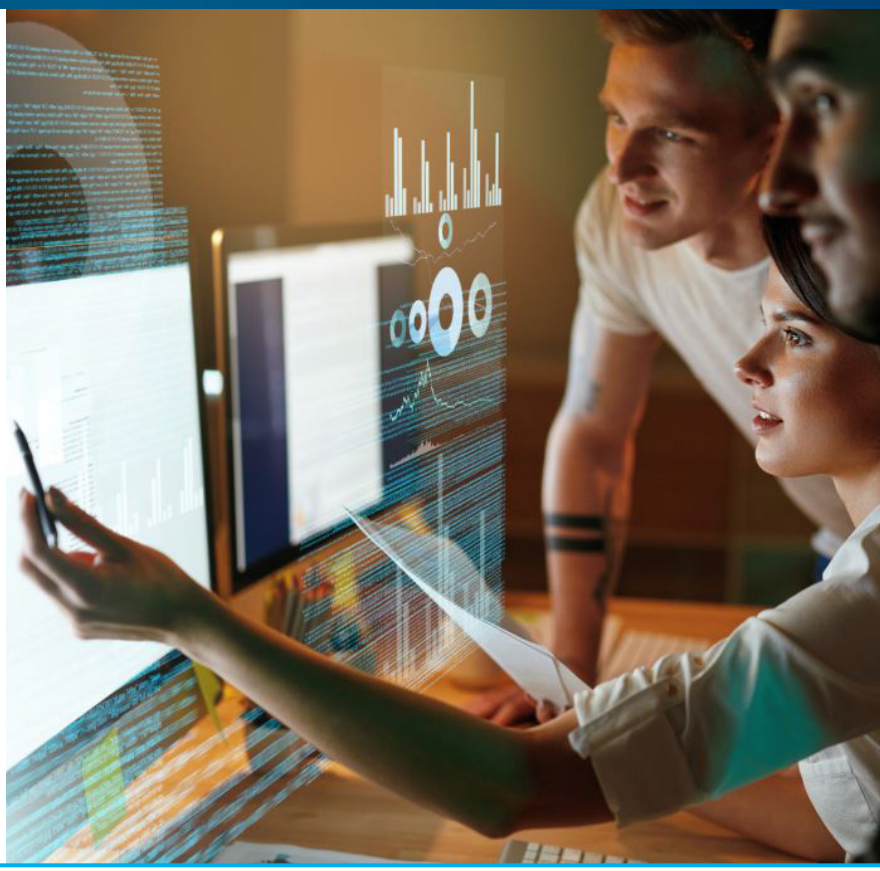
PRODUCT NOTE

CEVA-Toolbox™

Software Development Suite



CEVA-Toolbox

Introduction

The CEVA-Toolbox™ provides a software development framework for CEVA DSP cores, and includes a complete set of development, debug, and optimization tools for each of CEVA's DSP product families. All of these tools support the customer through the entire embedded application development flow.

Leveraging over 25 years of experience in developing software development tools and platforms for DSP cores, the CEVA-Toolbox development framework offers the most advanced set of features for DSP and embedded processor development. The combination of the CEVA-Toolbox and CEVA's state-of-the-art DSP core architectures ensures ease of programmability and optimal performance. By offering a fully integrated development platform with advanced graphical interfaces and highly efficient support for C/C++ level programming, the CEVA-Toolbox minimizes the need for DSP architecture-specific knowledge, which reduces risk and significantly speeds up time-to-market.

The CEVA-Toolbox supports both Windows and Linux operating systems.

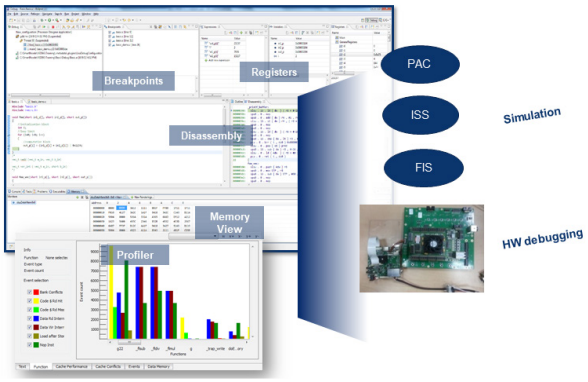
Key Benefits

- Provides field-proven, production-ready software development tools
- Minimizes the need for DSP architecture-specific knowledge
- Uses a familiar and intuitive Eclipse-based development environment
- Enables quick ramp-up for embedded programming
- Supports a state-of-the-art DSP Compiler with auto vectorization
- Creates small and high-performance code from a C/C++ source
- Easily detects application bottlenecks
- Enables you to extend the ISA to match custom application requirements (via the CEVA-Xtend)
- Supports integration with various standard tools (such as MATLAB and ESL Synopsys Visualizer)
- Provides an event-rich profiler
- Uses industry-standard technologies and APIs
- Supports the same tool chain front-end for all CEVA core architectures
- Supports code development that is compliant with safety applications (ISO26262)

