

Process Industries: How Edge Computing Can Solve Your Operational Challenges

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Enhance Your Networks to Collect, Analyze and Gain Actionable Insights from the Growing Amount of Data Produced by Your Digitized Operations

Introduction

Recent years have brought tremendous disruption to process industries.

From supply chain upheaval to a sluggish global economy, challenges have motivated many manufacturers to look hard at how they operate. Most face an ever-present mandate to keep costs in check while elevating productivity—two seemingly contradictory aims.

Even in relatively stable times, process production is innately complex. All process manufacturers use processes and formulas to turn ingredients and raw materials into products—but the concept spans distinct sectors, including food and beverage, chemicals, oil and gas, pharmaceuticals, mining and others. These manufacturers often face intense regulatory scrutiny and must meet stringent safety and security standards with significant national and regional variances. Additionally, the growing focus on environment, social and governance (ESG) performance improvement adds new layers of responsibility.

 WHITE PAPER

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How can process manufacturing organizations like yours address today's competing forces and still come out ahead?

The answer lies in advancing your technology.

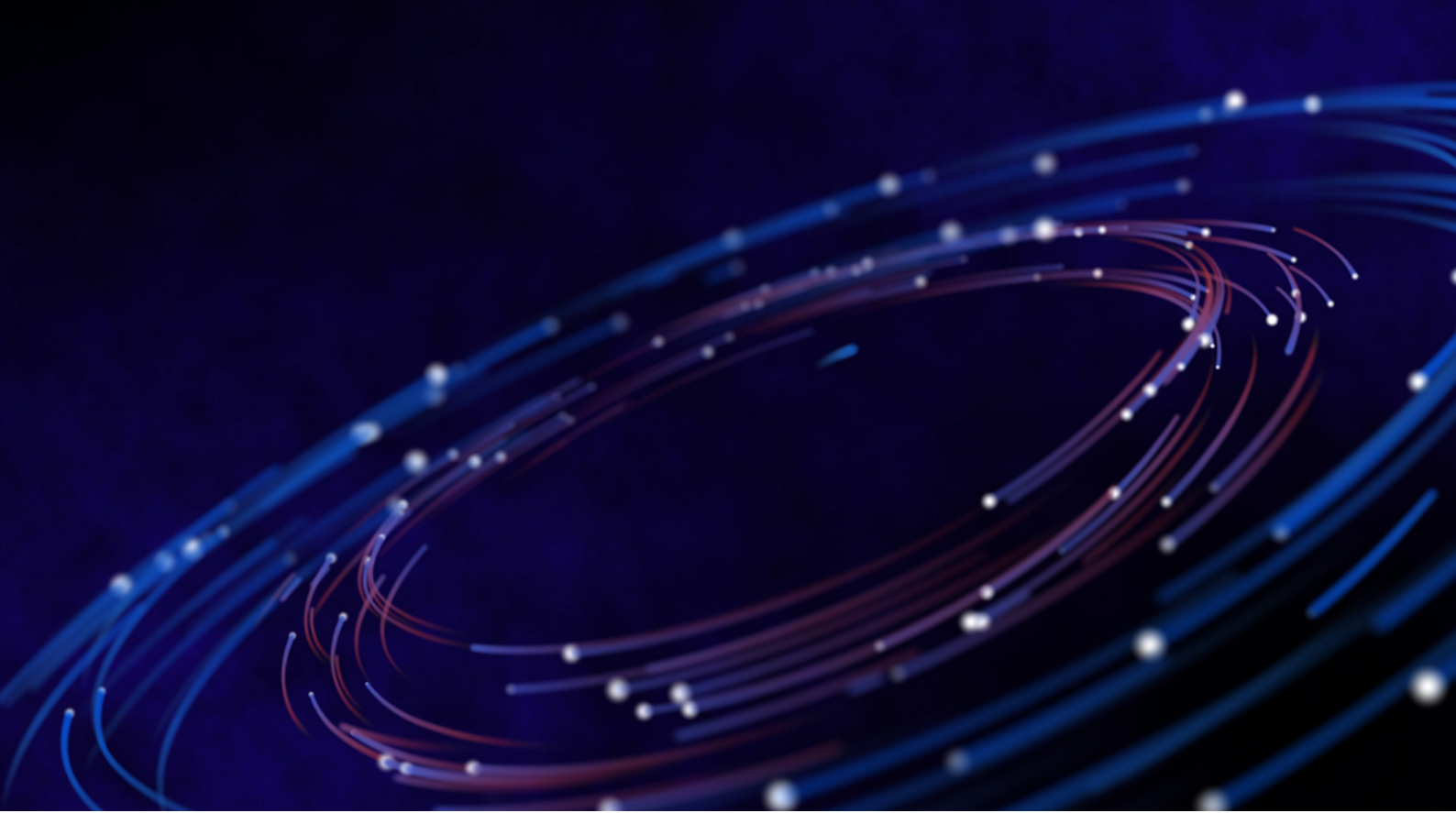
Today's process manufacturers have the unique opportunity to deploy industrial edge solutions that let you collect, analyze and act on data from connected operational technology (OT) devices locally. Overcoming the inevitable lag that occurs when you send data from the field to your information technology (IT) systems, edge computing provides insights in near real-time near where the data is generated, speeding decision-making and unlocking new efficiencies.

