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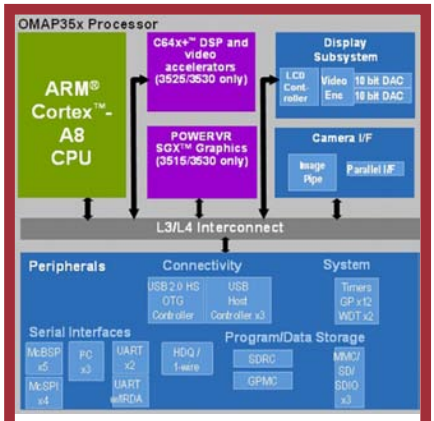
SmartPhone Accessibility

Barry Husbands, Blue Chip Technology's MD, looks at making Smartphone technology accessible to industrial systems designers.

The traditional role of industrial controllers has not changed dramatically over time, but users' expectations certainly have! Equipment operators and the general public, who have become accustomed to smartphone-like, rich multimedia experiences, find industrial interfaces implemented with monochrome alphanumeric displays disappointing by comparison. Furthermore, newer markets are creating opportunities that simply did not previously exist for controllers that are sufficiently powerful, energy efficient, small, rugged and cost-effective to make commercial and technical sense. Examples include digital signage, handheld instrumentation and fixed and mobile surveillance.



TI's Omap35x processor.

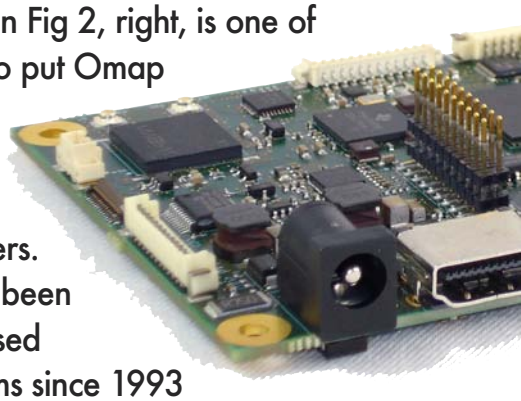
However new, integrated Arm RISC based multicore CPU technology allows industrial systems designers to meet these challenges in a way not possible with x86 silicon. Arresting multimedia interfaces backed by powerful computational capacity and connectivity can be achieved using low power, compact hardware.

We take a look at this Arm based architecture, why it suits modern embedded controllers and human machine interfaces, HMIs, better than other CPU architectures, and the functionality it has available. This is illustrated by a description of the RE2, one of the first embedded SBCs to give systems designers easy access to the technology and the advantages it brings.

Arm based designs power nearly all of the world's mobile phones. Their dominance in this and other embedded applications stem from the relative simplicity of the processors which makes them suitable for low power, high performance applications. The success of Arm, as a relatively small company, can also be attributed to its strategic partnerships and licensing agreements with the world's major semiconductor manufacturers. Arm cores manufactured by licensees are frequently components within more highly integrated silicon and also featuring additional functionality.

Omap 3 on board

Blue Chip Technology's new RE2 single board computer, shown in Fig 2, right, is one of the first products to put Omap 3 technology into the hands of industrial board level system builders. The company has been designing x86 based boards and systems since 1993 which places it in an ideal position to see and take advantage of the new opportunity created by Omap 3. Although power demand for x86 devices has dropped considerably from earlier levels of around 100W, it remains difficult to drop below about 8~10W, even using Atom processors. At this level, heat remains the enemy of compact product design, whereas the Omap 3's nominal 2W consumption can overcome the problem.



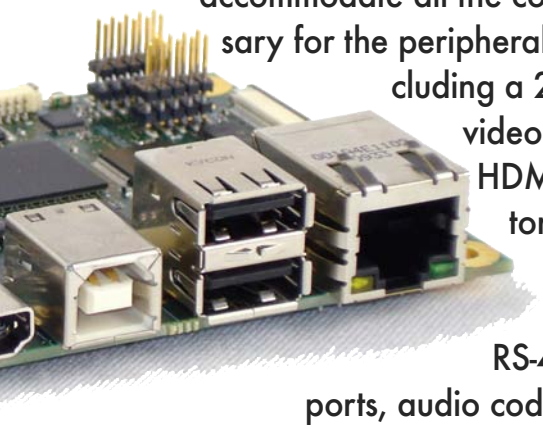
Blue Chip saw the benefits of the TI chip in terms

of two illustrative scenarios. The first involves an industrial controller with a monochrome alphanumeric display. Using RE2, this display can be replaced by a high resolution colour graphics touchscreen, transforming the user experience into an engaging and more informative interaction. This upgrade becomes viable as the RE2 board consumes no more space or power than the earlier generation board it replaces. Additionally, Omap 3's processing capability and I/O complement enable RE2 to function as a system controller as well as an HMI driver.

