Tackling the challenges of IoT device development

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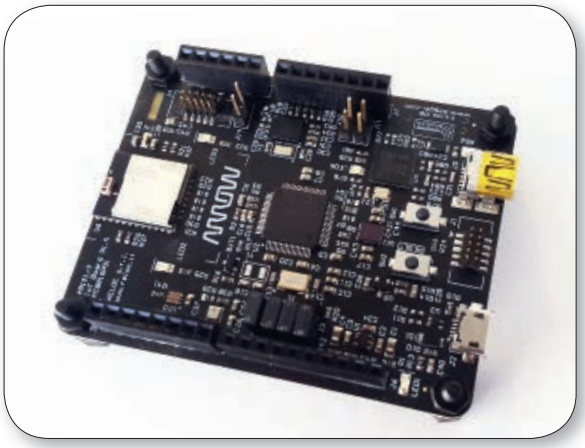
This article describes the ARIS (Arrow Renesas IoT Synergy) development platforms, which leverage the Renesas Synergy framework and address the specific needs of IoT device developers in ways that many established conventional embedded development platforms cannot do.



As more and more consumers and business teams encounter the concept of IoT and understand the opportunities it brings, the desire to harness its potential in millions of individual scenarios will be irresistible. The possibilities are limitless: maintaining an installed base of printer/copiers, managing a fleet of delivery vehicles, keeping control of industrial processes, monitoring the environment to improve air or water quality, accelerating medical research, cutting the costs of healthcare, improving comfort in the home, capping domestic utility consumption. The list doesn't just go on – it will never be complete.

IoT device developers need flexible hardware/software platforms to help create the smart, connected "things" that will handle sensing and local processing at the extremities of the IoT, and share data with the Cloud either directly or via upstream gateway devices. Suitable platforms must support the fundamental values of IoT devices, including low power consumption, high energy efficiency, and versatile communication options encompassing industry-standard protocols like Wi-Fi, Bluetooth Low Energy (BLE), NFC, Thread, and ZigBee. Arrow is responding to this emerging need through its growing family of ARIS (Arrow Renesas IoT Synergy) development platforms. Leveraging the Renesas Synergy framework, the ARIS concept addresses specific needs of IoT-device developers in ways that many established conventional embedded development platforms cannot do.

The Renesas Synergy platform is well suited to IoT development, supporting scalability and compatibility and enabling developers to reuse proven code to save development time. In future, the platform will be extended; new technologies will be employed, and new features will be permanently implemented, to launch embedded design applications more quickly and efficiently on the market.

It is based on the Eclipse Open Source integrated development environment (IDE) and hence offers a high level of flexibility as well as easy access and familiar user controls. The complete Renesas Synergy platform, which includes the Renesas Eclipse Embedded Studio (e² Studio) IDE as well as extensive ready-to-use software and application examples that can be easily adapted to the ARIS Board, can be downloaded and installed free of charge from the Renesas Synergy Gallery.

ARIS boards are developed in conjunction with Italian embedded specialist Reloc, which is strongly focused on IoT development, and has not only perfected the ARIS hardware but has also handled driver implementation and generated middleware for managing the peripheral devices to enable the boards to run out-of-the-box. The first ARIS IoT board, introduced in 2016, brought together the efficient and high-performing Renesas S7 microcontroller, featuring a 240MHz ARM Cortex-M4 core, with a rich set of sensors, and support for Wi-Fi, BLE 4.1/4.2 and NFC wireless communications including fully integrated software stacks. Ethernet and USB ports are also provided, while indicator LEDs, pushbuttons, a TFT-LCD controller, and a resistive touchscreen controller give the option to implement a sophisticated user interface. Ready-to-use on-board sensors include a three-axis acceleration sensor and two-axis gyroscope, a thermal sensor, and a humidity sensor. Device security and future-proofing are assured through features such as the integrated crypto bootloader and support for over-the-air (OTA) firmware updates.

Now, to help meet the specific challenges facing designers of small resource-constrained devices like smart sensors at the extreme edges of the IoT, Arrow has extended the ARIS concept by introducing the ARIS EDGE platform. ARIS EDGE is based on the ultra-low-power Renesas S1 32MHz ARM Cortex-M0+ microcontroller with analog and digital peripherals. Key features of the board are illustrated in figure 1.

