

Connected ports of the future

Making ports smarter and safer
with private cellular networks



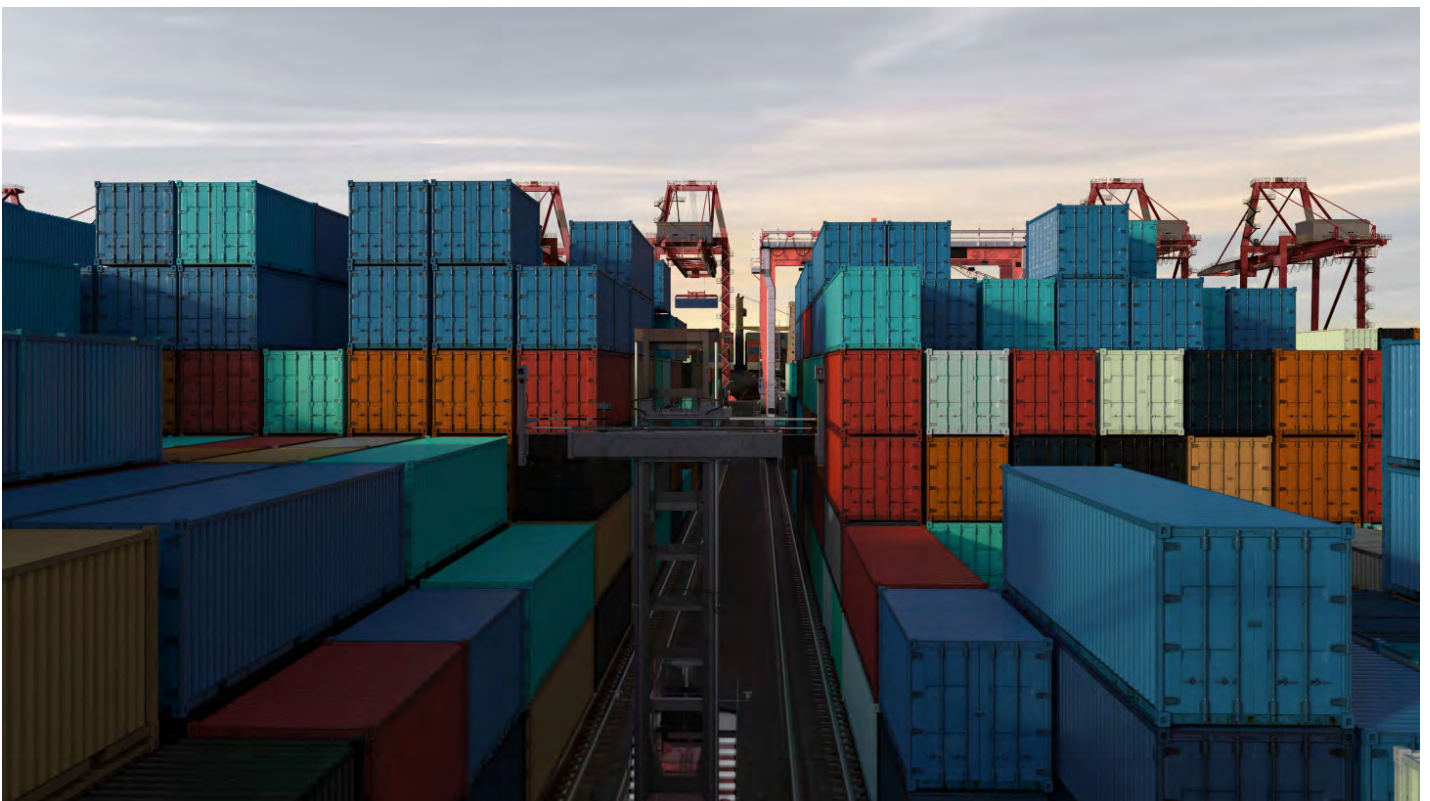
ericsson.com/ports



Connectivity will help us realize the vision of the Smart Port.

Ports are fundamental to the global economy, transferring up to 90 percent of the world's goods.¹ The shipping industry is growing and will continue to grow, and pressures are mounting for the industry to become more efficient and more automated. Yet most ports lag behind in modernization. Operations continue to be slowed down by vessel and truck congestion. How can ports meet rising demand while increasing efficiency, reducing costs and maintaining sustainability?

