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White Paper

Designing Edge Products for the Internet of Things (IoT)

Introduction

Today the Internet of Things (IoT) enables a level of communication, collaboration and interaction between devices, sensors, machines and people that has never before been possible. This connectivity is what is called an intelligent system, and it's revolutionizing the way we think about edge products. Forecasters anticipate that by 2020 we will see hundreds of billions of connected devices in the ecosystem. These components will need to work within any number of intelligent system applications, such as manufacturing, healthcare, retail and transportation.

As with any other revolution, this next wave of computing will pose unique challenges when it comes to designing edge products. Many original equipment manufacturers (OEMs) are already leading the way, thinking of ways to design, deploy and operate devices in the context of the system. These early adopters are considering how these devices need to integrate seamlessly and securely with a variety of services, hardware and backend server infrastructures. They are paying careful attention to the security of these devices, understanding the conflict that occurs when making a device secure yet easily integrated into a larger system. They are thinking about how these devices will capture, store and deliver data for analysis. In short, they are designing solutions that meet the unique needs of various industries. They know that end-users are demanding industry-specific experiences, as off-the-shelf devices are no longer satisfying the need for targeted solutions. To stay competitive and relevant, OEMs need to continue down this path and deliver even more highly integrated intelligent systems to the market.

In response to these challenges, Microsoft is doubling down on the future of the IoT and intelligent systems. Today the company is creating a family of products and services that enables designers and engineers to tap into the power of intelligent systems in all fields of human endeavor.

Lon W. Schiffbauer
Ph.D. Consultant

Unlocked Communications, LLC

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The Effect of the IoT on Edge Products

The IoT allows edge devices to connect to, communicate with and remotely manage other networked peripherals over the Internet. In other words, it transforms “things” into Internet-enabled edge devices and components. Whereas in the past, technology generally required a human catalyst—a user to access a computer system to pull data, for example—the new IoT megatrend enables edge devices to communicate with one another and provide the user with important information when and where it is needed.

Consider the following retail scenario: Let’s say a shopper walks into his favorite clothing retailer and buys a new jacket. Data surrounding the purchase (date, customer profile, price paid, number of units sold at this particular location, units remaining in inventory, etc.) is captured at the register. This information can then be used in a variety of ways. Retailers can use it to offer more targeted promotions and price points. Distributors can better understand how the product is faring in different parts of the country and adjust inventory levels accordingly. Manufacturers can better forecast production targets. Even fashion designers can hone in on what’s hot and what’s not. In the growing trend of “fast fashion,” clothing companies have to design, manufacture and stock shelves with new fashions within a month. This has created a year-round fashion calendar, rather than the tradition biannual cycle. Data from intelligent systems allows such companies to more precisely design and distribute the right products to the right locations at the right time.

This example shows how edge products need to integrate seamlessly and securely into an industry-specific intelligent system that can then access and analyze information. It also demonstrates how the data can be used in real time as well as in the future. For instance, retailers can offer on-the-spot promotions based on the buying habits of their customers. They can also use this information to provide targeted promotions in the future through customer loyalty programs and sales.

Design, Deployment and Operation of Edge Products

Historically, OEMs produced devices across horizontals according to market uses and demands. The idea was to design peripherals that could meet the needs of the broadest possible market. With the advent of intelligent systems, OEMs are becoming device operators. They are thinking about the design, deployment and operation of the device deep in industry verticals. For example, where “designing to spec” was once the name of the game, now interoperability is the goal. Tomorrow’s edge products will need to be able to “play nicely” with a wide variety of components in the intelligent system. Likewise, the balance between performance and flexibility is shifting. With interoperability comes the need to shift and adjust functionality. Devices that are able to adapt to ever-changing functional requirements could out-compete those that are not as flexible. The design and integration of edge devices in an intelligent system is nascent, so flexibility will be key as systems evolve.

Integrating Edge Products with Backend Infrastructures

Designing edge products that connect seamlessly and securely within intelligent systems comprised of a variety of hardware backend server infrastructures is no easy task. In fact, the two objectives of seamless connectivity and robust security often work at cross purposes, and yet delivering on both must be a top priority for any edge product engineer. For example, there are multiple security layers intended to safeguard against intruders. These measures are intended to provide increasingly rigorous levels of security, but each level also exposes the system to different risks.

Compound this with the connective nature of intelligent systems and the challenge becomes all the more daunting. Access control protocols have to protect the system from intruders, but they also have to connect with a variety of other devices in the intelligent system. Then the device has to connect to the network and authenticate itself before it can receive or transmit data. The challenge presented here is that it requires multiple sensors and devices to connect and share data seamlessly—preferably with as little intervention on the part of the user as possible. Yet this ease of sharing creates vulnerabilities.

Another factor to consider is the nature of the target system. Some “greenfield” gateways—those built specifically to enable IoT technology—may be on the device itself and be built specifically to enable IoT technology. Other “brownfield” gateways—those built over legacy devices—may be built over legacy devices. The most effective security systems are not plugged in as post-deployment add-ons, but rather are an integral feature of the device’s OS and leverage hardware security capabilities currently available. For this reason, developing in “greenfield” and “brownfield” gateways each carries with it different sets of challenges and opportunities. This principle can be applied to the Cloud servers as well. Servers that run an OS developed specifically to fully leverage the hardware’s security capabilities will allow the developer to deliver a more robust, comprehensive and embedded security solution.

