5G Momentum-verkostoitumistilaisuus

Cargo Handling Solutions Enabled by Private LTE and 5G

6.11.2019, Pekka Yli-Paunu

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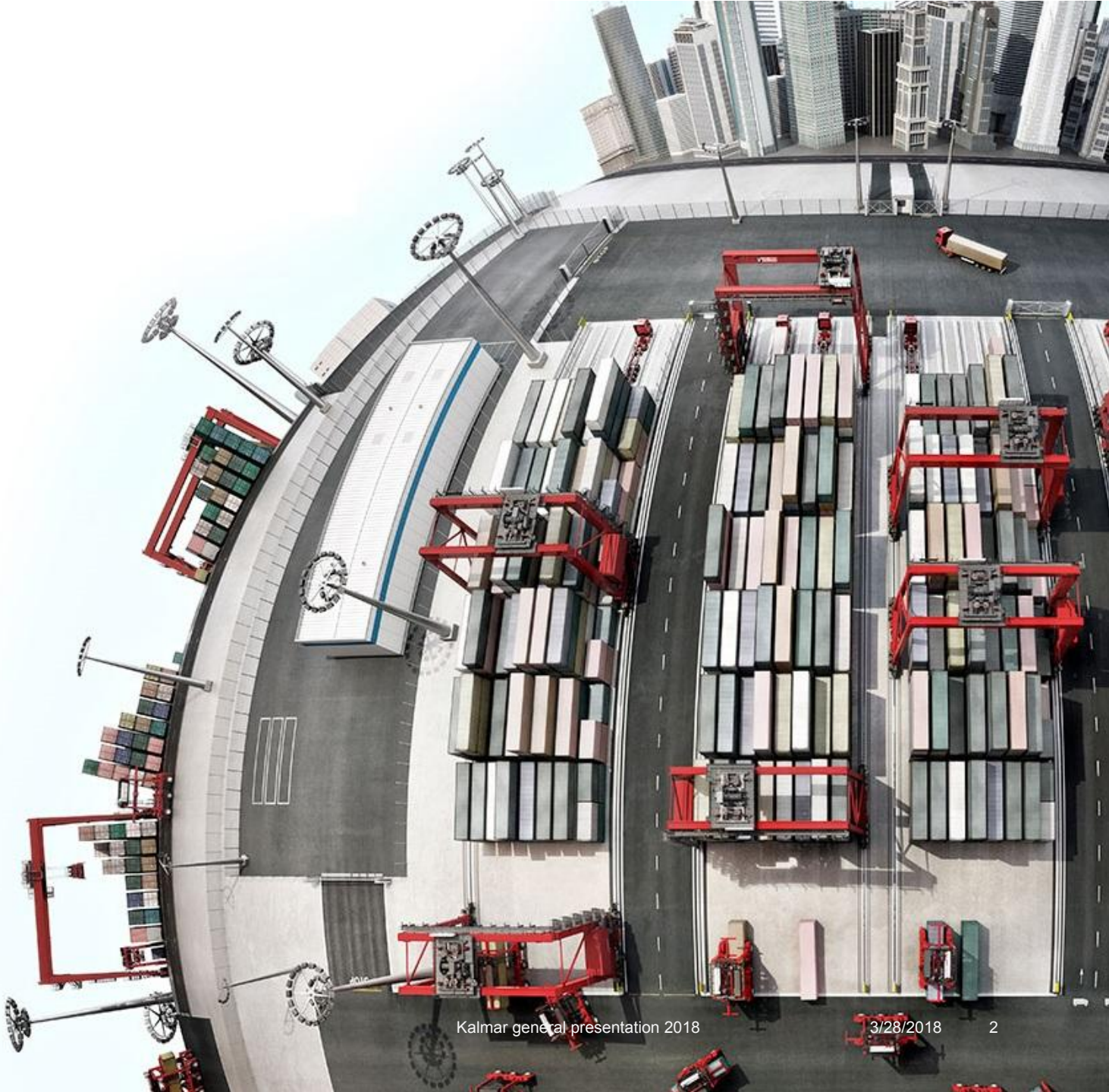

