delivered at their destination.
Delivery time/date (estimated)	Date and/or time when the shipper of the goods expects delivery will take place.
Design	The part of the software development process whose primary purpose is to decide how the system will be implemented. During design strategic and tactical decisions are made to meet the required functional and quality requirements of a system.
Dispatcher	A person who performs the detailed allocation and subsequent control of transport resources to individual transport orders.
EDI (Electronic Data Interchange)	The transfer of structured data in Electronic form between computer systems in separate organisations.
EGNOS	The European Geostationary Navigation Overlay Service (EGNOS) is Europe's first foray into satellite navigation. It is being developed by ESA under a tripartite agreement between the European Commission (EC), the European Organization for the Safety of Air Navigation (Eurocontrol) and European Space Agency (ESA). Several air traffic service providers are supporting the development program with their own investments.
Email	Electronic mail. Email allows the sending of information in an electronic format from one Internet user to another. Users are identified on the Internet by a unique email address.
Equipment	(In transport) Material resources necessary to facilitate the transport and handling of cargo. Transport equipment does not, under the given circumstances, have the ability to move by its own propulsion. e.g. sea container, trailer, unit load device or pallet.
Equipment of vehicle	- loading/unloading: Mechanical devices mounted on vehicle to enable loading/unloading, e.g. crane, derricks, rear lift platform.

Equipment of vehicle	- communication: See on board communication equipment.
e-logistic	e-logistic is the extension for online exchanges of documents, information, data in order to provide interactive shipping services to the users. A platform able to arrange the planning and management of the shipment, together with the possibility to monitor the flows. E-logistic is an extended definition of e-commerce related to transport and logistics
e-service	is a highly general/generic term usually referring to the provision of services via the Internet (the prefix 'e' standing for "electronic", as it does in many other uses). It is true Web jargon, meaning just about anything done online. e-Services include "e-commerce", although they may also include non-commercial services. Non-ecommerce e-services include (at least some) "eGovernment" services. (source: http://en.wikipedia.org/wiki/E-Services)
Fleet	All the vehicles, including drivers, at the disposal of one unit of (business or operation) management for performing the business or operation.
Fleet business transactions	Inquiry acquisition, offer calculation and submission, contract settlement, invoicing and payments.
Fleet management	Planning, monitoring, controlling and evaluating the movements and operations of a vehicle fleet.
Forwarder	The party arranging the carriage of goods including connected services and/or associated formalities on behalf of a shipper or consignee. The Forwarder represents the Consignor/Consignee. The Forwarder entrusts the transport of the goods from/to origin/destination to the Road/Rail Operator bearing the costs related to the transport. He entrusts Customs clearance of the goods to a Customs' Agent bearing the Customs tariffs and the commission. The Forwarder is defined as the party arranging the carriage of goods, including connected services and/or associated formalities on behalf of a Consignor or Consignee.
Freight	1. Goods in transport from one location to another. 2. The amount of money due for the carriage of goods and payable either in advance or upon delivery. 3. The revenue earned from the movement of cargo.
Freight and fleet management	The combined activities of freight management and fleet management.
Freight business transaction	Handling of market inquiries, offer and supplier evaluation, contract settlements including just-in-time requirements, invoicing and payments.
Freight centre	See Freight Village and Transport centre.
Freight invoice	The carrier's invoice for transportation charges applicable to a freight shipment.
Freight management	A set of activities related to the logistics chain from the supplier to the receiver of goods with the associated information and transaction flow.
Freight operation planning and preparation	Preparation of transport documents, such as transport orders, customs declarations, dangerous goods declarations and notices of dispatch.
Freight Village	A freight village is a defined area within which all activities relating to transport, logistics and the distribution of goods, both for national and international transit, are carried out by various operators.
Galileo	Galileo is a satellite navigation system and the European alternative to the US Global Positioning System (GPS) and the Russian GLONASS, both funded and controlled by military authorities. Devised by the EU and the European Space Agency (ESA), Galileo is designed for civil use only and should be operational by 2008.
HTML	Hypertext Mark-up Language. HTML is a document formatting language used to specify the format of Hypertext documents on the World Wide Web. HTML consists of ASCII text files with special tags to specify formatting information. This includes the specification of Hypertext links, graphics information and plain text.

