ARC SELECTION GUIDE

Industrial Edge Computing Platforms Selection Guide

ARC Advisory Group

Overview

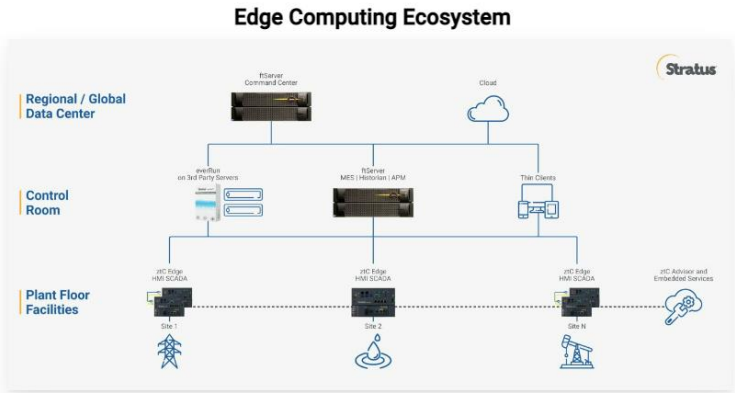
This ARC Advisory Group Industrial Edge Computing Platform Selection Guide provides a strategy for buyers, and technology and selection criteria for industrial edge computing used in industry. The specific target markets addressed are the manufacturing and industrial environments as well as system integrators, machine builders, and OEMs. Edge computing evaluation criteria and selection is of interest to both information technology (IT) and operational technology (OT) teams with its ability to modernize infrastructure and converge IT and OT environments.

This ARC Advisory Group Industrial Edge Computing Platform Selection Guide provides a strategy for buyers, and technology and selection criteria for industrial edge computing used in industry.

There are two primary categories of industrial edge computing platforms. Industrial edge computing platforms are deployed in process, discrete, and complex discrete manufacturing as well as smart infrastructure (power gen, smart city, water/wastewater applications) by in-house engineers or through system integrators. These edge computing platforms range from being industrially designed for plants and factory floor production lines, supporting standards associated with, for example, industrial PCs (IPCs), programmable logic controllers (PLCs), and programmable automation controllers (PACs), to being installed for facility operations and control room racks and operating under well-controlled environmental conditions.

These platforms collect and store data that is generated by production assets, machinery, and equipment. The data is often extremely critical, and end users often need to maintain control over their data. Many enterprises host data collected from manufacturing assets and logistic processes on-premises for several reasons, including security and intellectual property protection, performance constraints resulting from network latency issues and data integrity preservation. This trend of processing data close to the source is driving the need for powerful edge computing platforms. Similarly, the trend toward hybrid cloud concepts -- with local compute and data processing complementing cloud data storage and analysis -- also fuels the need for powerful edge computing to share, for example, historian data with local clouds, in addition to communicating subsets of data to a remote cloud.

Machine Builders and OEMs typically install edge computing platforms on machinery and standalone, sometimes geographically remote, equipment. A typical use case is a long production line with multiple machines that either are stand-alone and communicate data with both business systems and other edge computing platforms, or they are operated as clients and get information from a central command center. Machine builder and other OEM edge computing platforms must be robust enough to withstand harsh environment conditions, such as extended temperature range, high humidity, and continuous vibration.



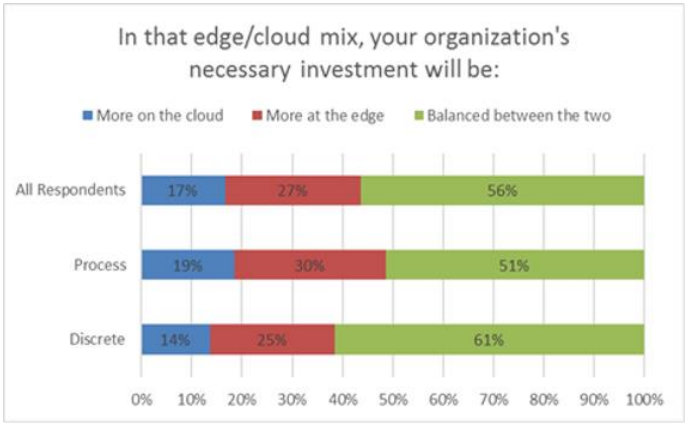
Example of Industrial Edge Computing Platforms Courtesy of Stratus Technologies

Industrial edge computing platforms make a lot of computing power available directly on the production line and machine. Additional use of application virtualization combined with compute power and fault tolerance enables teams to consolidate industrial software workloads, for example, HMI/SCADA, historian, MES, etc., on a single edge computing platform. This industrial trend -- workload consolidation -- is the capability to integrate multiple software assets that would otherwise be installed in multiple computers into a single yet redundant virtualized edge platform.

