ADLINK TECHNOLOGY INC.



Mainstreaming the Internet of Things

ADLINK Advances IoT with Proven Building Blocks, Intelligent Gateways, and Cloud-Based Remote Management

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Executive Summary

Embedded platforms are in transformation, evolving from standalone compute systems to becoming part of the Internet of Things (IoT). More than just Internet-enabled, these intelligent systems are networked and communicating, gathering and sharing information that enables insight and solves problems. Improving healthcare, enabling intelligent transportation systems, and modernizing manufacturing, intelligent IoT devices are delivering benefits to a wide range of industries, empowering business transformation all over the world.

While the concept of sharing and analyzing business information is not new, the IoT leapfrogs piecemeal, proprietary data applications by enabling time-sensitive data capture, access, analytics and action with standards-based third-party vendor solutions. Software, hardware and end-user applications work together in real-time to expand network access, functionality and intelligent performance to unlock data that was previously hidden. Now capitalizing on the business value of real-time data analytics is no longer limited to enterprises with the resources to develop their own proprietary systems. Through proven, standardized system components, today's IoT is flexible, widely deployable, and already enabling intelligent data applications in the mainstream business world.

This white paper offers a closer look at the IoT concept and its shift to broad deployability, illustrated by ADLINK's hardware, software and systems that encompass each aspect of IoT performance and connectivity. ADLINK's standards-based building blocks enable compact, rugged devices for non-stop data gathering; high performance gateways for securely connecting devices and systems for effective real-time communication of data; and secure cloud services for ensuring system health and performance.

Defining the Internet of Things

The Internet of Things (IoT) is taking shape worldwide and is based on the idea of connected intelligent systems – widely deployed, communicating and sharing information in real-time. The IoT enables the automated interaction between smart devices and systems, exchanging data to an offsite or cloud-based solution for meaningful, time-sensitive analytics. IoT goes beyond the simple exchange of data, and instead connects devices, systems and people in smart, real-world applications – creating environments like automated factories, smart cities, or connected healthcare. Traditional embedded systems are at the heart of this phenomenon, quickly evolving from standalone systems to creating a network of connected devices and systems.

The IoT is a very big concept – and part of the challenge in understanding its meaning and potential rests in the huge spectrum of applications that may benefit from an IoT business model. Connecting devices may sound simple in our digital world, but the IoT means different things to different users, and has extensively varied development requirements depending on the application. Although early IoT deployments have been limited to powerhouse firms with enough internal resources to develop their own proprietary systems, today's vendors are creating off-the-shelf, standards-based IoT solutions. Integrating these as building blocks, developers can more easily create high performance IoT frameworks for mainstream users.

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Real-Time Transforms the Value of Data

Any strategic business initiative requires knowledge of company performance, customer preferences, usage models, and operating costs – yet historically there has been an extended timeframe associated with collecting this type of data, only allowing evaluation and action after the fact. For example, sales figures or maintenance costs might be reported monthly, after various company divisions collected and shared all their data; any spike in activity or deviation from the expected numbers would be reviewed and managed only in the wake of its impact.

Gathering data from remote equipment takes a similar toll. Collecting information from standalone systems, perhaps widely distributed in a large geographical field, demands human intervention, time and enterprise resources. In the absence of a connected device, employees use company trucks to travel to these sites, take a physical reading from the equipment's data logger or sensor, and return the information back to the company's central system.

In both examples, data is gathered, shared and eventually analyzed and understood. Critical time passes between each phase of this process – undermining the opportunity to respond quickly to business or technical issues, and greatly limiting the value of data collected. IoT entirely changes this pattern, enabling a powerful advantage through real-time evaluation of time-sensitive data. By capitalizing on high-speed, reliable connectivity in multiple forms, devices can generate constant, real-time data that can be accessed from anywhere. And more importantly, that data can trigger immediate response. Systems can be shut down remotely to save further damage of failed equipment; nearby repair trucks can be located and routed for emergency maintenance; irrigation changes can be made to increase or decrease moisture levels; digital traffic signage can be changed to warn of accidents or weather; power can be diverted to where it is needed most; and maintenance can be scheduled in advance of a predicted breakdown.

