HPC Software in 2014

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Technical vs. Enterprise Computing

Technical Computing

- Top-line missions:
  - Find the oil
  - Design the minivan
  - Cure the disease
- Driven by price/performance
- Fast adoption of new technologies, algorithms, and approaches

Enterprise Computing

- Keeps business running
  - Communicate/collaborate
  - Market and sell the product
  - Accounting, HR, finance, …
- Driven by RAS: reliability, availability, serviceability
- Slow adoption of new technologies, algorithms, and approaches

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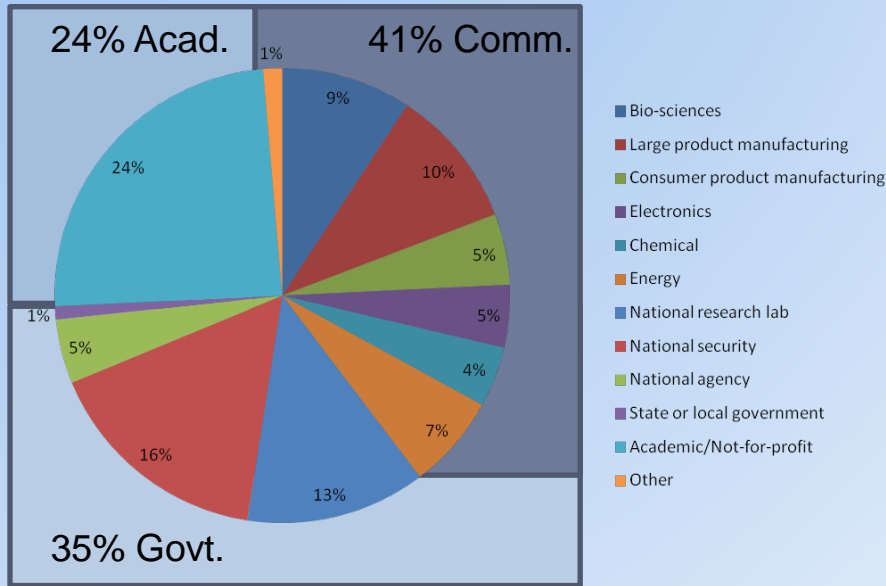# Where We Find HPC

High Performance Technical Computing (HPTC)

- Applications in science and engineering
- Top markets: academia, government labs, defense, manufacturing, bio/life science, oil/gas exploration
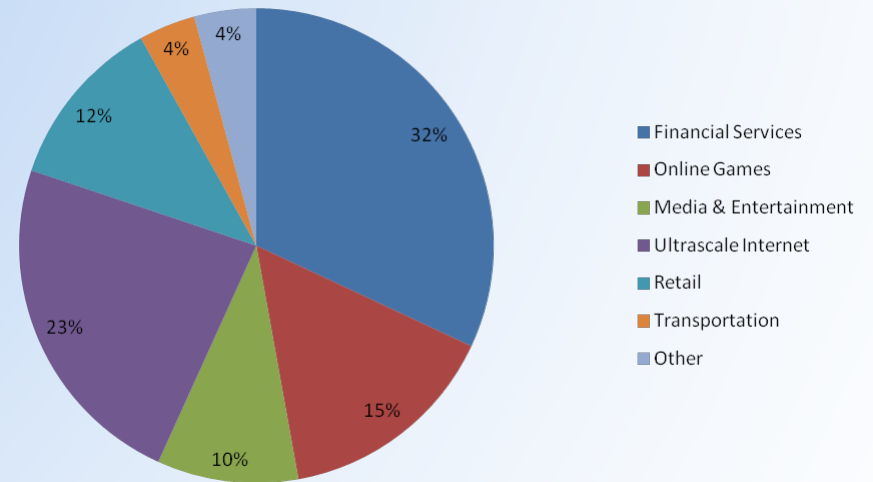
High Performance Business Computing (HPBC)

- Applications include trading, pricing, risk management, logistics, fraud detection, online games, analytics, …
- Top markets: financial services, ultrascale internet, online games, retail, entertainment

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HPTC and HPBC Vertical Markets

HPTC Total Market (2012 rev., 70%) by Vertical

24% Acad.

41% Comm.

35% Govt.

- Bio-sciences
- Large product manufacturing
- Consumer product manufacturing
- Electronics
- Chemical
- Energy
- National research lab
- National security
- National agency
- State or local government
- Academic/Not-for-profit
- Other

HPBC Total Market (2012 rev., 30%) by Vertical

- Financial Services
- Online Games
- Media & Entertainment
- Ultrascale Internet
- Retail
- Transportation
- Other

