FUSE—Field Upgradeable Systems Environment

Nallatech Ltd. offers a "circulation system" to link FPGA platforms with board platforms.

by Derek Stark
Design Engineer, Nallatech Ltd.
d.stark@nallatech.com

Dr. Malachy Devlin
Innovations Director, Nallatech Ltd.
m.devlin@nallatech.com

Xilinx's "Platform FPGA" initiative provides a visionary way forward for the development of a new generation of embedded systems. The Virtex-II™ family of FPGAs are at the heart of the initiative with many new and flexible features from an extensive range of hard and soft intellectual property. Nallatech – a Xilinx XPERTS Partner – has consolidated its board level systems expertise and is complementing the Xilinx effort with the Nallatech systems framework called FUSE™. This "Field Upgradeable Systems Environment" framework provides the fusion between silicon systems and hardware systems, allowing accelerated time to market and in-field support.

The FUSE Design Environment

The FUSE system was initially devised in 1998 as the first system framework to provide greater support to designers who require a distributed FPGA platform. Combined with a highly scalable board platform, the FUSE framework allows the rapid creation of new end products.

As illustrated in Figure 1, the FUSE system has evolved out of the proven framework used by the award-winning DIME (Dsp and Imaging Module for Enhanced fpgas) platforms. (For more information on DIME technology, see "Build Scalable DSP Systems with Nallatech DIME Modules" in this issue of *Xcell Journal*.) DIME-based platforms offer very flexible and scalable modular systems for FPGA-based product development. The goal of the FUSE framework is to provide product systems engineers with the following key benefits:

- **Intelligent hardware** – for Plug and Play
- **Harness latest FPGA developments** – to support Virtex-II family of FPGAs
- **Multiple platform support** – for Windows, Linux, etc.
- **Scalable systems** – to support high end applications
- **Flexibility** – to accelerate time to market
- **High performance and bandwidth** – for high speed communications
- **Field upgradeablity** – to streamline product support
- **Proven technology** – for risk reduction.

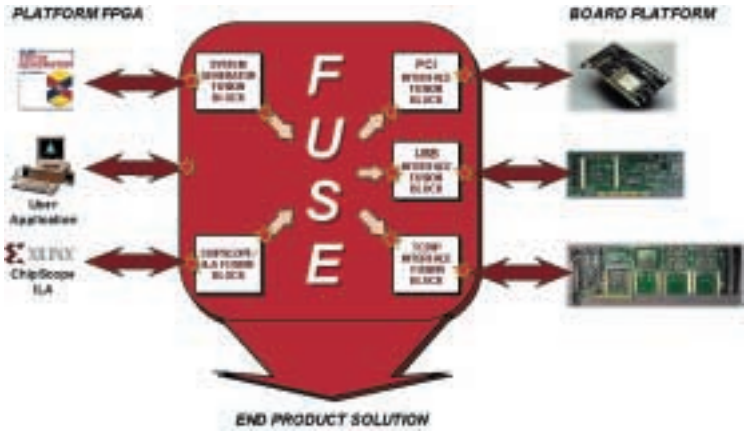

Figure 1 - FUSE: the fusion of the FPGA platform and the board platform

Systems Silicon and Systems Hardware Fusion

The FUSE framework is the circulation system for linking the features currently available for the FPGA platform to those available on a board platform. The FUSE system allows for the integration of features and standards from the board platform, such as DIME modules, with many of the high level design tools such as the Xilinx ChipScope ILA (Integrated Logic Analysis) debugging tool and System Generator software. The FUSE framework offers the capability to easily control and configure distributed FPGA systems, whether they are tightly coupled, such as on a PCI board, or loosely coupled over the Internet. This flexibility, along with the abstraction of the communications channel and control, enables systems engineers to kick start product development and to provide added value.

The creation of this systems environment enables the use and control of intelligent hardware such as Plug and Play detection of attached DIME modules. System hardware, based on the DIME standard, gives the ability to rapidly create ideal physical hardware platforms for many requirements. This is accomplished by harnessing the arsenal of DIME modules that provide a variety of real world interfaces, such as high end ADCs (Analog to Digital Converters), DACs (Digital to

Analog Converters), and imaging devices. The variety of DIME modules and DIME carrier boards allows for the immediate construction of highly scalable systems suitable to the application at hand as shown in Figure 2.

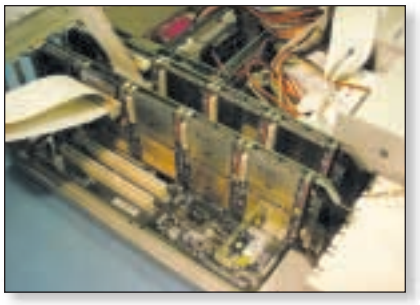

Figure 2 - High performance FPGA system with 16 Virtex-E devices capable of over 200 billion MACs

Fusion Blocks

One of the key elements and openness of the FUSE system framework is the use of Fusion Block™ interfaces. These blocks allow for interfacing support between the board platform and FPGA platform tools. For example, a Fusion Block interface can be provided to allow transparent interfacing between an FPGA-based card and ChipScope ILA software. Similarly, a Fusion Block interface can be used to facilitate interoperability among MATLAB™ modeling tools, System Generator software, and DIME modules. This interfacing capability allows designers to utilize data received from the platform, which can feed back information on the capacities available, or present the real world interface models to the designer.

