



Accelerate Your IoT Journey With Lumada

Transform Your Data Into Insights
That Drive Your Business

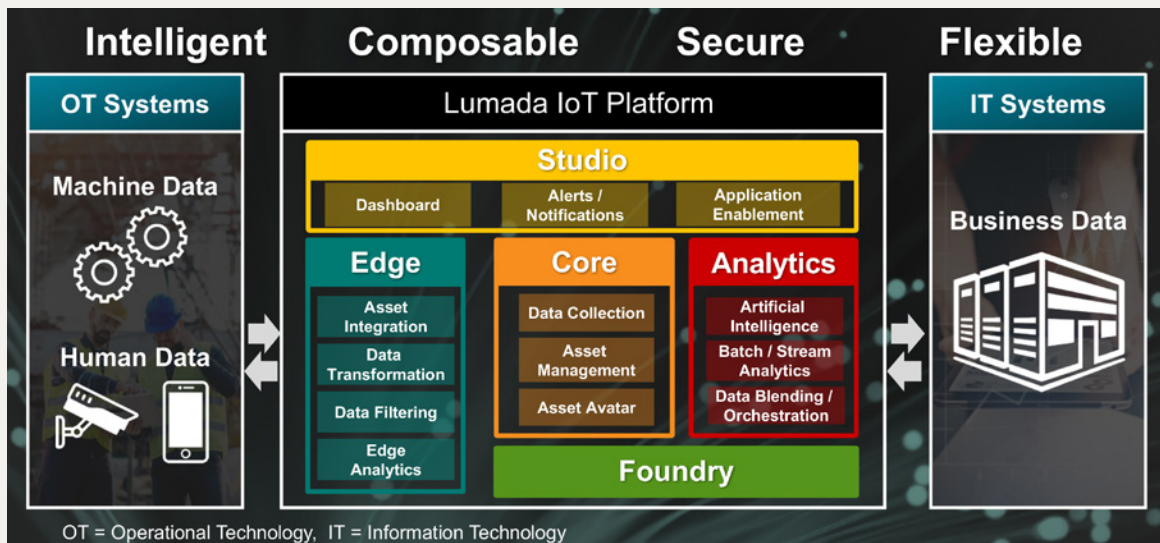
OVERVIEW

Industry today is undergoing a massive shift to new levels of automation driven by the internet of things (IoT). While adoption of the IoT holds the promise of more efficiency, lower cost and increased predictability, IoT solutions can be complex to implement and manage. If you want to reap the benefit of the IoT, you need a platform that meets your unique needs and is backed with industry-specific experience.

The IoT Offers Unprecedented Opportunity

The fourth industrial revolution is bringing sweeping change through digital transformation. The industrial IoT is leading the way, combining sensor data with human data to improve operational efficiency for manufacturing, energy utilities and transportation.

When operational technology (OT) and information technology (IT) merge with the power of artificial intelligence (AI) and advanced analytics, there is a vast opportunity to improve reliability and safety, eliminate unplanned downtime and reduce costs. Asset information from across your organization can now be put into the right hands at the right time, whether on the factory floor or in the central office, and all with actionable insights.



The IoT platform blends data from across the enterprise and combines it with AI and analytics to accelerate time to value from IoT adoption.

Lumada Powers Your Digital Transformation

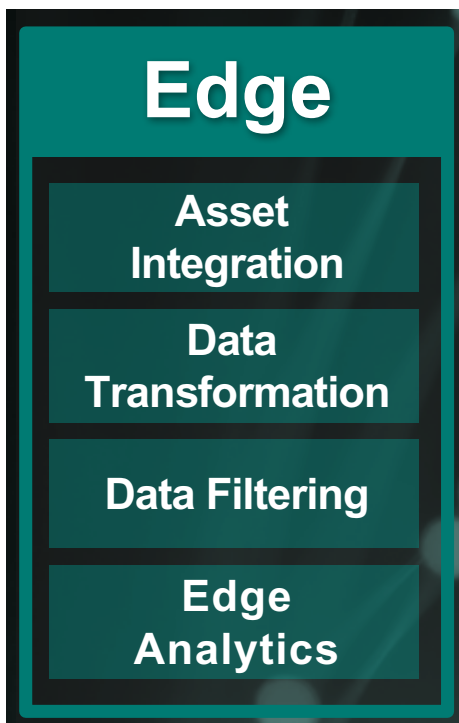
Lumada, Hitachi's intelligent IoT platform, enables companies in the manufacturing, energy and transportation industries to achieve digital transformation. With over 100 years of experience in building industrial systems and nearly 60 years designing IT solutions, Hitachi created Lumada to securely connect assets to business systems, delivering near real-time information. Lumada helps you improve operations with predictive analytics, informational dashboards and new automation capabilities.

