

Container handling – a new order

Not science fiction or fantasy, container-handling cranes are becoming increasingly intelligent, capable of making more decisions by themselves instead of following commands from above. It's time for the industry to challenge the current order.



UNO BRYFORS
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“We started to look into how container handling in the terminals can be made more efficient and found that by adding real-time information to the equation, we are moving towards intelligent automation. This allows optimisation of container flows and reduces the risk of dependency on one centralised system,” says ABB Ports Senior Vice President Uno Bryfors.

ABB Ports has been working with intelligent automation for some time now, allowing cranes to distribute work between themselves, and to proactively interact with vehicles to optimise terminal productivity. “We are moving forward on machine intelligence, and we will definitely see more happening in the near future,” he explains.

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Automation forms the basis for employing smarter machines, Bryfors notes, adding that port automation is on the rise, but with plenty of room to grow: “The deployment of crane automation, and gate and terminal process automation is now accelerating in all parts of the world. Today 6-7 per cent of the global container volume is handled by automatic stacking cranes, a share that will double when all ongoing projects are completed and in full production. Many ship-to-

shore cranes are delivered equipped with remote operation for automated, unmanned operation.”

But the lifetime of the cranes has an impact on the speed of change: “With an expected lifetime of more than 30 years, it will take some time before the majority of the world's fleet of 5000-plus STS cranes is automated,” he says.

Bryfors emphasises that the concept of intelligent automation is still new to the industry. Traditionally, the terminal operating system (TOS) has orchestrated all equipment and container moves, deciding which tasks to perform and how they should be carried out. “It is much better that TOS tells the machines what is to be done, and let them decide in which sequence the tasks should be performed.”

In a terminal with dozens or even hundreds of automated cranes and vehicles, Bryfors points out that it is impossible to coordinate everything and to achieve the best possible productivity. “With so many units, we need distributed intelligence. This gives machines the ability to adjust their behaviour according to a given situation, and to get the work done in the optimal, most efficient way.”

Bryfors clarifies that although machines are acting autonomously, they are not without supervision and control: “The role of humans



Uno Bryfors in the Terminal Simulation Studio at ABB Ports' facilities in Västerås, Sweden

remains vital, although very different compared to conventional terminals.”

He also reports that most customers are increasingly open to automation and intelligent equipment. “The drive in the industry is for productivity. Bigger ships are putting more pressure on the terminals. They need to handle more containers per call, and the terminals prefer doing this without adding equipment.”

With an eye to building for the future, Bryfors says that the necessary components are available today: “Now we actually know where everything is in the process. We just have to use that information as efficiently as possible, and there is always room for improvement, even in the most modern terminals.”

Remote remote

The concept of multiple terminals being operated from one centralised control room is the natural next step in remote operations enabled by empowered machines, and Bryfors sees it as a goal within reach. “The distance from the control room to the equipment can be much greater today. This

allows the industry to think in a completely new way, and to bring the work to the people, instead of bringing people to the work.”

He points out that only a few major terminals remain in city centres or in close proximity to downtown, and most have been moved outside cities for practical reasons like space limitations or access to deep water. It can also be financially very attractive to free up existing port space close to city centres. When terminals relocate, workers are left with lengthy commutes to their jobs. Remote operation resolves that problem, in addition to allowing for more flexible staffing solutions.

“With remote operations it is easier to accommodate peaks and valleys in container traffic,” Bryfors says, noting that the same team can serve multiple terminals: “The jobs are pretty much the same across terminals, and resources can be shifted between terminals as needed in a matter of seconds.”

And ticking the box on one of the fundamental goals in ports development, remote operation

gets people out of the dangerous parts of terminals. “Safer, greener, and more productive are our main goals. Automation and remote operation are central in reaching all three of these goals.”

Safety is also linked to occupational health. Remote operation allows the crane operators to be moved from crane cabins to an ergonomic and comfortable control room. For the operators this move is a significant improvement in their working environment, and enables real teamwork. It also allows the operators to continue in their careers to a higher age, and provides a great asset in recruiting the much needed next generation port professional: “The whole industry is struggling with a shortage of labour, and remote operator jobs have been proven to be more attractive than those on the cranes.”

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Automation, remote operation and the concept of multiple terminals operated from one location not only open for new operating models for big greenfield terminals; existing terminals of various sizes upgrading their ability to serve bigger vessels, resulting in increasing yard activity and land side traffic, can also benefit from these solutions. “We now see several existing terminals automating parts of their operations, with a step by step approach. It is important to select the approach that fits the terminal’s strategy, capacity and the remaining lifetime of the equipment”, Bryfors says.

Getting greener
With improving battery and fast charging technologies, Bryfors feels confident that all-electric terminals are the future. “By 2030 all major ports in California must be emission free, and the first zero emission terminal is already in operation in Rotterdam. Looking 15 years ahead, I believe there will be no diesel powered equipment or vehicles in larger terminals.”

