Welcome To The 52th HPC User Forum Meeting April 2014

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Wednesday Breakfast –
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Wednesday lunch –
Altair

Important Dates For Your Calendar

FUTURE HPC USER FORUM MEETINGS:

2014 Meetings:

- July 16, at Riken in Kobe Japan
- September 15 to 17, Seattle, Washington
- October 2014 in Stuttgart Germany at HLRS

2015 Meetings:

- April 13 to 15, Norfolk, Virginia

Monday Dinner Vendor Updates: 10 Minutes

- Broadcom
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Welcome To The 52th HPC User Forum Meeting April 2014

Welcome

Jim Kasdorf
HPC User Forum
Chairman

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Thank You To:
Adaptive Computing
For Breakfast

Introduction: Logistics

Ask Mary if you need a receipt

We have a very tight agenda (as usual)

- Please help us keep on time!

Review handouts

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

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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

HPC USER FORUM

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
- Jysoo Lee, National Institute of Supercomputing and Networking
- Paul Muzio, City University of New York
- Michael Resch , HLRS, University of Stuttgart
- Vince Scarafino, Industry Expert
- Suzy Tichenor, Oak Ridge National Laboratory

CHECK OUT OUR NEW WEB SITE: www.hpcuserforum.com

HPC USER FORUM

Agenda: Day One Morning

8:00am Meeting Welcome and Announcements
- Chairman's and Co-chairman's Welcome, Jim Kasdorf and Rupak Biswas

8:10am HPC Market Update and IDC's Top 10 predictions for 2014, Earl Joseph, Steve Conway and Chirag Dekate
Session Chair: Suzy Tichenor

8:30am HPC Leadership Project Talk: Trinity Next-Generation Supercomputer, Doug Doerfler, Sandia National Laboratories

9:00am HPC Leadership Project Talk: NERSC-8 Next-Generation Supercomputer, Katie Antypas, NERSC

9:30am Focus Area: HPC Industrial Partnership Initiatives
- Case History And Best Practices From The UK's Hartree Centre (Daresbury Sci-Tech Campus), Cliff Brereton, Hartree Centre
- Partnerships with Lawrence Livermore National Laboratory, Jeff Wolf, LLNL

10:30am Break
- Accelerate Manufacturing Design Innovation with Cloud-Based HPC, Steve Phillpott, HGST/Western Digital
- Case Study from ORNL, John Turner, Oak Ridge National Laboratory
- Example of a RENCI Partnership With Industry, Stan Ahalt, RENCI

12:15pm Networking Lunch

IDC HPC Market Update And Predictions For 2014

Top Trends in HPC

2013 declined overall – by $800 million

- For a total of $10.3 billion
- Mainly due to a few very large systems sales in 2012, that weren't repeated in 2013
- We are in the process of updating our forecasts forecasting – we expect healthy growth in 2014 to 2018

