Solution Brief

Real-Time Container Tracking
Artificial Intelligence

Empowering Automatic Container Tracking Across the Supply Chain with Coresonant's PortShield

The PortShield Real-Time Container Tracking (RTCT) System uses Intel® Technology to automatically track and optimize container operations across yards, ports, and terminals, without any manual intervention across the supply chain.

Coresonant®

About Coresonant

Coresonant Systems is a leading provider of innovative AI/IoT solutions designed to help businesses achieve greater efficiency, productivity, and profitability. The company specializes in developing cutting-edge AI/IoT technology that connects devices, data, and people, enabling organizations to make more informed decisions and optimize their operations. Coresonant's AI/IoT solutions are used by businesses across a range of industries, including manufacturing, logistics, transportation, ports, and mining.

The Challenges of Effective Container Operations

Ever since container shipping was introduced and standardized in the 1950s, it has emerged as an economical and popular method for transporting cargo. In 2021 alone, global ports managed approximately 849 million twenty-foot equivalent units of containerized merchandise, and this demand is only rising with the globalization of supply chains.[1]

However, between the steady rise in demand, the dynamic nature of shipping, and the sheer scale of global container operations, logistics professionals are struggling to effectively manage their complex container operations. Specifically, they struggle with:

- Real-time visibility of container location and activity
- Port, terminal, and depot congestion
- Collaboration and data sharing between stakeholders for efficient container movement planning
- High delays in handling time at the terminal
- Long container dwell times in the yard or depot
- Suboptimal utilization of container yard space
- Unreliable ETAs

With container operations that are constantly moving and growing, shipping companies are learning that manual container tracking and intervention across the supply chain is inadequate to coordinate logistics for the millions of containers they transport. Meanwhile, technology solutions up to this point have provided only fractured visibility across the supply chain due to the sheer scale of operations, ultimately rendering these solutions ineffective without a clear picture of the full container operations. Instead, logistics professionals have identified the need for a centralized container management system that integrates with their current infrastructure to provide uninterrupted, real-time visibility of each container, empowering stakeholders to optimize their businesses through a holistic, data-driven understanding of their operations.

The PortShield Solution: Overcoming the Complexity of Container Operations

The PortShield Real-Time Container Tracking System combines AI & IoT technologies with advanced business rules and algorithms to automate the real-time tracking of the containers across the entire supply chain. Offering visibility from the moment a container is incoming on a ship to the time it leaves the yard through the outbound gate, PortShield captures the end-to-end container process flow across yards, ports, and terminals.

Designed to overcome the everyday challenges logistics professionals face, PortShield also automates and optimizes tedious container strategies that are difficult to calculate manually at scale, including optimized yard placement, route planning, supply chain collaboration, and more. In turn, logistics managers can transform their operations and receive the support they need to achieve their business objectives, such as reducing Turn Around Time (TAT) and realizing fuel savings, while maintaining precise visibility of every container.

Key Features

AI-powered container arrival prediction and monitoring: PortShield integrates with terminal Enterprise Resource Planning (ERP) Systems to provide detailed information about incoming containers. Meanwhile, advanced AI and machine learning algorithms predict and monitor container arrivals, helping operators to anticipate and manage container flows more effectively.

Dock planning: The solution includes tools for optimizing dock planning and scheduling, such as real-time vessel tracking to get clearer insight into arrival times and berth management to ensure availability and vessel location optimization.

Critical shipment alerts: Before the vessel arrives at the destination, PortShield will provide pre-alert and arrival notices to users to ensure efficient preparation for arrival.

Dynamic truck assignments: The critical shipment alerts will enable the user to assign a trucker to move the containers out of the port after they have been unloaded from the vessel prior to the vessel's arrival.

Real-time container identification at gate: The solution leverages AI cameras at the yard gate to identify each container, generate the container details, and easily track time in the yard for accurate tariff calculation.

Automated put-away operations with slot suggestion: PortShield utilizes cutting-edge AI algorithms to recommend the optimal container slot allocation based on the container details and dispatch date. This optimized suggestion minimizes the number of movements required to retrieve containers from the stack, enhancing operational efficiency.

Advanced 2D and 3D yard modeling for planning: This feature empowers terminal and yard operators with intuitive graphical maps of the yard, offering visualization of container placement with available and occupied slots.

Real-time container slot capturing via container handling equipment: PortShield places an advanced combination of AI-based cameras and Differential GPS technology on cargo handling equipment to track containers in the yard.

Equipment status and health monitoring dashboard: This dashboard offers real-time updates on the status of cargo handling equipment, such as whether a machine is actively handling a container or is currently idle and unlocked, based on the machinery's spreader lock status.

