

INTELLIGENT FREIGHT

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Abstract

This paper introduces the main applications of new technologies in the field of the transportation of goods, with a focus on the organisational aspects of their implementation. It appears that cheap and perennial systems are systems with a huge number of users, which are essentially open, interoperable and able to facilitate the exchange of information between economical and administrative stakeholders. In the context of aggressive competition between companies, the systems supporting public policies and enforcement, because of their universality, play a major role in the standardization process, the building of ITS architecture and the deployment of the applications for intelligent freight.

Keywords: ITS, Freight management, Fleet management, Heavy vehicles, Weigh-in-Motion, WIM, Enforcement, Interoperability, Tachograph, Toll collection, Electronic platform, Tracking and tracing.

Résumé

Ce papier présente les principales applications des nouvelles technologies dans le domaine des transports de marchandises en insistant sur les aspects organisationnels de leur développement. Il apparaît en effet que la réduction des coûts et la pérennité des systèmes d'information, qui dépendent essentiellement du nombre d'utilisateurs, sont directement liés à leur interopérabilité, à leur ouverture et à leur capacité à faciliter les échanges entre les acteurs économiques et administratifs. Dans un contexte de concurrence très vive entre les entreprises, les systèmes découlant de l'application d'une politique publique, du fait de leur caractère universel, jouent un grand rôle dans la normalisation, l'émergence de l'architecture des systèmes et le déploiement des applications de fret intelligent.

Mots-clés: Transports intelligent, gestion du fret, gestion des véhicules commerciaux, poids lourds, pesage en marche, application de la réglementation, interopérabilité, chronotachygraphe, télépéage, plates formes électroniques, traçabilité, pistage.

1. Introduction

The development of systems based on technologies of information and communication in the domain of the transportation of goods (also called “ITS for freight” or “intelligent freight”) is a long process with a noticeable acceleration in the last decade. This process involves progressively all stakeholders of all modes of transport in all countries. The success of some applications, like the introduction of electronic sensors in vehicles, as far as they do not significantly modify the relative roles of the vehicle manufacturer, the vehicle owner and the driver, depends principally on the rules of the markets: when the business model is clear and each partner finds an advantage to the innovation, the system will eventually be launched and the first example rapidly induces generalization.

In many cases the situation is much more complex: if the advantage is more global than individual, some kind of obligation is required for the effective implementation. If the advantage is linked to the number of the users, which is generally the case with communication systems, the decision of one company manager depends on the anticipation he can make about the decisions of his colleagues, who are also his competitors. We shall examine in this paper the existing situation for some applications concerning freight and fleet management as well as enforcement of regulations. The question of integration of ITS applications in vehicles will be presented in conclusion.

2. Freight and fleet management

The carriage of goods and the related services and formalities are organized since many years in procedures covering all the physical, commercial and legal aspects. Exchange of information and documents have already been largely replaced by exchange of electronic data between the role players in the supply chain. These applications are in general use but not fully utilised, due to costs of solutions and lack of human resources for implementation.

The freight forwarder is often contracted by the principal, the consignor or the consignee, and the business relations between them implies exchange of information for commercial transactions before the agreement of the contract as well as during and after the transport until the definitive payment and solution of any difficulties. To organize goods movement, it is necessary to manage not only the carriage but also the planning of drivers and the operation of mobile resources (e.g. vehicles, containers...). This includes specification of driver tasks and the maintenance of vehicles and the interpositional transport units used. When goods are stored at certain points along a route in order to optimize operations or to change to a different mode, it is necessary to have agreements with multimodal hubs and warehouses. The use of transport infrastructures implies for the freight forwarder exchange of information with the entities in charge of operating them (travel information, access rights, fees and toll collection, safety and emergency services, regulation on transportation of hazardous goods ...).

The messages used by companies and public bodies involved in these processes have been standardized at international level by the Centre for Trade Facilitation and Electronic Business (CEFACT) organized under the umbrella of the United Nations. Vankemmel (2006) described this process, in which he was a pioneer for many years. The first standard (ISO 9735), issued in 1987, can be considered as the grammar of the Electronic Data Interchange (EDI) language, which allows the transfer of structured data, by agreed message standards, from one computer system to another by electronic means. The second fundamental standard is

ISO 7372, the Trade Data Element Directory (TDED), which is regularly updated (last issue January 2005). EDIFACT messages cover the processes of the whole supply chain, including the administrative procedures.