Thinking inside the box
Not just concerned with moving containers, Uno Bryfors and his team have done some thinking about the boxes themselves, asking: Has everything that can be, been put into containers?

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“More of everything is going in containers, and that allows ships to be more flexible, and less specialised. But containers also represent a limitation, with basically only three sizes to choose from. What may be needed are more specialised containers, not just bigger.” Fitting more freight into containers would allow the transportation industry to utilise existing infrastructure more efficiently, he argues.

Another shift in transportation might be back to speed. “The priority may shift from low cost to higher speed. With all the investments in accommodating larger ships and the time it takes to service them, costs may not have come down at all. Affordable higher speed transport may be the new differentiator, but it will require new ways of thinking and even more flexibility, for example in terminal operations.”

But will ships keep getting bigger? Bryfors notes that the biggest ships on order are really no bigger than the biggest ones sailing today. “That is a pretty good indicator that the perceived limit is being reached.” Bryfors observes that more big vessels will be delivered in the next 2-3 years for the Asia–Europe and North America–Asia routes, bringing the average ship size to 18 000TEU* and over 13 000TEU, respectively. “Once completed, there will probably not be a need for more big ships for quite some time,” he concludes.

More ships making more calls also give greater flexibility, a factor high on the priority list of cargo owners. “The number of port calls defines the number of opportunities to book transportation. With the bigger ships, if you miss one opportunity, the next one might not come along for days, or weeks.”

*1 TEU = 20 foot = 6 meter long container

Virtual terminal reality
“The virtual terminal is here,” Uno Bryfors confirms. “We can now run a terminal in a very realistic way without the real equipment. This brings many benefits enabling efficient project execution and system integration, as well as operator training, without tying up hundreds of millions of dollars in assets.”

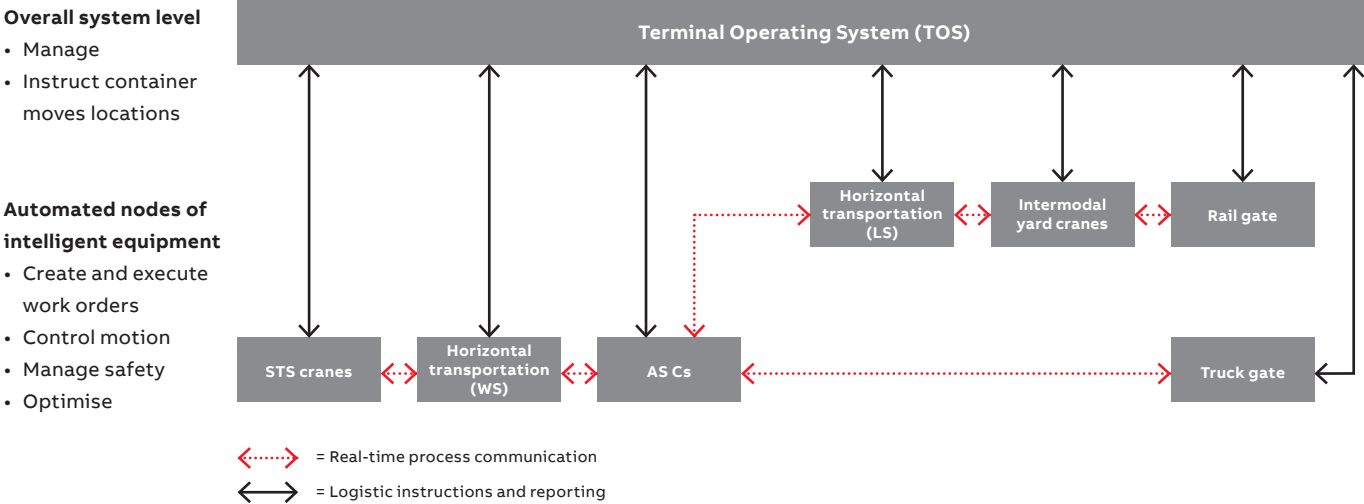
The simulated cranes and machines are interconnected, and these intelligent connections enable a terminal team to train on a terminal with empowered machines working together. All types of scenarios can be run without endangering humans, equipment, or cargo.

“We are not just training, but experimenting and testing. With simulated ships, ship calls with all their work orders, and the terminal, we can really see the interaction between the team and their terminal. Now we can learn about the real exceptions, the consequence of the consequence.”

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Expect the unexpected
Rounding off, Uno Bryfors has some thoughts about the place of ports in the entire logistics chain. “Environmental issues are important in pushing the development of container shipping and terminals, but also consolidation is driving change in the industry. We are seeing clear ties between terminals and shipping lines, and that could bring on many changes.”

With the industry converging around fewer players with more control, who will be driving future developments in the industry? “It’s hard to say exactly. It may be the shippers, the shipping lines, or the terminals. Amazon is one example of how a shipper could take control of its whole supply chain, and we see other developments impacting the industry too. The one thing we do know, is that the probability of things changing fast is much higher today than it was just a few years ago.”



Node automation architecture based on distributed intelligence