


Digital solutions for dry ports operations

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Reasons for dry ports digitalization

- the need for increasing the attractiveness of intermodal and multimodal transport operations;
- the need for developing a region-wide strategic vision of digital transport corridors;
- the lack of accurate and timely information;
- the need for the information about equipment failures and their consequences;
- the dry ports environments have become intricate partner networks that include the authorities, terminals, shipping lines, trucking and logistics companies, and off-dock storage providers.

The existing solutions can be divided into several fields of application

- cargo handling,
- dry port infrastructure,
- intermodal traffic and trans-shipment,
- customs,
- security,
- maintenance,
- energy and the environment,
- autonomous vehicles,
- warehouse robots,
- artificial intelligence.

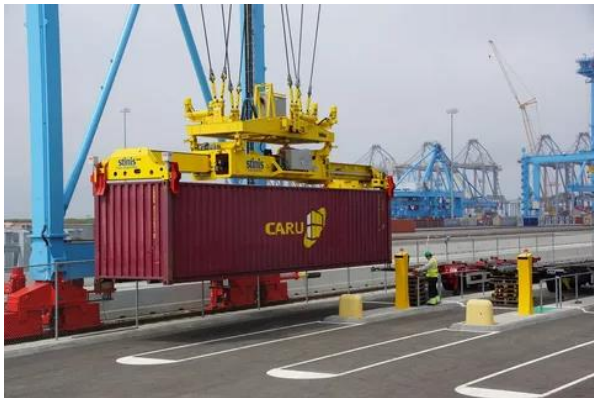
Infrastructure

Smart sensors are the key element of the dry port digital infrastructure.

Such sensors are embedded in container yards, roads, railways, and can transmit real-time data about operating conditions of berths and other infrastructure.

Sensors can reduce the need for annual inspections and provide data that helps owners schedule preventive maintenance more precisely. Many sensor-based structural-health-monitoring systems cost a fraction of the structures themselves, and this can mean a relatively fast return on investment (ROI) in countries with the high labor cost.

Cargo Handling



Every dry port needs its cranes and other cargo-handling gear operate at peak efficiency and to be properly maintained, helping terminal operators handle increased volumes and improving productivity. In this case the Reliable monitoring systems can ensure that connected cargo-handling equipment does this work in real time. “Black boxes” that are installed in one of the containers terminals on 200 cranes straddle carriers, trucks, and forklifts in the terminal, collecting information on location, status of operations, and energy consumption. The system analyzes the information in real time and shares it with terminal staff to identify operating bottlenecks and initiate appropriate action. The prototype’s developers estimate that it could shave up to 10% from operating costs by reducing equipment idle time and minimizing energy use.

Intermodal Traffic and Transshipment

Modern dry ports need the effective options for directing trucks and trains through frequently congested areas as quickly as possible. The solution is the adoption of the Terminal appointment systems, that can let trucking carriers reserve specific times for dropping off or picking up freight. By booking time slots in advance, appointment systems help minimize turn times, reducing the time that truckers spend clogging port arterial roads or sitting idle and contributing to poor air quality. Some of the terminal-logistics centers are testing a GPS-based traffic-monitoring system that tracks truck movements, notifies terminals when vehicles are approaching key facilities, and provides directions on how to proceed. In another application, it is embedded traffic-monitoring sensors along major port roads being tested.