Cargotec purpose: we shape cargo handling

MACGREGOR

HIAB

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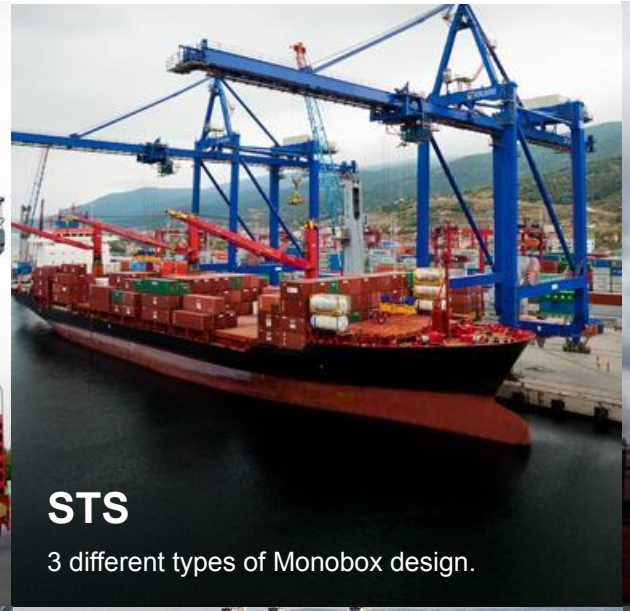
AGV

Fast charging solution with automation.

Shuttle & Straddle Carriers

Industry 1st fast charging solution for electric powered shuttle and straddle carriers with automation.

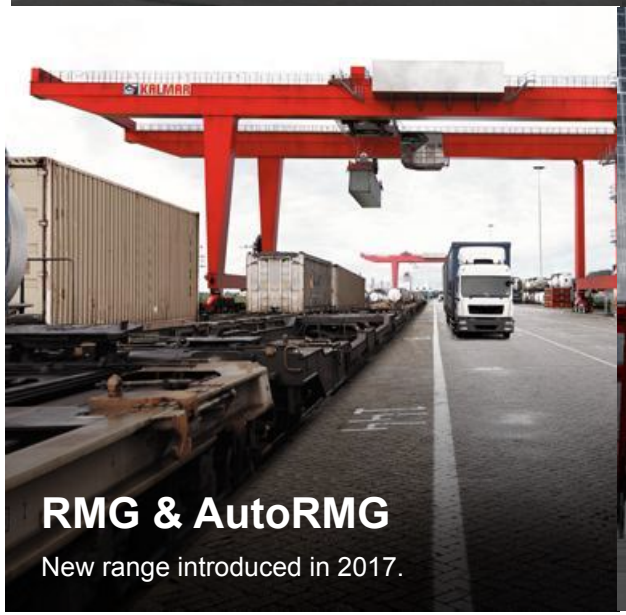


STS

3 different types of Monobox design.

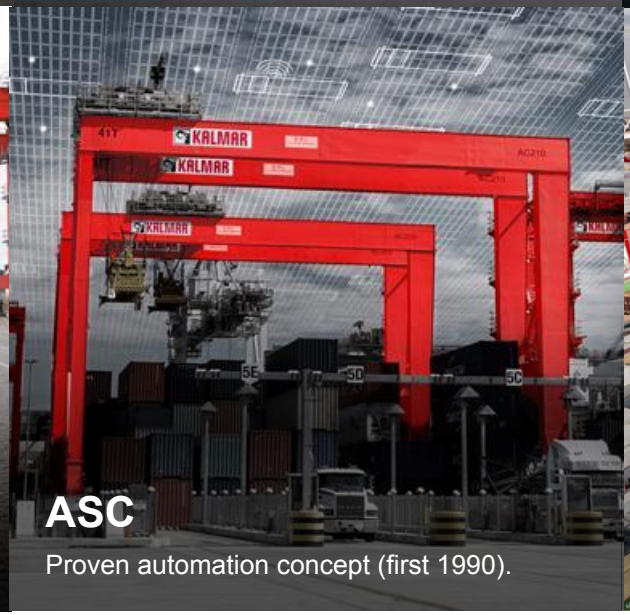
RTG & AutoRTG

Industry 1st all electric RTG with no hydraulic.



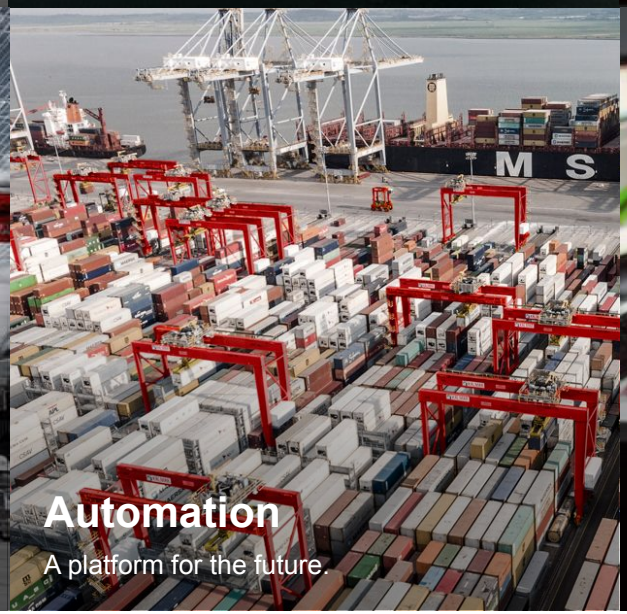
RMG & AutoRMG

New range introduced in 2017.



