

SAILING TO THE EDGE

A manufacturing perspective



Abstract

In the age of evolving enterprise IT, with an increasing number of workloads moving to the cloud, edge computing has emerged as a key enabler for use cases that depend on low-latency, real-time processing capabilities and cloud innovations for continued and sustainable progress. As we continue our steadfast journey into the future, aided by AI/ML, IoT, robotics, and automation, edge computing will play a critical role in shaping a scalable and secure environment for efficient data processing.

Amongst the various sectors that edge computing is disrupting considerably, the manufacturing industry is a notable one. With a plethora of use cases that are being enabled by edge computing, manufacturing companies are poised to unlock value at scale and reshape their operations. The manufacturing industry is making a shift toward merging information technology (IT) with operational technology (OT) for better transparency, improved efficiency, and informed decision making. Having said that, a fully automated edge computing platform has a critical role to play in driving industry-leading edge use cases, facilitating innovation, and delivering valuable business outcomes for manufacturers.

Redefining Manufacturing

The transformation of the manufacturing sector through technology has been truly remarkable. Automation, IoT, and data analytics have ushered in a new era, turning traditional factories into interconnected, intelligent ecosystem. This evolution not only streamlines production but also facilitates predictive maintenance, leading to reduced downtime and cost savings. Collaborative robots, or cobots, have improved workforce efficiency and safety, fundamentally altering the way products are conceived, created, and brought to market.

The key focus areas for most manufacturers now are quality, innovation, efficiency, sustainability, and adaptability. Excelling at all of those are paramount to meeting evolving market demands and customer preferences while remaining competitive in the global marketplace.

- **Greater innovation and agility** Scalable modernisation and innovation across processes and locations, enabling adaptability to new situations and use cases.
- **Quality assurance:** Ensuring the delivery of high-quality products that align with customer expectations and adhere to industry standards and regulations is a business imperative for manufacturers.
- **Operational efficiency:** Efficiency stands as a central focus for manufacturers, characterised by their commitment to optimising operations, minimising waste, and elevating productivity levels.
- **Increased safety:** Elevated safety standards, encompassing the creation of safer factories and careful policy development, is a critical priority for leading manufacturers.
- **Sustainability:** Manufacturers are progressively embracing environmentally conscious practices, such as the reduction of energy consumption, waste minimisation, and the exploration of renewable and recyclable materials to curtail their environmental impact.



Key business challenges faced by manufacturers

Manufacturing enterprises are often plagued by a multitude of roadblocks and continuous business challenges. They result in suboptimal performance and output, increased overheads, and missed opportunities. Here are some of the pertinent challenges faced by manufacturers:

- **Supply chain disruptions:** Manufacturers often encounter disruptions in their supply chains due to various factors such as logistical backlogs, geopolitical tensions, cost pressures, and low inventory levels. These disruptions can result in delays, increased costs, and difficulties in sourcing essential raw materials.
- **Real-time data processing and bandwidth optimisation:** There is an utmost need for quick decision-making and responsiveness that requires quick computing in ultra-low latency. This is required to reduce delays, offer real-time insights, and improve efficiency.
- **Efficiency and cost:** The integration of digital technologies and the adoption of Industry 4.0 practices can be complex for manufacturers. Implementing automation, IoT, data analytics, and AI/ML and integrating them into existing processes requires substantial investments and a cultural shift within organisations.
- **Regulatory compliance:** Adhering to evolving regulations, particularly in areas such as environmental standards, product safety, and cybersecurity, presents an ongoing challenge for manufacturers. Non-compliance can lead to financial penalties, damage to reputation, and legal repercussions.
- **Workforce shortages and skills gaps:** Attracting and retaining a skilled workforce remains a significant challenge for the manufacturing industry. An aging workforce and a shortage of workers with the necessary technical expertise to operate advanced machinery and technology create resource hurdles.









