PAPI (Performance Application Programming Interface) provides the tool designer and application engineer with a consistent interface and methodology for use of the performance counter hardware found across the system (i.e., CPUs, GPUs, on-/off-chip Memory, Interconnects, I/O system, File System, Energy/Power, etc.). PAPI enables software engineers to see, in near real time, the relation between SW performance and HW events across the entire compute system.

**PERFORMANCE ANALYSIS TOOLS**

- HPCToolkit
- Open|SpeedShop
- PaRSEC
- PerfSuite
- Scalasca
- SCORE-P
- TAU
- Vampir
- HPCView

**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, A15, X-Gene (ARM64), Raspberry Pi

**CRAY**
- Gemini and Aries interconnects
- RAPL power

**IBM**
- Blue Gene Series, Q; 3D-Torus, I/O system, EMON power on BG/Q
- Power Series

**Infiniband**
- Nehalem, Westmere, Sandy Bridge, Ivy Bridge, Haswell, Haswell-EP, Broadwell, Skylake, Knights Corner, Knights Landing
- RAPL power capping, Power on Xeon Phi

**Intel**
- Tesla, Kepler, NVML
- Cuda 8, PC Sampling

**NVIDIA**
- Tesla, Kepler, NVML
- Cuda 8, PC Sampling

FutureGrid provided resources for testing and development of PAPI-V

FutureGrid

WITH SUPPORT FROM

INNOVATIVE COMPUTING LABORATORY

SPONSORED BY

U.S. Department of Defense

National Science Foundation

SILAS Award

FIND OUT MORE AT [http://icl.cs.utk.edu/papi](http://icl.cs.utk.edu/papi)
WORKING TO BUILD MEASUREMENT TOOLS FOR CHANGING HARDWARE AND SOFTWARE PARADIGMS
AN IN-PROGRESS PROJECT WHICH WILL EXTEND THE PAPI PARADIGM FOR THE NEAR FUTURE

SYSTEM-WIDE MEASUREMENTS
The ability to measure inter-core resource counters (e.g., memory hierarchy, network, GPUs, PCI bus, power) with PAPI will greatly broaden the understanding of application performance on modern hardware. In addition, PAPI will incorporate a counter inspection toolkit designed to improve understanding of low-level events. We aim to define an accurate mapping between particular high-level concepts of performance metrics and underlying low-level hardware events.

QUICK ACCESS TOOL
PAPI-EX will develop an easy-to-use tool providing quick access to PAPI measurements by building on an open source version of a performance measurement and testing tool—papiex—created by an industry collaborator. An updated high-level API containing community requested improvements will support this tool.

DATA-FLOW RUNTIME SYSTEMS
In contrast to the traditional control flow model, dataflow-based programming models have become increasingly popular, especially on distributed heterogeneous architectures. Consequently, there is a growing demand on performance measurement tools for task-based, dataflow-driven runtimes. PAPI-EX will support integration with task-based runtime systems, enabling hardware performance counter measurements at true task granularity, as opposed to the thread/process granularity achievable today.

SAMPLING INTERFACE
PAPI-Ex is being extended to provide a portable, easy-to-use interface to sampling data, enabling the tools community to provide advanced performance analysis and optimization capabilities to the user.