

**Welcome To The 49th
HPC User Forum
Meeting
April 2013**



Important Dates For Your Calendar

FUTURE HPC USER FORUM MEETINGS:

2013 Meetings:

- April 29 – May 1, Tucson, Arizona
- September 9 to 11, Boston, Massachusetts
- October 1, 2013 in South Korea

2014 Meetings:

- April 7 to 9, Santa Fe, New Mexico
- September 15 to 17, Seattle, Washington
- October 2014 in Europe

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- Altair Engineering
- SUSE

Bronze

- Bright Computing
- Brocade
- Mellanox
- Parallel Scientific

Tuesday breakfast - Parallel Scientific

Tuesday lunch - Altair Engineering

PM Break - Bright Computing

Tuesday dinner - Intel and HP

Wednesday breakfast – Brocade

Wednesday lunch – SUSE

PM Break - Mellanox

Monday Dinner Vendor Updates: 10 Minutes

- **SUSE**
- **Brocade**
- **Mellanox**
- **Bright Computing**
- **Altair**
- **Parallel Scientific**
- **SGI**
- **IBM**

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Introduction: Logistics

Ask Mary if you need a receipt

We have a very tight agenda (as usual)

- Please help us keep on time!
- Note that the buses leave at 5:45pm for the special dinner event

Review handouts

- Note: We will post most of the presentations on the web site
- Please complete the evaluation form



Next Meeting:

Register

Information

Download Presentations

About The Forum

Prior Meetings

IDC Research

Contact us

SC12 Conference

International Supercomputing Conference

FUTURE MEETINGS

2012 US Meetings:

- September 17-19, 2012 Dearborn, Michigan Dearborn Inn

2012 International Meetings

- July 5-6, 2012 London, England Imperial College
- July 9-10, 2012 Stuttgart, Germany HLRS, University of Stuttgart



HPC@IDC

With sadness and fond memories, we note the passing of our friend and fellow HPC User Forum Steering Committee member **Allan Snavely**. Allan was one of the leading lights of the worldwide HPC community and a person who contributed substantially to advancement of HPC technology and practices during his all-too-brief career. We will miss him.

2012 HPC INTERNATIONAL MEETINGS	2012 HPC US MEETINGS
<p>July 5-6, 2012 London, England Imperial College</p> <p>July 9-10, 2012 Stuttgart, Germany HLRS, University of Stuttgart</p>	<p>Sept 17-19, 2012 Dearborn, Michigan Dearborn Inn</p> <p>REGISTER NOW</p> <p>REGISTRATION INFORMATION</p> <p>AGENDA</p>

STEERING COMMITTEE

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Rupak Biswas
NASA Ames
Vice Chairman

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Ford Motor Company

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California Institute of Technology

James Kasdorf
Pittsburgh Supercomputing Center

Doug Kothe
Oak Ridge National Laboratory

Paul Muzio
City University of New York

Michael Resch
HLRS, University of Stuttgart

New Research Studies

Special Study: Power & Cooling Practices and Planning at HPC Data Centers

IDC and DICE, the HPC Research Division of Avetec release a groundbreaking study on HPC data center power and cooling challenges, practices, trends and technology.



To access the study, click on image to reach DICE website and select Reports & Publications.

HPC Buyer Case Study: TACC

Council on Competitiveness, IDC Release Study on HPC and Innovation



THE INNOVATION EXCELLENCE AWARD

Welcome



Jim Kasdorf
HPC User Forum
Chairman

And

Rupak Biswas
HPC User Forum
Vice Chairman

HPC User Forum Mission

**To Improve The Health Of The
High Performance Computing Industry
Through Open Discussions, Information-
sharing And Initiatives Involving
HPC Users In Industry, Government And
Academia
Along With HPC Vendors
And Other Interested Parties**

