



10 PRE-REQUISITES FOR SMART TERMINALS

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READ THE FIRST 10 PRE-REQUISITES PAPER

In 2018, the first version of this paper was published, reflecting on the technologies that bring value to ports and terminals, yet also reviewing the level to which these technologies have been adopted. The conclusion then was that despite the vast availability of technologies, few have been widely applied, and many are looking for problems to solve.

The buzz today is centred around 5G. If the discussion is not about the suspected loopholes in Huawei’s technology, then it is focused on the enormous potential 5G offers for almost every environment. Once again though, is it a technology seeking a problem? 4G is already quite fast and has

been applied across terminals as a viable alternative to narrow band or WiFi. Due to the price drop of access points, 4G and 5G will address a problem in container terminals: real-time connectivity of equipment without latency. However, the harsh conditions encountered in terminals – an outdoor environment, steel everywhere, large structures, impact of vibrations, wind and clashes - make it complicated to get a stable and reliable signal to all moving equipment. The 5G technology requires even more access points than 4G (due to the higher frequency), yet can also be powered more, creating a stronger signal.

ASSET MANAGEMENT AND CONTROL

Enabled by 5G networks, real-time tracking of equipment and containers becomes feasible. This means that not only are all assets’ locations visible, but their technical status can be reported and made visible in the control room in real-time. The redundancy of connection points will not be a deal-breaker due to the acceptable pricing of the technology. For automated equipment as well, which requires a fail-safe and continuous communication, 5G provides a much better foundation than common WiFi connections. Due to the higher bandwidth and lower latency, delays in automated processes while communicating

Generation	Typical download speed	Technologies	LATENCY
2G	100 kbit/s	GPRS, Edge	0.5 S
3G	100 kbit/s- 8Mbit/s	UMTS, HSPA	0.1 S
4G	12 Mbit/s- 60 Mbit/s	LTE	0.05 S
5G	Up to 10 Gbit/s		0.001 S

with the central control system will be reduced to insignificant levels, enhancing the productivity of the machines.

Remote error handling and remote container placement will also become easier, due to high definition streaming of camera data. The reduced latency (resulting in lag of the movement after a remote input) will also be reduced even further, so that remote control becomes more natural and, as a result, faster.

WHAT ABOUT THE OTHER TECHNOLOGY TRENDS?

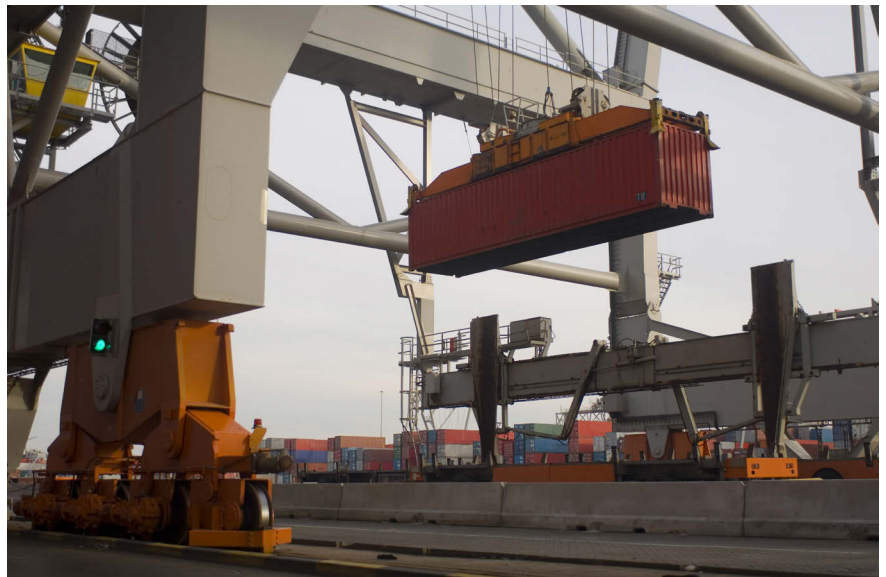
The word is not yet out on blockchain and, despite a true hype two to three years ago, it remains an underdeveloped technology. The complexity of implementation, due to the vast number of stakeholders required to make it work on a global scale, forms a barrier to the fast roll-out of this solution. How about artificial intelligence? While it is still a buzz word getting lots of attention, we are yet to see it really achieve a breakthrough in the maritime industry. Even when it is utilized in dedicated areas, such as predictive maintenance, one finds handling the vast amounts of collected data difficult, let alone deriving useful, reliable and predictive data from the pile of bits and bytes. Last but not least: the digital twin. Here we see adoption by some of the large equipment suppliers, developing digital twins of their equipment to facilitate the design and testing phase.

