Renesas Synergy™ Platform Charts Revolutionary New Path to Faster Embedded MCU System Development for IoT and Other Products

Integrated hardware/software solution reduces time spent on non-differentiated functions, frees developers to focus on application code

A COUPLE OF years ago when Renesas engineers first began to consider how they would package MCU-based solutions for the Internet-of-Things (IoT) market, they took a close look at the unique challenges this emerging opportunity presented. With applications running the gamut from factory floor automation and appliances to home automation and wearable computing, the opportunities appeared to be endless. Clearly developers who could bring their products to market first would gain a significant advantage.

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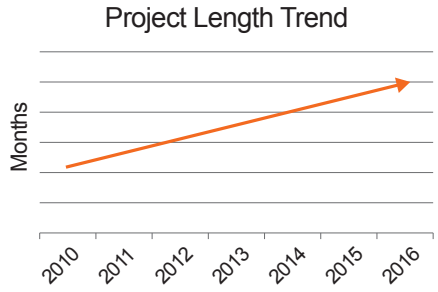
So any solution that could shorten the developer's time in the lab would offer a powerful advantage.

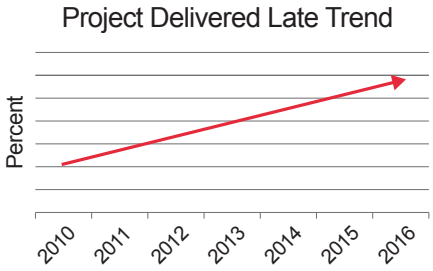
But the Renesas team noted something else, as well. As they explored this topic across industries, they noticed that the profile of their traditional MCU customer was changing. As a leading supplier of MCUs for many years, Renesas' engineers typically worked with a customer's hardware engineers. More often than not, the customer's hardware team came to Renesas with a detailed specification they were looking to implement. Once the hardware was defined, the customer's hardware engineers would pass the solution onto its software team to develop solutions. For the most part, hardware engineers drove the MCU selection process.

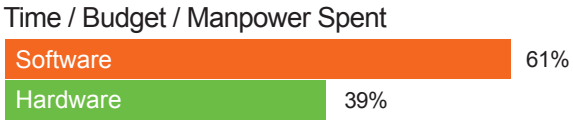
As the IoT market began to emerge, however, roles were changing. The more Renesas interacted with its customers, the more it became clear that the software component was becoming the dominant requirement in MCU selection. Software developers were now playing a larger role in defining the end solution and the type of MCU that would best fit their system requirements.

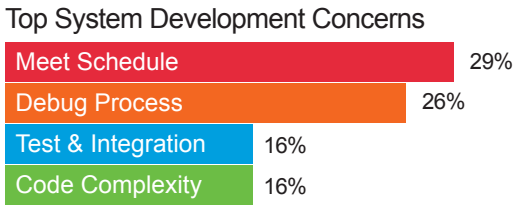
To address this new reality, the Renesas team should to better understand what key values were driving customers and how their priorities would impact MCU selection. Clearly any solution targeted at the huge IoT market would have to take into account the increasing importance of the software engineer's point of view.

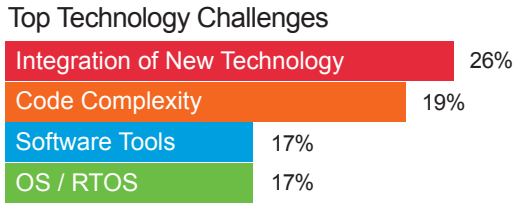
According to a UMB survey, delays in the development process were attributed to increasing code complexity, the integration of new technologies, and increasing time spent working with software development tools and operating systems. In traditional development cycles, designers devote large blocks of time to hardware design, driver design, middleware development, integration of the RTOS, and connectivity options. Each of these software development tasks is taking a larger part of the overall project development time. Yet, all of those software design tasks represent the basic core system functions. Often at the end of their development cycle when designers are typically under severe time constraints due to project deadlines, the customer is able to devote substantial amounts of time to the truly differentiating aspects of their design— the application code. Typically, this results in either delaying the launch of the product or limiting the features of the product.











2014 UBM Tech Embedded Market Study

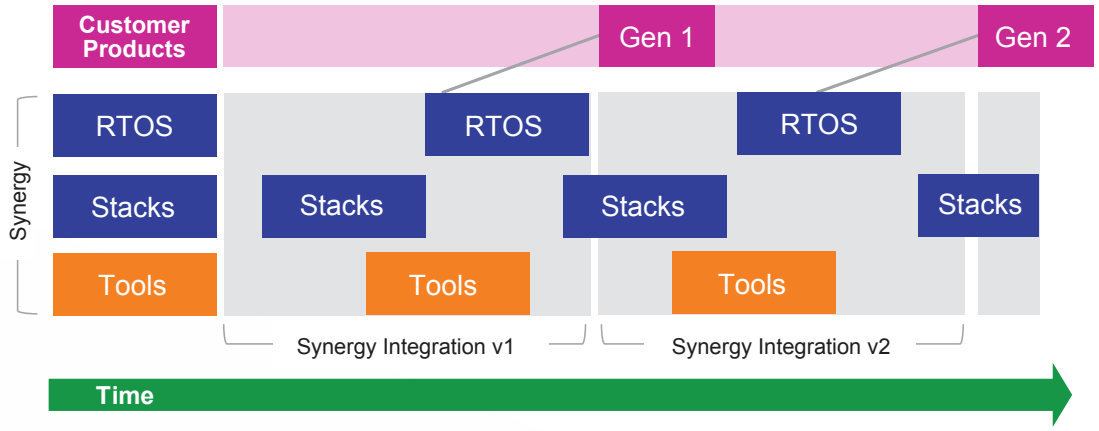
Software has major impact on projects

Recent research indicates that software development is driving up the cost and time needed to finish embedded designs.

At the same time, other trends are escalating the pressure on design teams. US and European electronics developers are increasingly outsourcing all but the core engineering functions required to differentiate their end-products. As engineering resources shrink, a growing number of firms are finding they can no longer develop new base technologies or new technology building blocks as they have in the past. As a result, developers are increasingly willing to move away from the traditional in-house development of these core technologies and instead use external resources and off-the-shelf components. It's a time-consuming and costly approach, however, to use a standard MCU and then to research, license, integrate, test, and maintain RTOS, stacks, middleware, and libraries from multiple software vendors. What if developers could get everything form one source—their MCU silicon vendor?

If they were to source their software from their silicon vendor, developers would need assurances. How long will the silicon vendor supply and support the software? Will the vendor make a long-term commitment to maintain, upgrade and support the software? Developers generally equate commercial quality with longevity. If the silicon vendor was willing to sell its software as a high quality commercial product, would that assure embedded system developers?