Steering Committee Members

- James Kasdorf, Pittsburgh Supercomputing Center, Chairman
- Rupak Biswas, NASA Ames, Vice Chairman
- Earl Joseph, IDC, Executive Director
- Swamy Akasapu, General Motors
- Vijay Agarwala, Penn State University
- Alex Akkerman, Ford Motor Company
- Doug Ball, The Boeing Company
- Jeff Broughton, NERSC/Lawrence Berkeley National Lab
- Paul Buerger, Avetec
- Chris Catherasoo, Caltech
- Jack Collins, National Cancer Institute
- Steve Conway, IDC Research Vice President
- Steve Finn, Cherokee Information Services
- Merle Giles, NSCA/University of Illinois
- Keith Gray, British Petroleum
- Doug Kothe, Oak Ridge National Laboratory
- Paul Muzio, City University of New York
- Michael Resch, HLRS, University of Stuttgart
- Vince Scarafino, Industry Expert
- Suzy Tichnor, Oak Ridge National Laboratory

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IDC HPC

Market Update



2013 IDC HPC Research Areas

Redefine key market tracking approaches

End-user based MCS reports:

1. HPC industries/applications/workloads report
2. HPC system software and middleware report
3. HPC storage and interconnect report
4. HPC processors/co-processors/accelerators
5. The emerging synergy of HPC and Big Data report

A new mid and lower end tracking of the HPC market

New And Potentially Disruptive Technologies:

- Big data -- HPDA
- Co-processors
- All types of flash/SSDs
- New software solutions
- Government programs to help bring to market new capabilities

The ROI With HPC



2013 IDC HPC Research Areas

Special HPC Research Areas & Reports:

- A new CIS – HPDA
- A deeper investigation into the lower half of the HPC market, including SMBs and SMSs
- The evolution of government HPC budgets
- Emerging markets including China, Russia, etc.
- The evolution of clouds in HPC and 5 year cloud forecasts
- Scaling of software – issues and solutions
- Worldwide Petascale and Exascale Initiatives

Redefining and expanding our market definitions/ tracking methods:

- Supercomputers, big data, clouds, tracking accelerators, and the missing middle, etc.

Top Trends in HPC

The global economy in HPC is growing again:

- 2010 grew by 10%, to reach \$9.5 billion
- 2011 grew by 8.4% to reach \$10.3 billion
- HPC revenue for 2012 exceeded \$11B
 - **Q3 2012 was the largest quarter ever in HPC**
- We are forecasting ~7% growth over the next 5 years

Software hurdles continue to grow

Storage and data management continue to grow in importance

The worldwide Petascale Race is in full speed

Big Data and accelerators are hot new technologies

HPC WW Market REVENUES: By Competitive Segment

	2008	2009	2010	2011	2012
cs1-Supercomputer	2,685,098	3,342,073	3,475,577	4,370,194	5,649,823
cs2-Divisional	1,390,617	1,078,575	1,268,735	1,236,684	1,209,698
cs3-Departmental	3,166,496	2,882,727	3,342,747	3,467,271	2,997,068
cs4-Workgroup	2,529,639	1,310,770	1,411,264	1,225,910	1,241,132
Total Sum of WW Rev	9,771,849	8,614,145	9,498,323	10,300,058	11,097,721

HPC WW Market SYSTEM UNITS: By Competitive Segment

	2008	2009	2010	2011	2012
cs1-Supercomputer	1,862	2,067	2,560	2,908	2,397
cs2-Divisional	4,029	3,596	3,914	3,724	3,650
cs3-Departmental	20,066	17,963	20,382	20,625	17,108
cs4-Workgroup	148,134	81,428	92,988	84,294	80,692
Total Sum of WW Units	174,091	105,054	119,844	111,551	103,847

