Automation 'standards': the search for consistency and repeatability

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The implementation of equipment and process automation has been an increasingly important topic in container terminal operations and there are important initiatives driving the market demand to concentrate on automation standardisation. With more and more automated container terminals being implemented, there is an opportunity to standardise the solutions and learn from each other.

The paper seeks to address what the current environment looks like for implementing automation at terminals, the keys to enabling a more professional and agile approach toward system integration, and the main areas that terminals need to focus on for a consistent and repeatable automation implementation in the future

Complexity

An automated terminal operation requires many different hardware and software systems to satisfy various business needs; complexity is a natural outcome. The necessary technical integration is complex and impacts equipment, systems and people. Typical projects have more than 35 interfaces that connect different software systems and pieces of equipment. In addition, automation requires time to develop the designs and concepts that need to be well defined up front and flexible enough for iterative development and tuning.

Navis terminal operating system integration with third party technologies has proven to be critical to meet go-live operational readiness. The number and variety of components involved in automation has created significant challenges to deploying a complete and integrated solution. Some of these challenges include:

- Functional specifications and interaction schemes need to be well defined in advance. The current process involves a time consuming and reactive process for software development that has led to an extended period of additional testing and solution refinement after go-live
- Generic communication channels are needed from/to TOS to/from third party technologies that are clearly defined with standardised data exchange patterns organised by equipment type
- Areas of equipment management need better definition from an operational perspective because the effort to address these areas after the go-live has impeded operational performance significantly

To mitigate the risks of going live with automation, all the components must pass through comprehensive testing during the integration process, prior to go-live. Testing should address
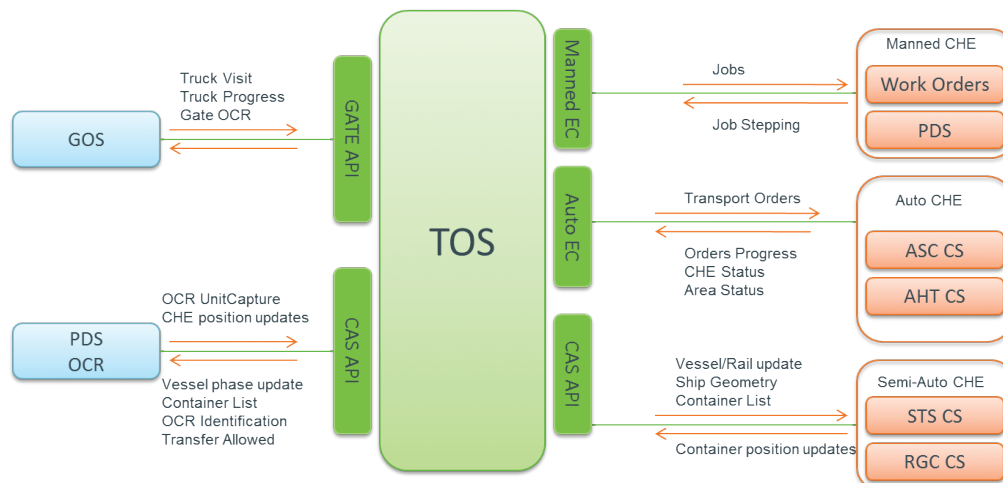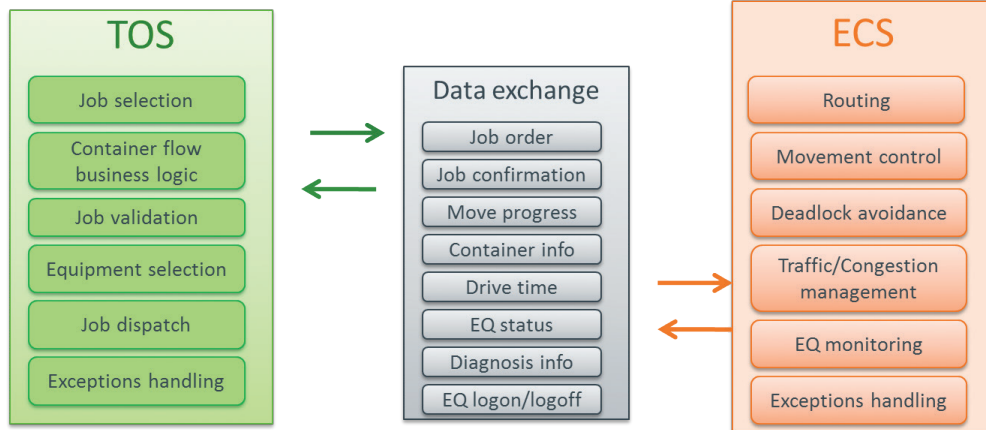
direct operational processes to prepare personnel for exception management with solutions. Qualified personnel should be on hand with consistent processes for testing to figure out root causes of issues and deliver agile solutions. Quality is the responsibility of the entire team.

Standard integration patterns

The terminal automation industry is striving for standards and generic integration patterns on interfaces and interactions, yet there is still a high rate of customisation and configuration that needs to take place for each project, depending on layout configuration, equipment specifications, and so forth. The industry needs to develop a clear definition for interfaces and solution modularity to handle the 'automation puzzle'. It also needs to align the processes that drive specifications, development, testing and deployment with clear criteria for go-live readiness.

