



ESSENTIALS OF AUTONOMOUS OPERATIONS

Chris Mason, VP of Sales – EMEA, Rajant Corporation

A MEETING OF MINDS

Rajant attended the 2017 TOC Europe Conference in Amsterdam as an Exhibitor. A fellow exhibitor was an organisation called DGWorld, exhibiting leading-edge capabilities in autonomous ground and aerial vehicles. At the time, there were relatively few organizations able to demonstrate this capability, resulting in a great deal of media and attendee interest in the solutions.

Ever vigilant to the requirements for communications in such an environment, Rajant made contact and entered discussions about their solution and requirements for 100% connectivity in one of their principal target markets – container ports.

Fast forward to 2020, and the announcement from DP World, UAE Region in Dubai contracting with DGWorld to provide a fleet of Autonomous In-Terminal Vehicles (AITV's) in their immense Jebel Ali Terminal in Dubai. Between 2016 and 2020, the two organisations underwent a whole series of tests and iterations of the solution, DGWorld developing and refining their autonomous system. Whilst the in-

telligence on the vehicle allows navigation around the complex container terminal environment, it needs tasks communicated to it, location and condition of vehicle monitoring, and in exceptional circumstances, remote control of the vehicle. All these tasks require 100% low latency connectivity between and around all the TEU, stacks of steel boxes impenetrable to wireless communications. DGWorld selected Rajant Kinetic Mesh industrial networking to deliver the essential communications, with Rajant BreadCrumb units mounted on each AITV and around the terminal to ensure 100% connectivity.

Rajant's attendance at the TOC Events and Port Technology International Events around the world is predicated on experiences of listening to Container Terminal Operators tales of poor communication, patchy connectivity, difficulties in the scalability of the network, concerns around security and the possibilities of unauthorised access and the inability to ensure 100% connectivity for their journey to digitisation.

“SAFETY IS THE OVERRIDING REQUIREMENT. UNPLANNED INTERACTIONS BETWEEN HEAVY EQUIPMENT AND VEHICLES OR PEOPLE ARE TO BE AVOIDED AT ALL COSTS.”

THE INHERENT COMMUNICATION CHALLENGES

Unsurprisingly, many wireless network technologies fail to perform in these environments, simply due to critical considerations in providing reliable communications:

- **Inclement Operating Environments**
 - Extreme temperatures, with dust and vibration, make these locations for truly ruggedized mobile and fixed network assets.
- **Metal Structures**
 - Not only do the containers block radio signals, but the cranes and yard infrastructure such as guard rails, light masts, and reefer stacks all contribute to making this a dense metal environment, challenging for wireless signals.
- **Full Mobility Requirements**
 - To capitalise upon the flexibility that wireless connectivity affords, there needs to be full mobility across the yard. Operations will operate in different areas at different times, meaning any asset, whether it be a crane, straddle carrier, or AITV, needs to be connected and therefore used in any part of the terminal.
- **Density of Mobile Assets**
 - Container ports are unusual in terms of the density of operational moving parts. In other industries, it is rare to find a 2 km X 0.5km space with hundreds of network devices, all needing to be connected 100% of the time, with minimal latency and high bandwidth to support the use of full-motion video from multiple sources.
- **Adjacent Wireless Networks and Visiting Vessels**
 - Many, if not most major container port operators have neighbours operating their wireless systems, and vessels with radios and radars can introduce interference.
- **Bandwidth, Latency and Jitter requirements**
 - The introduction of applications such as OCR cameras to capture container details and remotely operated and autonomous container handling equipment with multiple cameras, place demands on a wireless network that originate from a wired network environment.
- **Security Requirements**
 - Container ports are typically entry points into the country and have advanced security requirements as targets for illegal and terrorist activities. Ensuring data is secure across the wireless environment is a key consideration, mainly when remotely operating heavy equipment.