HPC WW Market Trends: By Region

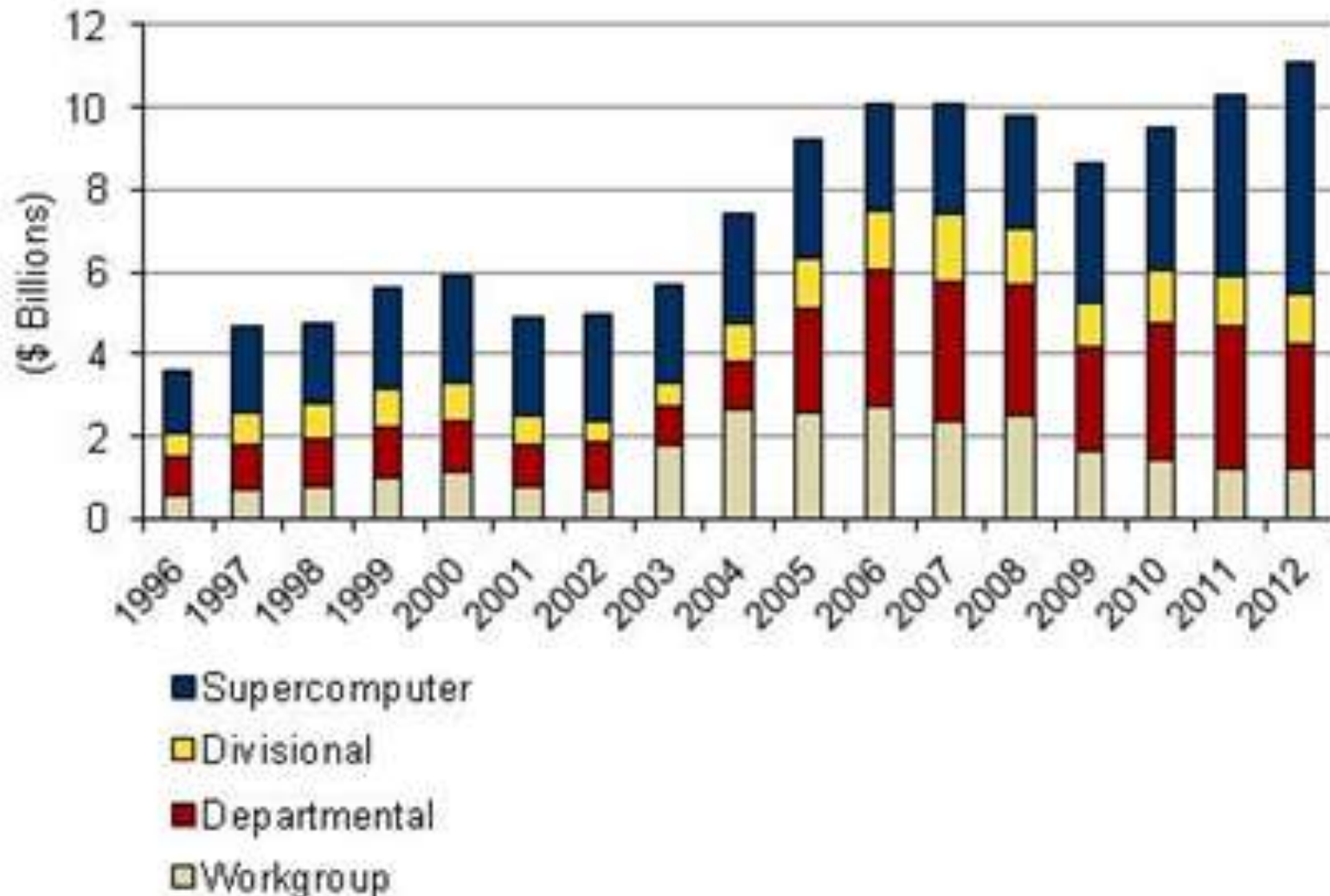
Data	2008	2009	2010	2011	2012
HPC server N.A. Rev.	4,936,229	4,269,442	4,582,620	4,644,549	4,821,984
HPC server EMEA Rev.	3,084,233	2,520,192	3,027,000	3,209,455	3,331,153
HPC server Asia/Pac Rev.	1,145,659	920,016	1,213,827	1,525,193	1,593,634
HPC server Japan Rev.	501,554	825,379	573,362	783,154	1,246,958
HPC server ROW Rev.	104,174	79,115	101,514	137,708	103,993
Total	9,771,849	8,614,145	9,498,324	10,300,058	11,097,721

