eBook: A Guide to Windows IoT for Industrial Applications

Microsoft

ARROW

Key Considerations for Operating Systems for Industrial IoT

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Automation infrastructure in industrial settings is undergoing a dramatic transformation. Smart devices with multimodal connectivity and cloud-driven analytics are changing how businesses view the power and opportunity that data brings. The technology landscape encompasses a wide range of device, network, and deployment topologies and the role of the device operating systems have become more critical than ever before.
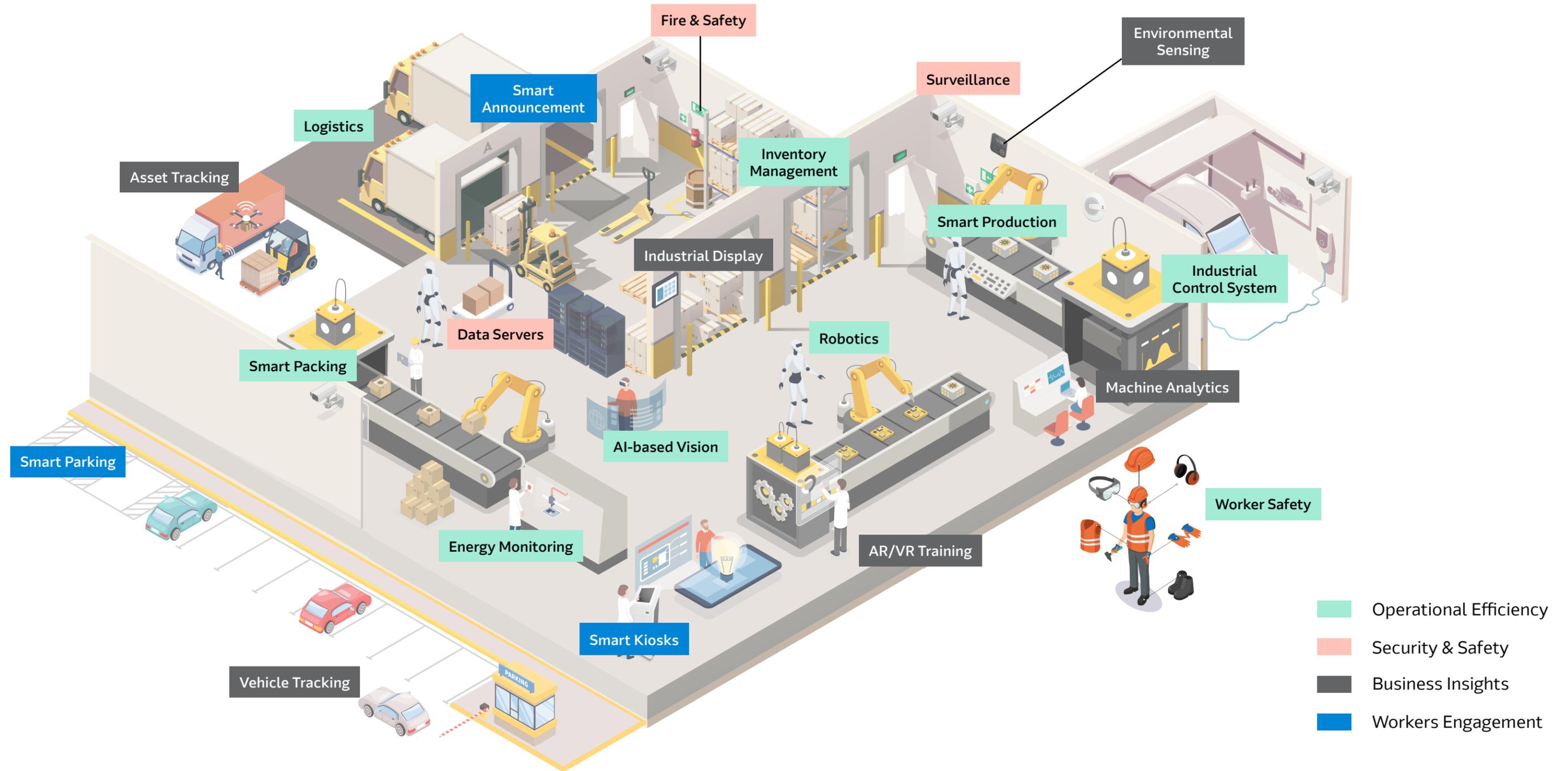
Operating systems play a vital role in Industrial IoT as they need to meet a variety of stakeholders' considerations. These criteria include:

