

Edge 4.0 Features, Functions and Business Requirements

The industrial 4.0 promise of greater automation, higher quality, more efficiency and increased safety requires an edge platform architecture with maximum flexibility. The rate of technology advances in cloud service offers, ML/AI techniques, compute capability, sensor accuracy, new standards, network reach and network capacity are all accelerating. Meanwhile, the large capital requirements and long equipment life-cycles of OT remain. The need to further integrate OT and IT becomes more important and more challenging.

How does this affect the requirements of the Industrial IoT 4.0 Edge Platform?

Critical Edge 4.0 Features and Functions

Universal Data Acquisition

Acquiring Data from every asset, sensor, process and situation is job one. Without data you are stuck. If your data acquisition is biased by or for an ISA95 system/vendor, cloud provider or ML toolkit, then your business risks data silos, data blind spots and expensive fixes as new technologies emerge. Using different data acquisition technologies/asset quickly becomes unmanageable and expensive so your edge must acquire data from old, new and future assets alike.

Universal Data Integration

The breadth of OT and IT systems and services consuming data is ever expanding. The operational environments grow in complexity as both cloud and edge gain acceptance and support for existing ISA95 systems remains. Therefore, systems acquiring and processing edge data can not dictate if, when and how data is formatted and integrated into this vast moving target. On the contrary, the edge must not only acquire data but must also filter, process, translate and enhance data so it can be integrated with any legacy, current or future OT/IT system.

Data Migration & OT/IT Convergence

Edge data must enable the business not create obstacles. By combining universal data acquisition with universal data integration, both migration and convergence is enabled. For example, FogLAMP can connect to an existing PLC or DCS maintaining data streams to existing historians and OEE systems while also supporting new data pipelines to multiple clouds and data science tools. As systems modernize and move to the cloud (or not) the same FogLAMP can maintain legacy systems while supporting the necessary new data pipelines.

Multi Cloud/Hybrid Cloud/Multiple Integration Methods

Cloud computing is a given. Today's conversation has moved to multi cloud, hybrid cloud and next generation virtualization and orchestration to support optionality. The edge must not impede this progress. Not only must it support these new architectures it must adopt the security and multiple ingress methods of each cloud provider to take advantage of the unique services offered.

Intercloud Communication

Opens doors for fast, secure and reliable intercloud communication. The Solution can parse and aggregate data on the fly. Also the option to combine data from various cloud and on prem sources is available.

Multiple Data Types

Traditional OT data is mostly time series with assets, attributes and values. The industry 4.0 vision requires supporting new types of data with time series. High-fidelity data like vibration data can detect nuances in machine behavior as bearings or gear boxes begin to fail. Video and thermal radiometric data can detect quality in a part or product during its manufacturing process. The edge must acquire, process and integrate the various data types. Like a self-driving car, it must enable the combination of these data types for advanced edge based AI/ML applications.

Distributed Edge Based ML/AI Life Cycles

The ML life cycle begins with the collection, cleaning and labeling of data regardless of type (time-series, video, vibration and thermal radiometric). To get enough accurately labeled data in reasonable time requires collecting from many machines in parallel with a single pane of glass. Sending the data to the data scientist's tools of choice. Building the appropriate models/machine. Distributing those models to the correct edge compute engine/machine. Executing inference on the edge. Then repeating the cycle as models get improved over time.

No Code/Low Code/Source Code Application Development

The types and numbers of edge applications are many. The diversity and skill sets of users in engineering, operations, maintenance, IT and management is vast. To help build and deploy the applications, the edge must accommodate the no code user even when building complex data pipelines. It must also enable the skilled hacker with the necessary freedom to do what is necessary.

Scale Up and Scale Out Management

Multi-tenant, role based, central management of edge applications, pipelines and configurations from assets to data sources to integrations and back. Understanding the logical and physical context of machines and their data as it relates to the business is required. Good security hygiene requires system level controlled updates, deletes and rollbacks as well as centrally controlled AAA services.

No Vendor Locks

Open Source/Open APIs/Intel, ARM nVidia or Google/Containers, VMs or Direct HW/Linux

Existing industrial technology stacks consist of 100s of protocols and no common data definitions. Connecting and securing this legacy with new equipment, clouds and emerging ML methodologies requires community, cooperation and open business models to bring it all together. Open source has proven its ability to do exactly that. In the late 90s the LAMP stack (Linux, Apache, MySQL, PHP) drove web application innovation and today, tools like Kubernetes enable the orchestration of the most complex cloud systems.

Total Cost of Ownership — TCO

Add it all up. The edge can quickly become a distributed system of 1000s of compute nodes.

- Capex/Operating environment (Hardware + OS + platform +App) FogLAMP <350MB + Linux (works on RaspberryPI 0)
- Supports bare metal, virtual machines and/or containers
- Opex — Scale with single pane of glass management and security best practices
- Single edge data acquisition API that integrates with everything
- Intelligent edge to reduce network and cloud opex (send the data that matters)

Critical Edge 4.0 Features

 **FogLAMP**

Compare Other

Critical Edge 4.0 Features	FogLAMP	Compare Other
Universal Data Acquisition and Migration	X	
Universal Data Integration	X	
Data Migration & OT/IT Convergence	X	
Multi cloud/Hybrid Cloud/Multiple Integration	X	
Multiple Data Types	X	
Time-Series	X	
Vibration Data w/ Signal Processing	X	
Video	X	
Thermal Radio Metric	X	
Distributed Edge Based ML/AI Life-Cycles	X	
No-Code/Low Code/Source Code Development	X	
No Vendor Lock/Open Source	X	
Total Cost of Ownership	X	

Other Basic Edge Features

 **FogLAMP**

Compare Other

	FogLAMP	Compare Other
Management	X	
Application Life-Cycle	X	
ML/AI Life Cycle	X	
System and Scale Life-Cycle	X	
Change Management	X	
Templating	X	
Data Acquisition Protocols +	X	
MQTT	X	
Modbus	X	
OPC-UA	X	
Files	X	
REST	X	
Long Tail	X	
Data Filtering	X	
Ingress	X	
Egress	X	
Data Processing	X	
Data Integration Popular Protocols+	X	
MQTT	X	
Kafka	X	
Files	X	
REST	X	
Long Tail	X	
Edge Rules Engine	X	
Edge Notification Engine	X	
Control	X	
Bi-Directional Communication	X	

Security

FogLAMP

Compare Other

Authentication Data Source (Must adopt what is available)	X
Certificates	X
Tokens/Kerberos	X
Passwords	X
Authentication Data Source (Must adopt what is required)	X
Certificates	X
Tokens/Kerberos	X
Passwords	X
Authentication/Authorization Users and Administrators	X
Role-based	X
Multi-tenant	X
SSO (Oauth/LDAP)	X
Encryption	X
SSL	X
Root of Trust	X
Adopt the root that is required	X
Independence trust/pipeline	X
Security Hygiene	X
Securely stored and signed packages and components	X
Single pane of glass updates, deletes, rollback	X
Single pane of glass configuration life-cycle	X
HW root of trust support	X
Commercial Support	X