

CONNECTING THE PORT OF THE FUTURE

Solutions designed to enable a seamless, secure, and sustainable port





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The promise of digitalisation

The digitalisation of a port has a massive impact on efficiency and sustainability.

But, digitalisation by itself is not enough. You need edge to edge wireless networks, to connect cranes, Rubber-Tyred Gantry Cranes (RTGs) and mobile devices.

For example, RTGs need high performance networks, with low latency, low jitter and low packet loss.

By upgrading their network, one of our port customers has had their average packet loss reduced by **100%**

Source: A Boldyn customer's validated performance improvement



How connectivity supports the transition to a Smart Port

In this ebook we'll look at the role of connectivity in enabling ports to transition to a digitalised 'Smart Port' model. We'll examine the role of connectivity for a typical container port and how the right connectivity solution can support the following three strategic imperatives:

- 1 Increasing operational efficiency
- 2 Achieving sustainability goals
- 3 Ensuring safety and security

Throughout, we'll show how ports and terminals around the world are choosing next-generation connectivity to optimise their results in each area.



“

By identifying hidden patterns in container characteristics using AI, terminals optimised stacking operations, reducing unproductive yard crane movements by 25%.”

Source: Hamburg Port Consulting, Expert Insights, October 2024



Connectivity for Smart Ports

Connecting equipment across ports is fundamental to successful digitalisation and the realisation of a Smart Port model.

When all devices are connected, real-time data feeds can be used to monitor operations, remotely control equipment, make timely decisions, and intervene promptly when needed.

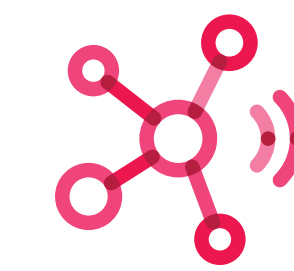
Two essential criteria for port connectivity: **coverage** and **capacity**



Coverage

Means that all cellular devices can connect to the network, wherever they're located in the port. It's about reach - all mobile devices can connect to the network, wherever they're located in the port.

If there's simply not enough usable signal reaching devices, typically because the mobile mast is too far away or canyons between stacked containers. Extending the signal's strength, bringing it into your port, ensures personnel and machines are connected supporting efficiency and safety.



Capacity

It's about signal strength - ensuring that data can always be delivered to wherever it's needed.

If you have to rely on a nearby mobile mast to provide connectivity the tower and the local network the service may be poor or unstable. This is where improved capacity is important.

Connectivity solutions for a Smart Port

Every port is different, and a connectivity solution that works for one may not work for another. Smart Port connectivity solutions will typically include some or all of the following technologies:

For indoor and outdoor coverage			For indoor coverage
Private Networks Secure high capacity, low-latency networks, connecting only authorised users and devices; for the Port's exclusive use.	Wi-Fi Connecting devices together, and to the Internet; making working environments more dynamic, efficient, and inclusive.	Small cells Low-powered devices, extending the coverage and capacity of mobile networks; making it easier to stay connected and efficient.	Distributed Antenna Systems (DAS) A network of antennas, extending mobile signals from local cell towers, bringing them into previously hard-to-reach buildings.

Let's see how these solutions can help ports to achieve three key objectives:

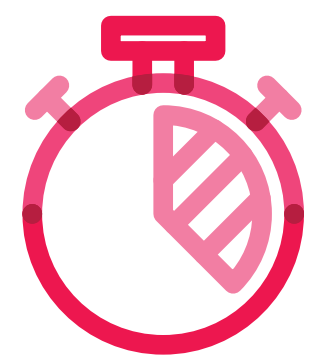


1

Improving operational efficiency

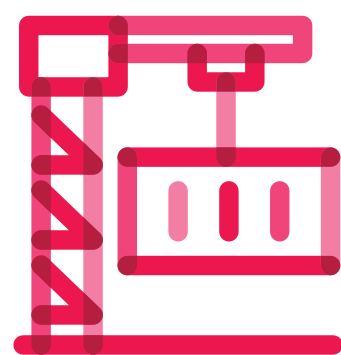
Rising consumer expectations of delivery times means goods must be shipped in ever-faster timeframes. For ports and terminals, this means continually improving turnaround times for docking, loading, offloading and onward logistics. Any delays must be anticipated and mitigated, and equipment downtime minimised.

