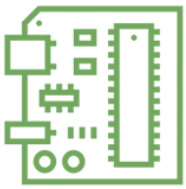
Jabil Software Services
(JSS)

- Embedded Systems
- Web & Mobile
- IoT
- Cloud
- Wireless Networking
- Wireline Networking



CASE STUDY

Jabil System-On-Module (JSOM)

Customer Needs

Jabil's *Smart Home & Appliances* (SH&A) sector manufactures a broad range of divergent products for residential and commercial applications, ranging from coffee machines to industrial cookers. Such products typically have similar needs in terms of user interfaces, edge logic, wireless communications, cloud connectivity, mobile access, and security.

This commonality of requirements led the SH&A sector to conceive of a reference platform with the ability to be quickly customized and leveraged across a wide range of products. The Jabil System-On-Module (JSOM) reference platform comprises a set of cost-efficient, programmatically configurable, small-footprint, IoT-enabled modules tailored to provide rich functionality for a wide range of products manufactured by the SH&A sector.

The JSOM reference platform is designed to be quickly tailored to meet the specific needs of any given customer, at minimal overhead and cost. This significantly reduces time-to-market and time-to-revenue for customers leveraging the platform. It also allows customers to respond more rapidly to evolving markets and to reduce the duration of product development lifecycles.

The JSOM reference platform is typically used as the core component of end-to-end IoT-enabled smart appliance solutions. It is usually coupled with a range of sensors appropriate to the product, a mobile application for device management, and an associated cloud solution.

The JSOM platform is designed to drive a small HMI, manage IO, and execute edge logic, amongst several other functions. The standardized JSOM control board is coupled with a readily customizable carrier board which supports the specific GPIO, display and audio needs of each application. The platform includes three SKU's:

1. *CONNECT*: Core platform with Bluetooth®/Bluetooth Low Energy connectivity.
2. *EXPLORE/HORIZON*: Core platform with Wi-Fi connectivity.
3. *BEYOND*: Core platform with cellular connectivity.

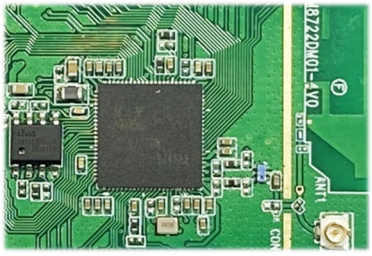
All SKU's support cloud connectivity. A cloud-hosted reference platform provides a range of services including device management, provisioning, secure firmware updates, connectivity management, and analytics. The Azure and AWS cloud platforms are supported, including support for multi-tenancy. A web-based dashboard facilitates the streamlined management of many thousands of JSOM devices via the cloud-hosted platform, including real-time monitoring, historical time-series data storage, geolocation, reporting and data analytics. An iOS/Android reference app is designed to be readily configured to meet the specific needs of any given customer application.

Scope

JSS developed all software components for the JSOM platform, including embedded components, cloud components and the mobile apps. JSS retains full end-to-end responsibility for the ongoing development and maintenance of the platform, including configuring the platform to meet the needs of specific customers.

JSS dedicated a team of 10 staff to developing the JSOM platform, including architects, embedded developers, cloud developers, mobile developers, and testers. The C programming language was used for all embedded components. Other technologies leveraged as part of the embedded development included Zephyr, FreeRTOS (I2C, GPIO & USB drivers), I2S/SAI audio drivers, MCU UI libraries (including LVGL & emWin), AQA/MQA and Python. MQTT was leveraged for messaging, although other messaging protocols are also supported. Angular and C#/.NET were leveraged for web/cloud components, and Flutter for cross-platform mobile app development. C/C++ was also leveraged for various platform components.