At Ericsson, we believe in the power of cellular to help transform ports into more productive and sustainable transport hubs. These digitally connected ports of the future will be able to seamlessly connect millions of shipments and track goods more efficiently and securely.



1. The International Chamber of Shipping

Four challenges facing ports

Ports face several challenges which must be overcome if they are to progress. Container shipping is growing in response to demands in consumer and industrial trade. This growth places greater pressure on ports to be more efficient and sustainable. They must also be competitively priced to attract major shipping lines. According to a Navis survey in Ports Technology, 67 percent of port providers see reducing operating costs as their priority.² We've identified four key areas that port providers must address to succeed.

Running a tighter ship

Ports only have a limited amount of yard space. So as both the volume of shipping trade and the size of vessels increase, ports are being forced to look at how best to utilize their assets. According to Port Technology,³ 76 percent of port providers see optimizing yard and terminal operations as their number one priority and challenge. This makes it imperative to reduce equipment failures and downtime of critical equipment, like cranes. Better asset monitoring is needed to help overcome business and economic challenges.

Unlocking gridlock and congestion

A congested yard is a problematic one. Yard congestion creates not only inefficiencies, but also more environmental impact. Congestion is being compounded by increasing demand as a growing number of vessels and trucks need access to a limited space. A shortage of port pilots is also creating longer waiting times for boats to be unloaded. According to the data from the COREALIS case study in Ericsson's Port of the Future report, vessels spend around 36 hours at the dock as they're unloaded and reloaded.⁴ And while any ship or vehicle is waiting, their engines are idling and emitting CO₂. Digitalization would make the unloading and reloading process faster and more efficient, cutting yard congestion and its environmental impact.

Making ports safer for people

Along with making their processes run smoother, increasing worker safety is a top concern for ports. Working among heavy cargo, dangerous equipment and many other hazards puts port workers at daily risk of injury. Almost 42 percent of marine casualties or incidents took place in the port area.

Getting greener by getting smarter

Regulatory bodies are requiring ports to reduce their greenhouse gas emissions, which along with scientific recommendations, are mandating ports cut their emissions in half by 2030. While a reduction of this nature will come from the sum of many measures taken, every effort will help. For example, the Port of Livorno, in partnership with Ericsson, is using 5G technologies to achieve an estimated 8.2 percent reduction in CO₂ as a result of improved yard movements in the container terminal processes and KPIs.⁵

Destination: Ports 4.0

To provide greater efficiency, lower costs, enable better monitoring and increase safety, digitally connected ports, or smart ports, must be created. Automation and connectivity will be fundamental to solving the four challenges we've outlined. But costly and inflexible legacy technologies like Wi-Fi, Bluetooth, or physical cables simply can't provide the connectivity required for smart ports. To build the digitally connected ports of the future, a much more powerful connectivity technology is needed.

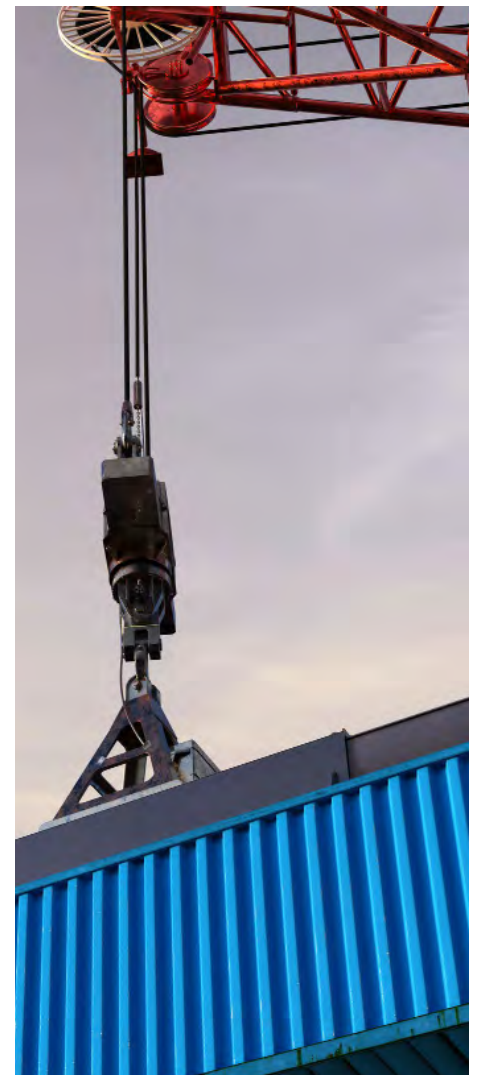
Private networks deliver the goods.

