



# Armed and ready . . .



Larger memory and more powerful processing are the embedded designer's weapons of choice. By **Vanessa Knivett**.

**T**he pc as we know it might be driving less of the microprocessor market than it once did, but it's a new generation of pc oriented micros that could be at the root of one of the notable technology trends playing out over the last few months.

It's by no means a new technique, but multithreading on multicore designs is growing in popularity as the conflict between processing power and power consumption reaches new heights in applications such as networking and multimedia content delivery.

Confirming a surge in popularity of multicore designs, it was the first time that no papers were presented about single core high performance processors at ISSCC this year – instead, five approaches to multicore processing were under discussion. Meanwhile, the first Multicore Expo was held in California in March, profiling some of the latest multicore, multiprocessing, or multithreading implementations.

Multithreading, whereby a cpu shares tasks (or threads) to make the most of the

**Right:** Paul Ledak, vp of engineering and technology services at IBM, holds a 12in wafer full of Cell microprocessors next to an image of an X-ray application.



IBM's Cell microprocessor is set to move from the gaming market into industrial and medical applications.

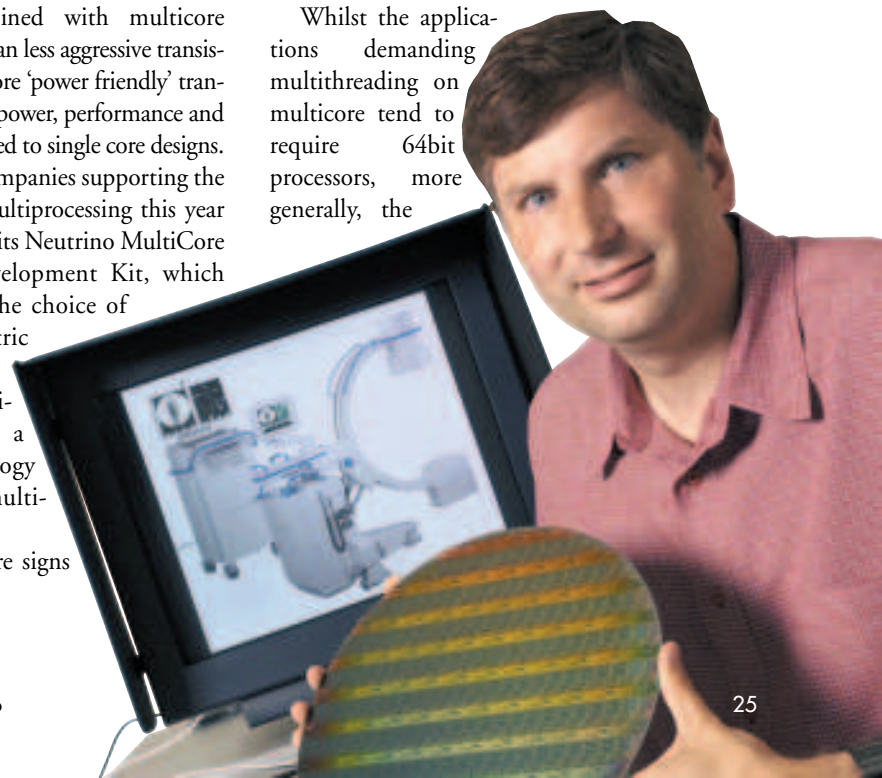
processor, combined with multicore processors can mean less aggressive transistor scaling and more 'power friendly' transistors, leading to power, performance and cost gains compared to single core designs.

Among the companies supporting the possibilities of multiprocessing this year were QNX, with its Neutrino MultiCore Technology Development Kit, which gives designers the choice of using asymmetric multiprocessing, symmetric multiprocessing and a new technology called bound multiprocessing.

And there were signs

that one of the best known examples of a multithreading, multicore chip – IBM, Sony and Toshiba's Cell – will move out of the gaming industry and into industrial and medical applications following IBM's collaboration with Mercury Computer Systems. Meanwhile, Freescale unveiled its third generation multicore dsp at the 2006 Spring Processor Forum. Based on the SC3400 StarCore technology, the quad core MSC8144 has been designed for wireline and wireless infrastructure applications providing voice, video and data – triple play.

Whilst the applications demanding multithreading on multicore tend to require 64bit processors, more generally, the





**"We are seeing an increased demand for general purpose mcus with flash memory, which provides flexibility."**

Bart Ladd, **NEC Electronics**

embedded market is moving to 32bit processing, as exemplified by the release of MIPS multithreaded 32bit risc processor cores for applications spanning set top boxes, network routers, digital TVs, digital



**Above:** The Sony Reader is an application that is driving demand for both removable and embedded memory technologies.

cameras and portable media players. Automotive applications are also behind a number of the latest 32bit releases, with dashboard, navigation, heads up displays and infotainment applications behind Fujitsu's launch of the MB91460 series of 32bit mcus with embedded flash.

Meanwhile, launching 28 32bit additions to its flash mcu line, NEC Electronics America's general manager for standard solutions, Bart Ladd commented: "Competition in the consumer electronics market continues to grow, and we are seeing an increased demand for general purpose mcus with flash memory, which provides flexibility for designers building high performance products in smaller volumes."