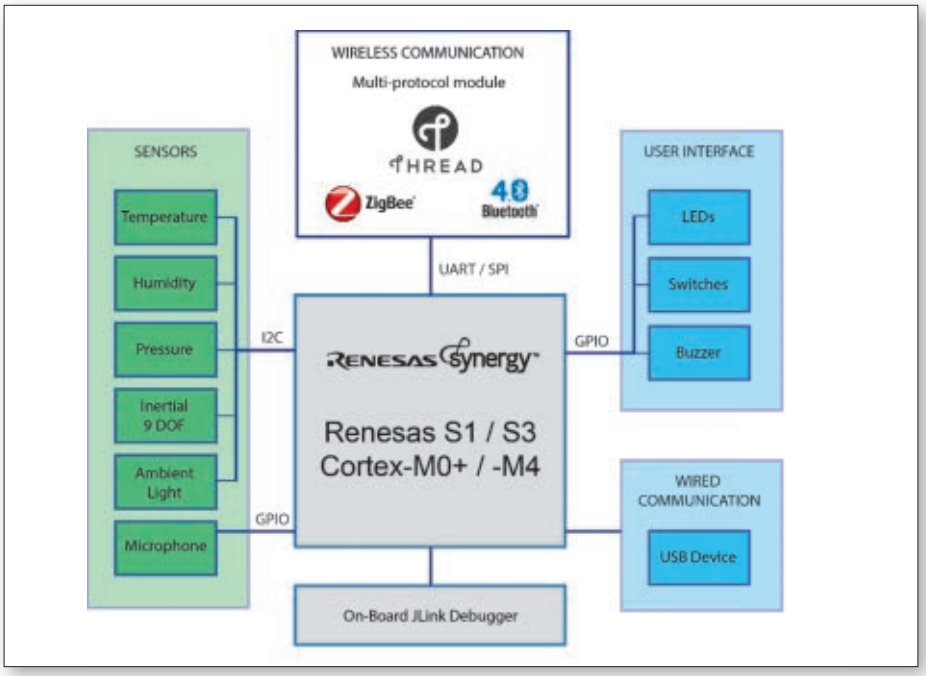


Figure 1. ARIS EDGE block diagram

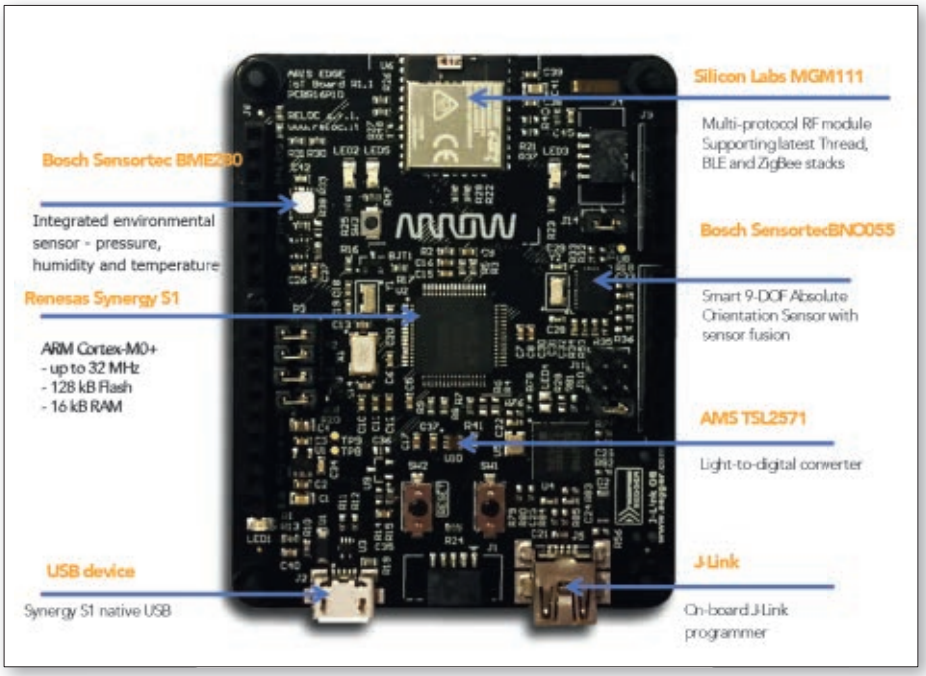


Figure 2. ARIS EDGE part description

The on-board Silicon Labs MGM111 multi-protocol RF module supports BLE 4.1/4.2, ZigBee and Thread. Modules enable the fastest time to market and are suited for use in products that will be built in lower volumes. The fully certified MGM111 module integrates all components (crystals, RF passives and antenna) required for a system-level implementation. At +10 dBm this module meets the worldwide regulatory requirements for IEEE 802.15.4 2.4 GHz radio used in both ZigBee and Thread networks. By incorporating the Thread stack, ARIS EDGE can be used for developing connected domestic IoT devices, benefiting from properties of Thread that help ensure reliable and secure communication, with high energy efficiency and easy interoperability. As a versatile platform for developing edge devices, the board also integrates a rich set of sensors including the state-of-the-art BNO055 Application Specific Sensor Node (ASSN) from Bosch Sensortec. This is a 9-axis absolute orientation sensor containing a MEMS accelerometer, gyroscope and geomagnetic sensor, with sensor fusion running on a 32-bit microcontroller, in a space-efficient 5.2mm x 3.8mm x 1.1mm SiP device.

A MEMS microphone and TSL2571 ambient light sensor (ALS) are also integrated, and a BME280 integrated environmental sensor handles pressure, temperature and humidity sensing. This advanced device is developed specifically for IoT mobile applications to simplify the integration of environmental sensing within tight constraints on power consumption and physical size. The unit combines individual high linearity, high accuracy sensors for pressure, humidity and temperature in an 8-pin metal-lid 2.5mm x 2.5mm x 0.93mm LGA package, designed for low current consumption (3.6µA at1Hz), long-term stability and high EMC robustness. Figure 2 gives an understanding of the board's size, shape and layout. In addition to providing a fully integrated hardware/software platform, ready to run with drivers and protocol stacks on board, the approach with ARIS also provides higher-level sample software to help users jump-start application development. Accordingly, ARIS EDGE comes with several software demonstrations that are relevant to IoT-edge devices. One example is a mesh networking demo that allows multiple ARIS EDGE boards to be connected to an ARIS IoT board, which acts as a gateway to push sensor data from the EDGE boards to a Cloud service. A second demo lets users explore how to view the board sensor data in real-time using a dedicated app running on a mobile device. There is also a demo that exercises the BNO055 absolute orientation sensor, which allows the absolute position of the board in space to be viewed on an Android device. IoT evolution is happening everywhere, all the time, right now. Equipment developers need an efficient, optimised device-development platform that not only accelerates time to market but – even more importantly - helps satisfy specific constraints such as very low power consumption and appropriate wireless connectivity. ARIS IoT and ARIS Edge platforms address this need by bringing together best-in-class software and hardware that are architected from the ground up for developing IoT gateway and endpoint devices. ■