Efficiency initiatives in these areas typically include:



Improving turnaround times

Integration of port operations with real-time cargo tracking and forecasting systems, with enhanced situational awareness to ensure rapid, safe and efficient loading and offloading.



Optimising berth occupancy

Improved forecasting of ship arrival times through real-time cargo tracking with accurate weather and tide forecasting, enabling berth planning and vessel docking processes to be optimised.



Reducing equipment downtime

Predictive maintenance regimes enabling faults to be anticipated and addressed before they occur, minimising downtime for cranes and vehicles.

Operational efficiencies of improved network connectivity to a RTG crane:

	Wi-Fi RTGs	Private Network RTGs	Improvement increase %
Average ping response time	43.5 ms	21.88 ms	50%
Average jitter	73.5 ms	6.43 ms	91%
Average packet loss	0.06%	0.00%	100%

A Private Network enables lower latency, higher reliability, higher availability and server and steering control.

Source: A Boldyn customer's validated performance improvement



Improving operational efficiency

Smart Port technologies driving improved operational efficiency

Ports are addressing these issue by implementing technology solutions that provide insights into port operations, enabling inefficiencies to be identified, and by deploying new digital technologies that enhance operational efficiency.

Technology areas include:

- **Advanced efficiencies:** Remote-controlled cranes can operate with advanced efficiency, leading to faster cargo handling while keeping operators safe. Konecranes is one manufacturer focusing on remote operation enabled by real-time streaming video to a crane control room.
- **IoT sensors:** Sensors are an integral part of improving efficiency, collecting data from equipment, infrastructure and container from across the port to drive timely action and decision-making. Port of Kokkola in Finland, for example, has made significant efficiency gains by deploying sensors across its 500-hectare port area.
- **Digital twins:** An IoT-based digital twin of the port can help to optimise processes and respond effectively to challenges. Port of Oulu, Port of Abu Dhabi and Port of Rotterdam are among many ports now using digital twins to visualise assets, operations, and flows.

The role of connectivity

New efficiency-improving technologies need networks with ubiquitous coverage of the port area and high capacity to support millions of sensors and devices. They also require low latency for real-time remote operation and high reliability to ensure safety and business-critical connectivity never fails.

The right connectivity solution can help by enabling:

- Predictive berth and crane planning enabled by sensor and video surveillance data
- Faster docking, loading and unloading using real-time weather and sensor data to predict vessel arrival and visit times
- More efficient identification of issues by remotely monitoring sensor data rather than inspecting the whole port area manually
- Insight into the status and condition of incoming containers and insurance responsibility using camera surveillance thanks to the cameras in the cranes
- Effective communications across the port and with partner organisations for efficient logistics and asset tracking

Key takeaway: The right network connectivity allows workers to perform their duties in a more efficient manner, creating less friction and reducing equipment downtime.

Private Network transforms efficiency at Port of Kokkola

One of Finland’s largest ports has deployed a state-of-the-art Private Network, bringing comprehensive network coverage to a 500-hectare port area with high and hard-to-reach patches.

Supporting IoT sensors and video surveillance, the network has transformed efficiency across the port, including a threefold increase in maintenance efficiency.



2

Achieving sustainability goals

The International Maritime Organisation (IMO) is committed to reaching net zero greenhouse gas (GHG) emissions by 2050—an ambitious goal, given that emissions from international shipping have been increasing annually since the slump of the COVID-19 pandemic.

While alternative fuels will be the real game-changer, ports can contribute towards the 2050 target by becoming cleaner and more energy-efficient in their own operations, and by helping shippers to consume less fuel too.

Emissions from international shipping **grew by 5%** in 2022, returning to 2017-2018 levels.

[International Energy Association, 2023](#)

The most sustainable ports are already making strides in several interconnected areas:



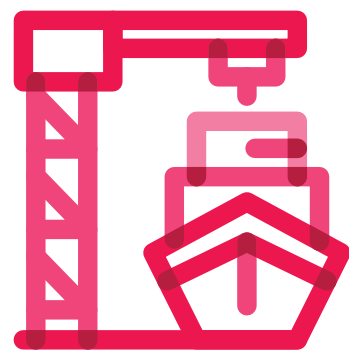
Port electrification:

Introducing smart port infrastructure and onsite green electricity generation is reducing the use of energy from non-renewable sources.



