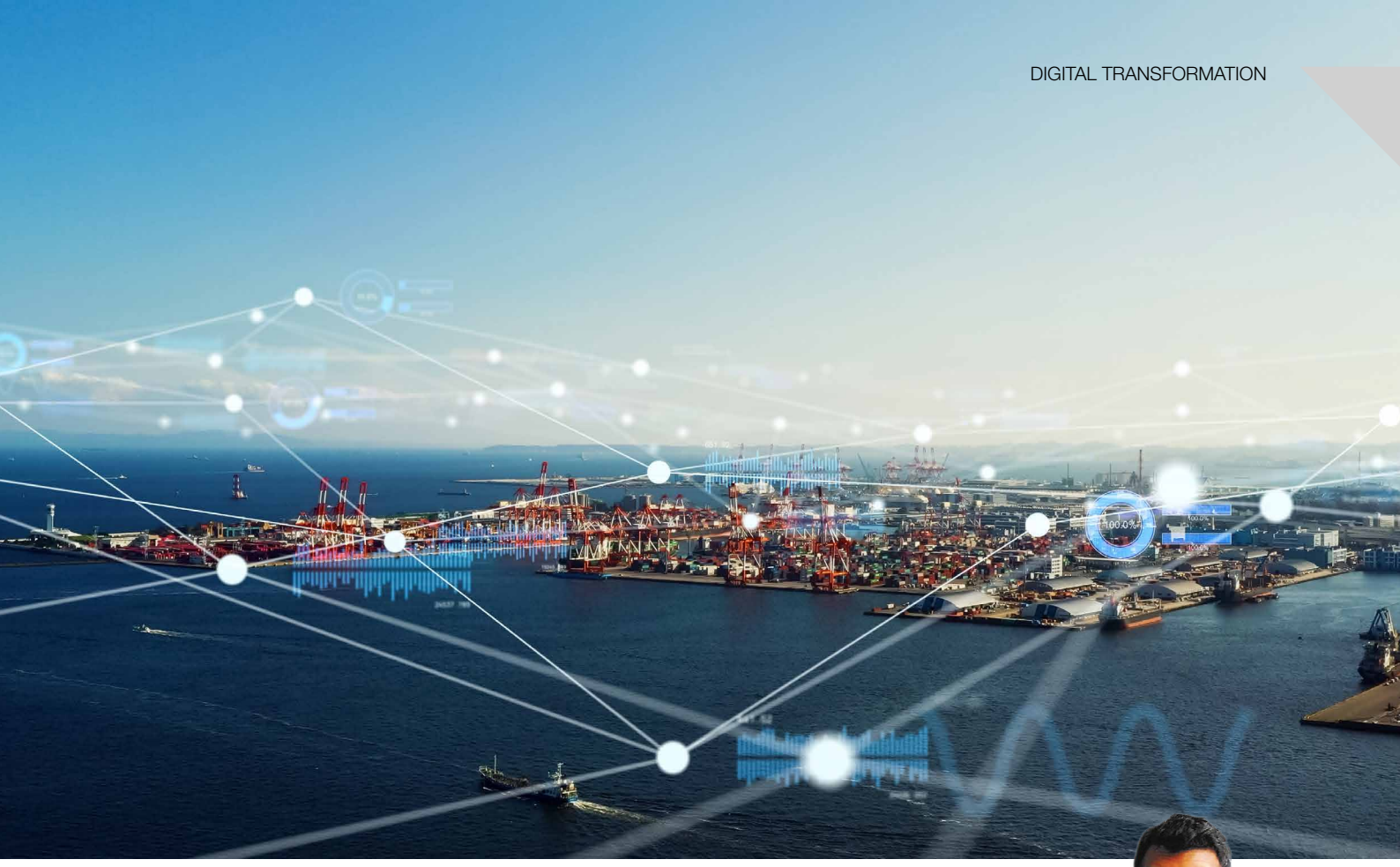

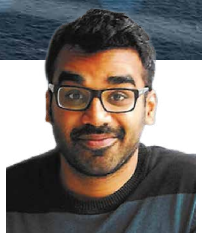

DIGITALISING PORT OPERATIONS WITH 5G CONNECTIVITY

By Venkatesh Ramakrishnan, Head of Maritime & Supply Chain Logistics Verticals, Enterprise Sales, Nokia

As the world begins to emerge from the pandemic and economies rebound, port operations find themselves under the spotlight. The backlog at container terminals is not the usual fare for the front page or presidential edicts. Yet, with supply chains struggling to meet ramping demand, the pressure is on our ports to improve their efficiency. This is accelerating the move to digitalise and automate operations, which will require, among other things, robust wireless connectivity. 5G will be a key technology in the transformation of operations by providing end-to-end connectivity for the fully digital port.

PORTS 4.0 AND 5G

Even before the pandemic stress tested the global supply chain, there were cracks appearing. Bigger ships, expanded loads, and larger call sizes have been increasing congestion in yards, and idle time has been steadily growing globally. Over the last decade, global supply chains have become ever more complex, pressuring terminal operations to be more flexible and resilient in the face of rapid shifts in demand. As key logistics nodes, ports and terminals are expected to be as data-driven and transparent as every other player in the intermodal supply chain. The pandemic dramatically exposed these issues, but they were known before it occurred.