Safety and Security

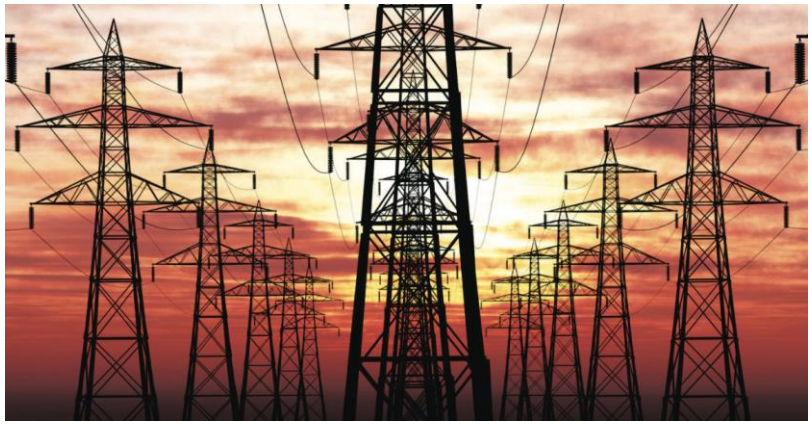
Dry ports are required to meet minimum safety and security levels for the facilities and assets they manage. They are responsible for monitoring physical infrastructure and ensuring that only personnel with proper authorization and clearance gain entrance to restricted areas. Among the array of smart technologies that dry ports can adopt to improve security: surveillance systems that use advanced video analytics to detect intrusions on the basis of movement and pattern recognition and then alert security personnel to potential threats. Many container terminals are upgrading from gate entry systems, adding more protection by requiring employees, truck drivers, and visitors to log in through systems that use networked biometric scanners. To address worker safety concerns, ports are installing sensor-based systems that enforce safe working procedures. For example, they use sensor networks that alert truck drivers traveling on dry port property to remain within road lines. Similar networks can keep cranes properly aligned during loading and unloading.

Maintenance

Maintaining of the track facilities is central to ensuring availability and proper dry port functioning. Maintenance can be assigned to any object in the existing digital tools. Planning and monitoring are centralized and visible in tables and on the site's graphical map. Rail and truck partners can be granted selective direct access and thus overview of the (non-availability) of tracks. Pickup trips can be adopted to the current situation and being performed more efficiently than before. Last but not least, maintenance work for several locations can be summarized in a "maintenance calendar" and maintenance partners can be informed electronically or have insight via the web interface. The approval and confirmation of the work carried out is available immediately after being entered in the system and is immediately available to the employees and partners. This minimizes maintenance and downtime.

Energy and the environment

Cargo Connected technologies help terminals reduce energy consumption and waste. One option is a motion-based terminal illumination system that lights up only when vehicles are in the vicinity. A prototype motion-sensitive lighting system installed at one of the terminals cut energy consumption by 80%, paying for itself in less than two years. The others are deploying similar smart lighting on port roads to minimize energy use. Some dry ports use drones as a low-cost option for inspecting equipment, patrolling waterways for oil spills, and checking on cleanup efforts.



Autonomous vehicles

Driverless trucks, cranes and other terminal equipment are now being tested. Combined with the type of control systems that transport and logistical companies have introduced, a clear picture is emerging of how cargo will increasingly be moved inside the container terminal without human intervention.

Warehouse robots

There are also examples of companies using small robots for the dry port processes. This field is rapidly developing. The testing of robotics on the warehouses is increasing 18% per year. The mobile warehouse robots are operating on the entirely autonomous compact devices that get an access to all the tight places possessing the expanded viewing area. Such a robots are able to provide quick cargo overload from trucks, wagons, handle the pallets and move the containers and boxes all over the warehouse.

Artificial intelligence

The artificial intelligence systems enable the cargo handling market participants to handle unprecedented amounts of logistical information.

The contemporary digital solutions for transport and logistical centers focus on efficiency improvements like traffic management systems, improving flow throughout the terminal area, automation, reducing costs or digital invoicing (customs) by improving lead time. However, the need for internet of things and digital platforms is driven not only from business perspective, but also from the perspective of dry ports shaping their environment instead of reacting to market fluctuations.

Moving towards a true digital dry port, using the full potential of an internet of things network and smart data solutions, it will be able to identify and take advantage of new business models within the larger ecosystem. The nature of the business makes this challenging, since it requires integration between the supply and demand side, assimilating not only logistics firms and suppliers and distributors but also their clients like industrial producers.

Digital copies of dry ports

One more aspect of the dry ports' digitalization is the unification of physical and digital worlds. This makes it possible for the client to cooperate with the physical object's digital copy in the way it was done traditionally.

The potential possibilities for the digital duplicate in logistics and endless for data collection and weak points investigation.