EDIFACT messages for Multimodal Freight - examples

Transport Order: IFTMIN - IFCSUM

Status report: IFTSTA

Transport Booking IFTMBP/BF/BC

Manifest: IFCSUM (EDIMAN)

Transport contract (CMR, CIM, Bill of Lading, Air Way Bill): IFTMCS

Dangerous goods notification: IFTDGN

Containers movement, maritime and inland: CO

Stowage plan (Bayplan): BAPLIE

Berth management: BERMAN

Waste disposal: WASDIS

Logistics, cargo handling: HANMOV

Invoicing: IFTFCC - INVOIC

Customs: Manifest, declaration, response: CUSCAR, CUSDEC, CUSRES

For road transport only, it is estimated that more than 6000 companies regularly use EDI systems in France, with approximately 1.5 million messages exchanged per day.

The traditional way to use EDI between two companies is to conclude an interchange agreement describing the types and meaning of data exchanged, with reference to the EDIFACT message(s) which will contain the data. It was well adapted for large companies but more difficult for smaller ones with numerous clients to enter in such agreements. With the emergence of Internet standards (ISO technical specifications series 15000-N, Electronic business eXtensible Markup Language (ebXML)) for business to business communications, a new method to use these standards is offered by service providers (electronic platforms or portals). This new method could be easier to use for small companies. It would allow the user to register at such a service on an Internet website, choose a profile according to the kind of business they want to develop through the service and to select the partners already registered to use it. Authentication of the persons appointed to represent the company, certification of documents if needed, protection of messages to assure confidentiality, availability of the service even in bad conditions of communication, archives management fall under the responsibility of the service provider, as well as the access to references, directories, codes (e.g. for countries, currencies, units of measurements...) and available XML schemes or definitions. This evolution has already been implemented in maritime transport as a result of the initiatives by Port communities (e.g. in France ADEMAR in Le Havre, PROTIS in Marseilles, converging in AP+), in air cargo under the umbrella of IATA (project eFREIGHT), and in European Inland Navigation (Directive RIS). These developments are based in particular on the remarkable work accomplished by the Trade Business Group n°3, specializing in Transport and Logistics. Concerning intermodal transport, initiatives are more difficult: a functional description of the exchange of information in the whole domain of intermodal freight and fleet operations can be founded in the Frame Architecture for ITS design in France coordinated by Denis (2007). This high level model is a synthesis of the various contexts identified for the implementation guidelines of EDIFACT messages.

To facilitate a large deployment of these technologies, EDIFACT and the OASIS consortium have launched the ebXML project to prepare the necessary standards, especially the CPP

(collaborative partner profile) and CPA (collaborative profile agreement) to clarify questions of responsibility and security of such systems. The objective is to facilitate trade and transport globally, even if the companies involved previously had no link between them, but to guarantee to them and to other potentially interested parties, that the reliability of all the actors of the supply chain have been appropriately checked according to national and international rules.

The delicate balance between facilitation of international trade and improvement of security is a permanent task of customs and particularly of the World Custom Organization WCO. Hopefully, automation of procedures, if it is correctly implemented, can provide at the same time a better productivity of the administrative processes related to transport and a higher level of security. The SAFE Framework of Standards (last version of June 2007 available on www.wcoomd.org) describes the general strategy of cooperation decided by the 171 administrations that are members of WCO. This strategy is based on harmonization of advance electronic cargo information, consistency of risk management and benefits provided to businesses that meet minimal supply chain security standards and best practices (authorized economic operators).

3. Enforcement of regulations

ITS can be a significant and useful tool for authorities responsible for defining and enforcing regulations, because of the possibility to delegate data collection and even identification of abnormal situations to automated sensors located on the infrastructure (roadside units, RSU) or installed in vehicles (on board units, OBU). The design and operation of systems used for enforcement need to take specifically account of possible fraud or vandalism by the owner of the systems or any other interested party. The risk management has to be organized from the beginning of the project, and the authorities must be prepared to provide the resources to maintain and update the systems if necessary.

