SMART PORTS
A DEEP TRANSFORMATIONAL MOMENT

Jose Antonio Gonzalez Florido, Global IoT Business Development Manager, and
Alejandro Cadenas González, Global Head of Strategic Partners, Telefónica Global, Madrid, Spain

We first heard of the digital revolution years ago when it started in the sectors where adoption speeds were higher, the entry barriers were low, and levels of dynamism in product development and commercialization were significantly higher than the average. These sectors were the online retail, IT and other tech-based verticals. Nowadays, the transformational effect of digital technology has permeated almost all environments. This is why the digital revolution is not actually a revolution anymore, but a transformation that is focused on people and how technology can help them to improve their lives.

The digitalization of industrial processes is turning the way we produce goods and services upside down as we look for higher efficiencies and better management of resources. This transformation is the so called 'Industry 4.0.', and the Internet of Things (IoT) can be considered its 'cornerstone' due to the clear need to capture information from all industrial assets.

The maritime sector is not an exception in this transformation and the change is starting to accelerate. This is precisely what is happening in the Port of Algeciras which is deploying the first LTE Private Network in the Spanish port system. The Port of Rotterdam is also using IoT technology to create a 'Digital Twin' of the port, and thanks to that make better decisions. Similarly, the Port of Seville is using a 'FIWARE Platform' to deploy IoT services for container tracking and to manage railway traffic, as well as monitor the main parameters of the Guadalquivir River.

Given the amount of fast-moving assets and calculations, a modern port network is the Formula 1 of the contemporary IoT ecosystem. Different moving assets like containers, trucks, cranes and so forth coexist with workers, loads and ships. It is thus very difficult to radio conditions together within such a dangerous environment.

MARITIME SECTOR 4.0.

We can define four different levels of Maritime Sector 4.0. adoption depending on the technologies that are being deployed where IoT plays a key role. These are expressed in Figure 1 and break down as below:

1. **Port Authority Digitalization:** Port authorities are very complex entities composed of a very different set of stakeholders with a final common goal: maximize efficiency, minimize environmental impact and enhance security for the end to end supply chain process. This first level comprises all technologies and practices oriented to implement digital tools in the usual activities of the port authority.

2. **Port–Terminal integration:** Agility is a must in the maritime business which means that intermodal and organizational integration between ports and terminals (their clients) is key for competitiveness and performance improvement. This second level of adoption includes all the mechanisms and technologies oriented to integrate the port's systems with external systems. What's more, this implies a consolidation of the information that can be exchanged via these integrations into an evolved operation model.

3. **Port–Terminal–City Integration:** This third level of adoption involves

information sharing and also the deployment of specific use cases oriented to manage the transfer of goods arriving/leaving the port through the city, increasing efficiencies, decreasing complexities and risks, and extracting real time information from all parties involved.

4. **End-to-End Supply Chain Integration:** This is the best-case scenario where all the stakeholders participating in the supply chain process are integrated, leveraging on the information of the other parties to optimize the supply chain process. This last level of adoption implies a much deeper presence of information exchanged across parties into the operating model
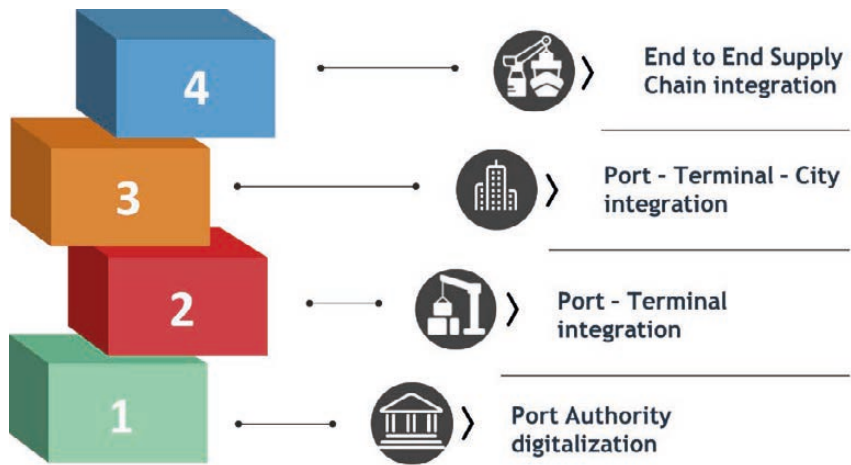
TECHNOLOGY IS KEY

