Tools for Embedded Developers

Software

Software infrastructure

The CodeRover family is a series of desktop software infrastructure analysis applications. CodeRover Browser is a stand-alone desktop source-code browser. It captures relationships between source code entities in a personal database for any combination of C, C++, Java, and SQL languages. A series of over 50 queries, plus graphical and textual views, allow developers to see their software from a variety of perspectives. CodeRover Browser provides a hierarchical view of a project by listing all entities by attribute. Attributes include name, size, and cyclomatic complexity. CodeRover Integrity is an automated source code quality assurance tool that measures newly written or modified software against pre-defined programming rules. It uses this analysis to provide a list of non-compliant instances for inspection and remediation. CodeRover Caliper analyzes a body of up to 500,000 lines of source code and produces a quality assessment report. The report provides quantitative and qualitative information about the application in graphical and textual forms. All three tools are available now for Windows platforms. CodeRover Browser is $195, Caliper is $1,195, and Integrity is $595.

Upspring Software
Burlington, MA
(781) 359-3300
www.upspringsoftware.com

Code verification tool

Poly C Verifier features a technology called abstract interpretation that checks the dynamic properties of a software application without actually running it. Instead of iteratively verifying software states, Poly C Verifier works on an abstraction of the analyzed software and evaluates the code a single time for the bounded region of possible integer values. Poly C Verifier is capable of detecting an attempt to read a non-initialized variable, access conflicts for unprotected shared data, referencing through null or out-of-bounds pointers, out-of-bound array access, buffer overflow, division by zero, invalid arithmetic operations such as square root of a negative number, overflow or underflow of arithmetic operations for integers and floating-point numbers, unreachable code, and illegal type conversion. Poly C Verifier is available now.

Polyspace Technologies
Beverly, MA
(877) 711-7659
www.polyspace.com

Model-based design tools

Simulink v. 4.0, Stateflow v. 4.0, and Real-Time Workshop v. 4.0 are parts of the Control Design Suite, an interactive, graphic modeling environment in which users can model, analyze, and simulate complex, large-scale systems. Users then convert the models to instrumented code for prototyping and hardware-in-the-loop simulation. Other tools in the suite measure performance, graphically compare models, and analyze the test coverage of model simulation. The suite also supports the integration of C, Fortran, and Ada code. For large projects, the tools include an integrated finder that shows information and attributes as hyperlinks to graphical models. The Control Suite (consisting of MATLAB, Simulink, Stateflow, and the Control System Toolbox), and Stateflow Coder are available now. The suite starts at $7,650. Stateflow Coder starts at $2,800.

The Math Works
Natick, MA
(508) 647-7000
www.mathworks.com

StarCore tool suite

This tool suite for the SC100 DSP core is optimized for designing DSP applications. The suite includes an integrated development environment (IDE), a C/C++ compiler, an assembler, a linker/locator, and a debugger. The compiler supports SoC and ASIC implementation, VLIW instruction-sets, and parallel processing units. Its DSP optimizations include DSP-C language extensions, leaf-function handling, register caching, loop unrolling, unroll-and-jam, peep hole optimizations, instruction mutation, instruction modification, predication-sensitive register allocation, and software pipelining using iterated modulo scheduling. CrossView Pro debugger will provide execution control of individual processors and processor combinations. It will also handle cross-processor breakpoints in the hardware and manage differences in on-chip debugging support in the data communications link, execution control, data access, trace facilities, and core architecture. Components of the SC100 DSP tool suite will be available in the first quarter of 2001.
**Plug-ins for Code Composer**

Developers can now use the SwiftNet Debug Manager and Register Configuration Tool as extensions of the Code Composer Studio. SwiftNet Debug Manager allows Code Composer Studio to communicate with an unlimited number of DSP targets in multiple locations, and facilitates live debugging and compiling over the Internet. When developers select processors by clicking on a pull-down list, the plug-in adds the appropriate processor information into the Code Composer Studio setup, opening as many separate debug windows as there are selected DSPs. The Register Configuration Tool allows programming of board control registers of the 4290 Quad C6201 VME and 4291 Quad C6701 bus boards. It provides a graphical user interface for setting parameters, such as interprocessor and I/O BiFIFO control, front-panel LED control, VME address configuration, process ID control/status, and controlling semaphores to allow access to board global resources. Check-off boxes in the tool’s GUI set all parameters. These tools come with the Code Composer Studio for the Pentek Model 4977, which costs $2,995. They’ll be available in the first quarter of 2001.

