

ENE[®] BARE METAL 1

PERFORMANCE TOOLS FOR NETLOGIC XLP AND CAVIUM OCTEON PLUS

Run Time Performance Visualization Tools for Optimization of “Bare Metal” IP Packet Processing Applications - Quickly and Easily Identify Performance Bottlenecks and Correct System Behavior

Optimizing and maximizing software and hardware performance in IP packet processing applications on multicore processors is a significant challenge, especially when applications are designed using a “bare metal” model utilizing a software development kit (SDK) specific to a hardware vendor. The Enea Bare metal Performance Tools (BMP Tools) provides the tools that are needed to maximize the performance and robustness of any XLP or Octeon Plus device application that uses either the full NetLogic SDK environment for XLP, namely NetOS/HyperExec environment, or the Cavium SDK environment for Octeon Plus.environment, or the Cavium SDK environment for Octeon Plus.

The Enea Bare Metal Performance Tools directly addresses the challenges of performance optimization by providing powerful graphical visualization tools that help developers identify performance problems.

- Software Profiling tools
- Source code function/line level CPU utilization
- HW counter mapping to source code at the function /line level, e.g. cache misses, pipeline stalls, etc
- System/Application Profiling tools
- Trace application based SW statistics over time – completely customizable
- 2-D or 3D display view of statistics, across all cores
- Logging and tracing tools
- Collect, store, forward and merge text/binary log data from all cores with global time stamp
- Graphical display of log entry data – filter on log type, individual log data entries, etc



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The “Problem” with High Performance IP Packet Processing

To ensure highest possible performance, packet processing applications are many times developed to run as a single “run-to-completion” loop in an OS-free environment, utilizing only silicon vendor run time libraries. The absence of a run-time platform, or an Operating System, also means a lack of development and debugging tools and related services. Silicon vendors like NetLogic and Cavium provide a host of tools for performance analysis, but these are mostly focused on run time collection. Making sense of the mountain of data that can be provided is a problem for developers. There are consistent themes from actual users of high performance multicore IP packet processing devices. See Figure 1

USER “PAIN” - BARE METAL APPLICATIONS

- Lack of quality tools for performance analysis
- Poor visualization of application performance across Cores
- Lack of consistent IPC for management & tools access
- Lack of system wide logging framework
- Lack of formal support from available silicon vendor run-time and tools solutions
- Lack of fielded system debug & problem analysis Solution

Figure 1 – Problems with existing bare metal solutions

Enea Bare Metal Performance Tools not only utilizes all the silicon provider’s run-time analysis capabilities, but extends them with its powerful host tools analysis framework.

The Bare Metal Performance Tools Concept

The fundamental issue for developers is: how to determine if the application design and implementation maximizes its usage of the multicore device’s features for optimal performance and correct behavior under all load conditions? Enea Bare Metal Performance Tools addresses this issue by focusing on the two most useful types of run time tools that can aid developers for performance optimization: a) Performance Profiling, and b) Logging. Bare Metal Performance Tools consists of an Eclipse based host tools suite called Enea Optima, a set of run time libraries and agents for data collection, and an IPC mechanism called Enea LINX for transport of the collected profiling and logging data to the Optima host tool, or to an external file for later analysis. See Figure 2

- **Minimal impact on performance Compatible with silicon vendor “Simple Execs,” , e.g. NetLogic or Cavium**
- **Software source code profiling**
 - Source code CPU Utilization
 - HW counters matched to source code
- **System Profiling:**
 - SW event counters and statistics

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- **Log collection and analysis**
 - collect, filter, correlate and visualize data from multiple log sources
 - available "Post-Mortem"
- **System wide IPC -LINX**
 - Intra-Core, Inter-Device
 - Available to applications

- Enea Optima
 - System Browser
 - SW Profiler
 - System Profiler
 - Log Manager
 - Log Analyzer
- Enea LINX
 - Inter-Core Transparent IPC
 - BMP Tools or Application Usage
- Bare Metal Debug Daemon

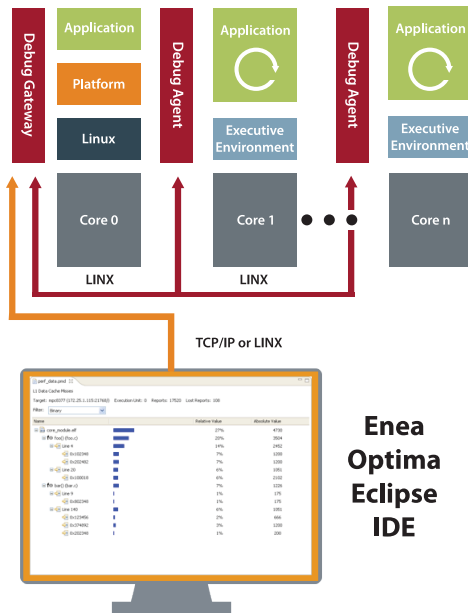


Figure 2 – BMP Tools Architectural Concept

Bare Metal Performance Tools Components

Enea Bare Metal Performance Tools brings existing Enea technology to the bare metal domain along with specific additions and adaptations for the bare-metal performance profiling and analysis use case on NetLogic and Cavium processors.

