ASCR - Computer Science Highlight

Objectives

- Improve programmer productivity for building sophisticated parallel Fortran applications
- Achieve high performance and scalability on leadership computing platforms
- Demonstrate value for mission-critical DOE codes

Impact

- Influenced Fortran 2008 standard (adopted Oct 2010)
- With LBNL, fixed scaling of GASNet communication library on supercomputers
- Improved Fortran support in ROSE compiler infrastructure

Productivity = Performance / SLOC

Performance (Cray XT4)

# of cores	HPC Challenge: STREAM Triad† (TByte/s)	RandomAccess* (GUP/s)	Global HPL† (TFlop/s)	Global FFT† (GFlop/s)
64	0.14	0.08	0.36	6.69
256	0.54	0.24	1.36	22.82
1024	2.18	0.69	4.99	67.80
4096	8.73	2.01	18.3	187.04

*Measured on Jaguar † Measured on Franklin

Source lines of code (SLOC)

HPC Challenge Benchmark	CAF 2.0 SLOC	MPI SLOC
Randomaccess	409	787
EP STREAM Triad	58	329
Global HPL	786	8800
Global FFT	~390	1130

Notes

- EP STREAM: 66% of memory B/W peak
- Randomaccess: high performance without special-purpose runtime
- HPL: 49% of FP peak at @ 4096 cores (uses dgemm)

Accomplishments in FY11

- Awarded "Most Productive Language," HPC Challenge Awards at SC10
- Demonstrated scalable performance on HPC Challenge benchmarks (IPDPS 11)
- Designed and implemented language extensions for asynchrony (PGAS 10)
  - collectives, copies, and function shipping

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