Properties of software for computational science, data analysis, and connectivity cannot be understood without accounting for the characteristics and behavior of the actual binary code. This project will overhaul, integrate, and enhance static binary analysis and runtime technologies to produce components that provide a foundation for performance, correctness, and security tools that operate on software at the binary level.

Dyninst: Components for Binary Analysis and Instrumentation

- Code Gen API
- Patch API
- Symtab API
- Parse API
- Instruction API
- DataFlow API
- StackWalker API
- ProcControl API

Static Analysis
Interpret symbol tables, parse binaries and reconstruct control flow, use instruction semantics and data flow to analyze operation and effects

Dynamic Instrumentation and Control
Control parallel program executions, inspect and instrument running applications

HPCToolkit: Performance Measurement and Analysis for Scalable Parallelism

Measurement: asynchronously sample multi-threaded, multi-node computations
Attribution: use binary analysis to map metrics back to optimized code
Analysis: attribute costs to code, pinpoint and quantify scaling bottlenecks, assess variability and imbalance, analyze behavior over time, identify root causes of losses, associate costs with data

Technical Challenges
Emerging architectures: ARM8-64, Power9, KNL
Increasing parallelism: millions of threads
Diverse hardware: multicore, manycore, accelerated
Increasing SW complexity & optimizing compilers
Fast and accurate measurement and analysis
Software testing and quality
Reliance on 3rd party software

Management Challenges
Increasing external support for sustainability: bringing SW to level where companies invest
Engaging tool developers, end-users

Outreach
2016 Scalable Tools Workshop, Lake Tahoe, CA, August 1-4, 2016

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