Reducing air and water pollution:

Improving environmental monitoring and analysis is reducing pollution and respond faster when it occurs.



Reducing port carbon footprint:

A port's carbon footprint can be reduced by enabling real-time data communication and adding advance efficiencies, optimising operations such as cargo handling and equipment usage to minimise energy consumptions and emissions.

Port of Los Angeles ‘Green Omni Terminal’

With berthed ships being the largest source of greenhouse gases and pollutants at Ports worldwide; the ‘Green Omni Terminal’ program has prioritised addressing them.

With a target to reduce CO₂ emissions by 3,230 tonnes per year, diesel ‘particulate matter’ by 0.6 tonnes per year, nitrogen oxides by 26 tonnes per year and reactive organic gases by 1.4 tonnes per year.

Using the ‘ShoreKat Marine Exhaust Treatment System’ to capture more than 90% of emissions, including carbon dioxide (CO₂) from stacks of berthed ships at the terminal.

These improvements are predicted to be the equivalent of removing over 14 thousand vehicles from Southern California’s roads.

Source: [Port of Los Angeles Green Omni Terminal Demonstration Project](#)



Achieving sustainability goals

Smart Port technologies supporting environmental sustainability initiatives

New technologies play a key role in helping ports meet their environmental pledges, and can also significantly lower operational costs.

Smart Port technologies currently being deployed at sustainability-minded ports include:

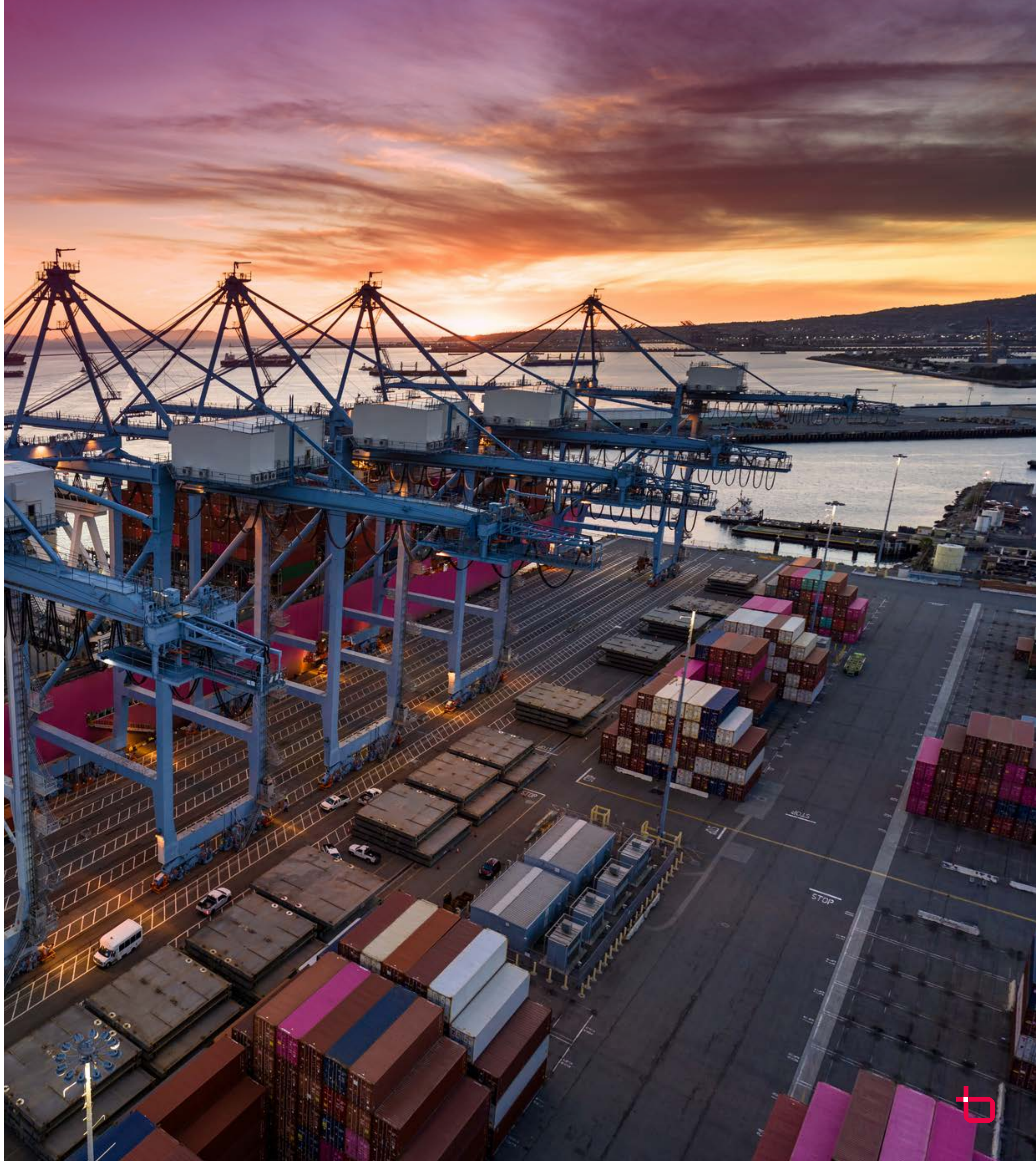
- **Smart building technologies:** Sensor and AI-based platforms that monitor usage and environmental conditions of port facilities, and automatically switch off lights, heating or air-conditioning when not required. [Port of Kemi](#), for example, has introduced smart lighting controls as part of a major port digitalisation project.
- **Environmental monitoring:** IoT and AI-based platforms to monitor the port for air and water pollution, raise alerts when pollution is detected, and provide data and audit trails for compliance with environmental regulations. [Port of Mallorca](#) and [Port of Gdansk](#) in Poland are among those using an IoT platform for air and water quality monitoring.
- **Smart energy generation and storage:** Integrated platforms to predict energy use and generate and store clean energy onsite to meet predicted demand. [Port of Singapore](#), for example, has introduced a smart grid management system that can improve the port's energy efficiency by 2.5% and reduce its carbon footprint by 1,000 tCO₂e per annum.