The integrated FUSE framework allows for straightforward integration of new boards and software tools by providing the hooks through the Fusion Block interfaces. The logical approach means that new tools can be rapidly integrated to provide designers with the latest design tools to increase their productivity.

Virtex-II PCI Card Supports FUSE System

In accordance with the introduction of Virtex-II as the first platform FPGA, Nallatech has introduced a variant of its existing and successfully proven DIME Carrier Motherboard, the Ballynuey3™. The card is a 64-bit PCI-based card with four DIME module slots that allow for resource expansion through the use of specific DIME modules. The PCI interface is contained in a Xilinx FPGA, thus allowing for full field upgradeability of the interface to the board. The board sports an onboard Virtex-II FPGA with connected resources, such as independent banks of ZBT (Zero Bus Turnaround) SRAM. System services are provided through the PCI interface, allowing operability through the Fusion Block interfaces to other tools such as ChipScope ILA debugging software. A functional diagram of the board is provided in Figure 3.

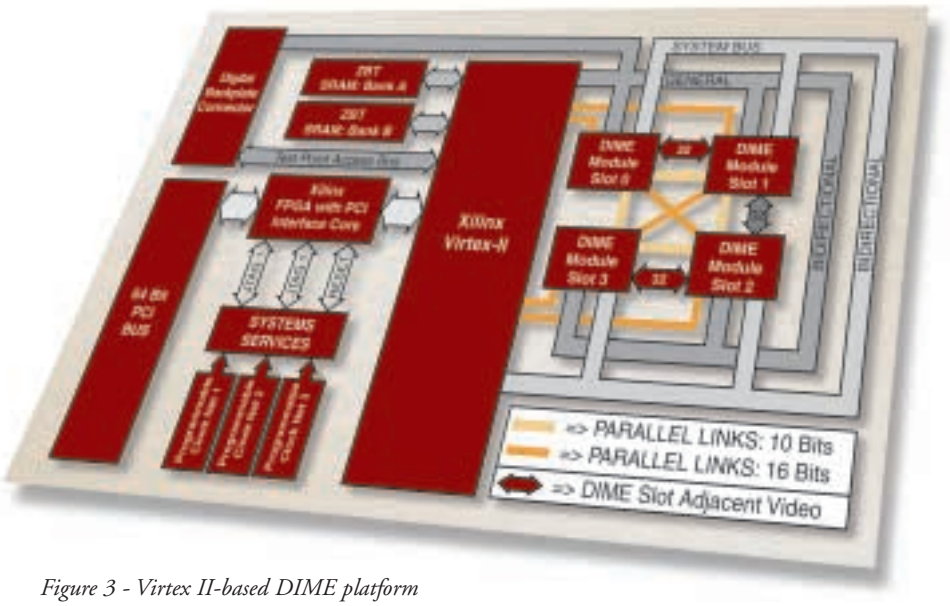

Figure 3 - Virtex II-based DIME platform

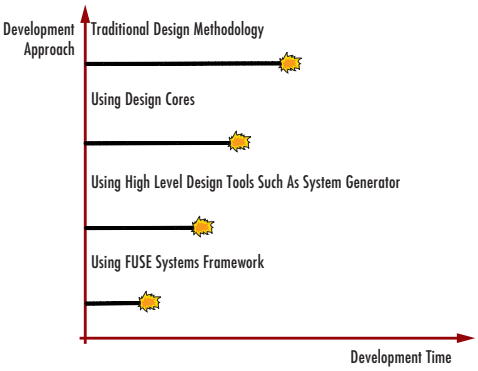

Figure 4 - Accelerating time to market with FUSE

Conclusion

As the complexities of product design increase, the tools and infrastructure to accelerate time to market are critical. The power and flexibility of the Xilinx FPGA platform initiative, complemented by the FUSE system framework from Nallatech, enable the most rapid delivery of final product solutions to customers, as illustrated in Figure 4. The benefits of the FUSE system framework approach have already been proved – demonstrating that time to market savings by a factor of five are realistically achievable.

A typical use of the FUSE framework was explained by Richard Chamberlain, image simulation engineer at Matra BAE Dynamics, "With the FUSE platform and DIME hardware from Nallatech, we were able to reduce our overall design time for our FPGA-based 3D simulator system by around a factor of five. This clearly shows the power of utilizing a proven systems framework to create an end product solution in an optimal design time."