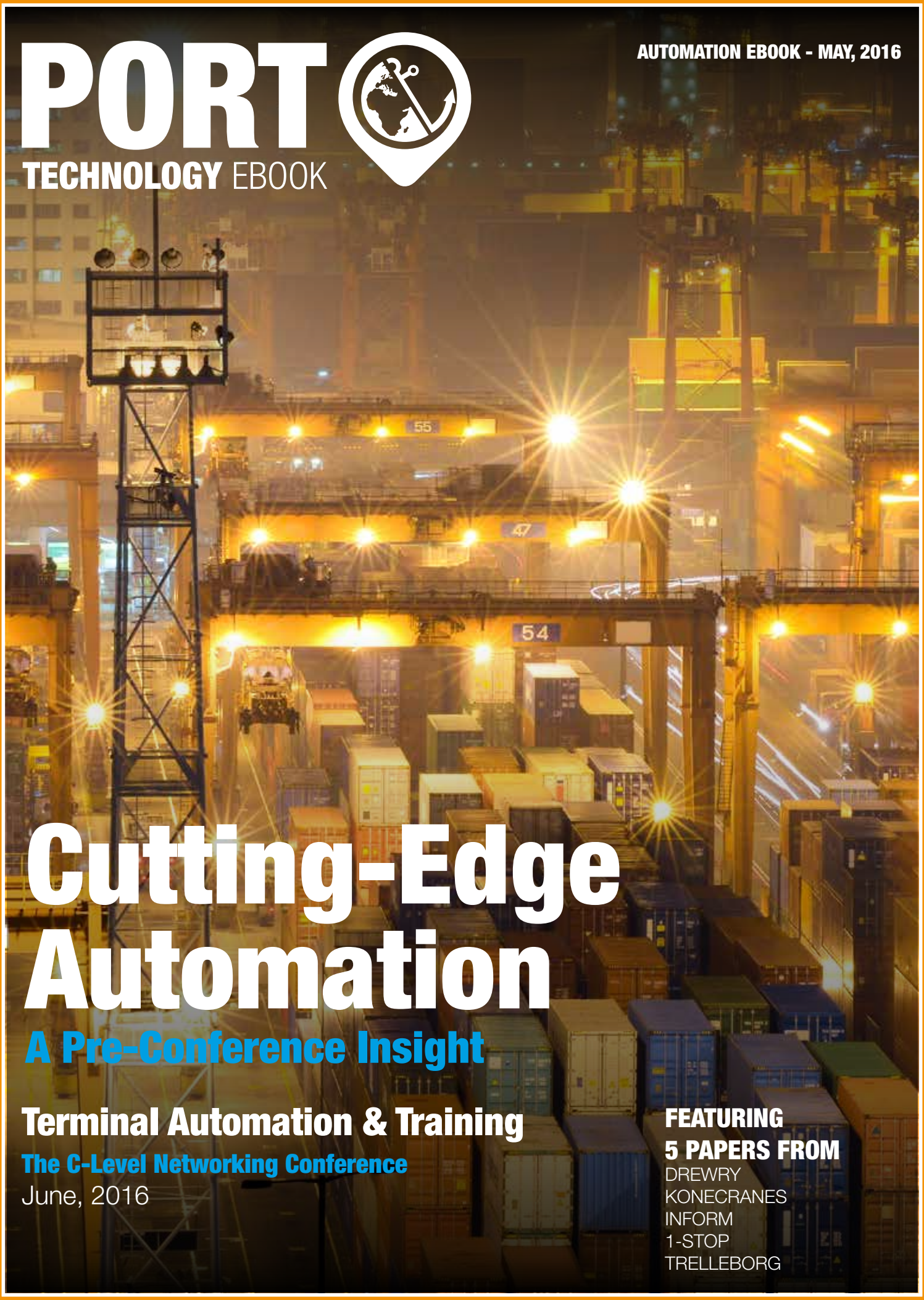
AUTOMATION EBOOK - MAY, 2016

PORT TECHNOLOGY EBOOK



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FROM THE EDITOR

Welcome to the Cutting-Edge Automation eBook. It's a pleasure for the PTI team to be producing these bite-size eBooks on specialist subjects, so firstly a thank you is due to those who downloaded our inaugural Container Weight Verification eBook and for the kind and constructive comments we received.

Such feedback helps the team recognise the impact we can have in expanding knowledge on pertinent topics, and how we can provide a better service for our readers. We hope this second eBook is as well-received and please get in touch with one of the team to share your thoughts if you wish to.

This Cutting-Edge Automation eBook was conceived with a binary intention: to provide a digestible and easy to disseminate insight into state-of-the-art automation, and to provide a key piece of pre-conference material for the upcoming PTI Terminal Automation & Training Event.

The eBook features contributors who will also take part in the specialist panel Q&A's at the PTI event and offers a flavour of what to expect from our handpicked speakers, as well as the event on the whole. Furthermore, this eBook serves as a conduit with which to learn and to inspire any questions you may have for our specialists that can be discussed, debated and ultimately answered during the event.

With a range of contributors, I hope this eBook offers you an insight in what to expect from our upcoming edition: Embracing Automation.

Richard Joy
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CONTAINER TERMINAL AUTOMATION

PROS, CONS AND MISCONCEPTIONS

Neil Davidson, Senior Analyst: Ports & Terminals,
Drewry, London, UK

Automation when used in the context of container terminals is a broad term and means different things to different people. To some, it is interpreted in a narrow sense, i.e. the replacement of human operation of equipment with autonomous computer control ('robotisation'). However, besides robotisation there is a raft of other 'automation' which results in the replacement of human activity, for example optical character recognition replacing a checker with a piece of paper or a hand-held computer, manually recording container numbers. Beyond these aspects there are also many other applications of what should strictly speaking be termed 'technology' as opposed to 'automation', for example anti-sway systems in cranes.

MANUAL BECOMES AUTOMATIC

Some types of "automation" have been in place for many years and now largely go unnoticed; for example, vessel planning and container stack inventory functions which were once manually done are now computerised in almost all terminals. Other types of automation are also common such as the checking of container numbers and container condition (damage) using cameras and optical character recognition at terminal gate. These were once manual functions which are now automatic through the deployment of technology.

This kind of process automation of background functions is largely invisible to the outside view. Much higher profile is automation of equipment whereby human drivers are either replaced by robotic systems and operate autonomously, or have human 'drivers' in a physically remote location from the equipment itself. The latter clearly has benefits in terms of driver safety and comfort, but does not involve replacing human drivers with robotics.

AREAS OF AUTOMATION

In terms of the physical movement of containers there are four main functional areas of a container terminal and automation (robotisation) can theoretically be achieved in any or all parts:

1. Vessel to quay (ship-to-shore movement)
2. Quay to stack (horizontal transfer system)
3. Yard stacking system
4. In-out gate function

Robotically operated yard equipment is the highest profile aspect of terminal automation, not only visually but also in terms of cost implications (both capital and operating) and terminal automation to date has mainly focused on items 2 and 3: the quay to stack horizontal transfer and the yard stacking system.

Terminals are typically described as fully automated if both the horizontal transfer between quay and stack, and the yard stacking system are automated. If only the yard stacking system is automated (and the horizontal transfer remains with manually operated equipment), a terminal is described as semi-automated.