The role of connectivity

Many of the sustainability initiatives outlined above rely on real-time data transfer between IoT sensors, cloud or edge cloud data processing platforms, devices and user applications. Ubiquitous coverage, high data capacity and low-latency connectivity are vital for their success.

Port-wide connectivity solutions can help ports to achieve their sustainability goals in multiple ways, including:

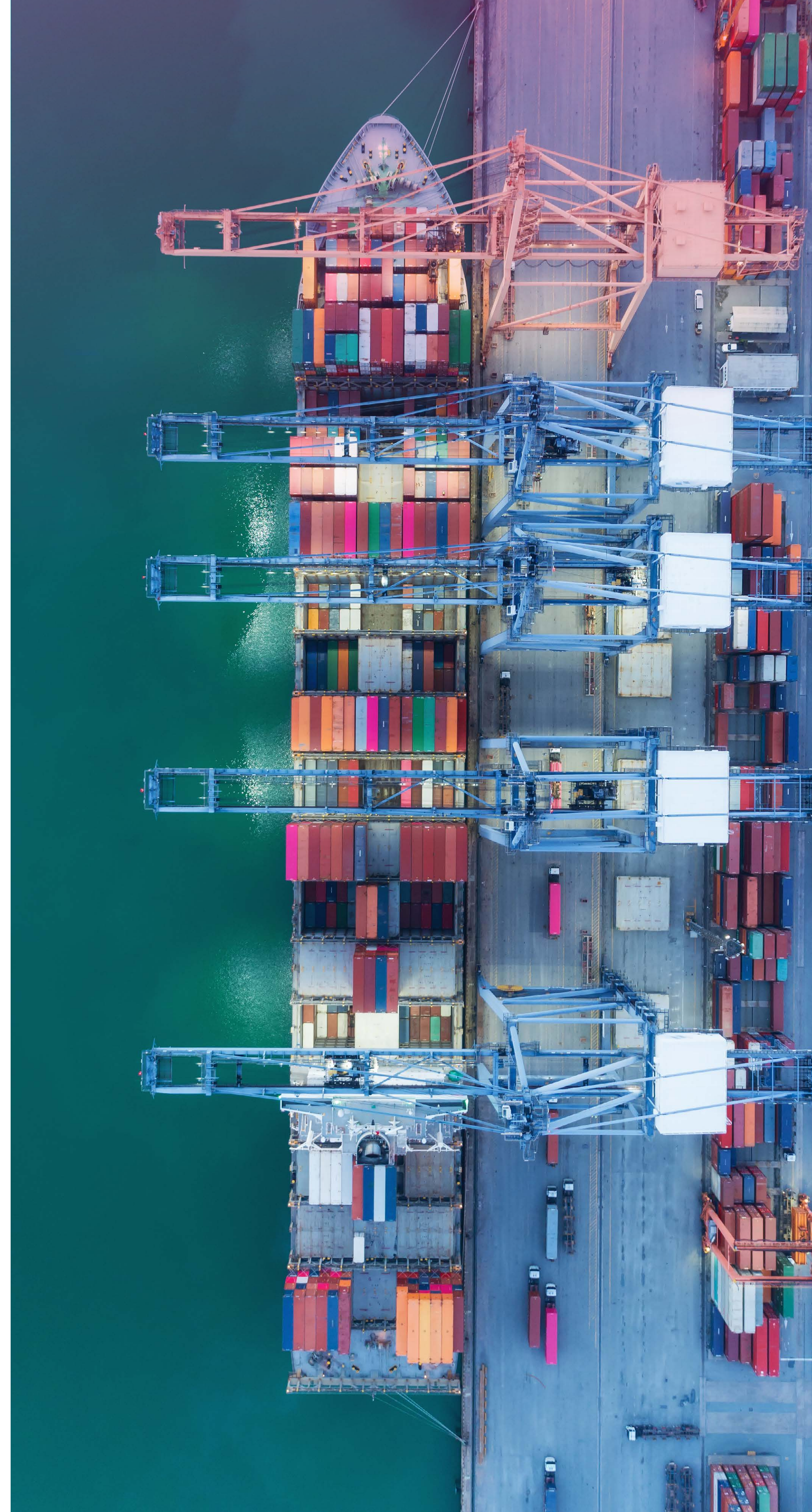
- Supporting real-time data collection from IoT sensors for automated control of HVAC and lighting systems, reducing power consumption.
- Enabling real-time monitoring of air and water quality to aid compliance with environmental regulations and support timely action to mitigate pollution.
- Enabling low-latency data transfer between autonomous vehicles and edge data centers, allowing energy-efficient AVs to navigate accurately around the port.
- Supporting continuous monitoring of equipment condition through sensors and video, to implement predictive maintenance regimes that reduce waste and fuel consumption.



Achieving sustainability goals

Key takeaway: To achieve sustainability goals at your port or terminal you will need to:

- **Optimise energy use:** Private Networks enable real-time monitoring and control of equipment, optimising energy consumption in cranes, trucks, and other port machinery.
- **Deliver support for operations:** By facilitating advanced vehicles and equipment, Private Networks reduces idle time and fuel consumption, leading to lower carbon emissions.
- **Enhance supply chain visibility:** High-speed connectivity improves data sharing, allowing ports to streamline operations, reduce delays, and minimise resource waste.
- **Integrate IoT devices:** 5G supports a dense network of IoT sensors for monitoring emissions, energy use, and environmental conditions, driving proactive sustainability measures.
- **Deliver a reduction in downtime:** Improved connectivity ensures smoother maintenance and logistics operations, reducing inefficiencies and their associated environmental impact.



Private Network supports energy efficiency at Port of Kemi

Finland's northernmost general harbour has deployed a Private Network to support digital transformation initiatives across the port—including the use of sensors to control lighting according to demand and usage.

3

Maximising safety and cyber security

Physical safety has always been a primary concern for port operations, which have traditionally required employees to work at height and in hazardous spaces.

More recently, cyber security issues have also come to the fore, as more operational technologies (OT) are connected to the cloud, and as ports—and the supply chains they service—become targets for cyber-warfare.

