IDC TECHNOLOGY SPOTLIGHT

Sponsored by: HPE

Connecting an organization's assets is only the start. Asset digitization on the edge is about connecting and analyzing the data as a whole across the operational enterprise.

Driving Asset Performance with Digitization at the Edge

July 2021

Written by: Kevin Prouty, Group Vice President, IDC Energy Insights and IDC Manufacturing Insights

Introduction

Connected Assets

Connected assets are not new in manufacturing. Robotics and plant floor assets such as assembly-line equipment and operational systems have been connected to networks in the plants for decades; however, these systems tend to be proprietary, siloed, and supported by workers with dedicated skill sets.

AT A GLANCE

KEY STAT

According to IDC research, the data generation in a typical 1,000-person plant will go from 1TB of data per day in 2018 to almost 5TB of data per day in 2025.

Having a unified view of plant floor operations in such environments is virtually impossible. When problems occur, workers must physically walk the plant and check each piece of equipment and its corresponding human-machine interface (HMI) screen to detect issues.

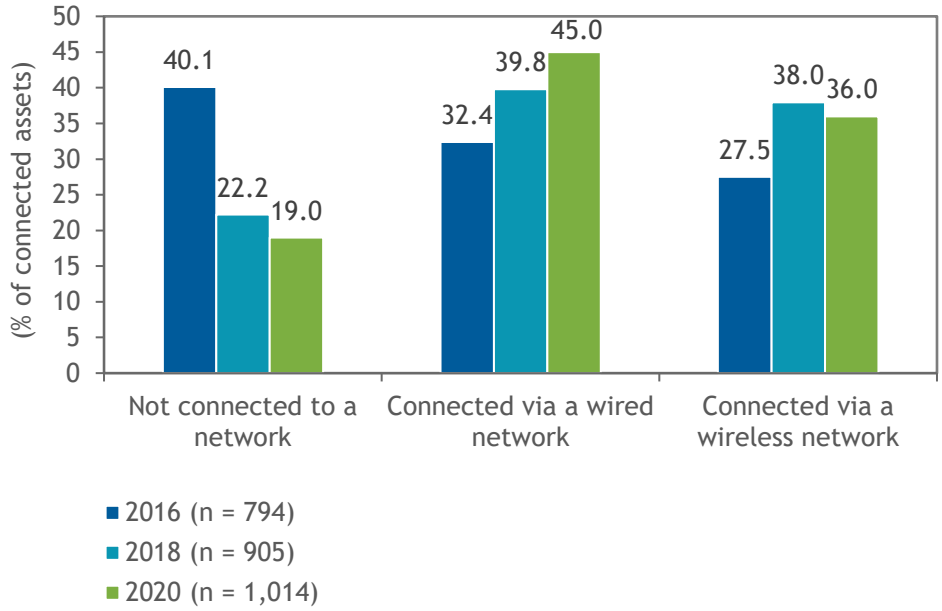
Over the past few years, advancements in IT and lower device costs have allowed manufacturing companies to aggregate plant floor asset data — assembly-line equipment, tools, and operational systems involved in the manufacturing process — into a common dashboard for improved visibility around plant floor operations and equipment performance. The goal is to improve operations efficiency by increasing asset uptime, improving maintenance productivity, and reducing costs. Specifically, a common dashboard has enabled:

- **Condition monitoring.** Organizations can connect an asset in order to monitor its condition, monitor performance, and warn of impending issues that could impact production (some companies are happy with condition monitoring outcomes and will not opt for predictive maintenance).
- **Predictive maintenance.** Using historical and real-time condition monitoring data from assets enables organizations to predict, and thus prevent, asset failures that could lead to downtime.
- **Asset performance management.** By aggregating and integrating real-time and historical failure data, along with asset documentation such as maintenance and repair records, inspection certification, and regulatory compliance, organizations can predict not only failure modes but also overall performance of the asset relative to other lines, other factories, and the business.

As Figure 1 shows, there is a race to connect important assets for manufacturing companies using wired or wireless networks.