Operating cranes, moving numerous containers, vehicles and equipment and monitoring the many workers in a port produces vast amounts of data. A smart port's infrastructure has to be able to handle and process all that data. A 5G-ready private cellular network provides the highest level of connectivity.

What is a private network? A private network is an on-premises cellular network deployed for an organization's exclusive use. It's a fit-for-purpose, high-performance and agile network that ensures the connectivity and security a port needs. Private wireless networks allow for secure remote operations, autonomous and connected vehicles, connected workers and predictive maintenance. Most private cellular networks today are LTE networks with 5G-ready capabilities. For instance, Ericsson's private network solution offers ultra-high bandwidth and super-low latency that lets ports run multiple use case scenarios on a single network, retain control of network resource allocation, and ensure that critical data remains on-site.

Advantages of a private LTE/5G network:

- **High bandwidth, low latency**
- **Supports important use cases**—voice, mission-critical Push-To-Talk (MC-PTT), autonomous machines, remote control, predictive maintenance, environmental sensing.
- **Open ecosystem** lets companies avoid vendor-lock.
- **Reliable and predictable performance**
- **Cost-efficient**—requiring a factor of 10 fewer communication nodes to cover the same area compared to Wi-Fi.
- **Rich device ecosystem** gives companies more choices for communications.
- **End-to-end security**, using SIMs, on both network and device levels. Wi-Fi standard only covers L1-L2 security.



2. Ericsson, ifm, and Arthur D Little. (2021, February). Connected Ports: A guide to making ports smarter with private cellular technology.

3. Ibid.

4. Ibid.

5. Ericsson. (2020, June). Port of the future: Addressing efficiency and sustainability at the Port of Livorno with 5G.

Four Smart Ports Use Cases

In our work and research with ports around the world, we've identified three use cases as the most promising starting points in the smart port journey. The use cases span the entire container port operation chain and are the most important and relevant cases for the cellular-powered smart port.

1. Condition monitoring
2. Automated guided vehicles
3. Drones for surveillance and deliveries
4. Smart cranes with automation and remote control

Condition Monitoring

Predicting the unpredictable

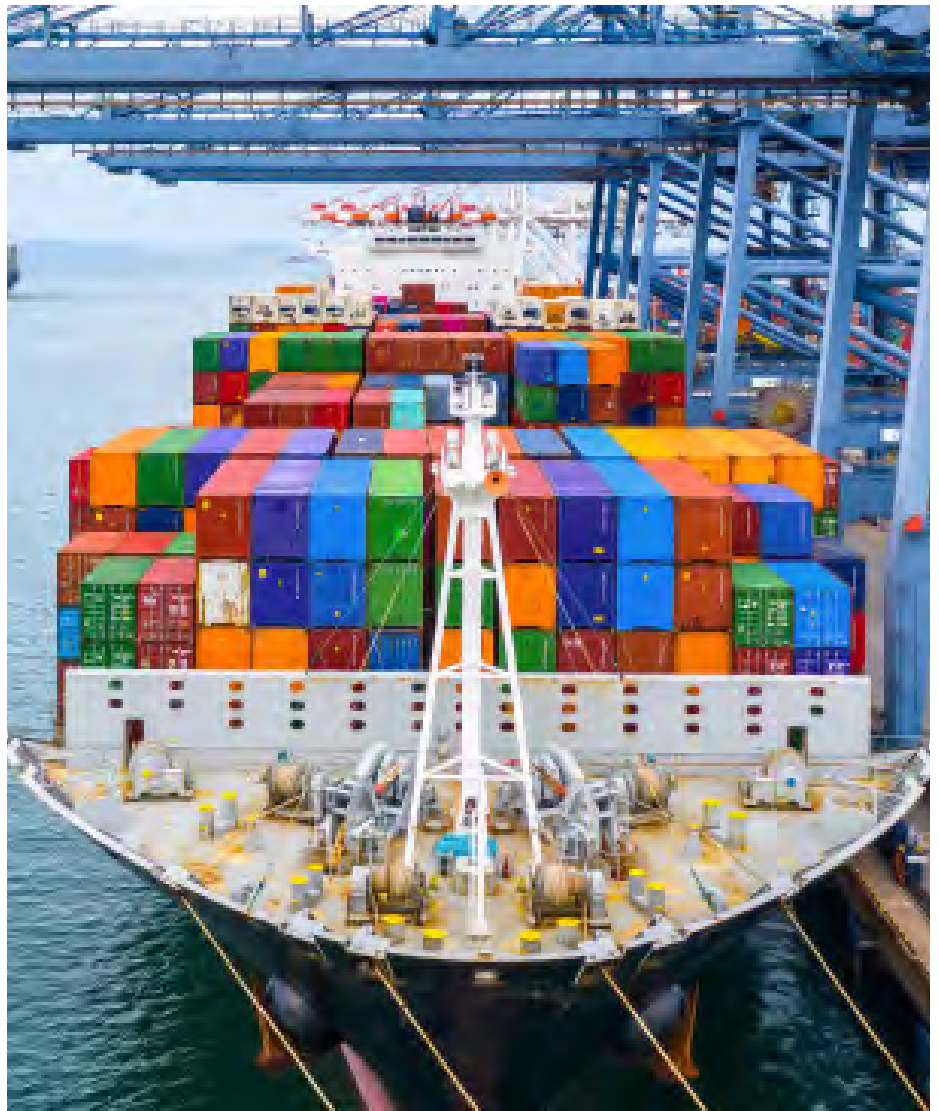
A machine malfunction that creates an accident or fire is costly, not just in repairs but in downtime. According to Port Technology, 25 percent of the costs of equipment damage is due to inadequate or incorrect maintenance.⁶ Smarter condition monitoring of equipment, assets, and maintenance services increases efficiency, lowers maintenance costs, and reduces downtime.