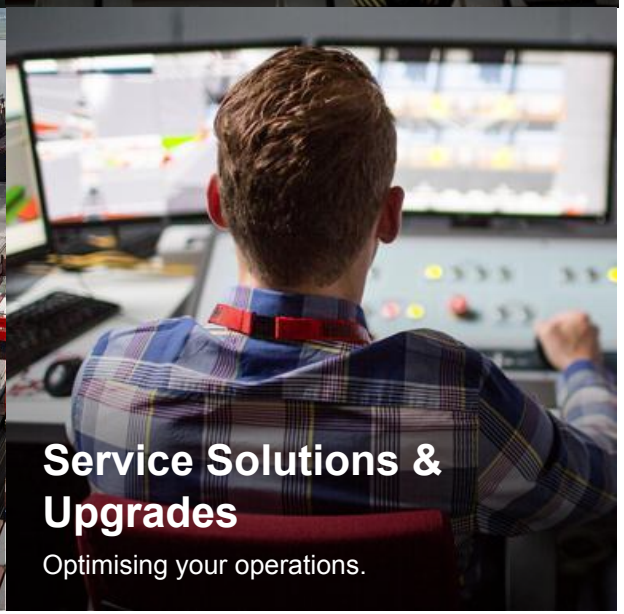
ASC

Proven automation concept (first 1990).



Automation

A platform for the future.



Service Solutions & Upgrades

Optimising your operations.

Digitalisation

- Digital solutions can help drive the optimisation of terminal operations
- Increased efficiency through real time view of all operations
- New possibilities to extract value from data

Automation

- Strong future growth expected for automated solutions
- Boosts safety and sustainability of terminal operations
- Increases operational predictability
- Helps combat labour shortages

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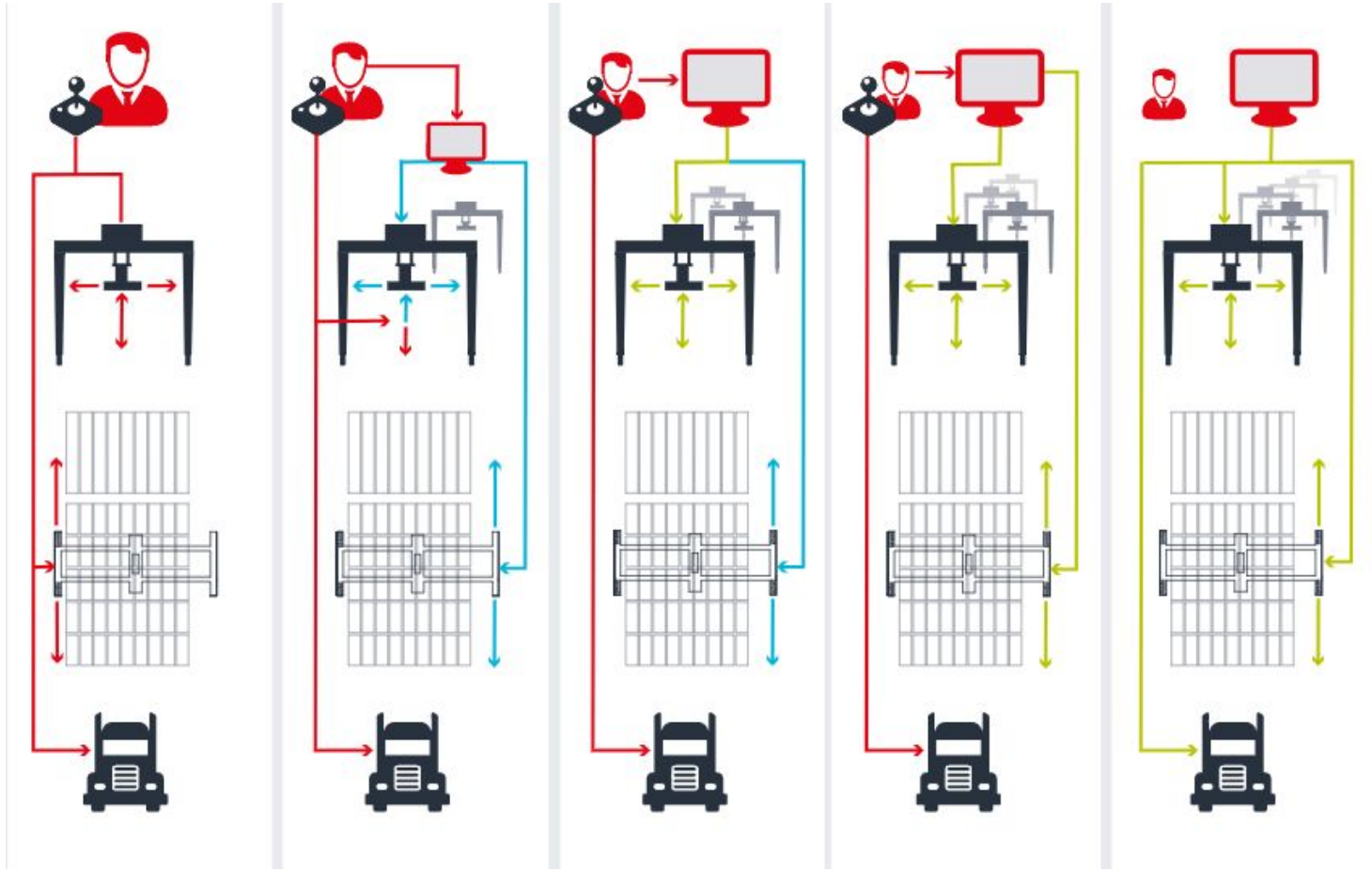
Stepwise Automation Opportunity