Industrial edge computing platforms, over time, are evolving with enough computing power and data storage space to handle a variety of high-end tasks. These edge computing platforms can execute programs for other devices and their applications, and can provide various functionalities and services, such as sharing data or resources among multiple applications or performing computations for an application. One example is the deployment of application updates from a repository to the connected visualization and control platforms, such as operator panels or other HMI devices or PACs/PLCs on a production line. Continued industry evolution is projected to see industrial edge computing platforms used, potentially combining data analytics and soft PLCs, bringing computing, and controlling functionality onto a single edge platform.

Major Market Trends

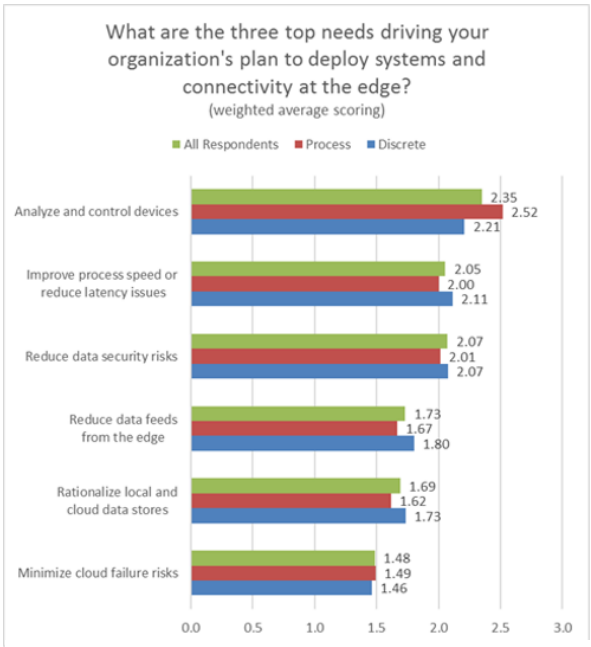
- Demand for industrial edge computing platforms will grow significantly, driven by growth in demand for applications requiring on machine or on production line physical hardware with the necessary computing power for functionality, such as analytics and control.



Trend to Hybrid Cloud Solutions Will Drive Industrial Edge Computing Market Substantially, Based on ARC Survey of 327 Industry Respondents

- The trend toward hybrid cloud solutions will drive substantial growth in the industrial edge computing platform market. End users and OEMs will require platforms that can perform both at the site and machine level while managing the data and information communicated to a local or hybrid cloud at an efficient level.

- End users and machinery suppliers will have to cooperate much more in the future to specify the most suitable industrial edge computing platforms. This will require, for example, machine builders to work closely with the end user's IT department, a trend that will accelerate with IT/OT convergence.



Core Automation Applications Will Partly Transition to Software-based Applications Hosted on Industrial Edge Computing Platforms, Based on ARC Survey of 327 Industry Respondents

- Core automation applications, such as PACs and PLCs, will partly transition to software-based applications hosted on industrial edge computing platforms, reducing the role or in certain cases eliminating the requirement for a traditional hardware PLC or PAC.

- Leasing models, such as industrial edge computing platform product-as-a-service, are not yet common in this space, but certainly some suppliers are considering this, along with 24/7/365 remote server monitoring and control.

- Value add will increase with digital services offered by machinery OEMs to end users as well as by the industrial edge computing suppliers to both OEMs and end users. Service providers are evaluating uptime SLAs, use of predictive analytics, and extended warranties.

- Organizations such as the Open Process Automation Forum and large end users are pushing for more open standards and interoperability which edge computing can facilitate.

Top Line and Regional Market Summary

- Industrial edge computing platforms are targeted at complex machines and production lines with many interconnected machines in a range of industries such as oil & gas, pharmaceuticals manufacturing, food & beverage, transportation, and other verticals. An industrial edge computing platform is designed to provide the full capabilities and benefits of computing at industrial sites and manufacturing locations, such as gathering and processing data in real-time, either at or near the point that the data is gathered.

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- In EMEA, industrial edge computing platform adoption is increasing rapidly in industries and applications such as EV and lithium-ion battery assembly, material handling equipment, semiconductor and electronics manufacturing, food & beverage, pharmaceuticals, and biotech. Applications for decarbonization, building automation infrastructure, and energy management are also increasing their use of industrial edge computing platforms. Historically, EMEA has had a strong machine building industry with a significant share of complex machines with turn-key suppliers of various machines on production lines. Market leaders in all production line industry segments, such as packaging machinery, have concepts for use cases of industrial edge computing platforms.

- In Asia, semiconductor, electronics, food & beverage, pharmaceuticals, biotech, cement & glass, and metal segments are key drivers of growth for the use of industrial edge computing platforms. Increased demand of industrial edge computing platforms is also due to growing investments related to renewables, decarbonization, EVs and lithium-ion battery manufacturing. Asia will have the highest growth of machinery production in the coming years as well as the overall number of production lines

coming online, with China fueling much of this growth. Asia's machinery production is currently strongest in the midrange of machine complexity, but with a clear trend toward manufacturers requiring even more complex machines in the future, Asia's machine builders will follow that trend, which bodes well for the growth of industrial edge computing platforms that are required in these more complex machines.

