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HPC Trends

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Actionable Market Intelligence for High Performance Computing

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# Future-Looking Trends (Tuesday a.m.)

- Multi-core, and its implications for:
  - Memory usage
  - Power consumption
  - System utilization
- Accelerators (e.g. GPU computing)
  - Programming models
  - System efficiency
- Big Data
- Adoption of HPC

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From "HPC User Site Census Report"

The primary challenges for users are:

- How to plan the balance between processors per node, cores per processor, memory per node, I/O and interconnect on node, total nodes, etc.

- How to adapt applications for node parallelism and on-chip (i.e., multi-core) parallelism.

- How to organize the overall job mix. Smaller nodes may be a better fit for processing large numbers of small jobs or large set of jobs with a broad range of requirements. Larger nodes may work best with a job mix skewed to larger problems.

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HPC System Architectures by Year
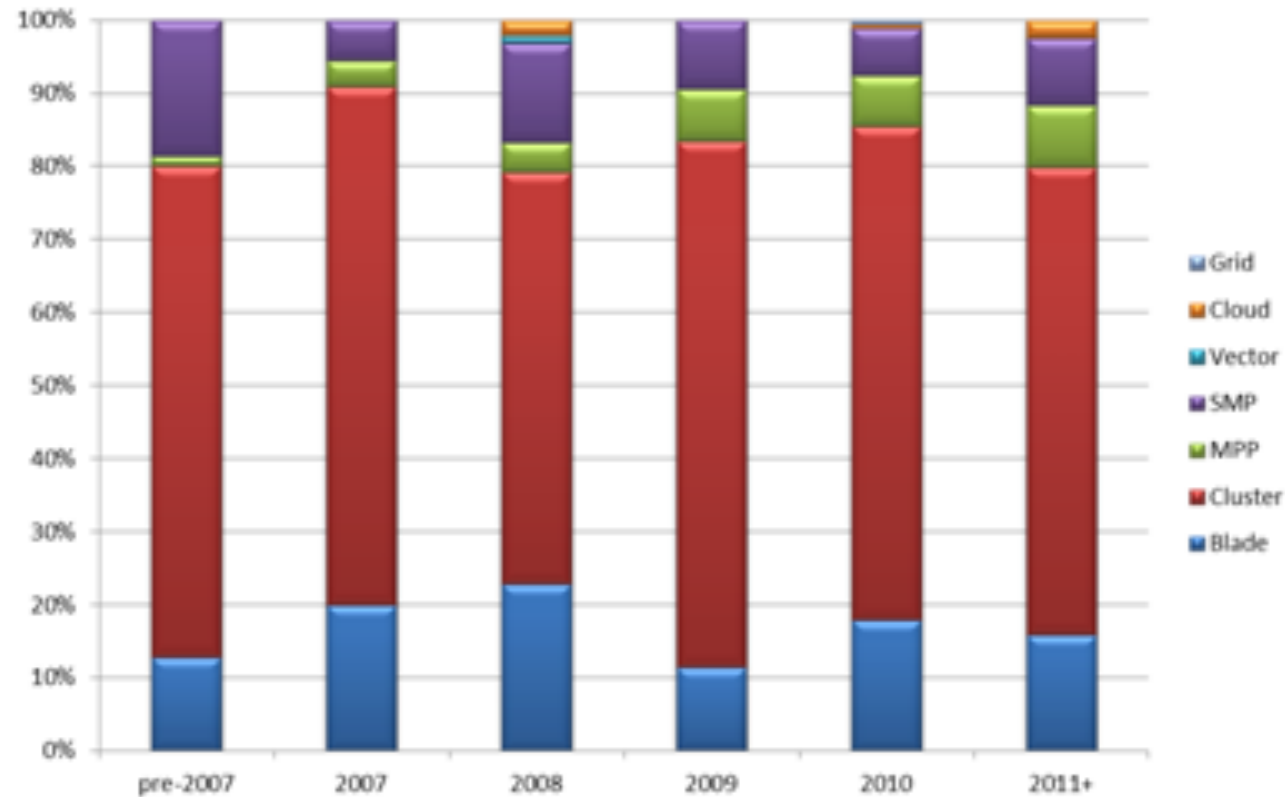
Sockets (CPUs) per node in clusters:
- 2, 66%
- 4, 14%
- 1, 9%
- 8, 6%
- Other, 5%