Key Features

Eclipse-Based IDE Development Environment:

- The CEVA-Toolbox IDE integrated programming and debugging environment provides a mature, powerful, and easy-to-use work environment.
- The Eclipse-based IDE enables you to use hundreds of Eclipse-compatible plugins, and provides a convenient and familiar working experience.
- Project management is easy and intuitive, enabling you to instantly create new projects or import existing ones.
- Source editing supports quick operations, such as refactoring, symbol browsing, automatic alignment, and C/C++ error parsing.
- You can tweak each project with specific Compiler- or Linker-specific options via built-in Eclipse project properties that use CEVA-Toolbox capabilities and boost application performance.
- The CEVA-Toolbox IDE integrated Debugger enables you to simulate the built projects in instruction set or performance accurate modes, HW debugging via CEVA-JBOX, or remote debugging of full systems integrating CEVA Debugger Interface.
- The CEVA-Toolbox IDE supports:
  - The ability to run IDE scripts for project build and management, as well as for debug, breakpoints, memory / register reads/writes and run control.
  - Node locked or network server license models are supported.



The CEVA-Toolbox Eclipse-based IDE integrates a full set of software development tools

Highly Optimized LLVM/Clang C/C++ Compiler:

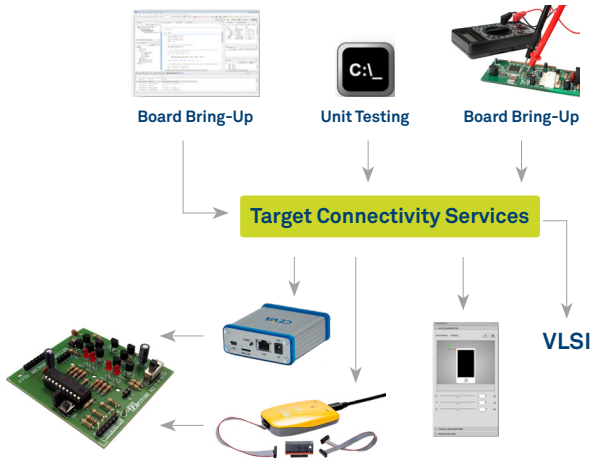
- Full support for the latest C and C++ standards:
  - C89, C99, C11, C++11, C++14 ISO language support, including their related standard libraries
  - IEEE floating point
- The C/C++ Compiler turns any porting task into a single-click operation. It is fully aware of all hardware resources and restrictions of the given platform, and generates a high-quality assembly code accordingly. With various optimization switches, generated code can be tuned either for speed or for size or for balanced speed and size optimizations.
- Vector programming support has been integrated into the Compiler to create a native programming experience. Dedicated vector types and operators enable you to define vector variables and perform vector operations on vectors as if they were integers - adding two vectors becomes as simple as writing V1 + V2.
- Auto vectorization support means that the task of turning standard C code into its vectorized form is mostly handled automatically by the Compiler. This enables standard C code to benefit from the outstanding performance of a vector processor even without an in-depth knowledge of the underlying processor architecture.
- Full ISA access using C-level intrinsics allows processor-specific optimizations right in the C code. When programmers want to utilize the advanced capabilities of any CEVA DSP core, they can simply use intrinsics, which are as easy to use as calling a C function. The Compiler, in return, translates the intrinsics into their equivalent single-cycle assembly instruction. Because almost all assembly instructions have equivalent C-level intrinsics, harnessing advanced processing capabilities in C code becomes a breeze.
- The VEC-C Navigator is an HTML-based tool with a full list of supported intrinsics, their APIs, and descriptions. The tools support a fast-filtering option, which simplifies the selection of the required intrinsic.
- The Compiler supports LLVM CLI-compatible options.

Architecture Simulator:

- Instruction Set Simulator (ISS):
  - Core and Memory Subsystem (MSS) functional simulation (no cycle accuracy)
  - For system and software development, verification, and debugging
- Performance Accurate Simulator (PAC):
  - Core cycle accurate with MSS transaction level modeling
  - For system and software modeling, optimization, and profiling
- Fast Instruction Simulator (FIS):
  - Visual Studio/GCC libraries for intrinsic simulation (VEC-C)
  - For algorithm and software development and debugging
- The architecture simulator supports a debug interface API, as well as interactive debug sessions (online and offline) and system core dump for memory and core registers.
- ESL software simulation:
  - Enables integration and debugging of CEVA cores into any system topology.
  - Support for one or more CEVA cores, non-CEVA cores, CEVA or user-defined HW accelerators.
  - OSCI System-C (transaction-level model) loosely timed interface, TLM2.0 API
  - CEVA Debugger Interface (DBGAPI)
  - Synopsys Platform Architecture supports CEVA IP (third-party ESL).
- Unit utilization visualization
  - Presents dynamic utilization of the core units (scalar, vector, load/store, and so on).

