FIIF Event: Private 5G Networks

Private 5G in Terminals

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Cargotec purpose: we shape cargo handling

MACGREGOR

HIAB

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Examples of our wide equipment offering

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Reachstacker

Straddle carrier

Terminal tractor

Container handler

Forklift truck

AutoRTG

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Loader crane

Truck-mounted forklift

Hooklift, Skiploader

Taillift

Recycling and forestry cranes

MACGREGOR

Cranes

Marine self-unloaders

Hatch covers, container lashings

Offshore load handling

Deck machinery

Mooring systems

A global reach with personnel in 30 countries and sales and service in more than 100 countries.

People
5,500

Service staff
1,500

Presence
100+
countries

Assembly
Poland
China
USA
Malaysia

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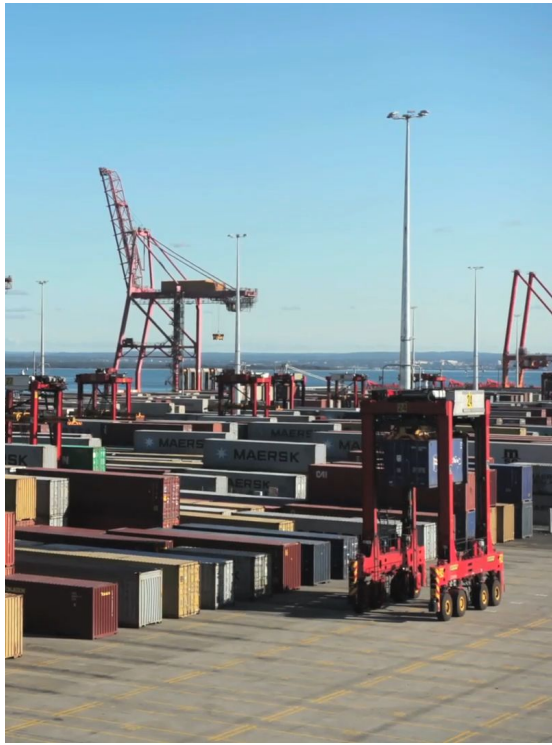
Challenges in Ports

- A pivotal challenge is the need to decrease the lead time and increase transparency of terminal operations (Industry 4.0)
- 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.
- With the global data sphere set to continue its exponential growth, there remains debate over how it can be used and what standards will be in across the container terminal industry.



Role of Private Networks

- Wireless communications systems builds the basis of smart and automated container terminal operations.
- Communication using push bars, leaking cables, and optical fibers needs to make system-level changes in the infrastructure design (lost of flexibility, costs, etc.)
- Container terminals are very challenging application environments for wireless networks. The functionality of existing proprietary WiFi based solutions does not satisfy the customer need fully today.
- Kalmar expects that standard private LTE and private 5G network solves the problems of today, at least better than the existing standard and proprietary systems (in security, quality of service, mobility and number of users).

Comparison

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

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Examples of Application Requirements on Private LTE/5G Network

Application	Description	Reliability	Latency	Bandwidth
Teleoperation of machine	Remote control (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, RTGs, ASCs, AGVs, etc.	99,9%	< 30 ms (safety signals)	10-20Mbps
IoT	Data acquisition with wireless sensors	90%	Best effort	Best effort
Security cameras	Human and vehicle tracking(video analytics)	99%	< 200 ms	2-5Mbps

Benefits for integrators?

- 5G technology improves bandwidth and reduces latency
- The most important feature is that it allows new business models where industry can deploy and manage own private network
- Value chain is changing
  - **Before:** vendors, mobile operators and end users
  - **After:** vendors higher diversity, integrators and service providers for multiple market segments like ports and terminals needing QoS, security and privacy

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Benefits for integrators?

- 5G provides better QoS but technology still not yet mature enough in all the parts of the end to end system.
  - Lack of 5G devices mainly modem form factor for industrial deployments (on-board)
  - Stand Alone mode not yet widely available
  - Installation and maintenance still quite complex
- 5G improves the deployment of private network but regulation is fragmented
  - Different countries offer frequency with different requirements

Situation is changing quite fast (new standards and new components)

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Next Steps

- Private LTE/5G is able to provide 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/5G commercialization is continuously progressing. 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 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/5G and the existing automation system of terminals has many potential areas where we have already developed solutions. For example, LTE/5G 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/5G for terminals.
- Automation systems like Kalmar One will change work methods and improve work efficiency also in other industries.


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Kalmar One Automation System


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