The Internet of Things is rapidly transforming our lives, changing everything from how we shop to how we stay healthy. The move to a smarter, connected world is also changing embedded development, affecting every industry—from manufacturing to telecom.

To facilitate this transformation, Intel and its partners in the Intel® Intelligent Systems Alliance introduced the Intel® Intelligent Systems Framework. This framework outlines the fundamental capabilities required for connecting, managing and securing intelligent devices in a consistent and scalable manner. By simplifying hardware and software integration, the framework frees developers to focus on unlocking the enormous value all the data—often referred to as “big data”—that intelligent systems collect, analyze, and exchange.

Since its introduction, more than 50 products in the communications, transportation, medical, mobile, industrial, and retail industries have been validated as meeting the Intel Intelligent Systems Framework hardware readiness requirements. The Alliance has played a key role in this rapid adoption. From modular components to market-ready systems, the 250+ global member companies of the Alliance collaborate closely with Intel to provide the solutions developers need to create smart, connected systems.

In this article, we take a close look at the framework and show how it streamlines development. We also explain how Alliance members are working with one another and industry partners to create framework-ready solutions. We then provide usage examples demonstrating the framework’s value to developers, OEMs, and end customers.

Intelligent Systems and Big Data
The Internet of Things brings together everything from enterprise IT to consumer electronics, enabling individual devices to work together for larger purposes (see Figure 1). Consider a smart parking system that networks smart parking meters, license plate readers, and a mobile phone app to cloud-based parking management services. The phone app could provide real-time parking space availability, take reservations, and offer price differentiation based on cloud-based analysis of parking demand. Municipalities that implement such a system can improve parking revenue and utilization, while increasing driver satisfaction, decreasing traffic congestion and emissions, and perhaps even reducing accidents.
Intelligent systems like these require tight security to protect financial data and other valuable information, as well as remote management capabilities to keep the far-flung equipment operational. Scalability is also critical. For example, a smart parking system may need to grow from a small initial deployment to hundreds of thousands of parking spots, bringing in a mix of equipment for different scenarios, such as garage kiosks, curbside meters, and pay-by-phone.

The Intel® Intelligent Systems Framework

The Intel Intelligent Systems Framework makes it easier for developers to rapidly create such networked intelligent systems by providing a consistent way to address the foundational capabilities of connectivity, manageability, and security (see Figure 2). Because the framework defines capabilities rather than specific implementations, it offers great flexibility. Developers can mix and match from a robust menu of off-the-shelf elements to design and scale their solutions. Freed from focusing on core capabilities, developers can instead concentrate on innovative features and services that deliver greater product differentiation.

Realizing the Vision

Intel and its partners plan to support the framework with an array of hardware, software, and tools, as well as integration services, training, and other support. Intel Intelligent System Framework-ready hardware—including boards, modules, and market ready systems—are available from Premier members of the Alliance, including Advantech, Kontron, and Portwell; Associate members such as ADLINK, Dell OEM, Eurotech, and National Instruments; and General member Digi International.

Figure 1. A growing emphasis on increasing the flow of information to the cloud is shifting the focus from isolated, fixed-function systems to an Internet of Things based on networking intelligent systems.

Figure 2. By identifying common requirements and consistent ways to address them, the Intel® Intelligent Systems Framework ensures the interoperability of elements based on Intel® technology.
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To complement these hardware solutions, McAfee and Wind River, both Associate members of the Alliance, are providing software components such as:

- Operating system and middleware, including Wind River* Linux* and Wind River* VxWorks; Microsoft* Windows* from Associate member Microsoft is also supported
- Security solutions, including McAfee Embedded Control and McAfee Deep Defender*
- Remote manageability capabilities supporting third-party management consoles
- Virtualization solutions enabling consolidation of multiple functions on a single platform

Tool support includes the new Intel® System Studio, which integrates multiple development tools into one comprehensive package, enabling developers to quickly and efficiently deliver reliable systems based on the Intel Intelligent Systems Framework. To learn more about this tool, see page 27. A second tool, the Intel® Firmware Support Package, supports low-level initialization through a standardized interface. The package can be easily integrated into any boot loader, such as core-boot and Wind River VxWorks BIOS. By replacing customized firmware with a standardized solution, the Intel® Firmware Support Package ensures backward compatibility and enables products to scale for rapid growth.

Framework services and support are provided by a variety of companies within the Alliance. For example, Arrow Electronics, a General member of the Alliance, offers system integration, training, and other support.

**Simplifying Smart Grid Development**

Hardware based on the Intel Intelligent Systems Framework is already in use and continues to gain momentum. One good example comes from the electric power industry, which is working to develop a flexible, efficient smart grid. One key element of the smart grid is the synchrophasor, which uses distributed measurements to maximize transmission efficiency and minimize outages. A major obstacle to deploying synchrophasors is the lack of standards for the phasor measurement units (PMUs) that communicate line conditions back to a supervisory control and data acquisition (SCADA) system.

Intel, Dell, National Instruments, and OSIsoft are helping overcome this obstacle through a synchrophasor data management solution. This solution combines high-performance PMUs from National Instruments with a Dell 19-inch server rack. The servers run phasor data concentrator (PDC) software from OSIsoft that collects and analyzes data from multiple PMUs (see Figure 3). This solution enables advanced visualization, analytics, and early warning systems to help utilities detect evolving disturbances and avoid widespread blackouts.

Validated and tested to reduce a utility’s engineering and development costs and risk, the synchrophasor data management solution uses framework-ready hardware to provide the open architecture utilities needed to precisely sync and manage transmission and distribution systems. In addition to helping utilities improve efficiency, the framework-ready components increase compatibility and speed integration. This lets utilities focus on improving energy management instead of struggling to connect, manage, and secure the hardware.

