Original Article

Development Of Digital Platform Technologies In Multimodal Transport

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Abstract

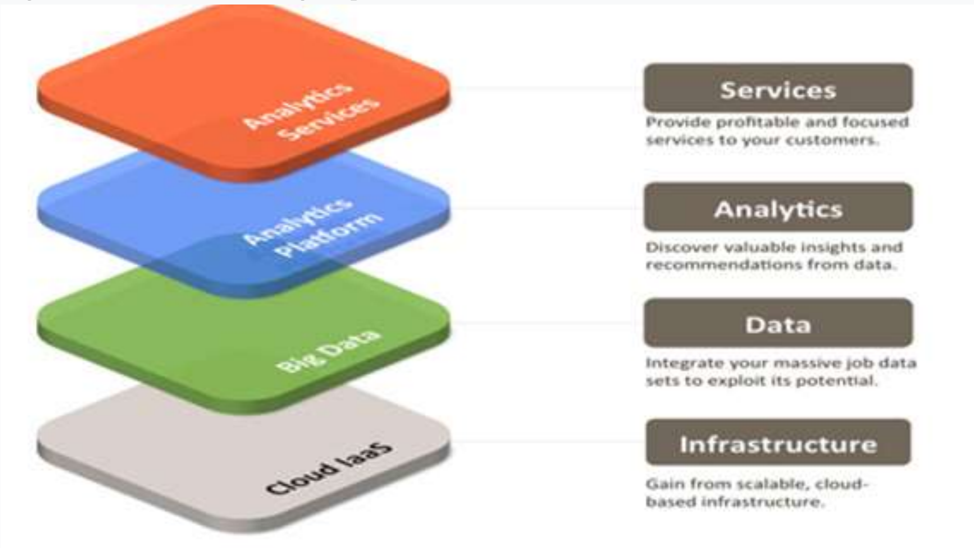
In multimodal transportation, digital platform technologies have been developed and modeled to provide clear solutions to specific problems, data analysis, and more accurate business decision making due to the great importance of separating concerns due to multiple connectivity options.

Keywords: Multimodal transportation, technologies, digital platform, innovative services, Cloud, Infrastructure, management barriers.

Introduction

Platform technologies are systems based on a platform architecture that distributes the system at different levels of abstraction. This is done in order to differentiate certain levels of functions or services. Each abstraction layer is based on the basic services of the lower layers. The uppermost layers provide the services on which applications are built. Lower layers deal with (connected) infrastructure and (raw) data.[1-2]

Figure 1: Illustration of a digital platform



Platform technologies are evolving, but due to increased connectivity and the many possibilities of communication technologies, sorting out the issues is important. Applications don't need to know where the data is or what protocol they need, they need services to access the data they need.

The support of these services is the responsibility of the lower layers in the platform. Currently, several platforms have been developed and are available in the field of transportation and mobility. For example, PlanIT LivingPlanIT operating system, IBM® Intelligent Operations Center, Oracle Smart City Platform Solution, MOBINET, In-Time, I-Travel or TNO Urban Strategy platform.

These platforms have the functionality to integrate sensors to provide information to end users, streamline processes and provide value added services to end users.

The platform technology is used in many innovative services such as Amazon, Airbnb, Deliveroo and Uber. All these services have the following main components:

• instead of basic goods and products, information is the main element;
• magical user experience (the user needs something extra "unimaginable");
• on-demand service (when the user needs it);
• design around network platforms (ICT platform with defined rules);
• coordination according to algorithms (there is no need for human intervention);
• employees are supported by technology (technology instead of teaching/learning);
• management of required assets and labor (no unused capacity).

Due to the significant reduction in costs and the services that can be achieved at the same time, these services are disrupting traditional markets. Since the platform is used and decisions are made by algorithms, the rules for all participants are clear but strict.[3-4] The platforms on which these services are offered define the rules to be followed by the providers and users of the services. It is also possible to monitor the quality of delivered services and establish fair pricing mechanisms based on real-time demand and supply data.

Operational activities requiring manpower do not require special education/training, so suitable workers can be easily found. Potential asset ownership can be avoided and organized in such a way that the risk of unused capacity is minimized and the organization is resilient to changes in demand. Availability of real-time and integrated data is a key requirement.

This is easier to identify when the entire process is in the hands of one organization. Supply and demand are more likely to match, and therefore service levels are higher when more people use the same service; This leads to a decrease in market competition, resulting in a few large players dominating the market.