**UML compiler**

The DesignPoint MC-2020 model compiler translates BridgePoint UML models into C++ for real-time embedded targets that use the VxWorks RTOS. The compiler utilizes a multitasking execution model that lets designers map threads of control in the BridgePoint UML analysis models to operating system tasks. Designers can specify which analysis threads of control should preempt other threads by assigning priorities to events. The MC-2020 optimizes associations for constant-time pointer-based navigation from one instance of a class to another. In addition, the model compiler uses a two-pass translation approach, thus eliminating data modeled on the class diagram, but not used in the action language. It can be configured to translate UML models into C++ compiled and linked for execution on a Windows NT development host, in which case the designer tests them in the Windows environment before actually sending the code to the target hardware. The MC-2020 is available now.

**Error prevention software**

CodeWizard v. 3.2 is a static analysis tool that automatically enforces a set of built-in C and C++ coding standards. It analyzes a body of code, flags rule violations by line number, and offers suggestions and explanation. The rules CodeWizard enforces were assembled out of public domain coding standards as well as consultation with experts. It also features Rule Wizard, which allows designers to create additional rules. Code Wizard is available now. It costs $995 for Windows and $2,495 for UNIX.

**Oscilloscope voice control software**

VocalLink is a software package that provides design engineers and technicians with a voice controlled multi-lingual user interface for TDS oscilloscopes. With a set of over 60 voice commands, users may control almost all major oscilloscope functions. VocalLink enables users to perform measurement routines with a single voice command. Supported languages include English, Japanese, French, Korean, German, Portuguese, Italian, Spanish, and Mandarin Chinese (simplified and traditional menus). The software provides audio feedback as well.
Port analyzer
The MultiTrace trace port analyzer is a new component in the RealView debug tool suite for deeply embedded cores. The RealView debug software includes three key technology suites: RealTrace, RealMonitor, and RealControl. The MultiTrace analyzer is the external collection unit for the RealTrace suite, passively collecting information from ARM SoCs containing an Embedded Trace Macrocell (ETM). The ETM monitors the instruction and data buses at full core speeds, using the MultiTrace analyzer to buffer the collected information before transmitting to the Trace Debug tools. The MultiTrace unit will be available in December. It costs $4,500 per development seat.

ARM
Austin, Texas
(512) 327-9249
www.arm.com

Hardware
Ethernet kit
The Ethernet Evaluation Kit is designed for use with the SX-Stack network protocol stack. It features a 10base-T (IEEE 802.3) Ethernet physical interface and Virtual Peripheral software modules implementing Ethernet-specific protocols. It enables OEMs to design Internet connectivity into embedded applications that require Ethernet networking capability. In addition to such applications as remote access and monitoring devices and industrial control systems, the SX-stack, which the kit supports, provides a bridge to Ethernet connectivity for legacy devices. The kit contains a demonstration board, an AC power supply, a serial cable, a CD-ROM containing source-code and other information, and a user’s guide. The kit gives designers experience with an Ethernet-specific version of iSX Web Server. iSX Web Server includes the following modules: IP, ICMP, EDP, TCP, HTTP, ARO, and DHCP. The kit’s demonstration board includes a 50 MIPS SX52BD embedded internet processor and an external 10base-T Ethernet interface chip. Ethernet iSX Web Server and NIC driver interface software are loaded into the flash/EEPROM memory of the processor. An external EEPROM chip is provided for storing Web page content. Also included are two DB-9 serial port connections, clock circuitry,
LEDs, and a DC power-in plug. The Ethernet Evaluation Kit is available now for 99$.