HPC WW Market Trends: By Vendor

Mftr	2008	2009	2010	2011	2012
IBM	2,590,380	2,531,567	2,819,087	3,362,098	3,551,723
HP	3,562,967	2,473,360	3,017,555	3,307,427	3,419,554
Dell	1,553,521	1,100,176	1,462,995	1,493,289	1,493,172
Cray	218,320	342,177	273,225	155,620	353,800
SGI	156,145	154,757	258,959	225,741	256,400
Sun	467,483	350,156	178,227	75,630	
Fujitsu	44,166	193,693	134,596	120,351	686,657
NEC	80,353	278,800	102,429	84,141	64,112
Appro	74,560	69,776	109,665	135,360	111,648
Hitachi	12,170	112,637	59,257	62,802	
Dawning	76,385	44,667	63,469	102,923	115,359
Bull	42,664	45,709	106,112	327,536	60,494
Other	892,735	916,670	912,747	847,140	984,803
Grand Total	9,771,849	8,614,145	9,498,323	10,300,058	11,097,721

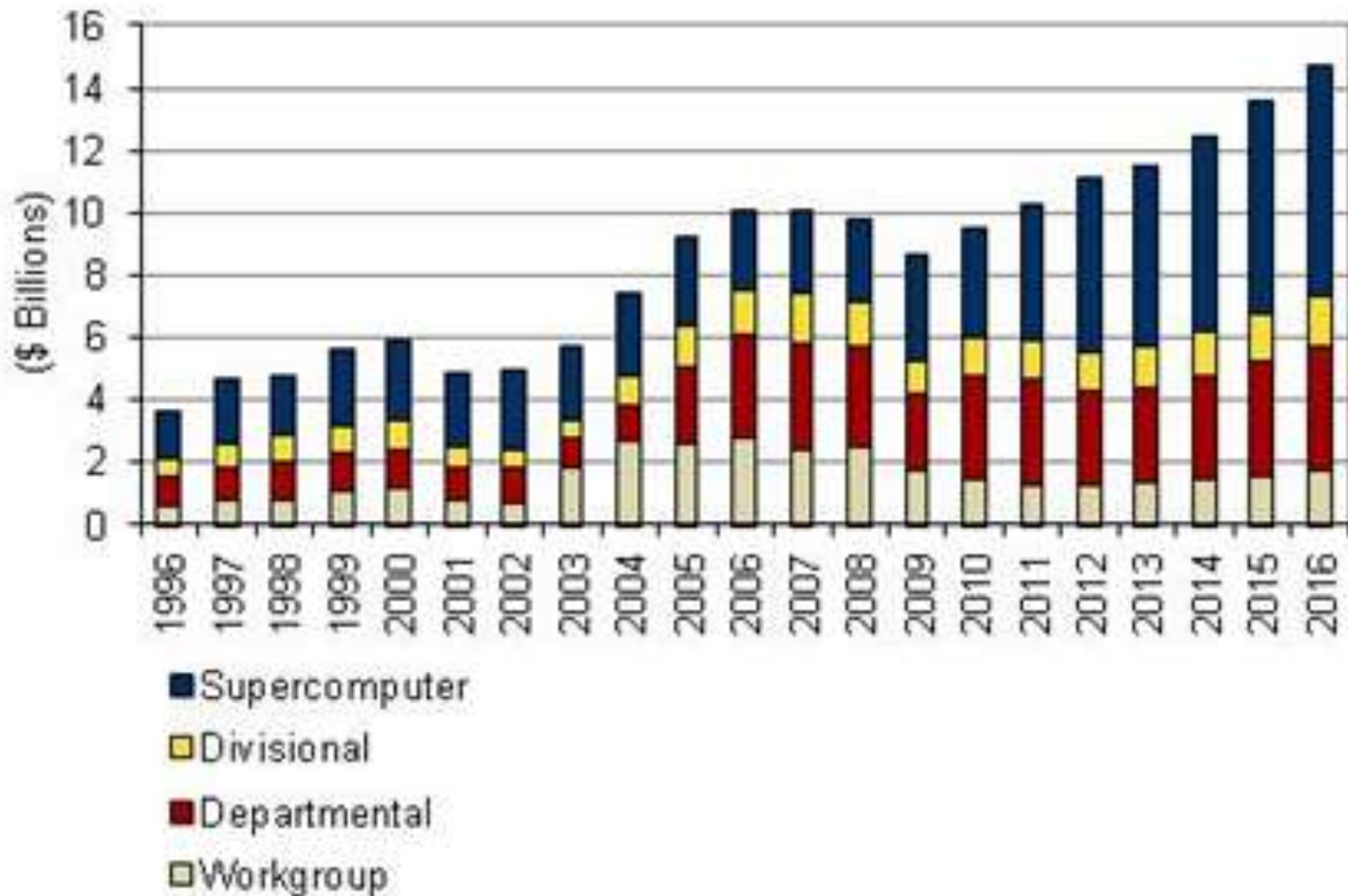
HPC WW Market Trends: A 17 Year Perspective