Remote controlled moves Supervised moves Automatic moves

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Automate the existing investment

- Retrofits
- Brownfield terminals

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Challenges

- A pivotal challenge is the need to decrease the lead time of terminal operations
- A common view is that this can only be achieved by digital solutions for end-to-end supply chain data management, supported by intelligent automation
- Together these would also improve safety and predictability and decrease costs.

Examples of Application Requirements on Private LTE/5G Network

Application	Description	Reliability	Latency	Bandwidth
Teleoperation of machine	Teleoperation (downlink) Video streams (uplink)	99,999% (control) 99,9% (video)	< 30 ms (safety) < 200 ms (video)	50-100kbps (control) 30-200Mbps (video)
Automated machines	Straddle carriers, AutoRTGs, ASCs, AutoRMG, AGVs, etc.	99,999% (control)	< 30 ms (safety)	10-20Mbps
IoT	Data acquisition with wireless sensors	90%	Not critical	Not critical
Security cameras	Human and vehicle tracking (video analytics)	99%	< 200 ms	2-5Mbps

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Issues with current wireless Technologies

- Communication using busbars, leaking cables or optical fibers means that there are needs to make big changes in the infrastructure design which means lost of flexibility, high costs, etc.
- The WiFi interference resistance and coverage are not enough to meet all requirements and therefore cannot support a large number of users in terminal environments