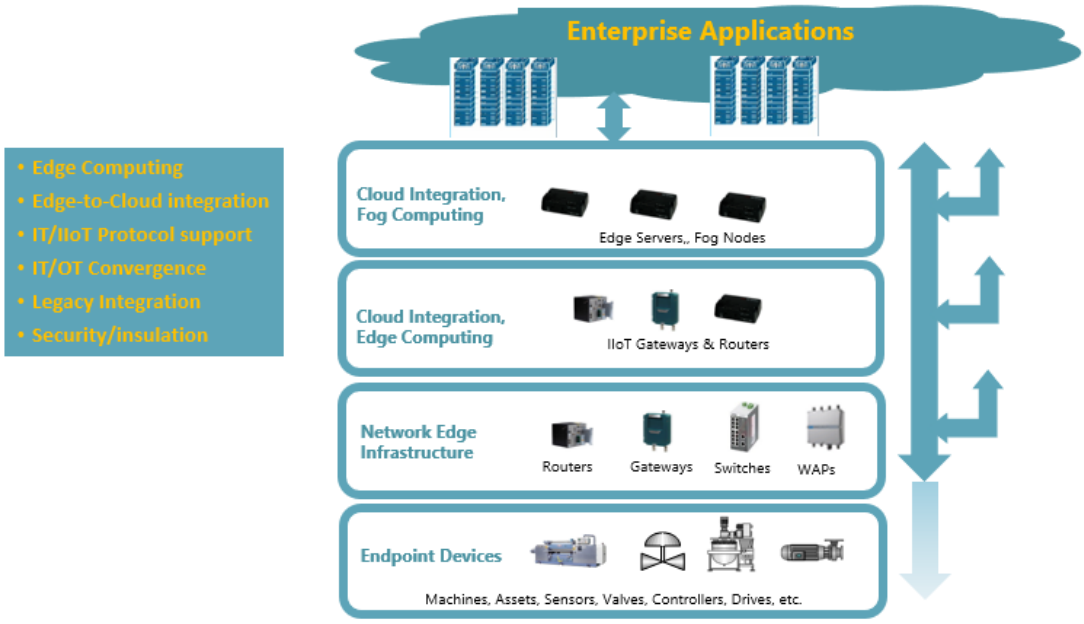
- In North America, demand in automotive, aerospace, life sciences, mining, chemicals, oil & gas, building automation, and data center segments are all driving growth in the use of industrial edge computing platforms, as well as future growth driven by planned US government infrastructure and semiconductor industry investments, which will also accelerate EV and lithium-ion battery manufacturing. North America machinery production output includes a lower proportion of complex machinery versus countries in EMEA, such as Germany or Italy. Midrange machineries require fewer industrial edge computing platforms than more complex machines. Production lines, however, with multiple interconnected machines, will increase their use of industrial edge computing platforms.

- Latin America is the smallest market and require fewer industrial edge computing platforms, having less machinery production and fewer production lines, but there will be growing opportunities in oil & gas and mining industries, as well as some opportunities in the food & beverage and discrete manufacturing industries, such as aerospace.

- Geopolitical issues, such as political tension between the US and China regarding Taiwan, economic issues resulting from the war in Ukraine, and continuing manufacturing shutdowns in Asia, etc. have the potential to slow down machinery and production demand as well as cause a number of economic headwinds.

Strategies for Buyers

Buyers in specific industrial vertical markets will have particular interest in industrial edge computing platforms to address common challenges or barriers related to rapid infrastructure modernization, managing legacy systems, connecting islands of automation, and ensuring regulatory compliance.



Industrial Edge Computing Platforms Positioned Between the Plant Floor and Cloud

- **Oil & Gas:** Edge computing supports operational excellence by enabling remote operation, efficiency, and safety in upstream and midstream with the ability to develop smart, connected oilfield equipment, enable terminal automation, and pipeline assets.

- **Digital Manufacturing for Discrete, and Complex Discrete Industries:** Edge computing is a foundational technology for digital manufacturing initiatives across electronics, semiconductor, automotive, and consumer goods.

- **Life Sciences and Pharmaceutical Manufacturing:** Production execution, reliability, quality, and compliance are critical processes powered by edge computing to eliminate data loss and unplanned downtime and ensure regulatory compliance.

- **Smart Infrastructure & Renewables:** Edge computing is well-suited for monitor and control and access control applications in smart city, smart transportation, renewable power generation, and building automation.

Industrial edge computing platforms for Machine Builders and OEMs are often fully integrated with the automation and motion control of machines, so buyers are mainly machinery OEMs. Industrial edge computing platforms for manufacturing and industrial end users are often fully integrated with

the automation and motion control of machines, so buyers are mainly operations, engineering, and purchasing that also specify and purchase IPCs, PLCs, and PACs, with growing influence from IT due to continuing IT/OT convergence.