PROS AND CONS

There are a number of positive drivers behind terminals choosing to implement robotic equipment control – the "pros" (in no particular order):

- ✓ Greater predictability and consistency of operations
- ✓ Substitution of (usually high wage) labour costs with capital costs. The aim is to achieve lower overall operating costs and also avoid the uncertainty that manual labour can bring (for example the potential for above inflationary wage increases, the vagaries of negotiations on manning levels and conditions and the possibility of disputes/stoppage/strikes)
- ✓ Greater safety (fewer or no humans present in the equipment operating areas)
- ✓ Less downtime due to external factors (e.g. in periods of high winds, manually operated yards may have to cease operations for safety reasons)
- ✓ Longer working hours (machines can operate 24/7 without the need for refreshment and comfort breaks, and have no aversion to unsociable hours)
- ✓ Denser yard stacking as more shuffling can be carried out because it is less costly/inconvenient than manual shuffling
- ✓ Greater accuracy and avoidance of human error
- ✓ Potentially greener and more environmentally friendly (for example automated equipment is usually electric rather than diesel powered)
- ✓ Reduction in equipment and cargo damage
- ✓ Terminals do not necessarily have to pursue full automation. Semi-automated solutions exist

At the same time, terminal automation also has a number of downsides (or perhaps some would say challenges to overcome) – the "cons" (again, in no particular order):

- ✘ Automation requires a high, up-front capital outlay, significantly more so than for a manual terminal
- ✘ Automated yard equipment has to be added in large capacity 'lumps' rather than gradually in small increments
- ✘ Automated terminals lack flexibility. Their physical layout is difficult to change once fixed (unless it is an automated straddle carrier solution), and it is fixed for the long term. Decisions have to be made at the design stage which require judging the terminal's needs over decades ahead. The activities of the terminal and the needs of its customers though may change markedly over time
- ✘ If activity levels temporarily fall, a manual terminal is more able to re-trench (dockers can be laid off for example)
- ✘ The processes carried out by a terminal are not necessarily stable and homogenous. They may be volatile and change over time (from minute to minute, day to day and year to year). Automation prefers a high degree of repetition and predictability
- ✘ In some locations, union resistance may make it difficult to achieve the full extent of headcount reduction that automation in theory offers
- ✘ Automation is a highly bespoke task which varies from terminal to terminal, and the quality of the terminal management and the software behind the automated equipment is key, as is the way that it integrates with all other systems on the terminal
- ✘ Automation does not necessarily (automatically) result in faster handling and higher service levels
- ✘ Automation projects carry greater risk and are harder to implement whereas manual terminals are tried and tested

THE PRESENT SITUATION

Terminal automation is by no means a panacea therefore and it should not be regarded as inevitable that all terminals will eventually be automated. Sceptics argue that in some cases automated terminals perform worse than manual terminals, or that the required service levels and intensity of asset use can just as easily be obtained by manual terminals. At the same time, there are clearly some automated terminals that perform very well.

What is evident is that automation technology is advancing rapidly and the take up is increasing. At present, there are over 30 semi and fully automated container terminals operational worldwide today, with a number of others under development.

In this respect, perceptions can play a part in some instances. Automated terminals are high profile assets and rightly regarded as state-of-the-art and highly advanced. There can be a temptation in some locations to seek to have a high degree of automation in order to send a message to the outside world about the level of skills and technology that an operator or a country can master. Critics argue that such moves are merely vanity projects although a kinder view is that they are a proving ground and learning process, and therefore a form of investment.

MISCONCEPTIONS

There are some common misconceptions about what terminal automation can achieve. One of the main ones is that automation 'automatically' results in faster vessel handling speeds - that it is some kind of cure-all. Automation is a powerful tool to be deployed, but it is not a magic bullet. Rather, automation first and foremost delivers stability, predictability and consistency of performance. This is arguably much more valuable.

Another common misconception is that automation "automatically" cures poor processes, but of course it does not. Rather, it simply results in faster execution of these poor processes. There is no gain in automating a poor process because it is the process itself that really matters; this is what has to be right. In this respect, the quality of the terminal management and the design, planning and operation of the 'IT brain' software behind the automated equipment is key. Ultimately therefore, it is about humans as much as it is about automation.

** This paper draws upon material published in Drewry's 2014 report "Container Terminal Capacity and Performance Benchmarks"*

ABOUT THE AUTHOR

Neil Davidson has over 25 years' experience in the port sector. He joined Drewry in 1997 and founded the company's ports practice. Neil has spoken at over 80 industry conferences, seminars and private briefing sessions worldwide and regularly contributes expert insight and analysis to the trade press and British national newspapers, as well as TV and radio.

ABOUT THE ORGANISATION

Drewry is one of the world's leading international maritime consultancy and publishing organisations. Founded in 1970, the company has over 40 years' experience within the maritime sector, employing over 90 specialists across offices in London, India, Singapore and Shanghai. The company provides research reports and consultancy services with a brand renowned for its quality. Drewry reports are sold in more than 90 countries and consultancy services are commissioned by over 70 countries.

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THE NEW ERA OF CONTAINER PORTS

THE INDUSTRIAL INTERNET

Sampo Pihkala, Product Manager: Industrial Internet, Konecranes Port Cranes, Hyvinkaa, Finland

A new era is beginning in the container handling industry thanks to the rise of the Industrial Internet, the world's hyper-connectivity, and the automation of container terminal operations. New business and operating models are being revealed that offer great opportunities. With that new risks are also being revealed. Opportunities can be exploited and risks can be minimised by building a sound IT network architecture.

THE INDUSTRIAL INTERNET

The Industrial Internet (more commonly called the Internet of Things) is the next phase in the period of evolution that began with the industrial revolution and continued with the Internet/IT/digital revolution. The Internet has been profoundly changing our way of life over recent years. People are now more connected, privately and professionally, than ever before in human history. This dynamic is now moving, thanks to advances in communication technology and connectivity, to the world of machines.

In the container handling industry, we can imagine an Industrial Internet world where every container crane is interconnected in the container terminal and throughout the logistical chain from point of shipping to point of delivery. The interconnectivity could include the goods owner, the point of the shipping container terminal, the shipping line, the receiving container terminal, the railway and trucking company, freight forwarders, and intermodal operators. In this scenario there are enormous opportunities to optimise delivery efficiency and reliability. All points in the container distribution chain are interconnected in theory – what might happen if they become interconnected in reality?

Machine service and maintenance is the area in which the Industrial Internet can bring the most immediate improvement. We are already seeing significant progress in this area. Crane manufacturers are delivering container cranes with built-in remote connectivity to crane manufacturing service centers. The cranes generate usage data on e.g. energy consumption, working hours, diagnostics sensors, safety alerts, and so on. The data is sent in real-time to the remote service center, where it is stored and analysed programmatically. The goal is to move from regularly scheduled maintenance regime to a real-time need approach, and on to a pre-emptive approach that can greatly reduce unscheduled downtime.

THE INTERNET IS THE BIGGEST THREAT

The Industrial Internet is an infrastructure of connected machines, a platform and foundation for real-time services. It contains many different levels of data, of varying degrees of importance and sensitivity, but it all needs to be transferred and handled reliably and securely. A sound IT network architecture is the key to this, and to successful TOS implementation and automated container handling.