There are a number of use cases to be deployed and each one of them will depend on the specific location, structure and nature of the port. In order to make sure that capabilities are deployed properly, technology comes into play. The four levels listed above have three things in common: connectivity, information and data processing, where security, feasibility and availability must be guaranteed. Below we review connectivity, information and data-processing:

1. **Connectivity:** At Telefónica we are convinced connectivity is the foundational layer for Maritime Sector 4.0 services and when we talk about mobility Private LTE solutions are the only ones that can guarantee the higher level of quality. We break these down as follows:

a) Reliability: Allowing configuration of the private network quality of service, managing end to end priorities at a device level, guaranteeing minimum latency

b) Coverage: With a dedicated licensed spectrum, free of interference. Wide range in outdoor and indoor

c) Capacity: Supports multi-service network (voice, data, messaging) with all types of traffic, and a very high number of devices

d) Security: Redundant solution with secure access based on SIM and user credentials. The traffic can be routed locally

e) Mobility: This is a solution with native handover by definition which allows extreme mobility without a session loss. It is possible to extend the service outside the private area through the public network

f) Evolution: Technology supported by 3GPP with evolution to 5G, including new standards such as MCPTT, IoT, and so forth can be considered pre-5G networks

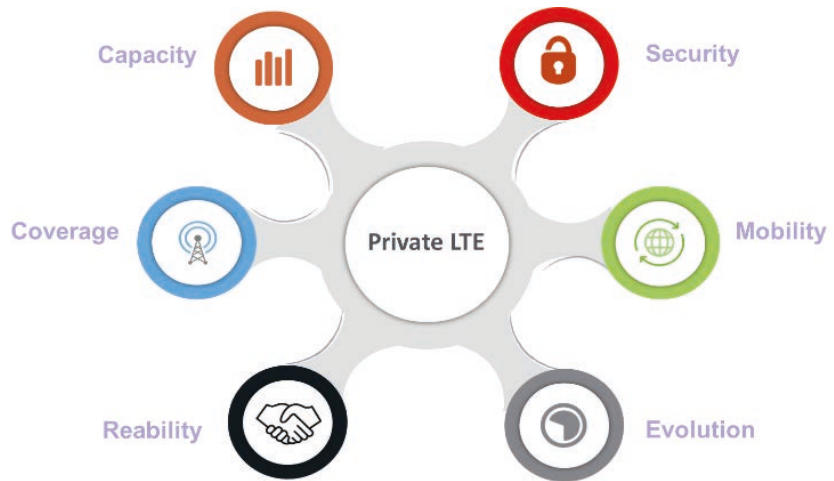

Figure 1. Maritime Sector 4.0. adoption

Figure 2. Features of a Private LTE Network

At Telefónica we are believers in full interoperability, so typically our solutions support connecting assets not just for private infrastructure but also to public ones, which becomes critical in mobility scenarios requiring connectivity beyond the port area.

This flexibility also includes satellite connectivity. This way connected ships get full connectivity not just while in or near the port, but also when the boat is far from regular cellular connectivity.

2. **Information:** Once we have the 'Communication Highway' up and running, the possibilities to transport information are huge. Thanks to IoT, it is possible to get almost any type of data from the world and connect it to

the internet. Keeping that in mind, with IoT we can collect all the information we consider important for both the maritime sector and the city (for example temperature, salinity, humidity, vessel and container tracking, fleet management, security, waste and light management, etcetera). This information can then be aggregated into a common point that is the service platform.

3. **Data Processing:** Information is a great asset, but the magic comes when that information is turned into actionable insights. That is why data processing is so important, and why the information should be shared with all the stakeholders of a given process.

A clear example is the concept of the

digital twin; that is a digital representation of a physical asset, typically composed of a set of variables that, aggregated and processed, describes and predicts the behaviours of the asset being monitored. In order to anticipate the behaviour, potential failures or problems and abnormal behaviors, a mathematical model is required in order to describe how the asset works. This concept is inherited from the industrial manufacturing world, where this technique is applied to assets that can go from engines to robots. It can also be applied to the whole manufacturing plant itself, as it can be a complex asset that can be modelled and predicted thanks to the real time data information that an IoT system can capture. Following a similar procedure, an entire port can potentially be modelled and accordingly a digital twin of the whole port can be very useful to predict water flows, issues with the cargo processed, or even problems with the coming ships.