From a technical integration perspective, Navis has a clear initiative to focus on standardisation when developing software and delivering services for implementing automation at terminals. Principles to consider that will help with consistency and reliability of integration include:

- The systems not only need to interface, they also need to 'understand' each other, defining clearly:
  o what, when and how the different systems communicate
  o the data involved in those communications
- Flexible and open architecture that will allow:
  o system providers to extend their product capabilities
  o better and proactive communication and interaction between systems
- A modular and de-coupled approach that will:

  o improve the testing and optimisation of the system integration
  o provide data to analyse real operational performance
  o create a long term system framework
- The equipment and operational intelligence that terminal operators are investing in for automation include TOS and Equipment Control System (ECS). These represent the 'spinal cord' of the eco-system at automated container terminals.

TOS-ECS integration

Dealing with the complexity of the system from TOS to ECS to the equipment is one of the major challenges that automated terminals need to deal with. From a technology perspective, ECS software providers are taking a step forward, but the maturity of existing solutions is not where they need to be. ECS software companies are focusing on increasing their software efforts on design, architecture, testing and deployment practices and are seeking to standardise their efforts to reduce future integration complexity and cost.

That said, progress on standardisation will be delayed by discussions on what the TOS-ECS functional split should be. Navis is focused on providing a single optimised logistics solution for both manned and automated terminals within the same technology footprint. This will serve to ease the adoption of automation and clarify the functional split and reduce the technical risk and capital investment.

The technical integration and operational interaction between TOS and ECS is fundamental. While Navis believes that ECS vendors should focus on optimising execution and coordination

of equipment, there are some important aspects to consider that will enable both TOS and ECS to perform their expected functions effectively and in an integrated fashion. This will ultimately impact operational readiness and minimise the time to value, as well as enabling consistency and repeatability when implementing automated systems at container terminals.

The way forward

The following points are highlighted by Navis as the main drivers for improved automation standards:

- Interaction schemes: clear definition for interface and solution modularity. Interactions between different software applications supporting container flows need to be defined upfront and well maintained to support both the basic and exceptional container flows. These interaction schemes must be defined in a modular way to gradually and consistently allow the connection of the different terminal equipment types while commissioning equipment and preparing the terminal for operations with live equipment testing
- Accuracy of the information: system providers must find effective mechanisms to push out data from software applications. This will improve the integration, and, information congruency problems could be solved. Information from real-time planning needs to be used in a consistent way. It is crucial to keep accurate information as move-times, transfer point occupancy or drive times change
- Data Transport Technology: Even though there are different transport mechanisms and technologies that

support various communications between systems, the industry needs to promote the modern data technology and infrastructure that supports automation. While richer and more accurate data will enable real equipment intelligence, technologies providing reliability on system performance, traceability on equipment events and maintainable data consistency will be fundamental

- Optimisation: Navis opened the N4 TOS architecture to include third party software optimisers to perform algorithms as an integrated part of the TOS platform. As such, the TOS is in the best position to perform job allocations utilising a holistic view of the entire operation and leveraging the complete set of operational data and business rules to provide feedback to the planning process and an integrated approach to exception handling

- Standardisation efforts: industry standardisation efforts have been pursued recently by PEMA and they need support to improve software compatibility between TOS providers, equipment manufacturers, automation software providers and the end-users (i.e.

terminal operators). Standardisation efforts must include definition not only on the technical interfaces and on the required data to be exchanged, but also on interaction schemes by equipment type and on testing processes, and alignment of processes to deliver acceptance criteria for operational integration readiness

- Integration management: a more professional and agile approach to system technical integration is needed. Project management with qualified resources that know every single interface across the implementation is required. Furthermore, collaboration between the terminal operator and multiple parties needs to have these project management counterparts involved to deploy the integrated solution

There is a good opportunity for our industry to set standardisation as a priority. If this does not happen, technical integration will continue to increase in complexity and delay the ultimate benefits of automation. The areas of focus are well known today and the benefits on getting a clear path for a standardised approach are huge and necessary for automation to be successful in this industry.

About the author

Dr Oscar Pernia is responsible for Navis Product Strategy, with an intense focus on analysing industry driving forces regarding operational efficiency and then developing effective operational input to Navis Roadmap. Prior to his current role, he focused on terminal automation, being part of the core team designing, testing and deploying the new N4 3.0 platform. Prior to joining Navis, Oscar worked for Hanjin Shipping at TTIA (the first semi-automated terminal in Mediterranean) leading terminal implementation and optimisation for three years. Here he created a young and talented tech-team which pioneered integration and operational concepts on systems architecture and control centre organisations for automated terminals. Early in his career Oscar spent eight years in IT with Algeciras Bay Port Authority where he held a variety of positions managing projects focused on technology, process optimisation and integration.

Elisa Rouhiainen joined Navis in November 2014 as Director, Partner Programs. Prior to Navis she has hold a variety of positions in Kalmar and Cargotec since 2004 ranging from product management, marketing, business development to sales management. During her career she has been based both in Finland, Singapore and India. Elisa holds Master of Science in Industrial Engineering and Management from Tampere University of Technology.

About the organisation

Navis understands that as operational processes become more complex, efficiency, collaboration and productivity are essential. As a trusted technology partner, Navis offers the tools and personnel necessary to meet the requirements of a new, and ever-evolving, global supply chain. The Navis N4 terminal operating system is a platform that can integrate partner technologies, enabling terminals to optimise productivity and enhance the service delivered to its customers.

Enquiries

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