Testimonials

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Automated Testing in HPC

A Testimonial by Costin Iancu
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Scientific Computing and Tools

- **Scientific programming is fraught with many challenges**
  - Very large scale shared/distributed memory systems
  - Mixed language apps (Fortran + …)
  - Mixed parallelism (SPMD + tasking + work stealing…)
  - Ad hoc synchronization constructs, communication libraries

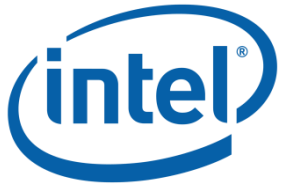
- **We need better tools for detecting concurrency/non-deterministic bugs**
  - Industry/vendors develop for the “data center” workloads -> need specialization for HPC
  - HPC folk skeptical of tools -> need precision, scalability and reproducibility

Why We Like Active Testing

- **Practical approaches to build very useful HPC tools**
  - **Dynamic program analysis** – portable and manageable implementation complexity, well suited for our multi-language multi-paradigm apps (C++, Fortran, MPI, OpenMP)
  - **Predictive Analysis** – run once to find a lot of bugs works well for our resource constrained environments
  - **Precise Analysis –** reporting few false positives helps to overcome skepticism
  - **Deterministic Replay** – useful in debugging

The UPC Connection

- **UPC has shared memory abstractions, one sided-communication and relaxed memory models**
  - Enables writing highly asynchronous programs
  - Easy to write buggy programs
  - Even easier when compiler/runtime is buggy (EXASCALE anybody?)
- **We decided we need automated tools to pinpoint synchronization bugs**
- **Circa 2009, Kathy Yelick mentioned there's a junior faculty doing interesting work in testing**
- **The success story**
  - UPC-Thrille scales up to 10,000 cores with < 2X overhead
  - Deployed at major DOE facilities on systems with > 100,000 cores
  - Started DOE and DoD funded projects in the area



ParLab Testimonial

Gilles Pokam
Advanced Programmability Research
Intel Labs

- Projects
  - RADBench – A Concurrent benchmark suite to help evaluate concurrency tools (w/ Nick Jalbert, Koushik Sen)
  - Concurrent breakpoints to debug multithreaded programs (w/ Koushik Sen)
- Impact
  - RADBench suite widely used to evaluate concurrency tools @ Intel Labs
  - Concurrent breakpoint idea inspired our Concurrent Predicate research, which is getting more traction in the community (ongoing plans to integrate it in a debugger)
- Publications/Patents
  - Radbench: a concurrency bug benchmark suite
    N Jalbert, C Pereira, G Pokam, K Sen
    Proceedings of the 3rd USENIX Conference on Hot Topics in Parallelism (HotPar)
  - METHOD AND SYSTEM FOR DETECTING ABNORMAL INTERLEAVINGS IN CONCURRENT PROGRAMS
    NA JALBERT, CL PEREIRA, GA POKAM
    WO Patent 2,012,087,402