Deliverables



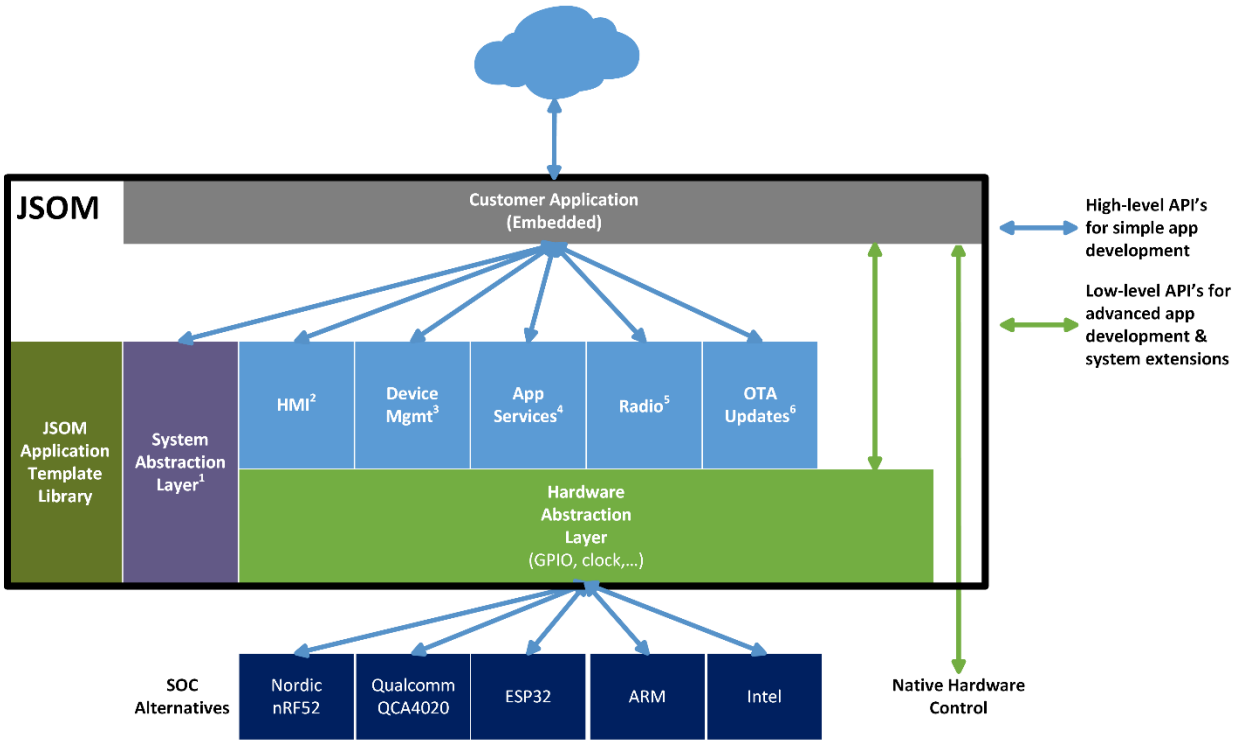
JSS provided the following key deliverables to SH&A:

- Embedded JSOM software package.
- Configurable mobile apps for iOS and Android.
- Configurable cloud application and web-enabled dashboard.
- Comprehensive documentation.

The JSOM reference platform was developed by JSS leveraging an Agile methodology across several sprints over a 12-month period. JSS and SH&A clearly agreed scope and schedule expectations, and JSS leveraged a formal project management methodology to ensure efficient delivery.

JSS delivered a complete Board Support Package (BSP) and a Software Development Kit (SDK) which is used to quickly customize solutions for specific customers with minimal coding. Some of the many platform features include digitally signed images, trusted boot, device drivers, hardware abstraction layer APIs, and service layer APIs. The SDK abstracts the complexity of the underlying platform and includes a range of lightweight API's.

The reference mobile apps include features for user registration along with the connectivity, onboarding, upgrading, and management of multiple devices. The mobile apps support connectivity via Bluetooth and Wi-Fi, along with bi-directional event caching and logging. The mobile apps also maintain the chain-of-trust from cloud to device. A block diagram of the architecture is shown below:



1: Simplified execution environment for threads, timers, interrupts, etc.
2: High-level graphics API's
3: Customized peripheral abstractions (SPI, I2C, UART, LEDs)
4: Messaging, logging, localization
5: Simple message service (BLE, Wi-Fi, MQTT)
6: Off-the-shelf secure DFU and OTA updates

Strategic Value

The JSOM platform provides SH&A customers with a curated, integrated, easily extensible and well supported platform for developing customized appliance control solutions. The fact that the JSOM platform has been carefully developed by Jabil helps to ensure high-performance and low-cost whilst minimizing supply chain risk.

"JSS was instrumental in developing the JSOM platform in accordance with the requirements specified by SH&A and within budget and schedule constraints. The SH&A sector quickly established a productive working relationship with JSS, and this relationship continues to deepen over time. JSS's work on the JSOM platform has facilitated several key customer projects."

***Raza Shah**, Jabil SH&A Engineering Head*

About Smart Home & Appliances (SH&A)

Smart Home & Appliances (SH&A) is a sector within Jabil's Green Point segment which engineers, builds and ramps some of the most innovative connected home and appliance products in the world today. The SH&A sector has shipped more than 100 million assemblies since 2005 and has a range of capabilities, including displays, LED lighting, connectivity, optics, robotics, miniaturization, OLED, fluidics & sensors.

About Jabil Software Services (JSS)

Jabil Software Services (JSS) delivers a broad range of advanced software services across several industries, leveraging an experienced team of architects, software developers and quality assurance engineers. JSS specializes in the efficient development of embedded systems, web & mobile apps, IoT solutions, cloud solutions, and networking solutions (wireless/wireline).