Accelerated Real-Time Processing of Radio Telescope data

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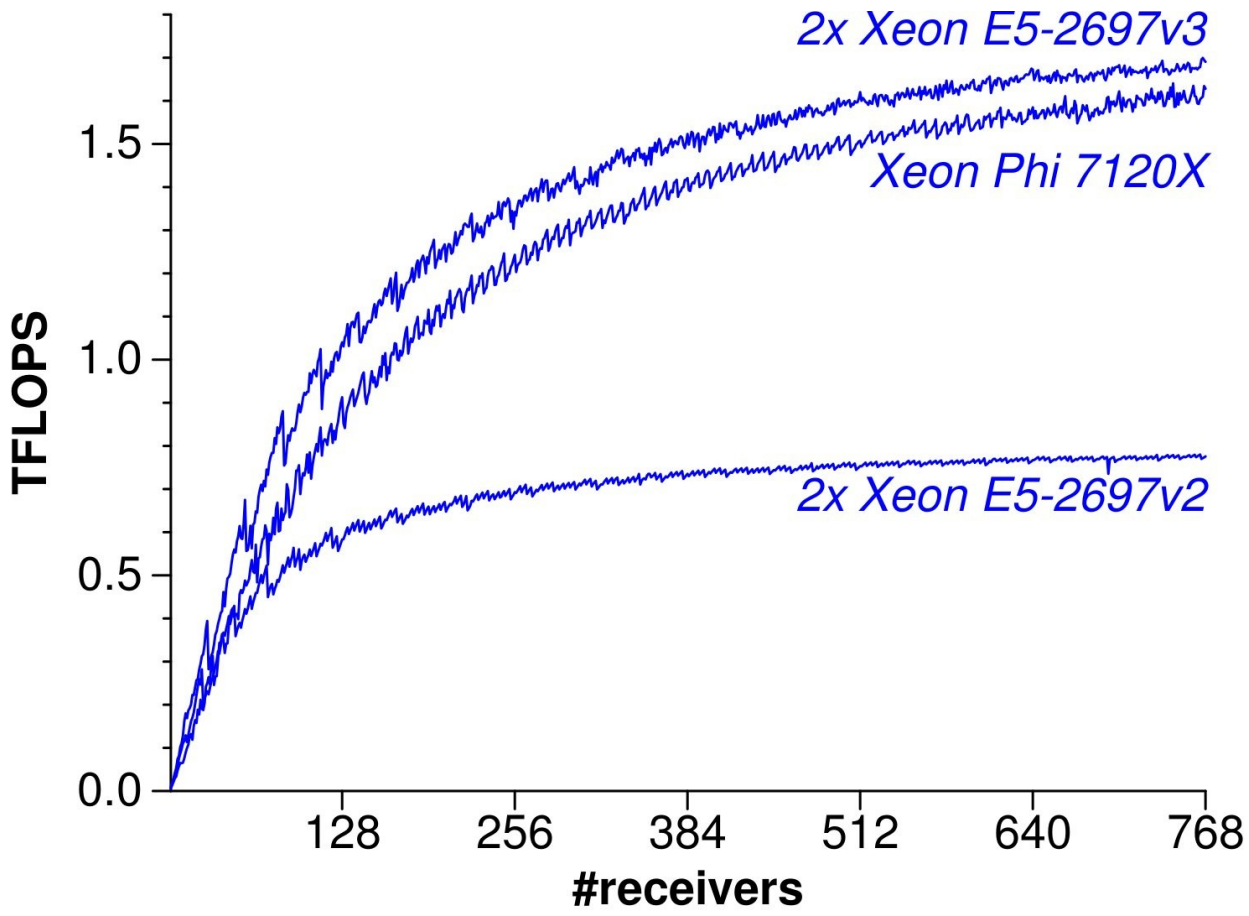
What's unique about my tuning work

