Challenge: The company was unable to handle petabytes of daily data from various sources for maintenance.

Solution: An improved IoT platform aggregates, processes and analyzes data, enabling planning of condition-based asset maintenance.

Outcomes: Annual cost savings reached more than USD$25M, along with improved service delivery with greater reliability.

Challenge

A global railroad company in Europe has the vision of transforming the conventional railway service into a “Trains-as-a-Service” model to provide a safer, more reliable and more pleasant passenger experience. Its digital transformation is aimed at reducing cost and risk while increasing customer loyalty and growing revenue. Areas the company is looking to leverage include insights for smart ticketing, integrated rail operations, smart security, human flow solutions and asset management. While this is a multiyear project, the first step was to build an automated asset management system through internet of things (IoT) analytics at the edge.

The immediate challenge faced by the company was an inability to handle petabytes of data collected daily from various sources: 300+ connected trains, 40,000+ signals per train, 30,000+ events, 25+ major systems. A much smaller data volume was required to enable condition-based asset maintenance. The company also needed the ability to visualize insights in a highly resilient, scalable and multitenanted fashion for operations staff to take the right action at the right time.

The company built its first IoT analytics platform for a continuous asset management system in public transit. Condition-based maintenance (CBM) was established, helping with cost reduction and promising a more reliable passenger experience. The company has completed a successful proof of concept (PoC) and sought to establish condition-based asset maintenance by leveraging Lumada solutions for digital innovation from Hitachi as well as Hitachi Vantara’s Data Integration & Analytics software.

Global Railroad Company

INDUSTRY
Transportation

HARDWARE
Hitachi Unified Compute Platform

SOFTWARE
IoT Core
Data Integration & Analytics

APPLICATIONS
Build and operate a data lake for business analytics.

SERVICES
Co-Creation Services From Hitachi Vantara

Outcomes
- Reduced amount of daily data ingestion.
- Improved service delivery.
- Enabled greater reliability.
Solution
Leveraging Lumada, the global railroad company developed a core IoT platform that aggregates, processes and analyzes data in three ways.

1. **Batch processing**: data integration and business analytics in a data warehouse.
2. **Near-real-time processing**: stream processing and rule-based event processing in memory.
3. **Real-time processing**: stream processing and machine learning (ML)-based analytics in memory.

The platform allows planning of asset maintenance based on conditions and aids in preventive actions against critical events, including malfunctions and failures in real time.

- **IoT device management.** More than 300 connected trains with control systems as well as industrial equipment, such as railroad track units, signals, switches and crossings, are equipped with sensors and actuators. Some are secured or unsecured IP devices themselves, such as CCTV.
- **Integration tools and management.** More than 40,000 data sources emit data per train. Various sensors, such as brakes, wheel sets, fuel tanks, windows and others capture data and send it through low-power, short- and longrange networks to the onboard server. That server acts as an optimized gateway that compresses data for real-time data transmission.
- **IoT data management.** Data is integrated and orchestrated with visual and programmatic management tools that Data Integration & Analytics software provides. The system pulls batch data communicated in FTP via the Wi-Fi network, processes it for data integration, and stores the analytics-ready data into the analytics database and time-series event database. Realtime train data is communicated via UDP protocol through a 3G network and is ingested into Spark-based stream processing. The analytics-ready data is then stored in the time-series event database. This data is also sent to the operations team for real-time monitoring.
- **Analytics.** Lumada performs business intelligence against data in the analytics database. The company also gains operational status and insights by aggregating and correlating telemetric and ambient readings, equipment performance, servicing and audit records from industrial control systems. The rules engine performs event correlation (more than 30,000 events each day) for fault prognostics while trend analysis is performed using machine learning. The rules engine sends real-time alert messages when anomalies are detected.
- **Application enablement and management.** Information is shared via dashboards and reports to aid in maintenance planning. The operations team gains insights into fleet conditions and detailed system health. They can perform drill-down analysis as well as share their investigations with other personnel. The real-time processing generates alerting and triggers fault diagnosis. With this insight, operations can prevent critical equipment or service failures from happening. Insights from the trend analysis and real-time monitoring are pushed through HTTP/HTTPS communications using WebSocket. Hitachi provides a graphical environment in which the company can create interactive, web-based dashboards and user-defined reports, as well as manage alerts and notifications. Additionally, the company can use Lumada to build, package, deploy and maintain microservices applications and scale them easily.
- **Security.** Data access is secured using role-based access control. Encryption is provided through SSL and HTTPS for data in transit.
- **Ease of use.** The company creates digital twins (called asset avatars) for each connected train to onboard data, aid with analytics, and create visualizations. The company uses visual and template-based tools and preconfigured libraries, which eliminates writing SQL or coding in Java or Python.
**Outcome**

The global railway organization has reduced the amount of daily data ingestion to 25GB per train, a manageable data volume to enable condition-based maintenance. Compared to time-based maintenance, the company projects an annual cost savings of more than $25M, along with improved service delivery and greater reliability. The company is happy with the results and is considering expanding IIoT Core software to manage connected devices to remotely perform provisioning, configuration and troubleshooting.

In summary, the company has deployed a system that is scalable, more manageable and built for the future. With improved data management, mobility and analytics in place, the company has a solid base for its digital transformation: It can expand into new functionality as needed improve overall operation railway operation and delight customers.