Real-time graphic container location tracking: With PortShield's web application, operators can search for and filter containers within the solution's 2D and 3D maps to retrieve the container's real-time location in the yard.

Ad hoc customer charts and reports: Customers can configure personalized reports to gain valuable insights into container operations. Dashboard analytics include daily inward and outward container count, occupied and empty yard slots, total yard count, and more.

Real-time container status for stakeholders through WhatsApp, SMS, and mobile app: This feature offers stakeholders text-automated real-time container location via SMS, WhatsApp, and mobile app.

Coresonant leverage the capabilities of Intel® technology to deliver optimized performance

Intel® Core™ and Xeon® Processors

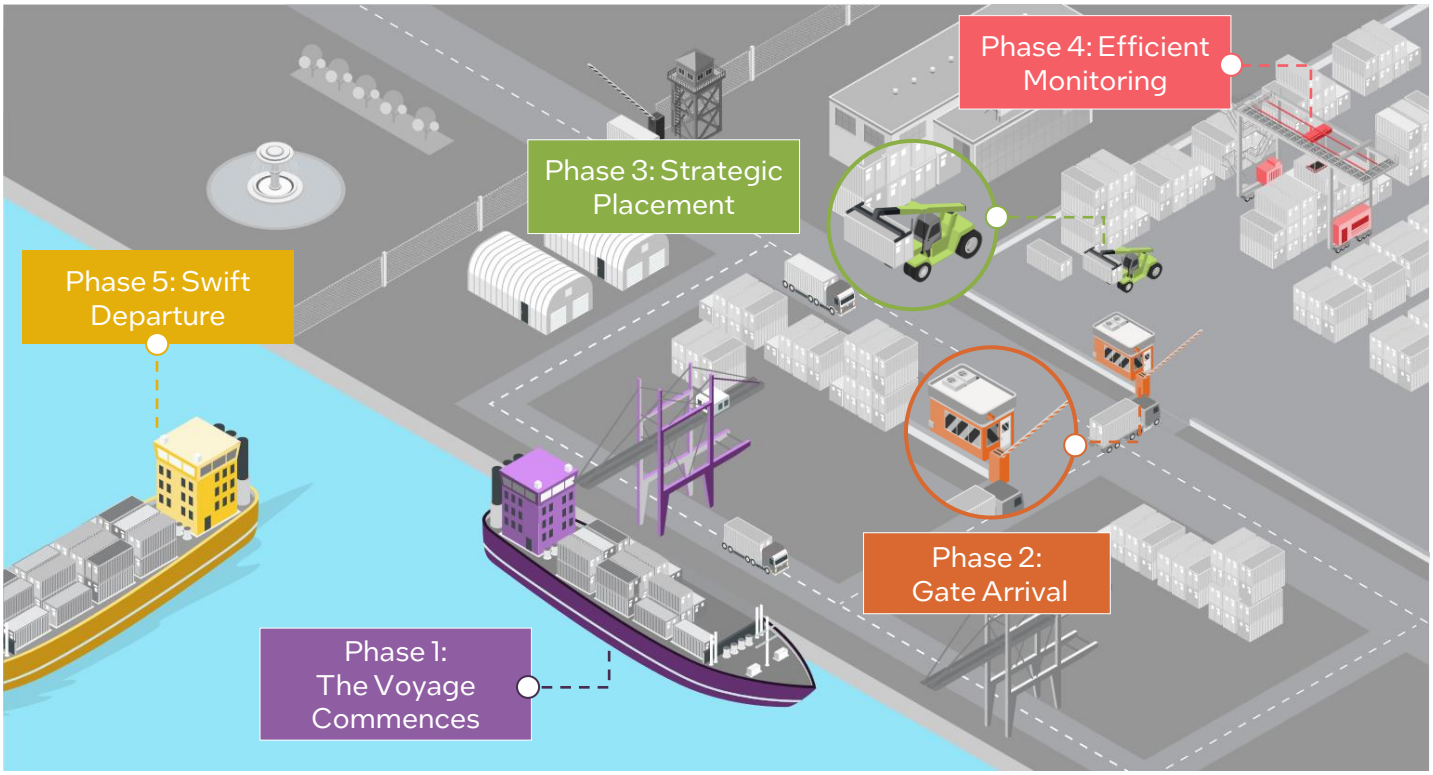
Traditionally, one of the biggest obstacles to implementing Real-Time Container Tracking has been the cost of deploying real-time data processing in yards, ports, and terminals. Coresonant overcomes this by leveraging Intel CPUs to develop powerful and compact edge systems that offer performance comparable to GPUs, but at a more affordable price point. Using Intel® Core™ and Xeon® processors, Coresonant's computer vision capabilities offer superior results with a 99% accuracy rate in container identification and the ability to provide real-time GPS coordinates of containers within a 10 cm range.[2]