3.1 Electronic toll collection

Electronic toll collection has been developed in different ways in various European countries: the first generation of systems aimed to facilitate payments for regular users of road networks equipped with barriers. Identification of the vehicle at toll gates by a simple transaction between OBU and RSU was relatively inexpensive. Back office processes to assure interoperability for the user could be put in place among a small number of infrastructure managers. The extension of tolls or road usage fees to open networks without barriers and to urban areas created the need to develop a more sophisticated system at a European level: according to the Directive 2004/52/EC on interoperability of electronic road toll systems in the European Community, a European electronic toll service shall be created by a set of rules and technical specifications allowing all the operators or issuers to provide the service with a single subscription contract. This means that a new information system will be organized, under the responsibility of the European Commission, involving a large number of infrastructure managers, European Electronic Toll Systems (EETS) operators and issuers of equipment such as OBU. The final objective is that the subscriber of a contract will receive a single invoice that includes all the toll expenses of all his trips throughout Europe, that the infrastructure managers will receive the part of the revenue collected by EETS corresponding to their traffic and that the companies whose vehicles do not comply with this regulation in one way or another will receive the notification of infringement and penalty in a short delay.

3.2 Electronic tachograph

The electronic tachograph was introduced, after several years of legal and technical European debates, as mandatory equipment of new lorries, by the Directive 2006/22/CE and the Regulation (CE) N° 561/2006. This system aims to record the rest and driving times of drivers falling under European social legislation and to allow control bodies to identify abnormal situations, including possible fraud or misuse of the vehicle unit and the cards delivered to drivers, companies, workshops and enforcers. To face the questions of interoperability in a context where several card manufacturers are in competition to provide type approved cards to the national issuing authorities of the member states and several companies compete to provide the vehicle units to the vehicle manufacturers, the European Commission appointed one of its units, depending on the Joint Research Centre, to act as the central point to guarantee the functionality of the system as well as its security and assist with risk management.

3.3 Speed control

Speed control is a very important factor with regards road safety, because of the increase in the probability of accidents at high speed and because of the effect of high energy if a crash occurs. Automated identification of speeding vehicles by radar has produced a real reduction of average speed on French roads and a significant decrease of the number accidents and casualties. The radars currently deployed check only the speed limits applicable to light vehicles and have little impact on the speed of lorries, whose limitations are inferior. In some countries the average speed between fixed points is calculated when the images of the heavy vehicle is captured by cameras located at these points. It seems to be a relatively simple way to enforce these specific speed limits.

3.4 Overloaded vehicles

Overloaded vehicles are a significant cause of the degradation of roadways and structures. If the design and maintenance of the road does not correspond to the weight of the lorries using it, the cost of maintenance can be increased significantly. Monitoring the axle weights and gross vehicle weights is an important task for infrastructure managers, especially in Europe, where differences between national regulations result in transgressions, confusion and voluntary fraud. The accuracy of sensors used for weigh in motion is not yet precise enough to identify overloading without any doubt, but they are a useful tool for the selection of vehicles with a high probability of being overloaded and to assist control bodies to focus their action on these suspected vehicles particularly in roads with high traffic volumes. The French Ministry in charge of transport has decided to put in place 10 installations for such pre-selection of possible overloaded vehicles. Technical progress and development of the market can result in a decrease of the price of such installations and eventually in better performance allowing automated enforcement. However the number of locations controlled with these instruments will probably remain relatively low. To achieve more efficient enforcement, it is necessary to envisage installed systems, which could record in a secured way the weight of the vehicle (and if possible of the axles). Considering the eventual consequences of some overloading, it could be imagined that an alarm would automatically be sent to the company, the control bodies and the infrastructure manager under certain abnormal conditions.

4. Conclusion: How to integrate the future ITS applications in the vehicles?

The above examples demonstrate that heavy vehicles are already integrated with a number of ITS systems. The development of localization based services will certainly increase the

number of sensors, processors and communication devices installed in these vehicles. Some questions will need solutions: Is it possible to assure the compatibility between all these devices and all their functions? This question is technical but also organizational : a common idea is that antennas, localizers and other sensors can be shared by several applications, as well as GPRS connections and hard disks and that shared architecture (or platform) could provide a more efficient, safe and robust support to all the applications than a collection of heterogeneous black boxes. It would be true if this architecture could take account of the precise requirements of all the applications involved and if the developments of these applications could take place in a timetable allowing the certification of the whole system. As mentioned previously, there are real risks of fraud and misuse of some of these applications, and this implies the need for an effective risk management organization. It is possible to imagine that this risk management organization will act on behalf of the different application managers, but the legal basis for that needs to modify the corresponding regulations or arrangements. This process takes time and could eventually be blocked at various levels.

More research is needed to compare the advantages and difficulties of this scenario with possible alternative ones.

5. References

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