ENEA® OPTIMA OSE

Integrated Development Environment (IDE) for the Enea OSE® Real-Time Operating System

Enea® Optima is a suite of powerful system debug, profiling, and tracing tools for the Enea OSE® real-time operating system. Based on the standard open source Eclipse™ platform and C/C++ development tools, Enea® Optima provides a complete integrated software development environment (IDE) that covers the entire life cycle of embedded systems, from board bring up, through kernel and application development, to fielded systems.

Read, Write and Build C/C++ Code
The amount of software needed to meet the requirements on devices and embedded systems is increasing. The sheer size of the source code can make it difficult for developers to navigate and understand.

The Eclipse C/C++ development tools, included in Enea Optima, feature a rich set of tools to help developers with these challenges. The workspace provides an up to date view of the entire source code and keeps track of changes made to the version fetched from the version control software. The parser and indexer allow the developer to navigate from a function or variable name to the declaration or definition, and back again, with a single keystroke. The content assist framework provides automatic completion of type, variable and function names, and assistance filling in function arguments. And the makefile builder and error parsers allow builds and compilation errors to be tracked and handled within the IDE even if the source code is built using external makefiles or scripts.

Debug Kernel and Application C/C++ Code in a Running System
In distributed applications, the nature of communication links often makes it difficult to stop execution on a processor in a running system to inspect and debug the state of the software, as is required with hardware assisted debug solutions. Multi-core hardware and multithreaded software also make the traditional debug model, where the user takes control over an entire program or process, more difficult to implement and more difficult to use.

Enea Optima C/C++ debug support and OSE optimized GNU debugger (GDB), together with the Eclipse C/C++ development tools, provide a flexible software based debug solution that allows developers to take control over individual threads, or groups of threads, from both program and kernel images, in a running system, without affecting the rest of the application.

Debug Kernel and Application C/C++ Code using a Hardware Probe
Before a processor or board can be used in a system and applications run on it, it must be able to boot and basic device drivers must be functional.

To assist in this phase of development, Enea Optima C/C++ debug support includes support for hardware assisted debugging, using BDI2000/3000 debug probes from Abatron AG. This provides a convenient debug environment that supports direct access to target hardware and that works when no software services on the target device are available.

Explore and Manage the System
As the amount of software in modern multi-CPU, multi-DSP and multi-core embedded systems increases, it becomes more and more difficult to get the understanding of system structure needed to be effective developing, testing and maintaining the software. To help solve this problem, Enea Optima tools let the user raise the abstraction level and get one coherent view of the entire system.

Figure 1. Enea® Optima C/C++ Debug Support

Enea is a global software and services company focused on solutions for communication-driven products. With 40 years of experience Enea is a world leader in the development of software platforms with extreme demands on high-availability and performance. Enea’s expertise in realtime operating systems and high availability middleware shortens development cycles, brings down product costs and increases system reliability. Enea’s vertical solutions cover telecom handsets and infrastructure, medtech, industrial automation, automotive and mil/aero. Enea has 750 employees and is listed on Nasdaq OMX Nordic Exchange Stockholm AB. For more information please visit enea.com or contact us at info@enea.com.

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Figure 2. Enea® Optima System Browser

Enea Optima System Browser allows users to navigate, search for, and find information in large, distributed applications and then drill down into details to find problems like deadlocks and resource leaks. Enea Optima System Browser also allows users to configure and manage target applications using a range of operations, from configuration changes (like setting environment variables), to loading, creating, or removing entire programs. Loading a program is as simple as dragging and dropping an executable file into the Load Modules view.

Analyze and Optimize Memory Usage
Enea Optima Pool and Heap Browsers present a wide range of information on application and kernel memory usage, from usage overview reports, to details about individual allocated buffers, including pinpointing problems like buffer overruns and memory corruption.

Explore Kernel and Application State in a Halted System
Enea Optima Kernel Awareness Plugins allow the all the capabilities of the System, Pool and Heap Browsers to be used to explore and analyze kernel and application state, even when the target system is halted, such as in a hardware assisted C/C++ debug scenario.

In addition to the support for the built in hardware assisted debug capabilities of Enea Optima, Enea Optima Kernel Awareness Plugins integrate with other hardware assisted debug solutions. This allows users of these environments to take full advantage of Optima tools to provide more powerful presentation capabilities than seen in traditional kernel awareness packages for C/C++ debug solutions.

Analyze Kernel and Application Resource Usage Overtime
Enea Optima System Profiler allows developers, support engineers, testers or automated test scripts to monitor system resource usage over time.

Figure 3. Enea® Optima System Profiler

Enea Optima System Profiler provides full access to the profiling mechanisms of the Enea OSE operating system. The profiling system can be used to track processor usage (total load, per thread, per program, or per thread priority), heap usage (total usage, or per thread), or the values of any counter instrumented into the application source code.

These capabilities allow Enea Optima System Profiler to provide a single uniform infrastructure for controlling and presenting the statistical information needed to find performance problems in embedded software. Information collected can be presented in either two- or three-dimensional charts, with advanced filtering, statistics calculation and analysis tools, or in tabular text format.

Analyze Resource Usage in Application C/C++ Code
When a performance problem has been found and located it has to be solved. What might seem to be insignificant details in the source code can have a big impact on overall system performance.

