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Simplify IoT solution development with Intel and Microsoft

Guide to understanding benefits of edge computing, when to choose market-ready solutions, and technical capability needs

Table of contents

Introduction

Two out of three organizations are planning to use IoT even more in the next two years than they do today.[1] As the IoT market matures, computing capabilities are increasingly being positioned at the edge. This brings processing and analysis power closer to connected data-generating devices and their users rather than handling data exclusively in the cloud or at remote data centers. Estimates show that by 2025, 75 percent of enterprise-generated data will be created and processed at the edge, up from less than 20 percent today.[2]

There are several factors driving this rapid expansion of edge computing:

- Latency and bandwidth/connectivity requirements

- Desire to reduce IoT data storage costs

- Need for real-time edge processing and analysis of massive data quantities to support scale and performance

- Ability to secure edge data while also ensuring consistent protection and compliance

> **2 out of 3**
> organizations are planning to **use IoT even more** in the next two years than they do today.

At the heart of this expansion is organizations' need to not only capture the full potential of IoT, but to also simplify the process of getting an IoT solution from concept to deployment so they can more quickly measure return on investment. Recently surveyed business and IT decision-makers, as well as developers, indicated that the median IoT adoption project takes a full year to reach deployment. That's a month longer than the median timeframe in 2019.[3]

As companies in manufacturing, healthcare, retail, and other sectors look at how they can more quickly build or implement IoT solutions to bring the power of intelligent environments to businesses, there are key considerations that impact their ability to do so. In this white paper, we will dive into the following topics:

- ✔ The two most common IoT objectives—remote monitoring and predictive maintenance—and how they tie into a shift from intelligent assets to intelligent environments.

- ✔ The impact emerging technologies can play in digital transformation and business strategies.

- ✔ Six questions for better understanding your IoT needs and speeding up development and implementation timelines.

- ✔ How to simplify and secure your edge architecture using Microsoft and Intel technology that is ideal for edge data and computing, inferencing at the edge, and hardware-as-a-service needs.

Aligning IoT deployment with business strategy

IoT is changing the way many companies do business, with the technology helping them become more efficient, safer, or offering new services and experiences for customers. But people are a critical part when a business starts on a digital transformation journey to adopt IoT technology. Not only must you have **people** committed to change—from leaders to employees—but it also requires **partners** who are well-positioned with the right technology. A **product strategy** is needed to outline how IoT solutions can add value or solve a specific challenge. And, just as important, make sure the right **processes** are in place, from pay structures to skillsets and incentives that align with desired outcomes. Only then can you move past connecting devices and collecting data to truly driving insights and actions that have a far-reaching impact.

Success in adopting IoT tends to be measured in terms of cost and production efficiency versus increased revenue or the number of projects in deployment. Other common success factors include quality, reliability, and security. When it comes to an emerging technology like edge computing, success is often measured in terms of being able to keep latency low, work within bandwidth constraints, ensure business continuity when connectivity isn't an option, or manage large quantities and various types of data.


Partnership | Product

People | Process
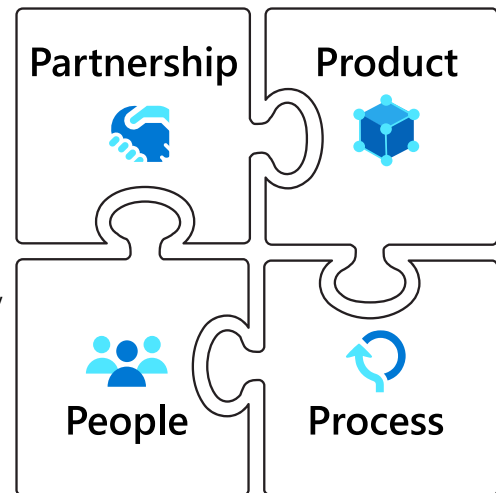
Growing use of emerging technologies

Using of emerging technologies in conjunction with IoT—particularly intelligent edge computing, artificial intelligence (AI), and digital twins—is becoming more integral to IoT solutions, according to surveyed decision-makers. Notably, those who incorporate emerging technologies into their IoT solutions reported more overall benefits from IoT deployment, which leads to more investment in IoT solutions in their organizations.[4]

These emerging technologies help propel IoT capabilities further by allowing systems to work both online and offline, by adding to analytic and predictive power, and by bringing the digital and physical words closer together. For example, digital twins technology produces digital replicas of real-world things, places, or processes to allow organizations to understand, control, simulate, analyze, and improve operations.