At Belden, we understand the complexity of process industries and the power of edge computing. We know that, as your organization advances digital transformation, you will connect more devices and have access to more high-value data.

In this white paper, we explain how edge computing can address your data collection and analysis needs today and help you build a foundation for the future.

“Edge computing provides insights in near real-time near where the data is generated, speeding decision-making and unlocking new efficiencies.”





Are You Ready for the Edge Computing Revolution in Process Manufacturing?

Harnessing the power of technology to advance performance is nothing new in process manufacturing. But we're in the middle of a massive shift that promises to reinvent how process manufacturers operate.



Today, **Industry 4.0** increases automation and employs smart machines and smart factories to accelerate production. By collecting more data on operational, material and machine states using smart devices, you can monitor against standards and analyze for potential process improvements and manufacturing efficiencies.



The **internet of things (IoT)** is a key element driving the evolution of smart industries. IoT refers to the deployment of smart devices equipped with software and other technologies that allow them to connect to OT devices and IT systems to share large amounts of data. The **industrial internet of things (IIoT)** refers to the use of sensors, actuators and other technologies that let you gain control of your plant complexity, in any process industry.



Edge computing is also propelling the shift to Industry 4.0. Simply put, edge computing solutions support data collection and analysis at the edge—meaning locally, where the data is created.

The fast and vast diffusion of smart instrumentation in the process industry has created enormous untapped potential for better management and decision-making through analysis of all that data.

Now edge computing has the potential to collect all that data directly at the source, without disruption to your process control systems, and bring it directly into the hands of those who really need it.



When edge computing is used to process operational data in an industrial environment, this is referred to as **industrial edge computing**. By moving processes closer to the devices that

generate data, industrial edge computing reduces the number of processes happening in the cloud and enterprise systems. When industrial edge computing hardware is supplemented with edge applications and complementary services, the result is an **industrial edge solution**.

Mining the Gold in Your Industrial Data

Process manufacturers can send operational (OT) data to information (IT) systems—and introduce IT technologies in the OT environment—but challenges are all-too-common. These roadblocks include:



Legacy Protocols

Most manufacturing environments have a large installed base of existing OT assets which may have been in place for decades and operate using proprietary or legacy protocols.



Response Latency

Manufacturing facilities may be hundreds to thousands of miles from data centers, and the distance can increase the time between initiation of a communication and a response.



Security

Transmitting data between IT and OT systems and/or between facilities introduces cybersecurity risks.



