

## Movement of the World's Goods Requires a Highly Mobile Network

Mobilize All Seaport Assets with a Secure, High-Performance Rajant Living Network™



With approximately 90 percent of the world's trade carried by the international shipping industry, seaports are vital-to and the focal-point-for the flow of commodities and capital worldwide.

This places immense pressure on seaport operators to manage the countless operational and security functions involved in the successful movement of cargo. The numerous workers, ships, containers, equipment, and vehicles roaming throughout the complex environment must be properly orchestrated to ensure the speedy flow of goods. As a result, many port officials are evaluating and implementing mobile communication technologies to help them improve productivity and reduce operational costs.

A Rajant Kinetic Mesh® network makes Living Network infrastructure possible and can enable anytime, anywhere connectivity that allows your people and machines to move and communicate simultaneously. With real-time access to information and applications, operations can be performed more efficiently and cost-effectively.

### Unmatched Wireless Networking

A private Rajant mesh network offers mobility, performance, reliability, security, scalability and flexibility that is unmatched by other broadband and mesh offerings. Our self-healing, peer-to-peer networks provide connectivity via a web of interconnected BreadCrumb® wireless nodes and our patented<sup>1</sup> InstaMesh networking software. All network nodes and clients can move all the time, anywhere within the network. Because each BreadCrumb can have multiple connections, there will always be a viable pathway to deliver your information. In fact, the more nodes you add, the more communication pathways you establish, and the more resilient your network becomes.

### Confronting Port Challenges Successfully

To optimize cargo movement, seaports employ a number of systems and technologies such as Supervisory Control and Data Acquisition (SCADA), Radio Frequency Identification (RFID), and CCTV access control and monitoring, all of which

According to the World Port Source, there are **more than 4,900 PORTS IN 196 COUNTRIES** around the world.

In the United States and its territories, approximately **3,200 CARGO AND PASSENGER HANDLING FACILITIES** are located within **360 commercial ports**.<sup>2</sup>

Around **90% OF WORLD TRADE** is carried by the **international shipping industry**.

- More than **50,000 merchant ships trade internationally**, transporting every kind of cargo.
- The World Fleet is manned by **more than one million seafarers** of virtually every nationality.<sup>3</sup>

generate volumes of valuable data, voice, and video. Having access to such critical information helps port officials, inspectors, employees, and tenants perform their tasks more productively as they move across the seaport. A Rajant wireless mesh network can help you address a number of communication challenges to achieve high levels of access.

- **Aging Infrastructure and Disparate Networks:**

Most seaport information systems have evolved over time into complex and massive infrastructures that utilize a wide variety of devices and technologies. Leveraging the existing infrastructure while integrating advanced communications is a major concern. Our wireless networks can seamlessly integrate with non-Rajant devices and technologies via Ethernet, including satellite, fiber, copper, cellular, point-to-point (PTP) wireless, point-to-multipoint (PMP) wireless, LTE, 3G/4G, and CCTV.

- **Large Volume of Containers:** The enormous volume of containers is constantly moving from ship to shore and shore to ship. As an example, the Port of Los Angeles recorded 877,564 TEUs (Twenty-Foot Equivalent Units) flowing through its port in one month<sup>4</sup>. Container movement can create interference and restrict signal range for many wireless communication systems. With multi-transceiver, multi-frequency BreadCrums, our InstaMesh software can dynamically redirect information packets to avoid interference and provide the fastest possible throughput.

- **Security:** Terrorists know that striking a port facility can significantly impair a nation's economy, and criminals view containers as inviting targets for theft or smuggling. Rajant networks include robust network security capabilities, including:

- Multiple cryptographic options including NSA Suite B algorithms<sup>5</sup>
- Configurable data and MAC address encryption
- Configurable per-hop, per-packet authentication between BreadCrums
- Layer-2 and Layer-3 client/server and peer-to-peer security solutions compatibility
- Harris SecNet 54<sup>®</sup> encryption compatibility

- **Harsh Coastal Environments:** While wireless networks offer the advantages of mobility without the limitations of wired infrastructure, wireless equipment must perform reliably in the weather and temperature extremes common to seaport environments. Our industrial-strength, rugged BreadCrumb nodes are designed for Ingress Protection IP67 and engineered to withstand the excessive humidity, wind, waves, rain, and temperature fluctuations characteristic on and near bodies of water. In fact, our wireless networks have been operating successfully in some of the most severe environments on earth, including mining, military, utilities, and public safety.