AI, which gives computer systems the power to make informed predictions and decisions using previously gathered information, is also gaining wider use in IoT solutions. With more than 80 percent of IoT adopters surveyed by Microsoft saying they are developing or implementing an AI strategy,[5] it is one of the advanced capabilities that powers the intelligent cloud and, increasingly, the intelligent edge.
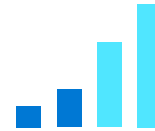
| Keeping latency low and working with bandwith constraint | Managing large quantities and various types of data | Enforcing security and maintaining compliance with regulations | Ensuring business continuity when connectivity isn't an option | Wrangling complex architectures and combining numerous solutions |

Benefits of using the intelligent edge to connect physical and digital worlds

As we look at the world around us, the intelligent edge touches every aspect of our daily lives—from connected coffee machines monitoring the data points for each shot of morning espresso, to connected retail displays and apps that help you navigate a store and find the products you need. It's helping connect the digital world with the physical by using devices that capture data. With edge computing and connections to the intelligent cloud, the systems and devices in your network can understand their environment, learn, and adjust to maximize business results.

Organizations that bring together the intelligent edge and the intelligent cloud as part of an IoT solution see improved operations, resulting in optimized automation and productivity. One of the biggest advantages of edge computing is that by moving cloud databases, analytics, and custom business logic to edge devices, organizations can focus more on business insights instead of data management. In applications where speed in handling workloads and real-time insight is important, companies are increasingly making sure to incorporate edge computing to stream, store, and analyze data at the source in addition to the large-capacity storage capabilities of the cloud.

Top trends driving IoT implementation

As IoT technology evolves, companies are using it for more cutting-edge applications, yet the two most prevalent use cases continue to be remote monitoring and predictive maintenance. The remote asset management market alone is predicted to grow from $16.5B USD in 2020 to more than $32B USD by 2025,[6] with demand for predictive maintenance expected to expand from $4B USD in 2020 to $12.3B USD by 2025.[7]

Launching even a relatively simple IoT project, however, can present challenges. Among surveyed IoT adopters, 95 percent reported having a project fail at the early proof-of-concept stage, and technical challenges were the most reported barrier to expanding IoT projects.[8]

Technology partners are helping solve for these trends by offering a wider range of plug-and-play sensors, cameras, and other devices for IoT uses, as well as low-code or no-code platforms that seek to lower the expertise needed to add or customize components within IoT solutions. For example, easily customizable platforms and devices from Intel and Microsoft can be part of larger market-ready solutions that include devices, edge computing capabilities, and cloud services all packaged for specific IoT uses. By simplifying parts of implementation, these products reduce the time it takes for companies to deploy IoT solutions and realize benefits from them.
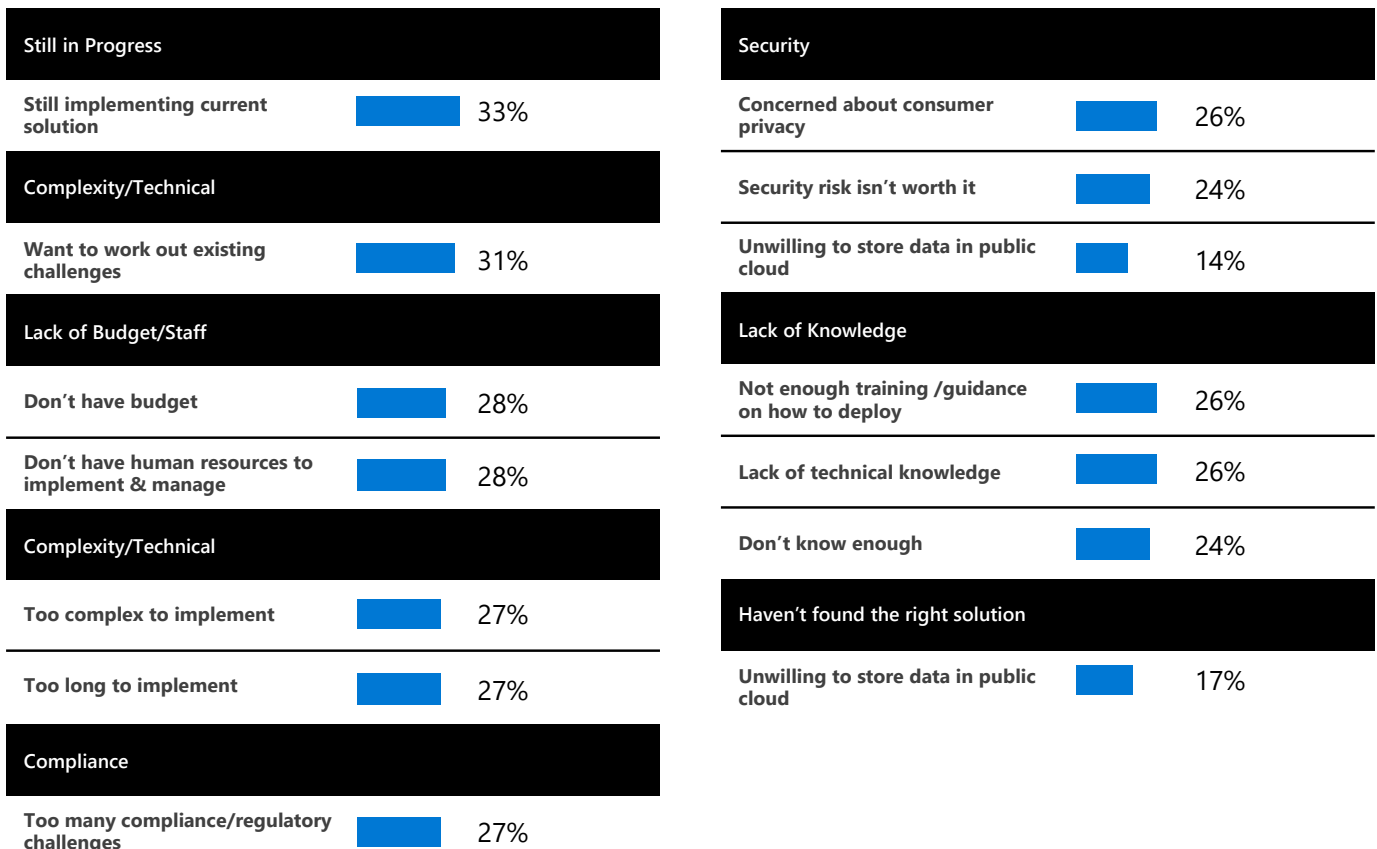
Challenges to using IoT more