When discussing the Industrial Internet, we need to use the word "Internet" with caution. The public Internet is the biggest cybersecurity threat imaginable to the IT network architecture that a container terminal needs to have. An Industrial Internet platform should never rely on public Internet connectivity – no matter how attractive and affordable an option it seems to be. The Industrial Internet should

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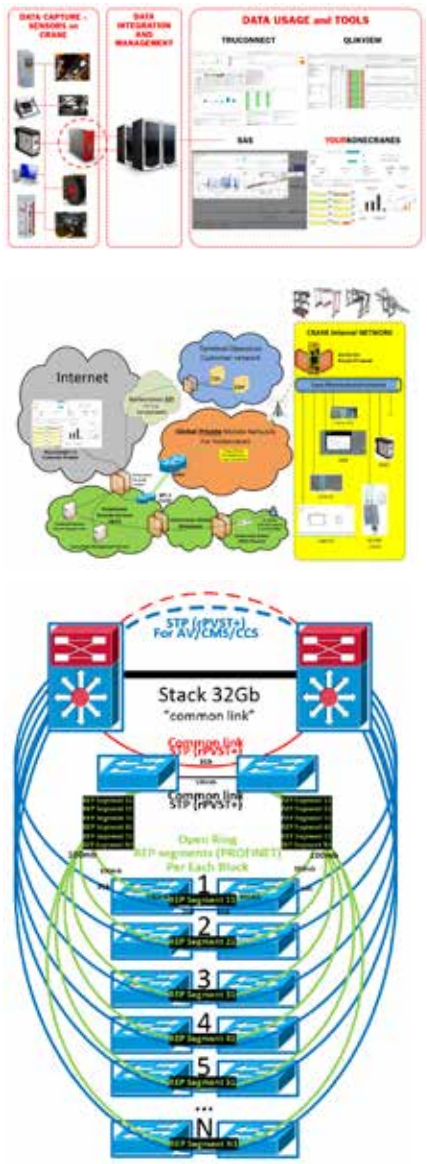

Figure 1 (top). The Konecranes Industrial Internet platform, the foundation for its real-time digital services: TRUCONNECT® is a remote service capability that is delivered as a standard feature with virtually all Konecranes lifting equipment; Figure 2 (middle). The Konecranes Industrial Internet architecture. The reliable connectivity platform offers API's for new requirements such as SOLAS/CGMV to be utilised by any TOS/ERP system; Figure 3 (left). Automated container handling system: IT network redundancy ring topology. The most time-critical safety/control bus communication has dedicated physical network interfaces to secure the data flow, maintaining crane operation even if link/hardware failure occurs

not contain even the remotest possibility that peoples' heart pacemakers, or a container terminal's STS crane control systems, could be accessed from the public Internet, regardless of the "impenetrability" of its surrounding security, encryption and access management. This is not about paranoia; it is about being uncompromising with safety.

DRAWING FROM EXPERIENCE

Konecranes has been developing its Industrial Internet capability and reach for about ten years. At the outset, it was understood that two-way communication and secure connectivity were required, which disqualified Internet-based solutions. A private APN and a cellular-based global connectivity platform was selected and implemented.

A lot of progress has been made in the last five years. Today, over 12,000 cranes are connected and online in some 80 countries. About 1,000 container cranes and lift trucks are connected and online, most of them located in places where Konecranes does not have a local service presence. This population of online lifting machines gives exciting possibilities to develop digital services. Konecranes' service business is collecting, sifting and analysing the growing body of data that is being generated.

This is just the beginning. Konecranes has an ambitious vision of the Industrial Internet. But getting this far required the complete commitment of the company's top management and the right technology decisions.

PRINCIPLES OF SOUND IT NETWORK ARCHITECTURE

The IT network architecture needs to be designed and built with top management commitment, based on clear business requirements and a long-term technology strategy with scalability. This is entirely doable. A container terminal will get far by starting with general compliance with laws and regulations, using off-the-shelf products for network build and implementation. An established Prepare/Plan/Design/Implement/Operate/Optimise approach will work well to reduce the network's 'Total Cost of Ownership', improve the agility of operations, increase access speed to applications and services, and increase the availability of required applications and services. To date, many container terminals have done only the "Implement" part.

When designing an IT network architecture for automated container handling systems (ARMG, ARTG) certain basic principles should be followed. The most time-critical safety and control data flows should be isolated from all the other data communication streams – both virtually and physically. A redundancy topology should be designed and built to meet the terminal's operational specifications in case of hardware failure. The convergence of the redundancy protocol needs to be quicker than the permitted timeout of the safety bus communication. A traditional STP is not quick enough to keep the automated operation running if topology changes occur in the IT network infrastructure.

The control and safety data traffic is very time-critical but the network also needs to handle potentially hundreds of HD-capable video streams needed for remote operation station operation in ARMG and ARTG systems. There is an obvious need for high bandwidth: the video and audio streams need to be in real-time. Carefully designed multicast routing with prioritised traffic definitions are the key elements for smooth handling of the AV data streams.

CYBER SECURITY AND CONTAINER PORTS

Security is extremely important throughout the IT network build process, affecting the IP and VLAN design, L2 and L3 ACL setups, and so on. A complete inventory of the production data flows should be taken: this is the fundamental information for implementing access control in the network. When the permitted traffic is known, defined and verified, security back-doors can be eliminated. The security of the network is only as strong as its weakest link.

Cyber-attacks have occurred in every industry in recent years. Soft targets are attacked first and most often. Understanding the security issues, and designing security into the IT network architecture at every phase of its build are the keys to bringing your container port safely into the Industrial Internet.

ABOUT THE AUTHOR

Mr. Sampo Pihkala is Product Manager, Industrial Internet, Konecranes, Port Cranes, Technology and R&D. He holds a B. Sc. degree in Telecommunications. Before joining Konecranes in 2008, he worked for 6 years in the telecommunications industry in Finland. He has been building and developing the Konecranes Industrial Internet platform and working as an IT Network Architect in automated container handling projects.

ABOUT THE ORGANISATION

Konecranes is a world-leading group of lifting businesses, serving a broad range of customers, including manufacturing and process industries, shipyards, ports and terminals. Regardless of your lifting needs, Konecranes is committed to providing you with lifting equipment and services that increase the value and effectiveness of your business.

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A NEW EPISODE IN RAIL OPTIMISATION

THE AGILE FORCE AWAKENS

Dr Eva Savelsberg, Senior Vice President, INFORM, Aachen, Germany

For many years the automation and productivity debate revolved around efficient waterside processes, smarter yard stacking and perhaps quicker truck/gate turnaround times. But recently the focus has shifted to rail yard operations and the possible gains associated with it. High performing hinterland systems are mission critical in order to manage peak demands and customer expectations.

More and more tasks have to be coordinated simultaneously at high-speed with permanent and unplannable changes. Not only is the large volume of data overwhelming, but we also have the massive amount of possible actions to contend with. This is where 'Agile Optimization' comes in. It can be used to speed-up and optimise the decision-making processes in rail crane operations. Powered by algorithms, the software is able to calculate routing options, handshake possibilities in the transshipment area and double cycle opportunities within a fraction of a second. The best results are immediately translated into optimised job order sequences for each crane – adapted to their grade of automation (manual, semi or full).

ALGORITHMS BEAT HARDWARE

Agile Optimization is a concept that takes human/computer interaction, rapid response to change and decision making quality to a new level. It benefits from the enormous advances in computer hardware over the past two decades. But gains in processor speed pale in comparison to the progress made by algorithms: hardware power has increased by the factor 1,200, while algorithms have improved by a factor of 55,000 in the same period. The joint forces result into a staggering factor of 66 million, or in other words: a planning model using linear programming that would have taken two years to solve in the 1990s, could be solved in just one second today.

The software can be used as an add-on to an existing TOS, following a best-of-breed strategy for selecting the solution that is most suited for a particular task, e.g. rail crane operations, yard management, and so forth.

A stronghold of agile optimisation software is the control and synchronisation of time-critical processes in real-time, e.g. optimised storing and stacking of containers in order to minimise rehandlers and retrieval times or the optimised sequence of rail crane moves. To gain a better understanding of how this works in practice, let's take a closer look at some applications in rail yard operations.