Consider Staff Requirements

Shortage of workers with IT skillsets is the greatest barrier for successful implementation, not just for the digitalization but also for the use of industrial edge computing platforms. This applies much more to machinery and equipment suppliers than to end users with a well-staffed IT department. Buyers should consider offerings of industrial edge computing platform suppliers to remotely carry out administration, service, and maintenance.

Have a Plan in Place for IT Security

Digital data from the shop floor contains a considerable amount of intellectual property that requires the latest cybersecurity tools to protect. Many industrial edge computing platform suppliers offer a variety of cybersecurity tools that are either developed in-house or via their partner ecosystems.

Ensure Scalability

As companies undergo their digital transformation journey, a growing number of new digital services and applications will be become available. Millions of smart sensors will be deployed in machines and production lines, which will cause the amount of data to grow. To ensure that this future demand can be met, the industrial edge computing platforms installed must be scalable, with scalable CPUs, additional storage capabilities, and interfaces.

Check Suppliers' Long-term Strategies

Make sure the industrial edge computing platform supplier is mature in this business with documented, relevant customer examples, has partnerships with the long-established automation suppliers if that is not their primary business, has short enough innovation cycles, and offers not just hardware but also consulting, maintenance, and other services.

With technologies, such as Industrial IoT/Industry 4.0, many new companies are appearing on the market without a long track record of installed industrial edge computing platforms. Make sure the industrial edge computing platform supplier is mature in this business with documented, relevant customer examples, has partnerships with the long-established automation suppliers if

that is not their primary business, has short enough innovation cycles, and offers not just hardware but also consulting, maintenance, and other services.

Carefully Evaluate the Operating Conditions

One of the key aspects of industrial edge computing platforms selection is the operating environment of the computing devices. Industrial environments can be quite harsh and include conditions such as extreme temperatures, vibration, humidity, EMI, and RFI. Available space to mount equipment may be limited so space requirements should receive special consideration. Cable trays and cable management can also be a challenge. These considerations are important for end users, machine builders, and equipment suppliers alike. The pool of available industrial edge computing platform offerings from suppliers can shrink significantly if specific environment conditions must be met.

Avoid Unplanned Downtime

Many industrial edge computing suppliers understand that unscheduled downtime is unacceptable for machines and production lines, and these platforms must be designed with that in mind by companies that have a reputation and track record of offering products and solutions that meet that reliability and availability criteria and are capable of remote maintenance.

Consolidate Your Software, Simplify Your Infrastructure

Most traditional automation and control architectures apply brute force to solve software challenges. When new software is added into a solution, for example, the usual practice is to add computers into the network. Over time, the architecture becomes silos of automation with ever-increasing operations and maintenance costs. Virtualization allows users to consolidate automation and control software assets into a single yet redundant virtualized device, instead of multiple physical computers.

Consider Solutions, Not Just Product Offerings

Suppliers of industrial edge computing platforms all offer hardware, but their offerings for software and services vary greatly. Some suppliers do not even offer an operating system and instead leave this up to the buyer. Industrial edge computing platforms require remote management software, and if the end user, system integrator, or OEM wants to use virtual machines, they will need additional software. Consider what best fits the needs: a supplier that leaves the purchase and installation up to the end user or OEM or a supplier that offers complete ready-to-run packages. The same applies

to service. Check if the supplier offers 24/7/365 remote edge computing platform maintenance. All these aspects should be considered given the qualification of the production and maintenance staff including the level of IT expertise, not just for the buyer but also the end user and OEM.

Are Consumer Grade IPCs an Acceptable Alternative?

Many suppliers offer consumer-grade edge platforms upgraded to cope with harsh environment conditions and sold as industrial edge platforms. Buyers must carefully question the typical lifecycle of such offerings. Investments in costly machines by end users have a longer lifecycle than consumer products. For example, are the products supported with spare parts and services for 7 to 10 years or just for 2 years? If the lifecycle is too short, buyers run the risk of ongoing upgrade costs of industrial edge computing platforms at the end user site, including machine downtime for the duration of the upgrade, which may not be acceptable.

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Are Cluster Solutions Adequate for Edge Infrastructure?

Combining two or more off-the-shelf servers using clustering software improves availability, but also increases cost, complexity, and risk. In addition to the extra systems, networking gear, storage, and software licenses required, there are the added development costs associated with making your applications "cluster aware" and with writing failover scripts. There are also the ongoing management costs associated with continually optimizing your clustered configurations. High availability edge computing platform solutions offer more reliable protection against failure, rather than recovery from a failure, ensuring all transactions are processed, with no data corruption or data loss.