Still in Progress	
Still implementing current solution	33%

Complexity/Technical	
Want to work out existing challenges	31%

Lack of Budget/Staff	
Don't have budget	28%
Don't have human resources to implement & manage	28%

Complexity/Technical	
Too complex to implement	27%
Too long to implement	27%

Compliance	
Too many compliance/regulatory challenges	27%

Security	
Concerned about consumer privacy	26%
Security risk isn't worth it	24%
Unwilling to store data in public cloud	14%

Lack of Knowledge	
Not enough training /guidance on how to deploy	26%
Lack of technical knowledge	26%
Don't know enough	24%

Haven't found the right solution	
Unwilling to store data in public cloud	17%

Figure 1 – Top issues that prevent organization from using IoT more

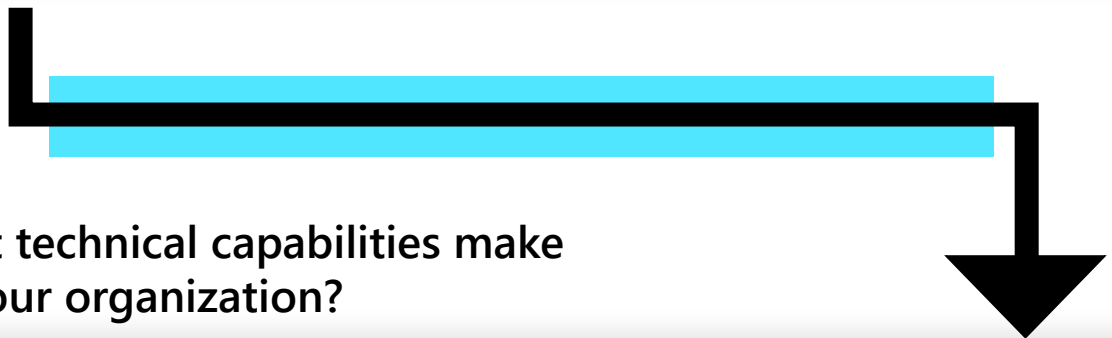# Six steps to speed up and simplify IoT solution timelines

Once a company embarks on its journey toward deploying an IoT solution, achieving business value as quickly as possible is essential. Finding the right mix of expertise and technology to create an IoT solution in a timely way that meets budget requirements is easier said than done.

