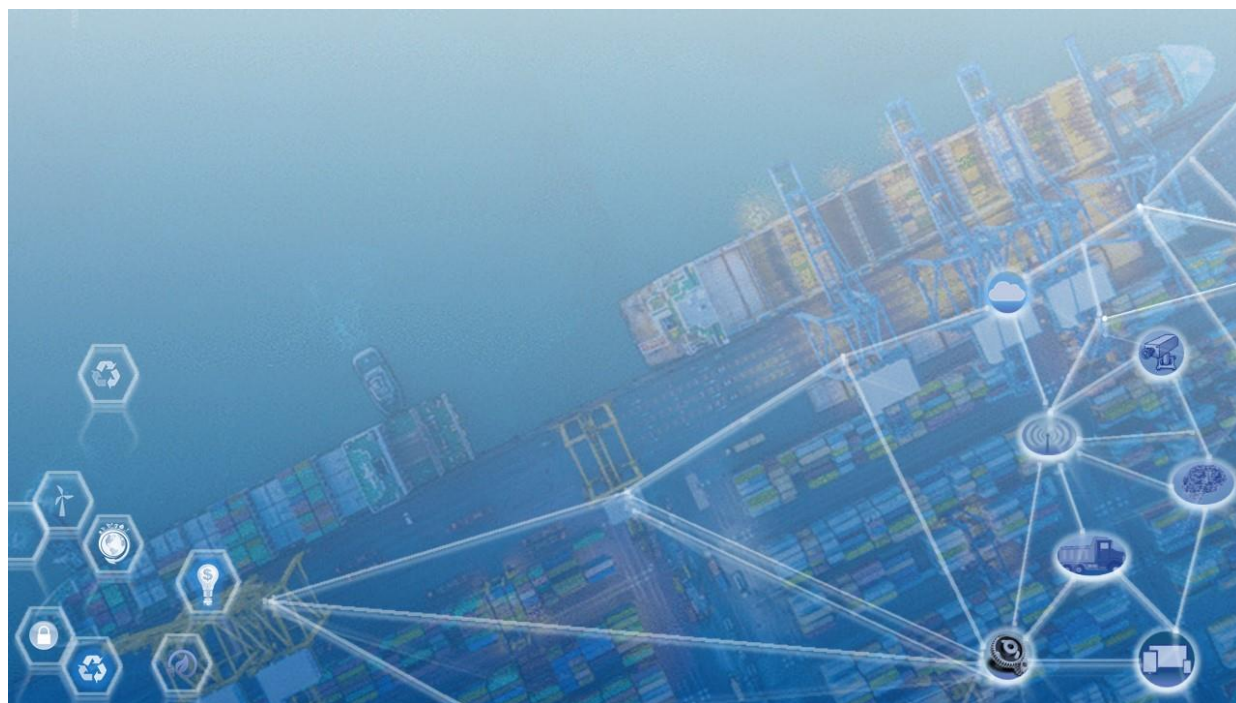


European Technology Platform Networkworld Europe

Webinar on Smart Ports

POST-EVENT DETAILED REPORT

Jointly Organized by



16th September 2022

Event Overview

Objective

The event aimed to provide a deeper understanding of the present and future needs and requirements of the port sector highlighting the valuable experiences and practices of different ports across Europe and China.

- **Location and Date:** Online, 16/09/2022
- **Duration:** 03h20min
- **Outreach metrics:** 154 registered, 68 attended. The webinar video and slides would be public on both NetworldEurope's and CCSA's website targeting outreach to more than 1800+ members from both sides.
- **Event Post-Report drafted by:** Fatma Marzouk, with contributions from NetworldEurope and CCSA organization teams.

Agenda

Smart Ports Workshop NetworldEurope & CCSA (Online)		
Date	Sept. 16 th CEST 9:00 – 12:20, Beijing 15:00 – 18:20	
Agenda	Talk Title	Speakers
09:00-09:20	Opening speech and introduction	Rui Luis Aguiar/ NetworldEurope, Steering Board Chair Wen, Ku / CCSA Board Chair
09:20-10:40	Session 1- Smart Port Solutions & Experiences Moderator Nan, Xinsheng Deputy Secretary-General of CCSA	
	5G Smart Port Project at Guangzhou Port	Li, Peiquan / Manager of Information Department of Nansha Port Phase IV
	5G Automated Docking System	Song, Xiaoming/ Deputy General Manager of Guangzhou Port Group
	Use of 5G in improving port operations at the Port of Livorno	Paulo Pagano/ Director of JLAB-Ports (CNIT)
	5G solutions, Smart Port at Yara Porsgrunn overview.	Stig Myrland/ Process System Manager YARA
10:40-10:55	Comments & Discussion	
10:55-11:05	Break	
11:05-11:45	Session 2- Future Requirements & Visions Moderator Jyrki Huusko Expert Advisor Group Vice Chair, NetworldEurope	
	Future Enablers for Ports	Eusebui Catana/ 5GLOGINNOV project coordinator
	Smart Port Future Platform	Chen, Dan / 5G BU Director of China Unicom
11:45-12:05	Comments & Discussion	
12:05-12:20	Closing words	Wen, Ku / CCSA Board Chair Rui Luis Aguiar/ NetworldEurope, Steering Board Chair

