ScalaReplay: Replay Using Histogram Timing Annotations

- Idea: preserve time in compressed traces
- Encode delta instead of timestamps
- Create delta histograms automatically
- Dynamically balance histograms

Trace sizes (NAS Benchmarks and UMT2K)
- LU Near-constant trace size
- FT Sub-linear trace size
- IS Non-scalable trace size

Replay accuracy (NAS Benchmarks and UMT2K)
- Accurate replay: DT, EP, FT, LU, IS, UMT2K
- Replay inaccurate in MPI Time: CG, MG
- Replay inaccurate in Compute Time: BT

ScalaTrace: Reconfigurable, Scalable Performance Analysis
Trace representation using Power Regular Section Descriptions (PRSDs)

Description of problem
- Size of machines is rapidly increasing (130,000+ processors)
- Tools will be overwhelmed with data
- Need scalable, online measurement and analysis

Future Directions
- Flexible framework for application-specific tools
  - Ability to select compression schemes for different fields, data types
  - Foster combination, interaction between data collection, analysis mechanisms
  - Adaptive, self-tuning runtime systems

Evolutionary Load-Balance Analysis with Scalable Data Collection
- Idea: Normalize measurements and models based on application semantics.
- Progress loops
  - Typically outer loops in SPMD codes
  - Include absolute progress towards some domain-specific goal
  - Basis for comparison of load over time

Effort Loops
- Variable-time loops, represent load
- Data-dependent execution

Scalable Compression Using Wavelet Transform
- Distributed pre-process effort measurements are consolidated onto fewer processes
- Progressive instrumentation
  - User marks progress loop explicitly

Load Balance in ParaDis
- Models dissipation dynamics in crystals
  - Load-annotated parallel transform
  - Recursive spatial domain decomposition
  - Balancer redivides nodes/arrows among, then y, then x

Effort for 64-node ParaDis Run
- Execution time: 247.21 seconds
- Force level:
  - 200
  - 250
  - 300

Near-term:
- Adaptive wavelet transform topology, equivalence class detection
- Full time-sequence compression

An Open Framework for Scalable, Reconfigurable Performance Analysis
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