The Intel® Distribution of OpenVINO™ Toolkit

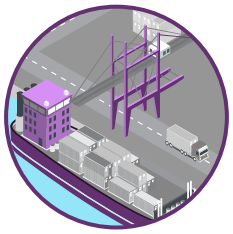
Coresonant leverages the Intel® Distribution of OpenVINO™ Toolkit to provide regular performance optimization and AI acceleration of its AI algorithms. Previously, PortShield was using regular servers instead of edge devices to perform inferencing of the OCR algorithm at the gate to capture the container number and convert it to text. After implementing the Intel® Distribution of OpenVINO™ Toolkit, Coresonant was able to achieve faster conversion and perform on-the-spot validation at the edge to ensure the accuracy of the captured numbers.

Unleashing Real-time Visibility: Empowering Tracking Across the End-to-End Container Journey

The Coresonant PortShield Solution offers a wide range of capabilities for managing and optimizing container operations across the supply chain — giving customers in the maritime industry a complete history of the location and activities of containers across the entire shipping, port entry, unloading, placement, and departure process.



1 Phase 1, The Voyage Commences: Aboard the ship, bound for the yard



From the moment the shipping manifest is issued to summarize incoming shipments, PortShield captures all relevant information through integration with the terminal's Terminal Operating System (TOS) / Enterprise Resource Planning(ERP) system. This integration with existing systems gives PortShield visibility into incoming marine traffic, including all relevant details about arriving containers such as:

- Container size
- Container category
- Container country of origin
- The container's end destination and dispatch date

Depending on these details, PortShield leverages AI to plan and optimize container pickup, automatically showing port and yard operators the best order of container pickup to increase efficiency, reduce restacking and avoid complex manual processes.

Features that Enable this Capability:

- AI-powered container arrival prediction and monitoring
- Critical shipment alerts
- Dock planning
- Dynamic truck assignments

2 Phase 2, Gate Arrival: Entering into the yard through the gate

When containers are being transported off the dock to the yard, PortShield automatically captures each container's unique identifying number in real-time upon entering the yard gate. Each container number is an ISO Standard number issued by the container association and poses no risk of duplication, eliminating the need for an additional unique identifier affixed to the container for tracking purposes.

To capture the container number, Coresonant strategically places an AI-enabled camera at the top of the gate to perform container recognition using AI vision. The AI algorithm converts the image into an ID number and updates the server with the relevant information. Here, all container details will be captured to generate a report that includes:

- Container number
- Gate number
- Lane type: In lane or out lane
- Entry or exit timestamp
- The captured image

This container identification also serves to provide confirmation of arrival and time stamp for each ingoing and outgoing container, informing users who use the facility on how much time a container is inside the yard to calculate the appropriate associated tariff.

Features that Enable this Capability:

- AI Neural Network Algorithm
- Dynamic truck assignments
- Real-time container status for stakeholders through WhatsApp, SMS, and mobile app

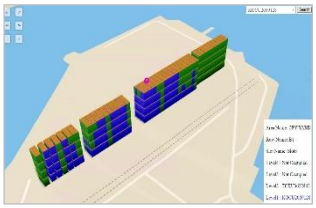
3 Phase 3, Strategic Placement: Optimizing container location in the yard

In the yard, strategic container placement is crucial to maximizing container holding capacity and simplifying container logistics. Leveraging the container details captured at the gate, PortShield suggests optimal locations to yard operators based on the container type, what type of material is inside, and the time and date of dispatch. Container location recommendations are determined to maximize space utilization and reduce the number of movements required to shift the container in and out of the container stacks during its time in the yard. By leveraging AI to minimize container movement, terminals can save fuel and maintenance costs and improve the lifespan of their container equipment.

Terminal and yard operators can also review 2D and 3D graphical maps of the yard to gain a simple visual understanding of container placement, with color-coded occupied and empty slots in container stacks. With these maps, operators have the option to explore segmented zones and lanes of the container yard to determine the optimal location for the container, all from the comfort of their computer. The images below depict PortShield's 2D and 3D maps highlighting all available and occupied container slots.