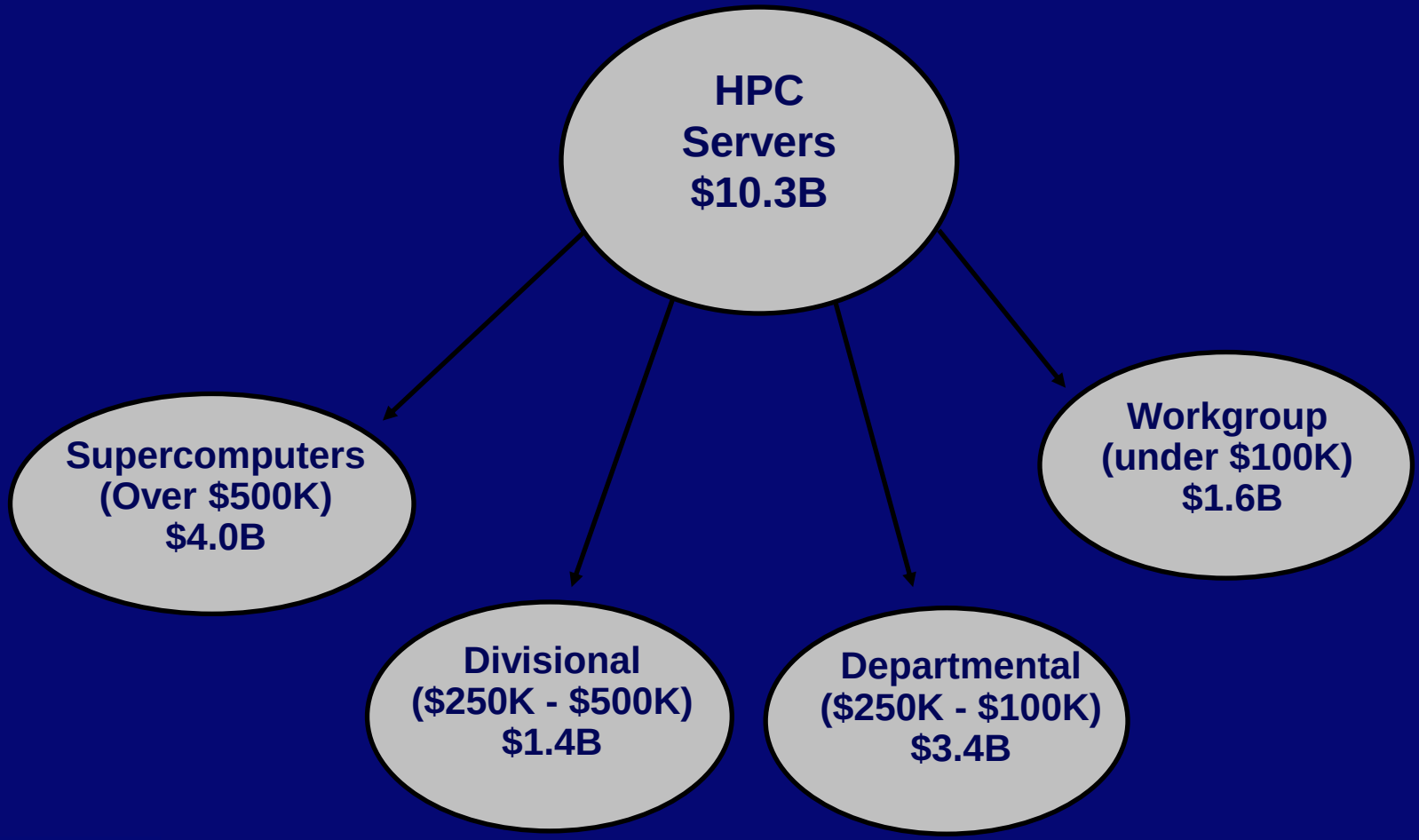
Software issues continue to grow

The worldwide Petascale Race is in full speed

GPUs and accelerators are hot new technologies

Big data combined with HPC is creating new solutions in new areas

IDC HPC Competitive Segments: 2013



2013 HPC Revenue Results

	2011	2012	2013
cs1-Supercomputer	4,370,194	5,654,960	3,994,740
cs2-Divisional	1,236,684	1,216,187	1,355,097
cs3-Departmental	3,467,271	2,979,230	3,363,263
cs4-Workgroup	1,225,910	1,247,366	1,585,666
Total	10,300,058	11,097,743	10,298,766

IDC
Analyze the Future

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2013 HPC Revenue Results: By Vendor

Mftr	2011	2012	2013
IBM	3,362,098	3,551,723	2,856,334
HP	3,307,427	3,419,554	3,343,758
Dell	1,493,289	1,493,172	1,478,322
Cray	155,620	353,800	436,741
SGI	225,741	274,693	310,581
Fujitsu	120,351	686,657	127,988
NEC	84,141	64,112	72,901
Dawning	102,923	115,359	200,497
Bull	327,536	60,494	77,322
Other	847,140	966,531	1,394,321
	10,300,058	11,097,743	10,298,766

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2013 HPC Results: Processors Shipped

	2011	2012	2013
cs1-Supercomputer	1,326,046	1,635,494	1,112,154
cs2-Divisional	412,784	426,099	443,452
cs3-Departmental	1,179,347	1,048,614	1,211,342
cs4-Workgroup	250,198	324,473	499,243
Processors	3,168,375	3,434,680	3,266,191

