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FIVE REQUIREMENTS OF A LEADING IOT EDGE PLATFORM

EXECUTIVE SUMMARY

Enterprises are building IoT solutions to increase productivity, reduce operational costs, improve safety and provide higher levels of service. But they face a number of challenges when deploying IoT solutions in many types of environments. For example, the environment for a national freight railroad system is so geographically dispersed that intensive IoT data transmission costs would undermine total project ROI. The environment for a manufacturing plant has so many brownfield assets that a solution not supporting legacy communications protocols would be virtually impossible to implement. And the environment for a commercial office building has multiple non-integrated operational systems that can lead to tenant dissatisfaction.

In order to overcome these challenges, enterprises should carefully evaluate how an IoT edge platform handles devices and data to maximize business outcomes. According to MachNation research, leading IoT edge platforms have the following 5 capabilities:

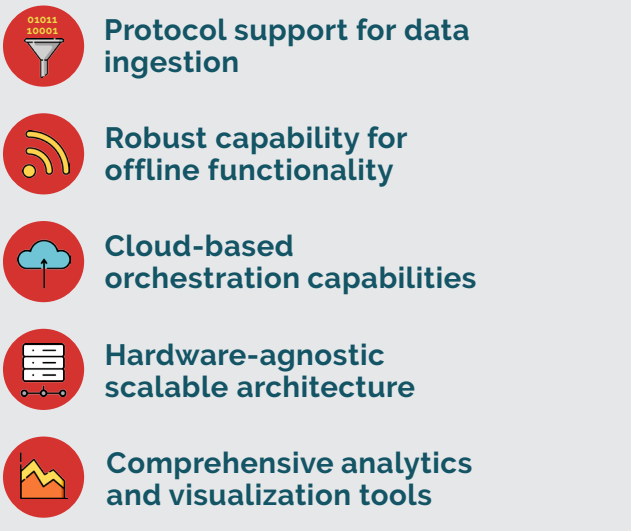
- extensive protocol support for data ingestion
- robust capability for offline functionality
- cloud-based orchestration capabilities to support device lifecycle management
- hardware-agnostic scalable architecture
- comprehensive analytics and visualization tools

This whitepaper discusses these 5 capabilities and presents 3 real-life use cases of enterprises using IoT edge platforms today.

INTRODUCTION

Enterprises and the public sector worldwide are looking for ways to increase security, improve productivity, provide higher levels of service and reduce maintenance costs. Many of them are using IoT solutions to improve their

FIGURE 1 Five edge capabilities



critical business processes or to drive innovation across their product lines. According to MachNation forecasts, worldwide IoT application enablement revenue will be USD1.8 billion in 2017 growing to USD64.6 billion by 2026 at a compound annual growth rate of 49%.

According to MachNation definitions, IoT edge computing is a technology architecture that brings certain computational and analytics capabilities near the point of data generation. IoT edge computing enables certain processes to occur in an optimal location to create more secure, reliable and scalable IoT deployments. An IoT deployment using edge computing takes advantage of connected IoT devices or gateways that offer functionality in areas such as device integration, data ingestion, data processing, analytics and device management.

> **Edge computing enables certain processes to occur in an optimal location to create more secure, reliable and scalable IoT deployments.**

Since the edge is critical to IoT success, leading IoT platform vendors must provide edge capabilities. In this whitepaper, MachNation discusses the five required capabilities of edge platforms. Then, MachNation presents three real-world IoT use cases that aptly demonstrate the importance of the IoT edge capabilities.

FIVE CAPABILITIES OF IOT EDGE PLATFORMS

MachNation research shows that IoT edge platforms excel in five capabilities. Vendors that have a complete set of capabilities for addressing edge requirements offer extensive protocol support for data ingestion, robust capability for offline functionality, cloud-based orchestration capabilities to support device lifecycle management, hardware-agnostic scalable architecture and comprehensive analytics and visualization tools. MachNation discusses these five capabilities below.

Extensive protocol support for data ingestion

Enterprise IoT solutions need an edge platform that supports a wide ecosystem of devices and best-of-breed hardware vendors. Given the many verticals and use cases being transformed by IoT, MachNation expects an extremely heterogeneous mix of devices that will be used to gather machine data and make it available to other IoT systems. In addition, there are at least several dozen well-accepted standards used in enterprise applications and a long list of proprietary ones that are being used in custom and off-the-shelf point solutions.