But there are steps that can be followed and questions that can be asked early on when choosing an IoT solution that works for your organizational needs and is flexible for the future. One of the benefits of working with an IoT partner is they can use their specific expertise to help companies resolve these questions to speed up the process.

1 What business challenge or opportunity do you want to address?

As simple as it sounds, starting with a clear idea of what issue you want to solve or what opportunity you want to create for your customers is paramount to avoiding potential complexity in finding the right solution.

Are you trying to collect and analyze data to improve efficiency, to help prevent equipment maintenance surprises, to track products and assets, to improve customer service—or perhaps a combination of all these scenarios? Clearly outlining the objective from the start sets the direction for IoT technology decisions and helps avoid unnecessary detours along the way.

2 What technical capabilities make up your organization?

The level of technical capabilities your organization possesses should influence the type of IoT solution you choose. Some solutions require simple devices while others may need something more sophisticated such as the addition of vision, video, or AI capabilities. Knowing what your teams can realistically develop by themselves helps guide decisions on adopting a solution that can be customized by your own developers versus a ready-made solution that needs less technical skill to deploy. For example, using a software-as-a-service (SaaS) model doesn't require much know-how but usually allows for less customization than a platform-as-a-service (PaaS) solution. Both, however, require less expertise to adopt than trying to build a comprehensive solution without a partner.

3 What is your timeline for reaching deployment?

For some companies, having the time and resources available to develop a fully customized IoT solution with numerous technology providers isn't a challenge. Many enterprises, however, want solutions that don't take the median 12 months to deployment. For those customers, technology providers and their partners can offer more market-ready packages that can be customized for specific uses. In addition to allowing greater flexibility for the long-term, these packages can help businesses deploy IoT solutions faster and with less risk of failure. Intel and Microsoft, for example, have joined their hardware, software, and cloud services experience to create IoT platforms on which an ecosystem of partners can build specifically targeted, customizable solutions. Those solutions provide scalability as enterprises of all sizes seek ways to harness the benefits of using IoT.

*[Customers] are trying to take on everything themselves. They're trying to be a device builder, a solution developer, a system integrator. **They're trying to be everything,** and that's where the complexity comes in. **It's about utilizing the right expertise from providers** to make it easy to achieve time to value and market. That way, customers **don't have to do all of it themselves.***

– Nandakishor Basavanthappa, Principal Program Manager for Azure IoT

4 What are your needs when it comes to the edge and the cloud?

Do you need faster processing speeds more than vast cloud storage? Is slightly higher latency acceptable? Connecting IoT devices to cloud computing for analysis, management, and high-capacity storage has become common, but there are some workloads that require extremely low latency times. Alternatively, there may be data privacy restrictions that don't allow businesses to send all collected data to the cloud without first anonymizing it. Using a combination of edge computing—collecting and processing data on-site near the sensors—and cloud computing often provides the best mix of benefits and can automate mundane tasks.

With innovations in field programmable gate arrays, video processing units, and processing speeds, edge-to-cloud computing modules can train specialized workloads in the cloud and then transfer them back to the edge for everyday use. Such technology also can be retrofitted into existing IoT solutions, increasing their capabilities without rebuilding from the ground up. But the specific tasks you want an IoT solution to help accomplish should guide the mix of technology and edge-to-cloud options you choose.
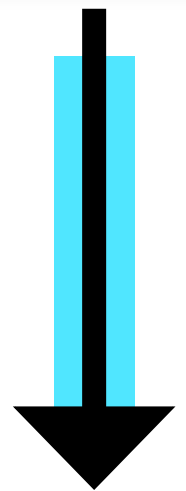
5 Have you built security into the foundation of your solution?

With workloads and data moving from the core cloud or data center to the edge, security for both cloud and silicon have never been more important. Yet more than 70 percent of existing IoT and industrial control systems (ICS) started 2020 running outdated operating systems with no updated security support, and nearly two-thirds had unencrypted passwords.[9] In addition to giving thought to the best ways to secure data, you need to consider where data will be stored or analyzed.

Starting with systems that build security into the hardware at the silicon level, including those built by Intel, makes this easier. Additionally, Microsoft Azure Defender, Azure Security Center, and Azure Sphere security tools protect data as it moves between the edge and the cloud. This includes adding secure connectivity to existing devices.