2013 HPC Results: Cores Shipped

CPU Type	2011	2012	2013
EPIC	152,420	74,156	9,309
RISC	1,126,142	1,956,455	1,093,706
RISC-BG	73,951	3,124,465	236,706
x86-64	21,077,350	24,612,643	27,287,873
Mix			170,240
Grand Total	22,429,862	29,767,720	28,797,835

IDC Top 10 HPC Predictions for 2014

1. HPC Server Market Growth Will Continue in 2014, after a decline in 2013
2. The Global Exascale Race Will Pass the 100PF Milestone
3. High Performance Data Analysis Will Enlarge Its Footprint in HPC
4. ROI Arguments Will Become Increasingly Important for Funding Systems
5. Industrial Partnerships Will Proliferate, with Mixed Success
6. x86 Base Processor Dominance Will Grow and Competition Will Heat Up
7. Storage and Interconnects Will Benefit as HPC Architectures Gradually Course-Correct from Today's Extreme Compute Centrism
8. More Attention Will Be Paid to the Software Stack
9. Cloud Computing Will Experience Steady Growth
10. HPC Will Be Used More for Managing IT Mega-Infrastructures

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1. HPC Server Market Growth Will Continue in 2014, after a Decline in 2013

2010-12: 3 successive years of record revenue growth

2013: A $800 million dip from exceptional 2012, but the lower half came back strong

We forecast that all HPC competitive segments will grow in 2014

2. The Global Exascale Race Will Pass the 100PF Milestone

China, the U.S., Europe (PRACE) and Japan will likely deploy 100PF systems in 2H 2014 to 2015

- Watch for the roles played by indigenous Chinese, Japanese processors

Peak ES systems will start arriving ~2020

- Power efficient (20 to 30MW), early ES systems will wait till 2022-24

The ES race will be as much a funding competition as a technology competition

3. High Performance Data Analysis Will Enlarge Its Footprint

- **HPDA = Big Data Using HPC**
  - Data-intensive modeling/simulation + newer analytics methods
  - Growing in established HPC domains + new wave of commercial firms
- **67% of HPC sites are using HPDA today**
  - Data analysis uses 30% of the HPC compute cycles on average
- **2016 forecast:**
  - HPDA servers: $1.2B
  - HPDA storage: $800M

High Performance Data Analysis Will Enlarge Its Footprint

"Clearly understand that HPC is not a mass consumption technology where we enable everyone in our organization with it. This is a deep engineering function. It's custom built and includes writing software to solve cutting-edge problems … Think of HPC not as an IT function but as a competitive business advantage. There's a hard link between HPC and PayPal's top line and bottom line."

PayPal CTO Jim Barrese (IDC interview, 2013)

4. ROI Arguments Will Become Increasingly Important for Funding Big Systems

- The former Cold War arms race is becoming an economic race
- HPC is a proven accelerator of economic competitiveness
- High-end supercomputers now cost $200-500 million
- ROI can be a scientific advance or corporate profit, revenues, new jobs or retaining jobs
- More large HPC centers have industry outreach programs

5. Industrial Partnerships Will Proliferate, with Mixed Success

- **Many national labs/centers added industrial outreach programs in recent years**
- **Partnerships typically have an ROI component (technology transfer, economic development)**
- **Some labs/centers have had shining successes (e.g., INCITE, SciDAC), while others are at the start of the learning curve and struggling**
- **It is important to share what has and hasn't worked**
  - The HPC User Forum is one platform for sharing

6. x86 Base Processor Dominance Will Grow and Competition Will Heat Up

Base Processors

- x86-based systems already capture about 80% of all HPC server revenue
- **The acquisition of IBM's x86 server business should enable Lenovo to further advance its x86 position**
- To grow share, other base processors (e.g., Power, ARM) will need to step up innovation and provide clearly differentiated value

Coprocessors (2013 MCS)

- Sites using coprocessors/ accelerators jumped from 28% in 2011 to 77% in 2013
- Nvidia leads the pack today
- Future purchase intent is strong for both Nvidia and Phi -- FPGAs are a distant third
- Most are still experimental
- Growth barriers remain in programming difficulty and lack of strong software ecosystems

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7. Storage and Interconnects Will Benefits As Architectures Course-Correct from Today's Extreme Compute Centrism