- Financial services and manufacturing (auto/aero plus consumer) are about equal
- Worldwide, private sector is growing faster than public sector
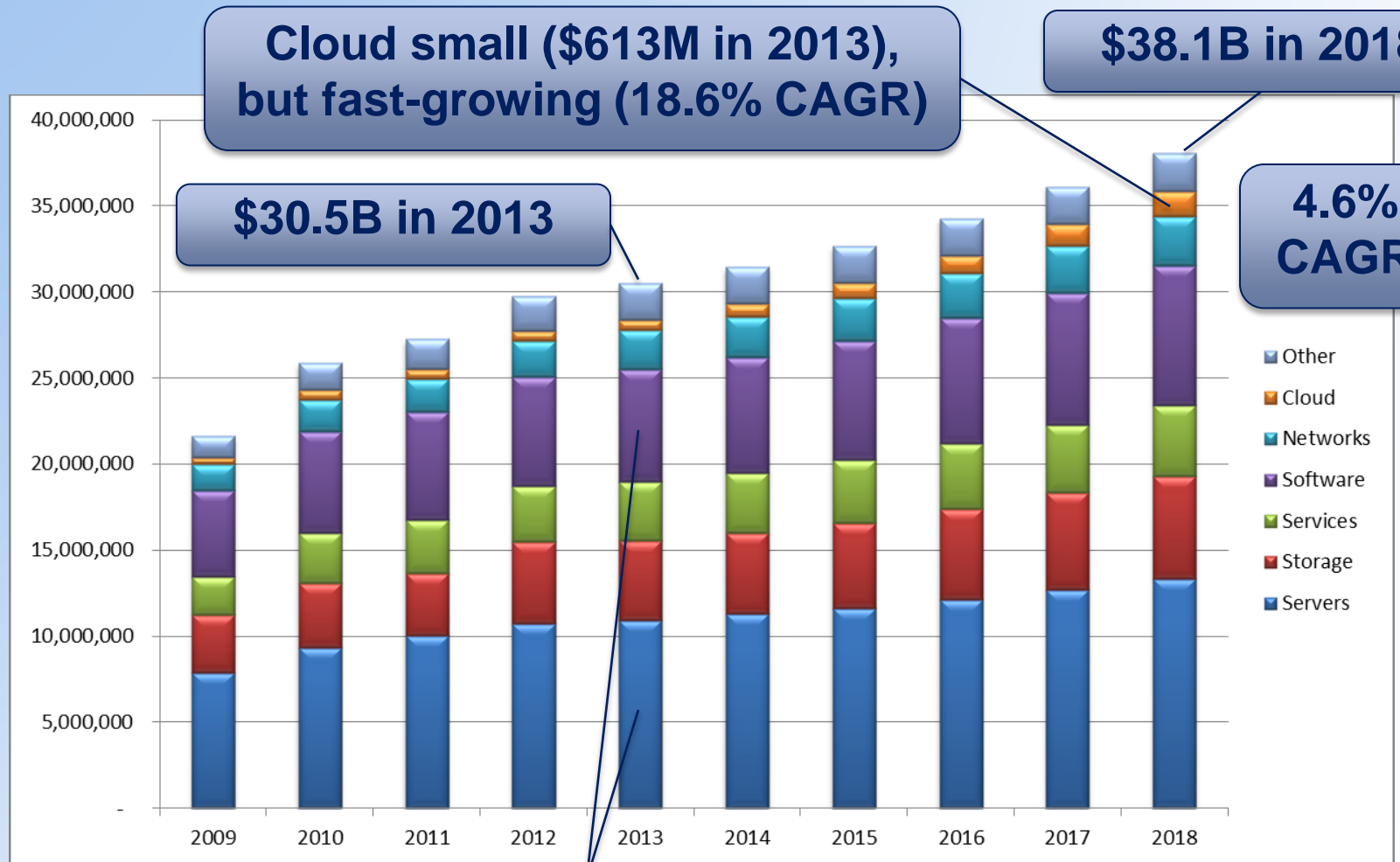- 2013 data available to clients

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Major HPC Software Studies in 2014

- <u>Annual HPC User Site Census</u>: Installation data including middleware and application software

- <u>Annual HPC User Budget Map</u>: Budget data showing percent of spending by category

- <u>Special Study: "The Big Data Opportunity for HPC,"</u> surveyed both HPC and non-HPC enterprises on Big Data applications and infrastructures

- <u>Council on Competitiveness</u>: "Solve. The Exascale Effect: the Benefits of Supercomputing Investment for U.S. Industry" (pending release)

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Key Insights

1. HPC usage in commercial markets is growing, with expanding application categories
   - Commercial growing faster than public sector
   - Big Data provides a breakout opportunity for HPC
2. Open-source is on the rise
   - Driven by pricing models and new categories
   - Includes increase in business computing
3. Software is the most critical limiting factor in scalability
   - New models of parallelism (multi-core, many-core)
   - Middleware, developer tools are important investments

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Total HPC Market Revenue ($K)

Cloud small ($613M in 2013), but fast-growing (18.6% CAGR)

$38.1B in 2018

$30.5B in 2013

4.6% CAGR

Servers largest segment ($10.9B in 2013), followed by software ($6.5B)

Legend:
- Other
- Cloud
- Networks
- Software
- Services
- Storage
- Servers

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2013 Market Performance

Table 3: 2013 vs. 2012 Comparison —
Total HPC Market Revenue
($, millions) by Product Class

Product Class	2012	2013	Change	Growth
Servers	10,744	10,943	198	1.8%
Storage	4,735	4,625	(110)	-2.3%
Services	3,238	3,414	176	5.4%
Software	6,333	6,497	164	2.6%
Networks	2,084	2,291	207	9.9%
Cloud	582	613	31	5.4%
Other	2,034	2,109	75	3.7%
Total	29,749	30,491	742	2.5%

Source: Intersect360 Research, 2014

2013 was fourth consecutive year of growth for the market but shows a marked decline in growth rate. By segment:

– Government : Down 2.4%

– Academia: Up 2.9%

– Commercial: Up 4.6%

– HPBC: Up 4.5%

– HPTC: Up 1.6%

Note on Storage: 2013 is the first "normal" year after the flooding in Southeast Asia in the second half of 2011, which caused a significant amount of revenue to be deferred from 2011 and recognized in 2012. Therefore, 2011 storage revenue was artificially low, and 2012 was artificially high. Storage revenue has seen 7.4% CAGR since 2010.

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Top Overall Application Categories

