

SoC Solutions Raise the Bar

By Nick Lethaby

Many embedded and real-time applications feature a microprocessor controlling one or more DSPs. In the past, these applications were implemented on boards using discrete processors. OEMs typically developed the application software using separate microprocessor and DSP teams. While this approach is optimal for producing the separate microprocessor and DSP subsystems, hardware-related or real-time bugs in the interprocessor communication mechanisms can make integrating these subsystems very time-consuming.

With the advent of SoC solutions that combine a microprocessor and DSPs on a single chip, such as TI's OMAP5910 and OMAP1510 processors, OEMs receive a more highly integrated hardware solution "out of the box." However, with software the critical path in most embedded real-time systems, it is important to consider the software development implications of SoCs.

SoCs provide pre-tested hardware for interprocessor communication, potentially eliminating the need to implement and debug complex shared memory or host port interface drivers and protocols. Unfortunately, a SoC implementation may remove visibility of microprocessor-DSP communications, making problem diagnosis more difficult. For SoC solutions to succeed,

embedded software providers must leverage the advantages of a standardized connection while alleviating intercore visibility issues.

One solution widely touted for development of heterogeneous multiprocessor systems is debuggers that provide a common user interface for both the DSP and microprocessor. However, in isolation, this approach is inadequate. First, it ignores the reality that most engineers are specialists in either DSP or microprocessor software. They do not need to debug software on both processor cores or learn a new set of tools simply because another team uses them. Just as important, it does not recognize that diagnosing intercommunication problems requires some level of correlated information from both the DSP and microprocessor cores.

Providing a common interface to set breakpoints on both the microprocessor and DSP is much less important than the ability to simultaneously halt both processors to view precisely how they are interacting.

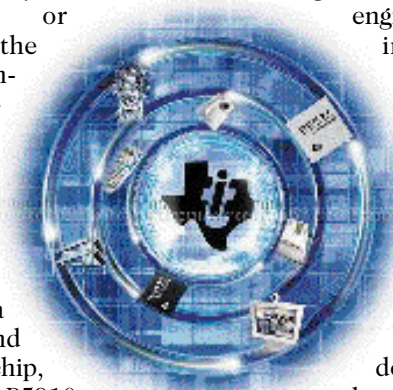
The key technologies for simplifying development of SoC-based designs are real-time operating systems (RTOSs) and co-emulation. RTOSs must provide off-the-shelf microprocessor-DSP communication software, such as basic message-passing and data-streaming

mechanisms along with a specific driver optimized for the communications link hardware. They should also support common microprocessor-DSP control operations such as booting the DSP from the microprocessor. Providing a robust communications link saves the development team weeks of work and enables them to focus on their application integration. A standardized software link can also be instrumented to work with sophisticated RTOS analysis and profiling tools. Such tools in turn simplify debugging of the OEM-designed application-specific communications services.

The second critical technology is co-emulation, which enables synchronized debug control—and therefore visibility—of both processors. For example, if in certain circumstances the DSP receives incorrect data or commands from the microprocessor, the whole system should be halted as soon as this error condition occurs. The developer can examine the state of the microprocessor at that point and diagnose why it is sending incorrect data. Such hardware assistance is essential in determining how the DSP and microprocessor interact in real-time.



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- 1 Computers/Computer Systems
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- 3 Digital Imaging
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- 8 Test/Measurement Equipment
- 9 Medical/Scientific Equipment
- 10 Aerospace/Marine/Military Systems
- 11 Automotive & Other Ground Vehicles
- 12 Consumer Electronics
- 13 Semiconductors
- 14 Other Components, Materials, Hardware & Supplies
- 15 Electronic Sub-assemblies
- 16 Power Supplies
- 17 Other

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Non-Manufacturing

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- 19 Independent R&D Lab
- 20 University/Colleges (including R&D Labs)
- 21 Distributor/Exporter/Importer of Electronic Related Prod.
- 22 Financial Community (Brokerage, Investment, Analysts)
- 98 Other

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- 1 Standard ICs
 - 2 Microcontrollers/Microprocessors/DSPs
 - 3 Memories
 - 4 ASICs/Custom Logic
- Test Equipment/Design Tools**
- 5 Emulators
 - 6 Logic Analyzers
 - 7 Device/Logic Programmers
 - 8 Hardware-Based Debuggers
 - 9 HW/SW Co-Design Tools
 - 10 Oscilloscopes
 - 11 HW Design Automation Tools

System Boards

- 12 Single Board Computers
- 13 CPU Boards (VME, Multibus, STD, etc.)
- 14 Embedded PC CPU Boards (ISA, PCI, PC/104, etc.)
- 15 Peripheral Boards
- 16 Memory Boards
- 17 Data Acquisition Boards

Computers & Peripherals/Software

- 18 Microcomputers/PCs
- 19 Workstations
- 20 Ruggedized PCs

Embedded SW Development Tools/Software

- 21 Real-Time Operating Systems/Kernels/Executives
- 22 Compilers/Cross Compilers
- 23 Assemblers/Cross Assemblers
- 24 Software Debuggers
- 25 Object Oriented Tools
- 26 CASE Tools
- 27 Simulators/Modeling Tools
- 28 Version/Change Control Software
- 29 Communications Software/Protocols
- 30 Integrated Development Environments (IDEs)
- 31 Libraries
- 32 IP Algorithms/Embedded Software
- 33 Code Generators
- 34 Visual Tools
- 98 Other

(please describe) _____

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