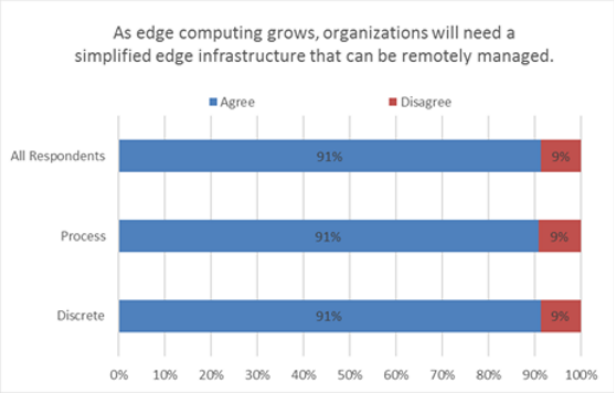
All of this is done without requiring any changes to applications to make them cluster-aware or requiring any failover scripts to be written. Edge computing platform-based redundancy doesn't require any special software, additional licensing, or any special skills. At the outset, and in the long run, it is more affordable to purchase, and much simpler to set up and operate than complex clusters with multiple hardware and software components.

Questions to Ask Industrial Edge Computer Suppliers

It is critical that buyers of Industrial Computer Edge Platforms seek suppliers that can provide satisfactory answers to the following points.

Hardware Alone is Not Enough

The industrial edge computing platform market is not a commodity device business. Instead, it is a solution business, and these suppliers need to offer a portfolio including software, applications, remote service, remote platform management, and on-premises maintenance and repair services or after-market services by OEMs. These offerings may also include consulting services and financing/leasing options. Understanding its customer's business models is crucial to an industrial edge computing platform provider building a sustainable partner-like relationship with end users and customers.



Remote Service and Platform Management Services Critical to Industrial Edge Computing Market, Based on ARC Survey of 327 Industry Respondents

The automation and control software that operates manufacturing plants and facilities is only as good as the platform it runs on. Edge computing platforms are recommended to protect, enhance, and consolidate automation and control software, whether operating a machine or piece of equipment, managing a production line or a plant, monitoring multiple locations from a control room, providing KPIs to a command center, or sending data to the cloud or enterprise. If the edge computing platform running automation and control software goes down, then the software – and its critical functionality – is unavailable.

Buyers must consider the importance of the underlying compute platform required to run the latest industrial software packages. Edge computing platforms purpose-built for industrial software should be considered for digitalization and digital transformation projects. Additionally, for long-life industrial assets, spanning 20-30 years, compute platforms must align closer those lifecycles, rather than the standard 3–5-year refresh cycles of traditional IT. Ultimately, the software – and ability to collect data – on which the value of Industry 4.0 is predicated, is essential, and is only as good as the reliability and performance of the computer platforms running it.

Have a Set of Competent Partners in Place

With software, partnerships with IoT suppliers, solution providers, and system integrators can add a lot of value by offering a complete solution portfolio, from operating systems, server management software, and remote edge computing platform maintenance software, to AI and network security apps, up to complete cloud solutions. Industrial edge computing platform suppliers must have an ecosystem of partners that can help bring these capabilities along with their own solutions.

Use of system integrators for their proficiency and experience deploying edge computing in monitor and control applications is an essential bridge between available market solutions and success in production. SIs can provide consultation and offsite system design which speed the FAT/SAT process to enable end users to get to market faster. Architectures recommended by SIs rapidly transform infrastructure to digitize processes and information while providing the new levels of reliability required by Industry 4.0 technologies.

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Provide References with Demonstrated ROI

Industrial edge computing platforms operate at the interface between the internet and the end user's or machines' intranets and are also connected via fieldbuses to machinery and other assets. New business models based on digital services are appearing everywhere. These products, solutions, and services must help machinery as well as end users lower their operational costs, increase their KPIs, and provide a short ROI, often less than 1-2 years. Look for suppliers with references that demonstrate such results. This is critical for buyers to justify their choice of an industrial edge computing platform supplier.

Ensure Cybersecurity and Scalability of Ruggedization

Both physical and cyber security are leading concerns to adoption of Industrial IoT applications. In terms of physical resilience of the edge computing device, protection from shock, vibration, temperature, and other harsh industrial conditions is often required. A good industrial edge computing supplier will be able to offer you devices that can exist in a wide range of industrial environments with appropriate hazardous area certification, depending on your geographic region.

Cybersecurity is also a key concern as industrial edge computing devices get closer to the process. While many aspects of cybersecurity are addressed in installation and the user's own cybersecurity policies, industrial edge computing devices should have basic cybersecurity features that you would find in any fit for purpose industrial device, such as a host-based firewall, ability to lock down ports, support of appropriate access controls such as role-based access control (RBAC), which is prevalent in manufacturing, and other features. Cybersecurity certifications are also now available for everything from edge devices themselves to host system software and certified secure development practices.

Scope of Industrial Edge Computing Platforms

The core elements of an industrial edge computing platform are to provide connectivity, high performance, and integrated data storage. Industrial Edge Computing Platforms provide functionalities, such as services, for other programs or devices. This includes things like sharing of data and resources among multiple automation assets and performing computations for an asset. Next to real-time data processing, industrial edge computing platforms must meet high reliability standards and in most cases are designed to avoid any unscheduled downtime.