- **System stability:** Critical industrial processes cannot tolerate experimentation. Often, safety, high cost of operational problems, and regulatory compliance considerations warrant industrial stakeholders to deploy highly reliable devices that deliver predictable uptime through their operational life.
- **Long operating life:** Industrial devices are often mounted in hard-to-reach locations and are critical enablers of process operations. Any disruption in device operation can lead to expensive downtime or loss of operational productivity. To avoid these costs, stakeholders require Industrial devices to have long operating lives. To facilitate long life, devices need to have operating systems able to stay current for a long time.
- **Security:** Security is an important consideration in choosing operating systems for industrial devices. Built-in security safeguards that minimize potential harmful effects for unauthorized access or accidental changes are key in creating a security-first environment. The ability to securely integrate devices into a broader facility infrastructure is also equally important to deploy holistic security policies across an industrial facility.
- **Analytics:** Data has become the new source of economic and business value to industrial companies. Device operating systems that facilitate collection, transmission and rapid analysis of data are gaining favor from industrial stakeholders.

Microsoft's device-to-cloud platform approach has been designed to meet the industrial IoT considerations delineated above. The Windows IoT operating system with Azure IoT offers an ideal foundation for industrial applications with long life, advanced safety and locking mechanisms, enhanced security, and scalability.

This eBook provides a comprehensive overview of the features and capabilities available in Microsoft operating systems for industrial applications. Comparison between Windows 11 and Windows 10 IoT versions, licensing options for industrial devices, and roadmaps are provided. An Arrow case study for a plant automation platform powered by Microsoft 10 IoT Enterprise operating system and Azure IoT is also highlighted.

Proliferation of Edge Devices in Industrial Applications

Fire & Safety

Environmental Sensing

Smart Announcement

Surveillance

Logistics

Asset Tracking

Inventory Management

Smart Production

Industrial Display

Industrial Control System

Data Servers

Smart Packing

Robotics

Machine Analytics

Smart Parking

AI-based Vision

Worker Safety

Energy Monitoring

AR/VR Training

Smart Kiosks

Vehicle Tracking

- Operational Efficiency
- Security & Safety
- Business Insights
- Workers Engagement

# A Device-to-Cloud Platform for Industrial Applications

Powered by Windows IoT Operating System and Azure IoT

Industrial applications can be transformed with cutting-edge technology on a dependable, lasting Windows foundation – enabled by Windows IoT operating system and Azure IoT cloud. Microsoft empowers solution providers to quickly create, deploy, and scale IoT solutions on a trusted operating system with familiar development and management tools.

Microsoft Device-to-Cloud Platform for Industrial Applications

Windows for IoT

Secure and manageable IoT OS with long-term support
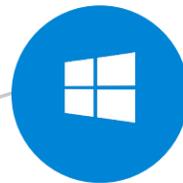
Azure ML + Azure IoT Edge + Windows ML + Windows Vision Skills

Offering hardware-accelerated AI to your device

Windows for IoT Device Management

Remotely reconfigure and update software and parameters of the device without the need to have physical access to devices

Windows for IoT Device Update Services

A solution for keeping devices secure. Provides full control of OS updates

How are Manufacturers Using Windows IoT & Azure?

– **Remote manufacturing operations:** Harness critical factory and plant data and control key production outcomes remotely. Track assets and performance, run what-if scenarios, and tune equipment with AI using real-time and historical data.

– **Automated quality control:** Increase production accuracy, repeatability, and quality. Identify and mitigate defects before they reach customers. Identify root causes, issue proactive alerts, and launch on-site investigations in real-time.

– **Inventory planning & optimization:** Use your existing internal sales data in combination with external data to optimize inventory, increase forecasting accuracy, reduce costs, and enhance customer service levels with AI and machine learning.

– **Build more agile smart factories:** Create the smart factory of the future today with IT, OT, and open, scalable, and trustworthy industrial IoT.

– **Create more resilient supply chains:** Improve service resilience and profitability with intelligent supply chain planning and execution.

– **Transformed workforce:** Combine productivity applications, intelligent cloud services, and security to transform the way employees work.