Features that Enable this Capability:

- Precise container location identification
- Automated put-away operations with slot suggestions
- 2D and 3D yard modeling



4 Phase 4, Efficient Monitoring: Keeping track of containers in the yard

PortShield's Real-Time Container Tracking System revolutionizes the industry by providing stakeholders with automated, real-time visibility of container location and activity, eliminating the need for manual communication and coordination with other players in the delivery route. To offer real-time container tracking in the yard, AI cameras are placed on cargo handling equipment such as mobile harbor cranes, rubber gantry cranes, and reach stacker cranes.

As the equipment transports and places containers, the camera captures the container ID while Differential GPS technology captures the precise coordinates of the container in the yard, including the longitude, latitude, and altitude with an accuracy of 10 cm.[2]

Once containers are placed, terminal and CFS operators can log into PortShield's RTCT web application and search for specific containers via the application's 2D and 3D maps. The search feature can be filtered by container number, dimensions, customer, and more to generate the exact container location. The web application also hosts dashboards on equipment status, yard traffic, and daily container movement to give operators further visibility into their operations.

Meanwhile, external customers such as importers and freight forwarders can also request the on-demand status of the container by SMS, WhatsApp, and mobile app. This feature is seamlessly integrated with the RTCT application to offer the automated search and response for container location upon receiving the customer's message.

Features that Enable this Capability:

- Real-time container slot capturing via container handling equipment
- Equipment status and health monitoring dashboard
- Real-time graphic container location tracking
- Ad hoc customer charts and reports
- Realtime container status for stakeholders through WhatsApp, SMS, and mobile app

5 Phase 5, Swift departure: Streamlining container movement out of the yard

The PortShield solution leverages advanced AI capabilities to help expedite the retrieval of containers for swift transportation out of the yard. During this process, the rubber gantry crane operator can select the container number for export. The software algorithm swiftly identifies the precise location coordinates of the container. With the container's location determined, it is transported to the dock for loading onto a ship by crane.

To ensure optimal operations, the solution incorporates logical container planning powered by AI. By referencing the container's dispatch date and time, PortShield intelligently plans the most efficient stacking of containers within the yard. This prevents containers from being buried too deep within the stacks, minimizing the number of operations required to access the specified container. Additionally, the solution enables the automated recording of container numbers during entry and exit, providing valuable data references for future reporting.

Features that Enable this Capability:

- Real-time graphic container location tracking
- AI container identification at gate
- AI-driven dock planning
- High precision container location identification

Deployment

Coresonant is committed to offering a seamless and step-by-step deployment that spans across the container process flow. Examining the customer site, generally, most customers will not have any cameras besides CCTV for security purposes and not meant for AI Vision usage. Coresonant takes into account the number of gates and lanes that require cameras, as well as the quantity of RSTs (Reach Stackers) and RTGs (Rail-Mounted Gantry Cranes) present. Based on this information, Coresonant develops a tailored proposal for the customer. The deployment plan involves initially integrating the AI cameras at the gates, followed by implementing the necessary hardware on the container handling equipment. All these components are then seamlessly integrated into the application, enabling real-time data connectivity and high-precision fully-automatic container tracking visibility.

Key Customer Benefits

PortShield offers anytime-anywhere access through centralized mobile and cloud information sharing, providing all stakeholders in the containerization process with real-time visibility for greater productivity and profitability.

Benefits For Port Operators

Lower turnaround time (TAT) with a highly efficient container process flow, enabling increased capacity to serve a larger customer base and effectively manage a higher volume of containers.

Reduce the cost of operations by leveraging AI algorithms that strategically plan internal logistics that focus on minimizing the number of operations required, optimizing routes, and conserving fuel, resulting in significant cost savings.

Drive profitability with a state-of-the-art automated facility that ensures superior productivity and complete process control over all container movements.

Benefits For Yard Operators

Maximize yard capacity and prevent congestion with a 360-degree view of your yard storage plan, real-time container location retrieval, and dashboards of all container details to guide yard storage.

Reduce container displacements to access and move containers with AI algorithms that calculate the most efficient way to stack containers based on the date and time a container needs to be picked up.

Reduce the cost and time per container checking in and out of the yard with an organizational system that accounts for each container.