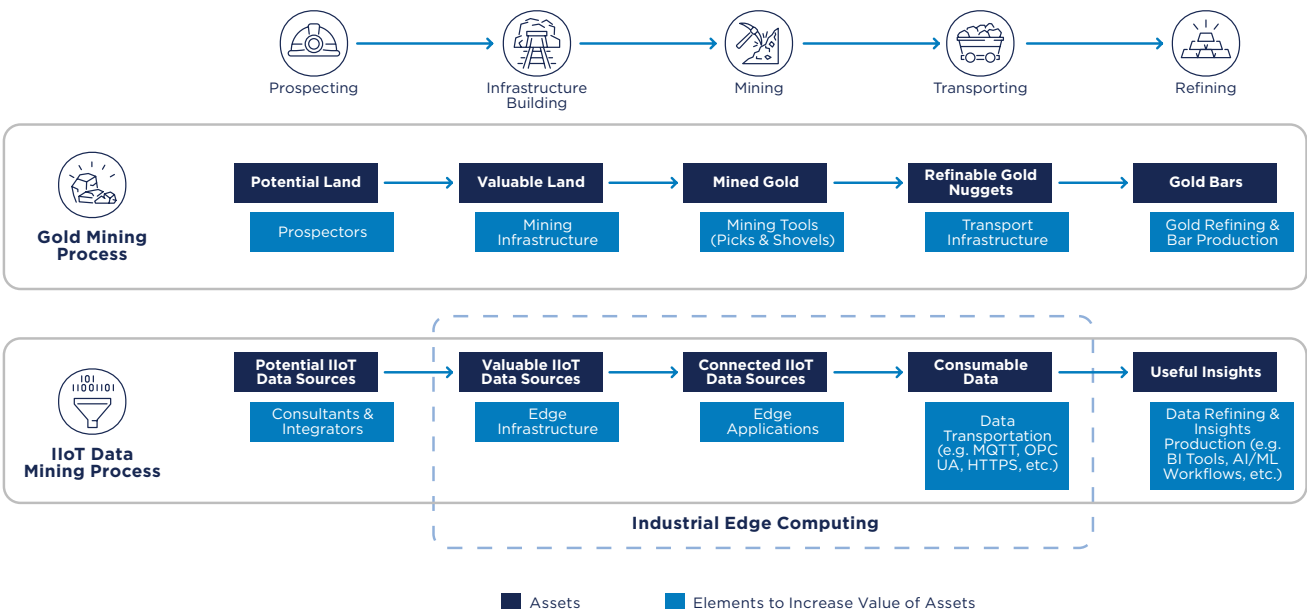
Complexity and Cost

Accessing certain data types and sending them to outside IT systems can be difficult, expensive, or slow.

These barriers stand in the way of operational efficiency and drive up costs. However, your connected IIoT devices offer a gold mine of data that you can use to overcome these hurdles and transform your operations—but only if you can access high-value insights.

To extract and process gold, you use specific mining infrastructure and tools, along with transportation and refining tools. In industrial environments, industrial edge solutions manage the end-to-end process of data collection, transmission and analysis.

Gold mining and industrial edge data mining follow a similar sequence of steps with specialized elements supporting each phase:
Prospecting, Infrastructure building, Mining, Transporting, Refining.



What Benefits Can You Gain from Your Industrial Edge Data?

You can collect many types of data from edge devices—such as environmental, operational and network data. For this data to be useful, however, it must provide insights that drive action or improvements to your operations.

In industrial environments, edge computing can yield significant benefits, including:

- **Improved process quality.** Handle complex data analysis at the edge, increasing your ability to make real-time decisions and improve your processes.
- **Lower latency.** Reduce the time that elapses between initiation of a communication and receipt of a response, allowing more expedient decision-making and action.
- **Higher bandwidth.** Limit data transfer by distinguishing between routine monitoring data and outlier data requiring attention.
- **Enhanced visibility.** Gain insight on what devices you have, where they are located and how they are performing, along with process status and critical alerts that need intervention.
- **Increased security.** Decrease risk by performing computing near the data source and distributing processing and storage functions around the perimeter to safeguard your network.
- **Greater flexibility.** Run complex workloads closer to where the data is generated to extract more valuable and timely insights.
- **Streamlined maintenance.** Identify when devices are functioning below expected benchmarks to perform proactive maintenance and prevent catastrophic device failures that can cause unplanned downtimes.
- **Reduced costs.** Deploy lower-cost, high-powered computing to reduce the need for IIoT hardware and save by limiting the amount of data transmitted, processed and stored in the cloud.



Favorite Edge Computing Applications in Process Manufacturing... Real Use Cases, Not Just Possibilities

For the past decade, process industries have been exploring—or at least dreaming about—how edge computing can significantly enhance productivity in manufacturing environments.

The potential to monitor equipment performance and material states in real-time—and around the clock—to optimize operations, reduce downtime and achieve cost savings is greater than we yet know. In addition, industrial edge solutions collect and collate data from various sources to provide never-before-seen visibility and quick, complex analysis of potential solutions.

Creative plant managers use edge data to improve their ability to solve complex operational challenges. Two popular uses available today include optimizing planned maintenance and addressing sustainability expectations.

