

The Logical Choice for Embedded Ada Development

Rational Apex Embedded

A Comprehensive Development Environment for Embedded Systems

Rational Apex Embedded is an integrated environment for designing, developing, and maintaining complex Ada and mixed-language (C/C++/assembly) applications. This powerful cross-development system combines the Rational Apex environment with time-tested embedded technology for host-to-target development of real-time embedded systems. The result is the most powerful Ada development environment for embedded systems ever available. Rational Apex Embedded real-time code generation, debugging, and runtime technologies have been used for more than a decade on some of the world's most demanding and most successful software projects.

Rational Apex Embedded provides the mature, production-quality, optimizing cross-compilers and related tools developers need to compile, debug, tune, and deliver high-quality Ada 95/83 and mixed-language applications. Rational's unique Optimal Recompilation for Ada dramatically accelerates the development process by minimizing the recompilation required for any source code change. In addition to its powerful cross-compiler, Rational Apex Embedded provides a wealth of time saving features, including a cross-linker, graphical symbolic debugger, disassembler, and extensive Online Help.

Embedded Support

Rational Apex Embedded completely supports Representation Issues per Chapter 13 of the Ada 95 Reference Manual, including bit-level representation clauses, length clauses and address clauses. Because it provides machine-code insertions, you can use standard Ada subprograms to encapsulate low-level, machine-specific code and eventually make this code in-line.

Developers also benefit from Rational's support for the Ada 95 Systems Programming and Real-Time Systems Annexes. These useful features, including protected types, offer maximum control over your embedded applications.

Reduces Turn-around Time and Application Size

To reduce bottlenecks created by linking large programs, Rational Apex provides a fast cross-linker, enabling developers to quickly edit, compile, link, and test their code. Persistent Intermediate Representation (PIR) of your application minimizes object file symbolic information, reducing the linker's work. The cross-linker's selective linking capability creates small executables by including only the subprograms and data your embedded application requires.

Produces and Debugs Optimized Code

Rational Apex Embedded produces code that is fast, compact and efficient. In addition to providing dozens of user-controllable optimizations, Rational Apex code generators perform instruction scheduling and branch target alignment.

Rational's PIR technology supports full debugging symbolics — even from optimized code — without recompiling. There is no need to recompile code with optimizations turned off.

High-performance, Configurable Runtime Options

Rational Apex Embedded is available in three different runtime variants: Rational Apex Embedded for Rational Exec, Rational Apex Embedded for Tornado, and Rational Apex Embedded for LynxOS. This flexibility supports a diverse set of application requirements.

HIGHLIGHTS

Comprehensive Ada 95/83 development environment for embedded, real-time applications

Offers choice of real-time operating systems, including Wind River's VxWorks (and VxWorks AE) and LynuxWorks' LynxOS

Mixed Language support for Ada, C/C++ , and assembler

Supports demanding embedded applications for PowerPC, MIPS, M68K, and Intel x86 families of microprocessors as well as the radiation hardened RH-32

Generates high-performance executables

Offers real-time and deterministic runtime performance

Provides integrated performance analysis tools

Provides comprehensive support for embedded systems debugging

Optional host-based instruction-set simulation for PowerPC, MIPS, and RH32

Offers a consistent development environment across multiple hosts and targets

Offers support for safety-critical applications

Rational Apex Embedded for Rational Exec is packaged with Rational's own all-Ada preemptive, multitasking runtime system. This runtime was designed specifically to support Ada runtime tasking semantics and offers the best Ada runtime performance available. The Rational Exec runtime is small, fast, and efficient, enabling it to be easily configured and tailored to customized hardware, without requiring compiler revalidation.

Extended runtime capabilities ensure even greater control over real-time performance. Mailbox support offers an option for inter-task communication, in addition to the Ada rendezvous. Semaphores are also supported. You can control other aspects of tasking, including time slicing, dynamic alteration of task priority and preemption-control algorithms. Support for interrupts is extensive, with standard Ada mechanisms for interrupt handling and very fast capabilities for interrupt service routines. Rational Apex Embedded provides direct, sequential, text and low-level I/O, as well as a family of timers and clocks.

Rational Apex Embedded for Tornado is integrated with Wind River's Tornado environment and VxWorks real-time operating system. Rational is the first Ada vendor to support integration with the VxWorks AE product (also known as Cirrus). See the Rational Apex Embedded — Tornado datasheet for details.

Rational Apex Embedded for LynxOS is integrated with LynuxWorks' LynxOS real-time operating system. Rational Apex for LynxOS maps Ada tasks to the LynxOS POSIX threads facility, providing a one-to-one mapping of Ada tasks to operating system threads. See the Rational Apex Embedded — LynxOS datasheet for details.

Powerful Debugging, Flexible Download

Rational Apex Embedded shortens the download-execute-debug cycle. A variety of download communication options are available, including a serial line, ethernet, or custom use. Rational Apex Embedded is integrated with Agilent Technology's emulation probes,

E5900/E5901, to allow fast program download debug using the standard Rational Apex Embedded utilities.

Rational also provides instruction set simulators for the PowerPC, MIPS, and RH-32 families of processors. They allow you to download and debug your target code without need of actual target hardware.

The Rational Apex debugger fully supports Ada exceptions, tasking and representation clauses. It also allows interactive subprogram calls, so you can write and use sophisticated debugging instrumentation subprograms. The debugger understands the Ada runtime and provides a single, consistent debugger model, even when using the additional real-time mechanisms provided by Rational Apex Embedded. You can even debug interrupt service routines and configuration code.

Safety Critical Support

The Minimal Ada Runtime Kernel (M.A.R.K.) is available for safety-critical projects. As its name implies, this reduced runtime is safety-critical certifiable (DO-178B Level A, B, and C) and has been designed specifically for the needs of the safety-critical programmer. This user configurable runtime is provided in source code form along with documentation and tests that are useful for achieving certification.

Multi-language Development/Debug Support

Rational Apex Embedded Duo provides seamless compilation and integration with the Rational Apex Embedded Ada compiler through common optimization and code generation. The Rational Apex debugger provides source-level debugging for mixed-language programs consisting of Ada, C, C++, and Assembly.

SPECIFICATIONS

Supported Targets

- All members of the PowerPC Family
- The Intel x86 Architecture
- Motorola M68k family including MC68020/30/40/60
- MIPS I, II architectures
- Honeywell RH-32

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