Figure 1. Top 10 Primary Application Categories, Total Sites
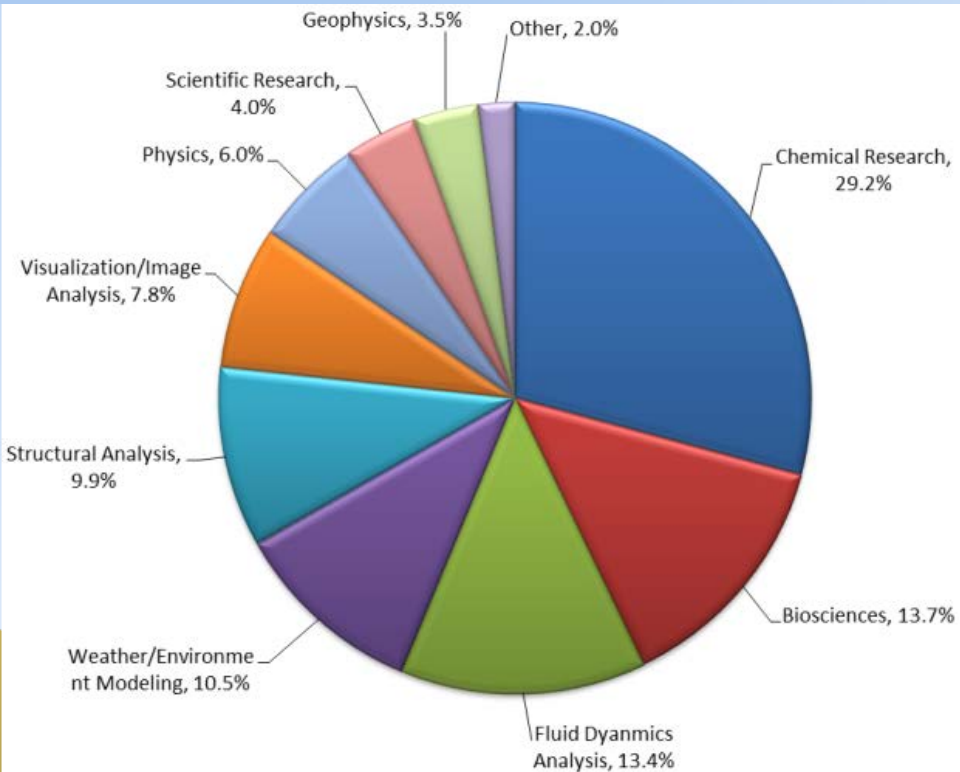*N = 1,076 mentions*
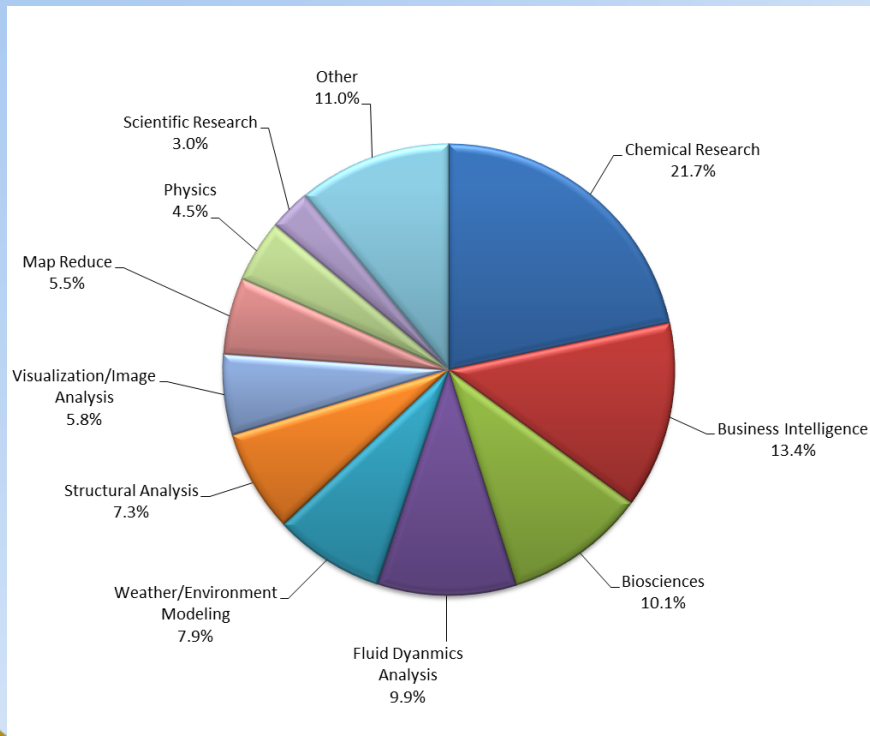
- Surveys conducted in the last three years
- 1,108 primary applications were reported by 435 HPC sites
- Three-fourths of the mentions were HPTC applications and one-fourth were HPBC applications
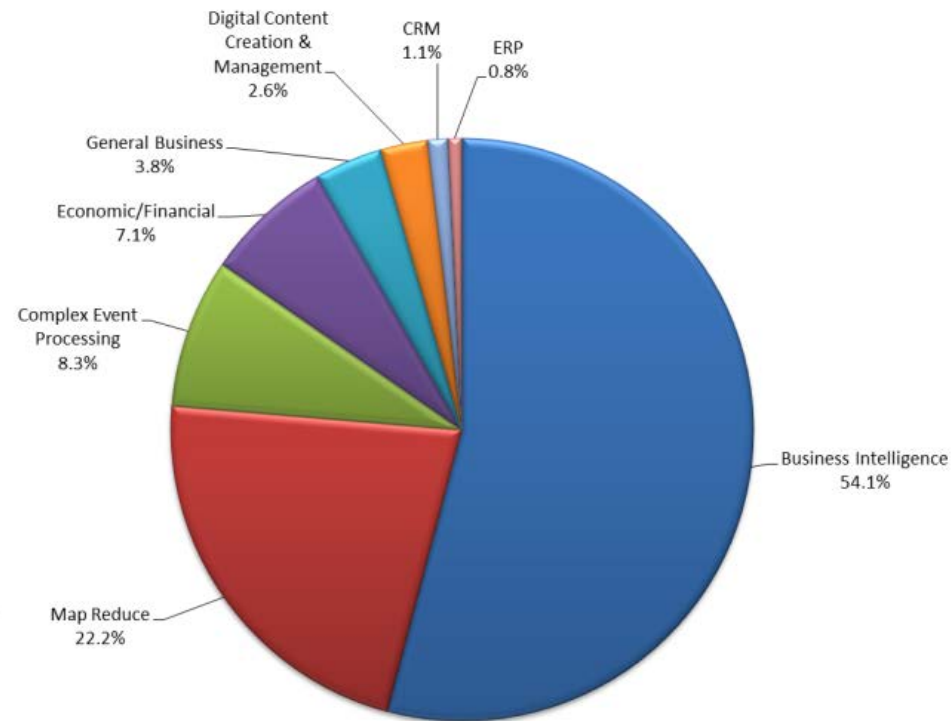- About 80% of the 496 unique application packages had only one mention