# Why Choose Windows IoT Operating Systems for Industrial Applications

Build confidence through 10+ years of long equipment support cycles

Maintain continuity and maximize your factory and equipment investments by maintaining support for the long term. Windows 10 IoT Enterprise provides consistent and predictable guidelines for the availability of support throughout the equipment's life.

Soft real-time performance

A soft real-time operating system is one where there is a small window of time for program completion rather than a precise moment due to a bit of jitter from the operating system. Soft real-time systems, though less precise, can be run on multiple cores and impose fewer restrictions on applications. Soft real-time devices are more often used within a broader control loop to trigger behaviors from a state machine. New in the "21H2" release, Windows IoT operating system now supports soft real-time performance.
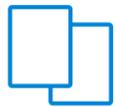
Create digital twins and drive consistent AI from the edge to the cloud

Turn data into insights with a consistent and comprehensive experience from the edge to the cloud. Simplify asset management and maintenance, and gain productivity with data, AI, and machine learning together to maximize process efficiency with the edge-optimized data engine. Azure AI and machine learning capabilities are based on a set of principles that include consistent application development, holistic security, unified identity, simplified device management, and a robust intelligent edge portfolio and ecosystem that offers choice.

Simplify complex environments

Connect brownfield equipment and future-proof new and legacy systems. Build IoT solutions that are compatible with industrial devices and systems through OPC UA standards. Enable an edge-to-cloud environment to contextualize data with powerful visualizations through Azure managed platform services, open-source software, and open industrial data models on the edge and in the cloud.

Advanced lockdown features to prevent unwanted changes

Windows lockdown features give extended restriction control over the OS environment and user experiences. These are extremely useful to prevent tampering of OS and unauthorized updates or data being written on the devices. Unified Write Filter (UWF) helps create a read-only environment, Shell Launcher helps boot to the app directly and restrict the use of specific keys on the keyboard, etc.

Secure operating system

Protect your assets with built-in security that proactively detects and stops threats before they happen. Windows IoT offers enterprise-grade security to help protect user identity through two-factor authentication; protect sensitive information through device data encryption; and protect unauthorized access through secured remote access.

Tested, proven, and stable

Stability is the key to industrial projects. The Windows IoT platform has had more than six years of market availability and is tested and proven. Countless security updates and bug fixes have made it incredibly stable and straightforward to integrate. Functional updates for the LTSC-version are limited to once every two or three years, further enhancing field stability.
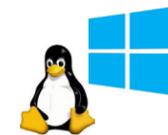
Build with the best of Linux and Windows on a single platform

Developers no longer need to choose between Windows or Linux – they can leverage the best of both on a single hardware platform. Microsoft is now giving developers the ability to build with both Windows IoT and Linux, together on a single hardware. With Azure IoT Edge for Linux on Windows (EFLOW) developers run containerized Linux workloads alongside Windows applications. This opens a world of capabilities for commercial IoT as well as AI/ML with the availability of pre-built modules.

Comparing Windows Versions for Industrial End-Points

Microsoft offers several Windows versions with identical features and capabilities, making it confusing for solution makers. Variations are based on terms of usage, update frequency, lifecycle, and deployment restrictions.

Windows Professional: Windows Professional version is for general use. It comes pre-installed with commonly used apps and it's the better choice for enterprise computers, laptops, and tablets. It's designed to be applicable to lots of different scenarios, with only light or no customizations needed. It receives automatic updates from Microsoft. This means you'll never miss a bug patch or security enhancement. Windows 10 Professional is an excellent solution for small businesses looking to upgrade their existing operating system platform to one with leading-edge features. The Professional version provides several features ranging from easy migration capability to increased security.

Windows Enterprise: Windows 10 Enterprise comes with all the features available with Windows 10 Professional and is targeted at medium and large businesses. It can only be distributed via Microsoft's Volume Licensing Program and requires a base installation of Windows 10 Professional. Enterprise offers several additional value-added features for enterprises. One important feature is DirectAccess, which permits remote users to access internal networks over a VPN-like system that establishes a bidirectional Internet connection.

Windows IoT Enterprise: Windows IoT Enterprise is a full version of Windows Enterprise that delivers enterprise manageability and security to IoT solutions. It is an ideal choice for embedded and IoT devices with a fixed function. For ex: industrial control systems, kiosks, ATMs, digital signage players, etc. Windows IoT Enterprise shares all the benefits of the worldwide Windows ecosystem. It is a binary equivalent to Windows Enterprise, so you can use the same familiar development and management tools. There are different versions of Windows 10 IoT Enterprise operating system that solution providers can choose from.

