Enabling simplicity: How sophisticated MCU solutions can help reduce the complexity of consumer electronics designs

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Innovation continues to flourish at the individual product-level as consumer electronics companies continue to find ways to add more appealing features and functions for end users in everything from thermostats and washing machines to wireless headsets and wristwatches. Clearly the push is on to “IP-enable” the entire consumer electronics industry in an aesthetically pleasing way. Put another way, complexity is out, and elegance and 24/7 convenience are in.

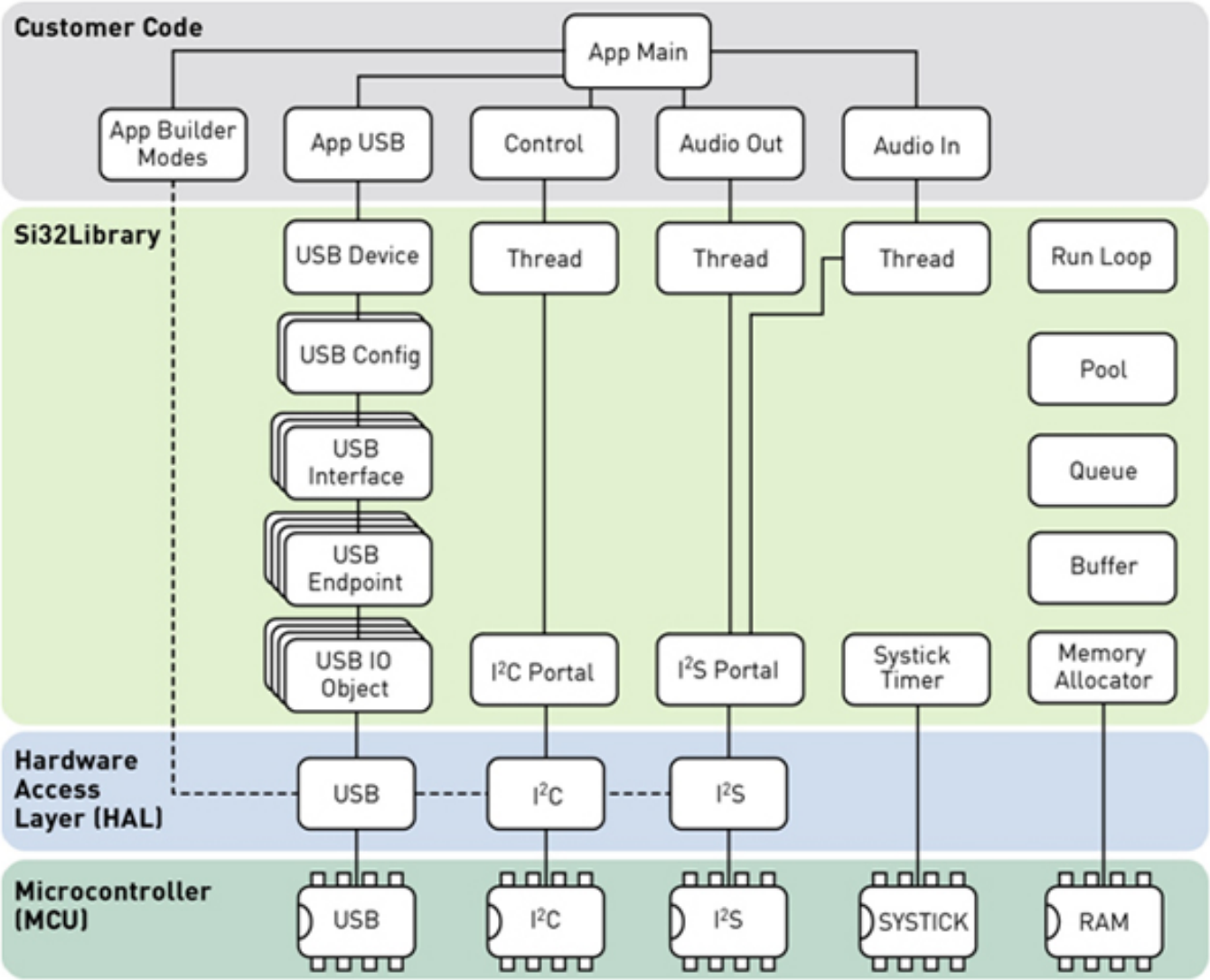
For many consumer electronics companies, the real and growing challenge is to find a way to successfully integrate three independent engineering disciplines in a seamless and synergistic way: hardware design, software development and mechanical engineering. From my perspective in the semiconductor industry and more specifically in the microcontroller business, what is fascinating to me is that chip companies actually have capabilities in place today to help bring these three engineering disciplines together in ways not possible in years past.