A Complete Ecosystem for Industrial IoT

To gain top value from industrial IoT, organizations must gather sensor data from assets, apply context and use that data to improve reliability, performance and safety. Lumada can help. Its intelligent, composable, secure and flexible platform is built upon four key pillars: edge, core, analytics and studio. Foundry, a foundational layer, supports these pillars with deployment, repair, upgrade and scaling services for industrial grade software, on-premises or in the cloud.

Pillar One: Lumada Edge

With sensors becoming cheaper and machines becoming smarter, the sheer volume and variety of data moving through the networks today is increasing exponentially. This highly distributed data is generated



by a wide range of devices and applications: All come in different formats and support various protocols. IoT contributes significantly to this rising data volume by generating a high frequency of relatively small amounts of data. Here are a few examples:

- A semiconductor fabrication lab can generate up to a terabyte of data per day.
- A jet engine generates a terabyte of data per flight.
- An autonomous car generates more than a terabyte of data every hour.

Lumada edge helps organizations deal with the challenges of integrating this data from sensors and assets into their business operations. Lumada edge:

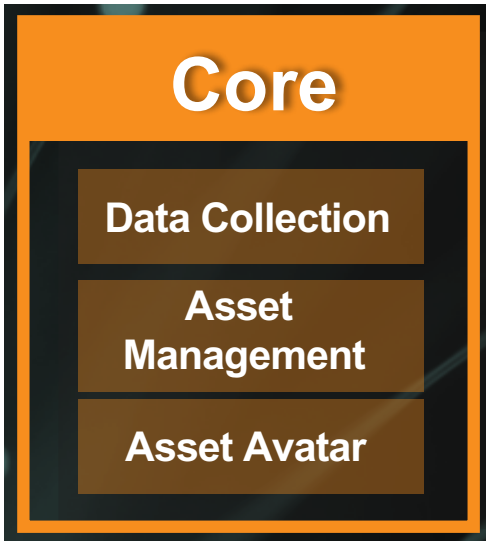
- Provides capabilities such as flexible streaming data ingestion via multiple industry-standard protocols.
- Delivers data prioritization to lower cost, data filtration to reduce overhead and real-time edge analytics to decrease latency.
- Identifies malicious events and devices for security monitoring and protecting connected assets from evolving cyber threats.

As edge computing grows, Lumada edge will expand beyond real-time analytics, with functionality that supports other key edge computing functions, such as security, scalability and resiliency.

Lumada edge is built to be composable, extensible, domain and hardware agnostic. Such systems as manufacturing automation, power generation stations, and vehicles and machines, have long relied on distributed computing for control of processes. However, emerging applications, such as autonomous machines, need architectural elements to support increased compute requirements for running AI models on the local machine. Lumada edge is designed for this.

The asset and edge software development kits (SDKs) with Lumada edge allow you to connect sensor data and human data from the factory floor or field assets. Lumada edge breaks down information silos to bring all your data together, from assets to business systems. With Lumada edge, you get a comprehensive and real-time view of asset status and can put information in the hands of people who need it without compromising security.

Pillar Two: Lumada Core



At the heart of the Lumada IoT Platform is Lumada core, which performs many functions to assist in managing assets and integrating data from those assets and business systems. Lumada core connects assets, collects data and makes this information available for analysis via open application program interfaces (APIs).

One of the key functions of Lumada core is identity and access management (IAM) through the asset registry. The IAM features of Lumada core maintain secure credentials across your assets, edge gateways and services, and management of these asset credentials is centralized and secure. The asset registry provides IAM via APIs for people, machines and gateways.