Windows 10 IoT Enterprise Editions

The Windows 10 IoT editions provide different options for OEMs to align with their solutions:

– **Windows 10 IoT Enterprise General Availability Channel (GAC)*** is based on full Windows 10 Enterprise supports Win32 and Win10 universal applications. The GAC edition allows devices to stay current on the latest build but offers less control of Windows updates and has a much shorter support timeframe with only 18 to 36 months maximum of support.

– **Windows 10 IoT Enterprise Long-Term Servicing Channel (LTSC)** changes the license terms to focus on OEMs that build dedicated appliances and 10 years of support while locking into a single build version of Windows IoT Enterprise. OEMs no longer need to worry about new features or new builds of Windows being pushed to the device which could cause problems in the field. 10 years of support and a great pricing model are compelling advantages for most OEMs.

*From Oct 2022, updates will be made annually, not semi-annually.

Comparing Windows Professional, IoT Enterprise GAC, and Windows IoT Enterprise LTSC Versions

	Windows Professional (GAC)	Windows IoT Enterprise (LTSC)	Windows IoT Enterprise (GAC)
Channel	Direct OEM + OEM system builder	OEM IoT embedded	OEM IoT embedded
Target device	General use computer	Dedicated IoT appliance	Dedicated IoT appliance
Licensed by	Physical computer	Processor w/4 price tiers	Processor w/4 price tiers
Pricing	Single high-end	High-end, value, entry, base	High-end, value, entry, base
Life cycle	Short	Long	Long
Support cycle	18 to 36 months	10 years	18 to 36 months
Windows update	Required (optional 365 day delay)	Optional w/full control	Optional w/some control
Update type	Features & quality	Quality only	Features & quality
Re-imaging rights	Not included	Included	Included
External recovery	Not allowed	Allowed	Allowed
Global shipments	Limited	Unlimited	Unlimited
Customization	Limited	Unlimited	Unlimited
Product key	Unique	Single	Single

The LTSC version is the simplest and most cost-effective license for dedicated-purpose/embedded devices. Other advantages include:

– Longest life cycle of all Microsoft products — up to 10 years

– Bit for bit identical operating system with licensing terms targeted towards embedded and IoT appliances

– Global licenses and multi-language support

New Product Updates for Windows IoT Client Operating Systems

With millions of intelligent-edge solutions in industrial applications, Microsoft continues to invest in new versions of the OS and release new products. Two new versions of the Windows client operating system were released in late 2021 - Windows 11 IoT Enterprise and Windows 10 IoT Enterprise LTSC 2021.

Windows 11 IoT Enterprise

Windows 11 IoT Enterprise is the next evolution of Windows for IoT and it is the most significant update since Windows 10. It offers many features focused on enhancing the end-user experience. New features include USB 4.0 support, Wi-Fi 6E, Windows Subsystem for Linux GUI (WSLg), which brings Linux GUI applications to the Windows Subsystem for Linux (WSL), and many more.

Key points release schedule, support, and availability of the LTSC version:
– Windows 11 IoT Enterprise LTSC version will be released in the mid-2023 timeframe
– Windows 11 IoT Enterprise will have only one release per year
– Windows 11 IoT Enterprise will get 36 months of support per build

We do not recommend the Windows 11 IoT Enterprise for industrial applications. Solution providers for industrial devices need the benefits of the long-term servicing channel (LTSC). Windows 11 IoT Enterprise only offers 3 years of support. We recommend solution providers consider Windows 10 IoT Enterprise LTSC 2021 operating system.