Safety and security considerations for modern ports include:



Ensuring physical safety:

Ensuring that health and safety risks are minimised, often by removing humans from hazardous spaces around the port.



Ensuring physical port security:

Deploying measures to protect the port from malicious intrusions and physical attack.



Ensuring port cyber security:

Developing cyber-resilience operations to monitor, identify and address network breaches and cyber attacks before they inflict any damage.

The Port of Los Angeles experienced **60 million** cyber attacks per month in 2023, up from **7 million** per month in 2014.

Source: [American Journal of Transportation](#), 2024



Maximising safety and cyber security

Smart Port technologies driving improved safety and cyber security

Many Smart Port technologies are designed specifically to improve the physical safety and cyber security. Digitalisation initiatives will typically include some or all of the following:

- **AI-powered surveillance and inspection:** Threats and risks can be detected in real time using AI to process feeds from cameras, drones, wearables and smart clothing, allowing prompt and preventive action to be taken. [Steveco](#) is one port operator using real-time HD video camera surveillance of moving container cranes.
- **Advanced efficiencies:** Remote control of cranes, safeguarding human crane operators from hazardous operations at height. [East-West Gate Terminal](#) in Hungary, for example, is eliminating the risk of crane operator injury due to remote-controlled operation with a latency of less than 20ms.
- **Secure IoT:** Private Networks keep data on site and restrict device access, helping to protect IoT networks in a world with increasing cyber security breaches.
- **Safer operations and workplace environment:** Wearables connected through an enhanced network can monitor worker locations, health conditions, and compliance with safety protocols, providing instant alerts in emergencies.

The role of connectivity

Maximising safety and security in a Smart Port world means being able to detect, prevent and respond to threats in real time, as well as removing employees from harm's way. The right combination of Private Networks and Wi-Fi can provide essential capacity and connectivity to ensure the effectiveness of Smart Port security approaches, including:

- Low-latency connectivity to enable remote control of cranes and other equipment
- Perimeter intrusion detection using real-time AI processing of camera vision
- Real-time detection of threats to worker safety via wearables and smart clothing
- Security monitoring and alerting using biometrics and facial recognition
- Data is kept secure by keeping all the data/traffic on-site within the dedicated Private Network with restricted device access

Half of the **2,400** health & safety maritime incidents recorded in 2022 took place in ports and terminals

[Port Technology International 2023](#)

Key takeaway: A robust connectivity foundation is essential for the effective operation of various technology-enabled port safety and security measures.