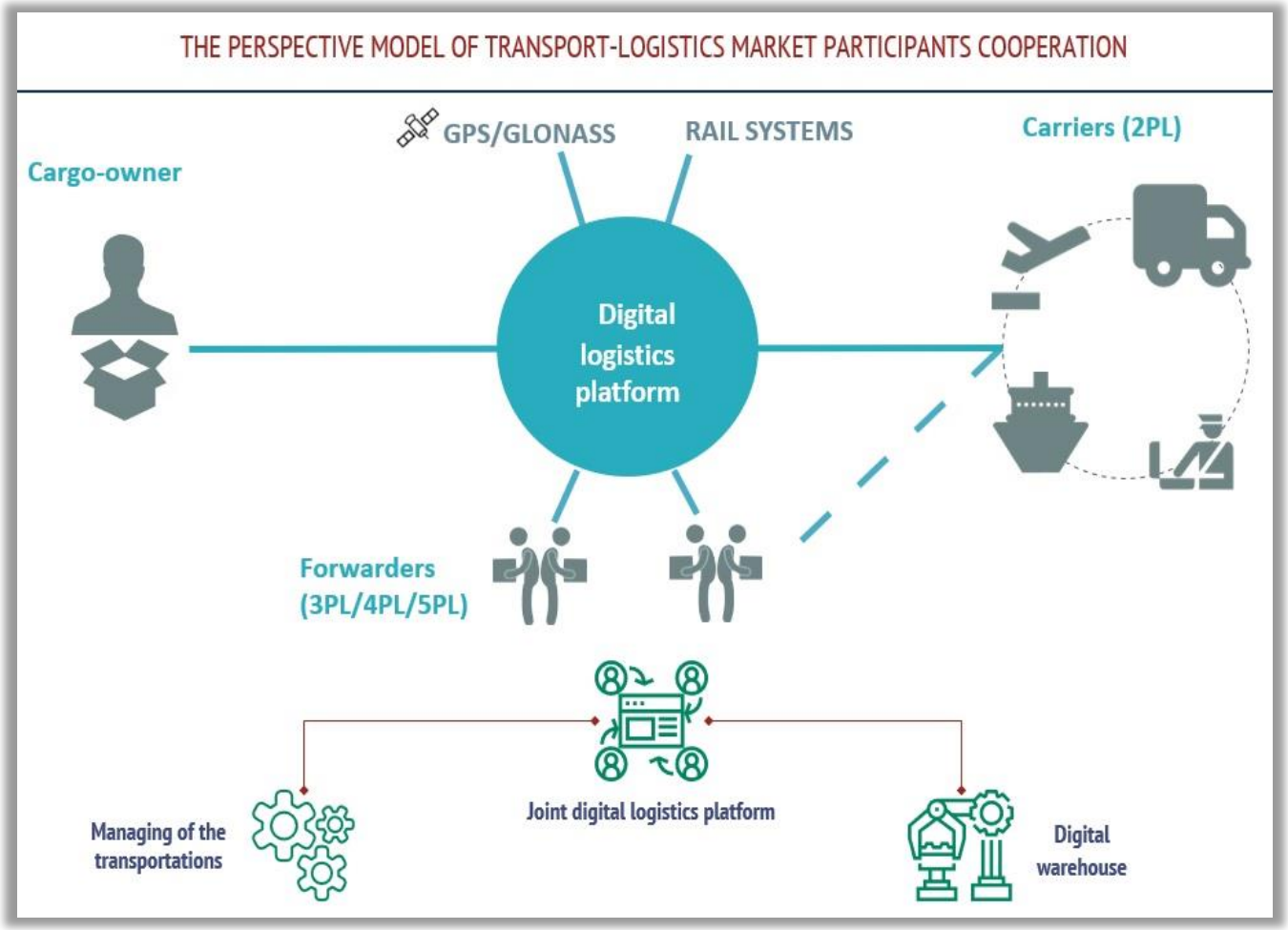
Warehouses and the enterprises use this technology to make the exact 3D-models of its centers and experiment with the changes in the configuration, or the implementation of new technical equipment in order to see its cooperation. Moreover, the logistics centers are able to create a digital twin and use it for the goals of testing different scenarios and effectiveness rise.