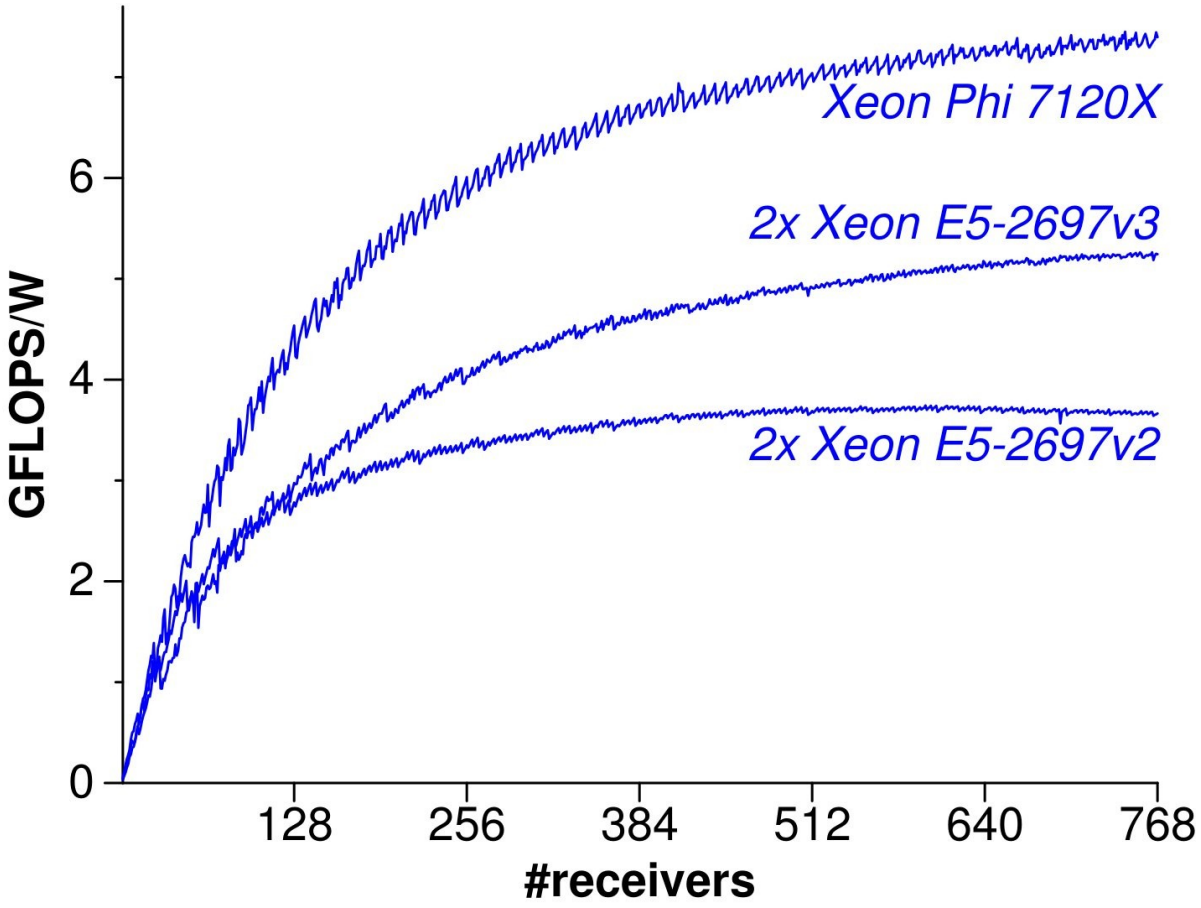
- correlator
  - combines data from radio telescopes
- signal processing
  - *FIR filter, FFT, source tracking, bandpass correction, correlate*
- compare *Xeon, Xeon Phi, AMD & NVIDIA GPUs, TI DSP*
- offload mode
  - external I/O too slow in native mode
- tools
  - vtune amplifier, disassembler, gdb
- custom-built power monitor
  - millisecond accurate
  - application measures per-kernel energy efficiency

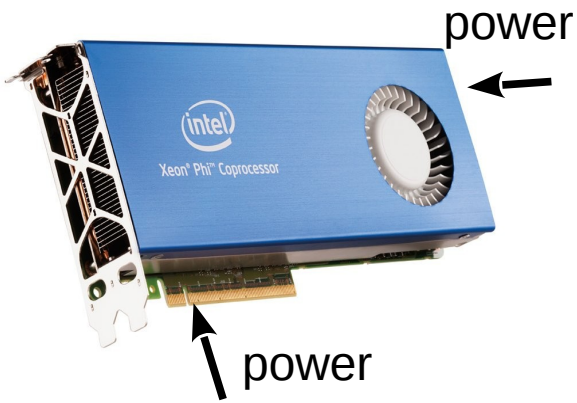
Performance

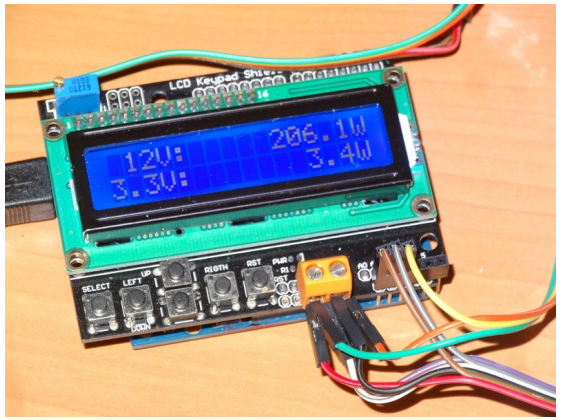


- optimizations:
  - intrinsics
  - prefetch; unordered streaming writes

Energy Efficiency







- Xeon: package power + DRAM
- Xeon Phi: whole board

Insights

- non-contiguous memory access on Xeon Phi much more problematic than on Xeon (TLB misses)
- some kernels: parallelized differently on Xeon Phi
  - cannot predict in advance what works better
- autovectorization not always efficient (→ use intrinsics)
- larger (32x16) register file of Xeon Phi minimizes spilling
- AVX2 FMA (Haswell): ~2x performance over Ivy Bridge