HPC Site Census: Applications

Figure 2. Top Primary Application Categories by Super Segments, Total Sites
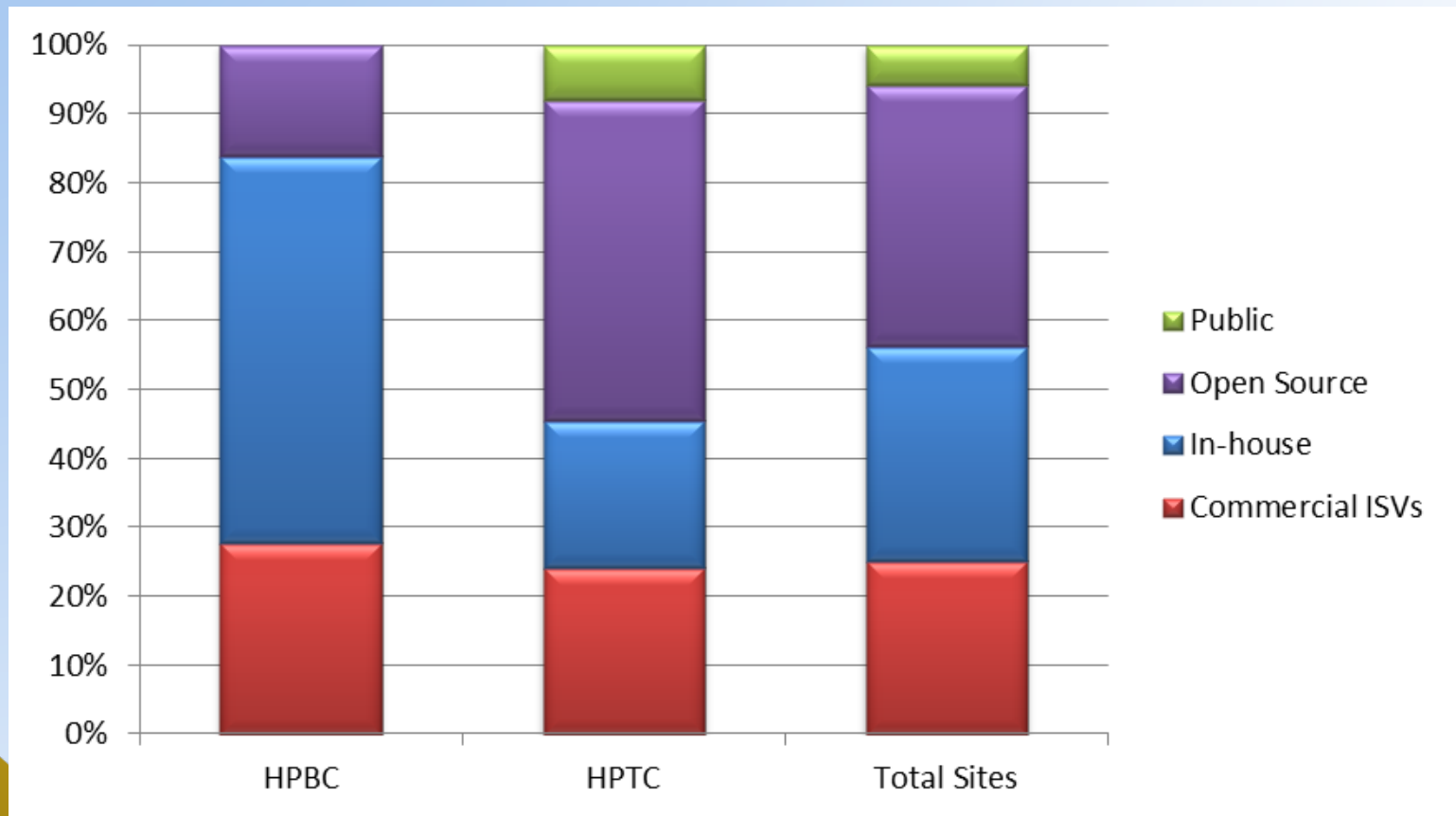