Windows 10 IoT Enterprise LTSC 2021

Windows 10 IoT Enterprise LTSC 2021 is the latest Windows 10 IoT operating system designed for IoT devices. New features and product enhancements include silicon support expansion, reduction of up to 40 % in the size of the operating system, and over-the-air (OTA) updates. Windows 10 IoT Enterprise 2021 LTSC (Long term servicing channel) version will continue to have a 10-year support lifecycle, consistent with existing LTSC versions.
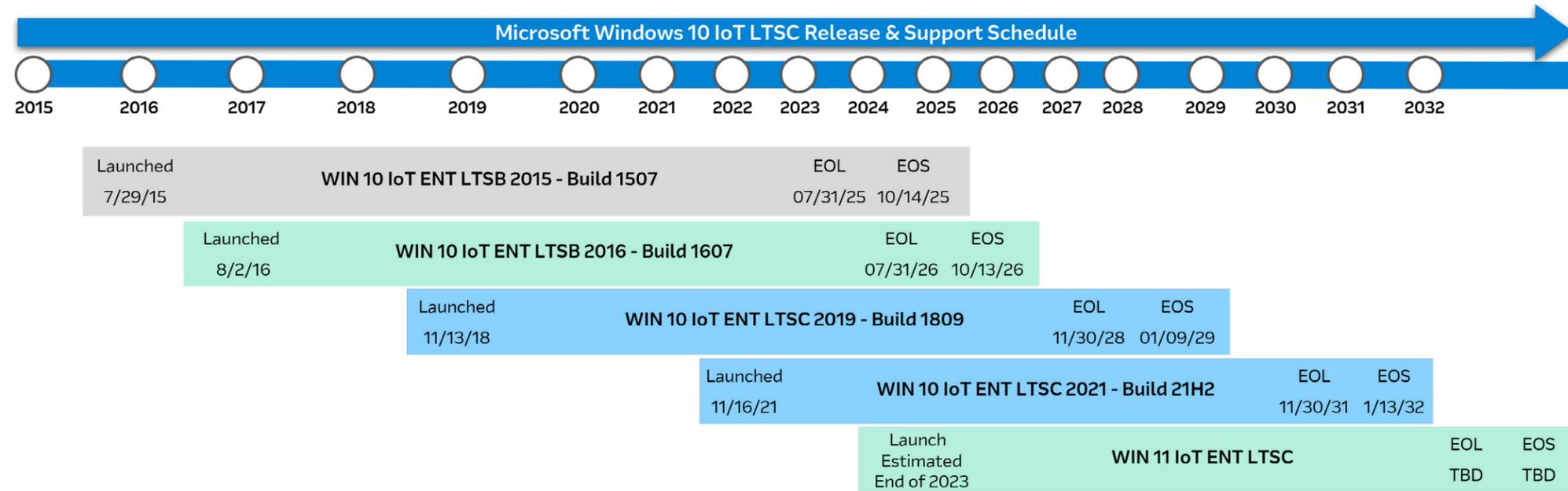
Another benefit is the ability to run Linux workloads via Linux Containers with Azure IoT Edge on Windows (EFLOW). Developers no longer need to choose between Windows or Linux – they can leverage the best of both platforms. This opens a world of capabilities for industrial IoT as well as AI/ML with the availability of pre-built modules.

Windows 11 vs. Windows 10 IoT Enterprise LTSC

Features by IoT Edition	Windows 10 IoT Enterprise LTSC 2019	Windows 10 IoT Enterprise LTSC 2021	Windows 11 IoT Enterprise
Servicing Channel	10 Years	10 Years	3 Years
Browser Support	IE11 and Edge	Edge	Edge
Multi-App Assigned Access	Available	Available	Coming in Future
Single App Kiosk Assigned Access	Available	Available	Available
EFLOW (Azure Edge for Linux on Windows)	Available	Available	Available
Shell Launcher V2	Available	Available	Available
Reduced OS Footprint	Available Limited	Available Limited	Coming in Future
ARM64	Available on GAC	Available on GAC & LTSC	Available on GAC
Soft Real-Time	Not Available	Available	Coming in Future
Unified Write Filter Updates	Not Available	Available	Available
Dual Operator Mode	Not Available	Coming Soon	Coming in Future
Windows Subsystem for Linux (WSL)	Not Available	Available	Available with GUI (WSGLg)
Wi-Fi 6e	Not Available	Not Available	Available
USB 4.0 (Inbox)	Not Available	Not Available	Available
New Modern UI	Not Available	Not Available	Available
GPU Compute Support	Not Available	Available	Available
Edge Device Image Builder Tool	Not Available	In Preview	Not Available
Device Update Center (DUC)	Not Available	Available	Available
WPA H2E Standards Support	Not Available	Available	Available

The best fit Microsoft OS for industrial devices designed in 2022 and 2023 is Windows 10 IoT LTSC 2021. The Windows 10 platform has been deployed in millions of devices and is tested and proven. Countless security updates and bug fixes have made it incredibly stable and straightforward to integrate.