6 Does your solution include scalability for the future?

An IoT solution that works at the proof-of-concept (PoC) or pilot stage is a good start. But you need to determine if full deployment will require more resources at the edge and/or in the cloud. Also, are there potential vulnerabilities or extra complexities introduced at the deployment stage that weren't present in the limited PoC stage? Looking ahead, consider whether a solution should incorporate—or at least be able to add—AI, machine learning, digital twins, mixed reality, or other capabilities to future applications. Intel architecture and virtualization technology, paired with Azure products and services, can provide that flexible foundation.

Benefits of working with Microsoft Azure and Intel IoT

Designing and implementing IoT solutions that consider your organization's existing and future needs can take time, resources, and expertise that not every company possesses or can easily obtain. This makes the growing selection of market-ready solutions more attractive as an avenue to find and quickly deploy IoT technology. Intel and Microsoft jointly offer the most expansive and fastest-growing partner network for IoT applications.

The partners making up this ecosystem start with Intel's hardware platforms, which use second-generation Xeon processors to handle complex workloads such as AI and accelerated machine learning, as well as flexible developer tools like the Intel Distribution of OpenVINO toolkit. Azure Stack Edge hardware with Intel Xeon Scalable processors, Intel FPGAs, and SSDs can rapidly handle AI and machine learning, store data, transfer it between the edge and the cloud, and handle other workloads in both online and offline modes to provide constant, reliable management.

Pairing Intel and Microsoft hardware and developer tools with the Azure cloud gives partners the ability to consistently build modern apps, run them on the cloud, extend them to the customer's edge or on-premises components, or use them across those locations. Partners also can manage their IoT device networks with Azure IoT Hub, a PaaS platform, or Azure IoT Central, a SaaS platform. Additionally, they can use Azure SQL Edge as their optimized database engine geared for IoT and Azure IoT Edge deployments.

To make deployment of solutions easier for customers, IoT Plug and Play offers an innovative approach by decoupling software on the device and the solution in the cloud. Instead, developers describe a device's capabilities using a declarative model. The type of data the device sends to the cloud is modeled with the Digital Twin Definition Language (DTDL), an open-source language for describing models for IoT digital twins. This allows new devices to be connected to existing solutions without any additional development or coding expertise. Solution builders and device builders also can connect through the Azure Certified Device Program, which aims to promote device compatibility and differentiation through certification. By helping to bring together solution and device builders, the program can speed up time to market for both.

A concrete example of ready-to-use applications available to partners and customers is an end-to-end video analytics solution developed by Intel and Microsoft that uses Azure IoT Central and Azure Media Services. This template simplifies the setup of an Azure IoT Edge device as the gateway between cameras and Azure cloud services. It installs low-code IoT edge modules such as an Azure IoT Central gateway, live video analytics on Azure IoT Edge, the OpenVINO Model server, and an ONVIF module on the edge device. These modules help the Azure IoT Central application configure and manage the devices, ingest the live video streams from the cameras, and then apply AI models such as vehicle or person detection. Simultaneously in the cloud, Azure Media Services and Azure Storage record and stream relevant portions of the live video feed.

No matter where partner solutions use Intel and Microsoft platforms, the data is protected by a security-first approach. Intel bakes in security at every level of their computing components to better defend against both existing and evolving threats; they also offer 15-year lifecycle silicon support. Azure Defender, used with Azure Security Center and Azure Sphere security tools, continuously assesses IoT and hybrid computing systems for threats or vulnerabilities, and Azure Sentinel provides intelligent security analytics across systems.