FIGURE 1: ***The Drive to Connected Assets***

Q ***Thinking about all of your plants/delivery systems/mines, about what percentage of the instrumented operational equipment is connected in the following ways?***



Source: IDC's IT/OT Convergence Survey, 2016, 2018, and 2020

While connecting assets to a wired or wireless network will not automatically improve overall operations performance, it allows manufacturing and industrial organizations to connect previously unconnected, siloed operations systems into a common area. This is a necessary and fundamental aspect of gaining visibility across plant floor assets from a single viewing pane or dashboard. Considerations include:

- Access to the data required for digital transformation
- Retrofitting or upgrading legacy assets that still require digitization
- The data needs of the connected asset system, which are enormous and will grow with increased connectedness
- The bandwidth, which, though larger than ever, is still limited
- The inability of existing engineers to support a high-volume data and analytics environment due to a lack of talent and skills

The benefits promised by condition monitoring, predictive maintenance, and asset performance management require data sharing and visibility across intelligent networks so that data can be captured, aggregated, analyzed, and acted upon.

These benefits can extend beyond alerts, predicting maintenance requirements, and optimizing asset utilization to improve production throughput, operational flexibility, worker productivity, and market responsiveness.

To realize the benefits though, manufacturing and industrial companies must address or consider system and organizational challenges. They must first focus on asset digitization to convert and aggregate operations sensor data across a production line or factory floor. Data governance is another consideration; however, it's not necessary to have a model in place to begin condition monitoring. What is important is data normalization — knowing how different types of equipment asset data correlate to each other. For example, if temperature is recorded in seconds and flow is recorded in milliseconds, there needs to be a way of appropriately time-stamping the data to determine when an issue occurs. Failure to do so can lead to false positives — creating alerts when no action is required.

Digitized Assets on the Edge

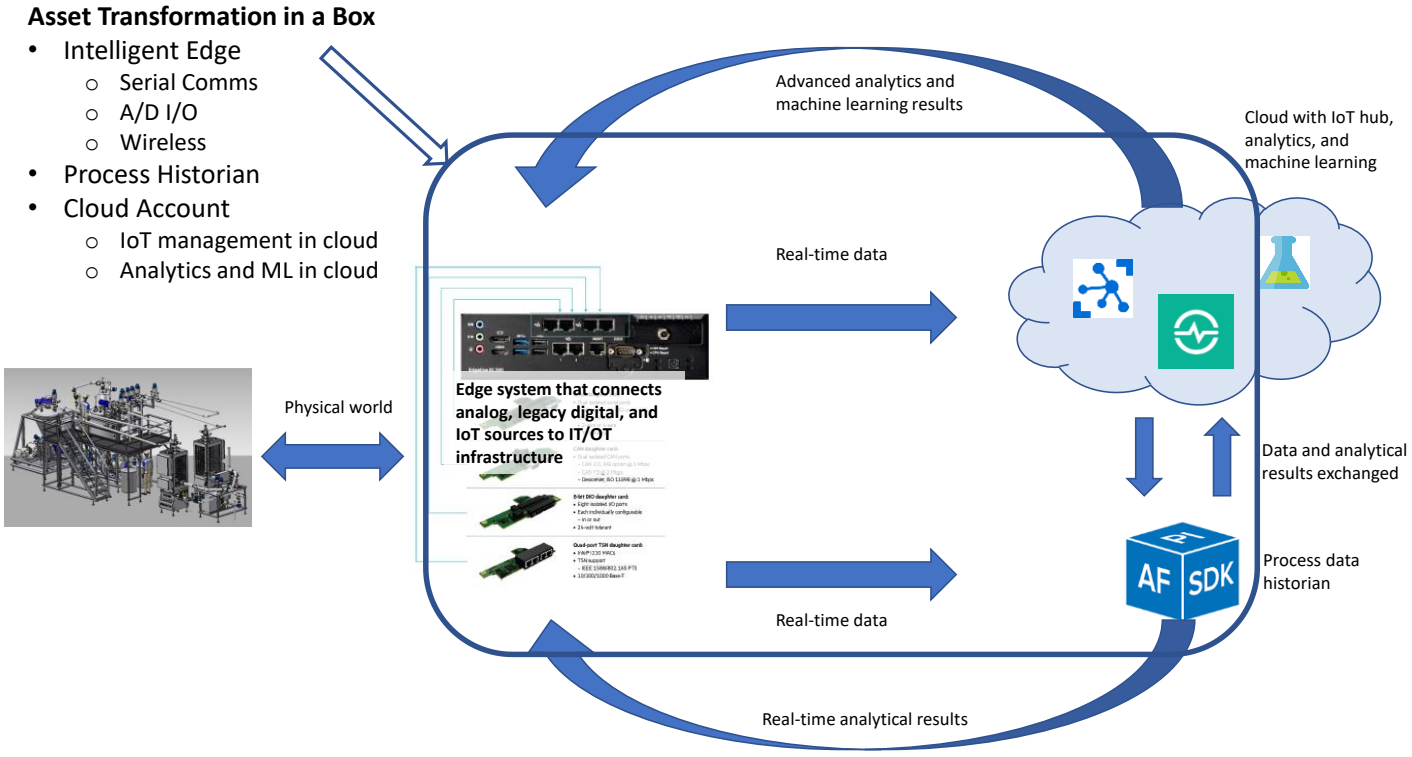
The journey to comprehensive digital asset management requires cooperative planning across operations and IT to be successful. The journey is best taken in steps, beginning with condition monitoring. For many manufacturing and industrial organizations, simply having visibility of plant floor equipment performance in one place and notification of impending issues is enough to justify the solution's costs. If there's a desire to progress to predictive maintenance, capturing, codifying, and tracking failure data are key to being able to predict potential maintenance issues and determine resolution. Considerations for comprehensive digital asset management include clear agreement on scope, understanding the various production processes the equipment supports, and additional data governance. Manufacturers must work through who has access to the data, where the data resides, role-based access, data warehousing, regulatory considerations, and so forth. No matter where manufacturers are on their journey, edge compute plays a pivotal role in connecting, aggregating, and integrating plant floor operations data. Organizations can now take a simple edge computing device with analog-to-digital (A/D) converters and connect to operations equipment sensors and other Internet of Things (IoT) data sources such as videocameras. This process is known as operations technology/information technology (OT/IT) convergence and provides the ability to digitize operational assets and display status on an IT-like dashboard.

