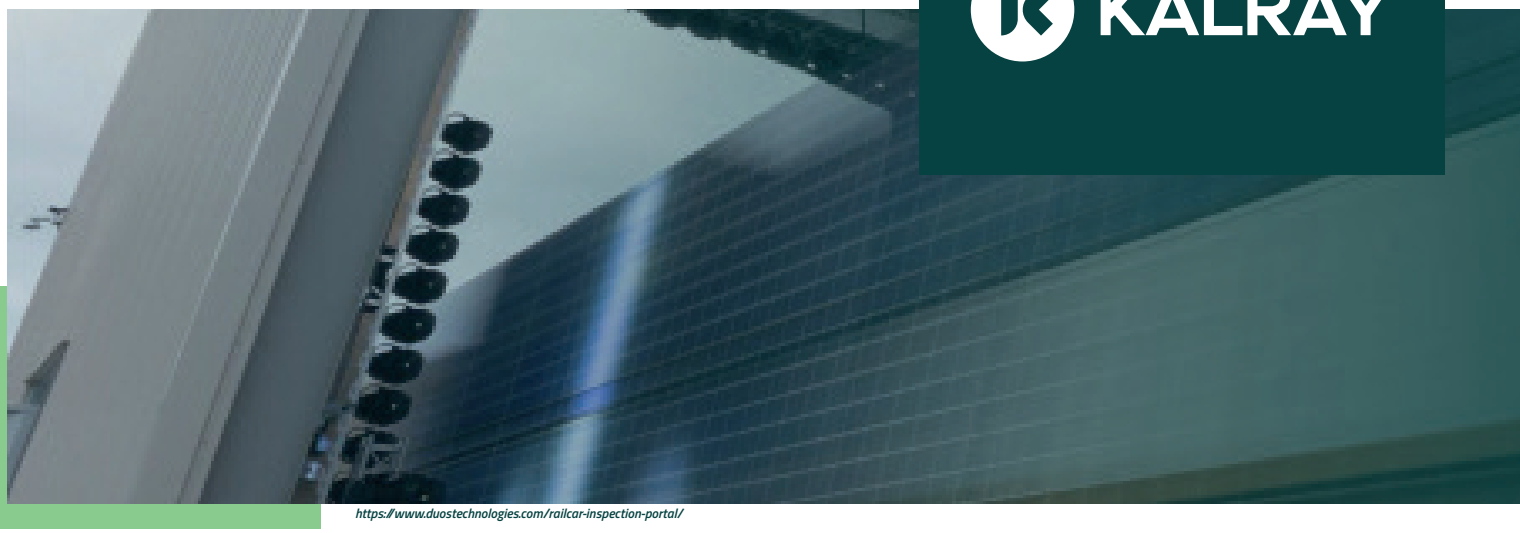
KALRAY



https://www.duostechnologies.com/railcar-inspection-portal/

HOW TO CATCH A SPEEDING TRAIN

Duos Technologies built a Railcar Inspection Portal (RIP) that uses 190 cameras to capture machine vision images from trains going 125mph.

Feeding images into purpose-built AI models check for evidence of cross-border smuggling and detect maintenance issues before they become a problem. Duos' approach to smart storage and data management empowers actionable insights and keeps trains on track - literally.

"When we hooked up the 190 cameras... and it started filling up that drive with images, we didn't miss a bit."

-Derrick Schmenk, Duos Technologies

Kalray and Dell Technologies Help Duos Technologies Reduce Railcar Inspection Times More than 100x with Smart Storage for AI-based Image Processing

Since 2001, Duos Technologies, Inc. ("Duos") has provided solutions for mission-critical applications to integrate safety, security, and automation platforms.

The Jacksonville, Florida-based company specializes in finding, building, and deploying technology solutions to push industry forward. Duos develops and operates a system called the Railcar Inspection Portal (RIP®) that was originally commissioned by Homeland Security, and Border Patrol on certain Union Pacific Railway routes to inspect trains for illegal contraband and illegal riders, and soon expanded into a full-scale system to inspect trains for possible maintenance issues. Using purpose-built AI models, the data from passing trains could prevent expensive track stops and deliver faster rail throughput for freight customers by detecting maintenance issues early.

The Challenge

In adapting the RIP for use with passenger trains, the system's requirements for storage and processing power significantly increased, as it needed to capture, compress, store, and analyze raw machine vision images from 190 cameras pointed at trains moving at speeds up to 125mph, then feed that data into an AI model to detect anomalies and alert proper authorities. As an added challenge, this edge application required extreme performance from a storage system without the benefit of a data warehouse.
The Railcar Inspection Portals (RIPs) use computer vision cameras to capture every angle of a train using a variety of optical technologies, including thermal

LIGHTWEIGHT POWER ON THE EDGE

When you don't have the luxury of a data warehouse, data orchestration is more important than ever.

For Duos Technologies, using NGenea to manage data movement across storage tiers ensured that the right data was available when they needed it.

While Tier 0 storage enabled flexible bandwidth with fewer components, the system worked together to deliver high-performance without slowing down the system - or the trains.

THE SYSTEM

- 2 NGenea NG-Stor Management nodes
- 4 NG-Box NVMe nodes
- 14 Dell acquisition servers
- Dell PowerEdge R750 servers
- NVIDIA GPUs
- NVIDIA Infiniband Network

imaging, and generate 60GB of data every second. Each pixel of the raw machine vision images represents a byte of data (3 bytes in the case of a color image). The data flow would fill up the average 512GB home computer in just four seconds. The data needed to be compressed, analyzed, and made available in a usable format for the user interface. As an edge application, Duos would not have the luxury of placing server warehouses on the side of the railroad tracks.