CEVA Debugger Interface for Multi-Core Debugging:

- The Debugger interface is a C++ interface that provides complete debug capabilities for all CEVA cores. It can easily connect to external applications and processes, and handles both simulation and hardware debugging.
- The interface provides full access to all DSP resources, as well as full DSP control, and full Debugger capabilities.
- Debugging and executing applications over an FPGA or development board is made easy via CEVA's hardware debugging over the Debugger interface. You can gain full control over a remotely connected CEVA hardware using its IP address and port number.
- The debugger supports C/C++ and assembler level debugging.
- The Target Connecticut Server (TCS) can be used to configure multi-core systems with any target option:
  - Debugging with a software simulator (ISS or PAC).
  - Hardware debugging with a CEVA JBOX3 debug unit.
  - RTL simulation connectivity (PLI)
  - Synopsys Platform Architecture (third-party ESL)



TCS is a single configuration GUI for configuring all tool targets and their properties

- Profiling of used maximum malloc and stack during SW simulation. For program debugging, you can view the maximum usage of stack and malloc size (for example, identify stack overflow).
- Direct connection and access to MATLAB applications.
- Support for concurrent debug sessions in multi-core systems.
- Full run control (step/in/over/out), SW/HW breakpoint and watch point, memory or register reads or writes, attach or detach, stack unwinding, addr2line, disassembly, stack unwinding.
- Different memory views with editing ability, variables, arguments and expression resolution.
- Support DWARF standard for debug info.

Binary Tools

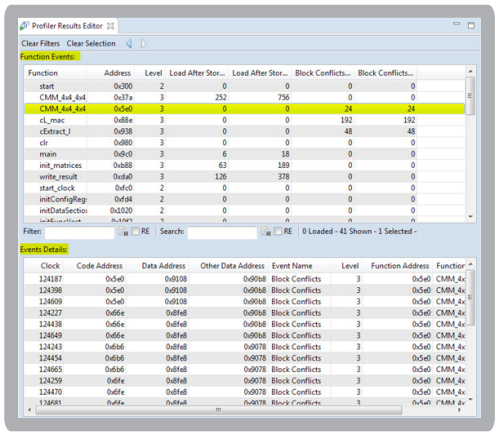
- The CEVA-Toolbox provides optimized GNU-based binary tools and utilities, for example, Assembler, linker, restriction checker supporting ELF/DWARF binary format.
- The enhanced CEVA Assembler supports smart unit allocation and extensive restriction checking with full pipeline awareness.
- The CEVA Disassembler enables you to reproduce original assembly code from object files and applications, including label references and assembly directives.
- The Linker and Assembler both support GNU CLI-compatible options.

Profiler

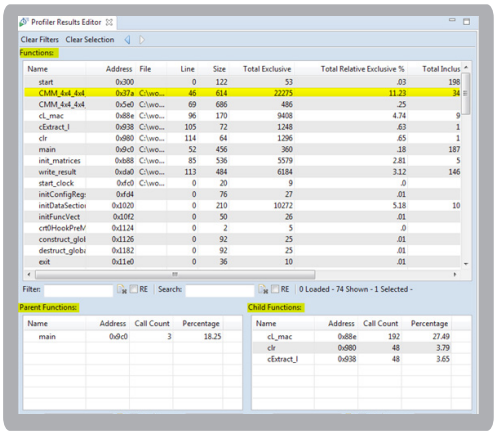
- Advanced profiler support for visualization helps analyze program execution results.
- Profiling information collection is very flexible, and enables you to choose between full or sampling profiling, focus on specific functions, sections, and various memory events.
- You can quickly identify your bottlenecks by using the various visualization dialogs and sortable tables.
- A rich set of events is gathered, for example, cycle count per function, processor stalls events, MSS events, code and data memory read and write events, code and data cache read hit or miss, TCM contentions, and so on.

CEVA-Xtend

- Enables you to instantly add new ISA capabilities for your specific application requirements to CEVA cores, ensuring maximum application performance.
- It is easy and intuitive to add your custom-defined operations and registers, enabling you to enhance the CEVA core with tailor-made ISAs and functionality specifically designed for your needs.
- Full tool awareness is provided on the spot, including Compiler, assembly, simulation, and debugging capabilities with full disassembly and register views.
- Automatically generated encoding schemes enable you to get full visibility of the extended functionality.



CEVA-Toolbox Profiler Events View



CEVA-Toolbox Profiler Functions View

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