Program Summary

Opening Speech and introduction

Wen, Ku (CCSA, Board Chair)

Mr. Wen, Ku welcomed the speakers and participants on behalf of CCSA and evoked that CCSA and Networld Europe have been jointly leading open communication initiatives through a series of events that have been widely acclaimed by members and communities from both sides. Mr. Wen, Ku stated that mutual learning and agreement on directions and strategies are critical for the global communications industry. Through his presentation, Mr. Wen, Ku briefly shed light on recent updates and news in China. Updates on the CCSA board include new members from industry, including several that are not headquartered in China. The number of CCSA board members is 52. The number of CCSA members increased from 400 in 2016 to 1000+ till now). Besides, CCSA's standardization work during the last 5 years has also led to 124 national standards, 1137 industry standards, and 184 CCSA standards.

Mr. Wen, Ku discussed the latest 5G network development in China, including: the increase in the number of 5G base stations in use across China (reaching 1.85 million in June 2022, with 295,000 built during 2022Q2); and a 5G average rate achieved in downlink and uplink of 341 and 71 Mbps, respectively. On the applications side, Mr. Wen, Ku elaborated further on the efforts of CCSA in supporting converged 5G applications as well as various industries through several activities, such as the co-organization of China Blooming Cup. In the last edition of the latter, 13 participating smart ports won awards. Mr. Wen, Ku expects that the proportion of commercial use will increase significantly this year. Indeed, ports carry out 90 % of the global trade and are therefore vital for economic development. Global top 10 ports, 7 in China. However, on the path to digital transformation, ports face several challenges, such as the requirement for increased efficiency, improved revenues, and increased reliability and resistance to operations in harsh environments. This calls for the use of E2E digital networks and sustainable development in technologies such as 5G, B5G, AI, and digital twins to help solve these challenges.

Rui L. Aguiar (Networld Europe, Steering Board Chair/ University of Aveiro)

Prof. Aguiar welcomed the participants and acknowledged the opening words of Mr. Wen, Ku, emphasizing that the events that NetworldEurope & CCSA have been organizing in recent years, targeting vertical industries, emanate from the recognition of the importance of communications to society and the belief that it is the needs of the different areas that should drive both institutions' work. Prof. Aguiar explained that such joint events and initiatives are an effort to guarantee that the continuous development of technologies is grounded in the reality of society and the needs of the market. As such, these events commonly revolve around the diversity of requirements that the vertical industries require, triggering discussions from a service point of view as well as from a technology point of view. Prof. Aguiar affirmed that in Europe, efforts have been dedicated to the development of vertical industries for at least the last 5 years, and that this trend will be kept on for the next few years. In this context, Prof. Aguiar revealed that, by June 2023, a set of so-called "hat projects" are planned to kick off. The mission of such projects is to enable the testing of applications and technologies for different vertical industries by providing technology platforms and frameworks (including funding) for entities developing the vertical solutions to perform tests in real-world usage scenarios. The diverse set of experiences planned within the scope of such projects would benefit various vertical industries and vertical domains such as e-health, smart ports, smart transportation, smart cities, and smart agriculture, resulting in shorter time-to-market and clearer visions of what the short and long-term technological evolutions should be.

Li, Peiquan (Nansha Port Phase IV, Guangzhou Port Group, Manager of Information Department)

Mr. Li, Peiquan started his presentation with a brief overview of Guangzhou port, explaining that after more than 200 years of development, the port has become one of the most prosperous world ports, the largest comprehensive main hub ports in China, and a gateway hub for high-level connections to the world. Indeed, the port provides 111 foreign container liner routes to the world (some routes for EU). The speaker evoked that Nansha Port represents the most important core port area for Guangzhou Port, and proceeded to discuss both agenda points together. On its way to modernization and full automation, Nansha port has passed through three different joint/phases (Nansha port phase I, II, and III). The three phases allowed the port to operate 16 specialized container deep water berths with a capacity of +15 million tons, holding a main cost line of 5718 meters and a water depth of 70 meters, accommodating the world's largest container ships, according to the speaker.