Scenix
Mountain View, CA
(650) 210-1500
www.scenix.com

Emulator
DProbe 430 is a modular emulation system for the MSP430 family of microcontrollers. The basic system consists of a base board and a selectable derivative board. It connects to the target hardware using adapters that have the same footprint as the microcontrollers the DProbe 430 is designed to emulate. The DProbe 430 features 64KB of emulation memory, and 64KB of execution breakpoints that stop before instruction execution; data break points that can be used to monitor reads and writes to specified variables of sections of data; protection logic that monitors writes to ROM or to unprotected areas of memory; and additional trace memory that records up to 64KB of bus cycles. An extension exists for the DProbe430 that contains four triggers which monitor bus states and external signals. DProbe 430 is available now.

Hitex Development Tools
Sunnyvale, CA
(408) 733-7080
www.hitex.com

Reference design platform
The NetFront browser has been ported to the 32-bit RISC-based microcontroller, creating a development platform suitable for Internet appliances. With NetFront, this reference design platform provides OEMs with open application interfaces and software modules including a web browser, Internet e-mail, HTML parser, HTTP, TCP/IP, FTP, SMTP, POP, and other network communications modules. It also supports JavaScript, cookies, Web printing, and multiple languages. Optional plug-in modules for the browser include JV-Lite2 JVM, SSL, and streaming video. The FR microcontroller features a 16-bit fixed-length RISC-type instruction set with CISC-type instructions, such as bit operation or memory access instructions. The FR MCU costs $5.

Chips

DSP core
When coupled with the StarCore SC100 compiler-efficient architecture, the StarCore SC110 allows OEMs to develop up to 90% of their code in C. It was developed for low-to mid-range communications with DSP requirements. These include consumer DSL client modems, voice-centric wireless handhelds, internet appliances, IP telephony, and automotive. The StarCore SC100 provides a 16-bit control code instruction set. It operates at 300MHz (900 RISC MIPS) at 1.5V and 120MHz (360 RISC MIPS) at 0.9V.

Motorola
Austin, TX
(512) 895-9705
www.motorola.com/sps

Flash memory controllers
The 68HC09AB32, 68HC908KX8, and 68HC908KX2 are members of the 8-bit 68HC08 family of flash microcontrollers. The flash memory on the 68HC908AB32 is capable of write/erase cycling to 10,000 cycles and programming as fast as two milliseconds for a 64-byte block. It is also in-circuit and in-application programmable, so OEMs can program late in the manufacturing cycle and make upgrades remotely in the field. Its features include 32KB of flash memory; 512 bytes of byte-erasable EEPROM; 1,012 bytes of user RAM; low voltage inhibit with optional reset; serial peripheral interface and serial communications interface modules; dual 16-bit, 4-channel timers, eight channel 8-bit analog-to-digital converter; 64-pin quad flat package, and a temperature range of –40 degrees to +125 degrees Centigrade. The 68HC908KX8 and 68HC908KX2 integrate flash memory with several analog functions,
including an internal clock generator that can be programmed to a specific target frequency. They’re intended for use in home and industrial security systems, building control systems, fluorescent light ballast networks, or interconnected home appliances. All three chips are available now. The 68HC908KX8 costs $2.70, the 68HC908KX2 costs $1.95, and the 68HC908AB32 costs $5.

Motorola
Austin, TX
(512) 895-9705
www.motorola.com/sps

Microcontroller
The W78LE58 and W78LE516 are 8-bit CMOS microcontrollers featuring in-system programming and flexible operating voltage between 2.4V and 5.5V. They’re suitable for consumer and communication applications that require reprogramming capabilities. They both feature seven I/O port pins, up to 24MHz operating frequency, and data scrambling capability for ROM data security. They have 32KB or 64KB of multi-time programmable (MTP) flash ROM for the main application code and 4KB of MTP ROM for ISP code to download data through the on-chip serial port or parallel I/O ports to the on-board ROM. The ROMs can also be programmed by a standard device programmer. Each chip also provides 512 bytes of on-chip RAM, including 256 bytes of auxiliary RAM and 64KB of program memory address space. They come packaged in 40-pin DIP, 44-pin PLCC, and 44-pin PQFP. They’re sampling now.