Leading IoT platforms must support an extensive mix of IoT devices that have myriad protocols for data ingestion. Platforms with a focus on edge provide a comprehensive set of protocols that can be used out-of-the-box. The list of protocols for industrial-minded edge platforms generally includes brownfield

deployment staples such as OPC-UA, BACNET and MODBUS as well as more current ones such as ZeroMQ, Zigbee, BLE and Thread. Equally as important, the platform must be modular in its support for protocols, allowing customization of existing and development of new means of communicating with connected assets.

Finally, leading vendors provide encryption, authentication and data protection functionality to address elevated enterprise security requirements of connected mission-critical hardware. Retrofitting brownfield deployments to secure machine data at the source is a capability exclusive to leading IoT edge platforms.

Enterprise IoT solutions need an edge platform with robust capability for offline functionality for resiliency, performance and reduction in operating costs.

Robust capability for offline functionality

Enterprise IoT solutions need an edge platform with robust capability for offline functionality for resiliency, performance and reduction in operating costs. To save energy or minimize risks due to connectivity interruptions, IoT assets are not always connected to the cloud. It is becoming increasingly clear that most, if not all enterprise IoT deployments will lean on edge processing technologies. The technologies make it possible to process a large amount of data generated by connected assets, adhere to low-latency requirements of industrial systems and meet established SLAs of mission-critical assets.

According to MachNation research, leading IoT edge platform vendors provide offline capabilities in three functional areas: data storage with normalization; event processing using rules and machine learning algorithms; and a set of edge-based integrations with local enterprise systems.

First, edge systems need to offer two types of data normalization and storage. They must offer these services to (a) successfully clean noisy sensor data and (b) support intermittent, unreliable or limited connectivity between the edge and the cloud. Providing both makes the overall solution more reliable and cost-effective.

Second, a flexible event processing engine at the edge makes it possible to generate insight from machine data. By analyzing this data with machine learning tools, enterprises can identify behaviors that are valuable to solutions including predictive maintenance and cybersecurity. In addition, by applying a set of rules to this data, enterprises can automatically send fault alerts to identify troubles in real-time.

Third, an IoT edge platform should integrate with local systems to optimize existing operational processes. Enterprise locations including manufacturing facilities, warehouses, oil refineries and remote field sites have many local systems

including ERP, MES, inventory management and supply chain management. A leading IoT edge platform will provide edge-based integration with these types of existing operational systems to help ensure business continuity and access to real-time machine data.

Cloud-based orchestration capabilities to support device lifecycle management

Enterprise IoT solutions need an edge platform with cloud-based orchestration capabilities to provide a centralized set of management and oversight functions supporting connected devices. An often overlooked yet critical aspect of distributed IoT platforms is their ability to manage and orchestrate newly deployed technologies and processes associated with connected devices. In order to harness the true value of IoT, an IoT platform has to provide a set of centralized, efficient and scalable tools for orchestrating the edge- and cloud-based requirements of connected assets.

The cloud-based orchestration provided by IoT platforms addresses provisioning, monitoring and updating requirements of connected assets. First, to simplify on-site deployment and add a level of security, a platform should provide factory provisioning capabilities for IoT devices. These API-based interactions allow a device to be preloaded with certificates, keys, edge applications and an initial configuration before it is shipped to the customer. This greatly reduces the amount of on-site work and troubleshooting that will be required to get the device online. Second, once the device is deployed and operational, the platform should monitor the device using a stream of machine and operational data that can be selectively synced with cloud instances. Third, using over-the-air update capabilities, the IoT platform should securely push updates to the edge. This includes updates for edge applications, the platform itself, the gateway OS, device drivers and also updates for devices that are connected to the gateway. This allows virtually all aspects of a device's lifecycle to be managed centrally and gives the enterprise complete control over a locally, nationally or globally distributed IoT deployment.

Hardware-agnostic scalable architecture

Enterprise IoT solutions need an edge platform with a hardware-agnostic scalable architecture to support a heterogeneous mix of deployed devices at scale. Today, most enterprise information technology (IT) environments are made up of heterogeneous assets from different makers each with a unique set of capabilities. IoT deployments are no different. Actual IoT deployments use equipment from several vendors. And over time, solutions

tend to amass a mix of components with each subsequent launch.

