BUY VS. BUILD

Evaluating the Requirements for SBCs in the Next Generation of Emerging Technologies

Emerging Requirements For Next Generation Single-Board Computers

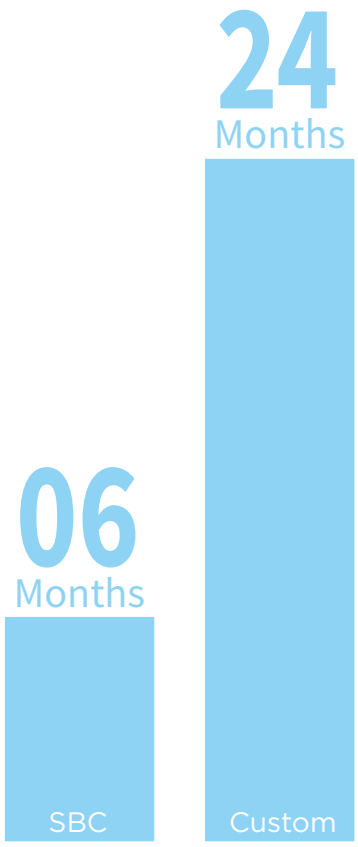
By Mike Rohrmoser, Sr. Product Manager

Smart, connected products drive significant benefits across almost every application.

Currently in industries from medical diagnostics and transportation to precision agriculture and entertainment, engineers are increasingly challenged to find new ways to design in greater intelligence, connectivity, and performance—while cutting costs, power consumption and size.

Single Board Computers (SBC) are an ideal platform for quick and focused product design. They continue to evolve in sophistication, and the range of possibilities continues to expand as well. And as those capabilities grow, so do the choices for design engineers. But what are the factors that matter most in SBC evaluation and selection?

Although design needs will appropriately vary based on important application criteria, industry and deployment environment, certain characteristics are consistently found across implementations. As engineers continue to refine their designs and rank their functional priorities, the following criteria can serve as a useful springboard for the consideration and evaluation of SBC options.



Using an SBC can reduce average development times by 75%

*Source: Digi International

Processor Platform

At the heart of every SBC is the underlying application processor platform. Traditionally, the majority of SBCs were based on x86 platforms and were somewhat derived from the typical desktop PC motherboard form factor, which is still evident in some of the form factor variants that are being utilized (Pico-ITX, Mini-ITX, microATX, EmbATX, and others). They range from "standalone" models to stackable solutions, like PC/104, to specialized "blades" for use in rack systems. With ARM-based System-on-Chip (SoC) platforms becoming increasingly more successful and capable by extending their reach into the x86 performance and capabilities bracket combined with low power consumption, broad operating system support, and cost-effectiveness, the SBC now also is an extremely viable option for a host of new applications as well as potential replacement for existing x86 based solutions.

"It's possible to create a compact SBC with integrated, pre-certified 802.11 a/b/g/n and Bluetooth 4.0 connectivity."

Form Factor

SBCs are available in a wide variety of available "standard" form factors and continue to shrink; giving designers much greater latitude in how they create innovative devices and applications that can leverage a much higher level of computing power. For instance, it's possible today to create a compact SBC built on an ARM-based System-on-Module (SoM) solution with integrated, pre-certified 802.11a/b/g/n and Bluetooth 4.0 connectivity in a footprint of just 50x50 mm, only 5-7 mm high. Such an SBC can provide scalable single to quad core Cortex-A9 SoC performance with a complete set of integrated peripherals and interfaces, from storage (SATA, SD) to user interface (up to four display, capacitive multi-touch). A level of computing power and flexibility paired with dramatically reduced power consumption and at a price point that was unthinkable at that size just a few years ago.

Choosing an SBC design based on a SoM provides an almost seamless migration path to direct component integration once an application warrants a custom carrier board design due to increased volume and/or application-specific customization requirements. Given that the SoM stays the same when used on the customer board design, software transition is in principle minimal and the SBC may also act as a reference design for the customized product development effort.

Reliability, Longevity, Availability

SBCs are often used in very specialized and environmentally challenging embedded applications. Specific industry standards related tests for temperature, shock, and vibration will ensure that the platform is able to operate reliably 24/7 without failure.

The selection of components a SBC is designed with also has a significant importance with respect to the overall product long-term availability. For example, a product like Digi International's ConnectCore® 6 SBC is built entirely using industrial temperature rated components, which of course contribute to overall reliability but also to long-term availability of parts from a procurement point of view.

Digi's SBC is also built around the scalable ConnectCore 6 SoM, which is a NXP i.MX6 based surface mount multichip module with integrated wireless connectivity. It eliminates the typical need for high-density module connectors (affecting cost and reliability), expensive multilevel board designs, increases durability in rugged environments, and offers a unique long-term availability approach for embedded, industrial-grade Wi-Fi and Bluetooth connectivity that does not rely on short lifecycle consumer product components.

Last but not least, it also enables you to move to a fully integrated, customized product design utilizing the single-component SoM without the traditional design complexities of a discrete design approach.

"Today's ARM-based SBC designs can achieve excellent power efficiency in mobile and fixed applications."

Low Power Consumption

Today's ARM-based SBC designs – even those that leverage quad-core processors – can achieve excellent power efficiency in both mobile and fixedpower applications. The inherent design advantages of the ARM platform and its advanced power-saving modes enable you to minimize and tune power consumption for applications, load, temperature, times of day, users and other application specific criteria. What's more, it also helps you design products that don't require active (fan-based) cooling. That lowers your design complexity while increasing longevity and, most importantly, reliability over time.