Storage

The fastest-growing HPC market segment

- $4.1B in 2012, $6.0B in 2017 (8.2% CAGR)
- $6B = size of HPC server market in 2000

HPC storage revenue will grow to record levels

The HPC storage market remains fragmented

The big players are turning their attention to this market

HPDA will boost storage budgets

Interconnects

The HPC interconnect market is in transition

Data movement/ management is a major paint point

- Multi-year shift away from today's extreme compute-centrism

The big players are turning their attention to this market

- Established players are advancing hard
- Much anticipation about Intel's fabric plans

IDC Analyze the Future

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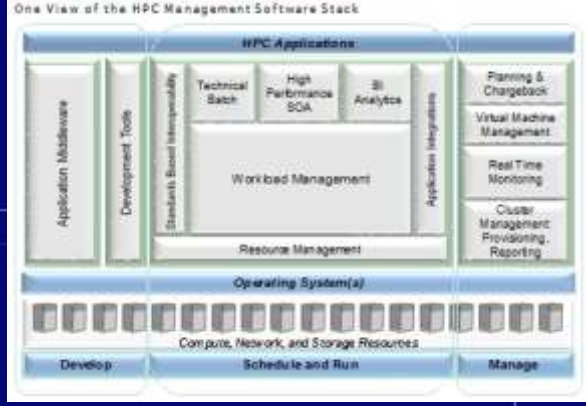
8. More Attention Will Be Paid to the Software Stack



Growing needs can no longer be postponed

- Robustness/resiliency in mega-compute and storage systems where there may always be some components in failure mode
- Autonomic and machine learning functions to relieve programmers/users
- New collaboration modes and environments (teams working across distances, cloud computing)
- Rebalancing the stack as architectures shift from extreme compute centrism

Vendors are already putting more focus on the stack

IDC forecast: HPC systems software will grow to $1.5B in 2017

9. Public Cloud Computing Will Experience Steady Growth

Sites exploiting cloud computing to address parts of their HPC workloads rose from 13.8% in 2011 to 23.5% in 2013

- Public and private clouds were about equally represented

Today's public clouds are still best suited for EP workloads

- More private- and public-sector organizations are using public clouds for drug candidate screening, other EP jobs
- Main cloud use scenarios: surge workloads, R&D projects, SMBs without HPC data centers

Public cloud use will accelerate as clouds overcome barriers:

- Data security, data transfer times, non-EP performance

10. HPC Will Be Used More for Managing Mega-IT Infrastructures

For managing large and diverse mega-IT environments

- Dealing highly mixed systems (hardware, software, different user access devices, etc.)
- Mega-IT centers linked between major geographies

For security and RAS

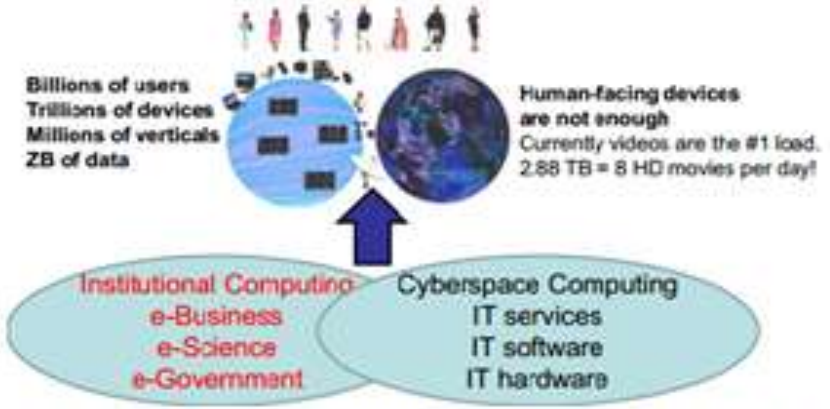
- Dealing with constantly failing components
- Monitoring the system complex for intrusion vs. failures

For example:

- PayPal using HPC to mange their IT infrastructure
- Google hiring HPC experts to design their next-generation architectures