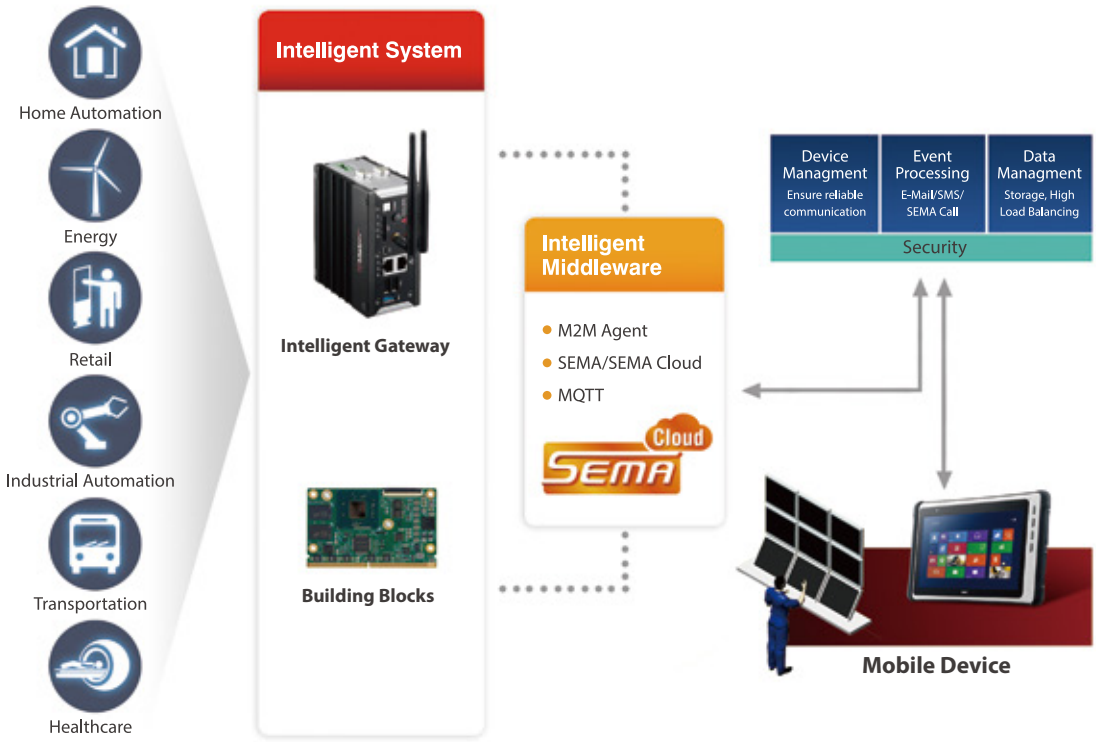


Figure 1:Standards-based Technology Enables Mainstream IoT
Intelligent data-gathering devices are enabled by small, high performance building block components; intelligent gateways provide ready-made platforms to ensure connectivity that effectively moves the data; and innovative cloud services optimize non-stop data access and system health analytics.

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Enabling IoT Devices with Proven Building Blocks

More than a standalone system or typical handheld device, IoT systems and devices function as part of a larger application – for example, helping create sophisticated, new computing environments such as intelligent transportation or real-time fleet management. These smart devices gather data through sensors and user applications and can vary dramatically in terms of form and function. A handheld device used to track fleet management activities, an intelligent safety system within a smart vehicle, a computer-integrated manufacturing (CIM) solution capturing production data on a factory assembly line – these 'things' and many more like them all have a potential role in bringing IoT value to global business.