Due to the growth of the maritime sector, we at Telefónica are going a step further in proposing what we call the "Port – City Communication HUB" which is based on FIWARE technology. Just to highlight why this is so important, two examples can be given where the "Port – City Communication HUB" can act as a facilitator of information, not only for the port and the city, but also for the final customers, the citizens:

a) Passenger Cruises: Have you ever experienced the chaos when a passenger cruiser arrives in a port with more than 4,000 people? If you live nearby a tourist port you will experience that quite often. Now, imagine that not only the city has information about the passenger cruisers (schedule, number of persons, interests, etcetera) but it is possible that the information is shared with the cruise passengers, including information like the main places, museums and monuments to visit, the best bars and restaurants to eat, if they are crowded or empty, and so forth

b) Hazardous goods: With this type of solution it would be possible to avoid dangerous situations (for example, a truck transporting hazardous goods stuck in the middle of a city due to water leak) by simply having an open data service providing information from both the port and the city

These are just two examples of what is possible thanks to the digitalization of the maritime sector and the deployment of data aggregation services and data analytics. This all starts from an optimized and reliable connectivity.
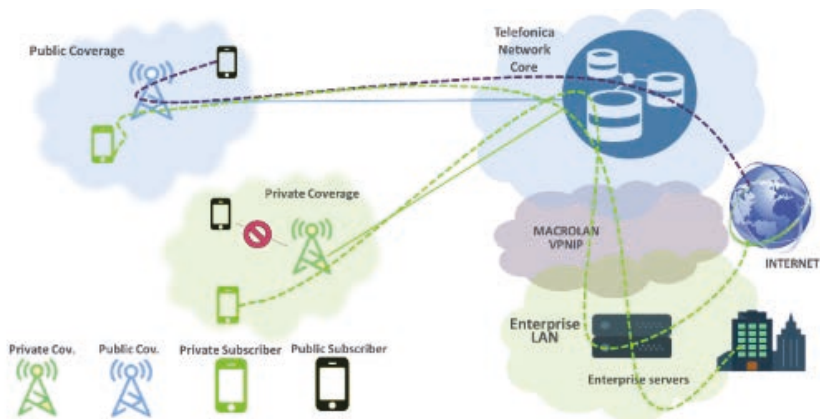

Figure 3: Virtual Private LTE Schema

THE FUTURE

Thanks to the Maritime Sector 4.0. revolution, stakeholders now have the tools to orchestrate the different components of this beyond connectivity approach defined above, with data driven decisions at its core.

The technology is ready to start, including the sensing technology, the connectivity, the platforms to aggregate the information and all the required data analytics techniques to extract all the information. The coming enhancements will speed up the process. Once the new sensing technology and the connectivity technology to connect what today cannot be connected is more widely deployed, new use cases will be identified. The building blocks to implement those will then be ready to use.

Digital twins and predictive models to improve mooring and casting off, remote controlled cranes, connected vessels, asset tracking, these are only a few examples that can help the customer to minimize operational costs, improve customer satisfaction, optimize revenues, and even generate new revenue streams. The collaboration among the different players around the port, from shipping companies, port authorities, integrators, operators and providers, will also manifest new business models. The revolution is here, and it comes full of opportunities that need to be together found out.

ABOUT THE AUTHORS

Jose Antonio González Florido is a strong believer in technology to help people. He is an Engineer in Telecommunications, with an MBA in Marketing and Sales, and he's a PhD candidate in Telematics. Jose is PMP, ITILv3 y Six Sigma - Green Belt certified, with more than 15 years of experience in technical and business roles, and a global view of e2e lifecycle of digital services. He is an active member of the 'Blockchainers Group' in Telefónica, participating in publications like "Blockchain prepara su revolución para las ciudades inteligentes", for the World Economic Forum 2018.

Alejandro Cadenas Gonzalez is Global Head of Strategic Partners in Telefónica IoT, which he joined in 2006. Before that, Alejandro was Head of Network and Services Planning in Motorola for 6 years. With more than 20 years of experience in technology, he holds an MSc in Electromagnetic Physics, Telecommunication Engineering, and holds a Telecom PhD and Executive MBA from ICADE-BS. He has 10 granted patents in technology, several technical publications, speaker in technology forums, executive professor in top tier business schools, was selected as spanish representative in European forum "Digitising European Industry".

ABOUT THE ORGANIZATION

Telefónica IoT is the Internet of Things global department at Telefónica, dedicated to developing and implementing IoT solutions in all industry segments. It offers its clients global end-to-end solutions around the world with the very best connectivity, and is available in all countries via its presence there or via roaming agreements and partnerships. Some of the main business areas covered by Telefónica IoT include Smart Mobility, Smart Retail and Smart Energy.

ENQUIRIES

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