Let’s take a look at each of these disciplines and how they can be unified, beginning with hardware chip design. For example, what can an MCU supplier do for a hardware designer? Clearly, a lot of things. Through low-power design techniques, we can reduce or eliminate the need for batteries, which add cost to systems and pose environmental issues. Through elegant analog/mixed-signal integration, we can eliminate the need for termination circuitry, discretes and external regulators among other components, thereby reducing the total bill of materials and minimizing design complexity. Score one for simplicity.

What about the software developer? By offering programmers an easy-to-use and free tool chain tightly integrated with the MCU, we not only make their jobs easier, but we can also provide configuration, programming and diagnostic capabilities that enable developers to tweak and optimize their designs to take full advantage of the hardware platform.

But why stop there? Vendors can also provide developers additional building blocks that can hook into the main application via function calls that in turn allow the developers to focus on their end applications instead of spending time on MCU-specific details. As can be seen in the following figure, an integrated development environment (IDE) comprises a set of flexible, scalable and portable source modules that enable core functionality for error handling, debug logging, memory allocation, data transfers, event notification and more. This library is delivered as source code that customers can use as-is or it can be easily modified and adapted to best suit their application. A simple object-based model allows for reuse and modularity

without the added complexity of C++.



And what about mechanical engineers? The key is to give them as much flexibility as possible to allow them the freedom to focus on how best to implement their creative ideas. By enabling smaller, simpler and lower-power designs, we can help give the product engineer much greater flexibility in the development process. For example, Silicon Labs' new 32-bit Precision32 MCUs offer an innovative dual-crossbar architecture that enables both analog and digital peripherals such as ADCs, UARTs, and I2C ports to be dynamically placed on virtually any pin of the MCU. Now if you are a mechanical engineer trying to place peripherals in a very precise way to adhere to strict form factor requirements, this level of flexibility can be a design-saver. This flexibility can also simplify PCB routing and quite possibly reduce the number of PCB layers needed, thereby reducing costs as well.

These are just a few examples of how a device like an MCU can help a consumer electronics companies merge three disparate disciplines – hardware, software and mechanical engineering – in a way that eases design complexity and fosters innovation.

Ultimately, the key to elegant consumer electronics design is simplicity. Consumers

demand it. OEMs need help providing it. And IC suppliers must enable it.

A simple case study helps illustrate this point. It's clear that consumers want and expect their consumer electronics devices to operate even if accidentally dropped on the ground. This is a highly desirable feature that OEMs want to provide because it provides a tangible benefit to a consumer. To help achieve this, an OEM may want to eliminate what often is the least reliable component in the design – the crystal oscillator. This timing device is a circuit that uses mechanical methods (a vibrating quartz crystal) to create an electrical signal with the precise frequencies necessary to operate ICs such as MCUs.

Silicon Labs' MCUs, for example, come with an advanced and innovative phase-locked loop (PLL) architecture that can generate the precise frequencies needed to operate the processor core as well as associated peripherals such as USB, thereby eliminating the need for an external crystal. By removing this crystal from the design, we eliminate a single point-of-failure while also dramatically reducing the overall system reliability risk. Therefore, by translating a seemingly simple customer care-about into a set of sophisticated circuitry, it is possible to offer greater simplicity to OEMs and consumers alike.

It is incumbent on IC suppliers to continually strive to enable this level of simplicity. Sometimes the greatest innovations come in the simplest forms.

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Mike Salas, general manager of microcontroller (MCU) products at Silicon Labs, oversees all aspects of the company's global MCU business. Mr. Salas joined Silicon Labs in early 2008, initially serving as director of business development and then director of marketing for MCU products. Previously, Mr. Salas was founder and CEO of Layer N Networks (later renamed Britestream Networks), a private venture capital-backed company started in 2000 that offered semiconductor solutions for the networked security market. From 1994 to 2000, Mr. Salas served as the director of business development at PMC-Sierra where he helped oversee the growth of the company from its early start-up days to a dominant networking semiconductor specialist with a run rate in excess of $700M. Prior to PMC-Sierra, Mr. Salas held various management and technology positions at Texas Instruments, the most recent of which was program manager for TI's 1394/FireWire product group. Mr. Salas holds a BSEE degree from the University of Texas at Austin.

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