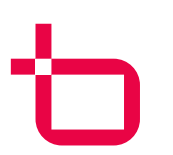
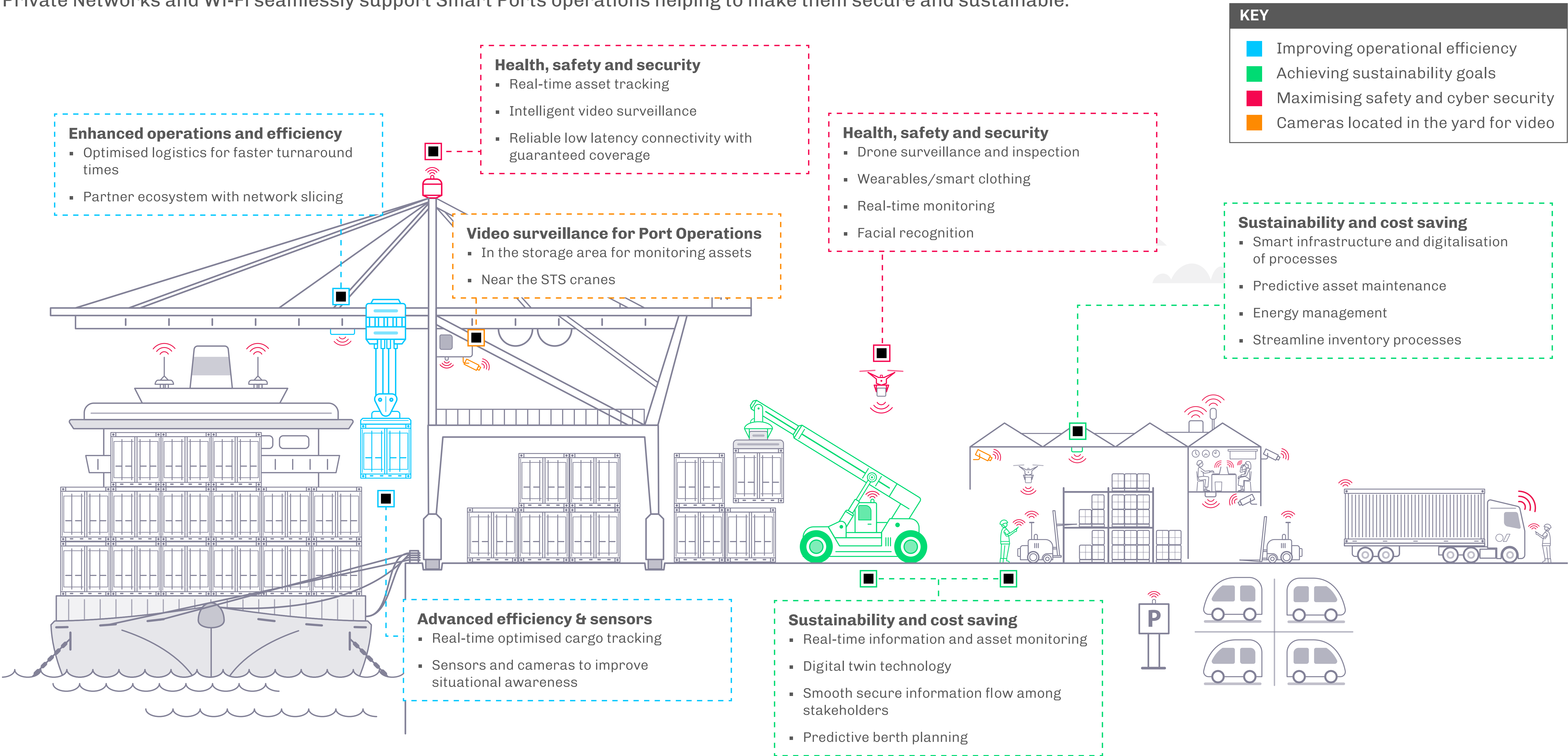
Steveco ensures port cyber security with Private Network

The leading dockworker and general cargo operator has deployed a Private Network with secure edge connectivity at its ports in Mussalo and Hietanen, Finland. The solution enables rapid transfer of streaming data for analysis with peace of mind over operational security.



Creating Smart Ports

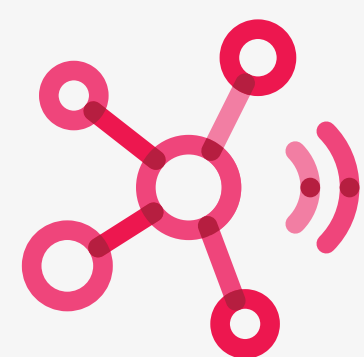
Private Networks and Wi-Fi seamlessly support Smart Ports operations helping to make them secure and sustainable.



Why Boldyn Networks

With over 30+ years’ experience in communication solutions, and multiple customers in the ports and maritime sector, we can help you to unlock the advantages of port digitalisation and Smart Port evolution.

We’ll help deliver tailored connectivity services that will support your operational goals and objectives for the future. Our in-house solutions and development teams execute the end-to-end process from initial assessment to future-proofing your investment.



High value, bespoke solution design

- Aesthetically designed and installed
- End-to-end optimised capacity designs
- We’re technology agnostic and vendor-neutral
- Designed to be future-proofed to your needs



Experience and expertise

- 80+ U.S. military bases
- Connecting 6 billion rides every year in 5 major transit networks
- 30+ years in communications in North America and Europe
- 5 city-wide networks underway including New York, London, and Rome
- 350+ higher education campuses



Market leadership

- Serving some of the largest and busiest ports in the U.S., Europe and the UK
- A seamless installation - we bridge the gap between you and the mobile network operators
- Smooth transition from legacy to new infrastructure, with no disruption to port operations
- We plan and design end-to-end optimised networks to support your Smart Port evolution