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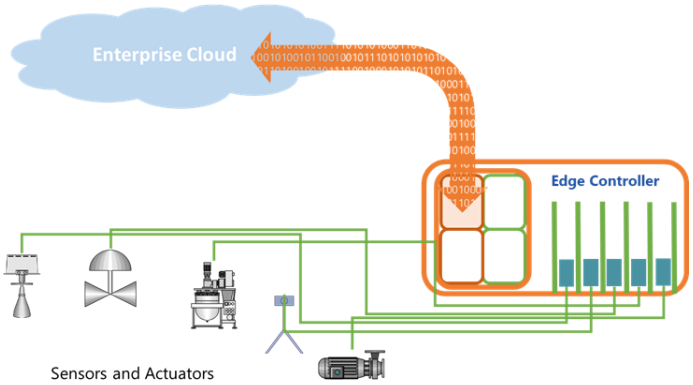
ARC defines industrial edge computing platforms as devices that are located at the edge and operate in an industrial environment, such as manufacturing plants or facilities, close to or integrated into the machines, equipment, and other automated assets. Industrial edge computing platforms are connected to the plant floor network and may be linked to a local intranet or to the internet. However, edge computing platforms may also be located on a machine, a piece of skid-mounted equipment, or another heavy asset. Industrial edge devices are often deployed in geographically remote locations, with limited network connectivity and bandwidth and significantly limited IT staff.

Automation assets, such as operator panels or PACS/PLCs, must communicate in all directions to the industrial edge computing platforms, the interfaces must be capable of connecting to the Internet via, for example, MQTT or OPC UA, as well as to the machinery via traditional fieldbuses.



Industrial Edge Computing Platforms, Such as Edge Controllers, Communicate in All Directions Between the Cloud and All Automation Assets

Industrial edge computing platforms typically run operating systems that support its functionality. Further, especially when automation control software such as an IPC, soft PLC, or soft motion control is integrated into the industrial computing platform, virtual machines (VM) must be supported, such as those from VMWare, ESXi, or vSphere.

Included in the scope is software directly related to the operation of the industrial edge computing platform, such as operating system, remote diagnostic software, and tools such as remote management software.

Technology and Supplier Selection Criteria

The following section is designed to help determine the most important aspects of the technology needed for the end users, system integrator, or OEMs application. While each end user, SI, and OEM organizations are likely to have different requirements, this list will provide guidance to help determine the most valuable criteria for selecting the industrial edge computing platform supplier that best meets the application's specific requirements.

Key Criteria Analysis

ARC developed the criteria list included in this report based on its thorough analysis of the industry best practices. Often the total solution is complex, and functionality involves combining an expanded range of capabilities and

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specific technologies. However, the criteria list goes beyond the technical requirements. While a product's functions play a major role, industrial edge computing platform suppliers have specific domain expertise, geographical presence, and knowledge of certain industry dynamics. These must all be considered in the supplier and technology selection process.

Fact-based Selection Process

The selection process begins with a definition of the **scope of the project,** including production processes, number of plants, number of machines, an individual machine, and integration with other systems. With this understanding, an organization can make the appropriate **team member assignments**. Reviewing and editing the ARC-provided **selection criteria** to ensure that the list fits the needs requires a team effort. ARC recommends that once the list is complete, appropriate questions for industrial edge computing platform suppliers are developed. This organized and logical list of criteria can provide the basis for a Request for Information (RFI) that is sent to suppliers considered. Evaluating supplier responses and developing a final ranking of RFI results is also a team effort. This process helps ensure inclusive, fact-based, impartial supplier evaluations and selections, while avoiding bias issues that typically hamper these activities. Incorporating the ARC selection criteria helps reduce effort and timespan for a supplier selection process, providing **faster time to benefit**.

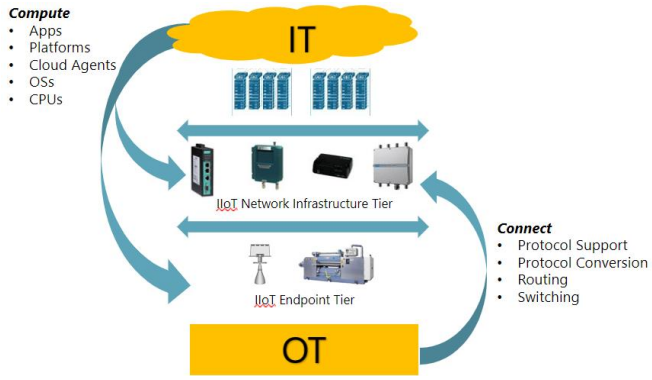
Consider Best Practices by Suppliers

While the selection criteria are comprehensive, the industry, plant or machine may have specific needs that ARC did not anticipate. Carefully consider any additions. Avoid those that constrain the capability of the new technology.

Carefully consider current practices that could be enhanced with new capabilities. Industrial edge computing platform suppliers develop product enhancements based on inputs from multiple customers and often include best practices derived from this input. If a function does not match the internal business process, consider the possibility that that supplier may have a better process. Be open to improvements.