**Providing Augmented Reality Experiences In-Store**

Today’s retail customers are accustomed to shopping online, where selection is virtually unlimited. Replicating this experience in a physical store is challenging, particularly for appliance stores. Refrigerators, washers, dryers, and televisions all take a lot of expensive floor space and have a high unit cost, yet shoppers want to see them firsthand before buying.

Intel, working closely with augmented reality specialist YDreams, developed an innovative solution to bridge the gap between online and in-store shopping. Based on an Intel Intelligent Systems Framework-ready system, the virtual shopping solution uses interactive in-store kiosks to display full-size images on high-definition displays (see Figure 4, page 8). Shoppers can interact with the displays to look inside refrigerators, learn about TV controls, and evaluate product features. The kiosk makes it easy to perform side-by-side product comparisons and filter selections based on price, energy ratings, and other parameters. The interface even includes an optional “virtual assistant” designed to help consumers and make the shopping experience fun.

Each kiosk is connected to the retailer’s inventory management system for order fulfillment, inventory management, and customer information. This enables kiosks to provide everything from current inventory to first available date for delivery. Social media tools like QR codes, text messages, and short URLs provide incentives like loyalty points, discount coupons, and prize drawings engage smart phone users.

![Diagram](https://example.com/diagram.png)
Intel® AMT, a hardware-based manageability solution that enables retailers to manage, and secure the solution efficiently. This allows developers and administrators to power down kiosks remotely, reducing energy costs.

McAfee ePO leverages Intel® Active Management Technology (Intel® AMT), a hardware-based manageability solution that enables remote diagnosis, updates, and repairs, even when a kiosk device is turned off or the operating system is not functioning. This reduces expensive onsite maintenance and lowers operational expenses. Intel AMT also allows administrators to power down kiosks remotely, reducing energy costs.

These framework-ready components make it easier for developers to put kiosks on the sales floor, and minimizes the effort required to connect, manage, and secure the solution efficiently. This allows developers and retailers to concentrate on the user experience, providing the engaging in-store experiences retailers need to keep customers coming back.

More on the Intel® Intelligent System Framework

The retail kiosk is just one example of how the Intel Intelligent Systems Framework-based systems can benefit retail applications. The framework capabilities can also help retailers unlock valuable data collected by point-of-sale (POS) devices, distribution systems, and even building automation systems. Retailers can use this data to drive sales, provide new customer services, build customer loyalty, enhance operational efficiency, and improve asset control. See “Building the Connected Store” on page 42 to learn more.

Digital signage provides a particularly powerful illustration of the framework’s value. The digital signage space has been plagued by fragmentation at every level, from physical form factors to advertising content management. To address this problem, Intel partnered with Kontron, Microsoft, Scala, and Flypaper to create a family of standards-based signage platforms and development kits. These solutions use the framework capabilities in conjunction with the Open Pluggable Specification (OPS) to speed deployment and enable advanced features like audience analytics. To learn more, see “Specifications for a New World of Digital Signage” on page 21.

Figure 4. Interactive in-store kiosks based supplement inventory with full-size, interactive appliance images and smart phone engagement.

Framework-based systems are also being deployed in digital security and surveillance (DSS) systems. With the transition to IP-based surveillance, security is becoming an IT responsibility. To succeed, IT departments need DSS solutions that are simple to deploy and maintain. Intel, Dell® OEM, Milestone Systems, AXIS Communications, and Ingram Micro have worked together to meet this need with SecurePod, a certified DSS technology bundle and training program. SecurePod leverages Intel Intelligent Systems Framework-based solutions to ease integration into existing IT infrastructure and ensure high reliability and security. To get the details, read “Integrating Surveillance into IT Infrastructure” on page 11.

In the medical field, a framework-based system with defined security capabilities can ensure data safety in every critical layer of the hardware and software stack, enabling transformative technologies like electronic health records (EHRs), mobile medical devices, and medical cloud computing. Find out how you can deploy these secure solutions by reading “A Multi-Layered Approach to Medical Security,” on page 14.

For industrial applications, framework-based platforms connect manufacturing equipment to a factory’s control room and to a central office. With this connectivity, factory operators can maximize operation uptime by performing predictive maintenance and real-time diagnostics remotely. In the meantime, enterprise executives can apply business insights to production plans and make real-time adjustments accordingly. You can learn more in “Maximize Uptime in the Connected Factory,” on page 38.

A Framework for Today and Tomorrow

Ultimately, the solutions that will deliver the greatest value in the Internet of Things will be those with the ability to connect, manage, and secure intelligent devices in a consistent and scalable manner while extracting intelligence at every point. By enabling the design of intelligent systems that can work in concert, the Intel Intelligent Systems Framework can help you realize this value now and into the future. With framework-ready solutions for a growing range of applications, Alliance members are prepared to be your partner in putting this platform to work.


For more on the Intel Intelligent Systems Framework, see http://www.intel.com/embedded-framework

Contact Intel

From modular components to market-ready systems, Intel and the 250+ global member companies of the Intel® Intelligent Systems Alliance (Intel.com/go/intelligentsystems-alliance) provide the performance, connectivity, manageability, and security developers need to create smart, connected systems. Advantech, Kontron, and Portwell are Premier members of the Alliance. ADLINK, Dell OEM, Digi International, Eurotech, McAfee, Microsoft, NEXCOM, National Instruments, and Wind River are Affiliate members. Arrow Electronics is a General member.