Evaluating DVFS and Concurrency Throttling on IBM’s Power8 Architecture
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Abstract
LLNL’s next supercomputer Sierra will be based on IBM’s Power Architecture. Early insights of how applications perform on this architecture are beneficial. In this work, we study application performance under different CPU frequency and concurrency settings on a Power8 system. DVFS and Concurrency Throttling improve both throughput and energy efficiency.

Methodology
- Measurement of application performance
  - Varying frequencies
  - Different number of threads per core
  - SMT8 vs. SMT4
- Measurement granularity
  - OpenMP parallel loop
  - Runtime frequency change
  - Energy control API
- Benchmarks
  - Graph500 – Breadth-First Search
  - LULESH 2.0 – Shock Hydrodynamics
  - miniFE – Finite Element Code

New Insights with DVFS and Concurrency Throttling
- Concurrency Throttling
  - Applications do not always need 8 threads per core
    - miniFE and LULESH perform best with 4 threads per core
    - Graph500 performs best with 8 threads per core
  - SMT4 performs as well as SMT8
- DVFS
  - Lower frequency leads to longer execution time for all benchmarks
  - However, applications have quite different slowdown when reducing the frequency
  - Memory bound applications like miniFE benefit from DVFS

Conclusions
- Applications benefit from using concurrency throttling
- Some application regions are insensitive to frequency change, providing energy savings
- DVFS and Concurrency Throttling improve performance and energy efficiency