Edge computing: An overview

Edge computing has made a remarkable journey in the last few years and is expected to play a pivotal role in revolutionising operations across verticals. To put this in perspective, Gartner anticipates that by 2025, about 75% of data generated by enterprises will be produced and managed beyond the confines of conventional, centralised datacentres or cloud.

While most industries are in the process of implementing edge computing to varied degrees, the early adopters are manufacturing, energy and utilities, telecommunications, logistics, retail and consumer goods, and healthcare. Riding this wave of popularity and outcome-orientation of edge computing, its global market is expected to be worth \$132.11 billion by 2028, up from \$40.84 billion in 2022, registering a healthy CAGR of 21.6% in the forecast period.

The edge computing revolution will be fuelled by advancements across the board:

-  Exponential growth in investments
-  The rise of 5G and Wi-Fi 6 connectivity
-  Hyper-connectedness and a boom in data generation
-  Further enablement of AI/ML, automation and robotics, smart sensors and IoT applications, and AR/VR
-  Computer vision
-  Containerisation

Edge computing plays a vital role in the manufacturing domain by addressing several critical needs. It enables challenging use cases, such as smart factories, autonomous vehicles etc., by minimising data latency. It helps optimise costs by processing data at the edge, reducing the reliance on expensive backhaul infrastructure. Compliance with local data residency laws is also made easier, allowing manufacturers to benefit from both cloud and edge technologies.

Edge computing helps manufacturing enterprises expedite IT/OT convergence by integrating emerging technologies into existing IT and OT infrastructure, data, and processes. It also provides more granular control over individual and enterprise data, reducing dependency on public cloud services and making it a versatile solution for manufacturing enterprises.

However, with their existing cloud-based strategies, manufacturers often find it difficult to manage a large volume of unstructured data sent to the cloud, as it requires a long response time and huge bandwidth. This makes it challenging to detect and prevent capacity bottlenecks in advance. Minimising downtime and plant emission rates are other significant issues that manufacturers cannot address with the existing proprietary systems within their plants. By deploying edge computing solutions, manufacturers can implement real-time monitoring and control mechanisms at the edge, enabling faster response times to potential downtime events and allowing for more immediate adjustments to reduce emissions.

Forward-thinking manufacturing enterprises are increasingly striving to achieve streamlined operations, better factory floor space utilisation, reduced costs, strengthened security and data privacy, optimised productivity, asset longevity, improved business resiliency, and sustainability. And edge computing is the answer to all those and more.



The key drivers of edge computing in the manufacturing sector

Manufacturing enterprises recognised the merits of edge computing early and put it to use to drive their Industry 4.0 initiatives. At the forefront of infrastructure-led disruption stands edge computing, representing a paradigm that unlocks a multitude of novel business possibilities. Leaders in infrastructure and operations (I&O) must proactively embrace this trend, accelerating the seamless integration of a diverse array of edge computing applications within the enterprise.

Edge computing in manufacturing offer several benefits, data security by localising sensitive information, support scalability to accommodate rapid expansion, enables efficient remote monitoring of dispersed facilities, and reduces costs associated with data transmission and storage in cloud.

Here's a lowdown of what's driving the adoption of edge computing in manufacturing verticals:

- **Industry 4.0 and IoT:** The emphasis on integrating digital technologies into manufacturing is driving the adoption of edge computing to implement IoT solutions and harness the power of connected devices and systems. Edge computing complements IoT by processing this data locally rather than sending it to centralised datacentres. This proximity reduces latency, allows for real-time analysis, and enables faster decision-making.
- **AI-enabled automation and robotics:** The role of AI/ML and automation cannot be overstated in smart manufacturing and digitised operations. In the new age of manufacturing operations, automation of repetitive and hazardous tasks is paramount. It saves both time and cost and, most importantly, reduces the risk of bodily harm. However, for advanced robotics to efficiently reduce human interventions, data processing needs to be near instant and seamless. Edge computing enables that and facilitates enterprise wide automation of tasks. Hence, manual intervention is required only for critical, perspective-oriented tasks.
- **Computer vision:** Computer vision applications in manufacturing benefit greatly from edge computing, as it allows for real-time analysis of visual data, enhances quality control, supports predictive maintenance, ensures safety, and enables rapid decision-making. This synergy between computer vision and edge computing is transforming manufacturing processes and contributing to increased efficiency and competitiveness in the industry