In July 2022, Nansha Port Phase IV project, the fully automated terminal in Nansha Port Area, was officially put into operation. Such a terminal represents a fully automated terminal built by domestic scientific and technological enterprises and institutions and encompasses four 100,000 metric-ton berths along with their supporting container barge berths. The terminal has been designed to make full use of natural geographical advantages (river to sea to rail multimodal transport), saving energy related to heavy-duty transportation of equipment and reducing carbon emissions. The terminal relies on advanced technologies such as Beidou navigation, 5G, AI, and unmanned intelligent guided vehicles (IGVs), adopting a new generation of automated container terminals. The speaker also dived into the set of key capabilities empowering the terminal, which include: Beidou navigation based (IGVs) for enabling very accurate positioning; a yard horizontally arranged for side loading and unloading; a single-trolley automatic quay crane supported by 5G private network and PLC, enabling a control delay smaller than 30 m; a slow-speed automatic rail crane; and a fully automated port area. Mr. Li, Peiquan shed light on some difficulties faced during the construction of the 4th phase terminal, which include the heterogeneity and complex working conditions of automation equipment, as well as the difficulty of driving IGVs. The so-called "super brain" information system helped tackle these difficulties, providing an optimal plan and dispatch for various operation scenarios such as container loading and unloading, etc. The speaker followed up his presentation by quantifying the remarkable expected benefits of automating traditional ports, which are mainly: saving about 70 percent of manpower and 100 Million RMB/year in labor cost; guaranteeing a higher level of safety for production, by ensuring a 95% reduction in human accidents; and lowering carbon emissions with a 794 ton sulfur dioxide emission reduction.

Paulo Pagano (CNIT / Director of JLAB-Ports)

Dr. Pagano began his presentation with a brief introduction about the port of Livorno, which is a hybrid smart seaport in Italy. The speaker highlighted that the port is envisioned to be lean, agile, resilient, and green, capable of providing high capacity and sustainable growth, aligning with the different European models for circular economy, etc... Then, Dr. Pagano spoke about the investment in innovation that the port has been witnessing as well as the work performed by CNIT to first collect the requirements from the communities and then make progress in concretizing the port of the future. Such efforts revolve around four activities, which are: Vessel & Marine navigation; E-freight & Intermodal logistics; passenger transportation (mobility as a service); and environmental control. The speaker elaborated further on these activities, highlighting particularly the information stack implemented in the Port of Livorno, which is structured as a private cloud with full decoupling of the three layers: Infrastructure As a Service, Platform as a Service, and Software As a Service. The Platform as a Service Layer supervises the data storage, processing, and sharing by hosting a Data Virtualization Layer. The different data could be related to assets on land and sea (like vessels, freight, and shippers), with each uniquely indexed within the data lake. After providing a brief overview of a recently published white paper by Ericsson,

considering Livorno port as an international reference for the design of 5G networks in industrial ports, Dr. Pagano provided some insights on how 5G features and use cases can be mapped into services and requirements in the port of the future. To cite a few, enhanced mobile broadband (EMBB) use cases can fit into the requirement of accommodating the traffic from touristic crowds or assisting people with disabilities. Ultra-reliable low-latency communication (URLLC) would support communication between the ships and shore side. (Mmtc) would ultimately be a good fit for supporting massive sensorization on ports and vessels. Afterwards, the speaker talked about the use case of freight management for the loading, unloading, and handling of general cargo thanks to a digital twin engine (fed by 5G collected Data).

Dr. Pagano's presentation also shed light on the environmental impact of 5G, which has been investigated and results in: 8.2% less CO2 emissions; 2.5 M.EUR less OPEX, as well as 20–25% more productivity. Looking ahead to what would be the future port of Livorno, Dr. Pagano stated some of the forthcoming activities. This would include, among others, establishing the connectivity to the port of the future; complementing a fiber optics backbone with 5G NPN targeting specific slices (MMTC, EMBB, URLLC), and the platform with Distributed Ledger Technology (DLT) based security. According to Dr. Pagano, the target is to have full control of port waters using (AIs monitors, bathymetric charts, Active/Passive radar sources, video streams, real-time kinematic network, and 5G Rel.16 for accurate localization, etc..) as well as to enable unscrewed shipping. Dr. Pagano concluded his presentation by speaking about the autonomous shipping trials that would take place in 2023 under the supervision of IT Cost Guard.