HPTC
N = 798 mentions
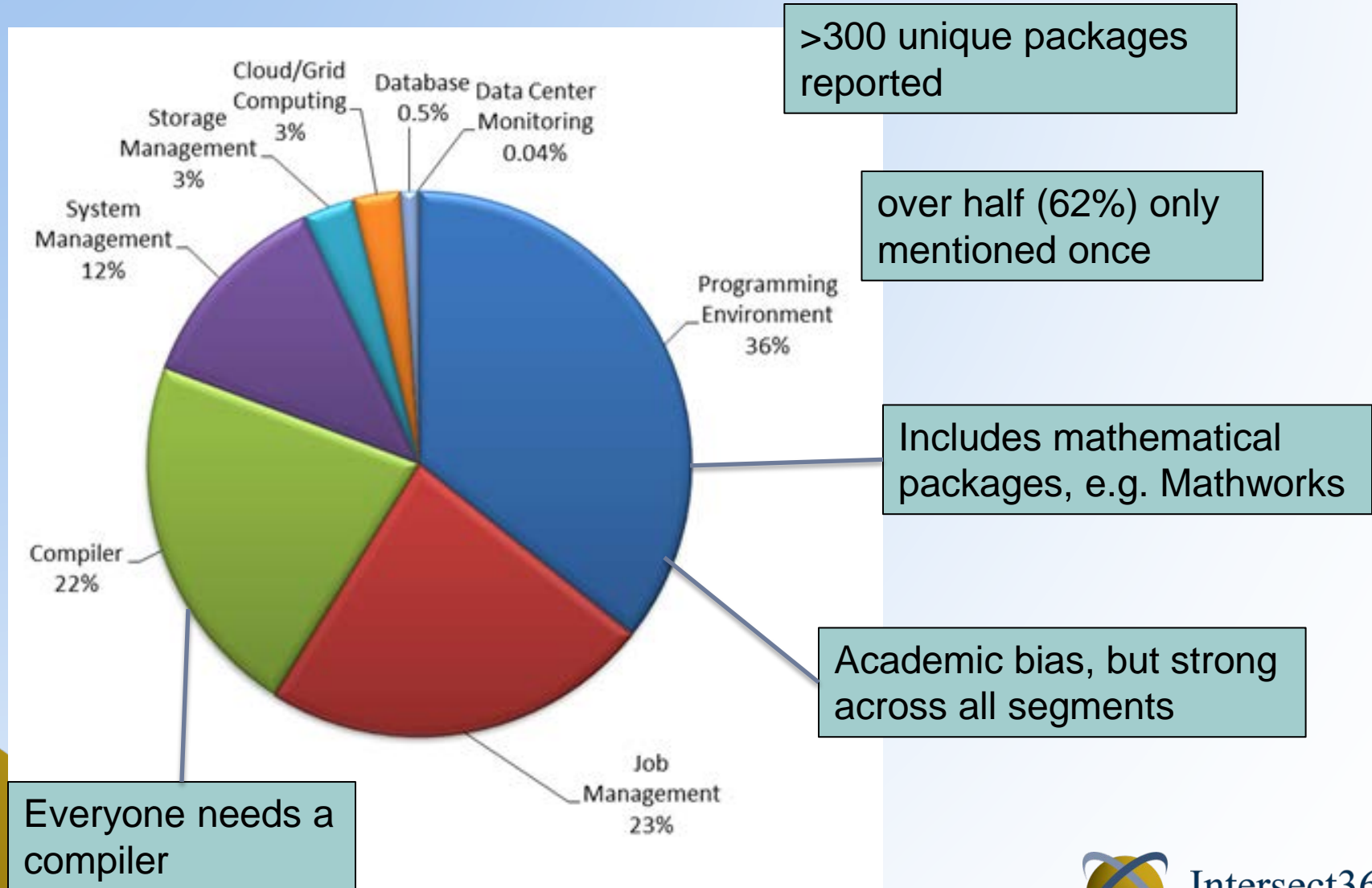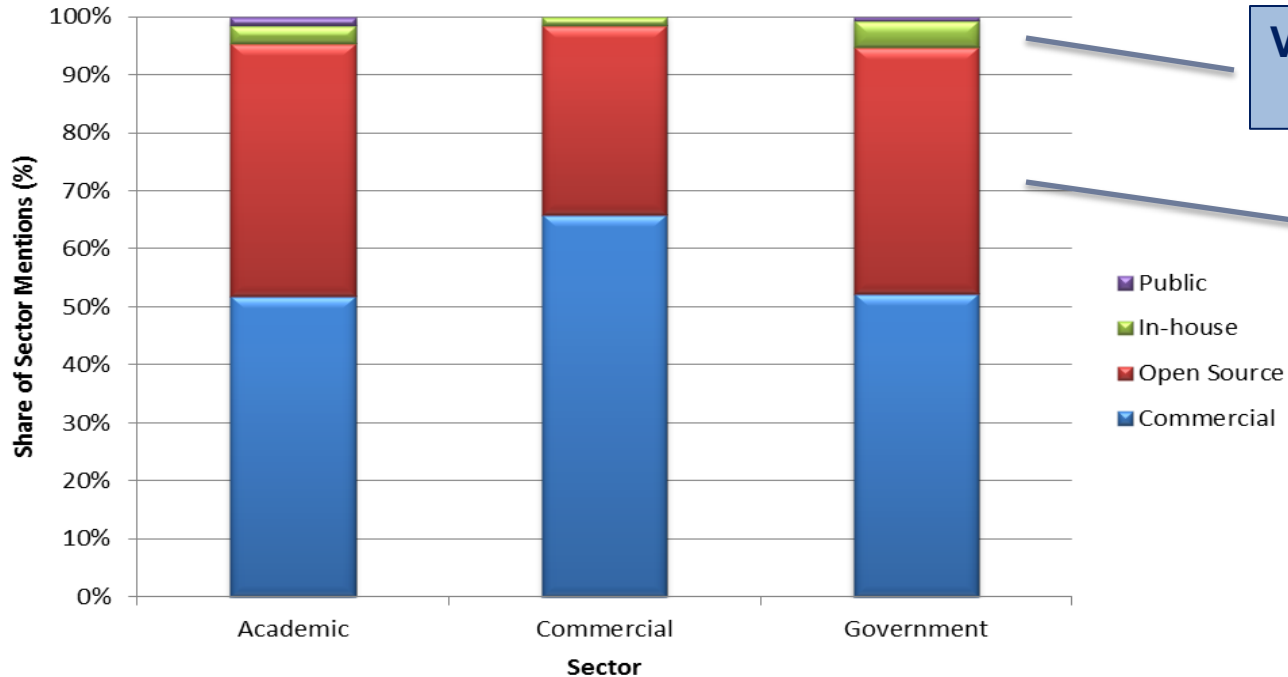
HPBC
N = 266 mentions

HPC Site Census: Applications

Figure 3. Supplier Type for Primary Applications, Total Sites
N=1,107 Mentions

Types of Primary Middleware Reported

>300 unique packages reported

over half (62%) only mentioned once

Includes mathematical packages, e.g. Mathworks

Academic bias, but strong across all segments

Everyone needs a compiler

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HPC Middleware by Sector

Very little middleware is developed in-house

Middleware is still a focus of academic research and therefore, open-source middleware is very prevalent

Middleware has a much broader target market than application software. Middleware functionality, efficiency, and reliability impact every user of the computer system while an application impacts a subset of users, and sometimes only one user.

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Changes in the CFD Landscape

CFD Software by Source by Survey Year
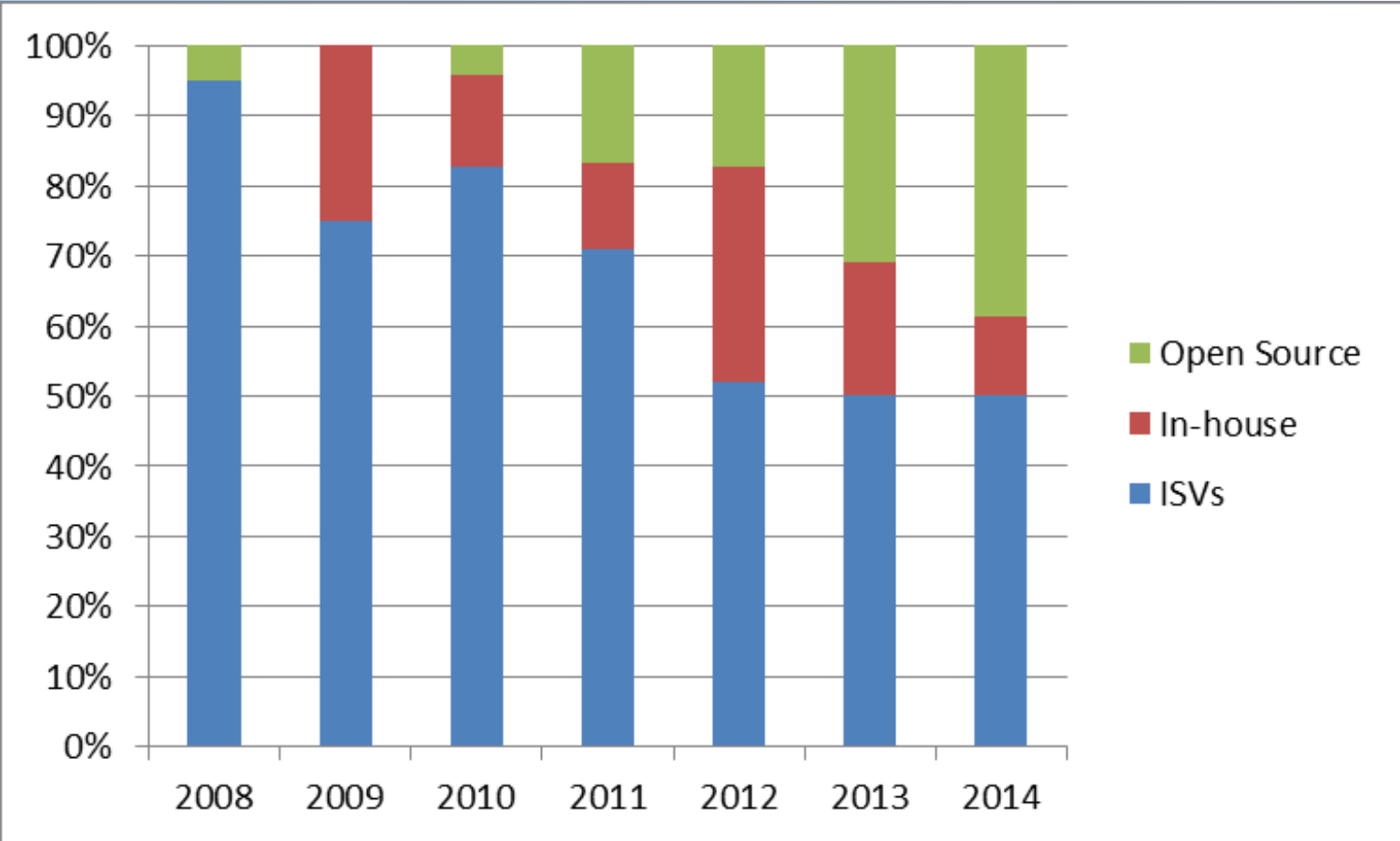
Big Data: Much More than Hadoop