From the developer's standpoint, sourcing the software from an MCU supplier offers numerous advantages. Large, established silicon vendors generally have the resources to support the development and maintenance of software over long periods of time. And since the silicon manufacturer usually has a large customer base, the software will be tested and proven over a very large number of customers. In addition, sourcing the silicon and software from the same company links supplier and vendor interests. Since the silicon vendor only makes money when products go into production, it has the same interest in accelerating the development cycle as the customer does. Finally, the silicon



- Continuously changing roadmap for RTOS, stacks and tools
- Synergy Platform takes care of integration of new updates
- Customers can ignore updates from multiple vendors

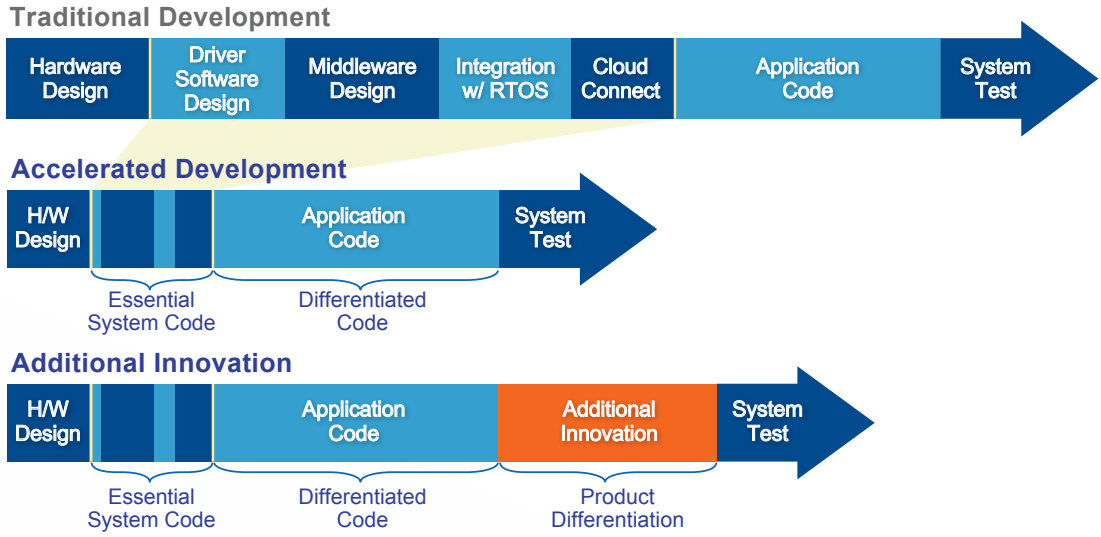
Minimize Total Cost of Ownership

By eliminating costly updates from multiple vendors, product developers can minimize total cost of ownership.

manufacturer has a vested interest in maintaining software quality because the success of its software is directly tied to its ability to continue selling MCUs.

What if designers could re-invent the development cycle so that more of their time could be spent focusing on the truly innovative aspects of their solution? What if MCU suppliers like Renesas could reduce the amount of time that designers spent on basic core system software development functions and, instead, allow them to increase the amount of time they could spend on their application code?

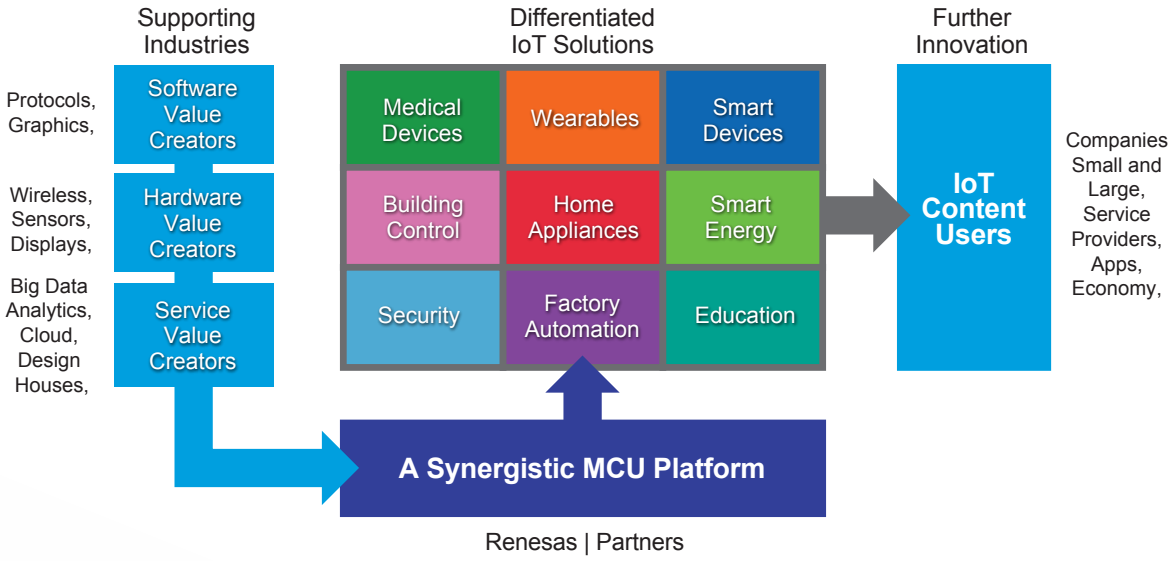
What would this new product development cycle look like? In the traditional development cycle designers, must grapple with continual updates and constantly changing roadmaps for their RTOS, stacks and tools. What if the MCU supplier offered a synergistic platform that took care of the integration of new updates so developers could reduce that portion of their development cycle and spend more



Shorten Your Time to Market

By eliminating many of the tasks associated with developing non-differentiated code, the Renesas Synergy Platform allows developers to spend more time on the innovative aspects of their product.

time innovating? And what if the MCU supplier offered and supported that software as a high quality commercial product, including APIs that would allow the developer to simply build his or her own applications on top of that software base? Ultimately, those questions led to the development of the Renesas Synergy™ Platform, an integrated hardware and software solution optimized for embedded and IoT applications.