Winbond Electronics
San Jose, CA
(408) 943-6666
www.winbond.com

Programmable DSP
The ADSP-21161 SHARC is a member of the Super Harvard Architecture family of DSPs. Capable of 600 million floating-point operations per second, it’s optimized for applications such as voice recognition, professional and high-end consumer audio, motor control, automotive entertainment, telephony, instrumentation, network analysis, network infrastructure, and wireless communications. The ADSP-21161 supports single-instruction, multiple data execution of 32-bit fixed and floating-point arithmetic. It has 1Mbit of on-chip dual-ported memory. This dual-ported SRAM permits the user to customize the mix between the percentage of memory dedicated to instructions and the percentage of memory dedicated to data for the specific application. Fourteen direct memory access channels facilitate data
transfer. System I/O is achieved through two 128-channel synchronous TDM and four serial ports, a 32-bit parallel port that includes a 32-bit SRAM controller, and an SPI interface. Clusters of DSPs can be built using the on-chip multiprocessing interfaces, which enable global shared memory within the cluster. Designers can also connect up to six SHARC DSPs and a host without designing extra circuitry. The 3.3V device is 5.0V tolerant for I/O. It’s sampling now.

Analog Devices
Norwood, MA
(781) 329-4700
www.analog.com

Low-power microcontroller

The ST72C254 is an 8-bit microcontroller. It’s a low power device with 8KB of flash memory. The ST72C254’s program memory is built with a single-supply flash technology that allows the microcontroller to be reprogrammed up to 100 times, either by inserting the device into a programming board socket or within the application by means of a standard serial port. Individual bytes can be reprogrammed without erasing the main program. This eliminates the need for an EEPROM to store configuration data. The contents of the program memory can be secured against unauthorized copying by activating a readout protection mechanism. A variety of noise immunity options are included, all of which are software selectable when the device is programmed. These include a three-level Low Voltage Detection circuit, a watchdog counter with three operating modes, and a selectable oscillator source, including a fail-safe backup oscillator and reset origin flag that allows the source of a reset to be identified to restart the application safely. The ST7 core is based on an industry standard architecture, with 63 instructions, including multiplication, and 11 addressing modes. With a 16MHz clock speed, instruction time is as short as 250ns, with interrupts managed in less than 1.5µs, while typically consuming less than 2mA/MIPS. The ST72C254 includes 256 bytes of data RAM, two 16-bit timers with input capture, output compare and PWM modes, a 1MBps SPI port, an I2C interface operating at up to 400kHz, a six-channel ADC with a conversion time less than 3µs, and 22 I/O pins, including eight that can drive 20mA loads. Samples are available now.

STMicroelectronics
Lexington, MA
(781) 861-2650
www.st.com

Software development platform

The C2000 is a development platform for DSP motion control engineers. It includes both traditional ROM devices and flash memory-based products with a flexible set of peripherals. Among these is the TMS320LF2407 flash DSP, which integrates 32K x 16 words of flash, 2.5KB of RAM, an A/D with 500ns conversion time, an on-board event manager providing pulse-width modulation (PWM) and I/O features to drive all motor types, and several other control-optimized peripherals like watchdog timer, SPI, SCI, and CAN. Another part of the C2000 platform is the C28x DSP core, which offers up to 400 MIPS of computational bandwidth to handle numerous real-time control algorithms, such as sensorless speed control, random PWM, and power factor correction. The platform is designed for use with the eXpressDSP open software platform, which allows motor drive manufacturers to use a library of DSP motor control software modules that conform to a defined standard for interoperability.

Texas Instruments
Dallas, TX
(800) 336-5236
www.ti.com

Communications chip

The QuickSD family is a series of chips for communications applications. They integrate multi-channel serial communications links with embedded memory, MAC blocks, and customizable logic. The devices embed up to 10 LVDS transceivers—eight bus LVDS data SERDES channels and two clock bus LVDS links. With each data channel supporting up 1Gbps speeds, QuickSD devices deliver up to 8Gbps total bandwidth. They also include customizable logic, memory, and MAC block.