With some edge compute devices delivering datacenter-grade compute to the "edge" or factory floor, manufacturing and industrial organizations have flexibility regarding how they want to process and store the data. Depending on the workload size of the data stream or data sovereignty issues that require the data to remain on-premises, manufacturers can elect to process and store locally, with the option of sending data anomalies to the cloud for further analysis. Alternatively, manufacturers can get started with a cloud-first solution on a small number of assets, but sending all the data to the public cloud is often not the best solution for the following reasons:

- Latency
- Security
- Cost
- Available bandwidth

Figure 2 shows a hypothetical simple asset digitization framework that can be a template for legacy assets.

FIGURE 2: ***Architecture of a Digitized Legacy Asset***



Source: IDC, 2020

Over 10 years ago, when an organization wanted to collect information from a 100-year-old hot press, it needed a small PLC, an A/D converter, plus all the PLC programming. Then it needed either an HMI connection or a data historian connection. All told, digitizing a pair of thermocouples and pressure sensors cost over $30,000.

Now, with ubiquitous connectivity, edge computing, and the cloud, the cost has dropped to no more than $1,000 to $2,000. Digitizing an asset such as this press allows it to be connected to an asset network, which enables all the benefits of predictive maintenance, in turn driving productivity, asset utilization, and higher throughput on all connected critical assets. But the biggest return on a relatively simple investment is digitizing operational data for better decision making.

The critical point is not just connecting the assets and generating more data but deriving new actionable insights from the existing data and from new data sources regarding the asset itself and in the context of the other assets in the full process flow. Aggregating data from these sources with data feeds from control systems provides a more holistic view of the entire operation, which enables employees in various functions such as plant management, finance, procurement, maintenance, and engineering to benefit from the same data — enabling them to make better, more informed decisions more quickly. Few businesses can justify the ROI from one proof of concept, so they need a common edge platform that can support a use case across multiple lines or factories, or even multiple, value-driven use cases. The value includes minimizing waste, reducing unplanned downtime, reducing routine maintenance, enhancing worker productivity, and increasing safety.