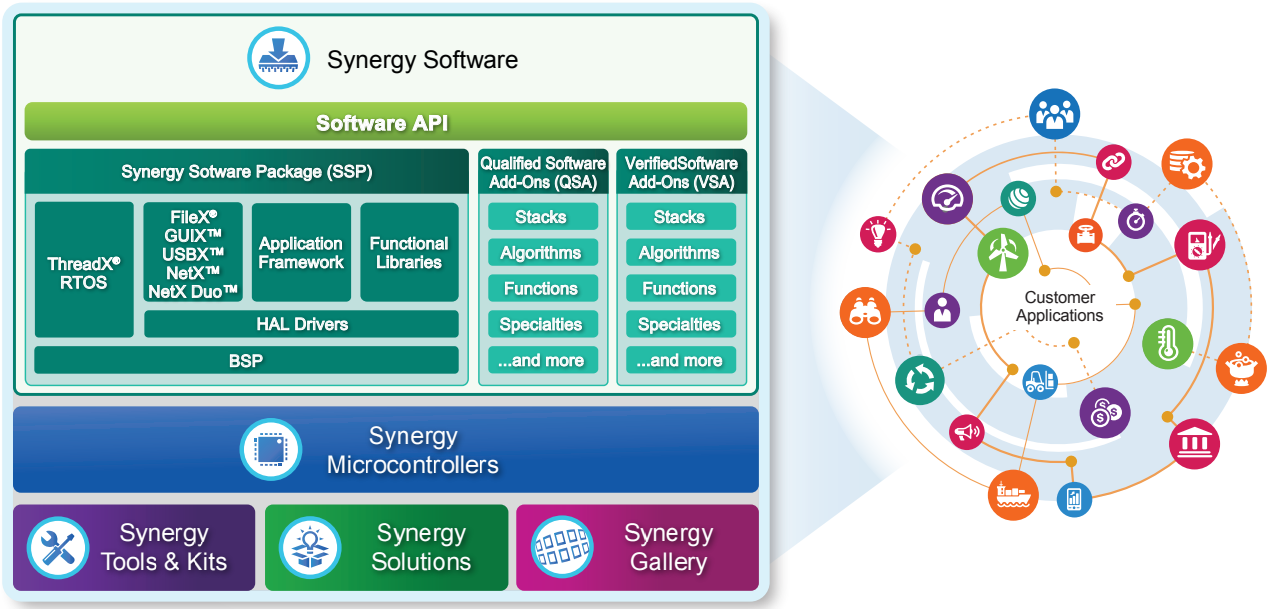


The Future of Embedded Computing

The Renesas Synergy Platform offers a model for the future of embedded computing.

Renesas Synergy Platform Elements

The Renesas Synergy Platform consists of five main elements: Software, MCUs, Tools and Kits, Solutions, and the Gallery.



The Renesas Synergy Platform

The core elements of the Renesas Synergy Platform.

The leading element of the Renesas Synergy platform is the qualified and verified embedded software which is tested to commercial standards and has ensured compatible with the Renesas Synergy MCUs, all supported by Renesas. The “qualified” Renesas Synergy software components are not only optimized and integrated for the MCUs, they are also rigorously tested for both performance and reliability. Sold, maintained, and directly supported by Renesas as a product, these qualified components undergo multi-level testing, and are warranted by Renesas to operate as specified in a software

Best Practices	Software Data Sheet	Industry Standards	Software Quality Assurance (SQA)
Software Development Life Cycle (SDLC): • Renesas SDLC guideline document • Requirements & traceability • Coding standards • Design descriptions • Code reviews and unit test development • Continuous integration and integration reports • Release process and management	**For Synergy Software Package (SSP) on multiple hardware platforms:** • Published and maintained on Renesas.com website • Specs and performance metrics tested and documented • Benchmarks, code size, context switch times, latencies, execution times, cyclical testing, fault tolerance and more • Basis of SSP warranty	**Well-respected standards for software development:** • MISRA C:2012 – Guidelines for the use of the C Language in critical systems • ISO/IEC/IEEE 12207 – software life cycle processes • CERT 2nd Edition – C programming language secure coding standard • Testing artifacts available for process certification – TUV, UL	**Professional software:** • Renesas SQA document – Software Quality Assurance plan • Requires traceability throughout development • Documented processes • SQA metrics & process artifacts available to customers • Test plans, test suites, and reports

Basis of Qualified Synergy Software

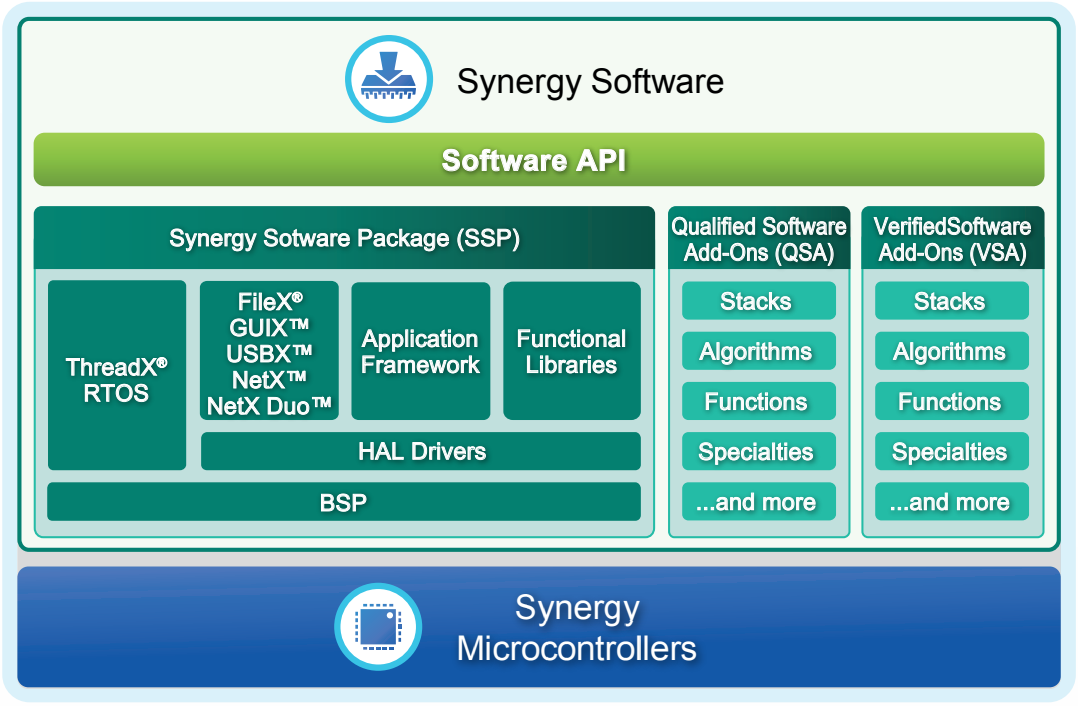
Renesas treats the Renesas Synergy Software Package as a product with high quality standards.

datasheet. This aspect is a first in the MCU industry. No other MCU supplier provides a software datasheet or provides such software warranties. The software datasheet is a specification of function and performance that also includes parametric data against which the software is warranted to operate. Some of the software components also undergo industry standard compliance tests as appropriate.

Renesas Synergy Software Package

The core of the qualified software components come in the Renesas Synergy Software Package (SSP). Provided with each Renesas Synergy MCU and included in the price of the MCU, the SSP supplies the key software components needed for all of the basic core system functions essential to the majority of embedded system and IoT applications. Renesas engineers selected a premium quality RTOS, Express Logic's ThreadX® as a basis for the SSP, added middleware components from Express Logic's X-Ware™, and integrated them with MCU device-specific Renesas software components including device drivers, middleware, libraries, and a flexible application framework with an API.

