SMARTER WAYS TO USE THE INTERNET OF THINGS
How to Apply New Paradigms to Increase Operational Efficiency

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EXECUTIVE SUMMARY

The Internet of Things (IoT) is transforming the way we work, play, and live. And it is key to transforming the way businesses operate, differentiate themselves, and make money in the years ahead. With enhanced situational awareness—the ability to perceive and respond to the surrounding environment—IoT adds incredibly valuable intelligence for complex decision making in a broad range of industries, including energy, automotive, aviation, oil and gas, healthcare, and more. This paper discusses these opportunities as well as the challenges they entail, and presents ways to overcome those challenges.

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THE PROMISE OF IOT

With billions of units generating more than $1 trillion in revenue today, the IoT market is already big—and it’s growing fast. Analysts predict the market will grow with a double-digit compound annual growth rate (CAGR), and IDC forecasts that revenues will double by 2015. The challenge is to translate the intelligence in connected embedded devices into new products and services that solve customer problems, drive customer engagement and loyalty, and deliver even higher value to the economy.

Analysts are unanimous about one aspect of IoT: the opportunity is huge. Experts predict that there will be anywhere from 20 billion to 50 billion connected devices by 2020. IDC forecasts that the volume for embedded systems will outpace any other mainstream system type, reaching 8.9 billion unit shipments by 2015 with 75 percent of revenue opportunity. Machine-to-Machine (M2M) technology adoption is also spiraling upward: There are already more than a billion M2M devices at work in sensors, smart meters, industrial control systems, mobile healthcare assets, video surveillance systems, automotive and telematics solutions, smart buildings, and more. Wireless M2M connections alone increased by 37 percent last year to reach 108 million, according to a report from market analyst firm Berg Insight.

The seemingly sudden arrival of IoT and its network of intelligent systems has actually been emerging for years. Innovations in network connectivity, mobile and wireless technologies, multi-core processing, M2M communication, sensor technologies, cloud computing, and data analytics have converged to create an entirely new form of intelligence—and astonishing new capabilities to optimize the productivity of processes and efficiency of decision making. For example, “smart” metering hubs can automatically report on usage via networks, saving the time and money of sending a human being to manually check meters, and allowing companies to optimize consumption in response to supply conditions.

Intelligent devices can provide heartbeat monitoring that gives doctors the data they need to determine diagnosis and treatment. They can send real-time traffic data to a consumer's GPS, helping optimize traffic flow and reduce consumption and emissions. And on the factory floor, they can help match fast-changing consumer tastes to production systems so that a broader mix of highly differentiated products can be manufactured around the globe and just in time.

These few examples show the potential of IoT for specific industry applications, but the companies that are actually building the market—particularly operators, device manufacturers, and system integrators—still have some very basic questions:

- What is the best way to connect the wealth of new applications, systems, and devices to complex and often fragile networks?
- How can Big Data inform and guide the design of systems and devices for a better connectivity experience?
- How can the operational efficiencies of IoT be scaled to create higher profit potential?
- How can successes and lessons learned be leveraged more broadly across multiple vertical markets to compound the benefits?

To answer these questions, it is critical to understand the factors driving the adoption of IoT, the challenges impeding scalability across verticals, and the differing requirements of operators and device manufacturers. The next sections examine these topics in greater detail.

WHAT’S DRIVING THE ADOPTION OF IOT?

The momentum behind IoT derives from macroeconomic trends, as well as trends that impact specific industries or groups of adopters. Key factors include the following:

- **High labor costs:** It typically costs at least three times more for a human to perform a task than a machine. Intelligent systems can now perform many tasks that require intelligence and situational awareness, such as utility meter reading, smart building monitoring, power management, and so on.
- **Huge real-time demand for Big Data:** Data has become the new currency of business, and intelligent systems can supply both the raw material and sophisticated, real-time analytics that shape and guide more intelligent business decisions.
- **The cloud:** Intelligent systems can be both an on-ramp to the cloud and a means of exploiting the cloud's potential. Through IoT, businesses can develop new services and offer them through software-as-a-service (SaaS) models, creating new efficiencies and economies.
• Ecological considerations: Machines can perform power management tasks with finer precision and faster response times than manual, human-dependent systems—saving energy, prioritizing usage, setting policies for response to outages, and so on.

• The “instant gratification” culture: Customers want everything now—whether it’s just-in-time servicing, real-time order fulfillment, or immediate answers to complex questions. IoT can accelerate many services, and in the process accelerate revenue generation, higher profitability, and new ways of monetization.

**OVERCOMING THE BARRIERS**

Two of the key groups of solution providers for IoT today are operators and device or system manufacturers. They have very different perspectives on the opportunities, but are both looking to develop solutions that will scale efficiently, increase average revenue per device, and create competitive differentiation, while responding to the needs of specific vertical industries. And they are both trying to respond to the same set of challenges. Specifically, they are struggling with the following:

• **Market fragmentation:** The IoT market is composed of many different vertical industries, and their applications tend to have little overlap, making scale-up of solutions very difficult.

• **Complexity and customization requirements:** The technologies involved in creating intelligent systems are extremely broad and complex, and most solutions don’t provide a seamless, end-to-end experience between the business backbone and the system or device domain, and thus must be customized to some degree.

• **Lack of specialized skills and expertise:** The skill sets required to build intelligent devices, as well as the requisite go-to-market (GTM) strategies, typically reside outside the core competency of operators and device manufacturers.

• **Slowly evolving standards in technology or application deployment:** The core components of IoT have often been implemented in an ad-hoc fashion, using multiple competing standards in development and deployment.

• **New ecosystem to manage:** Few operators or device manufacturers can create end-to-end intelligent systems without significant assistance from partners, but typically these partners are not part of their current ecosystem.

**DON’T DO IT YOURSELF—OUTSOURCE AND FOCUS ON YOUR CORE COMPETENCIES**

In dealing with these challenges, operators and device manufacturers sometimes take a do-it-yourself (DIY) approach and try to build internal competence rather than outsource key aspects of creating new devices and services for the IoT market. And all too often, that investment strategy doesn’t match their value equation. Customers perceive the highest value in the application and the device-specific middleware; that’s where the secret sauce is for operators and device manufacturers. But in many cases their research and development (R&D) investments are being made much lower down in their run-time or embedded stack, where customers perceive little to no value.

The net result, in many cases, is an excessive investment in R&D that actually detracts from the creation of the differentiating applications and services valued by customers, along with delays due to complexity, lack of experience, and the other factors mentioned above. Businesses end up driving operating expenditures (OPEX) higher, missing market windows, and failing to exploit opportunities.

**A SMARTER APPROACH TO IOT DEVELOPMENT**

For most operators and device or system manufacturers, it makes sense to move investment up to the application level and let a qualified partner focus on the non-differentiating, foundational “application-ready” technology. In other words, build a service-centric selling model rather than technical competence in an area that delivers little competitive advantage. The move to a service-centric model is an evolutionary process. Many operators have already taken the first step by offering connectivity services for M2M and intelligent systems applications.

This market is an immediate opportunity, but very limited: For instance, analysts have shown that for mobile operators, M2M traffic represents only 0.7–2.7 percent of total mobile revenue today, and is not growing rapidly. Forward-looking operators and device manufacturers are now searching for opportunities to provide service revenue enablement—delivering innovation platforms and developer environments that smooth the integration of enterprise apps with networked remote devices—in order to capture enterprise customers and application developers.
Beyond that, they are aiming to serve the market as service providers with bundled offerings for business-to-business (B2B) and business-to-customer (B2C) customers, along with IT services and service management offerings, in order to establish new service-centric revenue streams.

Wind River® is facilitating these efforts by reducing complexity, aggregating supply chains through higher integrated software solutions, and enabling rapid innovation and time-to-market for intelligent systems at lowered cost. Wind River is also working to simplify development, integration, and deployment of intelligent systems across IoT. Our focus is on delivering unparalleled capabilities in three core categories:

• **Connectivity:** Simplifying device connectivity for wireless and wired networks, speeding time-to-market, and reducing expense for device manufacturers

• **Manageability:** Delivering pre-integrated and supported management software—and collaborating with best-in-class hardware, software, and system integration partners—making it much easier to manage remote connected devices and reduce total cost of ownership (TCO)

• **Security:** Providing tightly integrated, state-of-the-art security capabilities for protecting devices and their data, while at the same time allowing for an end-to-end protection strategy in close cooperation with open standard partners and Intel® family members such as McAfee

“We are passionately engaged in making the intelligent connected world a reality by working to create end-to-end solutions from the device to the communications infrastructure to the cloud and data center.”

—Anton Steenman, Vice President and General Manager, Embedded Communications Group, Intel

A WIND RIVER SOLUTION

Wind River delivers on the demands of the IoT market with Wind River Intelligent Device Platform, a complete software development environment for jump-starting IoT development. Based on the Wind River real-time and general-purpose operating systems to increase productivity and cut time-to-market, it also includes ready-to-use components built exclusively for M2M applications.

Intelligent Device Platform delivers on the core categories described above with the following capabilities:

• **Connectivity:**
  - Pre-integrated smart and connected capabilities enable rich network options and a rich out-of-the-box experience to save development time and costs.
  - Validated and flexible firmware provides an extensive network of connectivity choices, including broad modem support and PAN, LAN, and WAN network access.

• **Manageability:**
  - Platform customization significantly reduces development time while increasing the product's life span and uptime.
  - An included intuitive web-based tool for anytime provisioning and device management reduces configuration and support costs.
  - The platform includes a variety of market- and operator-specific manageability standards.