- **Deployment and Maintenance Considerations**

- Ports are 24/7 operational environments. They are also environments where the core competency is moving containers as quickly and safely as possible – not management of complex IT systems. Similarly, deploying and maintaining an extensive, complex, vulnerable fibre infrastructure to connect network nodes is expensive, time-consuming, and can interrupt operations.

1. Removes the need for customers to adapt their operations to cater for deficiencies in autonomy or network performance
2. Leverages legacy investments in equipment
3. Provides a platform for further digitisation and the implementation of advanced big data solutions and analysis

DGWorld developed their own AI algorithms and autonomous vehicle conversion kits for any kind of vehicle, to ensure that the move to digitisation and autonomy could be performed with existing fleets. Similarly, Rajant Kinetic Mesh allows connection to the network of any equipment, either physically via Ethernet or wirelessly by secure SSID's on Bread-Crumbs, allowing Wi-Fi clients to connect. This means the transmission of data from any device enables local or cloud-based analytics and prognostics, further increasing efficiency and safety.

RETRO-FIT AND FUTURE-PROOF

All of the above challenges are the network-centric considerations DGWorld required to be satisfied and Rajant's Kinetic Mesh network delivered, hence the partnership. This is a granular level of detail that partners such as DGWorld need to include in their solution development. However, there is a similarity in the approach between Rajant's network and DGWorld's autonomous solutions, the combination of which:





Furthermore, Rajant ensures users can take advantage of future advances in their Kinetic Mesh by maintaining compatibility between past, current, and future Bread-Crumb models, meaning today's investment can be enhanced rather than replaced.

OWN YOUR SOLUTION - END-TO-END

Drawing on experiences from the mining industry might seem incongruous, but Rajant's extensive global experiences in this industry, as well as in container ports, gives great insights into the potential for automation and efficiencies in operational environments – and critically some of the fundamentals around ensuring end-to-end performance.

Mines, like container terminals, operate with applications based on business requirements. There is an overall plan about how and where to extract and refine the product, involving the movement of heavy items, as seldom as possible, utilising heavy machinery, the location and condition of which needs monitoring. The same ability to extract and deliver data to and from moving assets in real-time is a critical part of the daily business operations and for off-vehicle intensive analysis of data to gain valuable process efficiency insights. Like container terminals, mines are looking to gain efficiencies from automation, taking people out of harm's way, and utilising technology to enhance productivity and accuracy.

Like ports, in these environments, safety is the over-riding requirement. Unplanned interactions between heavy equipment and

vehicles or people are to be avoided at all costs. Therefore, managing the risk associated with autonomous or remote operations is a massive factor in solution selection. Part of risk reduction in an operational environment is ensuring that the operating organisation absolutely controls and preferably owns the assets and solutions delivering the business capability. Whilst the IPR for the automation solution and network is owned by the manufacturer, the control and direction of the solution must be within the control of the end-user. In networking, this is critical.

Ownership of the network gives total control over performance, scheduled maintenance work, hardware and software upgrades, and alignment with changing operational areas, new applications, and services. Only in this way can the network serve, rather than dictate, the operational processes of the business.

**“CONTAINER PORTS
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ABOUT THE AUTHOR

Chris Mason is the Vice President of Sales, EMEA at Rajant Corporation. Prior to Rajant, Mason worked with British Telecom (BT) in a variety of sales, business development and management roles to help worldwide organizations identify IT solutions for common business challenges. Mason has experience with the United Kingdom's Terrestrial Trunked Radio (TETRA) network for the Emergency Services and the Ministry of Defence. Mr. Mason also earned a Bachelor of Arts and a Master of Science in Telecommunications Business from University College London and is an active member of the Institute of Directors.

ABOUT THE ORGANIZATION

Rajant Corporation is the exclusive provider of private wireless networks powered by the patented Kinetic Mesh® network, BreadCrumb® wireless nodes, and InstaMesh® networking software. With Rajant, customers can rapidly deploy a highly adaptable and scalable network that leverages the power of real-time data to deliver on-demand, mission-critical business intelligence.