ThreadX® is a popular, industry-proven, priority-based and deterministic multitasking RTOS, offering basic system services such as pre-emptive and round-robin scheduling, semaphores, message queues, timers, interrupts and memory management. It also offers advanced features such as preemption-threshold scheduling to reduce context switches, an integrated event trace capability and run-time stack analysis. The ThreadX® RTOS has been deployed in more than 2 billion electronic products spanning a variety of markets since 1996.



Renesas Synergy Software

Renesas Synergy's SSP is built around the ThreadX® RTOS and other X-Ware™ components.

For TCP/IP stacks, Renesas engineers chose NetX™ and NetX Duo™. These two X-Ware™ components offer IPv4 and IPv6 capability in a small footprint, two-stack product. USBX™ supplies the USB protocols stack with host, device and on-the-go support. FileX®, another X-Ware™ component, gives the SSP an MS-DOS-compatible file system. And for GUI design and development, they added GUIX™, an X-Ware™ component that Renesas and Express Logic engineers specifically optimized for the Renesas Synergy MCU silicon design of the its graphics engine. GUIX™ Studio is a desktop design application provided to the Platform developers at no charge, enabling them to easily create a GUI layout before realizing it at the silicon and embedded software level.

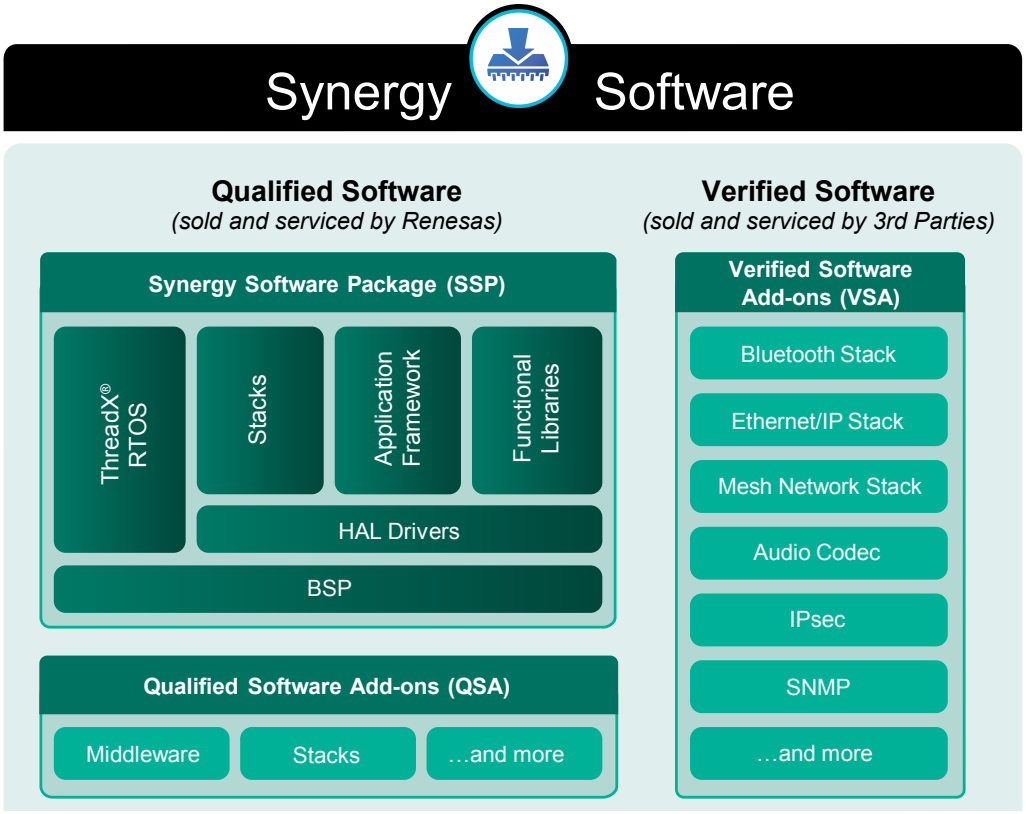
The SSP blends the RTOS, middleware and libraries with the low level peripheral functions through a specific framework using an API. This allows the application to access peripherals as easy-to-use, feature-oriented functions. The framework automatically takes care of the details of the RTOS integration. Since the drivers abstract hardware registers by using logically defined values, the API and parameters are consistent across the different series within the Renesas Synergy MCU family. This approach allows the developer to build solutions without spending time learning detailed MCU hardware specifications, specific register definitions, or ThreadX® specifics.

A complete set of low-level peripheral driver modules are available for a wide array of functions including memory, connectivity, analog, timing, system and power management, security and encryption, safety and human machine interface. Embedded developers who want access to individual peripheral drivers directly, outside the framework, may do so with direct calls from the application to meet application-specific requirements or to operate within time-critical bounds.

Renesas identifies additional software functions that may be added to the SSP in the future as Qualified Software Add-ons (QSAs). These components are qualified with the same rigorous standards used for the SSP, but are not included in the standard SSP distribution. An example of a future QSA component would be a special security function library.

Third-party Software Components

Software components that are developed by third-party developers and integrated into the platform are “verified” to work with the Renesas Synergy Platform and are called Verified Software Add-on (VSA) components. These VSA components have been tested for functionality and compatibility with the SSP and approved by Renesas. All test procedures and results are provided to customers. This greatly reduces the time customers will need to spend in the integration of third-party software components. An example of a VSA component would be a communications stack for Bluetooth®.



Renesas Synergy Software consists of SSP, QSA, and VSA components.

Software Access and Licensing

It's easy to obtaining and license the SSP, QSA components, and VSA components using the online Renesas Synergy Gallery which is described later in this document. The main differences between the three software types are that QSA and VSA components are not part of the SSP distribution and are licensed and obtained separately from the SSP. The SSP and QSA components are sourced from and supported by Renesas. The VSA components are sourced from Renesas as evaluation versions, but production licensing, maintenance, and technical support are handled by the third party vendor who created the VSA.

Customers simply register on the Renesas Synergy Gallery to download the SSP, which contains an SSP evaluation license inside. When it's time for full development or product production, the customer goes back to the Gallery to register and obtain an SSP development and production license. By entering the development and production license information into the Renesas Synergy tool suite, customers can register to benefit from the software warranty and gain the right to use SSP software in their company's end-products with no restrictions on how many different end-products will use a Renesas Synergy MCU or how many Renesas Synergy MCUs will be used in any one end-product. With this license, the customer's company receives software maintenance of the SSP from Renesas, including bug fixes, future updates and future upgrades.

The source code of the entire SSP is visible during development and debugging. For example, within the Renesas Synergy development tool suite, customers can view the source C code of all SSP components while single-stepping through the RTOS and communications stacks for complete code visibility. However, there are some components of SSP source code which, while they are visible, are also protected and cannot be printed, saved to a file, or modified.