The most comprehensive portfolio of IoT and Edge offerings in the market
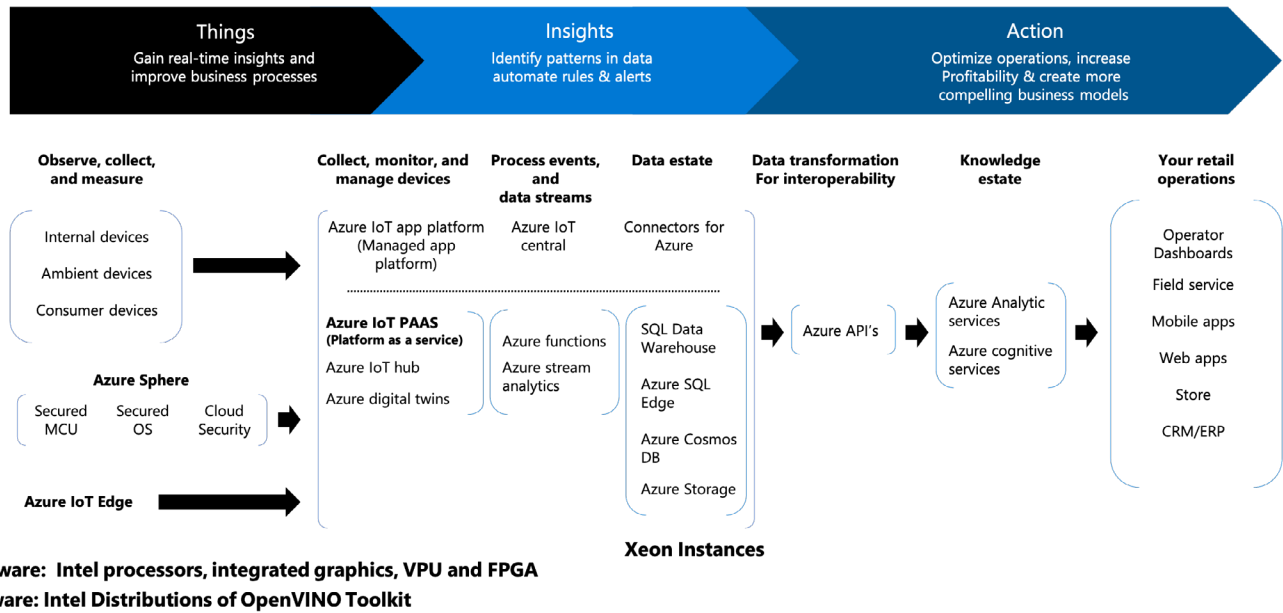

Figure 2 – Azure IoT and edge devices and services

More on market-ready IoT solutions

Healthcare

Manufacturing

Retail

Read more about a range of market-ready IoT solutions offered by partners using Intel and Microsoft technology. These solutions cover the most common applications of IoT in the manufacturing, retail, and healthcare industries.

Read more about IoT solutions

Using edge-to-cloud solutions for remote monitoring

Remote monitoring is one of the most common uses for IoT systems—one that has grown as more employees are working from home over the past year. Companies can constantly track the operational state and health of equipment and other assets in real time, monitor factory security, and check temperatures inside office buildings even when employees aren't there. RXR Realty, a leading real estate owner, investor, operator, and developer, recently launched an initiative to harness the power of Azure and its cloud, AI, and IoT capabilities to keep its tenants safer through touchless doors, temperature scanning stations, and similar measures. Through Microsoft products, including IoT Plug and Play, and Intel technology, it's possible to quickly set up or pivot IoT systems for emerging situations that affect office buildings, retail stores, or manufacturing and distribution sites

"We were already down the road using Azure, AI, IoT and edge. As we began to shift to the RxWell solution, we were able to just accelerate some of that and think through what were the other use cases."

– Scott Rechler, CEO and Chairman of RXR Realty

RXR expands IoT use to keep buildings tenants safe

RXR Realty, one of the largest real estate owners in New York City, needed a way to quickly integrate new safety measures for tenants after its buildings reopened for business during the COVID-19 pandemic. Working with Microsoft and key partners, RXR used Azure to create and deploy an intelligent, secure, scalable remote monitoring solution in just a few months.

The RxWell solution uses physical and digital assets, including Azure Digital Twins, to help keep employees informed and supported. Azure was chosen as the foundation because of its integrated offerings in IoT, AI, intelligent cloud, and intelligent edge services.

The solution helps RXR buildings and tenants stay safe by performing tasks that range from social distance detection to no-touch thermal sensors for detecting fevers—all managed through on-site devices, the cloud, and end-user apps. Azure IoT Hub serves as the point of entry to the cloud for data coming in from computer vision modules and other devices in RXR buildings. RXR also opted to use Azure Stack Edge to keep its hardware on-site and secure.

Azure Cognitive Services   Azure Stack Edge   Azure IoT Edge   Azure IoT Hub

Read RXR Realty customer story   Watch RXR Realty video

A component of remote monitoring is asset tracking, one of the fastest-growing segments within the IoT market, with shipments of asset tracking devices expected to grow 51 percent through 2024.[10] IoT in asset tracking helps solve potential problems around retaining too much or too little inventory in one place, reducing loss of product during transportation, and keeping both product owners and customers informed on exactly where their product is and when it will arrive as it moves through the supply chain.

Once prevalent in only high-value product markets, technology and cost improvements are now expanding IoT applications for asset tracking into lower-value markets and smaller companies.[11] Expanding into these areas is made simple with market-ready packages that use Intel RFP Ready Kits—bundling specific hardware, software, and support services for key industries—and IoT suppliers that build on platforms like the Intel Connected Logistics Platform (ICLP) combined with the Azure cloud.