An IoT device does not have to be handheld or mobile, and is essentially any computing engine in an endpoint solution that enables that solution to be intelligent and connected. An IoT device can be the hardware/software solution inside the dashboard of a car that enables automation via a mobile app. A device can live inside a pharmaceutical vending machine, accessing a cloud database to retrieve secure patient data required to dispense prescriptions. For developers, the challenge depends on the application. IoT devices and systems may need to be low power or high performance. For cost effectiveness, they consistently need to be flexible, upgradable, rugged, manageable, and standards-based.

ADLINK's building blocks for IoT systems come with an intelligent middleware stack called Smart Embedded Management Agent (SEMA). SEMA is essentially a board controller and toolset that collects system health data and transmits this information to the cloud using the secure SMP protocol.

Computer-on-Modules: Small IoT devices are often based on Computer-on-Modules (COMs), enabling performance and versatility in a very small footprint. ADLINK's COMs address a spectrum of power and performance options in standards that include COM Express®, Qseven® and SMARC® (Smart Mobility ARChitecture). These solutions provide solid options for graphics-intensive, mobile, applications, such as medical imaging and emergency response.

Computer Boards: ADLINK's single board computers (SBCs) encompass a variety of form factors (e.g., PC/104 and variations, EPIC, EBX, and PICMG), processors, clock speeds, memory configurations, I/O options and operating systems. These diverse options service the IoT's varied design and budget requirements, bringing field-proven reliability and performance to connected, intelligent platforms such as in-vehicle and infrastructure applications in transportation applications.

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Processor Blades: ADLINK offers rugged, blade-based technology in multiple form factors to serve a variety of industries: CompactPCI® for intelligent transportation applications such as networked security and safety, or vehicle control and diagnostics; AdvancedTCA® for next-generation telecom, datacom, and equipment manufacturer applications such as video transcoding, packet processing and 4G/LTE backup; and a VPX product line to meet the rugged environments in military applications where Size, Weight, and Power (SWaP) matters.

Industrial I/O and Control Systems: ADLINK has extensive field experience and works closely with customers to understand their requirements in industrial automation design. The IoT data acquired by ADLINK's various I/O modules and systems, including data acquisition (DAQ) cards, remote I/O modules, and digital imaging, are designed for all manner of industrial settings and keep production running smoothly and safely.

Industrial Tablets: ADLINK's industrial tablets enable faster time-to-market and reduced development costs for system integrators. With integrated WWAN or WLAN capability, real-time IoT data can be accessed easily anywhere to monitor and control equipment and optimize operation performance in factories, asset tracking and building automation.