If customers wish to obtain the source code of protected SSP components, they can use the Gallery to select a customized mix of these components for purchase. They will be given a quotation document that can be exercised with their local Renesas sales representative to complete the purchase of a source code license for the selected components. Once the source code license is entered into the tool suite, the purchased software components become unprotected and customers are free to save the source code of those components to a file, modify the source files, and print the source files. Examples of components with protected source code include the application framework, ThreadX® RTOS, the Application Framework, the NetX™ TCP/IP stack, and the GUIX™ graphics run-time library. A source code license must be purchased in order to get clear-text C code files. It should be noted that once any SSP protected component is modified, the Renesas Synergy Platform is considered customer customized and Renesas will not be able to continue the SSP qualification status,

and the warranty of qualified software components becomes void. Many of the remaining components of the SSP are not protected and are distributed as clear-text C code files within the SSP distribution. These include the low-level Renesas Synergy MCU peripheral drivers, board support packages, capacitive-touch library, and other components.

QSA components will also be available for download from the Renesas Synergy Gallery when registered customers apply for and receive a license file. That license enables customers to develop with and ultimately use the QSA components in production, similar to the process for SSP. QSA components will vary and may be available at no-charge as protected source code. Some QSA components will be available for purchase as binary files or as clear-text source C code.

VSA components will be available to registered Renesas Synergy customers on the Gallery for download as evaluation files which are in binary form or time-limited versions that have been verified to be compatible with the Renesas Synergy Platform. Customers who want to purchase these VSA components can use the Gallery to access the third party VSA vendors' website to purchase a license, source files, maintenance, and support on the VSA vendor's terms.

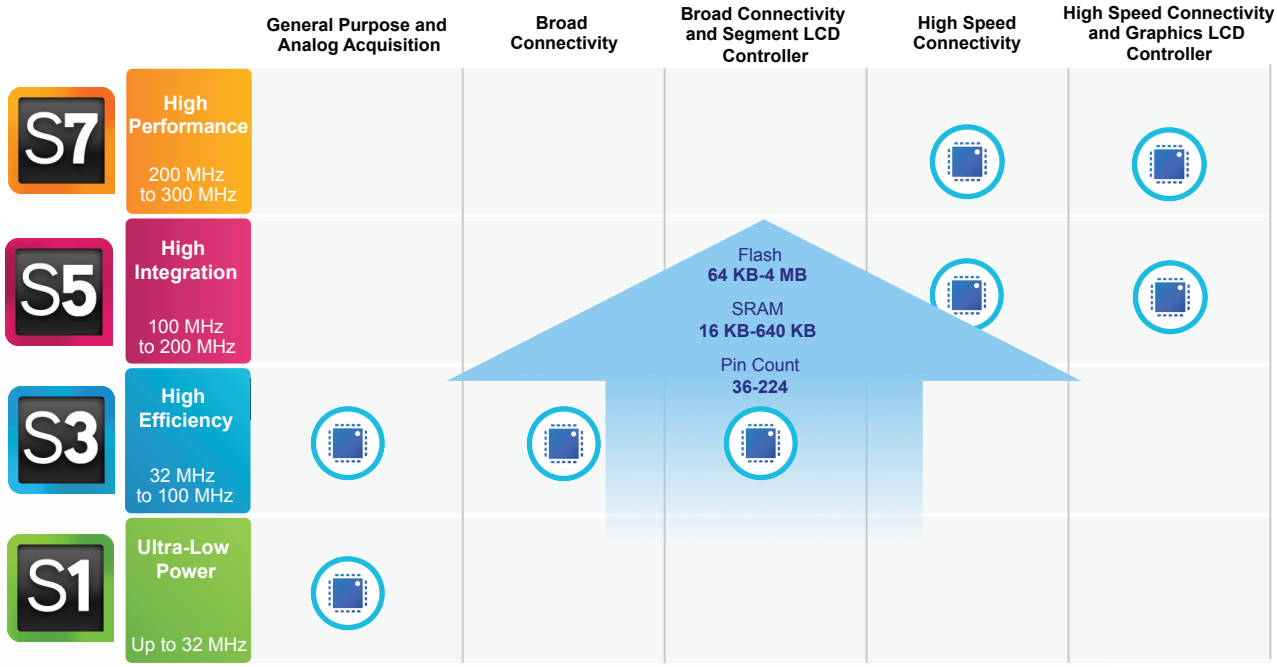
Compatible, Scalable MCUs

The device foundation for the Renesas Synergy Platform is a family of compatible and scalable 32-bit MCUs based on ARM® Cortex®-M CPU cores. Since the Renesas Synergy MCUs were designed from a clean start, with no legacy requirements, compatibility and scalability were designed in from the beginning. Compatibility means that across the board, all members of the Renesas Synergy MCU family have the same or similar peripherals to minimize the learning curve and maximize re-use of software. Also, the pin definition is the same or similar for all like-packages across the entire family for easy migration to higher or lower function. Scalability means that peripheral capabilities scale from lower to higher and higher to lower while keeping the same register footprint. For example, a simple 16-bit version of a timer peripheral and a complex 32-bit version of the same timer have the same basic control registers but the 32-bit version adds registers to match the added functions orthogonally and this has no effect on the 16-bit version. Also, the register address offsets are designed to simplify the software; if a timer function does not exist, the register also does not exist, but it does not change the overall register address offset scheme.

The Renesas Synergy MCU family begins with the S1 Series, an ultra-low-power MCU based on a 32 MHz Cortex-M0+ core. Three additional members of the Renesas Synergy MCU family, the S3, S5 and S7 Series, use Cortex®-M4 cores to support operating frequencies that currently range up to 240 MHz. Designed with industrial automation, motor control, sensor fusion, and similar embedded applications in mind, the Cortex®-M4 features extended

single-cycle multiply accumulate (MAC) instructions, optimized SIMD arithmetic, saturating arithmetic instructions and a single precision Floating Point Unit (FPU). These architectural attributes, along with integrated sleep modes and state retention capability, allow the Cortex®-M4 to deliver excellent performance at very low power levels.

Renesas' S3 Series MCUs are currently based on a 48 MHz Cortex®-M4 core and serve applications that demand higher levels of integration than the Cortex® M0+-based S1 Series. The S5 Series MCUs target more complex IoT applications using a Cortex®-M4 core running at 120 MHz at the top end of the performance spectrum, Renesas' S7 Series combines a 240 MHz Cortex®-M4 core with a wide array of high-speed peripherals. The entire MCU family offers significant amounts of memory on-chip all the way up to an industry-leading 4 MB of code flash and 640 KB of SRAM on the S7 Series. Shown below is the initial MCU portfolio. New members will be added in the coming months.