Optimizing Planned Maintenance

Edge computing solutions measure data and diagnostic information from sensors, actuators and other devices during normal processes to identify what equipment needs maintenance during planned shutdown windows.

For example, with edge solutions you can identify if a specific valve in a single machine—in a facility with hundreds of machines and thousands of valves—is performing below benchmarks. During scheduled plant maintenance—which can be planned up to a year in advance—your technicians can know exactly which valve needs repair and keep downtime to a minimum.



Addressing Sustainability Expectations

Manufacturers face new scrutiny from investors, media and the public about their commitment to sustainability. With edge computing, your company can handle processing closer to the source, potentially reduce hardware investments and lower power consumption—all of which can help reduce your ecological footprint. Also, edge computing lets you collect and collate information from different domains to analyze your environmental impacts and share these insights at the enterprise level for action and ESG reporting.



Technical Considerations for Deploying Industrial Edge Applications

Many manufacturers are advancing digitization and exploring opportunities to increase operational efficiency with edge solutions. To capitalize on the immense value offered by the data available from your connected IIoT devices, you need robust industrial edge solutions to process data in a safe, accurate, reliable way.

Knowing the key considerations and essential requirements for industrial edge solutions can help you make informed decisions on solutions that match your business needs.

Types of Industrial Edge Applications

Various industrial edge applications address common use cases in industrial environments, including:

- **Networking.** Applications that analyze, configure and manage industrial networks.
- **Ingestion.** Applications that collect, convert and or collate industrial data.
- **Security.** Applications that analyze, manage, or improve cybersecurity of industrial operations.
- **Control.** Applications that control industrial processes (e.g., IEC 61131-3 and 61499 software).
- **Analysis.** Applications that run simple (e.g., filters, run charts) or complex (e.g., artificial intelligence or machine learning) analytical functions on OT data.
- **Visualization.** Applications that visualize OT data in either read-only (e.g., dashboards), or read-write (e.g., human-machine interface, or HMI) format.
- **Storage.** Applications that store OT data in a persistent fashion.



Edge Computing Is an Evolution of Cloud Computing

While edge computing is revolutionary, it isn't all-new technology. Instead, edge computing is an evolution of proven cloud technologies that manufacturers can now deploy at scale locally in their industrial networks.

With roots in big server farms housed in data centers, cloud computing is the result of game-changing virtualization technology that allows several applications to run on a single, physical computer. Ever-growing demand for computational power has made microservices architectures the norm in cloud computing. Microservices split applications into small, specific tasks or services—and are often housed in containers that allow virtualization of multiple application runtime environments on a single operating system.

These reliable and time-tested cloud-native microservices architectures have now descended to the industrial edge, providing significant benefits, including ease-of-use, scalability, self-service and flexibility. You can now more easily deploy applications on edge devices, collect data on application performance and availability and more quickly make informed business decisions that elevate productivity, security and safety.

The Importance of Cloud-Powered Industrial Edge Computing

Revolutionary—but very real, and available today—industrial edge computing solutions address the challenges that keep you up at night. Advanced edge solutions efficiently sort, organize and carry data from the plant for consumption by the appropriate business intelligence systems that can unlock more of its value—all without disturbing your vital process networks.

Edge solutions provide a reliable hardware infrastructure, ready to be installed into all your system panels. A DIN Rail industrial-grade device with plenty of ports gets the data directly from the source, keeping your networks segregated starting from the field level. This powerful, yet small, component can talk with your smart instrumentation, connect to any PLC, collect data from wireless sensors and field buses, and let you easily add new sensors when and where needed. All this happens discretely, without touching your process control system.

This infrastructure serves as both nervous system and brainpower:

- Collecting all your data directly at the source.
- Contextualizing your data into structured data flows ready to be consumed in real-time by your preferred business intelligence suite.
- Giving you instant visibility into what you need to know at any time in an easy to access format on your preferred browser.





Technical Requirements for Edge Computing Devices

The applications and use cases inform the technical requirements of the hardware that will execute the applications. For example, applications that control industrial processes need high availability and low latency, but do not need to scale. By contrast, applications for analysis need to scale to match the volume of data and types of analysis performed but have low latency and availability requirements.

Additionally, manufacturers often expect edge compute devices to have longer lifespans in the field than is typical of IT devices. As such, you should consider warranties and end of life (EOL) dates when choosing hardware. Another key consideration is mean time between failures (MTBF)—or the average time the device operates between breakdowns—which can help you anticipate potential downtimes.