PRACTICAL PROPOSALS OF IMPLEMENTATION OF DIGITAL SOLUTIONS BY THE LOGISTICS INDUSTRY

Modern logistics sector lags in the point of digitalization behind the telecommunication, mass media, bank and retail business sectors. The majority of traditional transport and logistical centers still use a lot of “handmade” work. At present, there is a tangible trend in optimization of handling and logistics operation costs, that comes along with the other things, formed by finding a successful compromise between speed and reliability on one hand, and the cost on the other.

Moving to practical proposals of digital solutions implementation by the logistics industry, all these solutions can be most effectively integrated in the joint transport logistics digital platform of the region, as it can form online the best market proposal for the customer, based on the accumulated data, to achieve the optimization of the purchases, assets, production processes, logistic chains and financial calculations for the key trade operations and supply schemes, should cardinally change the approach of finding logistics solutions and transform the logistics market structure.

Digital Logistics Platform



Digital Logistics Platform

This digital instrument is able to:

- automate the business processes, analyze the consumers behavior and offer the optimal solutions to organize the transport flows;

- take into account the specifics of railway, auto, water and avia transport;

- simplify the agreement work between the logistics processes participants;

- accumulate, structure and analyze a large volume of data, predict events and minimize risks for participants in logistics processes;

- optimize transport and terminal assets utilization, improve its profitability and decrease the logistics expenditures.

The digital logistics platform is able to provide the optimal logistics and manage the distributive warehouses with the minimum amount of staff (the digital terminal).

Digital Logistics Platform

- **While managing the transportations the digital logistics platform:**

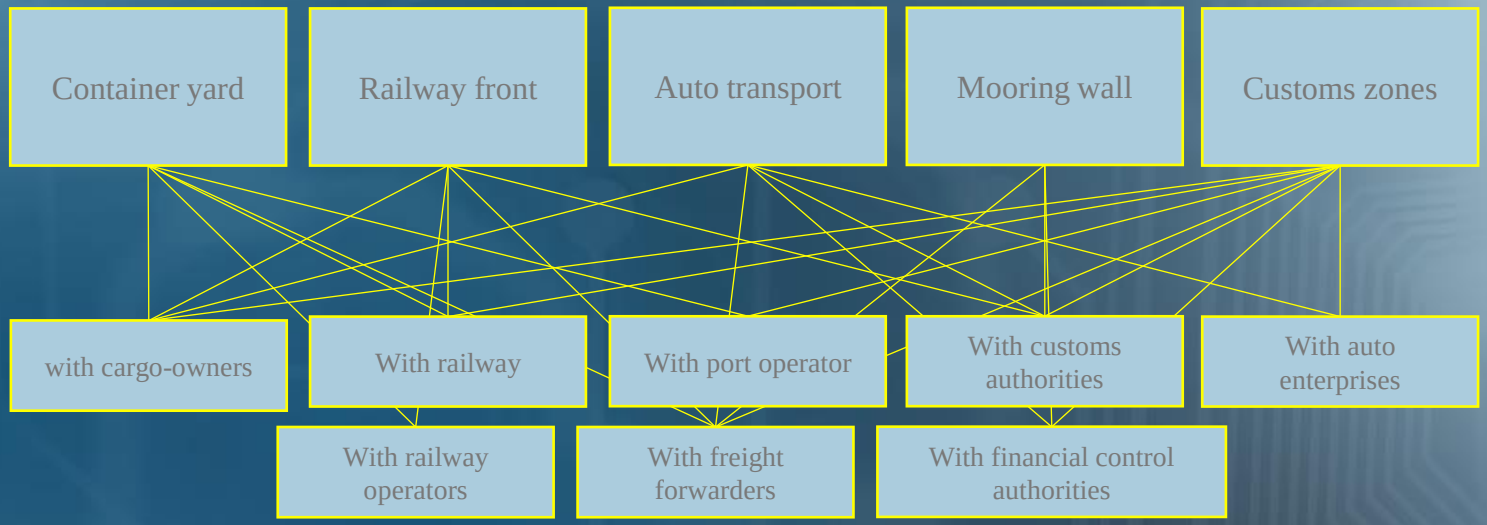
- searches the optimal routes using the technologies of machine learning;
- uses the comfortable interfaces for the forwarders and the clients;
- provides the integration with the governmental informational and clients supply chain systems, organizes the digital document circulation and cooperation with the customs.