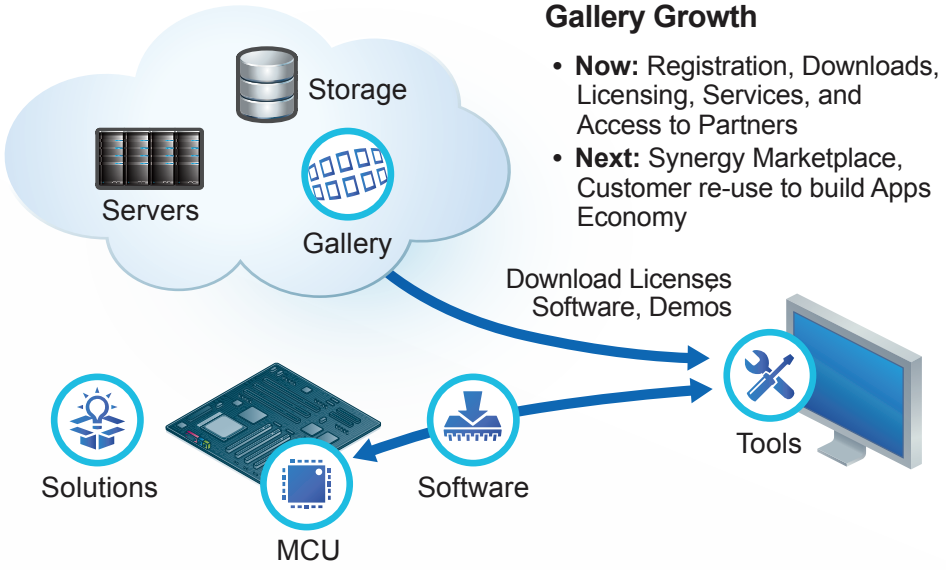


The initial Renesas Synergy MCU family covers a broad performance range.

Renesas Synergy Online Gallery

By providing a one-stop shop for all software components, the Renesas Synergy Gallery eliminates guesswork and ensures customers that software combinations of components from Renesas and from third parties in their Renesas Synergy project are well integrated and supported.

Initially, the Gallery will help customers gain access to all Renesas Synergy Software components such as the SSP and license files, evaluation versions of VSA components, demo software, tools, and documents. Future expansion of the Gallery will enable customers to download a variety of apps directly to Renesas Synergy MCUs that are running a virtual machine interface and connected to the web directly or indirectly. In this way, any hardware based on the Renesas Synergy Platform can have cloud services, including secure remote updates, feature enhancements, monitoring, and analytics. Further expansion of the Gallery will encompass ecommerce in a commercial environment allowing customers to purchase VSA components, licenses, maintenance contracts, apps, tools, design and test services, and many other valuable items directly from the Gallery.



Renesas Synergy Gallery

The online Renesas Synergy Gallery can be used to download software and manage licensing. Over time, the Gallery will incorporate ecommerce functions for software and services as well as provide a framework for secure cloud connectivity.

As a final step of the Renesas Synergy Gallery expansion, Renesas will offer to its customers the ability to duplicate the Gallery infrastructure completely under their own brand, or to lease a portion of the Gallery and personalize it with their brand. This capability will allow Renesas customers to create an apps economy for their own end-products. By re-using the proven security, provisioning, and ecommerce capabilities of the Gallery infrastructure, Renesas customers will be able to create their own web-based marketplace, build an apps economy, and sell apps and services to their end-customers. For example, a household appliance manufacturer could offer a way for their end-customers to go on line and download an upgraded laundry wash cycle capability directly to their existing web-connected washing machine. The appliance manufacturer could also sell services for its connected appliances such as on-line energy use and management, notifications to the appliance owner's phone, and more.

Security and Safety

To address the design challenges inherent in the majority of industrial and IoT applications, the Renesas Synergy Platform offers developers a wide array of options to boost security, safety and communications capabilities. The security and encryption blocks available on Renesas Synergy

Unique ID	True Random Number Gen	Crypto HASH Functions	Symmetric Key Crypto	Asymmetric Key Crypto	Secure Key Storage	Read-Out Protection
Security Software Library						

Threat	S7	S5	S3	S1
Product cloning	Best	Best	Better	Good
Product disruption with malware injection during update	Best	Best	Better	Good
Eaves-dropping during update	Best	Best	Better	Good
Privacy threat by firmware/data exposure	Best	Best	Best	Good
Add-on program to damage or steal	Best	Best	Best	Limited

Renesas Synergy Security Protection

Security was a high priority in the development of the Renesas Synergy MCUs.

MCUs enable developers to protect data that is transmitted and stored on the MCU, ensure authenticity of data and software programs, and achieve secure product lifetime management. Functional security blocks and software libraries make use of primitives for hashing algorithms and symmetric/asymmetric cryptography, as well as secure key generation and storage to provide a full set of secure services including secure boot and over-the-air firmware updates. And each MCU adds a long list of safety critical functions including ECC in RAM, ADC diagnosis, CRC, Flash Code Area Protection, RAM parity error check, RAM guard, and more.

Connectivity and Acquisition

Interconnectivity is obviously a high priority in the IoT market and the Renesas Synergy Platform addresses this need with an extensive lineup of capabilities. The S7 series MCUs, for instance, offer dual Ethernet with IEEE-1588 synchronization, high-speed USB, plus many serial interfaces on chip including UART, I2C, SPI, IrDA, QSPI, I2S, SDHC/MMC and CAN. For applications closer to the network edge, virtually every Renesas Synergy MCU also features a full array of analog interfaces including analog-to-digital, digital-to-analog converters, analog comparators, as well as temperature sensors. They also add a suite of timing functions for motor and industrial control applications. For cloud-related connectivity, the Renesas Synergy Platform offers secure SSL/TLS-based communications. Future cloud capabilities will include support of an embedded virtual machine and the ability to securely access the Renesas online Gallery.

Enhanced Tool Ecosystem

To speed development, Renesas' engineers have added a number of productivity enhancements to the Renesas Synergy Platform's supporting tool ecosystem. Renesas Synergy MCUs will be supported by e^2 studio, the Eclipse-based Integrated Development Environment (IDE) from Renesas. Eclipse is the de-facto standard when it comes to embedded IDEs. By adding new, solution-oriented components, Renesas' engineers have transformed the environment and e^2 studio into a true Integrated Solution Development Environment (ISDE). This platform provides easy and innovative ways to develop applications on the Renesas Synergy Platform, free of charge.

For example, a new Renesas Synergy Project Generator and Project Editor simplify development with Renesas Synergy MCUs by supporting various graphical configurators for every aspect of a project. From mapping out I/O pins to setting up a clock tree or easily adding and configuring software modules, it can all be done graphically with initialization C source code being generated in the background. Even adding and configuring ThreadX® RTOS threads becomes an easy task.