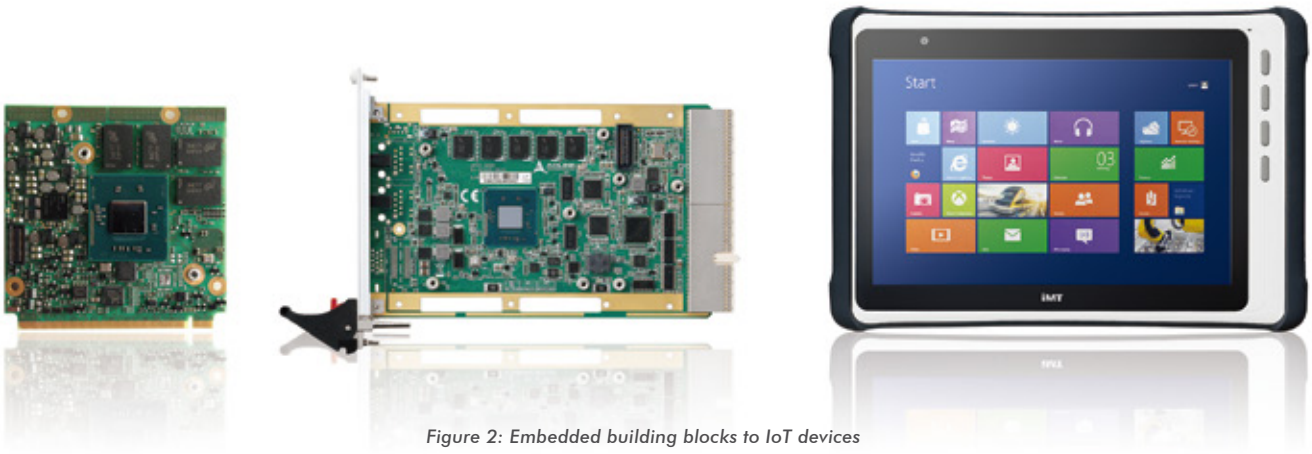


Figure 2: Embedded building blocks to IoT devices

Device-to-Cloud Strategies with IoT Gateways

The IoT requires effective communication between distributed intelligent devices and the network or cloud infrastructure. ADLINK's gateway solutions provide a pre-validated hardware and software platform for sharing data from device-to-cloud – enabling device security, smart connectivity, rich network options, and powerful device management.

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Market Opportunity for Connected Devices

According to IMS Research, as much as 85 percent of existing infrastructure includes legacy devices that need upgrade or replacement to enable IoT connectivity. Intelligent gateways are the intermediary between the data that already exists in the business user's network and the applications and services that add IoT value. There's a lot of existing data out in the world – siloed within various areas of any given business – and because of this, the initial market opportunity for IoT development is based on modernizing unconnected devices by giving them the ability to transmit data. Instead of reinventing foundational building blocks, ADLINK's gateway platforms enable businesses to reduce costs and offer new services by unlocking valuable data from legacy systems that were not formerly connected to each other or the cloud.

In addition to enabling legacy devices, ADLINK's gateways can be part of a cutting edge IoT solution –performing the functions of an endpoint device, as well as providing connectivity needed for secure data transfer. Analyst firm IDC validates the scope and market potential for IoT gateways, estimating there will be 50 billion IoT devices installed by 2020.

Flexible, Manageable and Secure

ADLINK's embedded IoT gateway platform provides an extremely compact footprint, with options based on the Intel® Quark™ SoC X1000 Series and Atom™ SoC E3800 processors. Communications options are flexible, and ADLINK's platform supports a spectrum of options such as WiFi, 3G and LTE. Integration with McAfee Embedded Control provides complete protection from unwanted applications, including comprehensive change policy enforcement and compliance management. This simple, lightweight software technology is essential to securing IoT and also makes IoT devices resilient to malware infections and attacks. Combined with ADLINK's Smart Embedded Management Agent (SEMA) Cloud, system operators have both the remote manageability and security critical to IoT deployments.

Open Architecture, Fast Development

ADLINK's new family of intelligent gateway solutions supports Intel® Gateway Solutions for IoT, a family of platforms designed to connect a wide range of devices. What makes them intelligent? ADLINK's gateway solutions are built on open architecture to ensure interoperability between systems, enable wide application development, and allow easy services deployment. These platforms include scalable Intel-based microprocessors for low power performance, and integrate a Wind River operating system and middleware that provides all critical elements to manage and communicate with IoT devices. Developers are enabled with a sustainable and secure software development environment based on the Wind River Intelligent Device Platform XT. This development tool features pre-integrated components that are fully tested and ready-to-use in securing, managing and connecting intelligent gateways.