IDC HPC Worldwide Technical Server Sales: 1996 to 2011



HPC WW Market Trends: A 21 Year Perspective

IDC HPC Worldwide Technical Server Sales and Forecasts:
1996 to 2016



The HPC Market Beyond The Servers: The Broader HPC Market

The Broader HPC Market Growth to 2016									
HPC Compute, Storage, Middleware, Application and Service Revenues, 2011 -- 2016 (\$M)									
	2011	2012	2013	2014	2015	2016	CAGR (11-16)		
Server	10,300	11,031	11,910	12,778	13,839	14,621	7.3%		
Storage	3,664	3,992	4,350	4,739	5,163	5,625	8.9%		
Middleware	1,147	1,233	1,326	1,426	1,534	1,650	7.5%		
Applications	3,370	3,618	3,884	4,169	4,475	4,804	7.3%		
Service	1,801	1,924	2,056	2,197	2,348	2,509	6.9%		
Total	20,282	21,799	23,526	25,310	27,359	29,209	7.6%		
Source: IDC 2012									

Questions?

Please email:
hpc@idc.com

Or check out:
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Agenda: Day One Morning

8:00am Meeting Welcome and Announcements, Jim Kasdorf, Rupak Biswas, Earl Joseph and Steve Conway
Morning Session Chair: Jim Kasdorf

8:15am Brief introductions by the end-user sites -- Each user site is asked to:

1. Explain the top 2 issues facing your HPC operations today
2. What new solutions do you need the most and are willing to pay extra to obtain?
3. What new technologies are you aware of that could revolutionize the HPC industry?

HPC Focus Area: The Skies Above: Aerospace, Astrophysics and Astronomy

9:00am Keynote: Engineering for the Mars Science Laboratory, James Donaldson, NASA Jet Propulsion Laboratory

9:30am HPC for Space and Astrophysical Sciences, Jill Dahlberg, U.S. Naval Research Laboratory

10:00am Recent Advances in Overcoming the Red Shift for CFD Simulation Analytics, Scott Imlay, Tecplot

10:30am Break

11:00am 3D Electronic Model-Based Type Design, Jeff Kreide, Gulfstream

11:30am Applying New Computing Techniques to Numerical Astrophysics, Brant Robertson, University of Arizona

12:00pm Networking Lunch

Brief Introductions By End-user Sites

Each user site is asked:

1. To explain the top 2 issues facing your HPC operations today
2. What new solutions do you need the most and are willing to pay extra to obtain?
3. What new technologies are you aware of that could revolutionize the HPC industry?

**Lunch Thanks to:
Altair Engineering**

Please Return Promptly at 1:00pm

**Thank You To:
Altair Engineering
For Lunch**



Agenda: Day One Afternoon

Afternoon Session Chair: Vijay Agarwala

HPC Focus Area: The Skies Above: Aerospace, Astrophysics and Astronomy

1:00pm HPC in Astrophysics, Donald Lamb, University of Chicago

1:30pm Petascale Supernova Simulation, Bronson Messer, Oak Ridge National Laboratory

2:00pm Panel: What are the HPC Trends in Aerospace, Astrophysics and Astronomy?