Smart Manual

At the same time, as embedded applications for industrial and IoT grow increasingly complex, the supporting documentation for these systems expands proportionally. One of the more challenging problems designers face is how to quickly find the information they need when supporting documents run can be thousands of pages in length. To address this challenge, the Renesas Synergy e² studio ISDE incorporates new "Smart Manuals" for the device and software platform to help create a context-aware development environment that automatically draws information from multiple locations. By simply hovering the cursor over an MCU register, the Device Smart Manual will pop up the register definitions within the editor. Similarly, by hovering over a Renesas Synergy API call, users can view helpful information like the function prototype, a description of the function, and details about various parameters. It even pulls in relevant app notes and media-rich instructional material depending on the topic.

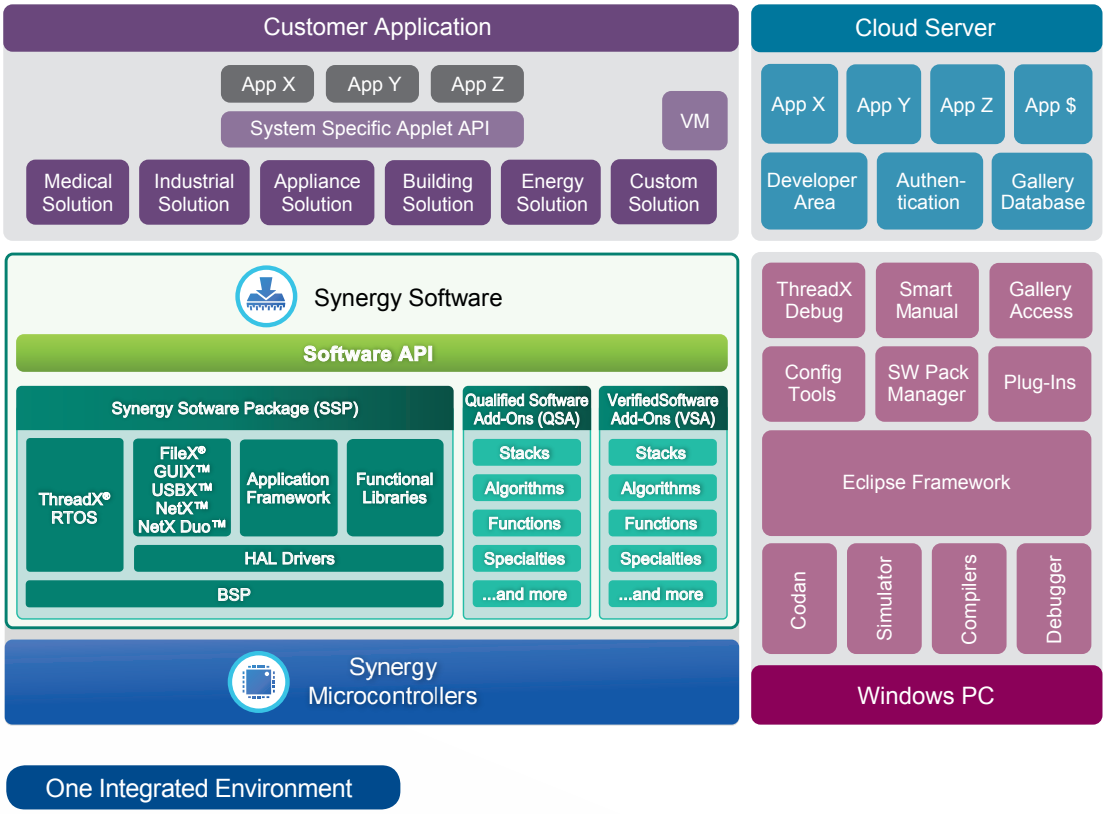
The Renesas Synergy e² studio ISDE provides the industry-standard GNU GCC ARM® Cortex®-M compiler as part of its free package. With purchase, the ISDE also supports IAR™'s ARM® Cortex®-M compiler and C-SPY debugger. The popular J-Link® from SEGGER was selected as the debug probe for the Renesas Synergy Platform, with code analysis functionality provided via the Codan plug-in for Eclipse.

To match traditional hardware tracing capabilities on this integrated hardware/software platform, the tool environment adds a high degree of RTOS awareness. Developers need to view the correlation between different operations to trace RTOS functionality over time. To accomplish this task, the platform adds Express Logic's TraceX®, a host-based analysis tool that provides a graphical view of real-time system events delivering a holistic view of code execution and timing.

Developers using TraceX® can track the occurrence of system events such as interrupts and context switches, identify the timing of events in the context of overall system operation, and more easily resolve programming problems. TraceX® works with ThreadX® which constructs a database of system and application events on the target system during runtime. Events are logged with time-stamps and active threads are identified so they can be displayed later with a proper time sequence and associated with the appropriate thread. TraceX® displays events graphically on a horizontal axis representing time. On the vertical axis, the various application threads and system routines to which events are related are listed. A summary display helps a developer analyze systems with many threads by showing all system events on a single horizontal line. When combined with the environment's traditional hardware debug capabilities, these capabilities provide developers who are using the Renesas Synergy Platform with tracing capability on both the hardware and the RTOS level.

Finally, the e² studio ISDE works directly with the SSP via the secure source builder and debugger utilities to manage visibility into protected SSP source files, accounting for purchased source

license files, and enabling users to always see the source C code but to only allow them to modify/save/print the source files that have been licensed. These and other features in e² studio ISDE allow Renesas Synergy Platform customers to take full advantage of the powerful and qualified SSP and the QSA and VSA components.



Developers use a single integrated environment comprised of the SSP, ISDE, Cloud and applications.

Kits and Solutions

Developers who want to accelerate their development cycle and take the guesswork out of using a wide variety of technologies in their own industrial and IoT end-products can do so using the Renesas Synergy Platform's wide array of kits and design examples. Renesas offers three types of Renesas Synergy Kits for general development around each of the Renesas Synergy MCU series devices, and two types of Renesas Synergy design examples to help developers implement designs for specific end-products or show them how to use specific technologies within the Renesas Synergy Platform. The three kit types are Development Kits (DK), Starter Kits (SK), and Promotional Kits (PK). The two types of design examples are Product Examples (PE) and Application Examples (AE).