Windows IoT Enterprise LTSC Release and Support Schedule 2022

Microsoft Windows 10 IoT LTSC Release & Support Schedule

2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032

Launched 7/29/15	**WIN 10 IoT ENT LTSB 2015 - Build 1507**	EOL 07/31/25	EOS 10/14/25

Launched 8/2/16	**WIN 10 IoT ENT LTSB 2016 - Build 1607**	EOL 07/31/26	EOS 10/13/26

Launched 11/13/18	**WIN 10 IoT ENT LTSC 2019 - Build 1809**	EOL 11/30/28	EOS 01/09/29

Launched 11/16/21	**WIN 10 IoT ENT LTSC 2021 - Build 21H2**	EOL 11/30/31	EOS 1/13/32

Launch Estimated End of 2023	**WIN 11 IoT ENT LTSC**	EOL TBD	EOS TBD

Product	Launched	End of life	End of support
Windows 10 IoT Enterprise LTSB 2015	07/29/2015	07/31/2025	10/14/2025
Windows 10 IoT Enterprise LTSB 2016	08/02/2016	07/31/2026	10/13/2026
Windows 10 IoT Enterprise LTSC 2019	11/13/2018	11/30/2028	01/09/2029
Windows 10 IoT Enterprise LTSC 2021	11/16/2021	11/30/2031	01/13/2032
Windows 11 IoT Enterprise LTSC	TBD	TBD	TBD

Windows 11 IoT Enterprise LTSC edition is **expected to be released end of 2023**

Additional Resource:

Download the Detailed Windows IoT Operating Systems Roadmap Information

Partner Case Study

Improve Factory Productivity, Precision, Performance, and Energy Efficiency with Full-stack Solutions from Ectron and Arrow Electronics

Arrow Electronics was engaged by Ectron to provide an end-to-end technology stack that allows stakeholders to deploy smart manufacturing technologies with ease. Ectron devices and software were complemented by Arrow's expertise in edge hardware, integration, and on-site deployment and support. Arrow's global presence and partner ecosystem helped Ectron gain scale and support implementations of a ready-to-deploy platform for customers.

Ectron's SmartEYE™ solution enables the digitization of manufacturing helping plant managers transform and automate their factory floors by combining edge computing and sensing technologies with cloud analytics and cutting-edge AI/ML methodologies. Stakeholders can harness data and analytics on-the-edge on several hundred data points in real-time, to monitor machines, personnel, energy usage, and processes and make accurate and precise decisions that facilitate OPEX reduction and product improvement.

The solution was successfully deployed as a pilot project in a large pharmaceutical company to test medical assays for pathogen presence and moisture content. Sensors were deployed on the dryers to constantly track the moisture and humidity levels of the assays during the manufacturing process. Granular data on moisture and relative humidity levels were gathered and processed locally on edge computers and then sent to the cloud to run analytics on real-time data and historical data. The solution offered hierarchical easy-to-use BI dashboards at every level and afforded real-time and historical information to the end-user. Stakeholders harnessed data-based insights to streamline and optimize the production process to ensure consistent product quality.

Ectron's SmartEYE™ System Architecture Solution Stack Components
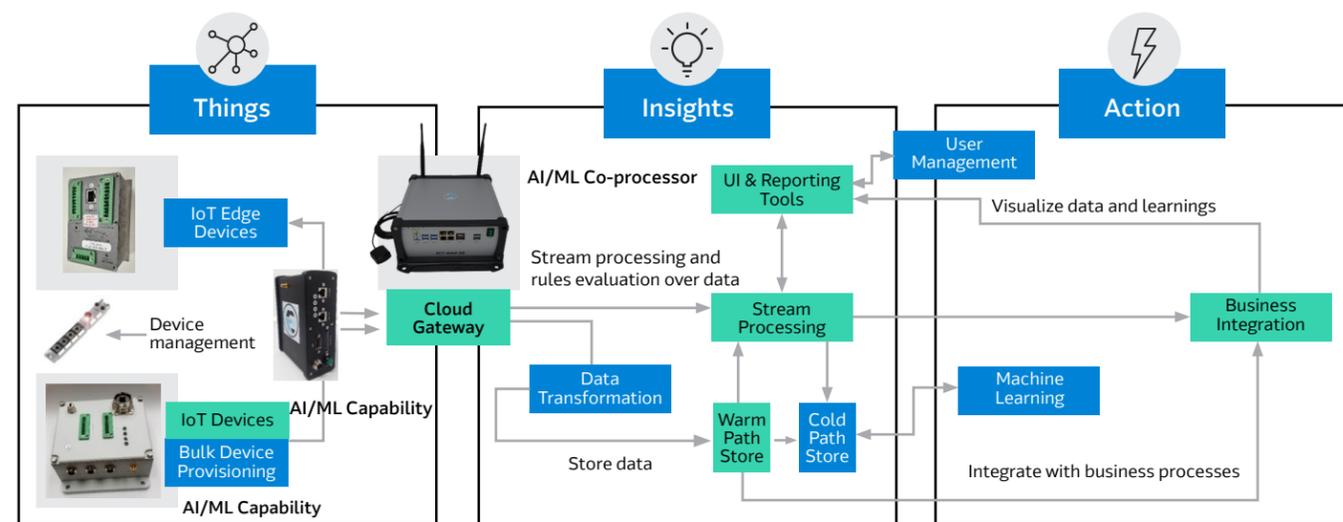
Ectron's SmartEYE™ Solution Stack Components