Lumada core creates and stores digital representations of physical assets called asset avatars. These asset avatars are a digital representation of the asset that allows you to see its complete status in near-real time. Using a shipping company as an example, each

truck (an asset) would have an asset avatar, which would provide sensor data, such as current speed, location, direction, fuel level and efficiency, and oil pressure. Fleet managers can get a complete picture of each truck in near-real time, so they can respond to problems quicker.

With Lumada core, all of the sensor information about each asset is at your fingertips. Not only do you get meaningful insights into the status of an asset, but asset avatars also allow you to take action using business rules based on the asset status. For example, you can set KPIs that trigger automation at the edge while sending sensor information to an analytics system in the central office. You get a 360-degree view of your assets, along with powerful automation capabilities.

Lumada core also provides asset templates to create classes of assets that report similar sensor data. For example, you can create an asset template once, and then use it to create asset avatars to represent individual machines, making asset management more efficient.

In addition, Lumada core has command and control features that allow your applications and analytics systems to send messages to assets to modify configuration or change behavior. These configuration changes are driven by data from an asset and can be propagated to all similar assets using the asset template. This approach allows you to quickly make changes to a large number of assets at once and ensure that each asset is updated without using manual processes.



Pillar Three: Lumada Analytics



Analytics is a critical enabler of IoT solutions. Being able to aggregate, store, manipulate and analyze data can fuel cost savings and deliver rich insights. But, without the right IoT platform, increasing volumes, variety and velocity of data coming from sensors, machines and other connected devices bring significant data-integration challenges.

Analytics capabilities on the Lumada IoT Platform help you prepare and blend machine and sensor data with data from other assets. This information may include data from your enterprise resource planning (ERP) or customer relationship management (CRM) systems to deliver transformative business outcomes.

Lumada's flexible framework provides actionable insights through advanced analytics and AI. Lumada is composable, enabling you to maintain your investments in in-house analytic systems, and integrate with your business applications with flexible deployment, on-premises or in the cloud.

Operational data from assets and sensors is blended with human data from IT systems

throughout your organization in an analytics database. Blending data from across the organization provides context, meaning and value to your data and helps eliminate costly data silos.

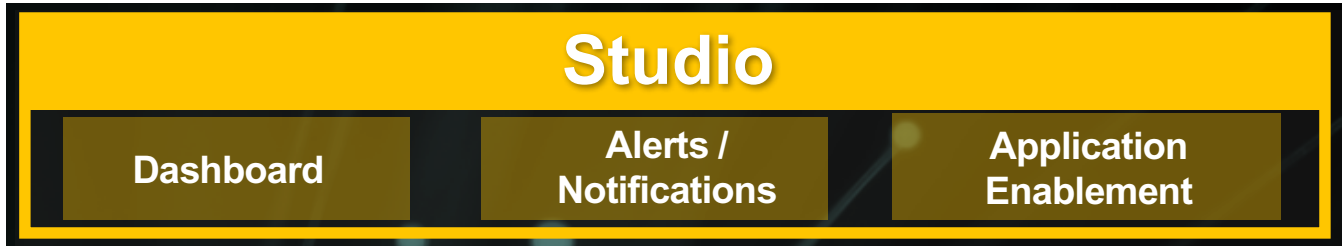
Lumada analytics empowers organizations to uncover patterns in equipment and device data with powerful machine learning (ML) and data mining tools. It applies insights to fine-tune equipment for better operational efficiency, and ingests and processes machine and sensor data in big data architectures.

Lumada analytics allows you to prepare, model and explore semi-structured and unstructured data sets. It connects natively to Hadoop distributions, NoSQL stores and analytic databases. And it operationalizes R, Python or Weka models and machine learning functions as a part of the data integration workflow. It also connects to REST APIs and SOAP web services to retrieve data from the cloud and public or private web APIs.

The blended data from Lumada analytics can have powerful results. For example, algorithms can use the analytics data to perform predictive and preventive maintenance services before operational breakdowns happen. With this insight, you can intervene and replace parts and entire machines before they fail and identify product quality problems ahead of time.