The ICLP architecture uses its gateway and tags to provide near real-time tracking, down to details such as temperature and humidity of products. When tags communicate with the gateway, the gateway in turn communicates with the cloud. This solution utilizes edge software for immediate tasks, and then uses Azure IoT and cloud applications, as well as Azure IoT Hub, to further process data for predictive analytics. Intel and Microsoft partners can customize this tracking package for individual uses and industries.

When used with ever-smaller and less expensive asset tag technology, these already built, ready-to-install solutions are more adaptable for specific uses than previous iterations. And they don't require the longer timeline needed for an IoT solution that is completely engineered and assembled from the start. They also tend to be more flexible for future scalability.

Asset tracking solution
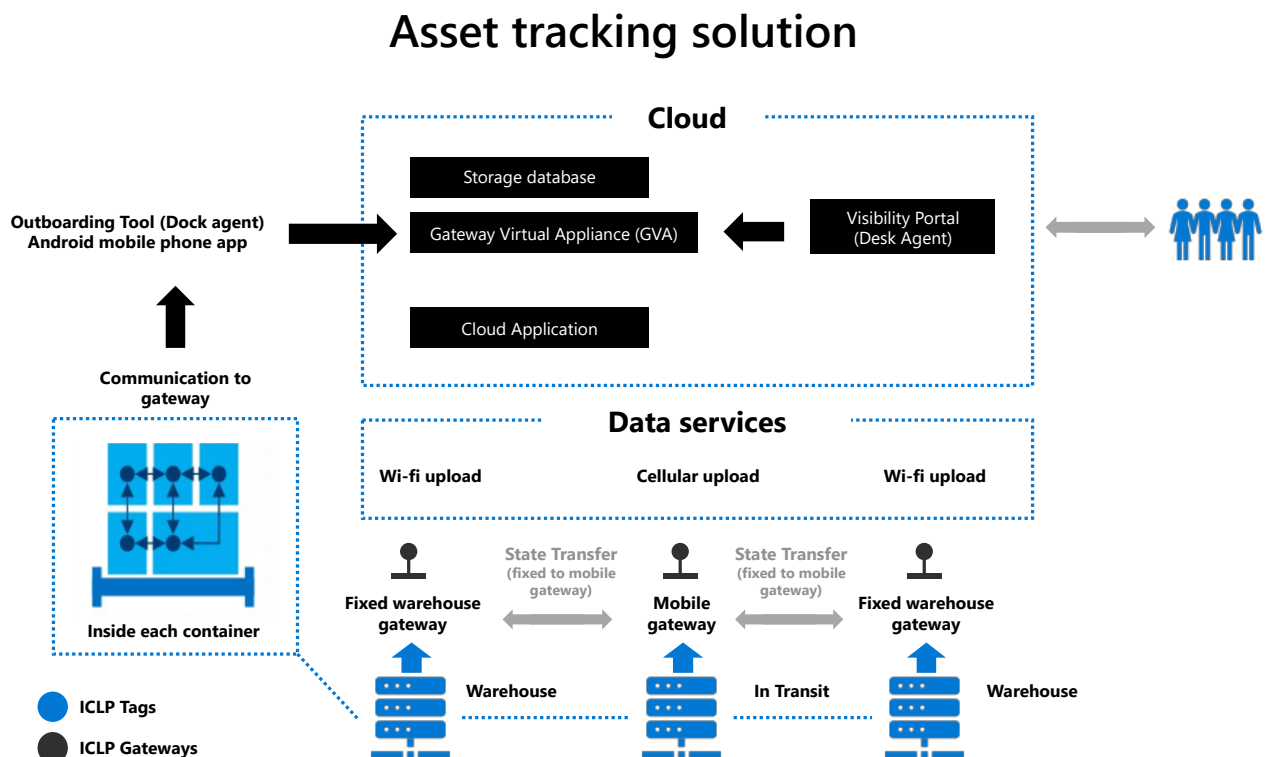
Figure 3 – Example of using Intel Connected Logistics Platform in asset tracking solution

11.

C.H. ROBINSON

C.H. Robinson, the world's largest third-party logistics provider, specializes in making freight move around the world. The company does that by leveraging technology to enable international commerce on a powerful supply chain platform.

Giving customers visibility on their freight at any moment is an important part of what C.H. Robinson does. This information includes not just the location, but also other vital aspects such as temperature, humidity, and shock during transit. Additionally, shipping information security is a priority.