Condition monitoring enables early detection of potential faults and their causes on the basis of individual vibration characteristics and other influencing factors. This allows for permanent and continual monitoring of critical machines and equipment.

For condition monitoring, the network needs to be able to manage high connection density and transfer data in real time, with extremely high reliability. Plus, the port site needs to process and analyze the data in the cloud securely. This real-time process monitoring is what helps protect a port's machinery. The permanent monitoring helps avoid damage to machine components, tools or workpieces, and creates shorter response times.

Cellular-connected sensors and a cloud-based solution enable condition data to transfer in real-time, reducing on-the-ground monitoring efforts by 40 percent, according to Port Strategy.⁷ These sensors require response times as fast as a fraction of a second, making a private 5G network ideally suited for this use case.

Ports can cut the spare parts, oils and resources needed for maintenance by 50 percent, according to SAAB RDS. And condition-based monitoring of cranes can reduce maintenance costs by as much as 75 percent.⁸



Automated guided vehicles

Steering clear of danger

Ports depend on large numbers of tractors, all of which require a human pilot to move horizontally across port yards. But poor communications between tractor drivers results in congestion and collisions, all of which impacts upon the port's productivity. According to ResearchGate, in the past five years, 36 percent of accidents in ports were caused by pilot error and 42 percent of accidents were classified as "traffic" accidents. By using automated guided vehicles (AGV), we can help avoid accidents and make workers safer.

An automated guided vehicle connected to a cellular network can receive work orders as well as positioning information from a central intelligence. This data supplies collision warnings and improves the accuracy, safety, and speed of operations.

To remotely control the AGVs while complying with safety regulations requires a connection with extremely low latency. 5G cellular can meet these requirements, making it a good solution for the remote control of AGVs in the near future. Deploying automated guided vehicles connected by private cellular networks will create payback in around two years and a return on investment by Year Five of 149 percent.

6. Ibid.
7. Ibid.
8. Ibid.



Drones for surveillance and deliveries

An eye in the sky

Security has become a major concern for ports. Thefts of cargo are common, resulting in disrupted supply chains. Twenty percent of all marine transport thefts happen at the port.

Another challenge is that papers and other documentation deliveries need to reach a ship before it arrives at the dock. Traditionally, ports use a tugboat or launch boat for making these deliveries, even though the package might be just a single envelope or piece of paper. Maersk Tankers reports that such deliveries typically cost more than USD 1,000 each.⁹

Ports are looking for a technological solution to these problems and the use cases provided through drones can deliver just that. Modern drones use 3D sensors connected by cellular to real-time analytics to navigate and collect data. Operated by a pilot remotely, drones can be deployed effectively for security surveillance, inspections and the delivery of documents to and from vessels.