A foundational edge platform to achieve these types of business outcomes must have several key capabilities:

- Industrial network connectivity through OPC, Modbus, Profibus, DeviceNet, and so forth, to the OT devices themselves
- Analog-to-digital converters to acquire the analog data then convert it to digital for processing
- Datacenter-class processing power to not only ingest data but also support processing accelerators that are often necessary to run large, complex logic routines for controlling and manipulating the processes in near real time
- Multiple forms of communications and connectivity such as Wi-Fi, LTE, and Ethernet as well as hybrid cloud support
- A secure platform at the device, network, application, management, and data layers to be part of a secure overall operational environment
- Ability to support containerized workloads and leverage a breadth of APIs for rapid interoperability
- Ability to manage data flows
- An open standards–based platform to prevent vendor lock-in
- Ability to be a manageable component of a large, distributed industrial edge network of devices

All these capabilities are critical to digitizing assets and going beyond simply collecting more data and dumping it into the cloud or an on-premises data warehouse. The right edge platform provides the foundation for businesses and IT to move condition monitoring approaches to individual assets for more prescriptive analytics on assets that take into account the entire asset network and business operating conditions. That foundation is the common architecture and data management infrastructure.

Another significant benefit of an open edge platform is the ability to rapidly adapt to accommodate real-time changes in the environment, which is challenging for traditional configurations with dedicated controllers, proprietary data managers, and data paths that are tightly coupled to the asset data itself. Historically, making changes to these traditional systems was difficult, expensive, and generally relevant only to the function of the asset.

An edge platform is built to be a data hub and gateway. Logic inherent within the edge device enables real-time decisions on storing data internally, locally, or in the cloud. Data can be ingested, processed, and analyzed locally in real time. The edge device becomes an important data broker because it is a controller or a data collector. With regard to logic execution, a network of edge devices can dynamically operate different parts of the logic, depending on compute load, network load, and local operating conditions.

Asset Analytics and Manufacturing Transformation

Digitizing assets is a journey that can begin with connecting assets and performing condition monitoring. This provides manufacturers with the advantage of increased visibility across plant floor equipment and processes. But to achieve the ROIs they are seeking, manufacturers also need the ability to add more use cases to the same base edge platform and to evolve their ability to unlock value from their industrial data as their organization matures.

Adding use cases to an edge platform can provide access to all the data needed to create actionable insights that improve the speed and quality of decision making across entire processes and value chains, increasing throughput and quality while minimizing waste. To scale use cases effectively, manufacturers need the edge component. Having the ability to collect, control, analyze, and act upon operations data in near real time is a key factor in deciding whether data goes to the cloud or is processed locally.

The advantage of an edge-to-cloud infrastructure is that it provides an agile foundation to support the journey from condition monitoring to asset performance management.

IDC research has shown that data generation in a typical 1,000-person plant will go from 1TB of data per day in 2018 to almost 5TB of data per day in 2025. This is an enormous increase and is driven mostly by IoT and digitization of assets and processes coupled with augmentation from automated vision capabilities such as video. As this trend continues, plants with bandwidth limitations will be further challenged to move future volumes of data to centralized or remote locations for aggregation, processing, and insight generation. Network bandwidth costs and latency will impede their progress. A datacenter-class edge platform will be a key means of overcoming these challenges by providing similar capabilities found in the datacenter or cloud, but now at the edge — closer to the data and where the insights are needed.

An important part of the digitization process is managing assets and processes holistically. The benefits of doing this are as follows:

- Aggregation and conditioning of data from existing and new data sources
- Application of advanced analytics and artificial intelligence (AI) algorithms to rapidly analyze the data and create new and more in-depth insights regarding asset health and performance
- A more holistic view of plant floor reliability, operational consistency, and overall performance
- Greater visibility into the orchestration and interdependencies of all the edge-enabled assets
- The ability to rapidly adjust to change through a distributed network of intelligent edge devices
- Distributed monitoring and diagnostics (M&D) operation for all assets

An M&D center is the goal of a transformed asset management strategy for many manufacturers. Manufacturers can transform asset and process operations by collecting all asset data and skilled technical staff status (i.e., location and availability of maintenance workers, how well maintenance workers are performing their tasks). By collecting the data in a distributed but interconnected environment, manufacturers can manage operations across lines, processes, sites, geographies, and people.