Stig Myrland (YARA / Process System Manager)

Mr. Myrland briefly introduced the main concept of 5G-SOLUTIONS project, which covers use cases spanning across five vertical industries, among which is smart port. After a brief overview of the 5G main capabilities (E2E Latency of 1 ms, 100 Gbps of throughput, slicing required), the speaker presented YARA small port, the 5G network setup planned by Telenor to provide coverage to the port's production area, as well as the main smart components such as automatic cranes and autonomous assets. The speaker also presented 'YARA Birkeland' which is the world's first electric and autonomous container ship with zero emissions, expected to replace 40.000 diesel truck loads per year and eliminate associated carbon emissions. After showing the elements and the topology on which the 5G based smart port setup relies, Mr. Myrland presented the multi-vendor cross-domain end-to-end 5G network provided by Telenor to support YARA smart ports requirements such as network slicing and low latency. A two-layer automation framework is implemented in order to automate the management and operation of multiple network slices. While the infrastructure automation is realized by Red Hat Openshift, the network service automation is achieved by orchestration systems. The speaker also provided some insights on how the 5G-based network serving YARA's smart ports can improve the network performance, namely in terms of latency and network slicing, in accordance with 5G key capabilities. For instance, in order to reduce the latency, vertical applications and traffic flows are processed at a User Plane Function (UPF) located at YARA's edge site. Moreover, an independent local gateway is set up in the port to provide a local breakout connecting YARA's smart port private network to a local 5G virtual core network. Dynamic slicing support has also been considered to meet the KPIs (Key Performance Indicators) for heterogeneous service demands that would coexist in the smart port context (such as of high speed upload link, i.e. EMBB service and of real-time control of straddle carries, i.e. URLLC service). The slicing support has been evaluated through drive tests, namely of the remote steering of a vehicle over Telenor's commercial non-standalone 5G network. The speaker's presentation covered the throughput experienced in upload and download for outdoor and indoor coverage scenarios, evaluated according to a measurement experiment.

The speaker concluded his presentation by stating the main open challenges for 5G industrial environment, which includes the steel reinforced port's infrastructure, which reduces coverage, and the lack of accurate positioning.

Eusebui Catana (5GLOGINNOV / Project Coordinator)

Dr. Catana highlighted a set of important open challenges related to the port sector, which include, among others, the supply chain efficiency, which largely depends upon data; the operational level, which requires real-time information to be provided for all actors; the transportation systems that need increased connectivity, etc. Then, Dr. Catana shared the finding of one study, which asserts that the adoption of 5G services within the next 3 to 4 years is a must for fostering and boosting ports' competitiveness. Afterwards, Dr. Catana stated the motivations of the 5G-LOGINNOV project, which include the increasingly higher cargo volumes that arrive in a shrinking number of vessels and the considerably stricter environmental regulations. As such, 5G-LOGINNOV's vision is to optimize freight and traffic operations at ports and logistics hubs by using new innovative concepts that would help in alleviating congestion and environmental challenges. In more detail, the project focuses on new generations of 5G Connected and Automated Driving (CAD) and on new types of IoT-5G connectivity devices through technical solutions, business models, and priority scenarios by deploying Logistics as a Service in real-life port-city areas. The project also helps to develop a leading market through collaboration with key vertical sectors. Dr. Catana's presentation dived into how such innovation is implemented and tested in the three 5G-LOGINNOV ports, namely Athens (Greece), Hamburg (Germany), and Luka Koper (Slovenia). The main applications developed at Athens's living lab include optimal selection of yard trucks to measure the different KPIs; the use of optimal surveillance cameras in conjunction with video analytics to track and trace various data related to port activities; and predictive maintenance services. Applications demonstrated at Hamburg's living lab include Floating Truck & Emission Data and the automated Truck Platooning Green Initiative. Ultimately, Luka Koper Living Lab addresses the logistics and port operation support scenario. As such, the project covers different 5G aspects, such as 5G enabled precise positioning, MEC, real-time tracking, and automated truck platooning enabled by C-V2X and V2V.

After summarizing the 5G-LOGINNOV impact, Dr. Catana concluded his presentation by emphasizing the different considerations required for the development of innovative services for logistics. This includes trust; new business ecosystems; standardized interoperability; value-adding apps; Data Market; and future 5G logistics networks.