There are several digital technologies, which taken in combination, have the potential to completely transform operations and make them more scalable, resilient, and transparent. 5G is a key enabler. It can connect workers, cranes, trucks, and vessels across the entire port system and offers high bandwidth, low latency communications. It creates a communications platform for edge cloud computing, Artificial Intelligence (AI) and machine learning as well as digital twins and more capable Port Community Systems (PCS). What all these technologies share is the importance of data: collecting, transmitting, analysing, and using data to improve workflows, predict equipment failures, provide transparency to supply chain partners and helping to design better processes.

OVERCOMING AUTOMATION BOTTLENECKS

An important area of research and development for several decades, the automation of cargo handling has focused on the two most popular yard machines, RMGs and RTGs. Starting around 2000, we saw the development of automated rail-mounted gantry (ARMGs) and automated electrified rubber-tyred gantry (AERTGs) cranes. Both technologies, while

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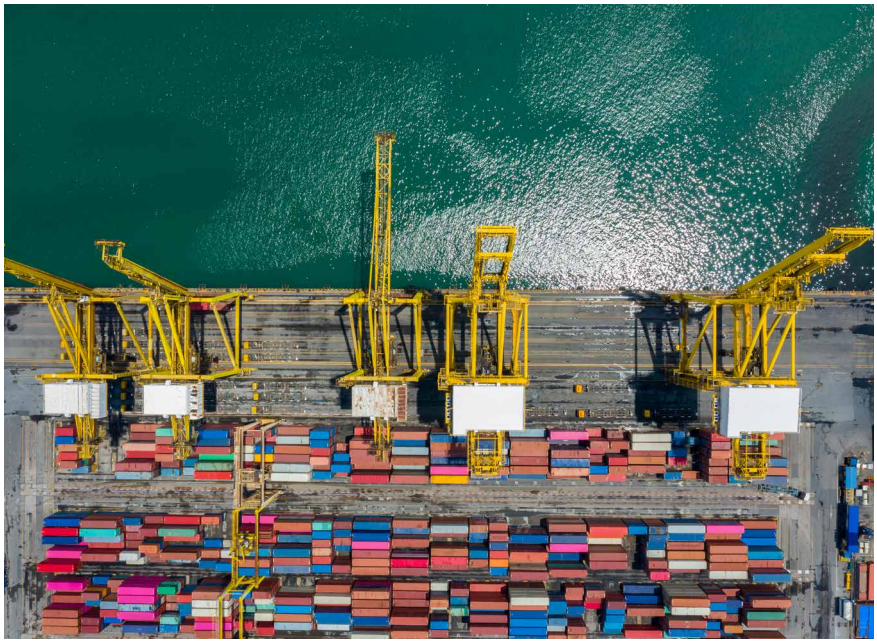
promising, are literally held back by their fiber-optic tethers.

5G wireless communications are one of the key technologies needed to solve this issue. The fiber-optic tethers limiting the freedom of movement of AERTGs, for instance, have been necessary because no wireless technology has been capable of providing the high bandwidth and reliable communications of cabled networks. A typical remote-operated AERTG will carry six to eight 4K video cameras. The streaming video from these cameras has been beyond the capability even of 4G/LTE networks.

5G has much greater flexibility and tremendous bandwidth capacity. As well as providing high bandwidth support for video, 5G enables low-latency machine-to-machine communications, which is critical in some automated and autonomous applications. It also supports control and automation protocols such as Profinet and Supervisory Control And Data Acquisition (SCADA).

Equipment vendors, such as Kalmar, are incorporating 4G and 5G private wireless solutions from Nokia into their systems for straddle carriers, automated stacking carriers and rubber-tyred gantry cranes. Beyond automation, this enables them to constantly monitor and log data from the equipment. They can measure hundreds of different variables and use AI and machine learning to spot anomalies in performance and identify components before they fail or cost the operator thousands of dollars in lost fuel costs.