- **While managing the digital warehouse the digital logistics platform:**

- minimizes the terminals infrastructure and staff expenditures by creating smart loaders using the computer vision technologies;
- manages the inner warehouse logistics and fulfillment;
- form the digital warehouse – a virtual twin (copy) of the warehouse with more than 40 technical parameters of the condition.

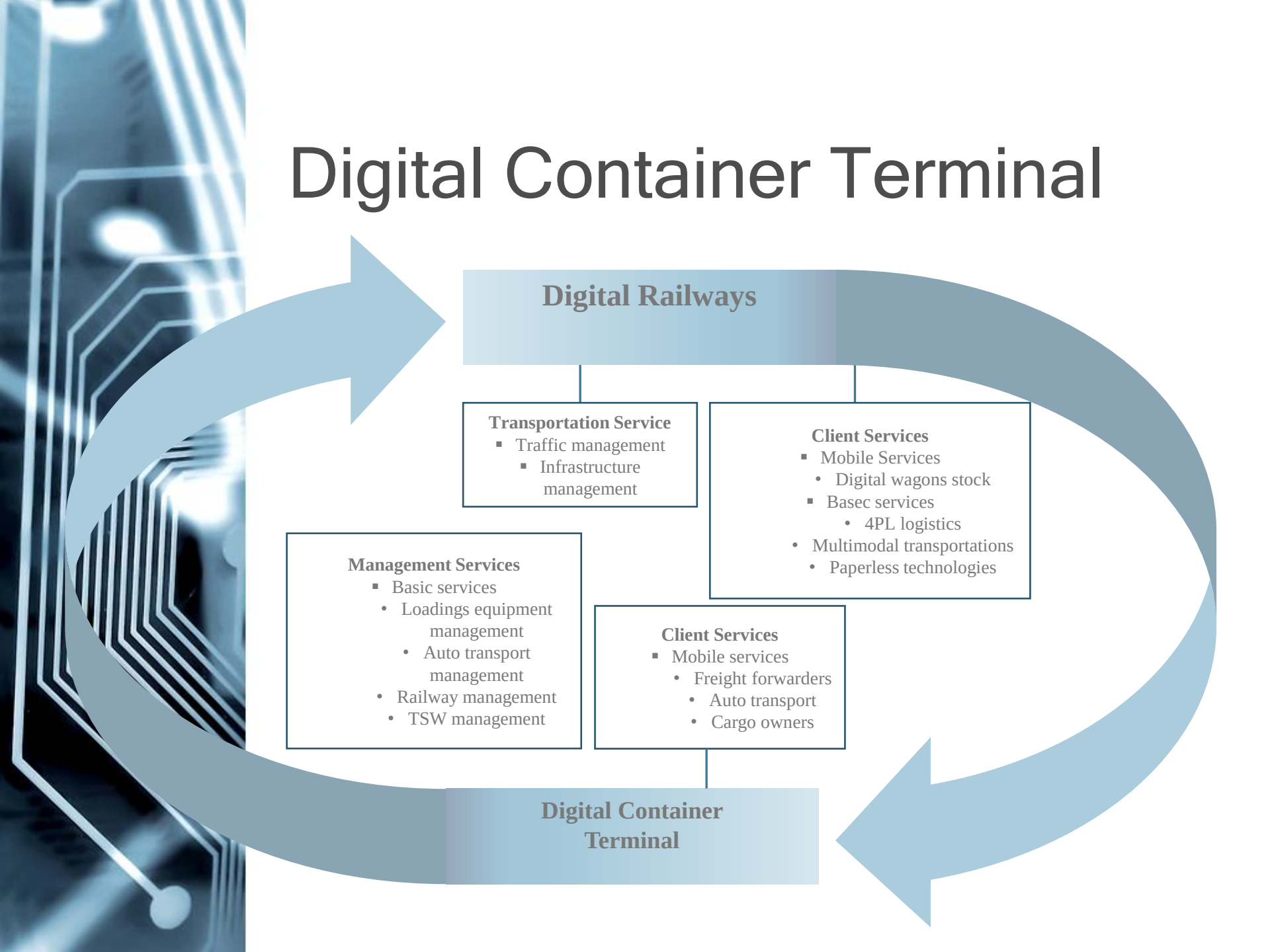
Digital Container Terminal

A service that is providing through IT solutions terminal business-processes management, its technical and technological coordination with all the stakeholders



- The approach to the terminal services on the principle of “singe window” and the possibility of terminal services reservation as a part of complex logistics door-to-door service;
- Monitoring of the actual and documentary cargo condition and the equipment on the terminal;
- Centralized/distributed electronic document circulation;
- Containers/wagons transfer;
- Cargo presentation for customs registration and monitoring of the customs clearance process;
- Centralized control of the powers of attorney;
- Formalization of the transportation and accompanying documents (railway and transport consignments).