HTTP	Hypertext Transfer Protocol. HTTP is the protocol Web servers and browsers used to send requests, accept requests, send responses and receive responses in respect of documents on the World Wide Web. It also specifies how to initiate transfer of data using other protocols such as FTP and SMTP.
Information model	Information model is an abstract but formal representation of entities including their properties, relationships and the operations that can be performed on them. (Source: Wikipedia)
Interface	A point of demarcation between two blocks through which information flows from one block to the other. (See logical and physical interface definitions for further details).
Intermodal change planning	Selecting transport modes and providing necessary booking.
Intermodal transport	Intermodal transport involves more than one mode of transport. For example, passenger stations which provide transfers between buses and trains are described as intermodal (see: intermodal passenger transport). Intermodal can be applied to the transportation of freight in a container or vehicle, using multiple modes of transportation (rail, ocean vessel, and truck), without any handling of the freight itself when changing modes. The advantage of utilizing this method is that it reduces cargo handling, and so improves security, reduces damages and loss, and allows freight to be transported faster
Intermodal Transport Unit (ITU or UTI)	Containers, swap bodies or semi-trailers suitable for intermodal transport. - Logistics The planning, execution and control of the movement and placement of people and/or goods, and the supporting activities related to such movement and placements, within a system organised to achieve specific objectives.
Internet	The term Internet is used in many ways in this document. It is widely understood to mean the global network of computers tied together via different types of networks. These computers use a standard set of protocols to communicate, mainly TCP/IP and UDP/IP.
Mode of transport	Mode of transport (or means of transport or transport mode or transport modality or form of transport) is a general term for the different kinds of transport facilities that are often used to transport people or cargo.

Where more than one mode of transport is used for a journey, or for transport analysis, the journey can be described as multi-modal.

Multi-modal transport	The carriage of goods by at least two different modes of transport.
Number of packages	Number of packages (content and packing) included in a goods item.
On board communication equipment	Radio or infrared communication equipment enabling voice and/or data communication between the vehicle, stationary or in motion, and fixed stations.
Party	Generic term for the different actors involved in a logistical activity.
Port Community System	Port Community System is supporting the requirements of governmental agencies and the requirements of the cargo interests, so a PCS covers, e.g., Customs requirements and handling, Immigration as well as the information exchange dealing with the necessary services in a port and the handling of ship and cargo.
Privacy	Privacy protects authorised participants from illegal utilisation or knowledge of information related to their components in the System.
Process	Process is a naturally occurring or designed sequence of changes of properties / attributes of a system or object. In technical perspective, process refers to operations or events which produce some outcomes.(Source: Wikipedia)
Protocol	A set of message formats (semantic, syntactic, and symbolic rules) and the rules for message exchange between peer layer entities (which messages are valid and when).
Required input	Required input includes information needed for the processing of the use case.
Real-time	Quality of a process, the execution of which is determined or controlled in time. The term is sometimes extended to refer to a delivery process which is perceived

	fast enough to be considered as almost instantaneous.
Road/Rail Operator	The Road/Rail Operator will transport the goods from the origin
Route plan	The path to be taken to get from a starting point to a point of destination or to supplement a trip plan.
Scenario	Scenario mirrors a set of consistent processes from the real working environment with specified constraints.
Server	Any service providing system.
Service Module	Service Module is a software object that provides specific applications. It also provides the interface to invoke such applications.
Service Module Provider	From an architectural point of view, the Service Module Provider (SMP) is a platform that provides the host access to the service module. On the contrary, from a business point of view, the SMP is owner of the service module
Service Provider	An entity that provides a service to a client.
Session	An interval during which a logical, mutually agreed correspondence between two objects exists for the transfer of related information. A session defines a relationship between the participating users in a service instance.
Shipment	A separately identifiable collection of one or more goods items (available to be) transported together from a consignor to a consignee. (Often synonymous with Consignment.)
Shipper	An individual or organisation that prepares a bill of lading by which a carrier is directed to transport goods from one location to another.
Shipper	See: Consignor.
Short Sea Shipping (SSS)	Short sea shipping is the intermodal transport of Intra-European cargo on a door-to-door basis, usually in containers or trailers. A large part of the transport is done by sea.
Specification	A definition of the requirements of a system. A specification consists of general parameters required of the system and the functional specification of its required behaviour.
SOA	Service-orientation describes an architecture that uses loosely coupled services to support the requirements of business processes and users. Resources on a network in an SOA environment are made available as independent services that can be accessed without knowledge of their underlying platform implementation. These concepts can be applied to business, software and other types of producer/consumer systems. Service-Oriented Architecture (SOA) expresses a business-driven approach to software architecture that supports integrating the business as a set of linked, repeatable business tasks, or “services”. SOA is usually based on a set of Web services standards.(Source: Wikipedia)
SOAP	SOAP (originally Simple Object Access Protocol lately also Service Oriented Architecture Protocol) is a protocol for exchanging XML-based messages over computer networks, normally using HTTP. SOAP forms the foundation layer of the Web services stack, providing a basic messaging framework that more abstract layers can build on.
Stakeholder	Stakeholder means a person or an organization that has a legitimate interest or obligation in a project or an entity. Stakeholders in a company may include shareholders, directors, management, suppliers, government, employees, and the community.
Status	Condition of object, person or process at one point in time.
Subsystem	A decomposition of a system into smaller collections of objects. decomposition may be performed recursively.
Terms of delivery	(General) All the conditions agreed upon between a supplier and a customer with regard to the delivery of goods and/or services.
Time of delivery	See Delivery time/date.