Commercial stability and operational flexibility

- Flexible commercial models with no upfront capex possible
- We’re in it for the long-term, making 20-30-year concessions
- Bespoke models for in-life maintenance, support and management
- Majority-owned by CPPIB a trusted investor with C\$699.6 billion net assets

Independently recognised awards for our global operations



Promoting Small Cells for Social, Economic Environmental Development



Affordable Connectivity



Best Wi-Fi Service Provider



Excellence in Commercial Deployment by a Private Network Operator



Promoting Small Cells for Social, Economic Environmental Development

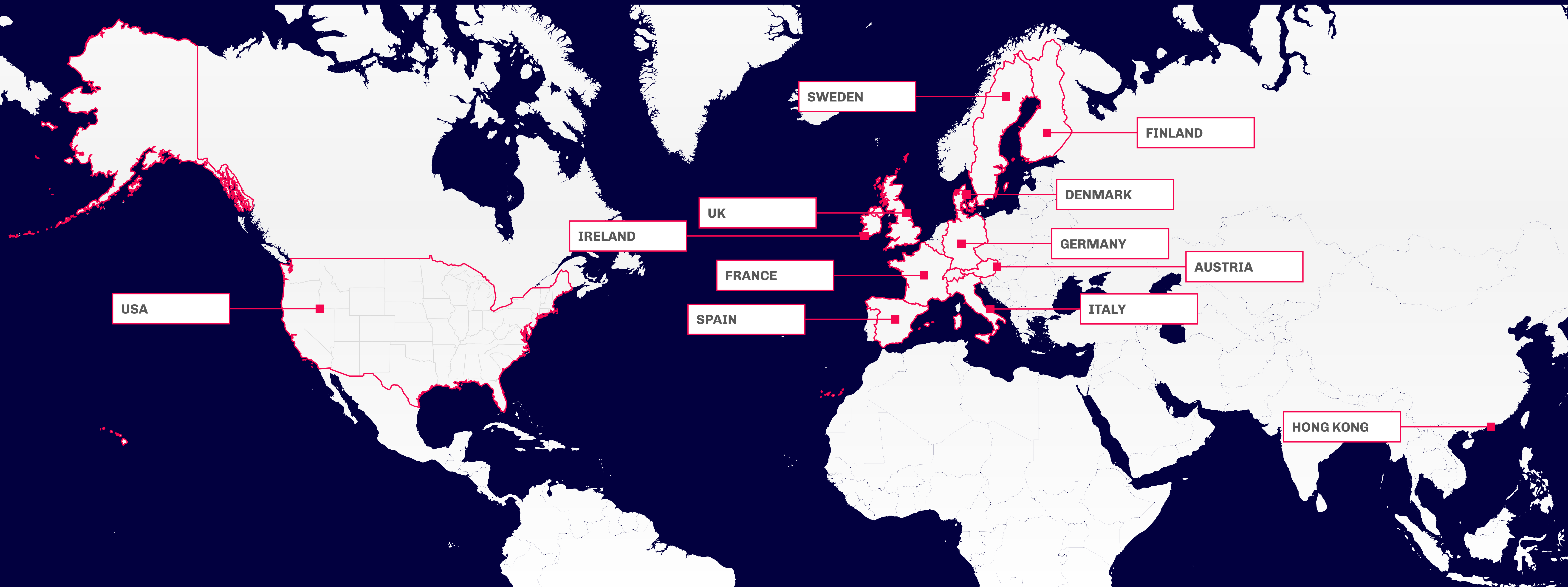


Infrastructure Initiative of the Year – Hong Kong



Our global customer base

We enable Smart Ports and terminals, with our global coverage, expertise and experience gained over 30 years. Our vendor and technology agnostic approach means our Ports customers have solutions designed for their specific needs and growth plans.



We can help get your port connectivity ready

Boldyn Networks delivers the advanced shared network infrastructure needed for a smart, inclusive, and sustainable future. We enable connected transit, venues, enterprises, heavy industry, college campuses and smart cities to create new possibilities in the way people live, work and play.

We don't just talk about the future. We exist to help build it. Creating the foundation from which a better collective future can be imagined.

To learn more visit boldyn.com

