ARM cores meet fpga fabric

Xilinx puts more flesh on the bones of its Extensible Processing Platform. By **Graham Pitcher**

Programmable logic has been making inroads into many areas which have traditionally been the province of other technologies, such as asics, assps and even microcontrollers. But there has been the realisation – mainly expressed quietly – that programmable logic doesn't have answers to all the questions.

Admitting this apparent shortfall, Xilinx laid the ground in April 2010 for what it called a 'new class of device'. Described as an 'extensible processing platform', this device would blend the power of an ARM Cortex-A9 MPCore multiprocessing system with the benefits of the programmable logic fabric.

At the time, Xilinx' Vin Ratford said the move had been made in response to demand from customers for more powerful programmable devices which cost less, consume less power and which are smaller than current fpgas. "FPGAs have always delivered on performance," said Ratford, "but they haven't always done so on power, cost and size."

Xilinx promised that more details would be forthcoming early in 2011. And, right on time, those details are now available.

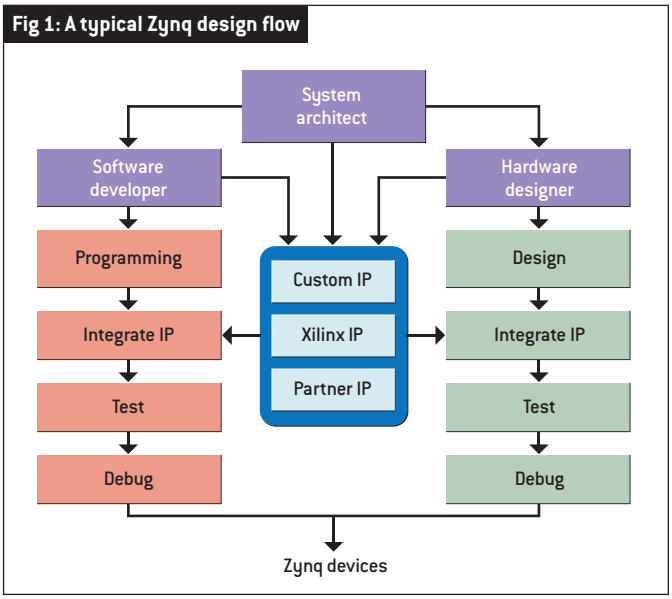
The family, which includes four members, is called Zynq. According to Stephane Monboisset, senior processing platform marketing manager, members of the Zynq family are 'assp like'. "Zynq is to extensible processing platforms what Virtex is to the fpga sector," he asserted. "But Zynq devices are not assps and they are not fpgas."

Meeting the user demand outlined last year, Xilinx says it has created devices which are 'more than a processor, more than an asic and more than an fpga'. "Embedded designers need devices which are more closely targeted at their applications," Monboisset continued. "But fpgas don't offer a viable alternative if you need performance with low power."

The Zynq family will be competing with three existing design options: asics; assps; and what Monboisset called two chip solutions – notionally a combination of microcontroller and dsp. "If you need performance and flexibility," he claimed, "none of these choices work. ASSPs are good if you have one that does the job and you don't need flexibility."

Zynq has three important elements, said Monboisset. "Firstly, it includes a complete ARM processing system, not just a core. The processor will boot first and will control the programmable logic fabric." It's a single die device, with the programmable logic fabric tightly coupled to the two ARM cores through 'more than 3000' internal interconnects. Both ARM cores can be clocked at up to 800MHz and feature the NEON multimedia extension, as well as single and double precision floating point support. "Although the ARM cores can be clocked in excess of 1.5GHz, running them at that speed trades off performance at the expense of power consumption," Monboisset noted. "But if more power is needed, then the programmable fabric can be used as an accelerator." Other features of the processing system include static and dynamic memory controllers, two L1 caches, each offering 32k for storing data and instructions, a unified 512k L2 cache and 256k of embedded dram.