OLYMPIC TEAMWORK

Running efficient rail operations is like running a relay race. The teams must be well-coordinated and able to pass a container from one member of the team to the next while maintaining maximum speed. Agile Optimization Software can help to ensure that each container transfer from yard to rail and from rail to yard is perfectly timed and executed. Based on

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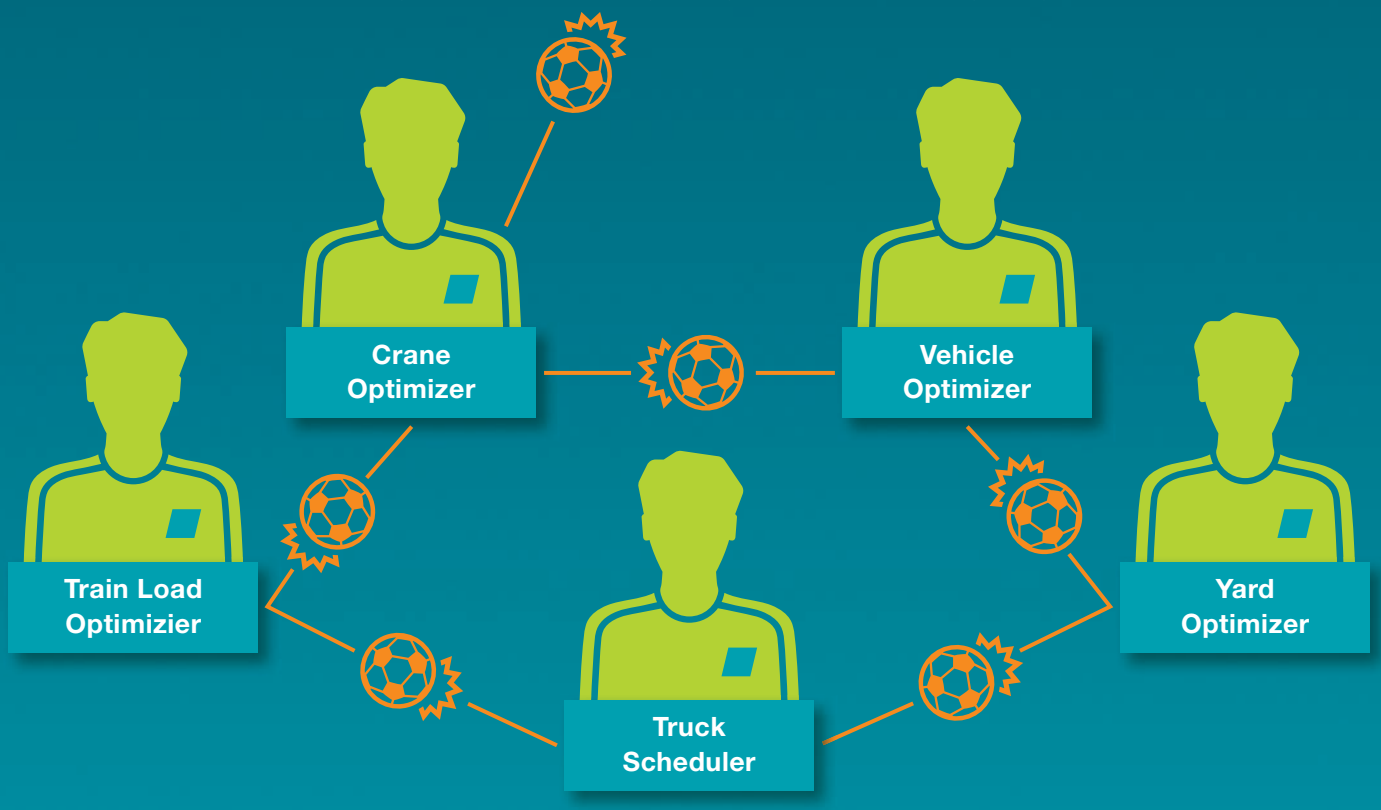

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the data it receives from the TOS, the software quickly analyses all jobs within seconds and proposes optimised handover times and transfer points at the rail area. Current work status, work load of each rail crane and handling equipment (manned or automated straddle carrier, reach stacker, AGV, terminal tractor, and so forth) as well as their associated rail productivity are also included in the calculations. Whenever the TOS provides updated data, the optimisation software automatically recalculates and updates the decisions to support the new operative situation. This real-time capability ensures that each container is moved at the right time and at the right place, giving them a head start for their next move.

AGILITY TRUMPS SPEED

Agility training significantly improves an athlete's ability to accelerate, decelerate, and quickly change direction with precise timing and body control. The daily challenge of a rail crane is similar: getting each container on and off the train as quickly as possible, immediately reacting to changing priorities or adjusted workload, constantly synchronising all routing decisions with the neighbouring cranes, anticipating the next move's impact on the following lifts, and so on. Agile Optimization software can act as a drill instructor.

Based on TOS data as well as container eligibility, handover times and locations, the software analyses all possible routing options within seconds and identifies those that are ideal for highest productive operation. Double cycles – the ultimate challenge for any rail yard operation – are proposed by the software whenever suitable and in support of minimising crane travel distances and times, which leads to increased equipment productivity. The best result is immediately translated into optimised job order sequences for each crane – adapted to their grade of automation (manual, semi or full). Positioning systems and interfaces to the crane's built-in control system can also be integrated.

PERFECT LINE-UP

Train load planning is a time consuming exercise. Dispatchers and schedulers usually spent hours figuring out which layout is best to maximise train utilisation. With several trains per day to plan and numerous technical and logistical requirements to consider, huge data volumes have to be handled in order to find a set of good layouts. And if just one item in the mix fails, the entire plan may collapse like a house of cards – with trains running late and costs way out of line.

Instead of hours, optimisation software just needs a couple of seconds to come up with an optimised plan. Once all information of incoming and outgoing trains has been imported from the TOS, the software quickly creates optimised train load plans at the click of a mouse. Dispatchers can compare several scenarios for the same data set by changing the strategy and objectives. Besides optimised railcar/slot utilisation, the software also minimises changes to the pin configuration.

Plans usually have a limited shelf life. Daily challenges like containers arriving late, equipment breaking down are commonplace. Disrupt the loading/unloading schedule and this will affect the efficiency of the operation if no countermeasures are taken. The software reviews and adjusts all planning decisions – right up to the moment before execution – and updates the job order sequences for all rail cranes in real-time.

Optimised train load planning has proven itself very effective in case of double-stacked rail cars with significantly higher train utilisation rates.

GLOBAL PLAYING FIELD

Top performers among terminal operators worldwide rely on optimisation software to keep their business competitive. HHLA's Container Terminal Altenwerder (CTA) in Hamburg, for example, is one of the most modern maritime terminals in the world, with a high degree of automation. Its rail facilities are recognised as the largest rail terminal in Germany. Optimisation software helps to handle more than

500,000 boxes (813,000 TEU) by rail per year (2013).

GCT Canada recently announced that they will be using INFORM's software to optimize the rail operations at their Deltaport terminal in Port Metro Vancouver. At the port of Los Angeles, TraPac, LLC will be using the same software to optimise all rail crane moves after the expansion of its semi-automated terminal. At Maasvlakte II in Rotterdam, APM Terminals' state-of-the-art automated facility, all rail crane operations as well as the container handover of the landside fleet of 62 fully automated transport vehicles (lift-AGVs) will be optimised by intelligent software. But this technology can also be adapted to the needs of any ambitious intermodal terminal looking for ways to drive up productivity levels. KTL Kombi-Terminal (Germany), for example, is a rail/road terminal close to BASF's chemical park in Ludwigshafen. Located in the centre of Europe, the terminal opted for a complete TOS for inland terminals by INFORM with optimisation modules in order to increase the efficiency of its operations. Capacity of the terminal allows the loading and unloading of up to 64 trains per day respectively, and up to 500,000 load units per year.