Quick Logic
Sunnyvale, CA
(408) 990-4000
www.quicklogic.com

IP Core

The Internet Tuner Ethernet intellectual property core is an Internet system-on-a-chip with Ethernet capabilities. It features a soft core, pre-configured drop-in design that can be used as a stand-alone chip or can be embedded in other application-specific silicon. It off loads MIPS from host processors. Along with an Ethernet PHY, Internet Tuner Ethernet provides non-PC devices with the protocols necessary to connect to—and send and receive data over—the Internet in a networked environment. The core uses streaming byte architecture for TCP/IP network processing and adds ARP, host IP routing, and an 802.3 Ethernet MAC. In addition to the hardware protocol stack, the Internet Tuner Ethernet contains a protocol engine, system peripherals, and a set of accelerators that allow for integrated network application systems.

iReady
Santa Clara, CA
(408) 330-9450
www.iready.com
OEMs

PCI
The PCI-8134 is a four-access stepper and servo motion control card. It's designed for harsh industrial environments and provides high pulse (2.4MHz) motion control of X-Y tables, robotics, conveyors, pick-and-place equipment, electronic and semiconductor test equipment, material handlers, textile machinery, and palletizers. This PCI-8134-based motion control card features pulse train for both stepping and AC/DC motors, with pulse rates up to 2.4Mbps. The PCI-8134 motion control ASIC enables trajectory planning. Both the acceleration and deceleration times are programmable, and the F-curve profile smooths motion during starting and stopping. Various operation modes are built in. These include continuous motion, absolute move, relative move, manual pulsing, simultaneous move, speed change on the fly, linear interpolation, and home return. The PCI-8134 is available now for $1,254. It costs $999 each in quantities of 10.

ADLINK Technology
Irving, CA
(949) 250-3339
www.adlinktechnology.com

Graphics system
The Graphics Master is a RISC-based system with a USB Master and compact flash. It includes an on-board four-port USB hub, a USB downstream power switch, and a USB slave/USB bus master. A second capability of the Graphics Master is its compact flash interface connector, which extends the existing flash memory options of 8MB, 16MB, or 32MB flash, and complements the 16MB and 32MB SDRAM running at 103MHz. The PCMCIA slot is subsequently available for device cards with such features as 802.11 or IDE. In addition to the USB Master and compact flash, the Graphics Master extends the serial ports from three to seven (with IrDA, RS-232, TTL, and RS-485 options), and complements Applied Data Systems’ I/O suite: a Controller Area Network (CAN) Bus, PCMCIA, 10Base-T Ethernet, and a re-configurable SMART I/O package that selects from 32 digital I/Os, 12 analog inputs, an 8 x 8 keypad, and two PWMs. The embedded Graphics Master is compatible with an array of operating systems, including WindowsCE, Microware OS-9, and WindRiver VxWorks. It also supports JAVA with an RTOS. The Graphics Master employs high-end graphics, with multiple high speed analog,
digital, and PWM inputs and outputs, with video interface up to 1024 x 1024 resolution, and up to 16-bit-per-pixel color in an LCD controller. The Graphics Master available now for $300 per unit in OEM quantities.

Applied Data Systems
Richardson, TX
(972) 238-8111
www.applieddata.net

**CAN bus computer**
The T-CAN is a programmable CAN bus computer that’s the size of a matchbox. T-CAN modules can provide local intelligence for controller functions, log-in, calibration, and other applications in distributed network systems. They can also control entire CAN networks. T-CAN’s flash memory capabilities make it possible to reprogram the modules on site or load new curves and other data. It supports data transfer rates of up to 1MBps, standard and extended frames, and automatic bit-rate identification. The CAN bus is accessed using device drivers. Data buffers with capacities up to 32KB make it possible to use the CAN bus for applications that need to transfer larger amounts of data.

Wilke Technology GmbH
Aachen, Germany
(024) 191-8900
www.wilke.de

**Single-board computer**
The EnCore platform encapsulates a single-board computer in a module that interfaces with a host baseboard by means of the PCI bus and a set of I/O signals that support direct peripheral and network connection. It allows engineers to write application software to a particular RTOS API in C, C++, or Java, and then move the application to different processors supported by that RTOS. It’s designed for use in systems that combine a 32- or 64-bit processor with application-specific logic. Encore modules feature a 120-pin PCI bus connector; three 44-pin headers, which provide two serial ports, an ECP/CPP parallel port, four USB ports, video and LCD signals, keyboard and mouse; and an audio interface. The EnCore 500 is the first Encore module. It’s available now for under $500 per unit in volume.

Ampro
San Jose, CA
(408) 360-0200
www.ampro.com