Leveraging Intel-developed sensors and Intel Connected Logistics Platform technology with Azure IoT Central, C.H. Robinson developed and runs Navisphere Vision to give employees and customers real-time shipment insights so they can verify their products reach customers on time and in good condition.

Learn more about the products C.H. Robinson is using:

Azure IoT
Central
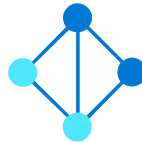
Intel Connected
Logistics Platform

Intel Xeon
Scalable
Processors

Read C.H. Robinson customer story

Watch C.H. Robinson video

Ready-made solutions for predictive maintenance

After monitoring and collecting data about assets or environments, analytics and AI applications can use data to predict a large number of outcomes, including the maintenance needs of critical equipment. Analyzing data collected from sensors can find potential problems before they're otherwise detectable. This allows a factory, for example, to have the right parts in stock and schedule qualified employees to perform maintenance before costly breakdowns occur. Businesses across a range of sectors also use this technology to optimize models to improve efficiency.

A predictive maintenance solution has long been available on the Azure IoT platform, and Azure IoT Edge ML modules support Azure Machine Learning, as well as third-party machine learning models, to help train devices to recognize defects or potential abnormalities that could eventually require maintenance.

MARINER
Insight to Achieve

Mariner has built production management solutions that use the Azure IoT suite, Intel hardware, and other joint technology to handle model training data, analytics, and machine learning workloads. The results of its analytics and machine learning help manufacturers stay ahead of equipment problems while also improving their productivity.
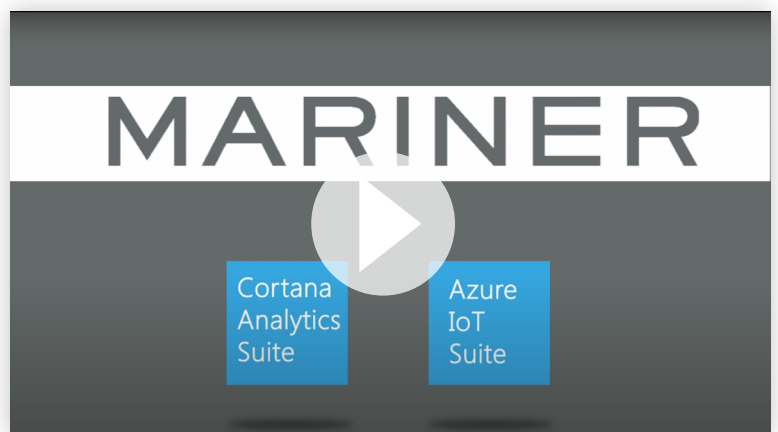
Read more about Mariner

Start exploring market-ready solutions

While IoT can transform the way businesses interact with customers, improve productivity, keep vital equipment running, and even help protect honeybees,[12] realizing the technology's promise requires solutions that are practical for enterprises of all size to implement without devoting unreasonable amounts of time or technical help. Demand for simplified end-to-end solutions is growing as IoT use increases, its capabilities become more sophisticated, and the combination of cloud computing power with connected edge technologies becomes more integral to IoT solutions.

Providers who offer end-to-end solutions, or partially built systems that can be easily customized for specific uses, are helping to reduce complexity and time to deployment. As are the toolkits that make adding new capabilities as simple as adding a printer to a Wi-Fi network. By partnering, Intel and Microsoft combine their complementary strengths in IoT hardware, software, and cloud services. Their expanding roster of partners use this joint technology to develop market-ready systems designed to implement IoT across manufacturing, retail, healthcare, and other industries.

This increasing number of platforms and product solutions from Intel, Microsoft, and partners can simplify provisioning of devices and IoT networks, reduce early stage deployment failures, and accelerate IoT deployment. Their solutions use a mix of Azure edge and cloud technology, platforms like Azure IoT Hub and Azure IoT Central, and fast and flexible Xeon processing power. They also can incorporate emerging technologies, such as AI and Azure Digital Twins, that give partners and end customers greater opportunities to increase productivity and offer enhanced services through IoT.

To learn more about potential IoT solutions that simplify development, visit www.theintelligentedge.com

Intel and Microsoft IoT partners

The Intel and Microsoft ecosystem of trusted partners supports customers by providing relevant IoT solutions that can be quickly and easily deployed. Explore the current Microsoft co-sell and Intel IoT market-ready solutions from these companies.

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