Supplier Selection Criteria Questions

End users, SIs, and OEMs seek to maintain peak performance of business-critical assets and applications, Industrial Edge Computing Platform suppliers must offer secure, rugged, and integrated solutions for the most demanding operational environments. These platforms must help to increase resource utilization and operator efficiency with minimal risk and IT resources on site. Critical capabilities for edge computing platforms revolve around maximizing reliability to avoid downtime, consolidation of software workloads through virtualization, and easy deployment and serviceability by OT or IT teams. Unlike limited function edge devices, industrial edge computing platforms must provide access, compute, scalability, and security in a simple to use, protected and automated solution.



Industrial Edge Computing Platforms Play a Key Role in IT/OT Convergence

Key Considerations for Selection, Sizing, and Deploying Industrial Edge Computing Platforms

Below are questions we find are important for customers to assess to help them select and size the right edge computing platform as well as gauge the supplier who can deliver this most efficiently:

1. Hardware

    a. Does the edge computing platform meet the environmental requirements where the machines are deployed, such as factory floor micro data center or UL Class I Div. 2?

    b. Does the edge computing platform have sufficient compute power and storage to meet the needs now, and in the future, such as transaction-based applications, web, I/O's and tags?

    c. How expandable is the configuration?

    d. Does the supplier have a range of edge computing solutions that can scale across the range of equipment and machines being sold into the marketplace?

e. Does the supplier understand that the OT assets (machines, skids, production lines, sites) will be deployed for years and probably decades and will the supplier support their edge computing hardware for many years so that spares are always available?

f. Does the supplier have a strategy to support the machines through their deployment lifecycle with simple upgrade paths to newer generations of edge computing platforms?

g. Is the supplier's hardware easy to deploy so that field technicians, who are not computer experts, could do this work?

2. Software and virtualization

a. Does the industrial edge computing platform supplier have a pre-integrated solution for its operating environment and virtualization layer so that it is simple to use and deploy; or is this additional work that must be done?

b. How easy is it for control engineers less familiar with virtualization to leverage virtualization and deploy?

c. Is the edge computing supplier's virtualization layer open so that one can easily integrate and deploy applications on the platform?

d. Does the edge computing suppler have tools that make it simple to deploy existing IPC applications and virtual machines?

e. Can the edge computing supplier help empower operators by extending control and monitoring to mobile devices like smart phones, tablets, and laptops?

f. Does the edge computing supplier have a comprehensive strategy to keep the end user or OEM updated on patches and new versions or is this something that they must do themselves?

g. Are there tools that make it easy to install patches and upgrades when it is convenient, or does the end user or OEM must figure this out for themselves?

h. How long will the edge computing supplier support their software releases, and do they have a mechanism to provide easy upgrades to new versions, or does the end user or OEM must figure this out for themselves?

i. Does the end user or OEM need to buy an application license for each node in a redundant configuration, even if the application is active on one node at a time?

3. Security

   a. Does the edge computing platform come pre-configured so that only the necessary external interfaces are available for the end user or OEM to use, or do they have to do all the work of locking down unnecessary interfaces to prevent physical tampering?

   b. Does the edge computing platform have security mechanisms to access the local management interface?

   c. Does the edge computing platform have basic security capabilities to help prevent cybersecurity attacks and unauthorized remote access?

   d. Can the end user or OEM easily deploy their own cybersecurity applications on the edge computing platform, and can the OEMs customer easily do that as well?

4. Redundancy capabilities

   a. Can the edge computing platform be deployed in non-redundant, high availability, or fault tolerant configurations so that field technicians do not need special training?

   b. What is the speed of failover that is require for redundancy for the end users or OEMs business?

   c. Is it easy to upgrade a non-redundant edge computing platform to a redundant platform without complex reconfiguration and special equipment so that field technicians do not need special training?

d. Are there tools available to help end users, OEMs, and OEMs customers to re-configure non-redundant systems if any edge computing platform needs to be replaced?

e. Is there complex configuration that needs to occur for the applications to run in an optimal manner in redundant configuration?

f. Does the redundancy solution require the purchase of additional licenses for each redundant platform?

5. Management, Monitoring, and Autonomous Operation

a. Does the edge computing platform come with an integrated management and monitoring capability that is easy to use, or does the end user, SI, or OEM have to create their own?

b. Can the edge computing platform be managed both locally and remotely?

c. Can the SI or OEM manage the edge computing platform remotely with the customer's permission?

d. Can the SI or OEM make sure that their customers can only access the capabilities necessary to run the machine at peak performance for their application so that they cannot access anything that might damage the machine?

e. If a customer has multiple edge computing platforms, does each platform have to be managed separately or is there a way to monitor and manage all of them from a central location?

f. If an edge computing platform-based solution become disconnected, will it continue to operate autonomously and, if so, for how long?

g. In a redundant configuration does there have to be a hard failure before applications switch over the redundant node or can the edge computing platform detect the potential of a failure and take proactive action?

h. Is there a way to monitor the performance of the applications so that the end user or OEM can determine if they are running optimally or whether maintenance is required?