In the final transformation of asset management, edge devices will provide intelligence at the local level but also participate in a wider asset network that allows local and distributed analytics to uncover performance insights across the network.

Benefits

The benefits of edge-based asset digitization are numerous, but the key benefits are as follows:

- Increased asset uptime that reduces asset investment
- Reduced costs of scheduled and often unnecessary maintenance
- Lower holding costs of unneeded spares
- Productivity improvements in maintenance and production staff through improved maintenance schedules
- Near-real-time decision making based on data in the context of the overall operation, not just a line or a plant

While the benefits of networked assets are similar to those gained from a simple single-asset project, the net effect of how assets work together can improve the overall process. But the previously mentioned benefits derived from a managed and distributed network of edge-based assets will operate to deliver value greater than the sum of the individual assets in the network. These networks of assets and edge devices provide the ability to automatically and dynamically adjust to real-time operating conditions of the network, the operating environment and, eventually, the business environment.

For example, a line of 10 presses can deliver significant value just through digitization and analysis of the individual presses. In an edge-driven world, the presses are orchestrated through a single overarching automation system that not only delivers data and insights but also optimizes workloads of presses and computing power. When a press goes down for planned or unplanned stoppage, the orchestrated operation can dynamically and automatically shift the production load in conjunction with business-level scheduling systems. This provides not only improved asset operations but also the optimization of all presses to meet overall throughput and yield goals.

Key Trends

The following key trends in asset management, IoT, edge computing, and analytics are impacting the digitization of assets:

- OT/IT convergence — using software and edge compute to digitize assets and operational technologies onto a single pane of glass (dashboard)
- The cost of digitizing an asset, which has dropped significantly through ubiquitous connectivity, cloud, and IoT technologies
- Increasing investment in cloud and edge by both technology vendors and manufacturing companies
- The emergence of IT-like and data skill sets for engineers and production staff
- The ability of edge devices to handle large data sets and connect to industrial equipment with the capabilities of new edge devices
- The ability to manage and control operations technologies using the tools and technologies that have connected, automated, and transformed the IT landscape

All these trends provide an opportunity for organizations to transform asset performance management into an edge-based distributed operation to be more agile and holistic and have the ability to share data beyond the existing silos.

Considering HPE

Hewlett Packard Enterprise (HPE) is a global edge-to-cloud platform-as-a-service technology company that helps organizations accelerate smarter operations, make better business decisions, and ignite innovation. Together with the company's analytics and industrial partners, HPE helps customers deploy solutions to acquire, secure, analyze, and act upon data-driven insights across industrial workflows to reach the digitization promise of Industry 4.0.

Using a broad range of computing, networking, and storage solutions, HPE can help customers deliver a seamless experience from the edge to the datacenter. For edge computing, HPE Edgeline Converged Edge Systems, featuring Intel second-generation Xeon Scalable Processors, are built for rugged environments and designed for power-efficient operations. HPE Edgeline brings datacenter-grade computing, storage, and near-real-time analytics to the factory floor, the refinery, the power grid, or a freighter. More importantly, customers can integrate operations and IT data into a single dashboard. This single-pane-of-glass view provides visibility across assets, processes, and sites to optimize operations, reduce maintenance costs, and improve worker productivity.

Customer Use Cases

HPE has helped customers deploy asset performance analytics in the oil and gas, energy distribution, and manufacturing sectors. The following examples are provided by HPE:

- A process manufacturer reportedly uses persona-based condition monitoring and predictive maintenance to better track asset utilization and anticipate maintenance requirements to prevent equipment failures, increase productivity, and lower costs. Machine sensors collect real-time operational data and feed into customized, persona-based dashboards. Tuning the dashboard to specific roles enables workers to more efficiently gather job-specific insights to make decisions more quickly and improve operational effectiveness. Improvements realized, according to the company, include:
  - Improved return on assets by reducing spare equipment inventory
  - Reduced unplanned downtime by anticipating equipment failures and scheduling repairs during planned outages
  - Reduced worker safety incidents by automating data collection
  - Expected 20% reduction in downtime
  - Estimated 50% reduction in planned maintenance costs
- A distributor of electricity and natural gas is fully digitizing operations to monitor energy consumption, improve power quality, prevent outages, and more quickly respond to customers. The smart grid collects data from 221 million meter reads daily. The introduction of new value-added services has reportedly increased data volumes over 830% in five years. The utility is now able to leverage its smart grid data to prevent and detect outages more quickly to improve power restoration times. Results achieved, according to the company, include:
  - 10% improvement in customer satisfaction due to faster resolution of power outages and customer inquiries
  - Thousands fewer truck rolls annually since implementing smart meters and analytics