Moderator: Don Lamb, University of Chicago

- NASA JPL
- Gulfstream
- * NRL
- * ORNL
- * Tecplot
- * Intelligent Light

2:30pm Break

3:00pm *Paving the Way for HPC in the Cloud*, Burak Yenier, UberCloud Experiment

3:15pm High Performance Data Analysis (aka "Big Data Meets HPC") Moderator: Steve Conway

- Big Data Use Cases, Radhika Subramanian, Emcien
- Big Data Use Cases, Darren Schulte, Apixio
- Big Data and HPC I/O Limitations In Today's World, Henry Newman, Instrumental
- Big Data Use Cases, John Hengeveld, Intel
- New Directions in the Lustre Community, Peter Bojanic

5:15pm Networking Break and Time for 1-on-1 Meetings

5:45pm Bus Leaves for Special Dinner Event at Pima Air & Space Museum

**Thank You To:
Bright Computing
For The Break**



Dinner Logistics

- **Special Dinner Event -- Buses leave starting at 5:45pm**
- **Sponsored by Intel and HP**

**Welcome
To Day 2 Of The
HPC User Forum
Meeting**





Dinner
Thanks to:
Intel and HP

Breakfast
Thanks to:
Brocade

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PM Break - Mellanox

Agenda: Day Two Morning

- 8:10am Welcome and Introductions: Jim Kasdorf, Rupak Biswas, Earl Joseph and Steve Conway
Morning Session Chair: Vince Scarafino
- 8:15am Technology Topic #1: Processors, Coprocessors and Accelerators (15 minute updates) Moderator: Vince Scarafino
- Microserver Research, Ronald Luijten, IBM Zurich Research Laboratory
 - The Future of x86 Processors, Stephen Wheat, Intel
 - 1HPC Directions at Nvidia, Cyril Zeller, Nvidia
 - Hybrid Processors with Personalities, Steve Wallach, Convey Computer
 - Processor Discussion: The Future of Processors, Coprocessors and Accelerators
- 9:45am HP Vendor Technology Update
- 10:00am BP HPC Plans, Keith Gray, BP
- 10:30am Break
- 11:00am HPC Activities and Directions in Russia, Alexey Shmelev, RSC Group
- 11:30am Intel Vendor Technology Update
- 11:45am IDC Big Data Update, Steve Conway and Chirag Dekate, IDC
- 12:00pm Networking Lunch

**Lunch Thanks to:
SUSE**

Please Return Promptly at 1:00pm

Thank You To:
SUSE
For Lunch



Agenda: Day Two Afternoon

Afternoon Session Chair: Steve Finn

1:00pm Disruptive Technologies Panel -- Panelists will briefly (in 2-3 minutes) present potentially disruptive technologies, Moderator: Earl Joseph

- System vendors: IBM, HP, Dell, Cray, SGI
- Processor vendors: Intel, Micron, Nvidia, IBM,
- Software providers: Intelligent Light, Parallel Scientific, SUSE
- Storage vendors: Panasas, NetApp

2:00pm Break

2:30pm Technology Topic #2: Advanced Visualization

- A Visualization Tool for Astrophysics, Hari Krishnan, NERSC
- New Visualization Center, David Pugmire, ORNL
- Visualization Infrastructure at the NASA Advanced Supercomputing Division, Chris Henze
- A 3D Fly Through of the Known Universe, Yushu Yao, NERSC
- Visualization at Oak Ridge National Laboratory, April Lewis

4:45pm New Methods for Measuring and Calculating ROI in HPC, Earl Joseph, Steve Conway and Chirag Dekate, IDC

5:00pm Meeting Wrap-Up, Jim Kasdorf, Rupak Biswas, Earl Joseph and Steve Conway

Agenda: Day Two Afternoon

Disruptive Technologies Panel

Panelists will briefly (in 2-3 minutes) present potentially disruptive technologies:

- System vendors: IBM, HP, Dell, Cray, SGI
- Processor vendors: Intel, Micron, Nvidia, IBM,
- Software providers: Intelligent Light, Parallel Scientific, SUSE
- Storage vendors: Panasas, NetApp

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HPC ROI Study:

Developing A Measurement Of How Investments In HPC Can Create ROI And Higher Levels Of Innovation