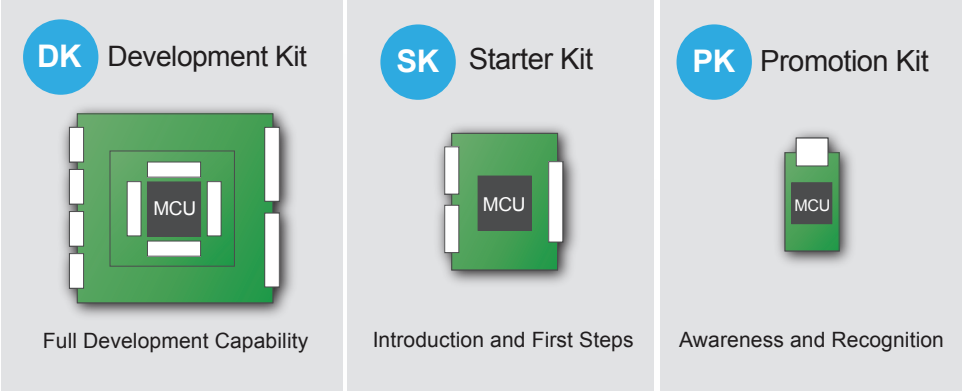
DKs offer a complete MCU hardware and software development platform with full access to virtually all the capabilities of the MCU. Developers may access all the MCU features and pins to evaluate device performance and power consumption, to build a core software application until their own

hardware development platform is available, and even to expand capabilities by plugging specialized circuit boards into DK expansion connectors and industry standard Pmod™ connectors. All DKs feature on-board J-Link® JTAG debug access, as well as a Bluetooth® low energy radio for wireless connection to a mobile device. At least one DK is available for each of the Renesas Synergy MCU S1, S3, S5, and S7 Series and they serve as a basis for the hardware platforms on which the SSP software is qualified. DKs have a suggested retail price range of $149 to $299.

As a lower-cost alternative to the Renesas Synergy DKs, Renesas offers Renesas Synergy SKs which provide an introduction to the Renesas Synergy Platform and outline steps to begin development. SKs are targeted at developers who may not have a specific application in mind yet, but who want to try out some key features of the Renesas Synergy Platform at minimal cost. SKs are available for a suggested resale price of between $29 and $99. Each SK provides access to most MCU pins. It also provides expansion through sets of connectors based on the Pmod™ standard and on the standard Arduino™ format for Arduino™ Shield plug-in boards. All SKs serve as a basis for SSP software qualification and have on-board J-Link® JTAG debug access for easy software development.

The Renesas Synergy PKs are very simple promotional kits designed to create awareness and recognition of just one or two key Renesas Synergy Platform features. PKs provide basic software debugging capability and are available at no charge.

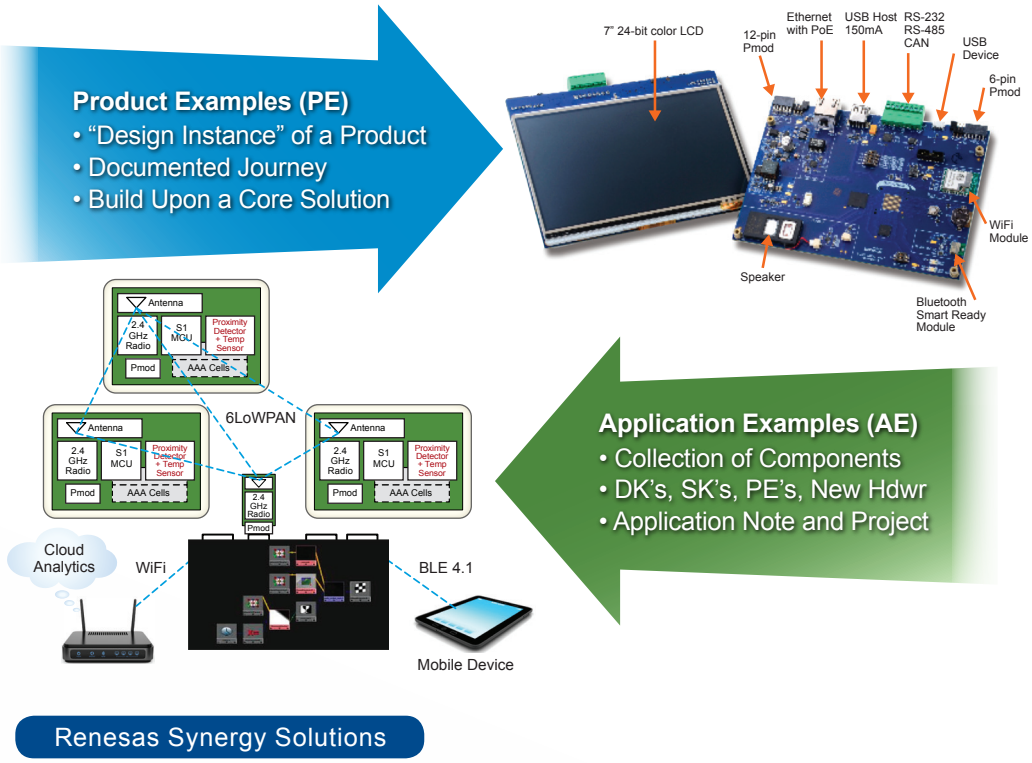
For developers who want guidance on how to implement a specific end-product or on how to use multiple technologies, Renesas offers multiple design examples in the form of Product Examples (PE) and Application Examples (AE).



Renesas Synergy Kits

The Renesas Synergy Platform offers three types of kits.

PEs represent a “design instance” of a particular end product. Customers can re-use portions of the PE directly in their own end-products to save development time. Equally important, developers can learn from the PE’s documented design journey and the methodology that Renesas engineers used to select or reject key components. With this knowledge Renesas Synergy customers can readily design their own product based on PEs even if their end-products differ greatly.



Renesas Synergy Product Examples and Application Examples.

Consistent with the unified hardware/software platform concept, Renesas supplies product-level support for both silicon and software. Accordingly, Renesas will stand behind and warrant the operation of software issues on all qualified software components against the specifications in the software datasheet much like it does with silicon products. To support the platform, Renesas has created a Renesas Synergy Platform 24/5 chat service, and a forum plus knowledge database including FAQs. It also provides access to applications engineers, online tech support and will offer on-site training seminars.

Kits for each Synergy MCU series • **Starter Kit (SK):** Key MCU features, introduction and first steps • **Development Kit (DK):** Full MCU system development	SK ($29-$49) DK ($149-299)
Product Examples (PE) • Design instance of an actual product • Documented journey of design process and decisions • Build upon a core solution • Learn, modify, replicate, re-use	Color HMI Networked ($299) Portable Wireless ($149) Networked Sensor ($99) More
Application Examples (AE) • Demonstrations based on a collection of boards, systems, plug-ins, software • Documented with Application Notes • Build upon core technologies	Cap Touch Interfaces Motor Control Industrial Network IoT Mesh More

Prices are estimates only. Subject to change.

Kits and Design Examples

Renesas Synergy Kits and design examples accelerate development.

Conclusion

The fast-moving industrial and IoT markets are forcing developers to re-evaluate their traditional approach to product development. Today's embedded designs are simply too complex to develop in a case-by case, step-by-step, serial fashion in which designers take a hardware design and painstakingly build their software infrastructure around it. The market demands a faster response and shorter time-to-market.