How Edge is helping address the key challenges

The ever-evolving use cases in the manufacturing space include advanced quality check measures, predictive maintenance, automation of factory floors and warehouses, worker safety monitoring, and real-time resource observability. These applications leverage edge devices to process data locally, enabling quicker decision-making. Here is a detailed look at five important use cases in manufacturing:

- Quality control:** Transform quality control in manufacturing by enabling real-time data analysis, anomaly detection, reduced latency, and immediate corrective actions. For example, cameras and sensors can check for defects or deviations instantly, resulting in immediate adjustments to eliminate faulty production. This enhances product quality, reduces wastage, and improves overall manufacturing efficiency.
- Production line diagnostics:** Enable rapid issue detection, localised data processing, and real-time insights to enhance production line diagnostics in manufacturing. Deployment of smart monitoring devices helps analyse data, detect abnormalities and potential issues, and take corrective actions immediately. This minimises downtime, improves production efficiency, and reduces maintenance costs.
- Warehouse automation:** house automation by facilitating real-time data analysis, optimisation of operations, and seamless integration with other systems. A great example of edge-based warehouse automation is the automated guided vehicles (AGVs), which navigate warehouses autonomously, optimising inventory management, order fulfilment, and material handling. This improves operational efficiency, reduces labour costs, and enhances overall warehouse productivity.
- Computer vision:** Computer vision applications in manufacturing benefit greatly from edge computing, as it allows for real-time analysis of visual data, enhances quality control, supports predictive maintenance, ensures safety, and enables rapid decision-making. This synergy between computer vision and edge computing is transforming manufacturing processes and contributing to increased efficiency and competitiveness in the industry
- Worker and resource safety:** Reduce accidents and foster a culture of safety within the organisation by facilitating real-time monitoring, immediate alerts, and proactive safety measures. For instance, if a worker enters a restricted area, the system can immediately detect this and issue a warning or halt nearby machinery to prevent accidents. This enhances safety, reduces risks, and ensures compliance with safety regulations.



Tata Communications Vayu Edge shaping value-driven outcomes

At Tata Communications, we specialise in helping our manufacturing customers accelerate their digital transformation by leveraging cutting-edge cloud-native technologies. Our focus is on helping our manufacturing customers build, secure, and manage enterprise-grade edge applications. We prioritise consistency, performance, reliability, and security, all of which are essential for manufacturing edge use cases.

In response to the evolving needs of enterprises, we have developed Tata Communications Vayu Edge, a comprehensive and fully-automated edge platform. It is thoughtfully designed for seamless integration with all types of cloud environments and is complemented by a suite of fully managed services, making it user-friendly and efficient solution.

For our customers, Tata Communications Vayu Edge presents three distinct deployment options: Prime (a SaaS-based edge platform), Proximate (an edge-in-a-box solution), and Private (Enabling the creation of a customised edge cloud with full control). These options offer pricing flexibility, tailored to meet specific business requirements.

Manufacturers can harness the power of Tata Communications Vayu Edge by availing a vast selection of over 50+ industry-leading edge use cases. The potential of this platform extends beyond its capabilities to its strategic technology partnerships.

With its substantial promise, Tata Communications Vayu Edge emerges as a catalyst for manufacturers embarking on their edge computing journey. It unlocks boundless possibilities at the edge, facilitating smarter factories enabling business use cases like warehouse automation, predictive maintenance, worker safety and much more.

To know more about how Tata Communications Vayu Edge can help you take your manufacturing operations to the next level, talk to us today.

For more information, visit us at www.tatacommunications.com