6. Maintenance, Support, and Service

   a. What will the aftermarket cost be?

   b. What will the TCO be?

   c. What will the payback time be?

   d. How long will the platform operate in service? Can the platform operate 10+ years or will it be on a 3–4-year IT refresh cycle?

   e. Does the edge computing supplier have different levels of support that can be tailored to the end user, SI, or OEMs needs and those of the OEMs customers?

   f. Are the support levels offered available on a global basis?

   g. Can the end user, SI, or OEM provide its own support with the edge computing supplier acting as a backup for deeper problems?

   h. Does the edge computing supplier offer comprehensive support and maintenance to quickly replace units, or does the end user, SI, or OEM have to stock spares?

   i. What happens if the edge computing platform needs replacing but is no longer available?

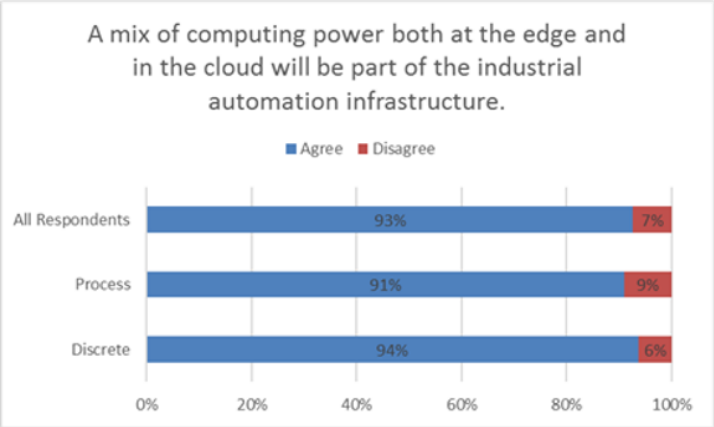
   j. Does the edge computing supplier offer comprehensive training programs for engineers and field service technicians?

   k. Is online help available for technicians?

   l. How long will it take to reach a person if the end user or OEM needs help?

Summary

For manufacturing and industrial environments, Industrial Edge Computing Platforms should be simple to deploy and maintain, protected from interruptions and threats, and operate autonomously. Continuous availability must be maintained for business-critical applications. The industrial edge computing platforms must be easy to install, deploy and manage across applications and existing infrastructure as well as scale to new areas of operation. The platforms must also be protected, mitigating operational, financial, and reputational risk by ensuring they are 'always on' and available, securing data from cyber threats or data loss. The platforms must also be autonomous, leveraging reliable, rugged technology that runs in any environment without human monitoring, maintenance, repairs, or support.



Industrial Edge Computing Platforms Are Expected to be Part of Virtually All Process and Discrete Applications in the Future, Based on ARC Survey of 327 Industry Respondents

For machine builders and OEMs, industrial edge computing platforms should meet all their customer requirements for reliable and smart machines. These platforms must allow the machine builders or OEMs customers to address key requirements for flexibility, security, reliability, and availability right out of the box or off the shelf and help enable digital transformation. They must enable faster machine design, build, and delivery providing the machine builder or OEM with a competitive edge. The platform must help the machine builder's or OEMs customers to speed up the time to market, increase standardization, provide machine repeatability, and simplify installation architectures by supporting all leading visualization, monitoring, control, and other business critical applications on a single platform that provides integrated redundancy and built-in security. Finally, the platform must be maintainable and sustainable, with the ability for the machine builder, OEM, or platform supplier to provide access and connectivity to be able to do diagnostics, analysis, and remote upgrades.

In summary, ARC recommends that buyers seek industrial edge computing platforms that are:

- Easy to install, service and upgrade with repeatable templates for faster provisioning and commissioning.

- Protected and secure out of the box or off the shelf; provide protection for machine investment; and feature integrated redundancy.

- Autonomous, self-managing, and healing, which enables always on performance to increase the OEE of the production line or actual machine.

- Industrialized grade provides scalability to expand as the solution requires, with no single point of failure, and single button restore if necessary.

Analyst: Craig Resnick
Editor: Larry O'Brien

Acronym Reference: For a complete list of industry acronyms, please refer to www.arcweb.com/research/lists/IndustryTerms/.

ALM	Asset Lifecycle Management
APM	Asset Performance Management
CPAS	Collaborative Process Automation System
CMM	Collaborative Management Model
CPM	Collaborative Production Management
CRM	Customer Relationship Management
DCS	Distributed Control System
EAM	Enterprise Asset Management
ERP	Enterprise Resource Planning
HMI	Human Machine Interface
IoT	Internet of Things
IIoT	Industrial Internet of Things
IT	Information Technology
MES	Manufacturing Execution System
OT	Operational Technology
PAC	Programmable Automation Controller
PLC	Programmable Logic Controller
PLM	Product Lifecycle Management
ROI	Return on Investment
SCM	Supply Chain Management
WMS	Warehouse Management System

3 ALLIED DRIVE DEDHAM, MA 02026 USA 781-471-1000