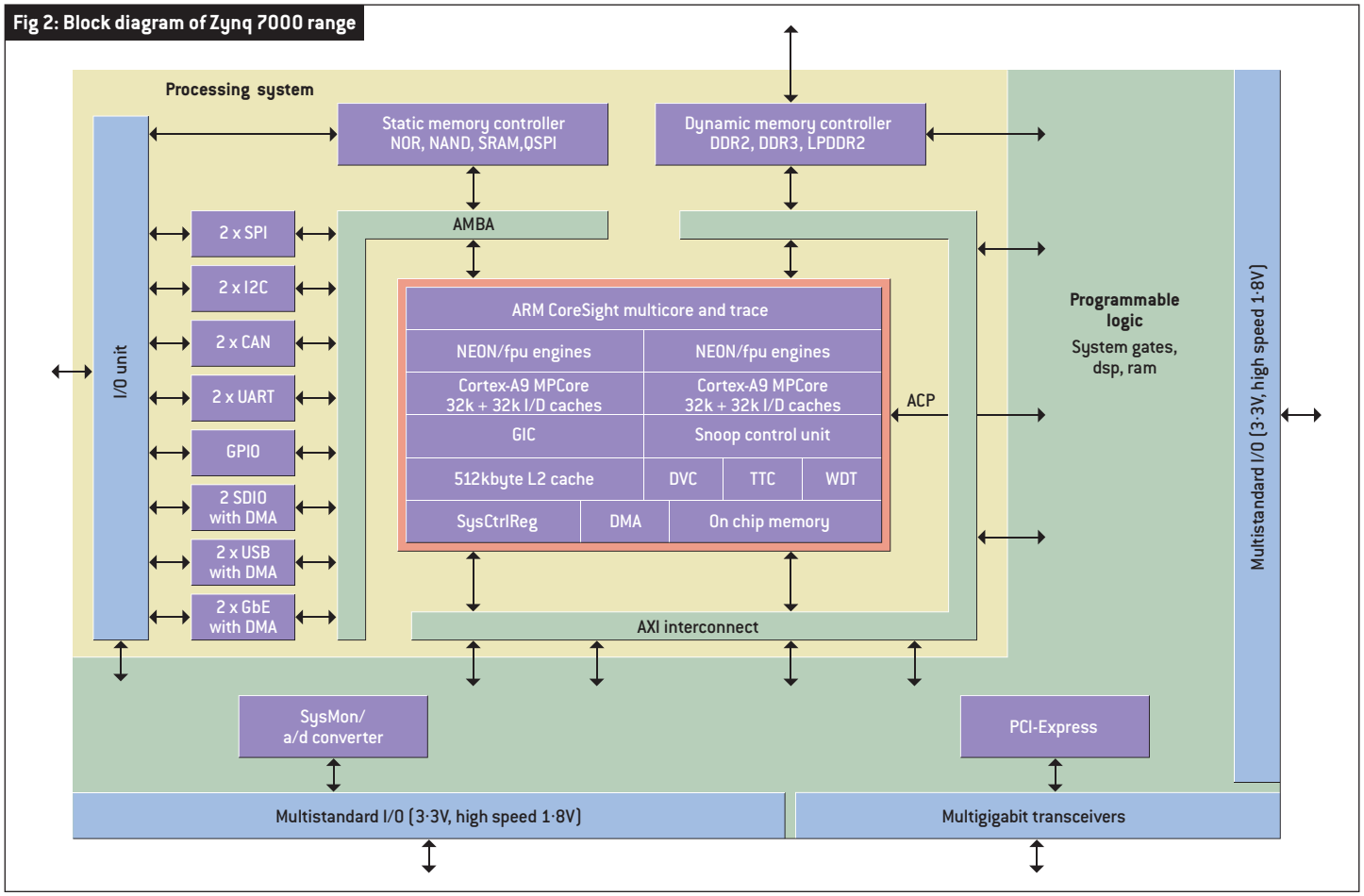
Fig 1: A typical Zynq design flow



Monboisset: "Software and hardware design can start in parallel from day one."

The second element is the programmable logic fabric. "This is based on Xilinx' 7 series technology," Monboisset pointed out. Across the four devices currently announced, the fabric extends from 430k to 3.5million asic equivalent gates. "In fpga terms," said Monboisset, "that's between 28k and 235k logic cells." The 3000 interconnects with the processing system support an internal bandwidth of up to 100Gbit over nine AXI interfaces. "There are also up to 760 dsp engines available," he added. Each of these is a dsp slice, with a 25 x18 multiplier and a preadder. "Together, these can offer more than 910GMACs of processing power."

Fig 2: Block diagram of Zynq 7000 range



The final element is external I/O. There are 54 processor I/Os supporting integrated peripherals and static memory, including DDR2 and DDR3, NAND, NOR and QSPI. There are up to 350 multistandard I/Os, 200 of which support 3.3V interfaces, the remainder run at 1.8V. Along with 17 a/d converter inputs, there are up to 12 transceivers running at up to 10.3Gbit/s. The two largest devices also offer PCI-Express interconnect.

The four devices launched are the Zynq 7010, 7020, 7030 and 7040. While all feature identical ARM based processing systems, they differ in the programmable logic fabric. The 7010 and 7020 are based on Artix-7 and optimised for cost and power. The 7030 and 7040, meanwhile, are based on Kintex-7 technology, bringing support for multivoltage I/O and transceivers.

For the moment, the range contains these four devices, mapped against a range of target applications, such as driver assistance, factory automation and broadcast cameras. Motor control is seen as one possible application in the factory automation sector. "Motor control is a company's 'secret sauce'," Monboisset claimed. "As every motor is different, designers have tended to use two chip solutions, but performance is lower because the two chips are not tightly coupled." Zynq devices are likely to target larger ac motors.

In the automotive world, changing standards rule out the use of asics. "While Zynq devices may not be as good as asics when it comes to cost," Monboisset admitted, "when you look at the total cost of ownership and at the risk, then it's a 'no brainer'."

The parts also use what Monboisset called a 'familiar design flow'. "Software and hardware design can start in parallel from day one," he claimed. "Software developers can start running code on a development board, while hardware designers can start using, for example, Xilinx IP. Once the hardware is designed, a board support package can be generated and software designers can use this to retarget and debug in an integrated environment."

Those designing with Zynq parts will be able to access the ARM ecosystem. "Any code will run," Monboisset asserted, "and developers can take advantage of work done by ARM partners."

While Xilinx has allowed a number of companies to take part in an early access programme – early access customers include Agilent's life sciences group, National Instruments and iVeia – other potential users will have to wait for devices until the latter half of 2011 or the first half of 2012. All parts will be in production by the end of 2012.

A range of operating systems will be supported, but Monboisset said there had already been an 'overwhelming request' for Linux. Interest has also been expressed in Android and Windows CE is a potential OS for graphical interfaces.

So far, virtualisation is not supported. "It's something that's been asked for and which we're looking at," Monboisset concluded.