WinSystems / ROBERT A BURCKLE

New directions
in EMBEDDED TECHNOLOGY

As processor performance and data rates escalate, embedded-system designers are facing a crisis in power management.

SERVING A WIDE RANGE of industrial, medical, military, and consumer applications, standardized computer and peripheral boards are the backbone of the embedded-system industry. Board standards give the designer access to compatible hardware and software to drastically reduce development costs and schedules. A typical embedded-system project may incorporate off-the-shelf chassis, processor, and user-interface sections and reduce the design effort to a single board. Robert A Burckle has been a part of the embedded-system industry for more than 30 years and continues to provide an influential voice in the development of board standards. Burckle has a master's degree in business administration/marketing from North Texas State University and master's and bachelor's degrees in electrical engineering from the University of Louisville. Burckle is vice president at WinSystems (Arlington, TX), a long-established and respected manufacturer of standard off-the-shelf single-board computers and PC/104, PC/104-plus, and STDbus products.

What is the most important technical issue facing the embedded-board industry today?

Power. By power I mean the balance between increasing processing power and the demands that this [increase] places on electrical requirements and thermal management. As chips become faster, smarter, and cheaper, new designs become quicker and more intelligent. Embedded-system designers must be cognizant of power sources, heat density, power distribution, and efficiency. We are all concerned with our environment and must be good stewards of it for our future generations. Embedded-design engineers will be challenged to strike a balance between electrical requirements, thermal dissipation, and processing power.

Computers now are everywhere, with previously unimaginable new applications developing daily. Device-oriented applications, such as automobiles, medicine, energy, security, communications, transportation, and wearable processors, are all being developed and networked together. From the smallest smart sensor to plant-management systems, perhaps billions of embedded solutions are possible. Yet, beyond the obvious thermal-management, power-delivery, and portable-systems' battery-life implications, when you multiply even moderate power savings by such a large number of embedded devices, it makes the judicial specification and management of system power significant.

There are many ways to manage power. Central, video, DSP, or FPGA-logic processors often individually consume more power than all other system devices combined. Ensuring that a processor is specified to meet current and reasonable future performance requirements without wasting power unnecessarily is of paramount importance. Both designers and users of embedded boards must make a careful and reasoned approach to selection of processor and interface hardware. It is great that we have such an abundance of technology across a wide spectrum of capabilities and architectures. But what direction should an embedded designer take when you factor in total cost, reliability, repair, long-term availability, software development, and time to market? It is easy to get lost in the myriad hardware and software solutions promoted by component and board-level manufacturers, completely losing sight of the implications of power.

Heat management and thermal solutions deserve special attention. As the chip geometries and packaging are getting even smaller, the power density is continually increasing at the package, board, and system levels. Sophisticated thermal analysis and engineering are required to isolate and remove heat from smaller and smaller areas. This [fact] is especially true with industrial and automotive applications that don't have the luxury of operating in an air-conditioned office. Solutions leveraging conductive, liquid, vapor-phase, and forced convection will adequately cool the parts but may add dramatically to system size and cost. Ultimately, the best solution is to use the lowest [power], most energy-efficient part that generates the least amount of heat gain for a given solution.

How do you think the industry should address the power issue?

Chip vendors, board designers, and standards organizations are all beginning to address this issue individually and through industry standards. For example, both Via Technologies with the Isaiah architecture and Intel

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with the Atom have made significant boosts to functionality and performance while minimizing power for the x86 processor. These chips support ultramobile and embedded devices with rich multimedia and wireless-broadband capabilities in small-form-factor, green PCs. The initial success of these processors lies in the fact that they do not sacrifice processing performance in favor of lower electrical power and elaborate cooling solutions.

Standards organizations are pushing for power management. For example, the ACPI [Advanced Configuration and Power Interface] specification developed by Hewlett-Packard, Intel, Microsoft, Phoenix, and Toshiba defines common interfaces for hardware recognition and device configuration for power management. It is a widely recognized standard for power management that puts the operating system in control of power management. Also, the SFF-SIG [Small Form Factor Special Interest Group] has introduced a board-to-board I/O-interconnect standard for embedded systems called SUMIT (pronounced "SUM it") that addresses the issue of faster, smaller, low-power processing, as well. The SFF-SIG seeks to enable practical, mainstream, real-world applications rather than extremely high-performance and high-power-dissipation systems. The SFF-SIG is the only industry group with an entire family of form-factor specifications with bus expansion optimized for the new, sub-10W, two-chip x86 platforms.

I believe that standards are a driving force for unity, commonality, and convergence in this industry. It is now time for embedded designers to recognize and embrace power as a critical design parameter. A problem can be solved only when it is recognized. The embedded industry is aware of the power issue and has begun to actively and aggressively address it. The result will be better, more energy-efficient products that solve problems, not create them.

—Warren Webb

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