Digital Container Terminal



The limitations for digital solutions application

- The standardization and the output of the market participants and regulatory organizations at every stage.
- Unification of formal documents, accompanying cargo and proving the fact of this or that transport and logistical service render.
- The output of the united legislation base on the international and national levels, regulation the relations between the sides of the digital transport-logistics process.

Main dry port digitalization cornerstones

- Dry ports usually specialize on handling particular types goods and have certain geographic and logistic peculiarities, which have to be taken into account while creating the terminals processes digitalization systems.
- Every dry port is a place where different material and information flows of a large number of logistics process participants are crossed: cargo owners, forwarders, linear operators, carriers, state authorities and many others.
- In perspective, the multipurposed systems that will be integrated with the other logistics chain participants IT-systems will be the winners of the dry ports digitalization market – not the IT-systems of the separate terminals.

Distributed Control System (DCS)

The basement of the dry port's DCS is an architecture of the system that is meeting the following requirements:

- availability of a wide list of potential stakeholders' categories (inner and external), the possibility of users' categories list expansion (independent designers, system integrators), the potentially large number of external users;
- separateness and independence of dry port's DCS from the status of external IT systems, security and cyber-attacks sustainability;
- the availability of a variety of integral services and the increase of its amount as far as the dry ports network and logistics services market develops;
- the requirement for integration with the internal management systems, providing the commercial activity of dry ports, its financial processes and operation functions;
- the exposure of architecture for further integration with the existing and perspective analytics platforms;
- the availability of interfaces for the establishing of cooperation with the state and private analytical platforms of the potential foreign partners.

Distributed Control System

The determination of the IT-platform perspectivity is based on the following requirements and factors:

- the possibility of flippy customizing the parameters of business analytics, scenarios modeling and transport and logistical processes planning;
- the possibility of scaling the territory borders of the system, its guidebooks, the wide spread sub allocating of the dry port’s infrastructure and the possibility of the distributed data storage.

Distributed Control System (DCS)

To provide the sustainable dry ports network operation the DCS should include and look ahead the following: `

- classification and scaling of the service types, including the dry port's operators' services, the dynamic pricing system for different services, classification and scaling of the list of system stakeholders;
- classification of the transported cargo types (including perishables and cargo, requiring special transportation conditions and temperature regime) and the reconcilability of these cargo types;
- classification of the transport vehicles due to its variety while doing multimodal cargo transportations;
- classifications of the customs regimes of the transportation (including export, import, transit).

Distributed Control System

The types of the services for the external consumers consist of:

- transport and logistics services in the frames of regional inner routes and international transport corridors cargo flows (in addition to the basic logistics services, such as cargo tracking, cargo searching, monitoring of transportation temperature regime and others);

- accompanying services for the cargo transportation customers (the cargo insurance, crediting, payment holiday and other financial facilities, customs formalities and procedures);

- IT services: operators check in order to reveal and to exclude the unreliable ones, the providing of maintaining the register and an electronic document turnover;

- the proving of the secured information exchange;

- informational-technological services, including the real-time authorized access to the data in the frames of standard request correlating with the security requirements.

Distributed Control System (DCS)

- The Cargo transportations intend to become more effective due to the personified digital services and facilities, transparency of the cargo flows and in combination with the grown-up effectiveness will reduce the market share of the uncontrolled transportations in the full volume of the cargo turnover.

- It is quite difficult to get a high level of transparency, because it does require both technical difficulty and a limited human intervention. Still at that very moment it is achieved, the benefits appear to be significant and are not limited by saving inventory and planning improving.

Thanks for your attention!