There is a lot of discussion about the ongoing economic viability of Moore's Law. In the last year, the 20nm node has moved front and center into the debate. Despite the rhetoric, industry leaders are actively developing products at 20nm, including Xilinx. There is only one explanation for the design activity; 20nm offers tremendous opportunity to create customer value, and in the case of Xilinx, enables customers to leverage products that are a generation ahead of its competition, and will provide the most compelling programmable alternative ever to ASICs and ASSPs.

Xilinx is optimizing the 20nm All Programmable portfolio to address the requirements of next generation ever ‘smarter’, highly integrated, bandwidth hungry systems. These applications include: 1) intelligent Nx100G - 400G wired networks, 2) LTE advanced wireless base stations employing smart, adaptive antenna, cognitive radio technologies, baseband and backhaul equipment, 3) high throughput, low-power data center solid state storage, intelligent networking, and highly integrated low latency application acceleration, 4) image/video processing including intelligent ‘embedded vision’ for next-generation displays, professional cameras, factory automation, advanced automotive driver assistance, and surveillance systems, and 5) leading edge connectivity for almost every application imaginable.

Staying a Generation Ahead at 20nm

To understand the true value of 20nm to Xilinx products and customer applications, it is important to understand the technology innovations that created an extra generation of value at 28nm. Rather than simply move to the next node with traditional FPGAs, Xilinx engineered numerous FPGA innovations and pioneered the first commercial All Programmable 3D ICs and SoCs. These All Programmable devices, shipping today, employ all forms of programmable technologies; going well beyond programmable hardware to software, beyond digital to analog mixed signal (AMS), and beyond single die to multi-die 3D IC implementations. This new generation of devices has now been proven with hundreds of customers.

At 20nm, Xilinx is now working on its 2nd generation of SoCs and 3D ICs, as well as next-generation FPGAs. Xilinx is benefiting from a multi-year head start over the competition in multiple areas; fine tuning real SoC and 3D IC products with hundreds of real customers; developing new ecosystems, supply chains, and processes for quality and reliability; ‘co-optimizing’ these devices with its next-generation Vivado™ Design Suite tools; and redefining how high-performance transceivers are optimized in the system. This allows Xilinx to infuse the added value of 20nm to each of the technologies pioneered and proven at 28nm, keeping Xilinx and its customers a generation ahead.
STAYING A GENERATION AHEAD AT 20nm

Figure 1: Xilinx is now working on its 2nd generation of SoCs and 3D ICs, as well as next generation FPGAs.

From 28nm to 20nm FPGAs with Optimized Performance/Watt

With 28nm 7 series FPGAs, Xilinx was able to provide an extra generation worth of performance/watt by combining innovations in process technology (HPL process with TSMC) with numerous design optimizations for minimal static and dynamic power and maximum performance of key building blocks. Xilinx was also able to provide the highest I/O, DDR and transceiver bandwidth, and the industry’s best transceiver adaptive equalization for in-system channel optimization.

The 8 series FPGAs lay the foundation for Xilinx to stay a generation ahead at 20nm. These devices will leverage the TSMC 20nm SoC process with similar performance/watt characteristics of the HPL process at 28nm. They will enable 2x system level performance, 2x the memory bandwidth, half the total power, and 1.5x more integration of logic functions and critical system building blocks. Designers will leverage higher speed fabric and 2nd generation system-optimized transceivers in high-performance applications, while developers of wireless LTE, DSP and image/video applications can leverage its faster DSP, BRAM, and DDR4 memory interfaces. All applications will benefit from Xilinx’s next-generation routing architecture that easily extends resource utilization beyond 90 percent for higher quality-of-results and faster design closure.

From First to Second Generation All Programmable SOCs

Xilinx 28nm Zynq™-7000 All Programmable SoCs represent the first hardware, software, and I/O programmable devices in the world. By enabling the integration of a dual-core ARM® A9 embedded system, DSP, logic, and mainstream AMS functions, Xilinx was once again able to provide an extra generation of system performance, integration, and power reductions.

To stay a generation ahead at 20nm, Xilinx will be delivering significantly higher system performance with a new heterogeneous processing system. This embedded system will be coupled to the next-generation FPGA fabric with >2x the interconnect bandwidth. On-chip analog mixed signal performance will double, while programmable I/O will be upgraded with next generation DDR4 and PCI-Express® interfaces. This new level of embedded processing performance and I/O bandwidth will be complemented by SoC level power and security management. This 2nd generation All Programmable SoC will enable the highest level of programmable systems integration and meet the most aggressive system level specifications.
From First to Second Generation All Programmable 3D ICs

Xilinx 28nm homogeneous and heterogeneous Virtex® 3D ICs doubled the design capacity, system level performance, and level of systems integration relative to what was possible with a pure monolithic solution—creating an extra generation of value. Both FPGA and transceiver mixed signal die are integrated with over 10,000 programmable interconnect through a silicon interposer in Xilinx's stacked silicon interconnect (SSI) technology.

To stay a generation ahead at 20nm, Xilinx will be extending its 3D IC architecture with a two-level interface, enabling both homogeneous and heterogeneous die integration based on open industry standards. This will result in increased logic capacity of >1.5x or 30-40M ASIC equivalent gate designs. In addition, these devices will feature 4x the transceiver bandwidth, leveraging >33Gb/s transceivers (ultimately going to 56Gb/s). In addition, DDR4 high-performance memory interfaces and integrated memory die with wide, high bandwidth, low power interfaces will enable the highest performance applications.

To support the highest levels and performance and ease of design, programmable interconnect bandwidth will increase by over 5x. With this new level of interconnect coupled to new types and capabilities of programmable die and memory, Xilinx is developing 2nd generation ‘All Programmable’ 3D ICs enabling the highest level of programmable systems integration.

From Optimized to ‘Co-optimized’ for Quality of Results and Productivity

In the previous four years leading up to 28nm, Xilinx developed, from the ground up, a next generation design environment and tool suite: Vivado Design Suite. Without this design suite, Xilinx’s 3D ICs could not be effectively leveraged. For FPGAs and SoCs, the new design suite further improves the quality of results (QoR) of designs by up to three speed grades, cuts dynamic power by up to 50 percent, improves routability and resource utilization by more than 20 percent, and speeds time to integration and implementation up to 4x.

Xilinx is now further ‘co-optimizing’ its 20nm silicon devices with the next-generation Vivado Design Suite tools. By architecting and optimizing the tools, devices, and IP together, designers can extract maximum value out of the silicon while shortening their design and implementation process. As a result, these next-generation 20nm FPGAs, 2nd generation SoCs and 2nd generation 3D ICs will deliver an extra node of performance gains, significantly lower power, and the highest levels of programmable systems integration, while further accelerating the time to integration and implementation.
Delivering Customer Value

Semiconductor industry leaders are finding value in 20nm and designs are underway. Xilinx sees tremendous potential at this node and is finding new ways to multiply that value through innovations established at 28nm and extended for 20nm. This portfolio will provide the most compelling programmable alternative ever to ASICs and ASSPs. Deploying 20nm technology into a combination of All Programmable FPGAs and 2nd Generation SoCs and 3D ICs is enabling Xilinx to deliver value that is a generation ahead of a typical process node and enabling both Xilinx and its customers to stay a generation ahead of its competition. Xilinx will be announcing more specifics by family as the portfolio is rolled out. Xilinx is already engaging with strategic customers on its 20nm FPGAs with restricted access to product definitions and documentation.

Take the NEXT STEP

To learn more about Xilinx's 20nm product development, please visit: www.xilinx.com/20nm