Indeed, whether it is for consumer goods requiring more refined motor control algorithms to be included on chip or portable devices providing advanced image processing, 32bit mcus are accommodating as much as 2Mbyte of flash. One example of this trend is Toshiba's MIPS based TMP19A64F20AXBG, which incorporates 2Mbyte of NANO flash, a combination of NAND and NOR attributes that is said to achieve high density and very low power consumption, ostensibly for battery operated consumer devices, such as digital cameras. Toshiba says the mcu's memory cells are connected in parallel to bit lanes, to provide the high speed random access required for embedded program memory. Meanwhile, program and erase times have been improved with the addition of NAND flash architecture with Fowler-Nordheim tunnelling.

With developers no longer restricted by cost to smaller microcontroller platforms with minimal ram, there has been an increase in the variety of embedded rtos available. Whilst Linux is finding application in the embedded domain, scalability and security are likely to be key factors governing rtos choice for the development of multifunction, connected devices.

Whilst the current generation of 32bit mcus with integrated flash caters to many of these devices' storage needs, vendors are using a variety of methods to strike a balance between ease of programmability and security. Program data and data stored is at risk of being poached because flash requires a voltage supply to erase contents, so when none is available, it is retained indefinitely.

MCU vendors are tackling the issue with a mixture of software and hardware approaches. For example, NEC's V850 32bit all flash mcus enable users to rewrite software multiple times, even after manufacturing and implementation, making it possible to shorten application development times. But there are a number of security features available to the oem that provide different levels of user interaction with the Flash memory once the product is in the field, including chip erase protect, block erase protect and write protect fea-



**Above:** Amino Communications' AmiNET124 set top box employs Texas Instruments' single chip DM642 dsp for H.264 decode and application software.

**Below:** 3D graphics for roaming games content is just one of the applications that will push the capabilities of smartphones.

tures. Notes Steve Norman, from NEC UK's Industrial Marketing group: "In a secure application, such as point of sale or medical, the entire flash memory can be securely protected from any interference. However, for an application that may need to be upgraded in the future (for example, a vending machine with new prices) or something like a washing machine that is storing program data in a small section of the memory, the oem can reserve space in the memory to allow this access."

**DSP in different guises**

Another mcu trend is that of integrating dsp capabilities. The AVR32, Atmel's 32bit embedded cpu, is one example, featuring dsp extensions for handheld multimedia devices. Such consumer infotainment applications require





"... it's difficult to digest the notion that a processor could be more powerful using fewer clock cycles."

Oyvind Strom, **Atmel**

the execution of computationally intensive dsp algorithms and minimal power consumption. Explaining how Atmel has tackled the power issue, Oyvind Strom, AVR32 product director said: "The approach we have taken with the AVR32 is to increase the amount of processing the processor can do internally during each clock cycle. Although it's difficult to digest the notion that a processor could be more powerful using fewer clock cycles, that is exactly what we are doing."

Strom has said that handheld multimedia systems typically require three assps/mcus and a dsp to perform board control tasks, which is very power intensive. Power reduction is among the benefits of combining mpu and dsp functions

Analog Devices' Blackfin 32bit rics processors are enabling portable media players, such as the V300, pictured, to play up to eight hours of Mpeg4 video and up to 16hours of MP3 music.



Car navigation systems are among the automotive applications that are driving the demand for 32bit microcontrollers with integrated flash.

on one chip – as important is that there is only one design flow and one set of design tools to contend with.

Forward Concepts' president Will Strauss confirms that, whilst the general purpose dsp market is seeing growth in 2006 thanks to 3G and 2.5G, the biggest opportunities are in the embedded dsp market where the market has grown to \$14.3billion, or almost twice that of general purpose dsps. "This embedded market is served by more than 100 chip vendors providing dsp technology in various forms. The many embedded dsp markets are dominated by companies like Qualcomm, Broadcom, Infineon and Marvell, while the major risc vendors have all added dsp capability to their IP offerings."

Strauss mentions TI's heavily promoted DaVinci video initiative, which may have contributed to a jump in consumer dsp/assp shipments in early 2006. These dsp based SoCs integrate coprocessor engines to accelerate digital video applications. Using APIs, the objective is to introduce digital video to an application without the designer having to program any dsp code.

It is generally recognised that the embedded consumer device market is the predominant driving force behind general electronics development

– yet it's easy to overlook the impact these developments will have outside the goal of enabling consumers to be connected anytime, anywhere.

For the purpose of simple illustration, take the example of high quality digital audio, an important factor in the success of both the MP3 and home entertainment market. Among the trends tipped by In-Stat at the beginning of 2006 was digital audio projection, which made headlines when Yamaha's YSP-1 digital audio projector received a 'Best of Show' award at CES. The device emits concentrated sound beams through an amplifier/speaker array, with the narrowness of the beam allowing it to bounce off walls without disruption.

In-Stat contended that digital audio projection would consume more than 1million dsps per year by 2007. But whilst the technology is likely to be introduced in integrated home entertainment systems in the future – notably digital tvs – military applications are emerging. The US military is reputed to already be using a highly directional hailing device that maximises energy on the intended subject while minimising impact on surrounding areas.

How society uses more powerful and more 'connected' devices will be interesting to see – but as the consumer 'embedded revolution' unfolds, other sectors will be keen to capitalise on developments. 