What is the current status then of the solutions we identified in our previous paper on smart terminals? We have tried to reflect on the changes, by marking each in 3 categories: less deployment, same, and more deployment.

1. CONNECTED TO THE OUTER WORLD – MORE

Although one would expect that all of the information sent to terminals is delivered in standardized digital formats, the reality is far from that. Timely data availability, data quality, and digitization are all problematic, leading to large inefficiencies in terminal operations and affecting the service that terminals provide. In many ports around the world, initiatives are taken to make the information accessible to all parties, yet there is resistance from certain stakeholders who believe their position may be weakened or even disappear if information flows freely.

Today's question is who gains control over the supply chain: large producers, whole sellers, 3PL suppliers, shipping lines, terminals, or consumers? Many platforms are launched, trying to become the travel agent of the container supply chain, or a centralized platform for buying goods. The verdict has not been delivered yet, but it is an area of large development. In all likelihood, terminals will not play a dominant



role in controlling the supply chain. Instead, we expect their role as physical hubs - for handling large ships, but also fine distribution towards the end consumer – to increase.

2. CONNECTED TO ALL ASSETS – MORE

Terminals are a collection of high-value assets, yet real-time information about the assets is not readily available to enable intelligent control. In most cases, there is some information locally available, but not centrally, and certainly not across the entire fleet. It is scattered, has no standard structure, and is often incorrect. The technology to enable this is there- especially with the support of private 4G/5G networks - and in a large portion of equipment that is already available. Besides this, the maintenance of all the on-board technology is typically a problem. Regular calibration of sensors (e.g. weighing sensors) is required to make sure the information coming from the machine is accurate and reliable. This is not yet standard practice though, largely because the actual use of the information is limited and defies the purpose of proper maintenance.

3. CONNECTED TO ALL STAFF - SAME

As important as connectivity to the physical assets is connectivity to human assets in the field, as this ensures people are removed from danger (think of location detection, or proximity sensors), as well as information in real-time to perform actions efficiently. Instead, people are often sent around to record information on paper that will be processed later. This, remember, is taking place in a time when almost everything can be accessed through smart-phones.

We could even think one step further here into augmented reality (now accessible through technology like the Google Glass) so that operators get immediate visual information while keeping their hands

free. While the possibilities are there, the maritime industry has not witnessed many developments when it comes to connecting people with intelligent sensor technology, although 5G may prove to be a game changer in this area.

4. REAL-TIME, HOLISTIC PLANNING, CONTROL AND OPTIMIZATION – SAME

A terminal consists of a series of interlinked, highly variable processes, hence dynamic, real-time planning and control is essential to be efficient. There are many planning, scheduling and dispatching tools in the market to assist and provide decision-making support, yet there is great resistance – especially from operators – to use these tools. On the one hand there is a degree of job protection behind this, but also lack of insight into the benefits. The efficiency gain does not come from some reductions in planning and dispatching staff, but by operating in a better way outside. Here the real expense is being spent on machines, fuel and labour. The rate of change, in terms of planning, scheduling and dispatching inside container terminals, is still slow, and even with the introduction of new technologies there are few changes to report.

5. REAL-TIME MEASURING OF KPI'S – MORE

In order to improve, one needs to know what's going on. Hence, the performance of the operation should be measured continuously, and to a great level of detail. Only then can you really explain the peaks and troughs of performance. Only measuring STS productivity, for instance, does not provide sufficient insight. Also, the circumstances affecting performance must be gathered so that a complete picture can be formed. Yard occupancy, gate volume, driving distances, and number of unproductive moves should all be monitored.

Some initiatives have been launched to gather information from various sources and create real-time insight into the state of equipment, its performance, and utilization levels. This is typically driven locally by terminals, which are creating data-warehouses and connecting TOS, maintenance systems and equipment to make sense of collected data. True success stories, however, are still limited.

6. CONTINUOUS ANALYSIS OF PERFORMANCE (KPI'S) – SAME

When all this measurement is in order, there is a solid basis for analysis; just gathering the data serves no purpose. It needs to be turned into insight and then knowledge so that the actual control improves. The cycle of measuring, analysis, and action should be continuous, so that the learning cycle also reacts to changes. Changes in volume, dwell times, truck patterns, or just the arrival of a new vessel service are likely to require adjusting operational strategies.

In this process, it is also key to make a record of implemented changes. While most changes in strategy will only have effect over a longer period of time, there will be cyclic, and independent factors - such as seasonal patterns – that have an influence. These effects must be taken into account when analyzing the result of change. In any case, a first, solid KPI measurement needs to be in place, with the real use following after once stable platforms have been established.