With Lumada analytics capabilities, you can make decisions and take action more quickly than ever. You can avoid costly breakdowns and delays, and make data-driven decisions about asset maintenance.

Pillar Four: Lumada Studio



Real-time dashboards are essential to monitoring connected IoT devices. Lumada studio brings together analytics information, alerts and notifications, and business application enablement in dashboards to give you fast, meaningful insights into your data. Dashboards in Lumada studio deliver prebuilt and user-defined reports, maps and interactive tools to visualize insights. These interactive dashboards help you visualize your operational and IT data alongside analytics data.

A variety of different plug-ins can be used to connect to data sources and applications across the company. Using these plug-ins, you can retrieve and blend IT data with OT data in real time or via caching in memory or a database. Unstructured data upload capabilities allow any file or document to be ingested, indexed and analyzed in Lumada studio. At every step of the process, Lumada studio enriches the knowledge you get from your assets by giving you the power to bring in relevant information from anywhere, at any time.

Accurate and governed data is routed to the appropriate analytics views for each role, including machine operators, facilities managers and company management. Lumada studio also delivers easy-to-use ad hoc analysis, data discovery and advanced visualizations. With Lumada studio, you can tackle the problem of data

overload and put exactly the right information in the hands of the people who need it, when they need it.

With actionable insights and reports, you can make decisions faster and act to avoid costly situations, such as asset failure. They allow you to optimize maintenance based on the data coming from your machines, not just preset maintenance intervals. This means more uptime and lower costs.

With straight-through processing, assets can automatically send messages to business systems to act on insights, utilizing both asset avatar and analytics information. From there, asset and IT data can be sent to a variety of analytics execution engines, ranging from basic rules engines to stream processing to machine learning via R and Python.

An example of the straight-through processing of Lumada studio is the ability to integrate asset data with an ERP system. These data-driven insights let you anticipate maintenance needs, order parts, and automatically make supply chain adjustments in anticipation of performing maintenance on the asset. By bringing together data from across the company and integrating asset data with business systems, you start to move away from a reactive approach and begin to reap the benefits of a smart, automated facility.

Co-Creation: Co-Create to Make the Solution Fit Your Needs

With our co-creation approach, we collaborate and innovate with you to combine our knowledge and jointly develop solutions that fit your business needs. We accelerate this process by leveraging Hitachi's deep industrial expertise and experience with machines, sensors and analytics. The faster time to value is also enabled by the way we capture what we learn and transfer this knowledge across industry to get a head start.



Discover New Opportunities Through Collaboration

Each co-creation phase is iterative: We work together to achieve and verify outcomes before entering the phases of deployment and fully integrating the solution into your business operation.

We typically co-create solutions in these phases:

- **Engage:** We work with you to examine your unique business and data-related challenges and set the go-forward strategy.
- **Build the model:** We analyze your data in depth to fully understand the problem and build analytical models to evaluate options.
- **Create the solution:** We assemble a solution from the evaluated models and execute a proof-of-concept project to verify the expected performance.
- **Validate:** We conduct a pilot deployment of the solution to verify it with live data and interfacing with your OT and IT systems.

Illuminate Your Data and Accelerate Your IoT Journey

Data holds immense potential to reduce costs, increase efficiency, overcome challenges and seize new opportunities. But until the data is illuminated, its power remains untapped. Lumada delivers the most advanced capabilities available today to turn data into action through its intelligent, composable and secure IoT platform.

- Lumada delivers real-time insight that operations personnel and control systems can act on.
- Lumada's composable architecture allows you to switch architectural components with third-party alternatives that run on the edge or in the cloud.
- Lumada is secure by design: Security is built into every aspect of the architecture and platform.

Hitachi combines great technology, services and expertise to accelerate the creation of IoT solutions by illuminating your data for greater insight.



Whether your IoT journey is just beginning or already transforming your business, our comprehensive co-creation services can balance your customization and speed of delivery: [Take a look.](#)



Hitachi Vantara At a Glance

Your data is the key to new revenue, better customer experiences and lower costs. With technology and expertise, Hitachi Vantara drives data to meaningful outcomes.

Hitachi Vantara

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