Ectron
– Sensors, hardware, networking, and integration
– SmartEYE™ PaaS (Platform as a Service)
– Custom KPI and dashboard development
– Deployment and maintenance

Microsoft
– Windows 10 IoT Enterprise operating system
– Azure cloud services

Intel®
– Hardware based on Intel® FPGA & Intel® processors

Arkessa
– IoT connectivity services

Arrow
– Solutions: Tiers of products designed specifically for analytics applications
– Product services: Design, support, or professional services
– Manufacturing services: Consultation, supply chain and logistics, integration, installation and set up

About Ectron

Ectron Corporation provides end-to-end solutions in the manufacturing chain from the first sensor touchpoint to the Cloud with SmartEYE™, its PaaS (Platform as a Service) with analytics and AI/Ml-enabled edge computers. Ectron is a Microsoft Partner and an Azure CSP that specializes in products designed to provide highly accurate data, even in harsh environmental conditions. Their products are sold to customers in the military, industrial, research laboratories, pharmaceutical, process control, and other industries.

Getting Started

Ready to get started with Windows IoT? You'll first need to sign up to request a Microsoft OEM Customer License Agreement (CLA). As an authorized distributor of Windows products, Arrow can guide you throughout this process and help you obtain the CLA you need to begin building with Windows 10 IoT.

Microsoft Customer Licensing Agreement

The Microsoft Customer License Agreement (CLA) is a single agreement that covers all Internet of Things (IoT) products. There is no cost and no financial commitment with no minimum purchase requirements to obtain a CLA.

As an authorized distributor of Microsoft products, Arrow has helped thousands of customers obtain the licensing required to design and deploy IoT devices powered by Microsoft Windows and Azure. Experience the full power and capabilities of Windows across your smart, connected devices by signing up free for a Microsoft CLA. Fill out the form to get started.

[Apply for a Microsoft CLA Now](#)

Useful Resources

– [How to Get Started and Simple Process Overview of Microsoft IoT Embedded Products via Arrow](#)
– [Windows IoT Licensing Guide](#)
– [Windows IoT Operating Systems Parts List](#)
– [Windows Operating Systems Check List](#)
– [Interactive Tool: Choose the Right Windows Operating System (OS) for Your Application](#)
– [Windows Blogs and Insights](#)
– [The Windows Champ YouTube Channel](#)

Learn how we can help you. Contact us at windowsiot@arrow.com and our experts will respond within 24 hours.

Arrow: One Distributor — Endless Device Possibilities.

As an authorized distributor of Windows, Arrow helps you to create, make, manage, and deploy smart, connected devices powered using the full power of Windows.

From embedded devices and systems to dedicated appliances and fixed-function devices, our dedicated team of Microsoft experts is here to help you simplify your IoT experiences.

– Authorized distributor of Windows licensing

– Trusted advisor of Microsoft offerings

– Best-in-class consulting from Arrow's certified Microsoft experts, including Microsoft MVPs and Microsoft Champs

– Rapid, day-of response times (M-F, 8a-5p EST)

– Global deployment capabilities

Arrow Electronics guides innovation forward for over 220,000 leading technology manufacturers and service providers. With 2021 sales of $34.4 billion, Arrow develops technology solutions that improve business and daily life. Learn more at **arrow.com/fiveyearsout**

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