In the second scenario, a large public digital signage display running fast, high resolution graphics can be driven by an RE2 system unobtrusively mounted behind the screen instead of from a sizeable, power hungry, standalone PC chassis.

Innovative SBC

RE2 has innovative features that support the Omap 3 processor, making systems development faster and easier. The board is laid out to accommodate all the connectors necessary for the peripherals it contains including a 24bit RGB TTL video controller, HDMI/DVI connector, USB host and device ports, RS-232 and RS-485 serial ports, audio codec interface, camera interface, 12 channel GPIO connector, Bluetooth, WiFi and 10/100 Ethernet ports and a utilities connector to handle On/Off, Reset and similar functions.



Memory comprises 256MB of SDRAM, 512MB NAND Flash and optional NAND Flash storage on a µSD Card. The board also accepts plug-in expansion modules such as the CM1 which adds full GPRS and GPS functionality. Other expansion modules are planned for the future.

Development acceleration tools

The RE2's support for the video controller plays a key role in systems development speed. Although the rewards for adding a colour graphics LCD can be considerable in terms of marketing appeal, the effort and resources needed to do so are also considerable and not to be underestimated. There are no industry standards for LCDs or touchscreens, and each model and manufacturer uses its own mechanical layout and fixing dimensions.

The display requires its own specific connectors and cables, some of which can be high density, and the controller electronics must match the requirements of the display, backlight and touchscreen. The bios must be adjusted for the display signal timing and sequencing requirements, and the entire exercise must be repeated when the display panel is withdrawn from supply for any reason.

Developed after long experience of these issues, Blue Chip's solution is the REsolution kit concept: the RE2, with Windows CE 6.0 installed, is shipped together with an off the shelf 3.5i QVGA to 7in WVGA LCD panel. The kit also includes a mounting plate, all necessary cabling and a Personality Module which is a transition board that fits between the RE2 and the LCD, absorbing the particular interface and power requirements of each chosen display, backlight and touchscreen.

The problems of matching to any particular panel are hidden from the RE2 board and the system designer. The RE2, optional CM1 module, Personality Module, display and all cabling can be assembled to the plate supplied to form a single slimline flat panel display sub-assembly unit.

Fig. 3 shows a view of ☞

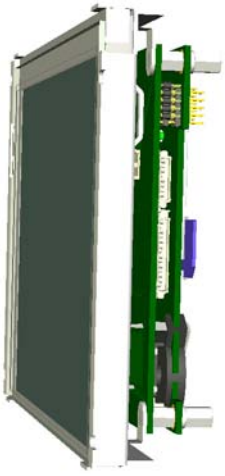


Fig 3: Blue Chip's REsolution.

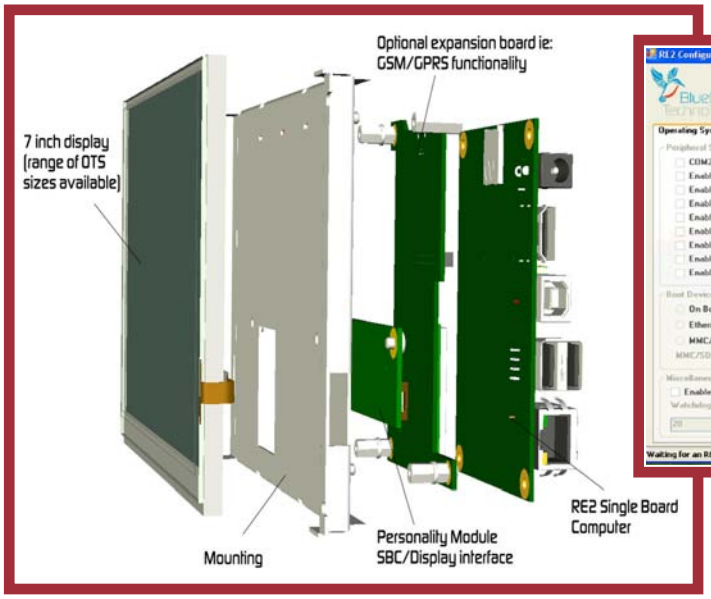
Broad Market Chips

Highly integrated silicon with additional functionality, TI's Omap range now includes the Omap 3 processor family with solutions geared towards mobile devices, along with versions that address the broader market. While maintaining Arm's low power attributes, Omap 3 integrates not only a number of processors but also a large peripheral and I/O complement. As well as Arm's Cortex-A8 core, it has a TI TM320C64x+ DSP, Imagination Technology's Power VR SGX graphics engine and Arm's Neon co-processor.