Connectivity

The Internet of Things (IoT) is pervasive throughout applications in virtually all vertical markets. Fully integrated and complete connectivity options must be considered and designed into a product right from the beginning—whether that be Wi-Fi connectivity to allow for product configuration or services, Bluetooth Classic for user device integration, Bluetooth Low Energy for low-power sensors or Ethernet for use-cases mandating wired network connections.

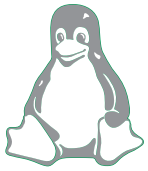
With connectivity also comes the need for security and trusted communication. Increasingly, the next generation of SBCs are equipped with Bluetooth Low Energy (aka Bluetooth Smart) capabilities and fully pre-certified 802.11a/b/g/n (2.4 and 5 GHz), software and driver support for enterprise-grade Wi-Fi security such as WPA/WPA2-Enterprise, cellular connectivity, and other options to ensure your device ties into larger computing grids. It also means that the SBC can be integrated into virtually any existing IT environment.

"With connectivity also comes the need for security and trusted communication."

Lastly, taking advantage of a secure cloud-enabled software platform such as the Digi Device Cloud℠ allows you to build products for the IoT almost immediately without any need to develop a cloud infrastructure, with all its associated cost, effort and risk.

Open Platforms

Most SBCs are supporting industry-standard operating systems, including Linux, Android, and Microsoft Windows Embedded Compact. This reduces learning curves and costs while reducing risk and accelerating development activities.



However, engineers invariably want to customize and refine their device designs as well as make sure that access to relevant software and hardware design components is available right from the start. Be sure your chosen SBC provides full and royalty-free access to source code of the software platform support (Board Support Package).

On the hardware side, access to functional and verified reference designs is as important as choosing a supplier that is established and present both locally and globally with their own and partner resources.

A Range of Applications

Connected SBCs are the ideal building blocks for a broad array of devices to provide levels of usability, control and sophistication not previously possible.

Medical Devices

For manufacturers in the life sciences industry, innovation is a non-negotiable requirement. Product complexity—including the inherent need for products to have seamless wireless connectivity—continues to grow, making it essential to have efficient designs that leverage reliable components with the power and simplicity that reduce points of failure, including support for the long product lifecycles in this industry. Medical/Healthcare devices need to become increasingly connected in order to create efficiencies in key aspect such as patient safety, reimbursement or even asset management/tracking. The complex and lengthy regulatory approvals further drive the need to shorten time-to-market and focus on core competencies.

The right SBC or SoM solution plays an integral role in bringing innovative medical products to market quickly. As a result, device manufacturers are increasingly relying on them for devices such as infusion pumps, ventilators, implantable cardiac defibrillators, ECGs, bedside terminals, patient monitors, AEDs and more.

Transportation

With focus on operational efficiency and safety, transportation applications are driving the need for connected and intelligent devices, requiring rugged reliability that eliminates vibration concerns. Embedded SBC and SoM solutions play a valuable role in devices for marine, vehicle, railways or aerospace applications.

In taxis, these embedded solutions can help optimize electric vehicles by controlling engine components while providing a fully integrated, state-of-the-art in-vehicle operator interface. In buses, they can monitor emissions and operate fare-collection systems. On a commercial vessel, they can power connected navigation systems or more sophisticated fish finders.

Consider taking advantage of connected SBCs and SoMs when building your next product. Allow yourself to focus on your core competency and significantly reduce your design risk while shortening time-to-market, without sacrificing design flexibility.

Precision Agriculture

Today, farmers are able to more finely tune their crop management by observing, measuring and responding to variability in their crops. For instance, crop-yield sensors mounted on GPS-equipped combines can use industrial-grade, ruggedized SBCs and SoMs to measure and analyze data related to chlorophyll levels, soil moisture and even aerial and satellite imagery. The platform can then intelligently operate variable-rate seeders, sprayers, and other farming equipment to optimize crop yields.

Wireless connectivity for cellular or Wi-Fi networks plus sensor integration through technologies such as Bluetooth Low Energy adds a powerful, real-time, in-the-field connected computing foundation to agriculture that uniquely drives the next level of efficiency.

Key Takeaways

- ✓ Single-board Computers (SBCs) are an ideal platform for rapid, highly focused product design; the range of possibilities continues to expand.
- ✓ Key criteria for SBC selection: processor, form factor, reliability, availability, longevity, power consumption, connectivity, and standards support.
- ✓ SBCs are an attractive choice for: medical devices, precision agriculture and transportation.
- ✓ SBCs allow you to focus on your core competency and significantly reduce design risk while accelerating time-to-market.
- ✓ Digi International has many SBC options ready to deploy. Need something customized or build-to-suit, our Wireless Design Services has years of experience and a library of proven IP to build exactly to your specs. Digi is your trusted partner to get your product to market faster and smarter.

About the author: Mike Rohrmoser is Senior Product Manager for Embedded Solutions at Digi International. In his role, with over 15 years of technical product management experience, he defines and owns Digi's global embedded solutions offering enabling customers to successfully build connected products across various markets such as medical/healthcare, transportation, precision agriculture, building automation, security and industrial. He has worked in software development, systems design and support, and product management in Germany and the US.

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PH: 877-912-3444
www.digi.com

Digi International
Worldwide HQ
11001 Bren Road East
Minnetonka, MN 55343

Digi International - France
+33-1-55-61-98-98

Digi International - Japan
+81-3-5428-0261

Digi International - Singapore
+65-6213-5380

Digi International - China
+86-21-5049-2199

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