- **Outgrown Wired Infrastructure:** Many seaport operations have expanded and outgrown the communications capacity of the wired network. Because our networks can support Wi-Fi, integrate easily with Ethernet devices, and scale to hundreds of high-bandwidth nodes, you have the flexibility to add capacity and reach when and where needed. Plus, wireless systems can be deployed more quickly and easily than wired systems. As a result, you can leverage your legacy investment while avoiding the challenges involved with installing cable in concrete and water.
- **Diverse Community of Users:** Customers and tenants demand a secure, reliable operating environment that helps them satisfactorily move cargo, repair vessels, and supply ships. In addition, port officials frequently interact with international and country-specific agencies such as the Coast Guard, Customs, and Maritime Administration. With highly-available broadband connectivity, you can supply secured, authorized information and application access for personnel, shipping lines, customs officers, and other stakeholders.

## Key Rajant Kinetic Mesh Features

- **Up to 300 Mbps physical-layer data rate**
- **Multiple, 2x2 MIMO-enabled antenna ports**
- **Military-grade security**
- **Scalable to hundreds of high-bandwidth nodes**
- **Multiple radios for interference avoidance**
- **Less than 1 ms latency**
- **Designed to IP67 for rugged environments**
- **Fully redundant—no single point of failure**
- **Multiple transceivers and radio frequencies**
- **Self-configuring and self-healing operations**
- **Wi-Fi Access**



## Optimizing Port Operations with a Rajant Kinetic Mesh® Network

For more than a dozen years, our networks have been successfully meeting the unique needs of a variety of industrial customers. For seaports, we offer many competitive advantages over traditional Wi-Fi vendors. Our wireless technology can turn your network into a strategic, highly-productive asset that can cost-effectively provide port-wide access, expand network reach, and enable network-wide mobility to support a variety of applications such as:

- **Edge Communications:** Wireless broadband offers an ideal solution to transmit real-time data, voice, and video at the network edge. In addition, you can provide information and application access to ships in port.
- **Mobile Vehicle Connectivity:** With BreadCrumb wireless nodes deployed on a variety of vehicles, a Rajant network can help you maintain communications with and control of UGVs (Unmanned Ground Vehicles) and AGVs (Automated Guided Vehicles), forklifts, and trucks as they roam among cranes and containers.
- **Autonomous Networking:** By equipping autonomous or semi-autonomous equipment with BreadCrumb nodes and device-specific command software, you can communicate with and control equipment such as Quay Cranes and unmanned vehicles.
- **Asset Management:** A Rajant network can provide real-time connectivity for telemetry; cargo, container, and equipment tracking; and equipment health monitoring.
- **Surveillance and Monitoring:** Because seaports are highly desirable targets for malicious attacks and terrorism, security is a top priority. A Rajant mesh network can support your perimeter security with secure, reliable connectivity for:
  - **Video Surveillance:** Today, IP cameras can be installed virtually anywhere and link to a central office, dispatch center or command center. With a Rajant network, you have the high bandwidth needed to stream video from remote cameras to dispatchers, security officials, and first responders. In addition, you can maintain visual communications with UGVs.
  - **Remote Access:** First responders and security officials can retrieve critical information such as container movement data, personnel, cargo, and tenant locations, arrest records, license plates, and fingerprints. Using smart phones, notebook computers, tablets, and in-vehicle information systems, officers and responders can prepare and submit reports, access email, and conduct Internet searches remotely.
  - **Improved Situational Awareness:** A dispatcher can instantly view incident details, analyze problem alerts, and get responders on-scene fast and safely. Emergency vehicles and officers fitted with cameras and BreadCrumbs can stream on-scene video, even in-route to an incident.
  - **Enhanced Evidence Gathering:** IP-based video systems connected to a Rajant wireless network can help gather and disseminate evidence for investigation and prosecution.
  - **Drone Communications:** Our BreadCrumb drone module can be attached to a single drone or a fleet of drones to collect and transfer large amounts of information securely. A drone with a BreadCrumb can also be deployed in a tethered configuration to work around obstacles and operate days or weeks over long distances.
- **Wi-Fi Access:** Throughout the port, employees can access ship manifests and get automatic updates on loading and unloading status to improve efficiency and reduce downtime.
- **Wi-Fi Asset Tracking:** With low power Wi-Fi asset tags, containers, equipment and people can be located instantaneously, improving port efficiency.

### Typical Networked Systems at Seaports<sup>2</sup>

System	Function
<b>Electronic Chart Display and Information System (ECDIS)</b>	Computer-based navigation tool used to pilot vessels; integrates information from GPS, automatic identification systems, RADAR, and other systems to continuously display a vessel's position in relation to land, navigation aids, and hazards.
<b>Industrial Control Systems (ICS's)</b>	Used for monitoring loading, unloading, and cargo; includes SCADA and distributed control systems.
<b>Terminal Operation Systems</b>	Used by operators to manage the movement and storage of containers inside a terminal; integrated with other systems such as financial, mobile computing, and Radio Frequency Identification Systems (RFID's) to increase logistic efficiency.
<b>Business Operation Systems</b>	Support business functions such as communications with customers, billing, and invoicing.
<b>Access Control and Monitoring Systems</b>	Support physical security operations; used for remote monitoring via networked surveillance cameras, as an example; monitor areas protected with access control devices such as badges.