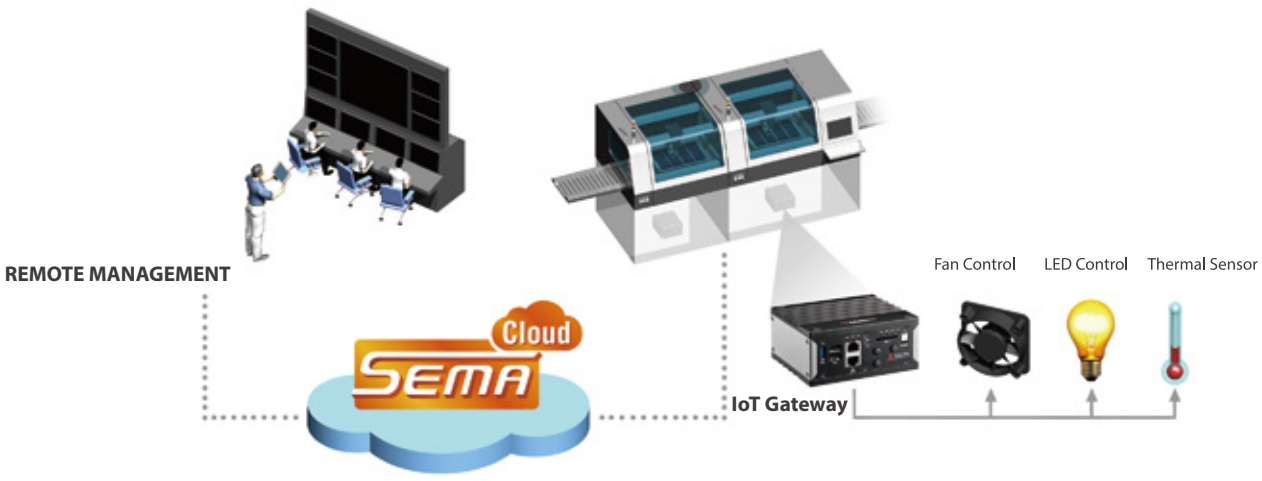


Figure 3:Factory Performance Optimization and Process Control Monitoring
ADLINK's embedded IoT gateway platform with rich IO interfaces, allowing connection to a wide variety of devices for automated data collection and analysis enables active early warning systems to avoid unexpected downtime in industrial automation

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Centralized Cloud Access Adds Business Value

Intelligent middleware and web-based services, such as ADLINK's SEMA remote management tool suite working together with the SEMA Cloud, facilitate the pushing and pulling of data in real-time for anytime, anywhere access. Cloud connectivity takes today's intelligent middleware a step further than previous generations of remote management technology. By employing a cloud server architecture and an M2M (machine-to-machine) stack on top of the intelligent middleware, embedded devices can connect to the cloud without additional design requirements. Pushing data to the cloud enables operators to verify, monitor and manage system performance from a single, central location – improving reliability and reducing management costs. For example, the M2M stack in ADLINK's Smart Embedded Management Agent (SEMA) Cloud pushes system data to the user's cloud server via any kind of TCP/IP connection. System managers have easy access to data and analytics through any commercial cloud portal, using any device (e.g., PC, tablet, smart phone).

Cloud-based remote management furthers system management by enabling observation anytime, anywhere. Embedded management agents continuously upload data through an encrypted Transport Layer Security (TLS, the successor protocol of Secure Sockets Layer or SSL) connection, shown in the user's information dashboard. The dashboard also shows temperature and power consumption information for different parts of the embedded system.

The SEMA Cloud and the always-on IoT framework together enable a new level of system reliability, preventing downtime more effectively than previously possible for offline devices. Operators can proactively interact with the system, detecting potential issues in advance, as well as responding quickly to down systems. For example, rather than react to a system error after the fact, system operators can use the SEMA Cloud to remotely connect and view current system status, influence performance, and even predict, prevent or troubleshoot critical system failures.