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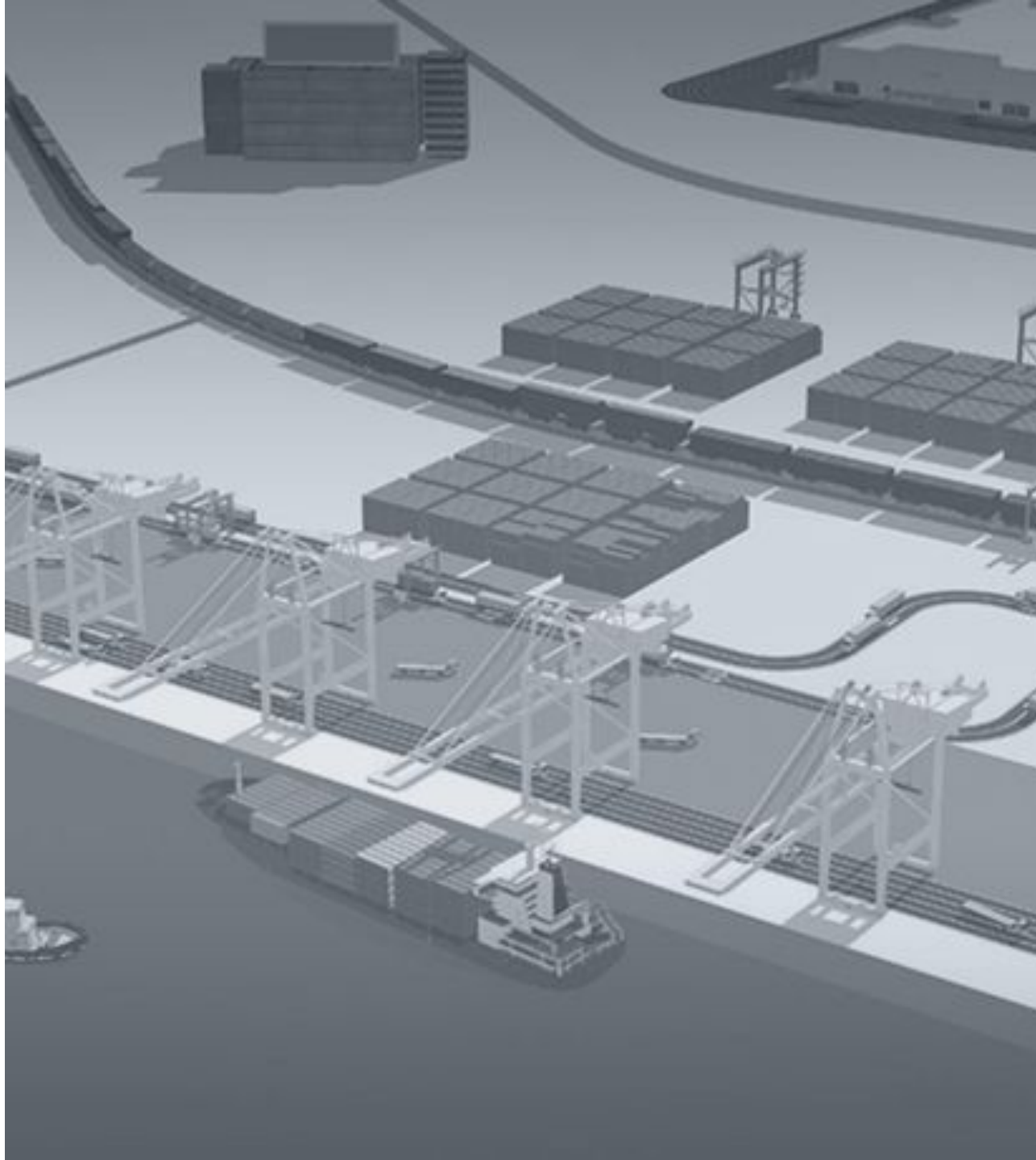
Comparison

Criteria	WiFi	Cellular Network
Security	Only unidirectional authentication. Unauthorized users can access the network	Bidirectional authentication
Quality of Service	No (proprietary solutions needed like Qosium)	QoS classification available
Mobility	AP reselection is performed with significant latency (proprietary solutions needed)	Comprehensive mobility management measures, such as handover, cell reselection and roaming
Number of users and interferences	No scheduling available. In addition, when there are a large number of users, the probability of collisions is great and the performance deteriorates quite much	The QoS assurance mechanism is based on centralized scheduling of multiple users and so supports simultaneous access of a large number of users
Frequencies	Unlicensed frequencies	Licensed frequencies (also unlicensed frequencies in some countries)

LTE Private Network Solution

Main advantages:

- Private LTE can provide good services
- Public network users cannot access the private network of the terminal.
- The latency and throughput within the private network are stable and predictable.
- Terminal can define their own network name.



Next Steps

- Private LTE is able to provide basic support for automated machine control and monitoring as well as teleoperation of cranes. The introduction of better uplink capacity enhancement, low latency, and high reliability will enable the extended features of these applications and also enable development of other high-end automation applications

- The LTE commercialization is continuously progressing. Its and later 5G's (URLLC) high bandwidth, reliability, latency, and connectivity features have large potential in the port and cargo terminal industry.

- Through uploading video streams to the servers and clouds for machine vision and other purposes, LTE and later 5G will have long term impacts on the port and cargo terminal infrastructure, transportation optimization, smart port products and business models.

Next Steps

- Kalmar found that the connection between LTE and the existing automation system of terminals has many potential areas where we have already developed solutions. For example, LTE needs to carry Ethernet Layer 2 protocols, networking with existing devices without changing their addresses while ensuring video monitoring quality and control system reliability and latency.

- Kalmar need global partner to provide components ensuring required service quality, including partnering models, to accelerate commercialization of private LTE for terminals.

- Automation systems like Kalmar One will change work methods and improve work efficiency also in other industries.

Kalmar One Automation System

Making your every move count.