Sources of Big Data applications	Business		Technical		Total	
In-house	49	37.7%	130	51.0%	179	46.5%
Purchased	45	34.6%	43	16.9%	88	22.9%
Open-source	35	26.9%	77	30.2%	112	29.1%
Unknown	1	0.8%	5	2.0%	6	1.6%
Number of applications	130		255		385	
Number of respondents	59		139		198	

Intersect360 Research, 2013-2014
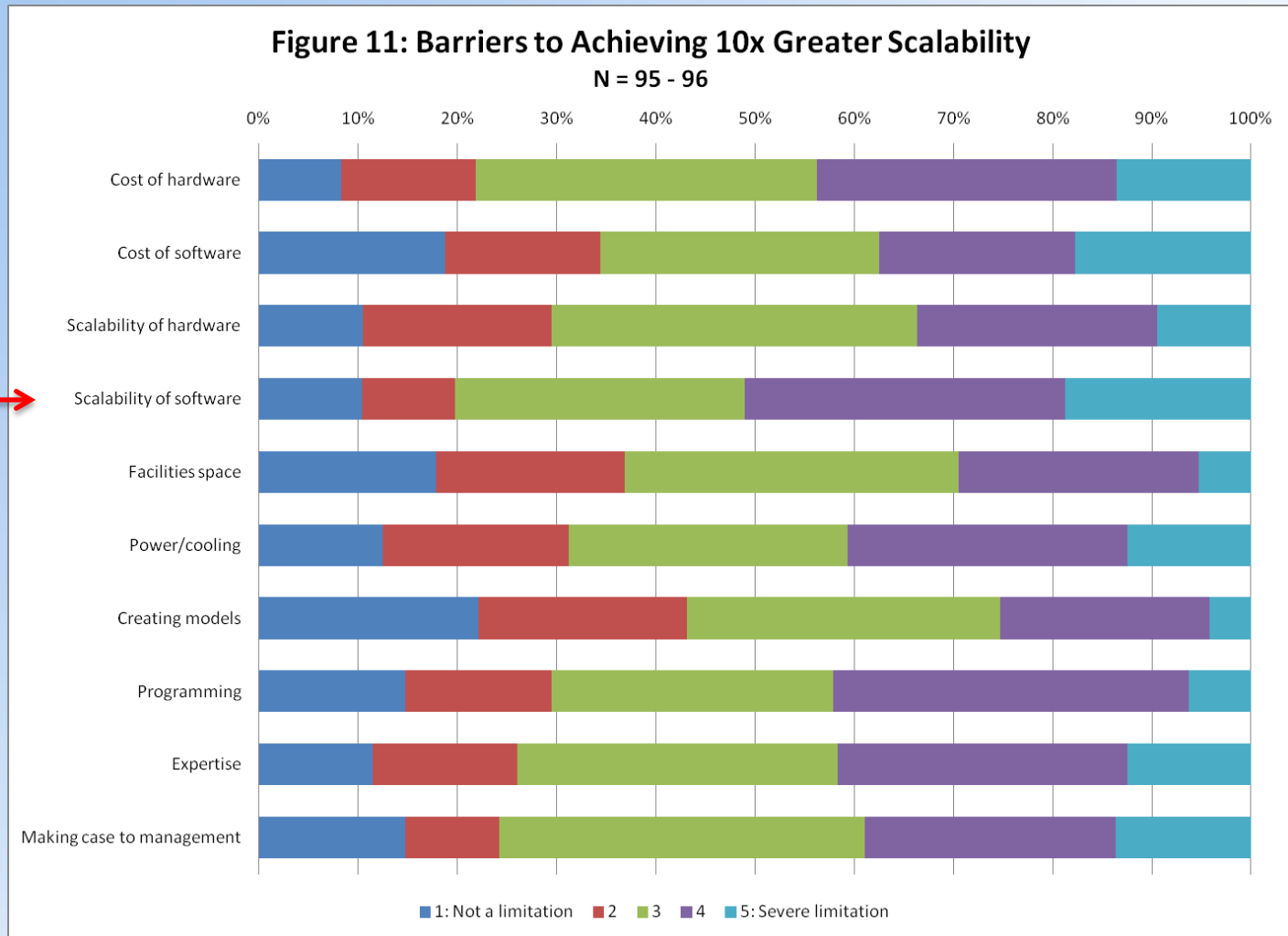
- Big Data is predominantly in-house applications
- Notable change from prior year: Non-HPC sites adopting more open-source

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Software in Commercial HPC

Figure 13: Mix of Commercial, Open-Source, and In-House Software, by Vertical
N = 100 (see Demographics for Vertical distribution)