Designing Edge Products That Capture, Store and Deliver Data for Analysis

For enterprise customers, data is a currency—a currency that can buy a competitive advantage. Engineers who can deliver this currency will themselves have a distinct competitive advantage in the marketplace. There’s no doubt that the opportunity presented by the IoT and intelligent systems is vast. However, it will require that engineers and designers rethink how edge devices capture, store and deliver data. At the end of the day, the end-customers care immensely about the promise of intelligent systems and their ability to monetize data. It’s going to be by virtue of edge products that users will be able to capture, store and later analyze the wealth of data available.

Providing Industry-Specific Designs

End-users are increasingly demanding industry-specific experiences. Off-the-shelf devices are no longer satisfying the need for targeted solutions. For example, retailers want handheld devices, point-of-service terminals and digital signs that all work together to deliver a connected retail experience, as well as provide real-time operational intelligence. This in turn allows retailers to do real-time promotions. As the previous scenario demonstrated, a retailer will be able to capture and analyze more real-time data around the buying habits of their customers, juxtaposed with inventory and pricing data. This will allow retailers to do more on-the-spot promotions for their customers, which can result in more transactions. This will be made possible by industry-specific devices connected through a retail-oriented intelligent system. Opportunities such as these will require engineers to shift from designing horizontal devices that work ubiquitously across multiple industries to more vertical products that are designed to meet a specific user need.

Microsoft Is Doubling Down on the Future of the IoT and Intelligent Systems

Today Microsoft provides a comprehensive set of traditional as well as Cloud-based technologies, devices and services that can help OEMs design and deploy superior intelligent systems. This allows engineers to harness a trusted and proven platform to gather data from edge devices, analyze it and translate it into real business value. For instance, Windows Embedded solutions provide a comprehensive platform that enables developers to build edge products that can connect seamlessly and securely within an intelligent system. They also provide a comprehensive set of tools that allow developers and engineers to design solutions that span the entire spectrum—from sensors, controllers, machines, devices—and all of the other components of an intelligent system—all the way to the Cloud.

Microsoft has also given careful thought to the users of this platform. Windows Embedded solutions is designed with features that allow engineers to bring the right solution to their design challenges. All of these solutions provide a natural user interface that makes it easier for engineers to develop solutions that include security, management and analytics. This allows for a rich human-machine interface, or HMI.

Microsoft has also thought about the application framework. This will increase the ease by which the edge device will be able to connect into a variety of intelligent systems.

Windows Embedded solutions also provide forward-looking security capabilities. These solutions deliver integrated layers of security throughout the entire IoT ecosystem, starting from the edge devices, eventually continuing on to the gateway, and ending at the Cloud servers. This line-of-sight security approach allows edge product engineers to better understand how their devices will fit securely in the intelligent system. Furthermore, this suite of security capabilities protects not only each layer of the ecosystem but the link as well. This security solution goes well beyond any post-deployment add-on that many companies feel they need to plug into their systems. It provides a comprehensive security solution at the OS level.

As leading-edge as Windows Embedded solutions are today, Microsoft is not stopping there. In the near future, Microsoft Azure Intelligent Systems Service (Azure ISS) will allow companies to fully leverage the potential offered by the IoT by securely connecting and managing data from a variety of sensors and edge devices. Microsoft Azure ISS marks a significant leap forward of the Microsoft Cloud data platform, developed specifically for designing and maintaining intelligent systems.

Companies using the Intelligent Systems Service to extend the Microsoft Azure Cloud across connected edge devices and sensors will be able to capture vital data, transmit it safely to where it is needed, analyze it, and make stronger data-informed decisions that will move business objectives forward. Though still in testing, the Azure ISS has the potential of being the most integrated enterprise solution for heterogeneous IoT environments to date.

Conclusion

The role of engineers, designers and OEMs is changing. Long gone are the days of supplying ubiquitous standalone devices. Today, OEMs are designers of edge devices that connect to industry-specific intelligent systems. Producers that are able to respond to this change and successfully make the transition will remain relevant and have a competitive advantage over those that do not. Microsoft Embedded solutions provide forward-thinking designers with the tools and technology needed to successfully make this transition. Microsoft provides a comprehensive set of traditional as well as Cloud-based technologies, devices and services that can help OEMs design and deploy superior intelligent systems. This allows engineers to harness a trusted and proven platform to gather data from edge devices, analyze it and translate it into real business value.

With Microsoft, OEMs can build on a proven platform, one that is already in use in the majority of companies around the world. It also means relying on trusted support and expertise. Microsoft is an industry leader with a clear and ambitious vision for what the IoT can mean for people and businesses in the future. This leadership position has attracted the best and brightest minds to the IoT cause. Finally, working with Microsoft allows OEMs to collaborate with skilled and innovative partners in their industries. Microsoft's global ecosystem of experts can give designers and engineers the edge they need in tackling complex challenges.