ASCN - 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

<table>
<thead>
<tr>
<th># of cores</th>
<th>HPC Challenge</th>
<th>Performance (Cray XT4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STREAM Triad(^1) (TByte/s)</td>
<td>RandomAccess(^*) (GUP/s)</td>
</tr>
<tr>
<td>64</td>
<td>0.14</td>
<td>0.08</td>
</tr>
<tr>
<td>256</td>
<td>0.54</td>
<td>0.24</td>
</tr>
<tr>
<td>1024</td>
<td>2.18</td>
<td>0.69</td>
</tr>
<tr>
<td>4096</td>
<td>8.73</td>
<td>2.01</td>
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</tbody>
</table>

*Measured on Jaguar  †Measured on Franklin

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

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)