Research Update, May 1, 2013

Earl Joseph – ejoseph@idc.com
Steve Conway – sconway@idc.com
Chirag Dekate – cdekate@idc.com



Background: Project Overview

A study that describes how increases in HPC investments can significantly improve economic success and increase scientific innovation

The study includes creating two unique models:

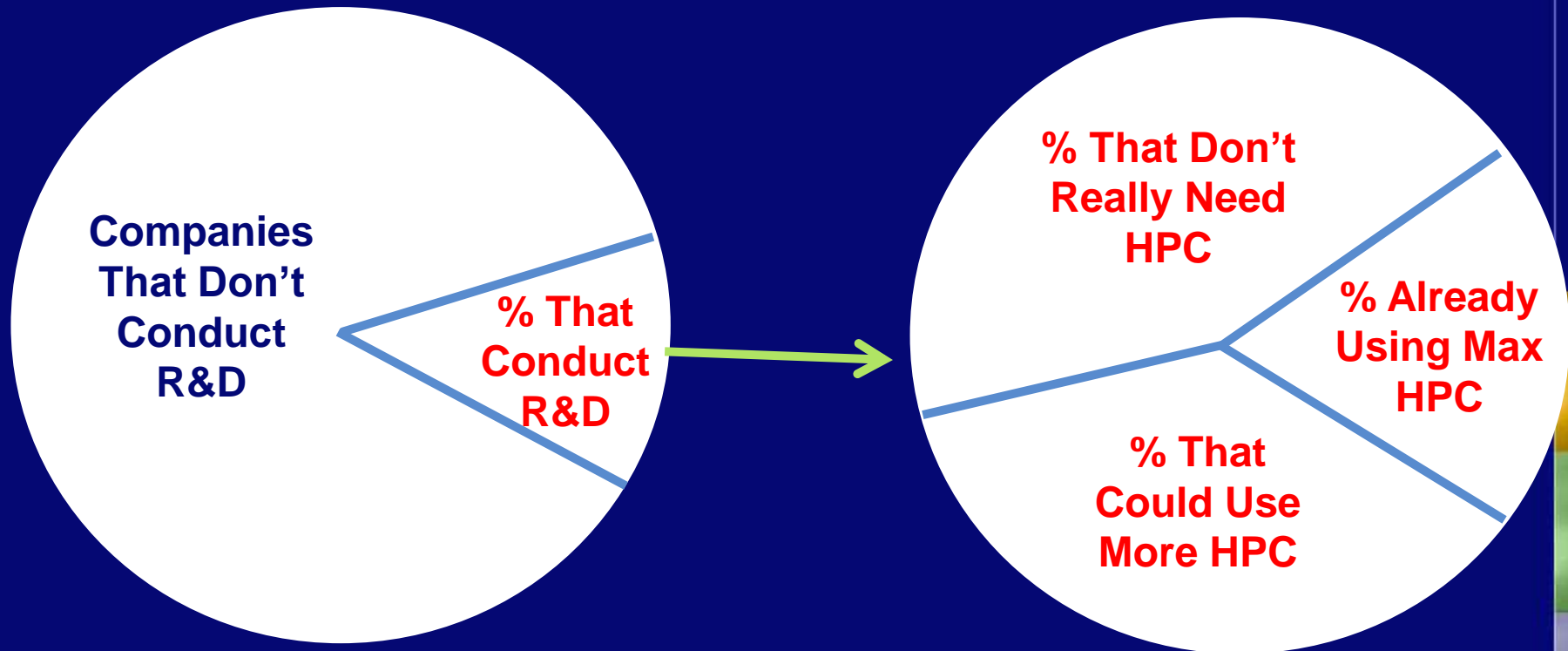
1. A macroeconomic model which depicts the way HPC investments result in economic advancements in the form of ROI, growth and jobs
2. An "Innovation Index" that provides a means of measuring and comparing innovation levels, based on the level of applying HPC computing resources towards scientific and technical advancement