Time of departure	Time of actual departure from a stated location.
Tracing	Activity, at request, of finding and reconstructing the transport history of a given consignment, vehicle, equipment, package or cargo.
Tracking	Activity of systematically monitoring and recording the present location and status of a given consignment, vehicle, equipment, package or cargo.
Transport centre	The premises and the facilities, related to freight transport services, e.g. facilities for transhipment, serving a number of transport companies. A transport centre is often owned and operated by several of the companies being served.
Transport order	A Shipping (Consignment) instruction or the task definition given by a dispatcher to a driver.
Transport service provider	A generic term for an actor in transport links within the logistic chain, e.g. carrier, forwarder or agent.
Use case	Use cases: In software engineering, a use case is a technique for capturing functional requirements of systems and systems-of-systems. Each use case provides one or more scenarios that convey how the system should interact with the users called actors to achieve a specific business goal or function. Use case actors may be end users or other systems. Use cases typically avoid technical jargon, preferring instead the language of the end user or domain expert. Use cases are often co-authored by business analysts and end users. (Source: Wikipedia)
Use case diagram	A diagram that shows the relationships among actors and use cases within a system.
Use case instance	The performance of a sequence of actions being specified in a use case. An instance of a use case. See: use case class.
Use case model	A model that describes a system's functional requirements in terms of use cases.
User	A service consuming object or system.
Vehicle and cargo management	A set of activities related to the management of individual vehicles and their cargo.
Vehicle monitoring	Beyond the contribution to fleet monitoring, it means closer consideration of the aptitude to operate, through diagnosis and predictions relating to driver and vehicle organs.
Vehicle operation	All activities related to the vehicle journey, such as vehicle, driver and cargo/passenger status monitoring and recording, actual
Vessel Traffic Management and Information Services	Vessel Traffic Management and Information Services (VTMIS) is defined as a (ICT) concept for harmonised information services to support waterborne traffic and transport management including interfaces to other transport modes.
Vessel Traffic Service	Vessel Traffic Services (VTS) is a service implemented by a Competent Authority, designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area [IMO A.857(20)].
Unified Modelling Language	Unified Modelling Language (UML) is a general purpose modelling language that includes a standardized graphical notation that may be used to create an abstract model of a system. (Source: Wikipedia)
Web Service	The W3C defines a Web service as a software system designed to support interoperable Machine to Machine interaction over a network. Web services are frequently just Web APIs that can be accessed over a network, such as the Internet, and executed on a remote system hosting the requested services.
XML	The Extensible Markup Language (XML) is a W3C-recommended general-purpose markup language. XML's primary purpose is to facilitate the sharing of data across different information systems, particularly systems connected via the Internet. It is a simplified subset of Standard Generalized Markup Language (SGML), and is designed to be relatively human-legible.

XML is considered “general-purpose” because it enables anyone to originate and use a markup language for many types of applications and problem domains. Numerous formally defined markup languages are based on XML, such as RSS, MathML, GraphML, XHTML, Scalable Vector Graphics, MusicXML, and thousands of others.

For a complete glossary, please see the following link:

http://www.unece.org/trans/wp24/documents/term.pdf
http://www.inttra.com/Products/shippingglossary.asp Shipping Glossary
http://www.tli.gatech.edu/apps/glossary/ Logistics Glossary
http://www.ciltuk.org.uk/process/glossary.asp Logistics Glossary

Port-Net
Promoting interregional co-operation of ports and multi-modal transport structures in the EU

Port-Net is an Interreg IIIc Network project with 20 partners from 12 European countries and Russia. Port-Net is running from 2005 to 2007 and has ? 1.7 Mill budget.
Port-Net's objective is to identify and tackle the main challenges faced by European ports in order to create better operational structures and capacities and achieve the best possible regional integration of ports. These targets will be achieved through workshops, lectures and best practice tours at the locations of the partners as well as through external expertise and studies.
Three components group the activities by topics. The first component deals mainly with the application and further development of EU-policies. The second deals mainly with improvements of the multi-modal transport structure while the final component focuses on tourism and urban development from a port perspective.

Lead partner of Port-Net is the Free and Hanseatic City of Hamburg but a democratic network structure guarantees equal involvement and a proper consideration of the interests of all partners. Project co-ordination is executed by Uniconsult, a port and transport consultancy from Hamburg

http://www.port-net.net/

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