Unlocking the future of physical hardware design

Summary

The unique characteristics of today's electronic products are increasingly defined by the 'soft', reprogrammable elements of the design. Read on to find out more…

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Author: Rob Evans

Creating electronic products that offer a genuinely competitive edge relies, in essence, on delivering designs that offer a distinct and recognizable advantage in the marketplace. In the past, the way components were physically placed and connected at the board level could provide a high degree of differentiation. Today, the increasing globalization of the industry and standardization of interfaces makes differentiation at the board level difficult to achieve and sustain.

As electronic products have advanced in response to evolving technology, the true differentiator today is most often the level of intelligence that has been embedded in that device – a trend that's evolved at break-neck speed since cost-effective microprocessors delivered the possibility some 20 years ago. This evolving shift into the soft domain in turn means that a product's real value is largely defined by the intelligence that's programmed into the device, rather than the unique properties of the physical platform it resides on.

What this means for companies developing electronic products is that time spent on board-level implementation details is really an overhead that provides very little long term return on investment. While software running on standard microprocessors offers a solution for parts of an electronic design, the need for control and customization of the underlying hardware platform in embedded systems has meant that custom board design has remained a significant challenge and a large part of electronic product development. The emergence of high-capacity programmable hardware devices such as FPGAs at relatively low cost has the potential to allow a much greater portion of the design process to be done in a soft domain, and free designers from the shackles of a fixed, upfront hardware implementation platform.

The failure of traditional design solutions

A crucial aspect of this, however, is the increased complexity and interdependency of design processes that it entails. As more of a design is moved into a 'soft' platform, the lines between the traditional design disciplines such as hardware, software and FPGA design begin to blur. Dealing with these design elements independently and with separate tools becomes increasing difficult and inefficient.

The move to higher levels of abstraction within individual processes helps to cope with specific complexities – for example, the introduction of high-level software languages and VLSI hardware devices – but at the same time increases the specialization required within each domain. Ultimately of course, these individual elements of the design must be brought together to create a final product, but the increased specialization of each piece is making the final puzzle much harder to assemble. This blows out design times and is ultimately to the detriment of product innovation.

A sequential point-tool approach to electronic product design is, in essence, yesterday's solution trying to cope with today's rapidly evolving industry. Driven by the pressure to maintain a competitive market edge, product development teams are seeking new ways to get more sophisticated, intelligent designs to market faster, while dealing with the increasing complexity this creates in the overall design process.

A unified solution

Rather than the traditional solution of approaching the design problem as a collection of independent processes that are eventually linked together, a unified methodology opens new possibilities by treating the product design process as a single problem.

Unifying the design processes at a platform level creates a product development system that can manage design complexity while harnessing the potential of 'soft' design within the programmable device realm. Bringing together all the hardware and software elements of the design process within one intrinsically-connected environment creates a singular design flow and data model that dramatically simplifies the process, promoting innovation and reducing product development times.

Importantly, unifying design processes also creates an environment where the abstraction level of those processes can be raised as a whole, rather than within each separate piece of the traditional point-tool collection. In this way the complexity of today's designs is managed as a whole, creating a new approach to electronics design that can increase productivity and reduce the need for highly specialized design skills. A truly unified system provides a design paradigm that can fully harness today's programmable technology and deliver productivity benefits that are needed to gain a competitive advantage through sustainable product differentiation.

Redefining the physical hardware platform

Today, the physical hardware platform is most commonly a custom-built PCB, developed as an integral part of the overall product development process. A unified system allows designers to adopt a 'soft' design paradigm and embed the intelligent portions of product – both hardware and software – within programmable elements that exist on a manufactured board. As a result the PCB becomes simply a host for the intelligent devices and a set of standardized physical interfaces needed to connect the programmed intelligence to the 'outside world'.

The emergence of a 'soft' design paradigm decreases the need for full custom hardware development at the board level and lends itself to an alternative concept based on some form of off-the-shelf reconfigurable hardware. When based on readily available low-cost high-capacity programmable components, this approach has the capability to provide designers with a complete hardware platform solution that minimizes, and in some cases, eliminates the barriers and delays associated with producing prototype and production hardware.

Smarter, reconfigurable hardware

Altium's NanoBoard concept was created to harness the full potential of programmable components as a development platform. In essence, a NanoBoard provides a vendor-independent, highly configurable hardware platform that communicates directly with Altium Designer – Altium's unified design system – via the high-level NanoTalk communications protocol.

By harnessing the power of high-capacity, low cost programmable devices, a NanoBoard allows the development and implementation of the embedded intelligence needed in today's designs, while its links to Altium Designer exploit the efficiencies delivered by a unified design process. At a conceptual level a NanoBoard is an open-ended reconfigurable

hardware platform that can be applied to application development and debugging, used as a proof-of-design prototyping platform, or indeed, as the final product hardware.

From a physical and hardware configuration perspective a NanoBoard could be manifested in any form that suits a general application area, with the option of plug-in FPGA/processor and peripheral boards that allow a designer to implement the required application. For example, a battery-powered compact NanoBoard module could be used as a reconfigurable hardware platform for creating portable instruments, or a ruggedized 'industrial' NanoBoard based on the VME or PCI Express standard could be created to target industrial rack equipment.

Regardless of its physical properties, a NanoBoard provides an off-the-shelf reconfigurable hardware platform into which both hardware and software can be programmed. This speeds development of soft designs and reduces, or potentially eliminates, the task involved in custom PCB design. As designs move further into the soft realm, the NanoBoard and Altium Designer will allow designers, regardless of their hardware development expertise, to quickly implement systems that deliver the device intelligence needed to achieve true product differentiation in the market.

At a fundamental level, the flexibility and unified design possibilities of the NanoBoard allow you to commit to hardware decisions much later in the design cycle and update or interactively change the design at any time, without time or cost penalties. This, reinforced by the native processor and FPGA device portability of designs created within the unified Altium Designer environment, has a profound effect on product design cycles. It streamlines hardware design, opens the door to concurrent software and hardware development, and raises design abstraction to a level where existing design skills can be used beyond traditional design boundaries.

The ultimate desktop reconfigurable hardware platform

Altium's latest NanoBoard release – the Desktop NanoBoard NB2–DSK1 brings the NanoBoard concept to the next level by offering the latest interface technology and device support within a reconfigurable product development platform.

Building on the success of the first NanoBoard (NB1), the new Desktop NanoBoard offers greater flexibility with application-specific plug-in peripheral boards and a broad range of plug-in FPGA/processor daughter boards. The Desktop NanoBoard's integrated color TFT touch screen provides an up-to-date application interface, while PC communications are through a high-speed USB 2.0 link to allow fast configuration and download to target devices.

In line with the goal of lowering hardware design barriers in application development, all physical design elements of the NanoBoard and its peripheral and daughter boards are supplied as part of the Altium Designer system. This, combined with the extensive physical design re-use features of Altium Designer, allows designers to quickly and easily move from the NanoBoard environment to custom PCB design and production with minimal engineering effort.

Developing electronics products that offer true differentiation in today's market is fundamentally linked to utilizing programmable devices to provide a configurable platform for embedding intelligence in the form of both software and 'soft' hardware. This requires a system that unifies hardware, software and programmable hardware design, and a reconfigurable platform that supports the exploitation of the freedom that a soft design paradigm gives. Within such a system engineers have the power to innovate and the tools to bring vision to reality faster than ever before.

Read more about Altium's NanoBoard by visiting http://www.altium.com/Products/NanoBoard/