Lecture 11.1
Top 500

EN 600.320/420/620
Instructor: Randal Burns
5 March 2018
TOP500

- Fastest 500 computing machines
  - According to LINPACK benchmark
  - Supposed to be general purpose
- Controversial
  - Other metrics represent other problems
  - Graph500: data-intensive supercomputing
  - Green500: best computing power per watt
- Currently “Sunway TaihuLight” Xiwu Chine
  - 93 TFlops, 10,649,000 cores, 15,371 kW
  - All Chinese hardware

http://ornl.gov/info/ornlreview/v45_3_12/images/a04_p10_lrg.jpg
Top500 Growth (Exascale coming)
## Top500: Flops/KW

<table>
<thead>
<tr>
<th>Rank</th>
<th>System</th>
<th>Cores</th>
<th>Rmax [TFlop/s]</th>
<th>Rpeak [TFlop/s]</th>
<th>Power [kW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Sunway TaihuLight</strong> - Sunway MPP, Sunway SW26010 260C 1.45GHz, Sunway, NRCPC National Supercomputing Center in Wuxi China</td>
<td>10,649,600</td>
<td>93,014.6</td>
<td>125,435.9</td>
<td>15,371</td>
</tr>
<tr>
<td>2</td>
<td><strong>Tianhe-2 [MilkyWay-2]</strong> - TH-IVB-FEP Cluster, Intel Xeon E5-2692 12C 2.200GHz, TH Express-2, Intel Xeon Phi 31S1P, NUDT National Super Computer Center in Guangzhou China</td>
<td>3,120,000</td>
<td>33,862.7</td>
<td>54,902.4</td>
<td>17,808</td>
</tr>
<tr>
<td>3</td>
<td><strong>Piz Daint</strong> - Cray XC50, Xeon E5-2690v3 12C 2.6GHz, Aries interconnect, NVIDIA Tesla P100, Cray Inc. Swiss National Supercomputing Centre (CSCS) Switzerland</td>
<td>361,760</td>
<td>19,590.0</td>
<td>25,326.3</td>
<td>2,272</td>
</tr>
<tr>
<td>4</td>
<td><strong>Gyoukou</strong> - ZettaScaler-2.2 HPC system, Xeon D-1571 16C 1.3GHz, Infiniband EDR, PEZY-SC2 700Mhz, ExaScaler Japan Agency for Marine-Earth Science and Technology Japan</td>
<td>19,860,000</td>
<td>19,135.8</td>
<td>28,192.0</td>
<td>1,350</td>
</tr>
</tbody>
</table>
Top 500 Evolution

Architecture Share Over Time
1993-2011

Performance Share

TOP500 Releases


- MPP
- Cluster
- SMP
- Constellations
- Single Processor
- Others

Lecture 3: Parallel Architectures
Who has supercomputers?

- Industry increasingly
Green 500

- MFlops/watt
  - Power efficiency will be the limited factor in reaching exascale computing
  - Also co-branded as environmentally friendly

- Lists dominated by heterogeneous computers
  - #1 = Shoubu (RIKEN) 6673.84 MFLOPS/Watt
  - Intel Xeon with PEZY-SCnp accelerators
Green 500

- MFlops/watt
  - Power efficiency will be the limited factor in reaching exascale computing
  - Also co-branded as environmentally friendly

- Lists dominated by heterogeneous computers
  - #1 = Shoubu (RIKEN) 6673.84 MFLOPS/Watt
  - Intel Xeon with PEZY-SCnp accelerators

- Convergence with Top500
  - T3=G10, T4=G5
  - Finite power infrastructure at any one site
  - Exascale requires green
Green Trends Efficiency

https://www.top500.org/files/green500/141120-SC14-Green500-BoF.pdf
Green Trends Architectures

https://www.top500.org/files/green500/141120-SC14-Green500-BoF.pdf
Exascale at 25 MW?

The Green500 BoF, SC14, Nov. 2014
POC: info@green500.org