Source: "Solve. The Exascale Effect: Benefits of Supercomputing Investment for U.S. Industry," new report pending publication, with U.S. Council on Competitiveness
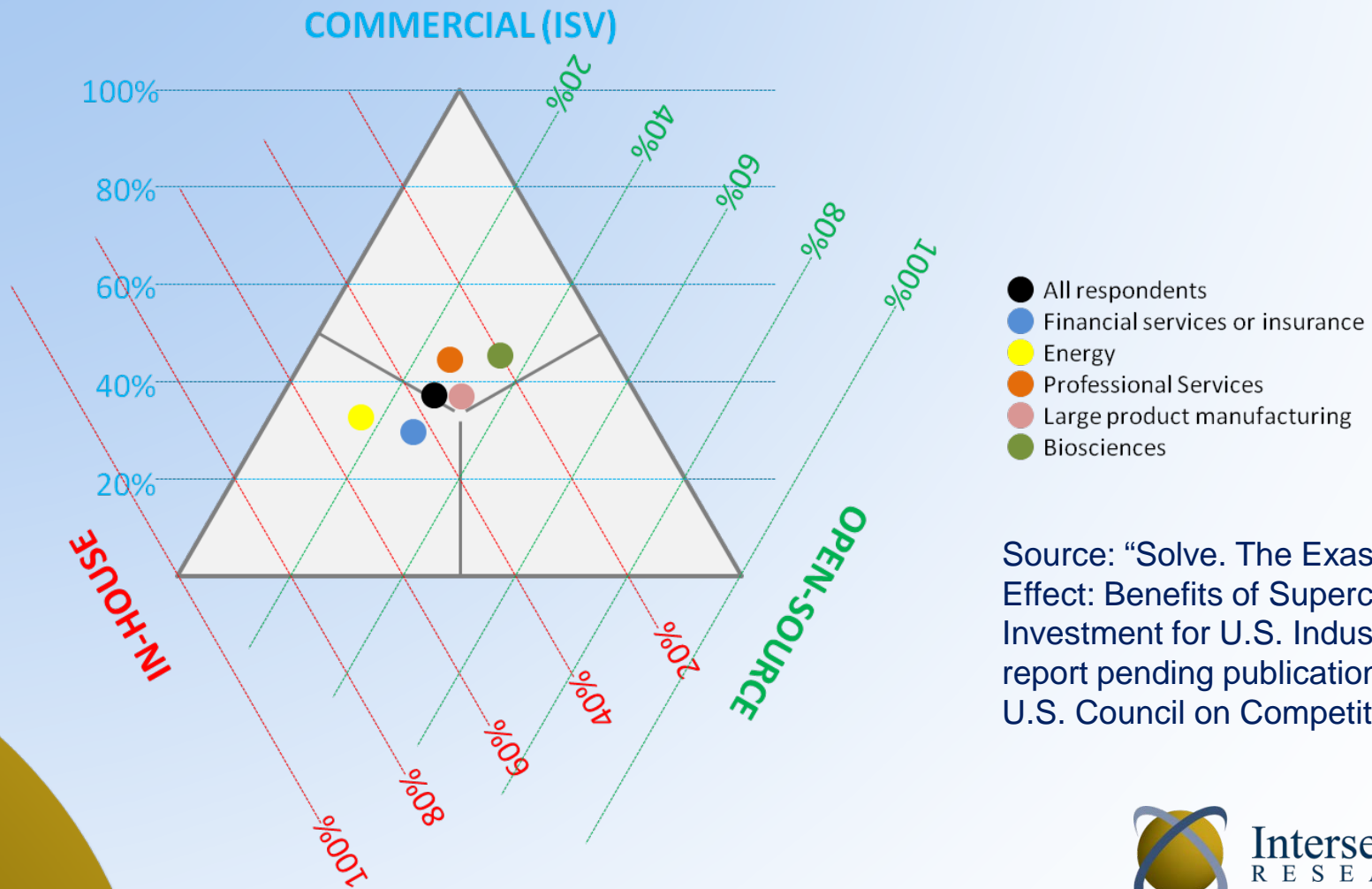
Barriers to Scalability

Figure 11: Barriers to Achieving 10x Greater Scalability
N = 95 - 96

Categories (top to bottom): Cost of hardware, Cost of software, Scalability of hardware, Scalability of software, Facilities space, Power/cooling, Creating models, Programming, Expertise, Making case to management

Legend: 1: Not a limitation, 2, 3, 4, 5: Severe limitation

Source: "Solve. The Exascale Effect: Benefits of Supercomputing Investment for U.S. Industry," new report pending publication, with U.S. Council on Competitiveness

