HPC and Hyperscale: Trends for 2016

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2014 HPC Market, 2015-19 Forecast

- Total HPC market in 2014 was $29.4 billion, up 2.8% Y/Y
  - HPTC: $21.5 billion, up 2.2%
  - HPBC: $7.9 billion, up 4.5%
- 4.2% CAGR forecast, reaching $36.1 billion in 2019
- Significant changes in vendor shares:
  - 2014: IBM selling x86 server business to Lenovo
  - 2015-16: #1 server vendor for HPC by 2014 revenue (Dell) acquiring #1 storage vendor for HPC by 2014 revenue (EMC)
- Energy segment (oil & gas) will miss forecasted revenue for 2015-16
What We Count As HPC

High-Performance Technical Computing
• Applications in science and engineering
• Includes verticals such as manufacturing, pharma, oil and gas

High Performance Business Computing
• Non-scientific business applications
• Includes verticals such as financial services, MMOGs, entertainment
What We Count As HPC

HPC Servers 2014 Worldwide Revenue ($000)

Intersect360 Research data from 2014 HPC market model and forecast, June 2015
A Caution About Forecasting

“When you create a forecast, it has to be bound by what is realistic, whereas reality itself has no such limitations.”

– Chris Willard
Chief Research Officer
Intersect360 Research
Worldwide HPC Revenue ($K):
2010-14 Actual and 2015-19 Forecast
Intersect360 Research, 2015
2014 HPC Server Revenue Shares

- IBM figure includes three financial quarters of x86 servers, pre-Lenovo transition
- IBM will be much lower in 2015
- HP could easily overtake Dell

Dell has traditionally used a narrower definition of HPC than HP has. Need to measure both with the same yardstick.
Users whose computational needs, application domains, and business model demand a web-scale infrastructure that incorporates scalability and performance. In general, includes organizations that have applications requiring thousands of servers to operate and require certain economies of scale to be viable. Examples include web search, content hosting, cloud hosting, online retail, social media, and others.

- Intersect360 Research has counted “Ultrascale Internet” as an HPC segment since 2007
- We have taken this segment out of our HPC methodology and are now tracking it in a separate advisory service
# HPC vs. Hyperscale

## Similarities
Application infrastructure that is distinct from general enterprise
Applications are arbitrarily scalable
Top tier users push boundaries and influence technology throughout industry

## Differences

**HPC**
- Primary focus is performance
- Large jobs
- Is still “HPC” on only a few nodes – there is entry-level HPC
- Largest supercomputers are >$100 million

**Hyperscale**
- Primary focus is scalability
- Many jobs
- At lower levels it is just enterprise computing – no entry-level
- Largest hyperscale installations are >$1 billion
# Tiers of Hyperscale (Draft)

<table>
<thead>
<tr>
<th>Tier</th>
<th>Annual IT Budget</th>
<th>Expertise Level</th>
<th>Buying Models</th>
<th>Financial Leverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elite – Tier 1</td>
<td>Greater than $1,000M</td>
<td>Technology innovators</td>
<td>Built to order; customer defines systems architecture</td>
<td>Able to leverage multiple levels of the supply chain, OEM, ODM, EMS, and component manufactures</td>
</tr>
<tr>
<td>High – Tier 2</td>
<td>$500M – $1000M</td>
<td>Strong systems management and technology integrators at all levels</td>
<td>Commercial-off-the-shelf hardware and software from multiple vendors</td>
<td>Able to manage multiple vendors, integrators, etc. Have ability to invest at the location/IT facility level</td>
</tr>
<tr>
<td>Mid – Tier 3</td>
<td>Under $500M</td>
<td>Strong systems management, software integrators</td>
<td>Solutions buy on hardware side, software from multiple vendors, open to services</td>
<td>Able to manage multi-vendor bidding process, and some degree of multi-vendor environment. Minimal flexibility on site selection.</td>
</tr>
</tbody>
</table>
Important Hyperscale Trends

• Software development: new languages, algorithms, standards (e.g. OpenStack)
• New application areas, particularly in cognitive computing / machine learning / AI
• “Competing standards” in server form factors: multiple generations of Open Compute Project and Beiji/Scorpio
• Deployment of high-performance technologies for selected applications (GPUs, InfiniBand, …)
SC15 Trends: Accelerated Computing

- Free download: Two new research reports
  - “HPC Application Support for GPU Computing”
  - “Accelerated Computing at a Tipping Point”
- 34 of top 50 HPC applications (9 of top 10) offer some level of GPU support or optimization

<table>
<thead>
<tr>
<th>Software Supplier - Package Name</th>
<th>Mentions</th>
<th>Rank</th>
<th>GPU Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaussian – Gaussian</td>
<td>118</td>
<td>1</td>
<td>Under Development</td>
</tr>
<tr>
<td>ANSYS – Fluent</td>
<td>114</td>
<td>2</td>
<td>Accelerated</td>
</tr>
<tr>
<td>Gromacs.org – GROMACS</td>
<td>93</td>
<td>3</td>
<td>Accelerated</td>
</tr>
<tr>
<td>Dassault Systemes - SIMULIA Abaqus</td>
<td>91</td>
<td>4</td>
<td>Accelerated</td>
</tr>
<tr>
<td>U of Illinois, UC – NAMD</td>
<td>75</td>
<td>5</td>
<td>Accelerated</td>
</tr>
<tr>
<td>NCAR – WRF</td>
<td>72</td>
<td>6</td>
<td>Accelerated</td>
</tr>
<tr>
<td>U of Vienna – VASP</td>
<td>68</td>
<td>7</td>
<td>Accelerated¹</td>
</tr>
<tr>
<td>OpenFoam Foundation – OpenFOAM</td>
<td>54</td>
<td>8</td>
<td>Accelerated</td>
</tr>
<tr>
<td>LSTC - LS-DYNA</td>
<td>53</td>
<td>9</td>
<td>Accelerated</td>
</tr>
<tr>
<td>AmberMD.org – AMBER</td>
<td>50</td>
<td>10</td>
<td>Accelerated</td>
</tr>
<tr>
<td>NCBI – BLAST</td>
<td>46</td>
<td>11</td>
<td>No</td>
</tr>
<tr>
<td>PNNL – NWChem</td>
<td>35</td>
<td>12</td>
<td>Accelerated</td>
</tr>
</tbody>
</table>

¹ GPU implementation of VASP is beta complete; formal release expected soon.
New study: Processor Outlooks for HPC

• 269 respondents, Q1 2016
• Current usage, planned future usage, evaluation of processor technologies: Xeon, Xeon Phi, Power (OpenPOWER), GPU, FPGA, ARM, others
• Forecast adoption of Xeon Phi, OpenPOWER, etc.
• Importance of hardware and software features
• Programming languages and models

Also: Outlook for InfiniBand vs. OmniPath, plus impressions of NVlink, CAPI, and other architecture elements
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