7. TRAINING AND CERTIFICATION OF STAFF – MORE

Having a serious training programme, for both on-boarding and to enhance operating skills, is a key factor in operational performance. Even though most operators are conducting or setting up training programmes, certification of the control room staff is still rare; our findings across more than 25 terminals (>250 planners) show the difference between worst and best planners to be as high as 50% (measured in resulting berth productivity).

Testing planners against a calibrated scenario – such as a near-to-live virtual terminal – is a possible way to get people in the right position. The importance of more advanced training tools has also become more widely accepted, albeit not as fast as the industry requires. We have seen quite dramatic results, but also improvements from the use of advanced training tools in the past year.

8. CAPABILITY TO LEARN FROM THE PAST – SAME

Returning to the hype word of artificial intelligence, it could be said that the ideas behind it are new, but the combination of large amounts of available data, and cheap,

cloud-based computing power, brings the ability to recognize patterns quickly nearer to being useful. Still, computers have a tough time recognizing the context of data. The potential is significant though, as the container supply chain is highly repetitive and therefore predictable. Learning about dwell time, pick-up and roll-over patterns may reduce the number of unproductive moves by factors. As terminals are struggling to get well-organised KPI's in place, the regular and consistent use of them remains a struggle as well. Too often, Excel is still the tool being used to analyze data, even with a range of more advanced data analytics tools available.

9. TERMINAL DEVELOPMENT BASED ON A 'MASTER PLAN' – MORE

When we look at how terminals have come about, we recognize that many resemble patchwork. Every expansion is planned when required, without looking at the bigger picture; buildings in the most inconvenient places, height differences, light poles, and roads with illogical routing, are all quite common. Of course, not everything can be taken into account, but we can go significantly further in looking ahead and making a robust masterplan, that withstands change of circumstances to a large extent.

Modelling can greatly help in the assessment of cargo flows, ship sizes, hinterland transportation patterns and dwell times during master planning, as well as acting as a source of reference for future decision-making. Even the consequences of changes parameters can be easily analysed and quantified. Modelling is becoming the standard for new terminals and terminal expansions or retrofits. Across the globe, the default has become that master planning requires in-depth modelling to facilitate decision-making.

10. A SOLID CYBERSECURITY LAYER IN PLACE – MORE

Last but not least, a terminal today needs to have its cybersecurity in order. There is a large degree of data exchange with many third parties, increasing the risk of receiving malware or viruses that can spread to others. The fact that containers carry high-value goods also makes them a potential target of cybercrime. Finding the right container by hacking into the system and setting up an illegal delivery is not a hypothetical scenario. This means that cyber security must be part of the daily IT process; making sure that staff are aware of the risk is key, as people are always the weakest link. It has become obvious that cyber security also needs to be a top priority for container terminals, especially at the board level. Reliance on IT and data, and their responsibility for valuable goods, are simply too great to ignore, yet there remains much to do.

CONCLUDING REMARKS

A quick inventory at a range of terminals during the last couple of months revealed that from these 10 pre-requisites most terminals have not fulfilled most. None of the points mentioned will require large investments, or be too complex to implement, but they do require an ability and willingness to change. In many cases, this only arises when there is a serious problem, such as a damaging cyberattack, or pressure from the outside (e.g. from local authorities) to implement adjustments and efficiency enhancing measures for higher levels of productivity. So, there still a long way to go.

REVIEW TBA IN THE AIS PORTAL

ABOUT THE AUTHOR

Dr Yvo Saanen is Commercial Director and Founder of TBA, a leading terminal design and simulation company in the Netherlands. He is in charge of all port and terminal related projects all over the world in the planning and optimisation process of container terminals by means of simulation and emulation. In this role, he has participated in various projects, ranging from long term development, process improvement, terminal extensions and the redesign of handling systems to design of greenfield terminals. Dr Saanen holds an MSc in Systems Engineering and a PhD on the design and simulation of robotised container terminals, both from Delft University of Technology. He is a Professor at the Rotterdam School of Management.

ABOUT THE ORGANIZATION

TBA is a leading international provider of software and services for ports and warehouses for ports and warehouses with over 150 live installations worldwide. Its product and service portfolio concentrates on marine, intermodal container and bulk terminals. Key services are terminal planning using simulation, support of complex software (TOS) implementations and TOS fine-tuning using emulation tools, as well as the training of terminal planners. TBA is also a leader in equipment control software (ECS) for automated terminals, having supplied the Euromax, APMTMV2 and RWG in Rotterdam, CTA in Hamburg, Antwerp Gateway, and Long Beach Container Terminal with TEAMS - TBA's Equipment Control Software.

ENQUIRIES

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