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Effects of Multi-Core
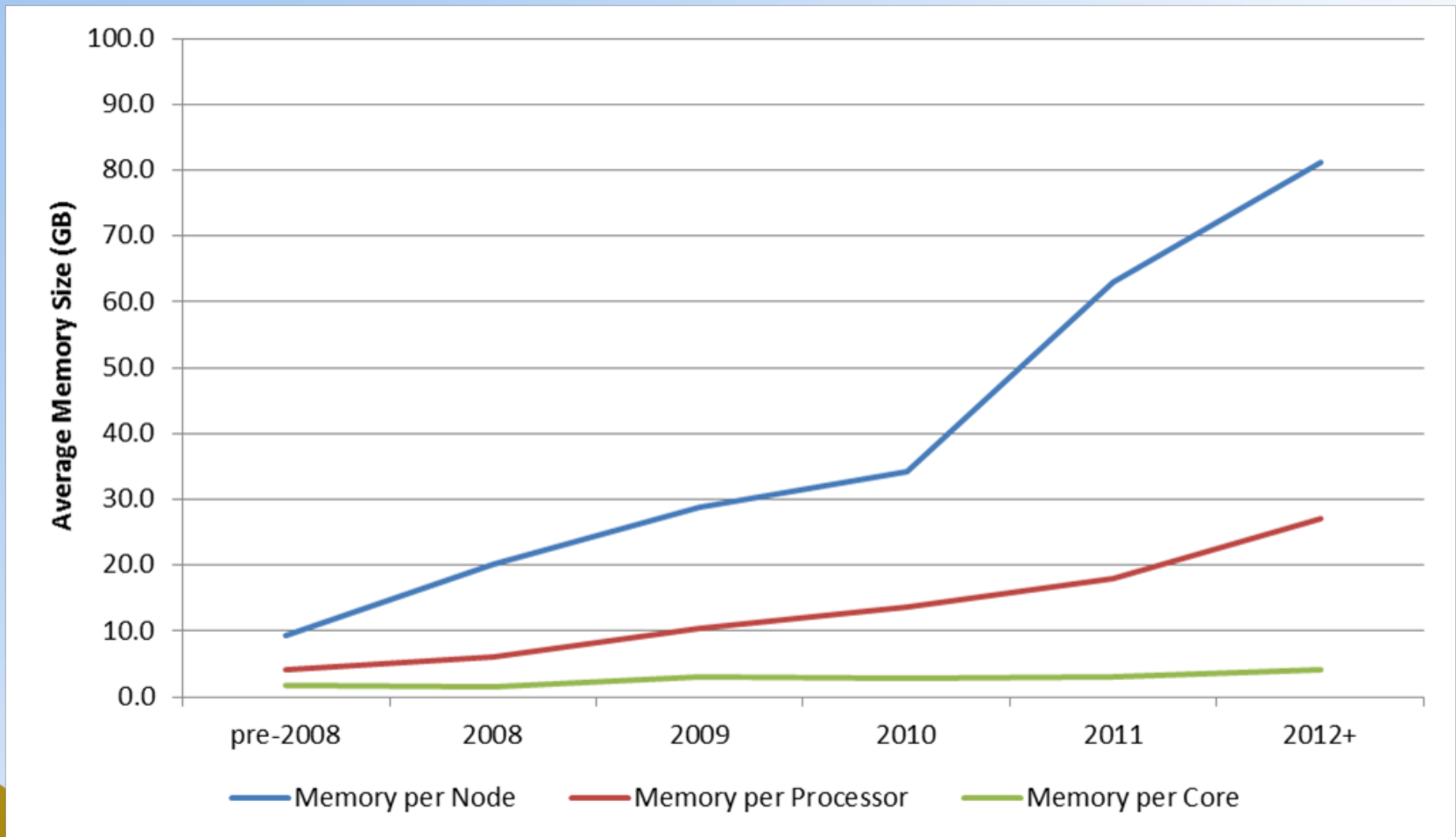
Effects of Many-Core

- Accelerator penetration has almost doubled from previous year
- Average number of accelerators configured per system has nearly tripled – 60 to 175
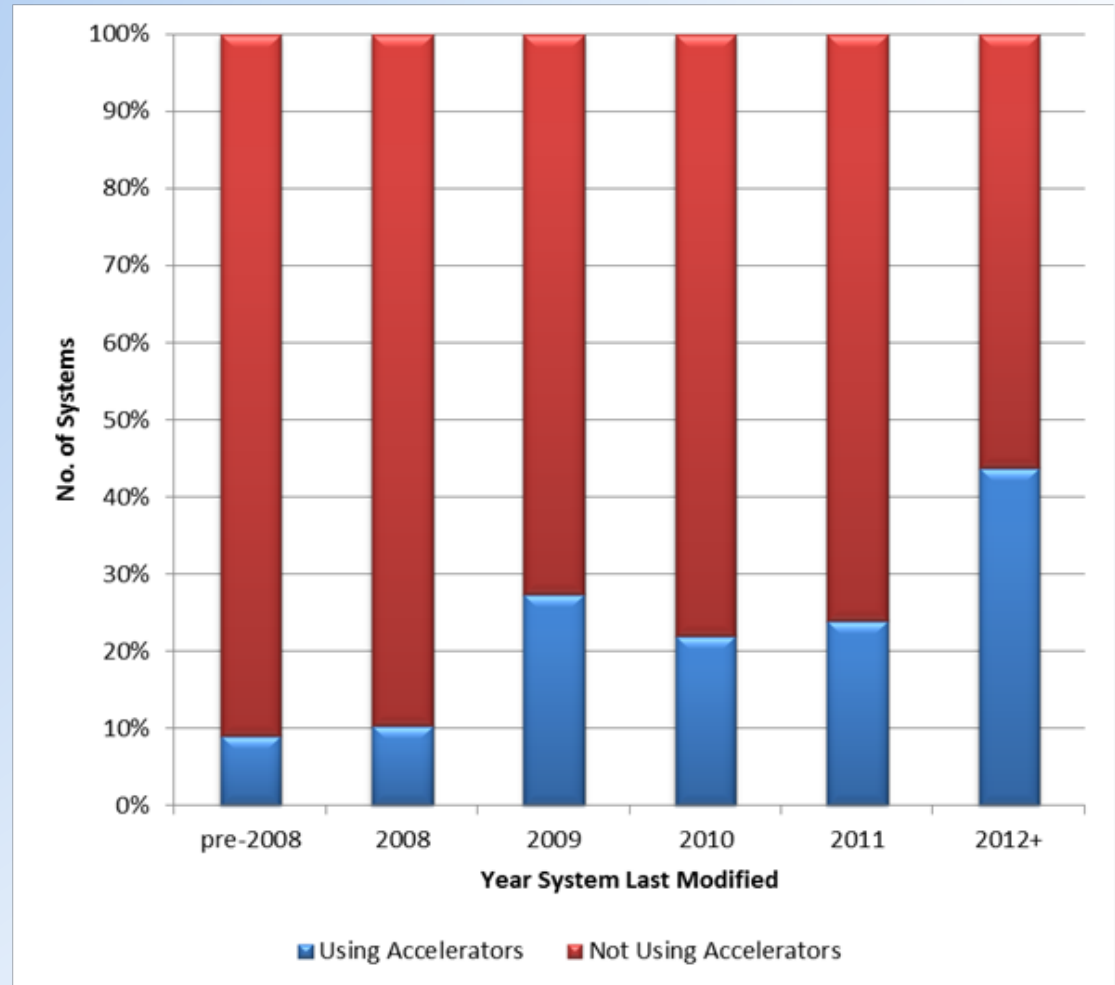
Effects on Skills Required

- Skill sets need to evolve
  - What does it mean to be a programmer?
  - What does it mean to be a sys admin?
- Industry finds a shortage of skilled talent
- Those who know both HPC and science / engineering are "highly valued individuals"

Working with Intersect360 Research

- If you are an HPC vendor:
  - We'd love to have you as a client
  - Advisory/consulting, data and insights, plus whitepapers, webinars, podcasts, etc.
  - Brief us any time
- If you are an HPC user:
  - Free access to research if you participate
  - See www.hpc500.com to join user group
  - Custom work for users also available
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Questions

**Actionable Market Intelligence for
High Performance Computing**