Chen, Dan (China Unicom/ 5G BU Director)

Dr. Chen, Dan's presentation is aimed at showing how digitalization leads the new economy and 5G enables smart ports. The speaker started her presentation by emphasizing that the next generation of technologies, led by 5G, play an increasingly important role in the digital economy. Then, the speaker highlighted that China Unicom has always been an active player in building the digital society, comprehensively upgrading its corporate strategy with clearly defined five strategic businesses related to: connection, computing, data, applications, and security. According to Dr. Chen, Dan, China Unicom accelerates the construction of intelligent and digital information infrastructure, which has, among others, the following features: high-speed ubiquity, air-ground integration, cloud-network synergy, intelligence and agility, green and low carbon, as well as security and controllability. In regards to applications' related achievements, China Unicom has deeply explored nine key vertical industries, continuously upgrading the 5G+ nature product capability. Capabilities for a higher performance network include 5G LAN and high precision positioning; capabilities for enhanced industry adaption include the support of more than 400 scenario-specific applications such as remote control, AI assisted inspection, etc... Capabilities for improved services include: one-click subscription to 5G APP store; one-click provisioning thanks to the automatic orchestration of network slices; and one-stop services thanks to controllable self-service capabilities. After evoking the three main pain points in the port sector, which include, among others: high efficiency requirement, high labor costs, and harsh operating environment, as well as the difficulty of building and maintaining multi-network and multi-RAT wireless communication. Dr. Chen, Dan also

spoke about China Unicom's 1+2+N smart port panoramic solution designed to address these points. The solution relies on '1' 5G network covering the entire port, '2' Layers of clouds providing computing resources to the application layer, and 'N' applications that automate the port operation. Such a solution encompasses 6 types of smart port services (remote control, unmanned collection, port area security, intelligent tally, smart inspection, and AR auxiliary) and has been put into commercial use in more than 20 industry scenarios and at more than 35 ports (such as Guangzhou ports). After going through two smart port scenarios that proved to be mature enough for large replication across the country (of Tianjin and Guangzhou Port), Dr. Dan concluded her presentation by stating that China Unicom will continue to work with partners to explore the national digital economy.

Closing Words

Mr. Wen, Ku, and Prof. Aguiar concluded the webinar with some brief words on the lessons learned during the session and with some comments on the necessity to work further on making achievements more sustainable, both economically and societally. Prof. Aguiar also highlighted that ports will increasingly be an interesting place for SMEs to find their niche market.

Main Lessons learned and recommendations for future steps:

The webinar outlined the influence of 5G and emerging smart technologies on the port sector. It particularly pointed out the following main lessons:

- 5G technology represents the pioneer mobile network solution being adopted by smart ports across EU and China, given its key capabilities, namely: high data rate, low latency, and slicing support, which perfectly fits the requirements of automated ports. Interestingly, these capabilities are not possible with other past or current wireless communication technologies.
- Large dimension ports will eventually have a dedicated operation and maintenance team, to co-work with operators on the joint-platform. For smaller ports, specific 5G virtual network standards could support operators' network bringing together public and private parts, significantly reducing the total cost. New port business ecosystems should be developed by EU as early as next year, which would help the whole port industry to move forward, not only big ports, but medium and small ports.
- Technical requirements for smart ports would include (targeted) 40 minutes network fault recovery and 2 hours faulty device replacement. When operating embedded in a public network operator, this should support 5G2B features, which would allow joint operation of both operator and industry partners. In this case, the industry partners could see and control part of the(ir) network parameters.
- According to experts' comments, 5G will not replace the existing legacy systems in the short term, but would rather ensure coexistence and even convergence with several of them (such as 5G/Wi-Fi convergence), while exclusively becoming the enabler for the most bandwidth-intensive and low-latency services required for the support of port operation.
- The participating smart ports through this webinar have proven that the adoption of 5G in the port sector leads to important societal, economic, and environmental benefits, preliminarily estimated to be capable of: i) according to Guangzhou port experience: saving 100 Million RMB/year in labor cost; guaranteeing a higher level of safety for production; reducing 95% of human accidents; and lowering

794 tons of sulfur dioxide emissions, ii) based on Livorno port experience, reducing 8.2% of CO2 emissions and 2.5 million € of OPEX while increasing productivity by 20-25%.

- According to research studies, the adoption of 5G technology within the next 3 to 4 years is a must for fostering and boosting ports' competitiveness.
- According to the experience of both the Port of Livorno and Port YARA, there are open challenges that need to be addressed by B5G, including: the lack of accurate positioning, the reduced indoor coverage due to steel reinforced concrete walls; the low end user power compared to 5G antennas; and cyber-security.