The availability and availability of information is growing rapidly. The platform technology must still be able to handle and process large amounts of (real-time) data. The integration of cloud technology, HPC clusters (high performance computing clusters) or grid computing (ie several computers geographically distributed but connected through networks) and artificial intelligence analysis should be supported by modern platform technology.[5 -6]

Difficulties. Digital platforms provide concrete solutions to specific problems. But, in general, the following problems are solved.

• If blockchains are not open, vendor lock-in may occur, meaning that service providers offer proprietary platform services with unique governance and business models. They are open to anyone who wants to agree to it. Thus, without consulting service from the vendor, it is not easy to expand the platform to provide new services. Interoperability and standardization are needed to easily add building blocks to other services.

• Many platforms focus on integrating services from specific domains.

• The services are designed for the platform and work only on that platform.

• Current platforms have data security and privacy challenges. Each platform has its own way of dealing with this, and the average technology is not flexible enough to effectively address data privacy and owner aspects and the ability to track where that data is being used.

Methods

According to Gartner's definition (as of 2001, still the definition), big data is data that is large in volume and increasingly high-velocity. These three vs. is called Simply put, big data is larger, more complex data sets, especially from new data sources, that are so large that traditional data processing software cannot handle them. But this big data can be used to solve previously intractable business problems. The Three Vs of Big Data:

• Size: The amount of data is important. Big data is about large volumes of low-density, unstructured data. This can be data of unknown value, such as Twitter data, clickstream on a web page or mobile app, or sensor hardware.

• Speed: Speed is the speed at which data can be received and (possibly) moved. Some Internet-connected smart products operate in real-time or real-time and require real-time evaluation and action.

• Diversity: This refers to the many types of information available. Traditional types of data are structured and properly placed in a relational database. With the proliferation of big data, data is entering new types of unstructured data. Unstructured and semi-structured data types such as text, audio, and video require additional preprocessing to extract meaning and support metadata.

In the past few years, two more Vs have emerged: value and authenticity. Data has intrinsic value. But until this value is determined, it is of no use. Equally important: How true is the information, how reliable is it?[7-8]

Today, big data has become capital. Much of the value of the big tech companies' proposition comes from the data they continuously analyze to drive efficiency and new products. Recent technological advances have reduced the cost of data storage and computing exponentially, making it easier and cheaper to store more data than ever before.

With the proliferation of big data now cheaper and more accessible, business decisions can be made with greater precision and accuracy. Finding value in big data isn't just about analyzing it (that's another benefit). It's an entire discovery process that requires specific analysts, business users, and managers to ask the right questions, recognize patterns, make informed guesses, and predict behavior. Another emerging technology is crucial here, and that is artificial intelligence

Results and discussion

Also, in mobility and multimodal transport, the amount of data is growing rapidly and the complexity of managing vehicles, transport chains or transport networks is expected. As a result, it will not be possible to select optimal options using manual planning or simple data analysis methods. Thus, AI solutions can support or even take control of humans to deal with large amounts of data and control complexity in (real-time) situations.

As explained in TNO and TKI Dinalog (2020), AI programs can focus on:

- people and objects, including road users, vehicles, cargo, sorting belts and infrastructure;
- processes and systems, including supply chains, transport hubs, traffic, policies and regulations.

Intelligent applications in mobility and logistics, such as self-driving vehicles (cars, trucks, trains, barges), smart electric charging, predictive maintenance, self-learning energy and waste management , cooperative mobility, sharing economy and self-organization. logistics.

Although such applications of AI have yet to be implemented, they will be further refined and tested in the coming years to support humans in their activities.

The main objective is to explore possible reasons for this slow adoption and assess how recent technological advances have changed the landscape and thus help overcome these barriers. The contribution of this review is therefore twofold: it advances existing knowledge by providing an up-to-date overview of existing and emerging ICT applications in the field of multimodal transport and existing electronic multimodal transport barriers.

The selected projects are digital platforms aimed at solving specific problems facing multimodal transport. The data was collected through the CORDIS and TRIP project archives and the projects' own websites.

The positive role of ICT in improving overall performance, visibility and communication among multimodal transport operators is recognized by many stakeholders, but after the existence of many barriers to ICT adoption that vary across modes, it is divided into three categories. Several factors of ICT adoption have been identified according to the sphere of influence that can be distinguished: user-related, technology-related and policy-related barriers. This section provides an in-depth study of the barriers to ICT adoption and related factors, with a focus on its impact on multimodal transport. Users here are transport-related organizations engaged in multimodal operations, authorities and companies that use ICT applications in their day-to-day operations and management..