Research Overview – Key Data and Metrics

- 1) Determine the time delay by the different sectors/categories (delay of investments → to returns)
- 2) Determine the type of return and size of return by year
 - Sales, profits, cost savings, employee growth, new companies/start-ups, innovation, etc.
- 3) Determine the % of each sector that can actually use HPC
- 4) Estimate the typical R&D and other costs per HPC \$ invested
- 5) Then calculate the results:
 - ROI per HPC/R&D dollar (overall and by sector)
 - Additional R&D investments required per HPC dollar
 - Total return for a country per HPC dollar, over time

Research Overview – An Example of the Parameters Needed

For each sector we need 4 basic ratios



Note: IDC has conducted over 5,000 light surveys for this data as of March 2013, it will likely require 5x to 10x more surveys

The Initial Models That Are Being Tested

The ROI models will be tested for two main types:

- ROI based on revenues generated (similar to GDP) divided by HPC investment
- ROI based on jobs created divided by HPC investment

The ROI models will be tested for variances by:

1. Industry sector
2. Country
3. Organization size

The Innovation models will be of four types:

- Basic Research/Major Innovations in government & academia
- Basic Research/Major Innovations in industry
- Applied Research/Incremental Innovations in government & academia
- Applied Research/Incremental Innovations in industry

The Innovation models will be tested for variances by:

1. Industry sector
2. Country
3. Organization size
4. Government, Industry and Academia

The UPDATED Innovation Index Scale

How would you rate this innovation compared to all other innovations in this field over the last ten years, using a scale of 1 to 10?

- 10 = One of the top 2 to 3 innovations in the last decade
- 9 = One of the top 5 innovations in the last decade
- 8 = One of the top 10 innovations in the last decade
- 7 = One of the top 25 innovations in the last decade
- 6 = One of the top 50 innovations in the last decade
- 5 = It had a major impact and is useful to many organizations
- 4 = A minor innovation that is useful to many organizations
- 3 = A minor innovation or only useful to 2 -3 organizations
- 2 = A minor innovation or only useful to 1 organization
- 1 = An innovation that is recognized ONLY by experts in the field

Early Results

Early Results

Note: These are VERY early results, and the final results could be very different

Sample characteristics:

- 49 sites in the database (as of 4/3/2013)
- The sample mix is:
 - 33 in Industry, 7 in Government, and 9 in Academia
- We have 40 innovations in the sample
- We have 22 financial ROI examples

Early Results

Note: These are VERY early results, and the final results could be very different

Note: This is from the first 49 data points

- The ROI in revenues for each HPC dollar invested is:
 - 29.2 times
- The ROI in profits for each HPC dollar invested is:
 - 6.46 times
- For sites that reported job creation, the HPC investment required per job created =
 - \$20K
- For each innovation in the sample:
 - \$1.15 million in HPC was invested

Early Results

Note: These are VERY early results, and the final results could be very different

Note: This is from the first 49 data points

The average innovation rating = 6.24

10 = One of the top 2 to 3 innovations in the last decade

9 = One of the top 5 innovations in the last decade

8 = One of the top 10 innovations in the last decade

7 = One of the top 25 innovations in the last decade

6 = One of the top 50 innovations in the last decade

5 = It had a major impact and is useful to many organizations

4 = A minor innovation that is useful to many organizations

3 = A minor innovation or only useful to 2 -3 organizations

2 = A minor innovation or only useful to 1 organization

1 = An innovation that is recognized ONLY by experts in the field

Research Schedule: 9/1/12 to June/July 2013

- ✓ 1. October 2012 – finalize the plan, surveys and overall research approach
- ✓ 2. November 2012 – conduct a limited number of surveys to both see what can be collected and start testing the two models
- ✓ 3. December 2012 – refine the survey guide and models as needed
 - Refine as needed
- ✓ 4. January – March 2013 – start the broad data collection/surveys – and review the initial results
 - We noticed that we need a larger data set
- Started 5. April/May 2013 – populate the two models with MORE DATA from both surveys and existing economic data elements
 - Refine as needed
- 6. May/June 2013 – present and refine the models as required, and create the 3 funding scenarios
- 7. June/July 2013 – disseminate the results

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