PROGRESS

1990s vs. 2010s

55,000 x

1,200 x

Σ 66 Mio. x

How long would it take to solve a planning model?*

1990s

2 Years

2010s

1 Sec.

*using linear programming

ABOUT THE AUTHOR

Dr Eva Savelsberg is Senior Vice President of INFORM's Logistics Division. She specializes in Agile Optimization Software which renders a wide range of terminal processes more productive, agile and reliable. Eva is also lecturer at the University of Aachen (RWTH), where she received her PhD in Mechanical Engineering in 2002. Eva has published four books and over 30 papers on innovation in freight transportation.

ABOUT THE ORGANISATION

INFORM specialises in Agile Optimization Software to improve operational decision making. Based in Aachen, Germany, the company has been in the optimization business for more than 45 years and serves a wide span of logistics industries ranging from maritime and intermodal terminals, distribution centres as well as bulk materials logistics.

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PRODUCTIVITY THROUGH DECISION MAKING

OUR EVOLVING PORTS

Michael Bouari, CEO, 1-Stop Connections,
Sydney, Australia

We are in an era of rapid digital transformation that affects all industries. Mobile technology, social media, cloud computing and advances in analytics are all contributing factors. The rate of innovation and adoption is accelerating and will likely continue to do so. This rapid change has an impact on decision-making. Decision-makers need technologies and solutions to support this rapid and accelerating change to help them make good decisions based on knowledge, experience, and sound logic have a much higher probability of delivering success in any business.

DECISION MAKING EVOLUTION

The idea of importing and exporting goods seems simple, but it gets complex very quickly with the multiple inputs from a range of people and institutions. Having so many variables and "middle men" that can potentially delay cargo, decision-making has become a critical function. Regardless of where a business is today, the evolution of decision-making relies on three key factors:

- Business Process Automation (BPA)
- Operational Engagement (OE)
- Port Community Insights (PCI)

Each factor provides varying degrees of benefit for any operator. However when all are incorporated into a terminal's approach to planning, managing and optimising for continuous improvement, exponential benefits can be realised.

BUSINESS PROCESS AUTOMATION

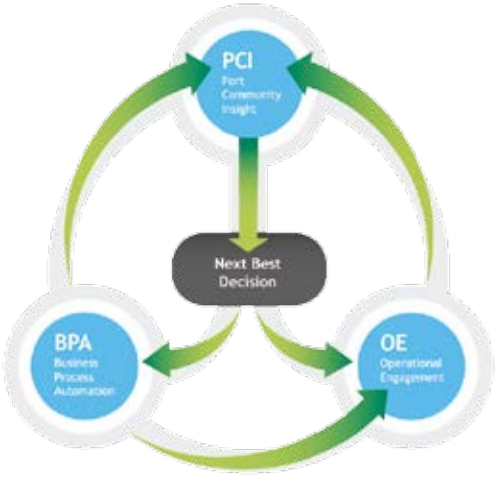
With the dawn of computers, the storage and processing of data has become streamlined. Businesses of all kinds now rely on enterprise resource planning (ERP) and/or operating systems to take care of key business processes such as financials, payroll, CRMs, HR, order entry and inventory management. As company information is increasingly stored in databases and interconnected systems, businesses also rely on these systems for integrity, security and governance.

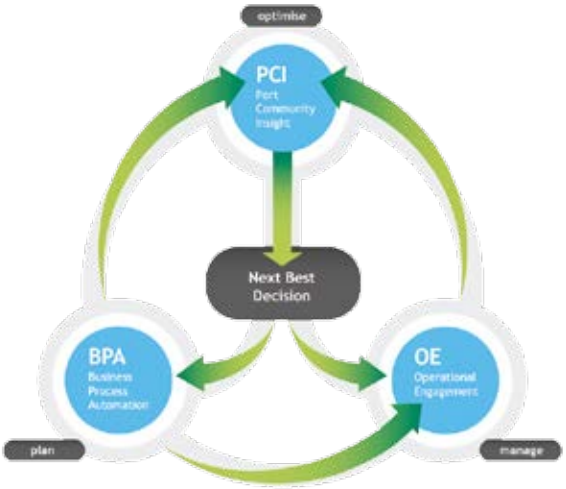
Each stakeholder in the supply chain has countless business processes. As processes are analysed and improved, some at least will be ripe for business process automation. Once the potential for automation has been discovered, the key is to try and automate a process as quickly as possible.

PLANNING THROUGH BPA

Any operator that uses technology to tap into the benefits of business process automation is immediately improving their planning processes. Terminals are able to plan capacity, labour and maintenance to improve truck turnaround time, security and container handling.

BPA when processed via a TOS allows electronic messages with information about a container and its contents prior to any truck and container arriving at a terminal gate. Therefore, the BPA system





validates information before a truck and container arrives at the terminal. Entry is automatic if all paperwork is in order.

OPERATIONAL ENGAGEMENT

Customer-centric business practices are being adopted widely across industries because that is what the customer wants and ultimately what brings you success. A customer-centric approach delivers information in a meaningful way, often in real time. It takes into account the needs of the individual customer and not just a segment.

A true example of how merely segmenting customers simply doesn't work is the example of a terminal that only allows hourly timeslots for pickup/drop off of containers regardless of how many containers a transport operator has for one customer. For example, most transport operators have 1-10 containers per customer, but in the event a large importer has 50-100 containers the transport operator needs another efficient approach.

This is actually a great illustration of the pitfalls that can come with business process automation when it's not accompanied by operational engagement. For businesses to survive and thrive, technology solutions must be able to be configured and adapted to suit the needs of the customer.

Operational engagement delivers a collaborative edge in a globally competitive environment. Solutions that leverage the BPA, customer-centricity , collaboration and integration internally, as well as in interfaces with other businesses (B2B), is enabling the

customers to achieve their unique needs and no longer restricted to the limitations of a single process.

OPERATIONAL ENGAGEMENT AT PORT TERMINALS

In ports and terminals there are many opportunities to improve business success through operational engagement. A clear advantage arises for terminals that transition from appointment schedulers to more sophisticated port wide vehicle booking systems to manage the cargo drop-off and pick-up. This provides transport operators access to all container and vessel information in one place as well as a full suite of container management features to manage their jobs. With improved truck utilisation and the ability to guarantee truck turn times, the advantages are compounded by the ability to access via multiple devices and channels, from websites, SMS and email, through to mobile devices.

This approach requires collaboration and real-time information sharing to provide a seamless experience for the customer and improved management opportunities for the terminals. Each terminal maintains its own database and is also able to access information that enables better planning for resources and terminal capacity management, minimising re-handling and keeps labour costs under control.

PORT COMMUNITY INSIGHTS (PCI)

It is impossible to take all variables into account without the use of integrated and cross-functional systems and technologies. Technology alone takes us part of the way to the next best decision via BPA and integration and data sharing through Operational Engagement brings us closer. The circle is then completed with analysis and feedback via Port Community Insights, gleaned from data captured during Operational Engagement and transactional data captured and recorded during day-to-day operations.

Port community insight systems facilitate gathering, mining, organising, transforming, consuming, and analysing diverse sets of data with statistical modelling tools to detect patterns, report on what has happened, predict outcomes with a high degree of confidence, apply business rules and policies, and provide actionable insights.