The Cortex processor is available at 600MHz or 720MHz: at 600MHz it quadruples the performance of today's fastest Arm9 devices. The C64x+ comes in 430 or 520MHz versions and the peripheral set includes USB host and device controllers, LCD control, camera and serial interfaces, memory support and other functions. With such integration, Omap 3 enables significant PCB space savings while achieving low power consumption and high performance. The architecture is ideal for advanced user interfaces, improved graphics, video and connectivity in mobile and handheld as well as fixed applications.

Each processor on the Omap 3 integrated design handles best suited tasks. The Cortex core's general purpose capabilities are complemented by the arithmetical processing power of the C64x+ DSP, while the Power VR graphics engine accelerates 2D and 3D graphics rendering.

Media and signal processing acceleration is also provided by the Neon 128/64bit SIMD. Cycle count, and therefore processing time, are considerably reduced with this architecture, even after allowing for the overhead associated with multiprocessor operation. In software, the Omap 3 supports Windows or Linux, using the latest version of Windows Embedded CE 6.0 or the Linux digital video software development kit which includes advanced Linux drivers, the application framework and codec libraries.



this assembly and Fig 4 shows its component parts. This unit can be integrated as an intelligent HMI into a larger OEM machine or used as a complete standalone controller. Omap 3 processing power and the board's I/O configuration is sufficient for many applications, even with computationally intensive demands. The applications can be environmentally demanding as well, as the board runs fanlessly, uses soldered RAM and Flash memory and is optionally available as a –40~+85°C extended temperature version.

A further key development aid supplied with RE2 is the Configuration Utility. This enables designers to control RE2 configuration from a PC screen, as shown in Fig. 5, easing display configuration, allowing minimisation of power demand and performing other utilities. For example, to minimise power on a task known to be undemanding, CPU frequency can be set to 250MHz. For other tasks that vary in computing demand over time, CPU frequency can be set to automatic. Peak demand can be met with full processing speed while the device can be throttled back during lower activity levels. Automatic power saving also contributes to this process and peripherals can be individually enabled or disabled to further conserve power. Peripheral deselection has the additional benefit of preventing unwanted channels accessing the RE2.

Display configuration is eased because the

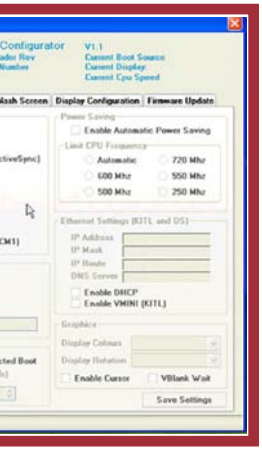
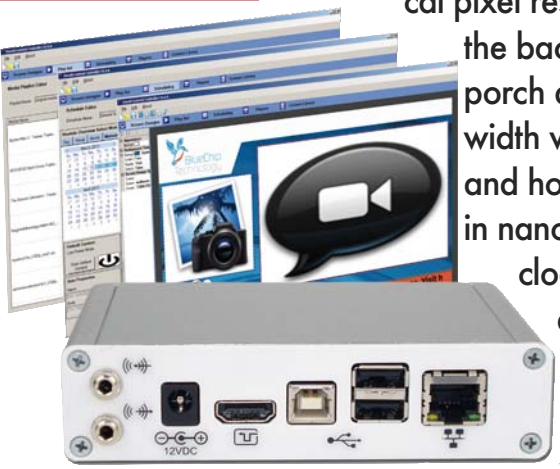


Fig 4, far left: REsolution kit components. Fig 5, left: the RE2 configuration utility screen. Below, Fig 6: a digital signage product using the RE2 board.

SBC's Configurator allows detailed parameter settings for a display panel to be incrementally adjusted. These include horizontal and vertical pixel resolution, and the back porch, front porch and sync pulse width with vertical and horizontal timings in nanoseconds. Pixel clock settings can also be incrementally adjusted, and all settings can be tested before writing to the configuration.



A solution is also available for designers needing to drive larger or non-standard displays. In hardware, this comprises a version of the REsolution kit which interfaces to LVDS displays. The Configuration Utility then allows the display resolution and other parameters to be set up.

The RE2 SBC represents a revolutionary step forward for board level systems designers as it gives full access to the new multimedia possibilities created by the Omap 3 family coupled with the development acceleration provided by Blue Chip Technology.

Omap 3's low power multiprocessor core and extensive peripheral I/O integration enables the RE2 to be tiny and cool running while delivering advanced colour graphics multimedia and applications processing performance. Using Blue Chip's development acceleration components, designers can now take this new technology to market within their products in minimal time. ■

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