Cloud computing. The need to invest in IT infrastructure and purchase expensive hardware and software solutions can hinder effective business practices. Cloud computing is an alternative to the high cost of investments in IT resources and management, provided by IT professionals, which minimizes barriers related to technology and, in particular, users. Access to existing data centers, application processing, and on-demand solutions (software as infrastructure, software as platform, and software as a service) leverage the latest network and database technologies flexibly and conveniently to combine them to provide information services.

Companies using cloud computing pay only for certain computing resources on demand, which must be accessed through a web interface using smartphones, computers and other devices. Software as a Service (SaaS) has become a popular way to access certain software through an Internet browser for a fixed or one-time subscription fee (O ' Sullivan, 2007).

By using cloud technologies as a service, organizations are freed from the burden of managing the complexity of ICT programs and can focus on core business strategies. This is of strategic importance for small and medium-sized enterprises, which are otherwise unable to deploy sufficient ICT solutions to support their business needs, or lack the in-house capacity and expertise. On the other hand, users of on-demand services also need to be aware of the security implications before using these features, which may be offset by increased costs.[9-10]

A typical example that uses cloud computing in a multimodal transportation environment is the cloud-based e-logistics market. ELMs are web-based ICT systems that connect shippers and customers for spot sales of transportation services (known as open ELM) or for information sharing and long-term cooperation (known as closed ELM) (Wang et al. , 2007)

The traditional method of communication between shippers and carriers, and between their customers (receivers) is characterized and fragmented. For example, if a customer wants to search for a specific shipment, they need to contact the shipper, and then contact the relevant carrier for an update. If the freight forwarder was involved, this process would be more complicated.

Figure 3 shows how a closed ELM can be used to manage the order fulfillment process and accelerate communication throughout the supply chain. The process starts with the customer placing an order in ELM and the order is automatically transferred to the shipper. After that, transportation planning and execution is done between the carrier.

During the delivery of transit goods, the system is constantly updated about the status of this batch (for example, through real-time tracking using GPS). A closed ELM can be hosted on-premises or by a third-party technology service provider based on cloud computing. The latter is often referred to as cloud-based ELM. One of the biggest advantages of using cloud-based ELM is that it allows for centralized management of all information related to a particular load.

Therefore, any change can be communicated to all participating parties at the same time. Increased visibility gives companies more control over their supply chain and the ability to proactively respond to emergencies. The system can also facilitate financial calculations and performance evaluations such as total cost of delivery and on-time delivery. ELM transforms the communication system between shippers, bringing together different modes of transport into an interconnected, streamlined supply chain and delivering several benefits, including lower costs and improved customer service.

Wireless / mobile communication technologies and Internet materials. To enable operators to track individual assets/containers during multimodal cargo operations and obtain additional cargo information such as temperature and humidity of frozen or liquid goods or mechanical condition of the vehicle, radio frequency identification (RFID) tags give permission microchips, are used (Wang and Potter, 2007, ENABLE, 2010a, ENABLE, 2010b, Ferrer et al., 2010).

Jones points out that RFID technology is widely used for identification and security in the Business to Business (B2B) market, while NFC has broad applications in the Business to Consumer (B2C) market.

The potential for developing additional applications using NFC technology in supply chain and/or multimodal transportation is huge. The need to purchase or develop custom hand tools that hinder integration and creation can be replaced by seamless product flow with the development of smart mobile apps using the NFC framework and everyday cheaper mobile devices.