INTEGRATING PCI INTO EXISTING SYSTEMS

Integration of Port Community Insight (PCI) into business processes can be achieved in various ways depending on the state of the current decision-making process within the enterprise. Three approaches to integrating PCI into existing systems could include:

1. Incorporating PCI into the decision-making processes by extending the current decision-making process that might include BPA and Operational Engagement
2. Use the insights provided by PCI to adjust business logic to enhance current decision-making processes and improve performance
3. Use data and insights collected and identified by PCI to extend BPA and Operational Engagement application processes to more decision areas

A phased implementation of PCI enhances existing decision processes based on Operational Engagement and BPA, creating a loop of continuous improvement and optimisation without requiring a major transformation.

NEW PRODUCTIVITY OPPORTUNITIES

Port Community Insights enhance Operational Engagement when terminals gain a broad insight into the background and behaviour of shipping lines and transport operators. This knowledge helps in devising planning strategies.

Terminals now have valuable insights into the behaviours of transport companies and shipping lines, and this allows them to use predictive analytics tools to ascertain what will happen in the near future to prepare themselves.

SUMMARY

BPA generates value by automating processes for cost effectiveness and efficiency. Operational Engagement systems ensure your business is focusing on collaborative practices and a customer-centric approach. OE consistently provides new opportunities to capitalise on the value in BPA.

Port Community Insight (PCI) provides feedback into port and terminal systems, generating a loop of continuous improvement, based on data captured during Operational Engagement and transactional information being stored and managed via BPA.

RESULTS SO FAR

Ports and terminals that have applied one or many 1-Stop services aligned with this model of productivity have experienced enormous cost savings, increased capacity by operating differently and also inceased revenue as they become the port or terminal of choice. Some of these results are:

- Importers, exporters, freight forwarders, transport operators and terminals have gained more certianity in how they operator and can rely on consistent and efficent truck turn times and service levels
- Terminals have been able to flatten peak period demand with labour and equipment across 24 x 7 operations
- 2 to 4 hour queue times to mostly no queues at the terminals.
- Truck turn times at some terminals were reduced from 91 minutes to 37 minutes (and in some cases as low as 15 minutes averages)
- Terminals moved to auto-gates with complete validation that incudes container, truck rego, driver and time zone booking
- Terminals in South East Asia experienced a 20% increase in truck servicing and a 30% decrease in dwell times in the first 2 weeks of operation
- Trucking companies are experiencing up to 5 times more utilisation per truck
- The import and export community is able to clear cargo more quickly through a community payments platform that links to shipping line and terminal systems for the immediate release of cargo
- Container reuse allows shipping lines to experience a 33% saving via triangulation and virtual container parks features

ABOUT THE AUTHOR

Michael Bouari is Chief Executive Officer of 1-Stop Connections, an Information Communications Technology (ICT) solution provider that is connecting and automating the port community. Michael has over 19 years' experience in B2B technology solutions for the supply chain and freight and logistics industry.

ABOUT THE ORGANISATION

1-Stop is a globally recognised leader in innovating and delivering integrated solutions to increase productivity for the Port Community. 1-Stop is committed to working collaboratively with all members of the community to deliver efficiency gains for everyone.

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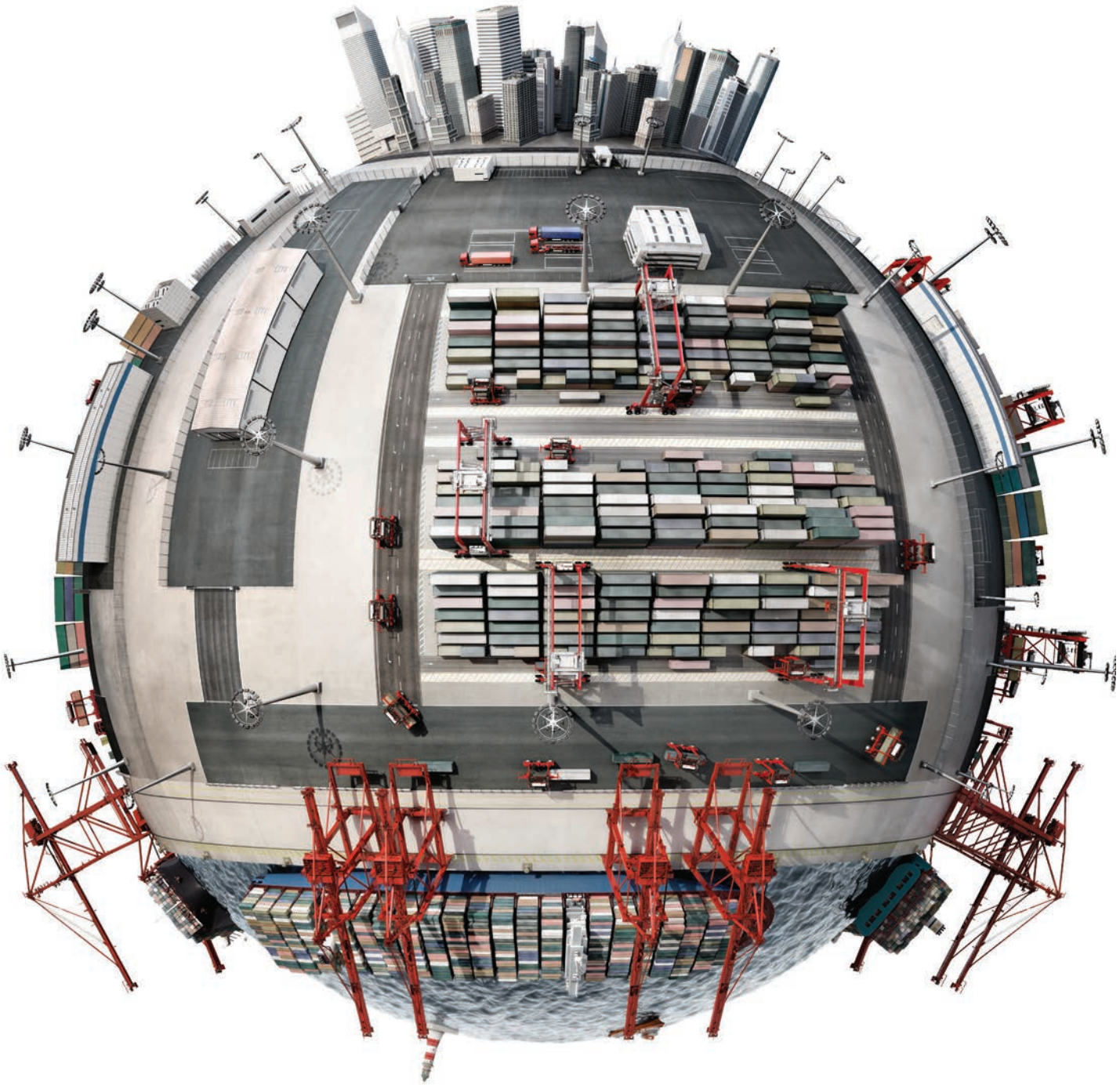

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KALMAR

THE REALITY OF AUTOMATION

AUTOMATING TODAY'S REALITY

Richard Hepworth, Managing Director,
Trelleborg Marine Systems, Dubai, UAE

Shipping, it goes without saying, is a critical industry within the rapidly evolving global economy and one that will be impacted hugely by the evolution of technology. Whilst the shipping industry is a notoriously conservative one, it is not immune to the advances of technology and we cannot avoid embracing it. If current industry players don't, others will, and we could risk losing our relevance and be replaced.