Bare Metal Performance Tools and NetLogic XLP and Cavium Octeon Plus SDK Run Time Environments

Enea Bare Metal Performance Tools are completely integrated into both the NetLogic XLP run time SDK architecture and the Cavium OCTEON PLUS SDK architecture. All SDK and Linux services are available with minimal impact on performance. Adding Bare Metal Performance Tools is simply a "drop in" to the vendor SDK environment.

Bare Metal Performance Profiling

Profiling helps developers optimize a slow performing application by visualizing runtime hardware constraints caused by the non-optimized implementation. Enea Bare Metal Performance Tools provides two types of performance profiling visualization via the Optima Tools Suite – Source Code Profiling and Application Profiling.

Source Code Profiling – identify at the source code level where constraints such as



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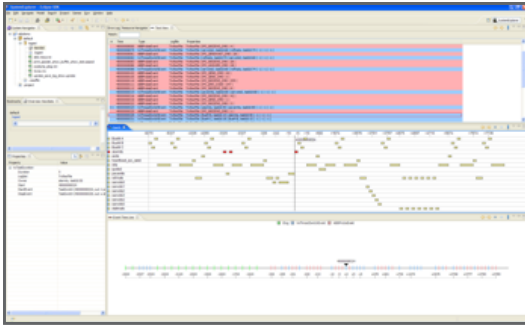


Figure 6 – Bare Metal Performance Tools, Optima Log Analyzer example – text and GANTT charts of log events

Multicore IPC-Enea LINX

Enea LINX is a major component of Bare Metal Performance Tools. In any multicore solution, the IPC (Inter-process Communication) mechanism is extremely important. All Enea Bare Metal Performance Tools components use the LINX framework. But applications need IPC too, and so Enea LINX is available to all applications including Linux and NetOS applications. Enea LINX provides an open, scalable, media/ interconnect independent, multi-OS, and application transparent solution for messaging communications between all cores, applications, and even to external devices. Any application can be an endpoint for LINX messaging, and any endpoint may communicate with any other endpoint in a LINX connected system – intra-core, inter-core, or to external devices. Find LINX on the Enea website for more details. The LINX concept is illustrated in Figure 7.

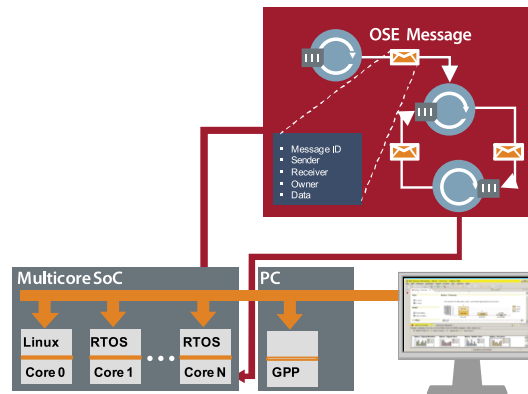


Figure 8 – Enea Flexible, scalable, interconnect independent message based IPC

The Enea Bare Metal Performance Tools Advantage

Enea Bare Metal Performance Tools is not an alternative solution for the NetLogic or Cavium supplied SDKs for run time environments and tools. It augments those solutions by providing a powerful performance tools analysis framework (Optima) along with the addition of a robust IPC mechanism and a “drop-in” debug agent that is useful to applications. Bare Metal Performance Tools on the target side is an overlay onto the existing NetLogic or Cavium SDKs, so that all SDK build, configuration, and device boot-load services are utilized. Then just simply install the Enea Optima Bare Metal Performance tools for the host development system (Linux or Windows) and you’re ready to go! The Bare Metal Performance Tools distribution also contains some example applications code that illustrates all key features of the

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PERFORMANCE TOOLS FOR NETLOGIC XLP AND CAVIUM OCTEON PLUS

PRODUCT FEATURES & BENEFITS

- Ensures maximum performance for multicore, bare metal applications
- No impact on normal performance (on/off)
- Aids in locating and fixing difficult to find bugs and performance problems
- Provides visibility into “black box” system execution
- Correlate HW counters with source code at function or line level
- Highly granular visibility into overall CPU utilization of any function or line of code
- User-defined statistics against which applications are profiled
- System-wide logging framework, including post mortem support
- Collect, filter, correlate and visualize data from multiple log sources
- Log visualization - synchronized Gantt charts, textual browsers, plot views, state-charts, sequence charts
- Intra-core, inter-core, inter-device process communications software is available to application
- Industry-standard Eclipse-based host tools