IoT platforms that provide leading edge capabilities are capable running on a wide range of gateways and specialized devices. IoT hardware is powered by chips that use ARM-, x86-, and MIPS-based architectures. Using containerization technologies and native cross-compilation, the platforms offer a hardware-agnostic approach that makes it possible to deploy the same set of functionality across a varied set of IoT hardware without modifications. This improves performance and reduces the technology and labor costs of maintaining multiple versions of production software and hardware.

In addition, visionary platform vendors employ the same software stack at the edge and in the cloud allowing a seamless allocation of resources and ensuring that edge-based operations are not limited by cloud-based tools. Platforms that are capable of shifting resources between the edge and cloud are better suited at meeting anticipated and unexpected application demands. This makes the overall system more scalable by improving resiliency and operational efficiency.

Comprehensive analytics and visualization tools

Enterprise IoT solutions need an edge platform with comprehensive analytics and actionable visualization tools to deliver insight to a diverse group of stakeholders. The most valuable element of an IoT solution is the insight that it generates for the enterprise, but distilling that insight from copious amounts of machine data is extremely difficult. Due to resource, latency and bandwidth constraints, a lot of the data generated at the edge must be processed and analyzed at the point of generation. IoT platforms that fully support the edge with analytics and visualization tools will enable an enterprise to analyze data, generate insights and provide actionable visualizations for end users.

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IoT platforms with leading edge capabilities will offer an open and modular approach to edge analytics. Out-of-the-box, edge platforms can aggregate data and run common statistical analyses. For capabilities that require specialized analytics, the platforms should make it easy to integrate leading analytics toolsets and use them to supplement or replace built-in functionality. Then, leading IoT platform vendors will enable edge data to be visualized and actioned on a set of mobile-ready customizable and interactive dashboards suitable for different end users. This makes it possible for a truck operator and a fleet manager to access interactive dashboards that deliver a combination of useful information and relevant controls for each of their respective roles. For develop-

ment of other types of bespoke presentation layers, customers should be able to select their own best-of-breed visualization or application provider.

USE CASES

Enterprises use IoT edge platforms to lower operating costs and drive innovation. IoT solutions can help enterprises increase employee security and safety, offer a better user experience,

lower equipment replacement costs, lower dispatch/operations costs and optimize business processes. MachNation presents three real-life use cases below to help illustrate the value of an IoT edge platform.

A commercial real estate management company offers a better tenant experience, higher building efficiency and improved security while reducing costs

A major building management company is relying on the power of IoT edge computing to improve operations and to provide a high level of service to their tenants. Commercial buildings are filled with specialized management systems including plumbing, lighting, elevators, heating, ventilation, air conditioning, water and advanced security systems. Like the smart city environment, cross-system integration requires data from disparate systems to be brought into a common platform. Current solutions on the market did not give the flexibility and capabilities required to deliver the personalized tenant experience and seamless operations.

With the help of an IoT edge platform, one building management company is offering individual personalization and convenience while maintaining state-of-the-art security behind the scenes for their tenants and guests. The solution uses applications running on edge gateways throughout the building to offer frictionless access controls and convenience features.

The experience begins when a person enters the building. Face-tracking cameras capture and identify a building tenant. Using integration with the escalator systems, the platform activates the escalators to take the tenant to the main floor. Facial recognition algorithms identify the tenant and pass on this identification to the security turnstiles that lead to the elevator lobby. The tenant uses his smartphone, or biometric identification as second factor authentication to authenticate with the edge-enabled turnstile gateway. The IoT edge platform feeds user metadata to the elevator control systems to provide the Schindler elevators with the appropriate floor number to which

the user intends to go. This allows the platform to run an algorithm that optimizes elevator flow to get all tenants and visitors to their destination as quickly as possible while saving energy.

Additional checks are performed within the elevators to monitor passenger flow and to ensure that elevators are optimized on their positions based upon load and calls. All of this is invisible to the tenant, allowing the building management company to offer excellent security and convenience without requiring any changes in tenant behavior.

A white goods manufacturer improves tracking of work equipment and tools

A white goods manufacturer is taking advantage of an IoT solution running at the edge to help improve the overall efficiency of the assembly process and positioning of workers. Before this solution was deployed, the manufacturer identified that workers were wasting a lot of valuable time trying to track and locate specialized tools and determine their availability for use. Even when a tool was located, sometimes it was in need of maintenance and had to be serviced. All of these challenges led to assembly inefficiencies and higher costs. By deploying an IoT edge platform, the manufacturer was able to increase worker efficiency by 20% and eliminated unplanned tool downtime using a predictive maintenance solution.