Key Customer Benefits (continued)

Benefits For Shipping Lines

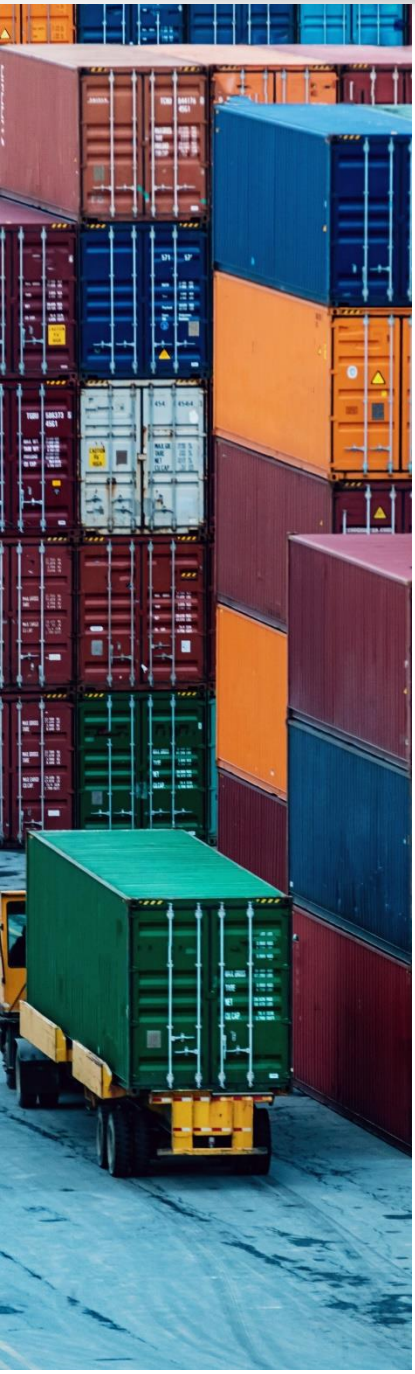
Accelerate turn around time (TAT) with swift offloading and on-loading of containers.

Accurately assess container traffic without needing to manually communicate with operators.

Benefits For Freight Forwarders

Easily communicate cargo status updates to customers on an as-needed basis with greater transparency into container operations.

Track containers in real time to gain visibility into container location and optimize container loading and unloading, without needing to manually communicate with multiple operators.



Case Study: Major Riverine Port Authority Unlocks Container Management Efficiency with PortShield

Challenge: A major riverine port authority was managing container operations manually, resulting in an error-prone process due to manual, repetitive tasks. One significant challenge they faced was accurately identifying container locations in the yard, leading to long turnaround times and 8-24-hour process delays.

Solution: By implementing PortShield's Real-Time Container Tracking Solution, the port authority was striving to find a simpler way to identify and track their managed containers to enable faster import and export clearance.

Results*: By eliminating time-consuming manual container tracking, the port authority was able to increase its capacity and service more customers with the same available resources. The enhanced visibility and predictability of container operations offered by PortShield improved their customers' experiences and generated new revenue streams for the port authority through value-added services like committed delivery timelines and on-time resource readiness guarantee. This increase in capacity enabled many reported benefits, including:

- Revenue improvement of approximately 10-12%
- Top line increase of approximately 8-10% from new revenue streams
- Cost saving estimates of 16% due to automated compliance with industry security mandates, reduced engagements to third-party agencies, and optimized spares inventory management for container handling equipment.
- Operational efficiency improvement of 300%, as shown by the reduction in cargo clearance time from 12 hours to 3 hours.
- A streamlined cargo clearance process: Physical coordination among 12 agencies and 24 officials was significantly reduced to only 7 agencies with online access and 8 officials.[3]
- Improved customer experience with accelerated container processing, reduced congestion even during peak times, and enhanced predictability of cargo clearance.

*Data from internal tests results of Coresonant. Intel does not control or audit third-party data. Please review the content, consult other sources, and independently confirm if the data provided is accurate.

Conclusion

Today, logistics professionals face significant challenges in their shipping operations, from lack of visibility into container location to unreliable ETAs to issues in finding available space for containers. The PortShield Real-Time Container Tracking System mitigates these challenges by providing logistics managers with real-time fully-automatic tracking and analysis of their container operations. With an advanced combination of AI and IoT technologies, PortShield provides optimized yard placement guidance and storage planning — helping shipping companies reduce turnaround time and realize fuel and manpower savings while maintaining precise visibility of every container.

Learn More

- PortShield Coresonant Website
- Intel® Core™ Processors Product Page
- Intel® Xeon® Scalable Processors Product Page
- Intel® Distribution of OpenVINO™ Toolkit Product Page
- Intel® Optimization for TensorFlow Introduction Webpage
- Intel® Optimization for PyTorch Introduction Webpage

[1]Statistica: Container throughput at ports worldwide through 2012 to 2021 with a forecast for 2022 through 2025. April 2022.Worldwide - container port throughput | Statista Martin Placek.

[2]Internal Data of Coresonant.

[3]Data from Internal Test Results of Coresonant.

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