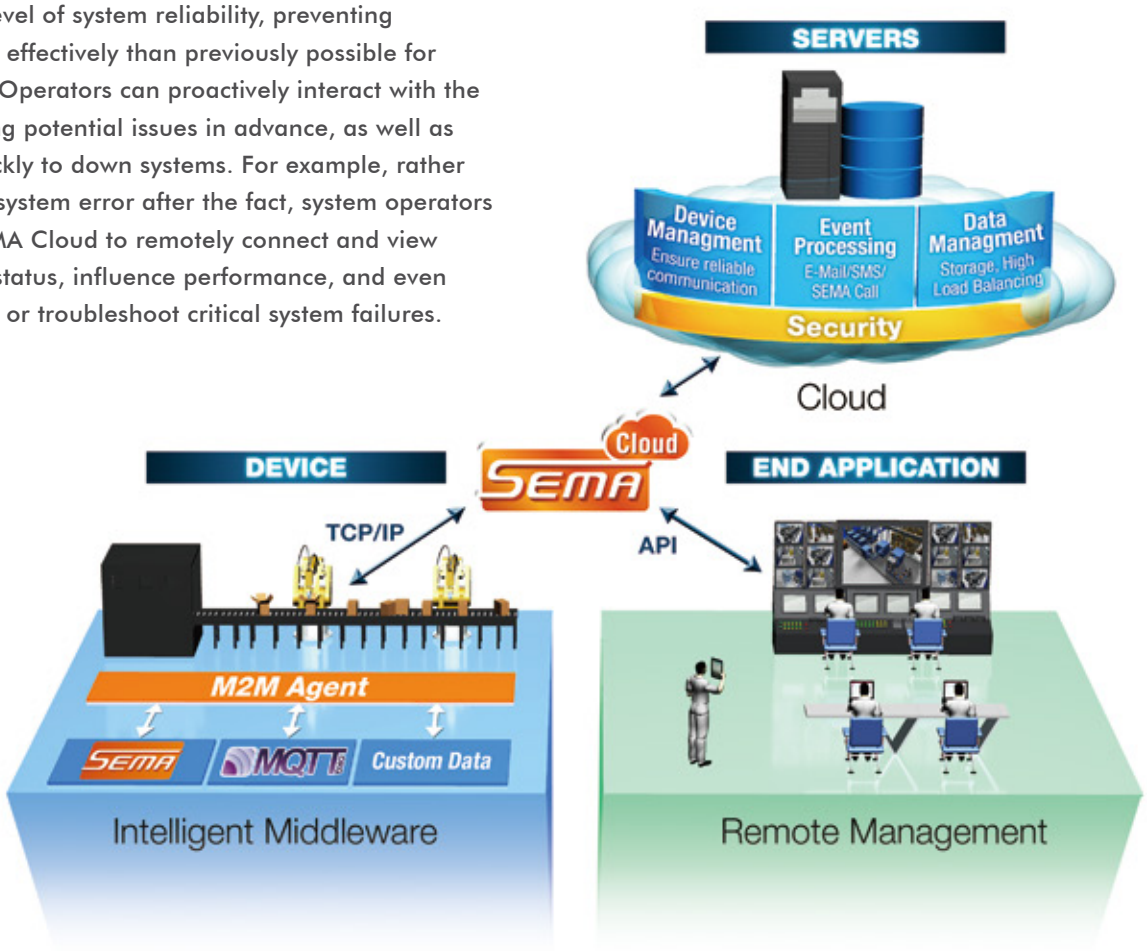


Figure 4: SEMA Cloud- A Solution to Configure, Control and Manage Your Devices

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Remote Management Has Broad Business Value

Remote management through the SEMA Cloud delivers broad business value; ready access to system health is available well beyond industries with an inherent need to monitor distributed networks, and can now be implemented in nearly any embedded arena. For example, a telecommunications station can be serviced prior to failure, or key parts to refrigeration equipment ca be placed upon prediction of performance issues. Likewise, HVAC repairs can be scheduled for when actual repairs are needed, rather than because today is Wednesday, and they should be included on the day's maintenance route.

