PAPI (Performance Application Programming Interface) provides a consistent interface (and methodology) for hardware performance counters, found across a compute system: i.e., CPUs, GPUs, on- and off-chip memory, interconnects, I/O system, file system, energy/power, etc. PAPI enables software engineers to see, in near real time, the relationship between software performance and hardware events across the entire compute system. FIND OUT MORE AT http://icl.utk.edu/papi

PAPI (Performance Application Programming Interface)

**Standard Features**
- Standardized Performance Metrics
- Easy Access to Platform-Specific Metrics
- Multiplexed Event Measurement
- Dispatch on Overflow
- Overflow & Profiling on Multiple Simultaneous Events
- Bindings for C, Fortran and Matlab
- User Definable Metrics derived from Platform-Specific Metrics
- Support for Virtual Computing Environments
- Performance counter monitoring at task granularity for dataflow runtime PaRSEC

**Supported Architectures**
- AMD X86
- ARM Cortex A7, A8, A9, A15, X-Gene (ARM64), Raspberry Pi
- CRAY Gemini and Aries interconnects | RAPL power
- IBM Blue Gene Series, Q: 5D-Torus, I/O system, EMON power on BG/Q | Power Series
- Infiniband
- Intel Nehalem, Westmere, Sandy Bridge, Ivy Bridge, Haswell, Haswell-EP, Broadwell, Skylake(-X), Kaby Lake, Knights Corner, Knights Landing | RAPL; power capping, Power on Xeon Phi
- Lustre
- NVIDIA Tesla, Kepler, NVML | CUDA support for multiple GPUs, PC Sampling
- Virtual Environment VMWare, KVM

**Performance Analysis Tools**
- Vampir
- TAU
- HPCView

**FutureGrid**
FutureGrid provided resources for testing and development of PAPI-V

**R&D100 Winner**

**Innovative Computing Laboratory**

**The University of Tennessee**

**Center for Information Technology Research**

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- THE UNIVERSITY OF TENNESSEE KNOXVILLE

**MORE**
- HPCToolkit
- OpenSpeedShop
- PaRSEC
- PerfSuite
- Scalasca
- SCORE-P
PAPI provides tool designers and application engineers with a consistent interface and methodology for the use of low-level performance counter hardware found across the entire compute system (i.e. CPUs, GPUs, on/off-chip memory, interconnects, I/O system, energy/power, etc.). PAPI enables users to see, in near real time, the relationships between software performance and hardware events across the entire compute system.

Exa-PAPI builds on the latest PAPI project and we will extend it with:

• Performance counter monitoring capabilities for new and advanced ECP hardware, and also software technologies;
• Fine-grained power management support;
• Integration capabilities for exascale paradigms, such as task-based runtime systems that support dataflow programming models;
• “Software-defined Events” that originate from the ECP software stack and are currently treated as black boxes (i.e., communication libraries, math libraries, task-based runtime systems, etc.).

The objective is to enable monitoring of both types of performance events—hardware- and software-related events—in a uniform way, through one consistent PAPI interface. That implies, 3rd-party tools and application developers have to handle only a single hook to PAPI in order to access all hardware performance counters in a system, including the new software-defined events.

The Exascale Computing Project (ECP) was established with the goals of maximizing the benefits of high-performance computing (HPC) for the United States and accelerating the development of a capable exascale computing ecosystem. Exascale refers to computing systems at least 50 times faster than the nation’s most powerful supercomputers in use today.

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