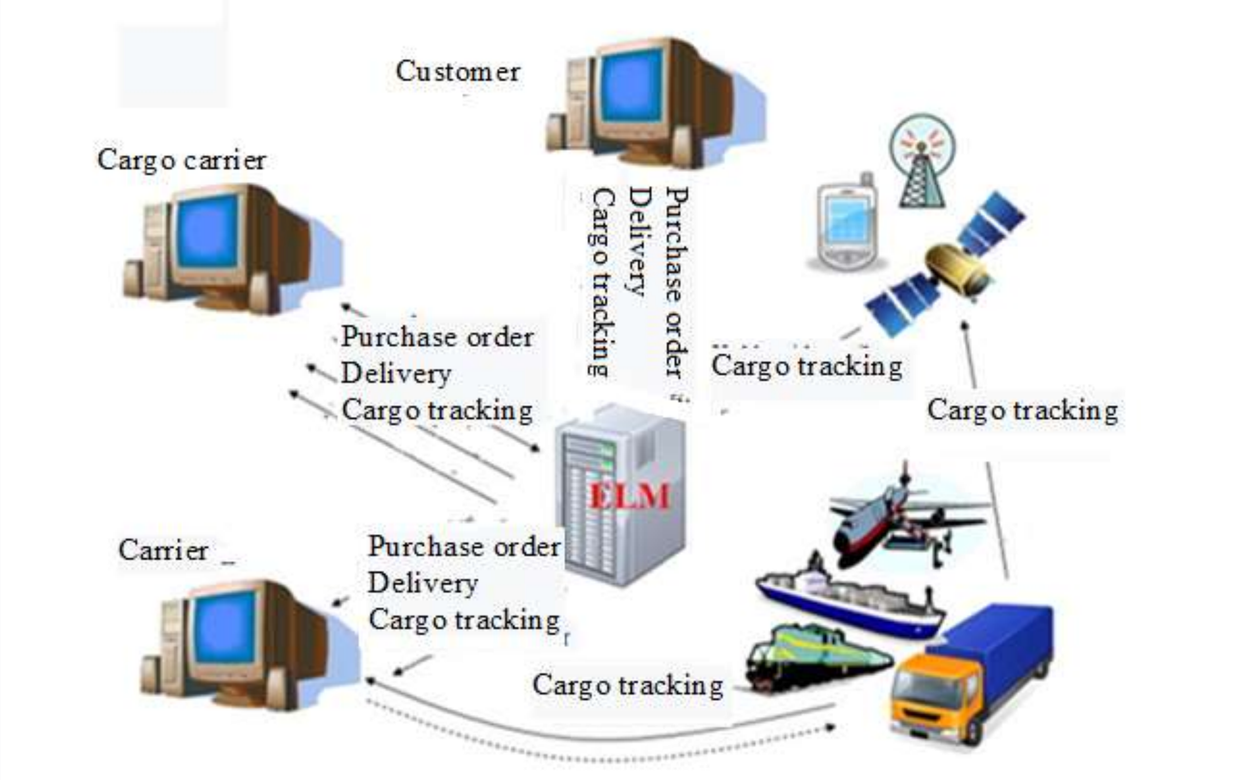


Figure 3. General point of closed ELM operational model.

For example, a driver arriving at a terminal can use the built-in app to scan their mobile phone to notify the operator of their arrival, and then provide immediate feedback on where to drop off the goods on the mobile device. If the mobile device has GPS enabled, it can automatically notify the driver about the next task. The app can expand to faster customs clearance, anytime tracking of goods, and dangerous goods guidance. Technologies can overcome a number of barriers to ICT adoption, including company size, integration visibility issues, and financial constraints.

Container tracking is another area of Internet of Things software. Container tracking typically relies on RFID tags attached to shipping containers, boxes, and pallets, which are then read at various points along the way. A limitation of using RFID only for container tracking is that data can only be captured if the appropriate infrastructure such as RFID readers is available.

Information processing systems are needed to organize the multimodal transport process. Information transport systems include information collection, storage and transmission. Since there is a large flow of information and various parameters, information and communication systems are required. In the multimodal process, transport and information systems must meet the following criteria:

• The system must be integral, that is, it connects all positions of the logistics service;

• Multi-functionality and compatibility of the system prevents the division of language, text and video communications;

• The system should be flexible, computers provide opportunities for the implementation of central and individual solutions;

• The system should work efficiently - bring economic benefits; however, data transfer should not be expensive;

• The system should be maximally portable, but should be oriented towards modern systems;

• The system should provide high speed of transmission (Batarlinnė 2011).

In order to effectively use IT in multimodal transportation, planning of cargo reloading operations requires a terminal first. Enterprises that carry out multimodal transportation solve technical issues of cargo transportation and provide information about the cargo being transported at the same time. The main task of organizing work in the terminal is to optimize each reboot operation and interaction;

efficient use of transport modes. Information systems are activities that facilitate the flow of cargo management, in particular, continuous information, used in terminal management.

In accordance with the concept of an automated control system, the terminal should have an information system that performs the following functions:

• planning of terminal and logistics center programs;
• planning the use of the equipment;
• planning the processing of loading operations;
• management of containers;
• management of acceptable automated equipment;
• ability to manage and implement necessary changes;
• obtaining information and statistics on working with equipment.

When it comes to multimodal transport, transport container transport can be analyzed in different modes. The cheapest way to ship a container temiryo‘l va dengiz transporti orqali amalga oshiriladi.

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