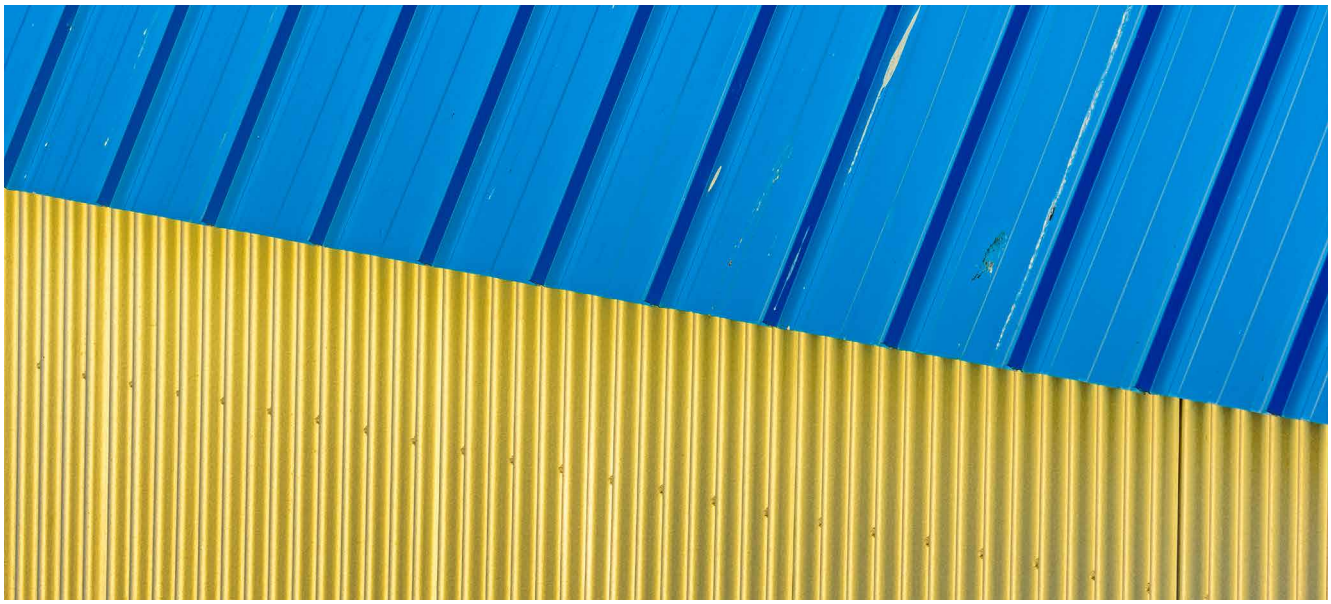


ONE COMMS NETWORK

The other area where 5G shines is its ability to consolidate multiple existing networks onto one. There are a variety of older wireless technologies that ports and terminals employ for specific use cases such as wireless sensor networks using low-powered wide area networks (LPWA) and proprietary systems for machine-to-machine communications such as beacon networks for AGV guidance. Both can be supplemented or even replaced by 5G.

Dock and yard workers today typically rely on professional mobile radio, TETRA and P25, for push-to-talk services. For general purpose data comms, Wi-Fi provides an outdoor extension of the terminal office LAN. 5G can provide push-to-talk and, even better, push-to-video services for workers on the move, as well as data communications. While Wi-Fi is capable enough for moving data files around the terminal, the many metal surfaces of container stacks cause radio interference that can create dead zones, which is difficult to solve for Wi-Fi radio network on a regular basis in a dynamic environment with containers being moved constantly. 5G employs much more robust technologies for overcoming interference and can provide seamless coverage with less outdoor radio access points and no need to re-engineer coverage as the yard configurations change.

This ability of 5G to provide seamless coverage solves one of the long-standing issues faced by Terminal Operations Systems (TOS), namely their inability to maintain seamless data links between mobile and central applications.
And despite the work done on Port Community Systems (PCS), the full



digitalisation of port operations has been hampered by a similar issue, which has led to isolated data lakes and documentation bottlenecks.

5G can solve these issues by providing a single wireless communications platform for all applications across the port and terminal, making digital transformation of the end-to-end PCS possible. From gate automation systems and vehicle booking systems to yard crane scheduling and traffic management, 5G provides seamless connectivity everywhere, to capture the data generated by each transportation mode within the port, update it, and analyse it using AI and machine learning. This enables predictive data analysis for better planning of resources and personnel, simplified documentation processing and provides real-time transparency to other intermodal supply chain partners.

THE FUTURE AND 5G

There are many other use cases for this kind of digital connectivity from drone inspection and security surveillance, to monitoring worker fatigue and safety. 5G drone control opens the possibility of simplified surveillance of yards using video and infrared, as well as other kinds of sensors mounted on the drone to sense environmental hazards such as chemical leaks. Drones can also be used during incidents and events to provide near immediate situational awareness for first responders. Smart personal protective equipment (PPE) and wearables can provide constant feedback on the health and safety of workers including fatigue levels. These are only some of the use cases that will be made available by reliable, fast wireless communications.

The pandemic has been a wakeup call for everyone, port terminal operators perhaps more than most. It has highlighted issues, however, that have long been understood. 5G has been under development for close to a decade and has always had a special focus on its role in future industrial infrastructure solutions. That future has dramatically arrived, and 5G will play an increasingly important role in the digital transformation to Port 4.0.

ABOUT THE AUTHOR

Venky Ramakrishnan heads the Global Maritime & Supply Chain Logistics Verticals within Nokia Enterprise. His work includes consulting and helping enterprises with their supply chain digitisation/automation vision, rolling out dedicated LTE/5G networks and deploying use cases with strong business benefits for end customers. He is based out of Munich, Germany and comes with experience in retail and supply-chain.

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We help build the capabilities needed for a more productive, sustainable and inclusive world.

“FROM GATE AUTOMATION SYSTEMS AND VEHICLE BOOKING SYSTEMS TO YARD CRANE SCHEDULING AND TRAFFIC MANAGEMENT, 5G PROVIDES SEAMLESS CONNECTIVITY EVERYWHERE.”