Derrick Schmenk is the Research, Development, and Innovation VP at Duos. When presented with the project, he ran the numbers and called long-time partner Dell Technologies, who suggested a dual solution featuring Dell servers and Kalray storage solutions for high performance without the bulk.

Lightweight Power for Heavyweight Performance: Enter Kalray

Duos and Kalray worked together to architect a solution using Dell, Kalray, and NVIDIA products to deliver significant processing power without the heft: just 2 NGenea NG-Stor Management nodes and 4 NG-Box NVMe nodes offered half a petabyte of usable capacity with an ingest rate over 80GBps.

Using NGenea NG-Box building blocks, each drive could be written concurrently - the data broken into multiple blocks and spread across multiple drives. To maximize throughput while ingesting 60GBps, the storage system needed to read and write data with maximum flexibility. Kalray's NG-Box offered Tier 0 storage to enable supersized data flow and flexible bandwidth, and it was uniquely qualified to meet Duos Technologies' needs with fewer components. For high bandwidth read and write capability, Kalray's NGenea product family offered the most balanced solution and, with higher performance and less heft, was a perfect fit for this edge AI application.

After rail-side cameras capture images at 60GBps, 14 Dell acquisition servers ingest the data. Duos Technologies chose to include Dell PowerEdge R750 servers, which met their needs for not only scale but also security of data ingestion at the site. Dell servers are built for just such AI workloads, and perfectly complement Kalray's NGenea. The system then writes the data to GPUs at 20GBps. Additional servers with NVIDIA GPUs add power to accelerate throughput for data analysis. The solution uses NVIDIA SDKs for high-speed image compression via NVIDIA GPUs and NVIDIA CUDA SDKs in AI algorithms, and the team is alerted when anomalies are detected. The hardware is all connected via an NVIDIA Infiniband Network.

Results

The configuration succeeded from the start: "We realized it was going to work when we turned it on," said Schmenk. "When we hooked up the 190 cameras and pushed it, and it started filling that drive up with images, we didn't miss a bit."

Thanks to fast and secure processing by Dell servers and hyper-efficient Kalray storage, Duos was able to help their customer strategically place these monitoring portals where they matter. As a result, freight companies can catch maintenance issues before they snowball into track-stopping disasters – and the system essentially pays for itself.

MAXIMIZING THROUGHPUT AT 60GBPS

190 machine vision cameras within the inspection portal generate 60GB of data every single second. Storing, processing, and analyzing that data quickly is imperative to the mission of the RIP.

When that data is analyzed quickly, operators can determine the health of the train's mechanisms and address potential maintenance issues before they become a serious problem.

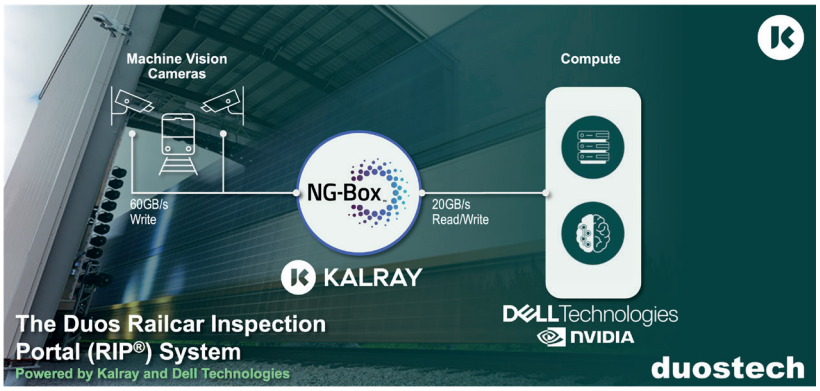
Speedy analysis of big data drives a safer - and more profitable - freight system.

" We can expand to even a terabyte per second. That brings us into territory...that we thought was unattainable before."

- Derrick Schmenk, Duos Technologies

The RIP System, Powered by Dell Technologies & Kalray

Catch anomalies that lead to breakdowns or derailments



With this project in place, Schmenk is exploring the art of the possible. Not only is this kind of storage and processing power within reach, but the system is also scalable. "While this system may write 80GBps, we can expand that storage platform to even a terabyte per second. That brings us into territory where we can explore markets that we thought were unattainable before," he said. As use cases and data inevitably expand, the powerful combination of Dell PowerScale and NGHub can cost-effectively enable projects at massive scale.

And he's happy to have found another trusted partner in Kalray: "I shopped probably 100 different storage vendors before choosing this technology. Honestly, Kalray was number one. I felt like I was talking to somebody equal to me. It was a great experience."

Looking Ahead: Speed and Safety

Underlying the RIP is a proliferation of data. Without the power to store and process the data, the insights gleaned therein would be locked inside the train, emerging only when it was too late. Railways are safer and more efficient thanks to the strategic collaboration between Kalray, Dell, and Duos Technologies.

Elliott Berger, a Solution Architect with Dell Technologies said, "The Duos RIP system is an excellent example of a new HPC solution driving game-changing business value. Traditional enterprise storage systems cannot meet the performance demands required by HPC solutions. Dell and Kalray have joined forces to deliver an optimized HPC storage solution that delivers the throughput and capacity needed to manage rapid data growth and increased demands from data-intensive HPC and AI workloads like the Duos RIP system."

Enhanced storage solutions aren't just a boon for the freight industry. Dell and Kalray are working together to deliver solutions for data-intensive applications in every industry. As HPC and AI / ML become table stakes, this high-powered partnership enables unmatched performance across all storage infrastructures to unlock the power of data.

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