With recent enhancements to the GoLINC mobile data center, GE and Intel are filling a critical gap in the Industrial Internet. We believe this open platform will help fuel analytics-driven innovation across many industries.

Have you ever felt overloaded by too much sensory input? The results can be problematic, even risky if you’re driving at the time. The same holds true for trains, ships, oil rigs, and many other industrial assets. The data processing challenges on these complex machines are growing rapidly as the number of sensors increases; yet so are the opportunities to transform operations by using all the available data effectively.

A modern locomotive, for example, has as many as 200 sensors generating more than a billion data points per second. Vibration sensors surround critical components, video cameras scan the track and cab, while other sensors monitor RPM, power, temperature, the fuel mix, exhaust characteristics, and more.

Through fast analysis, the torrent of data from these sensors can help monitor locomotive health in real-time so dispatchers and power planners can make better, faster decisions to improve utilization and mission outcomes. The data can also be used to predict on-board problems and make quick adjustments, such as reducing speed so a train can make it home before a critical part fails.

Yet most of today’s locomotives lack sufficient on-board processing power to make full use of all this data. To make matters worse, the data from different subsystems, such as the brakes, fuel system, and engine, remain separate, stored in isolated “boxes” that prevent unified analysis. The data is available, but the technology needed to process it in the most effective manner is not. As new sensors are added to the machine, the problem escalates.
Turning Sensor Data into Real-Time Intelligence

GE and Intel have come together to solve this challenge, and to lay the foundation for faster innovation across the full spectrum of industrial applications. GE GoLINC is a mobile data center that puts powerful data processing and flexible communications close to the data. GoLINC is purpose-built for rugged and remote industrial environments. It has proven its value on thousands of GE and non-GE locomotives run by nearly all of the tier one railroad operators in the United States.

GoLINC is a flexible system that holds multiple modules supporting a wide range of functions, such as wireless communications, networking, and the translation, processing, and storage of all sensor data. Individual sensor subnetworks no longer have to support all of these functions separately. For example, the proliferation of cellular antennas on a modern locomotive can be replaced by a single antenna—and a single module—that handles all communications. In addition, each high-performance GoLINC compute module can host multiple applications, including GE GoLINC Data Optimizer, third-party vendor applications, and home-grown customer applications. With this approach, hardware is consolidated, data is unified, and customers have full control over the applications that monitor and control their machines.

Unlike other on-board processing solutions, GoLINC is an open platform that can be integrated easily with diverse sensor networks, hardware modules, and software applications. Users can configure GoLINC to meet current needs, and then grow and adapt it as those needs change. Both hardware and software are built to support simple, non-disruptive upgrades.

Powerful Computing for Better Results

The compute modules of GoLINC are powered by 6th generation Intel® Core™ i7 processors—Intel’s most powerful processor family for embedded applications. High-speed, multithreaded processing, built-in graphics acceleration, and exceptional energy-efficiency provide the performance needed for high-speed analytics and sharp data visualizations in constrained environments.

Advanced reliability features in Intel Core i7 processors help to provide a more trusted foundation for hosting applications that are critical to operational safety and efficiency. These processors also provide optimized support for virtualization using the Intel Wind River Open Virtualization Platform (OVP) for embedded Linux®. By providing all the benefits of virtualization without compromising performance, OVP helps to improve flexibility and utilization, while simplifying failover and making it easy to support diverse software solutions on a unified hardware platform.
The benefits of a GoLINC on-board data center are considerable.

- **Smarter, faster decision making.** Sensor data is analyzed immediately, so time-sensitive decisions can be made without the delays associated with transferring high-volume data to a centralized data center (an inherently slow process that can be further disrupted in remote locations where cellular service is unavailable). Operators can detect and respond to issues instantly, before they escalate into more serious problems.

- **Efficient, low-cost data transmission.** Since sensor data is filtered and analyzed on-board, only critical alerts and other small messages need to be sent over costly cellular connections. High-volume data transfers are performed at stations to take advantage of fast, low-cost Wi-Fi connections. Given the size of the data sets, the savings can be substantial.

- **Simpler and more efficient management.** Intel processors are designed to enable efficient remote management of the computing platform using proven tools and methods. GoLINC extends these advantages. As one example, hot-swap modules allow for simple, non-disruptive replacements and upgrades, so even a hardware failure can typically be resolved in seconds.

### Intelligence Everywhere

Even higher value can be achieved when the power of GoLINC is supplemented with cloud-based analytics using the GE Predix® platform or other big data solutions. These systems are built to perform sophisticated analysis of massive data sets. Data from years of sensor readings across thousands of locomotives and millions of miles of track can be combined and analyzed to identify trends, patterns, and hidden relationships that impact all aspects of performance and logistics.

These more sophisticated insights can help operators safely run more trains at higher speeds and higher capacities on existing track, while orchestrating resources more efficiently to eliminate bottlenecks, reduce wait times, and lower maintenance costs. They can help identify subtle problems, such as minor track irregularities or manufacturing weakness in one component that might lead to failures in another. They can also provide insights that help GE and other software vendors continuously improve the algorithms in their on-board applications, so GoLINC decision making becomes increasingly effective over time.

### A Gateway to the Industrial Internet of Tomorrow

GoLINC is an important step toward an even more ambitious goal. GE and Intel are working with other industry leaders to unleash an Industrial Internet of Things that will fundamentally transform the way businesses manage and control their most important and complex assets. Designed specifically for industrial use cases, the Industrial Internet will provide many of the benefits of the more familiar consumer Internet, but with the performance, reliability, security, and specialized protocols needed for critical industrial applications and highly sensitive data.

In the Industrial Internet, GoLINC fills a role similar to that of a personal computer in today’s consumer Internet. Like a PC, GoLINC adheres to a broad set of industry-standards (both computing and industrial) that allow it to host and interface with an enormous range of hardware and software components, including sensors, on-board applications, and back-office and cloud services. Also like a PC, the processing power and interoperability of GoLINC provide a flexible platform for innovation and customization that will empower diverse vendor communities to add value across many different industrial segments. With this open and agile foundation, growth of the Industrial Internet may soon rival that of today’s consumer Internet.

### Moving Forward with Confidence

From energy and transportation to manufacturing and healthcare, GE and Intel are working together to help organizations integrate higher intelligence into every facet of their most critical processes. More and smarter sensors, faster and more sophisticated analytics, and industry-specific applications will drive continuous improvements to help companies deliver better results faster, more reliably, and at lower total cost.

GE and Intel have already worked together to optimize and validate the Predix platform on Intel processor-based servers, which can help to improve performance, reliability, and cost models across a wide range of public and private clouds. Through shared planning and targeted engineering collaboration, GE and Intel are now extending their collaboration to drive faster innovation for a host of ground-breaking digital solutions for the Industrial Internet. GoLINC is a powerful step forward. Many more will follow.
LEARN MORE

GE
GE GoLINC Mobile Data Center:
www.getransportation.com/railconnect360/golinc

GE Predix Platform:
www.ge.com/digital/predix

GE RailConnect 360:
www.getransportation.com/railconnect360

Intel
Intel® Core™ i7 Processor Family:
www.intel.com/content/www/us/en/processors/core/core-i7-processor.html

Intel and the Industrial Internet of Things: