IoT Demands New Approach to MCU-based Embedded Designs

Modern Development Requires Integrated Hardware/Software Platform

One of the toughest challenges the IoT market faces is its impact on embedded system complexity and development time. It's general knowledge that those who get to market first have the potential to reap the largest profits. Given that market researchers estimate the IoT market to be worth over $7 trillion dollars with billions of devices being deployed each year, missing out on being first could significantly impact a company. The IoT market today lacks accepted industry standards which means companies who get to market first will have the greatest opportunity to influence those standards and gain an edge over the competition.

The IoT market forces embedded developers to reconsider their definition of system-level design. They must stop thinking of their application as a discrete, stand-alone unit. Instead, they must think in a broader sense about how their application fits into an interconnected world. Doing so, in turn, will force developers to adopt new technologies such as cloud connectivity, sensor networks and wireless communication. Many of the microcontrollers (MCUs) currently in use were never networked in the traditional sense, meaning there is a shortage of developers who have the expertise required to build IoT devices.

Most developers will require a deeper understanding of connectivity issues and large, complex networks to succeed in the IoT market. At the same time, universal interconnectivity increases system vulnerability. Security risks lie at each stage of the product lifecycle from manufacturing and development to deployment and remote updates. Most devices connected to the Internet today have inadequate security capabilities. Clearly developers will need a far better command of security and safety technologies to meet customer expectations.

As an industry-leading manufacturer of MCUs, Renesas offers developers some natural advantages such as unparalleled experience in many critical vertical markets including healthcare, home appliances, building automation, factory automation, and energy management. The extensive knowledge base Renesas brings to these markets gives the company valuable insight into the challenges developers face. Renesas's value proposition is tailored to match customer needs in those markets in terms of quality, reliability, support, security and safety.

Complex Designs Take Time

Learning about how to connect devices to the cloud, adding security and even just transitioning to using a 32-bit MCU forces developers to devote more time to testing and debugging their new products and dramatically forces them to reconsider their design priorities. Designers already face major time and resource constraints as they try to develop new embedded products for a market where product lifecycles and time-to-

market are shrinking. In a connected environment, companies that can shorten their product development cycle will likely find more success meeting market demands.

While the IoT market covers a broad field of applications, most require a base set of fundamental capabilities and peripherals which are provided by the MCU. To succeed in the IoT market, developers will need MCUs that offer an extensive set of connectivity peripherals, analog I/O, significant on-chip memory and robust security and safety functionality. The embedded design market is overflowing with semiconductor suppliers offering full-featured MCUs but Renesas offers key advantages which are lowering total cost of ownership and getting those development projects to market quicker by providing an integrated hardware and software platform.

To be successful, developers must eliminate many of the low-level, but time-consuming integration tasks they have had to grapple with in past designs. Traditionally, developers start development at the silicon level and then work their way up to higher levels of software which include the middleware and application code. Without an available integrated solution, developers must wade through multiple software stacks and tool options to find the best solution for their application. Time spent evaluating each vendor, understanding their licensing terms and IP acquisition costs uses valuable time that otherwise could be focused elsewhere.
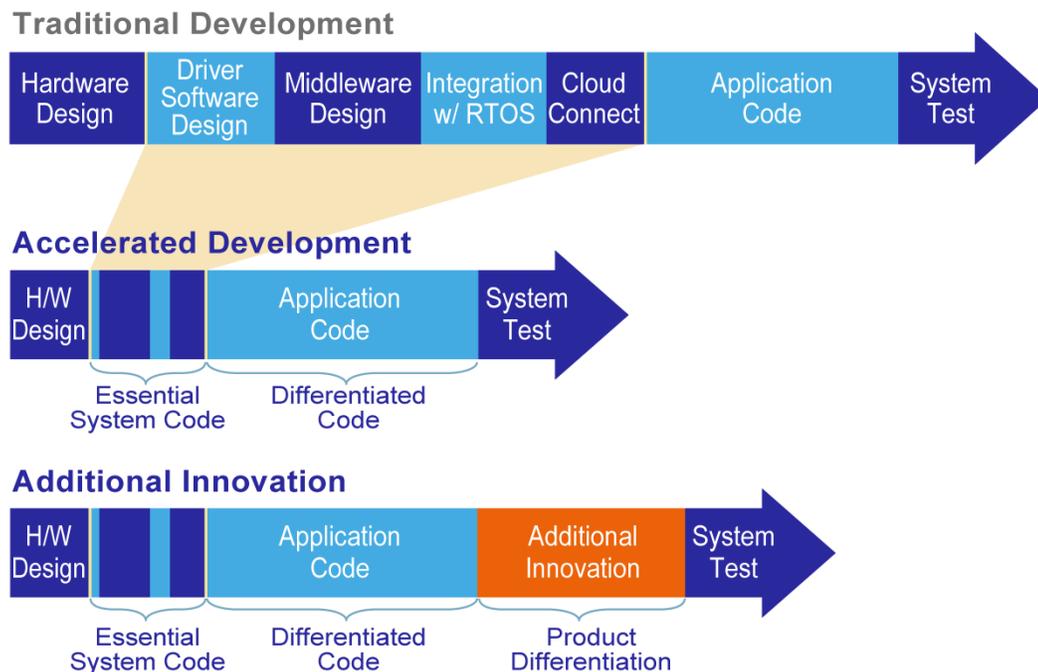

Figure 1: *Developers can free themselves of spending time on low-level tasks, but instead focus on getting to market before their competitors do.*

One of the biggest headaches developers face is the time spent integrating all the software components from multiple vendors and then testing and qualifying them at the system level to maintain high quality levels. During this process, the team also must stay abreast of changes in the marketplace and the latest advances in best development practices. Invariably designers must delay working on the truly differentiated aspects of their design – the end-application code or new features – until the end of the development cycle. In the long run, the developer faces enormous uncertainty, the risk of cost overruns and a late entry to market.

Developing, identifying and purchasing software stacks and tools is only the beginning. Developers must then spend time and energy tracking each vendor asset and ensuring that their development road map and bug fixes continue to support their product going forward. Often, each tool, stack and RTOS vendor has a separate roadmap forcing the developer to keep up with the latest releases as they add new features which in turn can add new challenges and bugs to their development efforts.
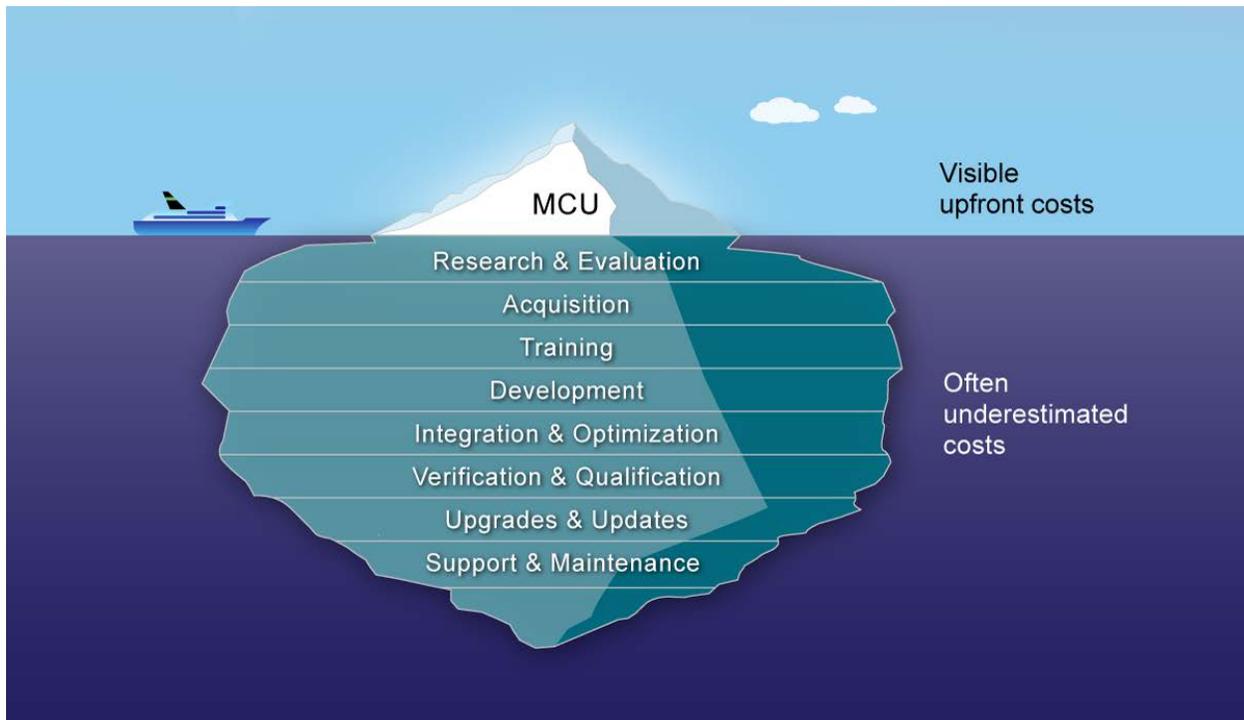

Figure 2: *By simplifying the creation and management of key software components and tools, the Synergy Platform reduces the total cost of ownership.*

Unified Hardware/Software Solution

The Renesas Synergy Platform™ is designed to circumvent these obstacles and challenges. To minimize total cost of ownership and allow developers to focus on their

product differentiators as soon as possible, the Synergy Platform treats hardware and software as a unified product. The benefits begin at the silicon level where the Synergy Platform is built around a family of compatible and scalable MCUs based on the Arm® Cortex®-M core. Common features across the MCU portfolio simplify product development and provide upward scalability and compatibility when designs grow above their original scope. The MCUs combine low power consumption with a small silicon footprint, an extensive set of peripherals and a range of 64 KB to 4 MB of on-chip code flash. To meet emerging IoT requirements, each MCU offers a diverse set of connectivity interfaces and a broad array of security and safety features.

The real payoff in terms of lower cost and faster development comes at the software level. Each Synergy MCU comes with a comprehensive package of qualified software components and professional development tools that are included in the price of the MCU. The Synergy Software Package (SSP) features all the crucial software components engineers need to build non-differentiated functions essential in most IoT development projects such as enabling and configuring MCU peripheral functions. The SSP is built around Express Logic's ThreadX® RTOS and includes middleware components from Express Logic's X-Ware™ and adds MCU-specific software components such as device drivers, middleware, libraries and a flexible application framework with an API. Each component in the platform is integrated, tested, qualified, scalable and reusable. As a result, designers spend less time on driver implementation, middleware and RTOS integration and more time focusing on the truly innovative aspects of their design.

The SSP is far different from typical in-house software solutions. Developed using industry-accepted best practices and following a robust software development life cycle, the SSP is a qualified software product with an accompanying datasheet. A software datasheet for MCUs is an industry first. The SSP meets widely accepted standards, tests and benchmarks, such as MISRA-C, as well as published SQA metrics, documented processes and product lifecycle practices such a ISO/IEC/IEEE 12207. Moreover, Renesas provides full product-level support for the SSP including maintenance with scheduled update releases, errata publishing and management, issue tracking and bug fixes.

With the Synergy Platform, there are no barriers to getting started; designers can begin developing end-products immediately by simply getting their hands on a low-cost target board kit or starter kit. A choice of Synergy's Eclipse-based e² Studio integrated development environment (IDE) and included C compiler or IAR's Embedded Workbench for Synergy IDE are provided free of charge with virtually an unlimited number of development seats and constant maintenance. Developers simply register on line as a Synergy Platform user, which automatically grants full rights to develop with and use in production the entire Synergy Software Package and associated software development tools.

Conclusion

The stakes in the IoT market are high. In five short years research analysts forecast over 10 billion new connected devices will ship each year. In this hyper-competitive environment, traditional approaches to product development are unlikely to suffice.
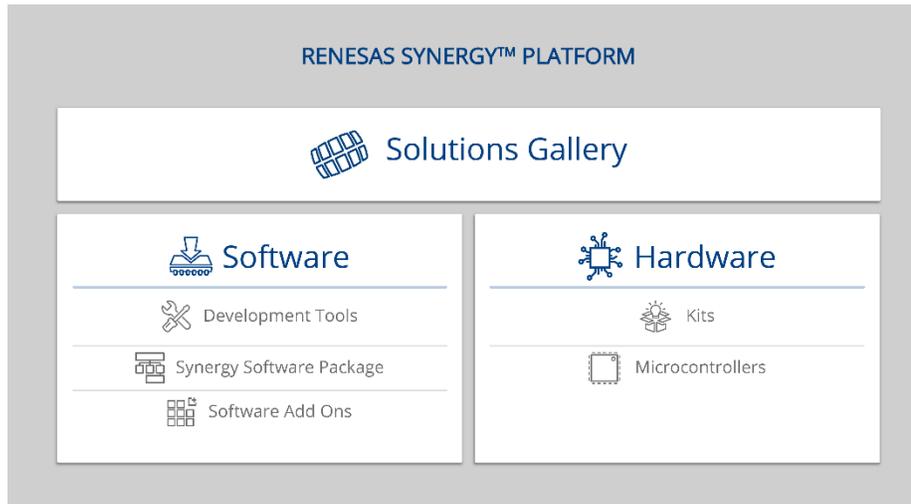
Figure 3: *The Synergy Platform*

Each element of the Synergy Platform -- the hardware with MCUs and kits, the software with SSP, development tools, and software add-ons, and the Solutions Gallery -- contributes to the goal: faster and cost-effective development. By simplifying or eliminating many of the non-differentiating tasks in development projects, this new approach promises to shorten the development cycle by up to one-third. In the highly dynamic IoT market, that advantage can mean the difference between product success and failure.