• **Security:**
  - Features designed for M2M development protect critical data throughout the device lifecycle.
  - Customizable secure remote management ensures end device integrity via secure boot, provides encrypted communication between device and cloud-based management console, and limits exposure of untrusted applications through device resource management.

By creating a standardized approach where a large number of the DIY pitfalls are eliminated, Wind River makes it easier for companies to focus on their specific differentiators while speeding time-to-market.
Wind River further differentiates itself through its vertical industry experience and by removing the complexities of building embedded devices and managing partners for IoT applications. Specifically, Wind River delivers the following:

- **Expertise**: Connected devices fall squarely within our sweet spot of expertise. Wind River delivers the hardware optimization, connectivity, software security, and adherence to industry standards and protocols essential to IoT.
- **Partner ecosystem**: We have a strategic set of partners that includes leading independent software vendors (ISVs), value-added resellers, board vendors, and distributors such as Intel, McAfee, Kontron, Wurldtech, and Digi International.
- **Platform**: Intelligent Device Platform is a complete and proven development environment for connected device applications.

**INDUSTRY EXAMPLES IN ACTION**

The combination of focused approach, proven platforms, and deep expertise in multiple vertical industries offered by Wind River enables businesses to develop and deploy revenue-generating intelligent systems that scale. Below are just a few examples of real-world applications that are currently in development.

### Retail: Intelligent Vending Machines

A vending machine can be a cash cow—if it is always working properly, stocked adequately, and providing the products consumers want. Through intelligent devices, it can be all of that and much more. Using radio-frequency identification (RFID), vending machines can proactively communicate when inventory needs to be replenished, cutting the cost and inefficiency of restocking according to schedule rather than need. The same technology also enables modern payment concepts through emerging mobile phone payment standards. In addition, it can alert the owner to unplanned downtime caused by power outages, vandalism, or equipment failures. It can also track consumer purchases and purchase behaviors in real time and provide up-to-the-minute reporting on consumer tastes and preferences, so the owner can change inventory when needed and even target advertising and promotional activities more precisely and effectively.

### Energy: Smarter Distribution of Smart Energy

Distributed energy sources such as solar and wind power are approaching 10 percent of total generated power, and maintaining quality power is becoming incredibly difficult without a dynamic demand mechanism to manage customer consumption in response to supply conditions at critical times, market price, or demand situations. Given the unpredictable nature of solar and wind power, suppliers need the ability to plan for contingencies with some margin for error. Improving power quality and reliability and enabling a wide range of end user applications are key drivers, and each can only be addressed through the massive volumes of data collected and analyzed by intelligent devices. M2M monitoring and control enables the smart grid to adjust to ever-changing conditions with higher reliability, security, and performance than ever before.

### Automotive: Proactive Servicing for Automobiles

Car owners know when to bring in their automobiles for routine maintenance—but they never know when a critical part or system might malfunction and leave them stranded on the shoulder of the freeway or in a dark alleyway. Through sensors, M2M communication, and real-time data streaming, connected cars can now send alerts when a key component needs repair so the owner can bring in the car for servicing before there’s a breakdown. This capability increases efficiency by better managing inventory and decreasing stock costs for the dealership, while also increasing customer satisfaction and loyalty. It also provides lots of predictive information to optimize additional processes and goods quality.

The same technologies can also be applied to help prevent theft, provide stronger safety and control systems, and even provide more targeted in-vehicle entertainment. Again, these capabilities
can easily be extended to other vertical industries for a variety of similar applications. For example, in the industrial market, IoT can provide predictive maintenance to determine when a component may be nearing failure. By acting before a problem occurs, major issues potentially costing millions of dollars can be reduced.

**Healthcare: Better Diagnosis and Treatment Through Intelligent Devices**

Approximately 75–80 percent of all U.S. healthcare spending is related to one or more chronic conditions (heart, kidney, lung issues, or other forms of serious ongoing illness or disability, for example). Smart M2M devices, services, and applications enable healthcare professionals to understand patients’ conditions and make accurate, timely, and realistic recommendations. In some cases (such as administering insulin to a diabetic), action can be taken or a caregiver can be alerted who can assist a loved one needing help. There are hundreds of M2M-based healthcare services in hospitals, doctors’ offices, and homes, as well as on mobile applications.

**CONCLUSION**

The potential of the IoT market is huge, but actual benefits achieved by businesses have been constrained by the complexity of producing real-world applications. This will change—rapidly—once operators and device manufacturers are free to focus on their true value add: innovative new services and applications.

Wind River is creating a path to revenue by eliminating the need to develop internal competency in areas that don’t help differentiate service providers. Wind River Intelligent Device Platform delivers rapid innovation and time-to-market for IoT, radically simplifying development, integration, and deployment through unparalleled connectivity, manageability, and security. It is the enabling technology for creating breakthrough operational efficiencies and profits.