- A manufacturer of environmentally conscious, reusable food containers has deployed an industrial IoT solution to gain real-time insights from plant floor machine assets to improve throughput and quality. This growing company recently added state-of-the-art injection molders to meet growing customer demand and sought to connect both new and legacy molders to monitor asset performance and production processes. The reported results achieved include:
  - 50% reduction year over year in quality issues
  - 45% improvement in throughput
  - 45% increase in output
- A European energy company and distributor of natural gas, with over 12,000km of natural gas pipeline, underground storage, and regasification terminals across Europe and Latin America, is seeking to achieve the following:
  - Optimize the gas delivery pipeline with improved measurement processes
  - Reduce operational and maintenance costs
  - Enhance security, predict maintenance, and forecast demand

  An IoT solution was deployed to deliver improvements to safety, security, and profitability, according to the company, through a combination of machine learning algorithms deployed on edge computing. The new data platform captures and analyzes up to 352 million measurements per hour across the company's pipeline assets in near real time, allowing more accurate demand forecasts and the ability to predict maintenance issues before they occur. The platform supports real-time management and control and offers cloud-based flexibility to enable proactive and automated rollout of new master data management (MDM) software to ensure data accuracy and consistency.

Challenges

Manufacturers face the following challenges in digitizing assets and making them part of a distributed and secure network:

- It still costs something to digitize, and each asset has to show value from the digitization.
- Internal skill sets around data and cloud are limited.
- Connectivity is not completely ubiquitous at the individual asset level and the broader network level.
- Deployments typically involve working with a number of vendor partners.

Each of these challenges can be overcome but must be addressed as part of a larger asset management strategy.

Conclusion

As manufacturers struggle to make use of their industrial data, advancements in digital technologies and lower edge device costs are making asset digitization a reality, allowing companies to aggregate, analyze, and act upon plant floor asset data. The journey to asset performance management is a significant undertaking that involves a data governance strategy; however, the journey can be taken in steps, beginning with connecting plant floor assets to gain visibility and monitoring asset performance with condition monitoring. Manufacturing and industrial companies embarking on this journey should not lose sight of comprehensive asset performance management because it will inform the data collection needs at each stage. As an example, failure data collected in condition monitoring will be necessary for predictive maintenance. For many, the benefits of condition monitoring — increased asset uptime, improved maintenance cycles, and reduced costs — will be enough and can be accelerated when scaled across a single factory or multiple locations.

About the Analyst

Kevin Prouty, *Group Vice President, IDC Energy Insights and IDC Manufacturing Insights*

Kevin Prouty is Group Vice President for IDC Energy Insights and IDC Manufacturing Insights. He is responsible for managing a group of analysts who provide research-based advisory and consulting services that will enable energy executives in oil and gas and utilities to maximize the business value of their technology investments and minimize technology risk through accurate planning. Kevin's research specialties are utilities, manufacturing, enterprise applications, and product innovation.

MESSAGE FROM THE SPONSOR

About HPE's Edge-Based Asset Performance Solutions

For additional resources on improving asset performance with edge-based solutions, you may also be interested in:

1. ***Intelligent Factory Video***
2. ***CenterPoint Case Study***
3. ***Texmark Case Study***
4. ***Edgeline Family Guide***

IDC Custom Solutions

The content in this paper was adapted from existing IDC research published on www.idc.com.

IDC Research, Inc.
140 Kendrick Street
Building B
Needham, MA 02494, USA
T 508.872.8200
F 508.935.4015
Twitter @IDC
idc-insights-community.com
www.idc.com