The drones require a network that can accommodate high-resolution video,

provide high-accuracy positioning, very high bandwidth and low latency.

Smart cranes with automation and remote control

Safer, more efficient smart cranes

A shipping port operates as an intersection point between sea and land transport. The handling of cargo by cranes is one of the key tasks performed in ports.

Traditionally, operators rely on large human resources to operate cranes. However, with increased labor costs, harsh working environments, and insufficient personnel, smart cranes offer an immensely appealing opportunity.

Automated smart cranes are often located in the port's container yard and are used to stack containers and move cargo. With 5G connected remote control ability, these cranes carry out their operations in an autonomous manner, allowing crane operators to supervise multiple cranes simultaneously, minimizing the risk of human loss while massively increasing loading speeds and efficiencies.

The vision for 5G technology and connectivity allows for the real time tracking of assets, ship to shore crane technology and management of cargo for port operators, further facilitating flexibility and the reliable deployment of innovative smart port solutions.

All of this can be enabled by a 5G private network.

Each of these four use cases will enable a container's journey through a port to be faster, safer and more efficient. But when combined to work in unison, the value multiplies significantly. Ideally, when deployed together, complete payback can be achieved in less than two years.

The four use cases discussed all work best and generate the most ROI when powered by a 5G-ready private cellular network. Once the network is in place, great potential exists to expand with additional use cases within the smart port, and integrations with other industries—for example, a fully connected supply chain.

9. Ibid.

Smart connectivity for the smart port of tomorrow

Only robust wireless connectivity can handle the huge amounts of data and voice communications that are mission-critical to smart ports. A 5G-ready private cellular network introduces the high-speed connectivity, low latency and strong performance—optimized for the Internet of Things (IoT)—required in a port's complex, dynamic environment.

Ericsson's broad portfolio for private networks, including the most extensive radio portfolio of any major Tier-1 vendor, can help meet port operators' diverse wireless networking needs. Ericsson has the global experience and references to provide proven technology that can easily be deployed in ports. In addition, port operators can test and readily utilize 5G technologies with Ericsson's cost-effective software-only, upgradable solutions.



Private network solutions from Ericsson

Ericsson's private networks portfolio is plug and play. Our solution has options ranging from as low as 100 user licenses, consisting of Small Core, to 25k users, called Large Core. Ericsson's Radio System portfolio comes in a range of sizes. Radios the size of smoke detectors can accommodate small indoor building spaces. Our medium-sized radios, called micro radios, are ideal for average to medium applications. Our macro radios can cover a reasonably large area, with a moderate amount of subscriber density.

Ericsson Private 5G brings the high quality, fast and secure connectivity that allows ports to mobilize the efficiency—and safety—improving use cases we've outlined. We have a broad portfolio for private networks that can help ports with different wireless networking needs, including the most extensive CBRS radio portfolio of any major Tier-1 vendor. Ericsson has the global experience and references to have proven technology that can easily be deployed by ports. In addition, with Ericsson's software-only upgradable portfolio, ports being able to test and readily utilize 5G technologies can be cost-effective with Ericsson solutions.

Why choose Ericsson wireless solutions?

For ports looking ahead to the digitalized future, smart ports powered by Ericsson Private 5G promise to deliver a substantial triple bottom line that includes more efficient operations, greater safety for workers, less downtime, and even more responsible environmental impact thanks to shorter idling times for ships and vehicles.

Ericsson's solutions are based on 3GPP (formal standards); these adhere to large ecosystem players in device manufacturers. Working with a large number of operator and ecosystem partners, Ericsson is the market

leader in 4G and 5G deployed technologies, and that level of robustness comes with so many deployments in its technology. Ericsson is unique in that the private network portfolio utilizes the same radio and baseband portfolio that the larger providers utilize and thus enables a broad reach that can help fit the solutions needs for larger multinational company needs. In addition, Ericsson has extensive relationships with many of the world's providers, so pathways towards hybrid solution offerings that consist of partnerships with local operators can be easily facilitated with Ericsson's involvement.

How can we help you?

Bringing about change is never simple. But the advances of automation enabled by private networks have the potential to solve many of the port industry's ongoing challenges—and even shape the future of the industry.

Find out how we can help you with a proof-of-value concept at your own port. www.ericsson.com/ports



About Ericsson

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Cloud Software and Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

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