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What Development Environments are Supported?

The ReadyFlow Board Support Package for C6000 processor boards is written to work seamlessly with the Texas Instruments DSP/BIOS real-time kernel which is included free of charge with TI's Code Composer Studio.

Developers using PowerPC-based embedded processor boards have traditionally used either Wind River's VxWorks environment, supported by the Pentek Model 4996 VxWorks Board Support Package, or a Linux environment. ReadyFlow offers an additional option: integrated support for eCos, an open source, royalty-free, real-time operating system intended for embedded applications.

eCos-based applications can be developed with GNU open source development tools including the GCC C-language compiler, GDB debugger and Insight GUI interface for GDB. ReadyFlow packages for PowerPC-based processor boards include the board support package, a complete distribution of eCos, GNU code development tools, complete documentation and example applications.

Users of card-cage based instrumentation often find themselves frustrated by the fact that when their new devices are delivered, they are unable to put them to immediate use. Because these instruments are largely software controlled, a certain amount of programming is generally necessary in order to put the new cards through their paces. Then, if something does not go as planned, there is no way of knowing for sure whether the problem lies with the new code you've written, or with the hardware itself.

To address this issue, Pentek has developed the ReadyFlow Board Support Package for all its board-level products. These packages:

- Provide development tools for quick start-up through application completion
- Allow programming at high, intermediate and low levels to meet various needs
- Are illustrated with numerous examples
- Include complete source code for all board functions
- Include complete documentation and definitions of all functions

What's Included in the Package

In general, functions appropriate to the board-level product, such as:

- A "How to" section
 - Build object libraries
 - Compile and link application programs
- C-callable functions
 - Initialization and test
 - Data movement and communications
 - Backplane I/O
 - Mezzanine peripheral I/O
 - Control of board resources
- Utilities
 - Flash memory program loaders

The package contains C-language examples that can be used to demonstrate the capabilities of Pentek products. The examples included provide the answers to most of the questions that occur with first-time users of our products. These programming examples will also help you get an immediate start on writing your own application without having to reinvent the wheel. They provide sample code that is known to work, giving you, the new user, a means of verifying that your board set is operational.

ReadyFlow Board Support Packages are designed to reduce development time not only during the initial stages, but any time new hardware is added to the system. All packages are built with a consistent style and function naming convention. Similar parameters on different boards have similar function calls, thereby allowing immediate familiarity with new hardware as it's added, further shortening the learning curve.

Example, Model 4205 Processor

As an example of a processor board, the Model 4205 package includes support for the following:

- Real-time kernel
- Choice of schedulers
- Thread support
- Synchronization primitives
- Timers, counters and alarms
- Memory allocation
- Debug and instrumentation support
- Interrupt and exception handling
- ISO C and math libraries
- Serial and Ethernet device drivers
- Wallclock device drivers
- TCP/IP networking stacks
- GDB debug support
- SCSI device support over Fibre Channel

Example, Model 7141

As an example of a PMC module, the Model 7141 software radio transceiver package includes data structures and routines to support the following:

- PCI Bus interface and DMA controller
- Board control registers
- Endianness control
- Timing bus control and clock selection
- Triggering, gate enable and polarity
- Data input device management for the A/D and the GC4016 DDC
- Data output device management for the DAC5686 D/A and the DUC
- Delay memory operation
- Interrupt generation and handling
- FPGA configuration
- Test modes and hardware revision codes
- Hardware voltage and temperature monitor ▶

eCos Features

- Real-time performance
- Low interrupt latency
- Low task switching latency
- Small memory footprint
- Deterministic behavior
- Highly configurable
- Full feature set
- Open source kernel
- No runtime licensing, fees or royalties
- Open source GNU development tools

► Embedded Configurable Operating System (eCos)

ReadyFlow offers PowerPC software developers a powerful new option for embedded application development. ReadyFlow includes integrated support for eCos, an open source, royalty-free, real-time operating system intended for embedded applications. As an alternative to costly operating systems, eCos-based applications can be developed with free GNU open source development tools including the GCC C-language compiler, GDB debugger and Insight GUI interface for GDB.

ReadyFlow packages for PowerPC based processor boards include an eCos enabled board support package, a complete distribution of eCos, GNU code development tools, complete documentation and example applications.

eCos Core Components

Designed as a full-featured, real-time operating system, eCos delivers a complete suite of functions needed in many embedded applications including:

Hardware Abstraction Layer (HAL) - provides a software layer that gives access to hardware.

Kernel - includes interrupt and exception handling, thread and synchronization support, a choice of scheduler implementations, timers, counters and alarms.

ISO C and Math Libraries - provide standard compatibility with function calls.

Device Drivers - include standard serial, Ethernet, Flash ROM, and others.

GDB support - provides target software for communication with a GDB host enabling application debugger.

eCos is Highly Configurable

A key feature of eCos is its highly configurable design. The kernel is scalable to include only the components needed for a specific application, allowing a small efficient footprint for simple applications, or a full-featured configuration for more complex systems. In addition, eCos can be built without an actual kernel for applications that might not need multitasking, further reducing the memory footprint and improving execution speed.

eCos configuration is performed through the graphical configuration tool shown below. The user interface displays the properties of each component including parameters, switches, sizes, component description, etc. thereby allowing developers to easily rebuild the kernel as needed.

Kernel Benchmarks

Applications developed with eCos can benefit from excellent kernel run time performance. Below are timing benchmarks generated on the Model 4205 MPC7457 I/O processor board running at 1 GHz and configured with a 2 Mbyte L3 cache:

Function	Average Time (usec)
Thread Switch	0.59
Put or Get Mailbox	0.29
Mailbox Put/Get	0.77
Post Semaphore	0.14
Wait Semaphore	0.16
Post/Wait Semaphore	0.80
Wait for Flag [AND]	0.21