PENTEK: DSPS, FPGAS, IP, XILINX - MADE "EASIER" IF NOT "EASY"

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Q. **First of all, tell us a little bit about yourself and your responsibilities at Pentek.**

A. After working as design engineers for a test instrument manufacturer, when the company scaled back operations in 1986, four of us founded Pentek. We adapted the digital signal processing, frequency synthesis and data acquisition technology from the instruments we had designed into open-standard board level products.

At Pentek, my duties involve new product definition, development of presentations that explain our technology to our customers and sales engineers, conducting customer seminars, webcasts and training, authoring technical papers and making presentations at industry shows and events.

Q. **When engineers talk about FPGAs, the first names that probably pop into their head are Xilinx and Altera. Pentek, in contrast, has built quite a successful business based on FPGA- and DSP-based boards. Would you give us just a nutshell summary of what Pentek does?**

A. Pentek delivered the first commercial DSP board based on a Texas Instruments processor in 1987, and the first commercial software radio board, based on the Graychip digital down converter (DDC), in 1991. As FPGAs acquired DSP capabilities with hardware multipliers, Pentek was among the first to offer FPGA design kits for our boards so our customers could easily add their own IP algorithms.

Pushing the envelope of FPGA resources, in 2003 Pentek series of extremely high-performance FPGA cores for FFT, DDC, and pulse compression algorithms and now offer a wide range of DDCs as factory-installed IP cores on Pentek products.

Our latest products take full advantage of gigabit serial interfaces, following open industry standards including XMC and VXS. These interfaces eliminate data bottlenecks that otherwise would restrict data transfers required in high-performance embedded systems.

Q. **Pentek is a Xilinx partner, and one of the things you mentioned in the pre-interview was how Pentek can help engineers sort through the Xilinx FPGA families and find ones that are "best matches" for their design needs. How would you recommend an engineer go out figuring out the "best" Xilinx FPGA for his design application?**

A. Development tools for the very latest devices often need to stabilize, so look at the release history – you don't want to be the very first user. If you're considering a new generation FPGA device just released, compare features with the previous generation devices to see if the new features in the latest generation really offer a tangible benefit in your application. If not, stick with the previous generation for better pricing, availability, and tool support.

The sub-family approach Xilinx has taken in Virtex-4 and Virtex-5 generation devices, allow you to choose devices based on the type of resources you need most – logic, DSP, serial interfaces, and embedded computing. With common footprints (pin definition) across sub-families, you can design one board that can accommodate different resource requirements.

Q. **Xilinx comes out with new FPGAs quite frequently. Are there new ones that you find particularly exciting? New capabilities that make possible new or better applications?**

A. Since we are most interested in the DSP capabilities, the new DSP48E engine in the Virtex-5 devices with its 25 x 18 multiplier and 48-bit accumulator improves the dynamic range and accuracy of DSP algorithms, which is extremely important for software radio and radar applications.

The Virtex-5 also extends the gigabit serial interfaces in the "T" suffix devices with clock speeds now at 6.25 GHz to support the rapidly growing use of serial standards for moving data within embedded computing systems.

Q. **The "design process" can be just as important as the actual technical specifications of the design itself. How would you recommend a designer go about an FPGA-based application? Should he talk first to Xilinx, and then to companies like Pentek? Or vice-versa? Should he "spec out" his requirements first and then approach vendors in the FPGA space? Or should he engage when he is still at the "early design phase?" In terms of your own projects, at what stage do you recommend a customer engage with Pentek, and how do you recommend structuring the "design process?"**

A. We talk to many customers who are just beginning their design study, and this often proves to be extremely helpful. We can explain to the customer why we have chosen a particular device for each of our FPGA-based products and what some of the tradeoffs are. We can show exactly what algorithms, IP and features we were able to incorporate in specific FPGA devices for each product to give him a sense of what might be possible in his design.

In some cases, one of our standard products might satisfy his application, or we might be able to modify a standard product by adding a few critical features. This invariably saves time, money and risk in his project.

Q. **FPGAs often strike fear and dread in the hearts of the uninitiated. Tell us about Pentek's *GateFlow* - what is it? How is does it make working with FPGAs easier?**

A. Each of our FPGA-based products are offered as a standard module with a wealth of FPGA resources, A/Ds, D/As, DDCs, DUCs, memory, timing and clocking systems, and bus interfaces. They are all connected, tested and supported with software drivers.

Because a large percentage of the FPGA resources are unused, all of these products are supported with our GateFlow FPGA Design Kit to help our customers add their own FPGA code the existing FPGA infrastructure. We provide a complete Xilinx ISE project folder that the customer installs on his ISE workstation. It includes VHDL source code for all of our functional modules, pin definition files, and everything else our designers developed for the standard product.

The customer can keep all of the supplied VHDL modules and build his own algorithms around them, or he can modify, delete or replace those modules, as required. This extreme flexibility lets the customer start with a fully functional FPGA design on an actual hardware board with

working interfaces and software support, which he does not have to design, debug, characterize and document. The GateFlow concept was pioneered by Pentek and has now been adopted by many vendors.

Q. **One of the most interesting features about *GateFlow* is how it works with "intellectual property" or IP. There seems to be IP from vendors like Xilinx, IP created by vendors like Pentek, and then IP created by the customer himself more unique to his application. Does *GateFlow* help Pentek customers integrate these types of IP? What does *GateFlow* bring to the "IP Party?"**

A. GateFlow includes all of the "arms and legs" of the FPGA design, tailored for the unique collection of data converters, DDCs, memory and interfaces of the specific hardware module. This part of the design is often the most difficult to develop because it depends heavily on the particular characteristics of each peripheral device.

IP cores are usually algorithm engines with input, output and control ports that need to be connected to data and control structures of the actual hardware environment. GateFlow sets the stage for these IP connections, often saving the designer months of working out interfaces issues.

Q. **For customers that are new to IP, is it common (or even possible) for them to get boards from Pentek that are "nearly there" in terms of the IP on board? For a customer doing, say, a software radio application, can he come to Pentek and get a board that is 95% ready?**

A. Yes, in some cases we need to add a special time-stamp function, or a triggering mode, or a unique data format to meet the special requirements a customer may have. Since our engineers designed the product and are extremely familiar with all of the FPGA structures, they can often make the change much more efficiently and far less expensively than the customer.

Q. **Thank you for this interview.**