System monitoring and management services also add a revenue-generating opportunity to the IoT. Instead of end-users handling system management in-house, IoT providers can outsource monitoring, management and maintenance of devices and systems for greater convenience and higher efficiency for their customers. IoT value extends even further as data can be used to improve business operations beyond equipment maintenance. With real-time data, operators understand how machines are used and can apply appropriate actions. Machines can be shut down during slow portions of user activity, rerouted to support increased demand, or restocked quickly to meet customer preferences.

IoT Expertise and Alliances Create a Competitive Edge

As a Premier member of the Intel® Internet of Things Solutions Alliance (Intel® IoT Solutions Alliance), ADLINK works closely with Intel in ongoing development of products and platforms based on the latest high performance Intel® technologies and processors. From modular components to market-ready systems, Intel and the 250+ global member companies of the Intel IoT Solutions Alliance provide scalable, interoperable solutions that accelerate deployment of intelligent devices and end-to-end analytics. Close collaboration with Intel and each other enables Alliance members to innovate with the latest technologies, helping developers deliver first-in-market solutions.

As part of the Alliance, ADLINK integrates existing toolkits with Intel's own software, as well as creates new tools, and offers systems integration and other services that help their customers to create more value in their industries. **As one of five Premier members of the Alliance worldwide, ADLINK collaborates with Intel® to align technology roadmaps and innovate at the highest level.**

The significance of Premier membership goes beyond advanced technology to include new business exploration and co-marketing and co-selling opportunities. Premier membership also reflects a close working relationship between Intel and ADLINK, providing greater benefit to customers in the strategic development of IoT innovations.

IoT Impact is More Intelligent Application of Data

The Internet of Things is enabling devices and systems to collect and share data to enable real-time business value. Yet, the IoT's complexity and cost have been daunting enough to restrict deployments to only those firms who could afford to develop their own proprietary systems for data analytics. To date, the market has remained fragmented, costly and without standards-based solutions.

ADLINK is driving change in this dynamic, offering standards-based IoT technologies and building blocks that allow fast and proven system development. ADLINK's IoT building blocks enable fast time-to-market with smart devices and systems; device-to-cloud business strategies; and cloud access for remote management capabilities that reduce costs and support smarter maintenance operations.

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Connected systems can do more by using the intelligence produced by embedded processing in real-time. With centralized data and sophisticated analytics, volumes of previously hidden or delayed data can now add immediate business value. IoT end-user data can fuel modern applications like smart cities, automated factories, in-vehicle safety systems, intelligent transportation, energy grid automation, connected health and more. Using ADLINK's comprehensive framework for standards-based IoT functionality, more industries can embrace IoT business advantages. IoT development and deployment are much simpler, devices and systems get to market much more quickly, and risk is removed from the equation. Allied with Intel and supported by both a rugged design pedigree and real-world IoT experience, ADLINK is superbly poised to help developers and OEMs innovate high performance IoT designs.

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About ADLINK Technology

ADLINK Technology is enabling the Internet of Things (IoT) with innovative embedded computing solutions for edge devices, intelligent gateways and cloud services. ADLINK's products are application-ready for industrial automation, communications, medical, defense, transportation, and infotainment industries. Our product range includes motherboards, blades, chassis, modules, and systems based on industry standard form factors, as well as an extensive line of test & measurement products and smart touch computers, displays and handhelds that support the global transition to always connected systems. Many products are Extreme Rugged™, supporting extended temperature ranges, shock and vibration.

ADLINK is a Premier Member of the Intel® Internet of Things Solutions Alliance and is active in several standards organizations, including PCI Industrial Computer Manufacturers Group (PICMG), PXI Systems Alliance (PXISA), and Standardization Group for Embedded Technologies (SGeT).

ADLINK is a global company with headquarters in Taiwan and manufacturing in Taiwan and China; R&D and integration in Taiwan, China, the US, and Germany; and an extensive network of worldwide sales and support offices. ADLINK is ISO-9001, ISO-14001, ISO-13485 and TL9000 certified and is publicly traded on the TAIEX Taiwan Stock Exchange (stock code: 6166).

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