At the same time, shipping itself is already evolving in other ways. Broader alliances between shipping lines has created a 'Power Four' of 2M, Ocean Three, G6 and CKYHE; giving individual companies within each alliance the benefits of larger, more cost-effective networks (allowing them to pool and use their largest and most efficient vessels). Vessel sizes themselves continue to increase, with fewer ports able to accommodate them, and increasing concerns about how they will.

Of course, these factors are creating new demands on ports, which increasingly need to compete to attract 'super' shipping lines. Super ships need super ports, with enhanced physical infrastructure and technology to support them. In turn, the new breed of super ports will require new technologies and skillsets to establish a foothold in the new world of shipping and thrive.

That's where automation makes its entrance, as ports and terminals look towards automated technologies to cope and compete in this increasingly complex landscape.

Promising all the benefits of safety, reliability, efficiency and reduced human error, automation aims to speed-up loading and unloading and allow ports to quickly process the increased throughput that super shipping lines, and their super ships, will bring with them. It is clear there is huge opportunity in raising port efficiency, with 45% of all container vessels currently delayed by over eight hours upon arrival.

Whilst we're at the beginning of the transformation curve, with stakeholders across the industry beginning to take the concept and benefits of automation more seriously, ports, terminals, shipping lines and their suppliers need to start to take practical steps now to enable the 'Port of the Future'.

NAVIGATING A DATA LAKE

Accommodating automation, and ensuring it is effective, will require a fundamental shift in the way many ports and terminals approach operations. At the heart of automation is data; its capture, analysis and, most importantly, its transformation into actionable insights. If ports are to evolve to compete, they will need to put data at the heart of operations, using it to inform real time and strategic decision making, as well as offering the opportunity to remove 'best guesses' thanks to robust data sets and machine learning.

Given the hugely conservative nature of the industry, and the fact we've really evolved relatively minimally in the past 50 years, this will require a significant shift in

The smarter approach

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mindset. In fact, long-established facilities, shipping lines and suppliers will need to adopt a 'start-up' mentality to ensure they don't get left behind. Doing the same old thing will inevitably mean becoming irrelevant and potentially being replaced. The new business currency is data: it's time to collect it, and learn how to use it. If you're in the shipping business, you're now in the technology business.

A key facet of this is access. To drive up efficiencies throughout the whole supply chain, there are multiple stakeholders that need to be kept informed in real time. Data access needs to be democratised: to be available consistently and securely. We require a shipping data lake, a repository with the ability to handle millions of tasks and access requests at once. Within that, stakeholders will need their own data lakes, as well as collection and management capabilities. This clearly requires new infrastructure and skills that many currently operating in the industry simply don't have.

With that said, I spoke to futurologist Gerd Leonhard recently, who raised the point that, in the future, access to data will be more important than the ownership of it. Ports, terminals, shipping lines and suppliers, will all share and exchange their data within a common platform, one that's accessible by everyone. In turn, those that upload their data will benefit from having access to everyone else's. This strongly collaborative structure is one that may seem like a huge step to take. Again, the industry will need skills and infrastructure that we simply don't currently have. There will have to be a fundamental shift in the market mindset, we will have to adopt a 'fast fail', start-up mentality and commit to a sharing economy.

In short, the future isn't about doing one thing well, it's about connecting to everybody around you that is doing adjacent things well. This will mean forging mutually beneficial relationships with clients and the potential for new forms of joint ventures with competitors and start-ups. In this context, it will be interesting to see how industry bodies evolve, since there will be democratised access to open source data, and hyper-collaborative ports and terminals that are looking to each other for guidance and best practice.

SUPPLIER SUPPORT

Suppliers will also need to find ways to evolve their offerings and business models to support the Port of the Future. They will need to move far beyond simply manufacturing and supplying products. They will need to be able to offer services in four ways:

- Objects: We will still require physical infrastructure and suppliers to supply it. However, equipment needs to become smart, the pieces that make up a port will increasingly have to communicate with each other. This will require a dedicated communications network, the foundation on which data management, information sharing and collaboration will be built
- Data: Ports and terminals will need to be able to collect, standardise and manage data. They will need to be able to make it useful, in turn, this management of large volumes of data will require more robust IT infrastructure
- Data as a service: As well as being able to collect and manage data, stakeholders will need to be able to offer it back to customers in a useful, insightful way. This will require treatment and analytics expertise, and data management support, which will require software development and port operations expertise
- Integrated solutions: The 'objects' that suppliers supply will no longer be enough, they will increasingly become commoditised, so suppliers need to add value in other ways, in assisting with integrated planning, holistic optimisation, collaboration and advanced integration amongst ports. This in itself will require software and ocean supply chain expertise

IMMEDIATE EVOLUTION

Shipping is ripe for disruption, and we need to evolve immediately. We're already seeing huge change in certain places – take the obvious example of the Port of Rotterdam and its fully automated container terminal. Other facilities need to act now to keep up. As suppliers, we're only too aware of the need to support them.

For our part, we're starting to look at how we can evolve our business model and our offering so that we're best placed to support the Port of the Future. We've begun by building on our current core competencies, which span from vessel approach, through docking, mooring, transfer and departure.

We're focusing heavily on systems integration and data: two key components that we believe will help us support even the most progressive port owners and operators in the future. We're looking at how we can evolve our current offering to elicit data driven insights that will prove valuable to our customers in future and we look forward to sharing more of our strategy as it evolves.

ABOUT THE AUTHOR

Richard Hepworth is a Chartered Mechanical Engineer, having studied for his degree at the University of Manchester Institute of Science and Technology and now holds the position of Business Unit President for Trelleborg Marine Systems, based in Dubai. Richard has over 20 years' experience working in the offshore and marine construction industry and has held a number of roles both within Trelleborg and other large engineering companies in this sector, covering engineering, project management, sales, business development and general management.

ABOUT THE ORGANISATION

Trelleborg Marine Systems designs, manufactures and installs bespoke fender systems, docking and mooring equipment, oil and gas transfer technology and vessel efficiency technology for marine environments all over the world. Trelleborg works with specifiers on a project by project basis to determine best fit solutions and supply fully integrated systems to fulfil even the most demanding specifications. Whether the project calls for equipment for a single berth, or an entire port, in-house design coupled with manufacturing and installation expertise ensures operational performance is maximised and long term maintenance is minimised – keeping whole life costs low.

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ELECTRIC HORIZONTAL TRANSPORTATION

IN CONTAINER TERMINALS

Interest in electric horizontal transportation at terminals is growing rapidly. At terminals utilising automated stacking cranes (ASC), the options are the automated guided vehicle (AGV) or the shuttle carrier, either manually operated or automated. As container movement between the quay and container yard is a potential bottleneck, the Kalmar FastCharge shuttle carrier offers a major advantage by fully decoupling activities at both ends. This concept provides greater added value depends on the characteristics and requirements of the terminal.

INTRODUCTION

In recent decades, container volumes handled worldwide have grown dramatically. Larger ships place a heavy demand on terminal infrastructure, and fast loading and unloading requires close cooperation between STS cranes and the container stack. For many years, the straddle carrier and terminal tractors were the default options for horizontal transportation, with straddle carriers also capable of handling stacking.

HORIZONTAL TRANSPORTATION

In the 1990s, the flatbed AGV was the first driverless horizontal transportation system at terminals. Today, the high productivity of STS cranes can be limited by the AGV's need to be present to load and unload containers. Generally, each STS crane requires a minimum of five AGVs.