Ports that are leased by terminal operators may use different systems. At times, owners of landlord ports have little awareness of what networked systems terminal operators run and may not know what cyber security measures are used to protect the systems. In addition, the physical location of IT systems can vary, as some are managed remotely from locations within and outside the U.S.

## ROI: Raise Productivity, Cut Costs, Improve Service

- **Increase Productivity:** Anywhere, anytime communications can help you better utilize resources while maximizing efficiency through mobile access to data and applications, decision-making information, and collaborative processes.
- **Improve Security:** Better situational awareness helps to reduce losses and damage by enabling first responders to plan and coordinate on-scene actions. Armed with reliable intelligence, personnel can be more effective and safer.
- **Mitigate Risks:** Gathering and disseminating court-accepted video evidence can help reduce pay-outs from fraudulent claims.
- **Reduce TCO:** Rajant wireless networks can be deployed cost effectively since no cables have to be run. A complete network can be installed in days rather than weeks or months, requires minimal maintenance, and enjoys low management costs.
- **Increase Revenue:** A Rajant communication network can give you the increased capacity to support new service offerings and handle larger volumes.
- **Decrease Downtime:** With a Rajant communication network and predictive maintenance model, you can access ongoing maintenance information that can keep vehicles and equipment operating at peak efficiency. This can reduce downtime and decrease maintenance expenses, especially for expensive 24/7 equipment such as Quay Cranes.

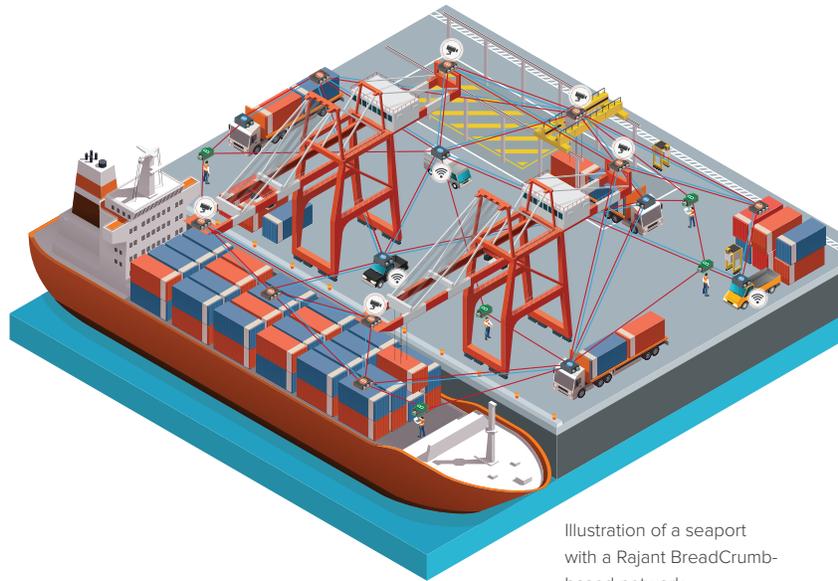


Illustration of a seaport with a Rajant BreadCrumb-based network.

## Summary

Your ability to move cargo in and out of port quickly and efficiently directly impacts customer retention and profitability. With the right wireless mesh network, your seaport can operate more productively, increase business agility, and protect people and assets more fully. Over the past dozen years, Rajant customers have depended on our wireless networks to help them obtain the timely information they need to enhance business strategies and maintain their competitive edge.

When choosing a wireless mesh solution for your seaport, choose the wireless mesh network that can support your operations with high-performance, secure real-time communications. Choose a Rajant Kinetic Mesh® solution and achieve unparalleled seaport connectivity.

<sup>1</sup> U.S. Patent 8341289B2

<sup>2</sup> U.S. Department of Homeland Security, Office of Cyber and Infrastructure Analysis (DHS/OCIA), "Consequences To Seaport Operations From Malicious Cyber Activity," March 2016.

<sup>3</sup> International Chamber of Shipping, "Shipping and World Trade," 2015

<sup>4</sup> Port of Los Angeles. Press Release, "Port of Los Angeles Registers Another Record Month as Cargo Surges to 877,564 TEUs," December 2016, [www.portoflosangeles.org/newsroom/2016\\_releases/news\\_121416\\_November\\_TEUs.asp](http://www.portoflosangeles.org/newsroom/2016_releases/news_121416_November_TEUs.asp)

<sup>5</sup> NSA Suite B implementation is not certified. Contact Rajant or your authorized Rajant Kinetic Mesh Partner if you require an NSA-certified Suite B system.