Requirement	Considerations
Compute Resources	Processor, memory and storage capabilities should match the applications that will run on your edge devices.
Form Factor	Size, shape and physical arrangement should match the space where the device will be used and its applications.
Temperature Rating	Wider operating and non-operating temperatures may be necessary in industrial environments.
Power Requirements	Factors such as industry, region and application affect the power input needs for industrial devices.
Power Distribution	Power over Ethernet (PoE) and power over data line (PoDL) can reduce wiring needs and installation complexity in industrial environments.
Approvals	Various industries, regions and applications may require specific standards and approvals for safety, quality, communications and other factors.
Native Networking Interfaces	Industrial edge devices may need interfaces to support both IT and OT applications.
Native Edge Application Management	Edge compute devices often have pre-installed container managers and hypervisors to run containers and VMs from various vendors.
Security	Hardware-based code prevents unauthorized code from running on edge devices, safeguarding sensitive data.

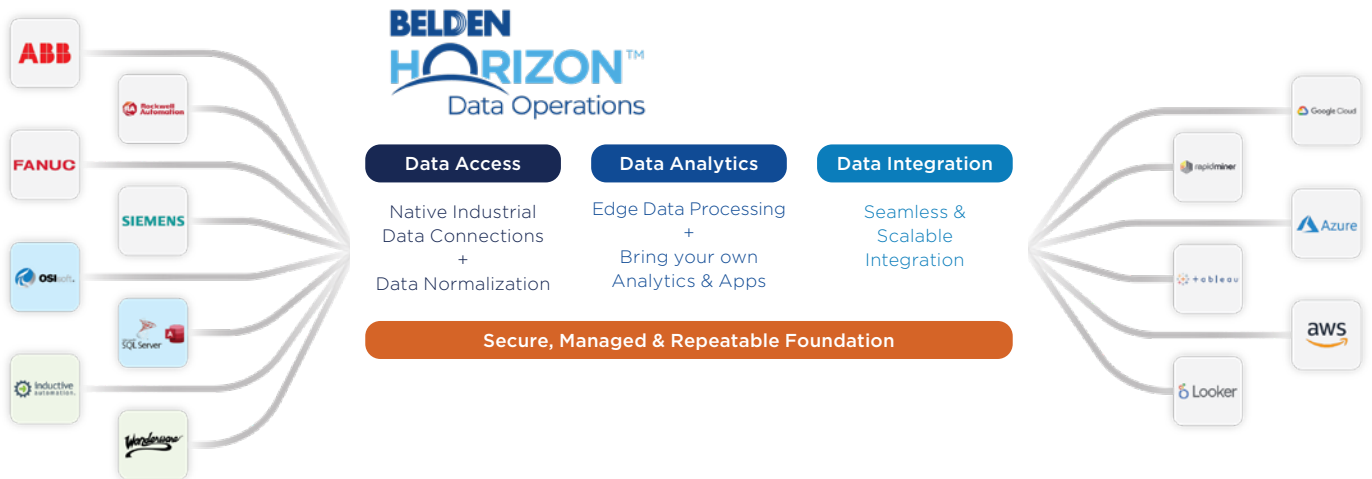
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As IIoT advances, process manufacturers must be capable of acting on intelligence gathered at the network edge, where the physical and digital worlds meet. Industrial edge computing systems must collect, analyze and process data close to the source where it's generated to deliver the most value to your manufacturing operations.

Belden's industrial edge solutions include a converged ecosystem of hardware, software and services designed to deliver useful business outcomes. Applications running on edge devices connect with both IT and OT data sources, transform data into proper formats and generate data for use throughout the enterprise. With insights derived from this data, you can increase visibility and achieve new levels of productivity without disrupting ongoing operations.

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Belden Industrial Edge Orchestration



Let's build the future.



About Belden

Belden Inc. delivers the infrastructure that makes the digital journey simpler, smarter and secure. We're moving beyond connectivity, from what we make to what we make possible through a performance-driven portfolio, forward-thinking expertise and purpose-built solutions. With a legacy of quality and reliability spanning 120-plus years, we have a strong foundation to continue building the future. We are headquartered in St. Louis and have manufacturing capabilities in North America, Europe, Asia, and Africa.

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