The ideal decoupling buffer is created by placing containers on the ground at the interchange area next to the STS. By decoupling the STS and ASC, one shuttle carrier can achieve the same productivity as two AGVs.

The Kalmar shuttle carrier can transport single 20 foot and 40 foot containers as well as two 20 foot boxes in twin-lift. With the ability to pick up any container rather than only the outermost, and to stack containers two high, the AutoShuttle enables fast decoupled transfers, especially when serving more than one STS or in dual cycle operations with simultaneous loading and unloading.

HYBRIDS

AGVs and shuttle carriers currently offer electric driveline with diesel as the main power source. Diesel/electric has also seen the introduction of hybrid designs, allowing smaller engines with batteries or super capacitors supplying peak capacity. New battery technology allows the engine to be sized for average power. These designs also feature regenerative energy systems can convert braking and spreader lowering energy into electric power that is stored for later use.

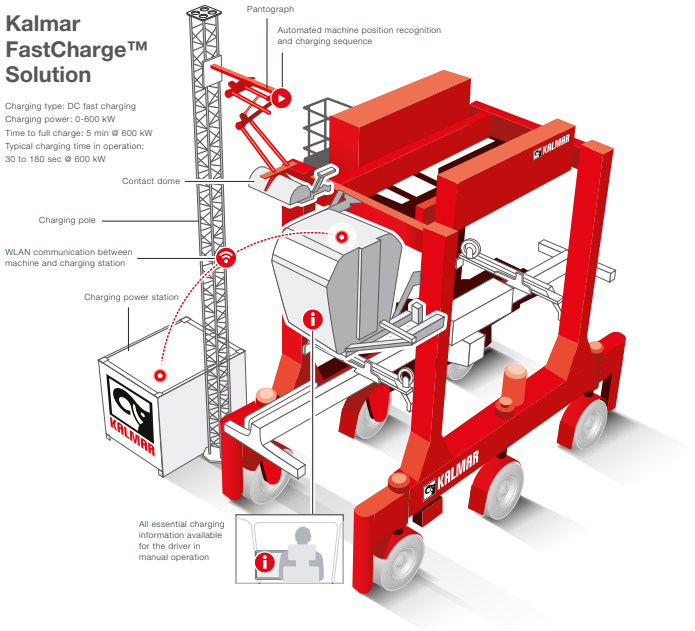
WHY FULLY ELECTRIC?

While hybrid systems provide excellent economy and reduced emissions, the ultimate target is emission-free (at least at the point of use) horizontal transportation. As legislation becomes more stringent for CO2 and NOx, electric driveline with batteries is the only alternative. Further advantages include less noise, reduced maintenance with fewer components, and up to 50% increased energy efficiency.

THE FULLY ELECTRIC AGV

Commercial usage of electric AGVs has been limited by the cost of batteries and charging facilities. AGVs require almost 10 tons of lead-acid batteries to provide an operational time of eight hours. Actual runtime is considerably less. One study quotes an average operational stoppage or unpowered waiting time of 36 minutes for each hour. Recharging involves removal and replacement of the battery, which requires the AGV to be driven to the exchange station. As recharging takes over six hours, at least three battery packs are required for every two AGVs.

Development of the all-electric AGV required a redesign of the vehicle chassis to accommodate the weight of the batteries. Newer designs based on fast charge technology have been announced, but details of operation have not been disclosed.



NEW TECHNOLOGY BATTERY

Lithium-ion batteries, introduced in the 1970s, have seen a steady progression in performance and capacity, with recent developments enabling extremely fast charging. In electric buses, high-charging capability can partly recharge the battery in as little as 15 seconds. Compared to lead-acid, Li-ion offers up to 80% weight savings for the same capacity and has better low-temperature performance. Li-ion technology is also safer than the alternatives.

The higher cost of lithium-ion batteries in a fully decoupled shuttle operation is offset by less vehicles required compared to an AGV setup. Whether using a battery station or fast charging, twice as many AGVs are required to achieve the same number of moves as the shuttle.

FULLY ELECTRIC POWERED FASTCHARGE SHUTTLE / STRADDLE CARRIER

Fast charge batteries have allowed Kalmar to replace the diesel engines in shuttle and straddle carriers without a weight penalty, offering tremendous advantages in a proven vehicle design. Experience of the batteries already utilised in Kalmar's hybrid straddle carrier enabled to optimise battery capacity and supplement onboard charging with regenerative energy systems. Available in both manually operated and automated carriers, Kalmar FastCharge offers a highly flexible concept for both existing and greenfield terminals. In hybrid terminals, where ASCs are being introduced gradually, FastCharge enables expansion while retaining fully decoupled container transfers.

FAST CHARGING

Charging of the Kalmar FastCharge AutoShuttle is achieved with a pantograph system, fully automated and similar to that on electric buses. The technology enables very high charging rates at up to 600 kW with rapid on-board charging. Since driving cycles are short, frequent 30-sec charging periods do not slow container transfers. Pantograph charging stations can be more easily positioned than battery exchange stations at convenient locations along shuttle working routes.

ELECTRIC AGV VS. FASTCHARGE

In most terminals, one FastCharge AutoShuttle is capable of the productivity of two AGVs. The reduction in vehicles compensates for the higher cost of the FastCharge solution, with additional savings when the AGV charging stations are taken into account.

AGVs are dependent on the robotic charging station. Owing to the heavy batteries, the station requires substantial foundations. Compared to a battery station for 30 AGVs, the cost of the FastCharge station for 15 equally productive shuttles is approximately 80% less when building costs are included.

The FastCharge AutoShuttle uses a tried and trusted vehicle design. Proven features of existing shuttle carriers are used in the FastCharge model. The lifetime of lead-acid deep cycle batteries is generally 400 to 800 charge cycles. One AGV manufacturer promises 1,200 cycles, with the recommendation that almost 10 tons of batteries per AGV are replaced every 2.5 years. By comparison, fast charge battery manufacturers quote as many as 20,000 cycles, which conservatively equates to a 10+ year battery lifetime in the FastCharge solution.

Space is valuable in terminals. The increased manoeuvrability of the AutoShuttle allows for higher productivity and maximum land usage. AGV terminals need waiting bays on the apron to ensure a sufficient number of AGVs to maintain STS productivity. AutoShuttles do not require such spaces, and the smaller fleet reduces traffic congestion.

CONCLUSION

When selecting horizontal transportation for a terminal, conversion to an all-electric solution needs careful consideration. When calculating the total cost of ownership, new factors need to be taken into account, in addition to old criteria such as the type and number of vehicles, which can take on a new meaning in the green terminal. Decoupling ship-to-shore and yard operations allows equipment to operate at its best performance, improving throughput. New battery technology is under rapid development, helped in part by its ready acceptance in public transportation.

ABOUT THE ORGANISATION

Kalmar, part of Cargotec, offers the widest range of cargo handling solutions and services to ports, terminals, distribution centres and to heavy industry. Kalmar is the industry forerunner in terminal automation and in energy efficient container handling, with one in four container movements around the globe being handled by a Kalmar solution. Through its extensive product portfolio, global service network and ability to enable a seamless integration of different terminal processes, Kalmar improves the efficiency of every move.

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APM Terminals


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MORNING

The morning sessions will focus on defining automation and breaking the concept down into five distinct areas:

- Misconceptions of Automation
- Process Automation
- Automated Decision Making
- Full Automation through 'Robotisation'
- Terminal Automation of the Future

AFTERNOON

In the afternoon sessions we will explore the lack of investment in training port and terminal workers.

There is a real need for the increased use of simulation training tools and to provide better learning environments that can reduce inefficiencies, and ultimately, save a terminal millions every week.

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