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Cores per Processor

Cores per Processor	pre-2007	2007	2008	2009	2010	2011+
1	36%	12%	11%	4%	5%	3%
2	41%	48%	25%	22%	11%	6%
3-4	20%	34%	55%	66%	54%	32%
5-6	3%	0%	0%	3%	15%	30%
7-8	0%	6%	6%	2%	8%	12%
9-12	0%	0%	0%	1%	4%	8%
13-16	0%	0%	2%	0%	1%	6%
17-32	0%	0%	0%	0%	1%	1%
>32	0%	0%	0%	1%	0%	2%
Total Systems	**59**	**50**	**83**	**122**	**178**	**155**
Avg Core/Processor	**2.2**	**2.9**	**3.7**	**5.7**	**4.9**	**11.8**

Source: Intersect360 Research, 2012

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Memory Configuration
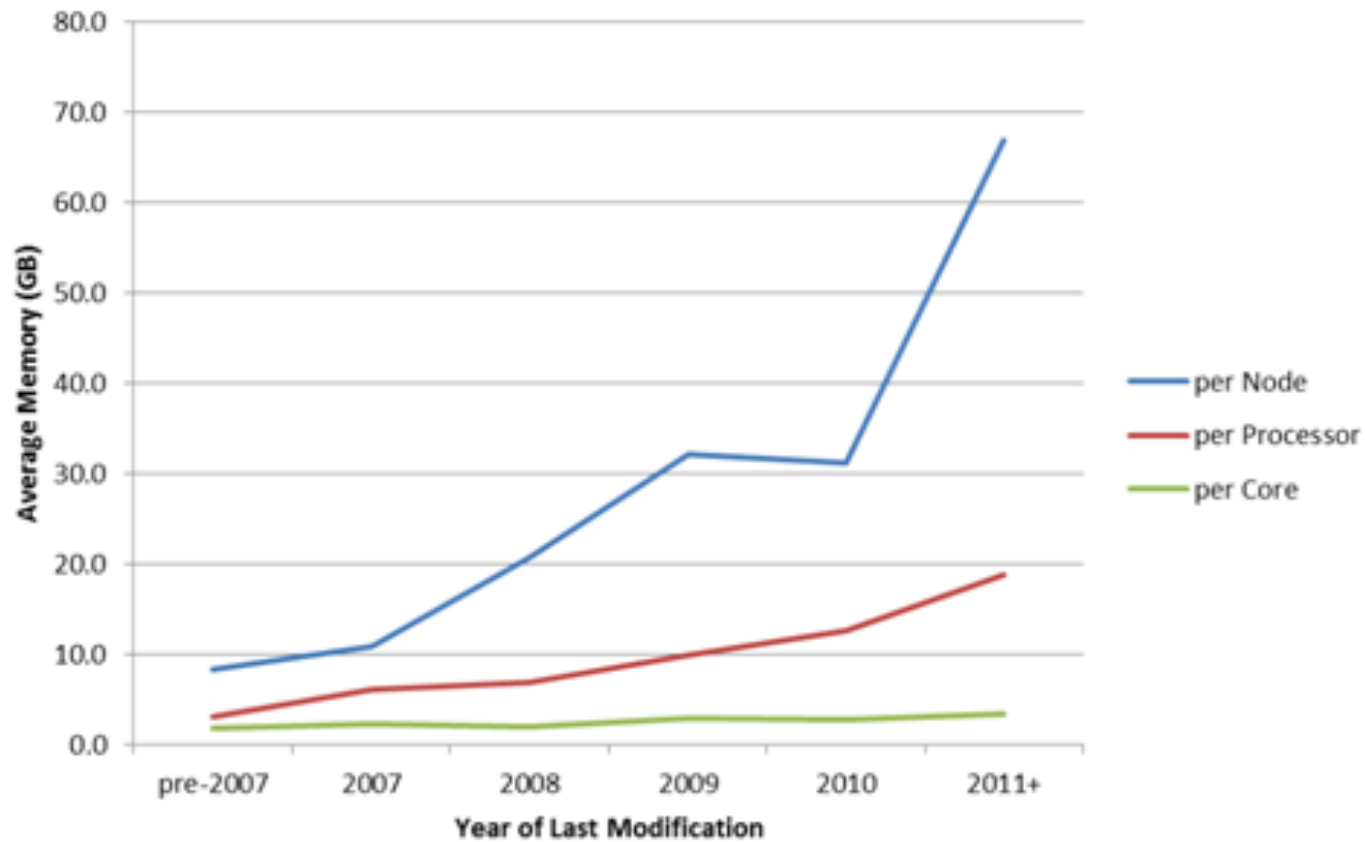
Accelerators (Mostly NVIDIA GPUs)
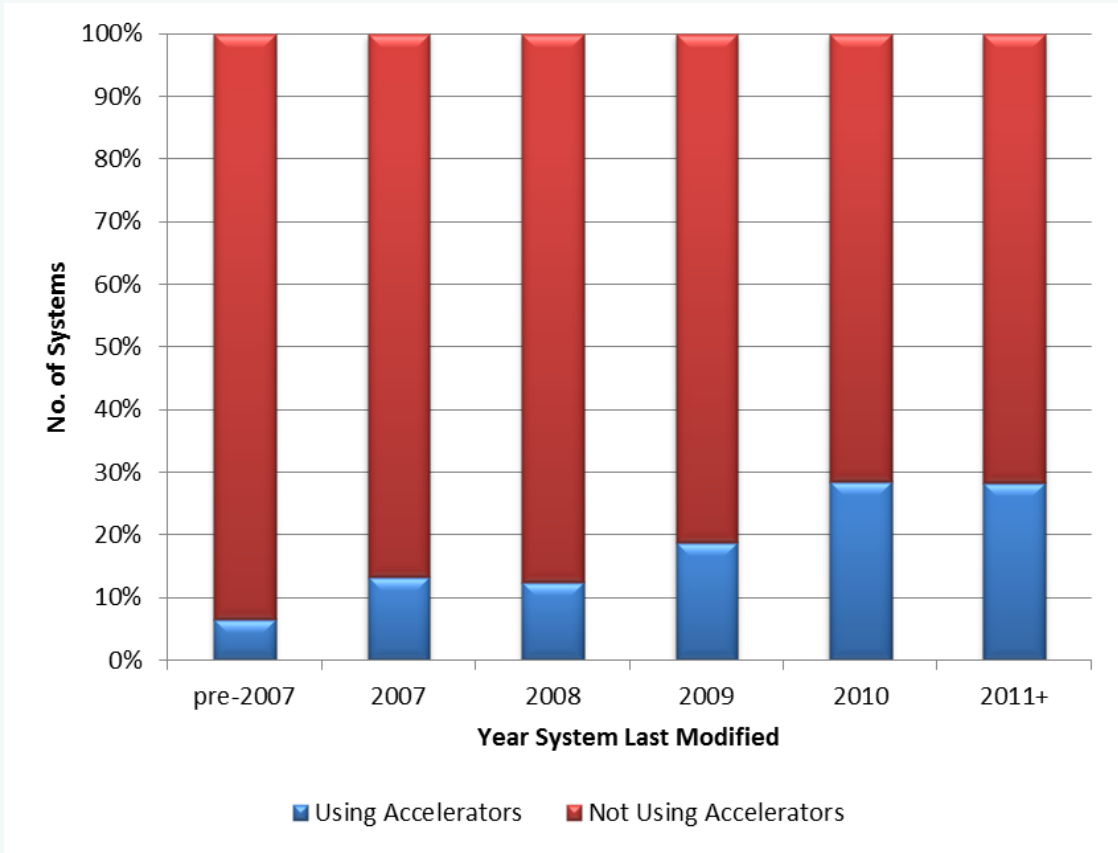
Challenges of Architecture Trends

- Power consumption

- Cost of memory

- New models of parallelization

- Languages and programming models

- System efficiency

- Personnel for administration, optimization, programming services, etc.

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Where Big Data Comes From

- "Big Data" is not a specific application type, but rather a trend – or even a collection of trends – spanning multiple application types

- Data growing in multiple ways:
  - More data (volume of data)
  - More types of data (variety of data)
  - Faster ingest of data (velocity of data)
  - More accessibility of data (internet, instrumentation, …)

- Data growth and availability exceeds organizational ability to make intelligent decisions based on it

Different Types of Big Data

- "Big" in Big Data is a relative term, like "High" in High Performance Computing, not absolute TB or IOPS

- Different types of challenges:
  - Large files
  - Large numbers of files
  - Many users of files (concurrent access, copies)
  - Fast rate of ingest
  - Long lifespan of data
  - Short lifespan of data

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Important Insights on Big Data

1. It is much broader than Hadoop – many different types of users and applications.

2. Money is being spent on it now – often 25% of the annual IT budget.

3. Performance matters – even enterprise users are buying based on performance.

Big Data trends will lead to the adoption of HPC technologies in more areas.

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