Figure 4. Enea® Optima Source Profiler

To help developers eliminate these problems, Enea Optima Source Profiler uses the hardware counters built into most modern processor cores to correlate the number of data and instruction cache misses, pipeline stalls, address translation cache misses, and so on, to exact locations in the source code, from executable files, down through functions, to individual source code lines. By counting completed instructions, processing hot spots in the source code can be located and optimized.

Record or Act on Kernel and Application Events
Enea Optima Log Manager allows developers, support engineers, testers or automated test scripts, to record behavior and to debug applications at the level of system or application events, rather than as individual source code lines, even while the system is in operation and stopping it is not an option.

Enea Optima Log Manager provides full access to the automatic event action mechanisms of the Enea OSE operating system. The event action system supports operating system events such as thread creation and termination, message transactions, context switches and error conditions. Enea OSE also allows application-specific events to be signaled from instrumented code.
versions of the software, and allow the user to compare the results. Or the logs can come from different nodes in a distributed, multicore system and be merged into a coherent single system image.

Users can configure the amount of data to include in the dump file, both in terms of the set of threads for which to save the information, as well as the kind of information and data regions to save. With no more than a few kilobytes of saved information, Enea Optima can provide a comprehensive view of the state of a faulting thread.

The Enea OSE kernel can generate post-mortem dumps both of individual programs, when the fault can be isolated within a single protection domain and the rest of the system can continue to run. And of the kernel and system as a whole, before a system restart.

**Full Insight into Heterogeneous Systems**

Enea Optima, including the C/C++ debug tools, support simultaneous connections to multiple processors in Enea LINX distributed clusters. This, together with the fact that Enea Optima supports not only Enea OSE, but also the Enea OSEc real-time operating system for DSPs, and Linux systems, gives users a complete view of a distributed application, without having to start and manage multiple tools or multiple instances of the same tool.

Because Enea Optima tools communicate using regular Enea LINX communication mechanisms, there is no need for dedicated communication software or hardware on each processor in order for the tools to be able to connect. If Enea Optima tools can reach one processor in a cluster, they can reach all processors in the cluster. The initial host to target cluster connection can be made over any media that the Enea Gateway protocol supports, such as TCP/IP. Template code to enable Enea Gateway communication over custom media is included in OSE and Optima releases.
Automotive Measurements and Export the Information
Information is of little value to software testers, support engineers or developers if it cannot be shared. Enea Optima tools provide several mechanisms that allow users to save and share captured information. All tables support desktop clipboard mechanisms, so wherever information is presented in a table, the user can select the relevant lines and paste them into an email or problem report. Enea Optima System Profiler and Enea Optima Log Manager can save and open data as binary dump files or in XML format. Both formats are public and documented to allow other tools access to the data.

All the capabilities on the target system and all code to handle the file formats that Enea Optima uses are available in a public and documented API, featuring a complete object model of the target system. This can be used to implement custom tools that plug into Enea Optima to present application specific information. The API is also accessible from script environments, providing a solid and feature rich foundation for automated test and measurement scripts, without the need for dedicated test code on the target, or fragile printout pattern matching code in the test scripts.

Eclipse and Open Source Standards
Enea is committed to the vision of Eclipse as a platform to enable users to run different tools from different vendors, without sacrificing the benefits of an integrated environment. Enea Optima releases, apart from featuring a preconfigured Eclipse installation, include a separate package containing the Enea Optima tools in the Eclipse update site format. This package allows users to integrate the tools into their own custom Eclipse environment or into Eclipse based tools platforms from other vendors.

PRODUCT FEATURES
- C/C++ IDE
- C/C++ Debug Support
- System Browser
- Pool and Heap Browsers
- System Profiler
- Source Profiler
- Log Manager
- Log Analyzer
- Post Mortem Dump Support
- Kernel Awareness Plugins

- Lowers cost, since the open source base and flexible license model allows customers to purchase what is needed and nothing else, be it support on open source parts, or licenses for commercial plugins for use in other Eclipse based environments.

- Reduces risk, since kernel awareness plugins provide presentation of kernel and application state, without direct dependencies between kernel data structures and partner debug environments or scripts.

- Increases end product quality and performance, as a result of the insight provided to testers and developers, even into complex multi-processor and multi-core systems.

SUPPORTED TARGET OPERATING SYSTEMS
- OSE 5.6 or later for the Optima Source Profiler
- OSE 5.3 or later for other Optima tools
- OSE 4.6.1 or later with limitations

Maximizes, being based on a standard Eclipse platform, freedom of choice of additional tools, from the vast eco system of Eclipse products, commercial and open source.
## Supported Target Architectures
- PowerPC®
  - ARM®
  - MIPS®
  - OSE Soft Kernel

## Supported Host Operating Systems
- Microsoft® Windows® XP / Vista / 7 (x86-32/64)
- SUSE® Linux Enterprise Desktop / Server (x86-32/64)
- Red Hat® Enterprise Linux Desktop / Server (x86-32/64)
- Solaris™ (SPARC®)

## Supported Partner Debug Environments
- Freescale™ CodeWarrior™
- ARM® Development Studio

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