The newly deployed solution uses an edge platform deployed directly on IoT gateways on the factory floor. The platform's built-in support for various tracking, positioning (RAIN RFID, Bluetooth Low Energy, Near-field Communications, etc) and two-way communications across different protocols is leveraged to identify a tool's status and a worker's location. By combining this data, the organization is more efficiently able to track, optimize and predict worker output. The IoT platform running at the edge taps into this data to provide real-time, web-based, visual maps of tool status and worker location. All this data is accessible via PCs and smartphones to help workers find the nearest available equipment and bill of materials requirements for their next work products.

The edge platform is directly integrated with the manufacturer's existing JD Edwards ERP system deployed in an Oracle cloud. This system is now being used to automatically schedule workflow, assign and track tool usage and disposition and predict usage patterns in real-time. The IoT edge platform also offers a set of local dashboards to factory floor managers allowing them to access aggregate views

of in-process work orders and tool allocation and prediction against planned production schedules.

A rail company enhances monitoring and safety at railroad crossings nationwide

By implementing an improved positive train control solution with IoT, a US-based freight rail company is enhancing its monitoring of and safety at rail crossings while lowering overall system costs. Positive train control, a solution mandated by the United States government, requires a freight rail company to track train movement and implement safety mechanisms to protect against collision and derailments. The management of this deployment requires regular dispatch of trucks to remote locations to conduct routine maintenance, ensure track health and enforce safety at railroad crossings.

To improve and future-proof its positive train control investment, the freight train company chose to implement an IoT edge solution. The solution provides three critical benefits.

First, the company needed to more tightly control connectivity costs over its system of 20,000 railroad crossings. Failure to do so would jeopardize the anticipated ROI of the project. By implementing a new communications network with IoT edge processing, the company was able to reduce long-term project costs by a predicted 80%. And using edge processing allows the company to reduce the overall bandwidth traversing the network which keeps the new network performing optimally. Now the company is able to run business intelligence in

the field and reduce overall bandwidth requirements on the network.

Second, to improve operational visibility of the positive train control system, the company deployed ruggedized IoT gateways that support myriad legacy communications protocols. In order to work in this brownfield environment, the edge platform needed to support SNMP, CANBUS, MODBUS, AMQP and STOMP protocols to establish bidirectional communication between railroad crossings and the back office platform. Now the IoT platform is integrated with railroad maintenance systems to automatically generate tickets when on-site maintenance is required. In the second phase of the project, the railroad company will be applying predictive maintenance algorithms to identify potential faults and preemptively dispatch operations crews.

Third, the rail company needed to better manage costs of future innovations and solution upgrades. Fortunately its chosen edge IoT solution had the ability to push software updates, core device drivers, installed software and

business-specific logic to devices in the field. This capability simplified and reduced maintenance costs of the overall system by replacing traditional in-field maintenance activities with standard, automated, IT control processes. As the IoT edge platform supports new protocols, machine learning strategies and emerging technologies, the rail company can continue its low-cost innovations in the future: the company has future-proofed itself against costs associated with simple platform and software upgrades.

For this large freight rail company, an IoT edge platform has significantly reduced overall costs, increased the flow of operational data and paved the way for future innovation.

CONCLUSION

Enterprises and the public sector worldwide are looking for ways to increase security, improve productivity, provide higher levels of service and reduce maintenance costs. Yet enterprises face many challenges when choosing to deploy an IoT solution. These challenges can impact overall IoT deployment costs and timing. So many enterprises are using IoT edge platforms to improve their critical business process while overcoming these deployment challenges.

Enterprises should select leading IoT edge platforms that have 5 capabilities – extensive protocol support for data ingestion, robust capability for offline functionality, cloud-based orchestration capabilities to support device lifecycle management, hardware-agnostic scalable architecture and comprehensive analytics and visualization tools. Platforms that meet these requirements will simplify the short-term deployment experience while offering long-term flexibility as enterprises choose to innovate with new IoT services.

MachNation is the only insight services firm exclusively dedicated to covering the future of Internet of Things (IoT) middleware, platforms, applications and services. MachNation specializes in understanding and predicting these technology sectors including their impact on digitization, hardware, communication services and support tools. MachNation specialists have provided guidance to the majority of the world's leading IT and communications firms.

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