HPC Will Be Used More for Managing Mega-IT Infrastructures

- China expects 100ZB of home sensor data by 2030
  - 40-50 appliance/device sensors per home
  - 200TB of sensor data per home x 500 million homes in China = 100ZB
- The Chinese Academy of Sciences NICT Project
  - NICT = New-generation ICT
  - 10-year collaboration (2012-2021) to prepare for country's needs in 2020-2050.
  - Developing an HPC-driven infrastructure to process ZB of data
  - Developing a powerful single home sensor in place of 40-50 sensors
  - Sample application: identify the top 100 green households in Beijing
  - Will rely on open-source software such as DataMPI for sorting and page ranking



Source: "Cloud-Sea Computing on ZB of Data," Dr. Zhiwei Xu, CAS

Conclusions

HPC is still expect to be a strong growth market

- Growing recognition of HPC's strategic value is helping to drive high-end sales
- Low-end buyers are back into a growth mode

HPC vendor market share positions will likely shifted greatly in 2014 and 2015

Recognition of HPC's strategic/economic value will drive the exascale race, with 100PF systems in 2H 2014/2015

- 20/30MW exascale systems will wait till 2022-2024

The formative HPDA market will expand opportunities for vendors

Questions?

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- Accelerate Manufacturing Design Innovation with Cloud-Based HPC, Steve Phillpott, HGST/Western Digital
- Case Study from ORNL, John Turner, Oak Ridge National Laboratory
- Example of a RENCI Partnership With Industry, Stan Ahalt, RENCI

12:15pm Networking Lunch

Lunch Thanks to:
Broadcom

Please Return Promptly at 1:15pm

Agenda: Day One Afternoon

1:15pm Focus Area: HPC Industrial Partnership Initiatives
Session Chair: Suzy Tichenor
- HPC Industrial Engagement Initiatives: Realities, Myths and Dreams, Andy Jones, NAG
- Industrial Partnership Programs, Merle Giles, NCSA
- Partnerships for Innovation at Los Alamos, David Pesiri, Los Alamos National Laboratory

2:45pm HPC Vendor Technology Update: Bill Feiereisen, Intel

3:00pm HPC Vendor Technology Update: HP

3:15pm Break

3:30pm Technology Focus Area: Processors, Coprocessors and Accelerators
Moderator: Vince Scarafino
- Speakers will discuss the current status, performance results, market trends and experiences with processors, GPGPUs, MIC, ARM, Atom, and others
- Micron's Automata Processor, Paul Dlugosch
- The IBM-DOME 64bit Microserver Demonstrator: Findings, Status And Outlook, Ronald Luijten, IBM Zurich
- ARM Processor Directions, Dwight Barron, Hewlett Packard
- Intel, Joseph Curley
- Nvidia, Dale Southard

5:00pm Networking Break and Time for 1-on-1 Meetings

6:30pm Special Dinner Event

Agenda: Day One Afternoon

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Thank You To:
Panasas
For The Break

Dinner Logistics

- Special Dinner Event
- Sponsored by Intel and HP

Welcome
To Day 2 Of The
HPC User Forum
Meeting

Dinner
Thanks to:
Intel and HP

Breakfast
Thanks to:
Mellanox

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Mellanox

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DDN

Wednesday lunch –
Altair

Agenda: Day Two Morning

8:10am Welcome: Jim Kasdorf, Earl Joseph and Steve Conway
Session Chair: Doug Ball

8:15am Teratec, a European Industrial Initiative, Herve Mouren, Teratec

8:45am The CREATE Ships Navy Enhanced Sierra Mechanics (NESM) Project, Adam Hapij, Weidlinger and Associates

9:15am Building a Partnership with Five Universities, Holyoke MGHPCC, John Goodhue

9:45am Break

10:15am Featured Talks: HPC Innovation Award Winners

- Introduction by Chirag Dekate

10:45am Vendor Technology Update: DDN's WOS Storage Technology, Mike Vildibill, DDN

11:00am New Technologies from China: Inspur

11:30am A Rare Look at Real World Data Analysis of Supercomputer Faults - DRAM, SRAM, and GPGPUs, Nathan DeBardeleben, LANL

12:00pm Networking Lunch

Thank You To:
DDN
For The Break

Agenda: Day Two Morning

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Altair Engineering

Please Return Promptly at 1:00pm

Thank You To:
Altair Engineering
For Lunch

Agenda: Day Two Afternoon

1:00am Preparing Applications for Next Generation IO/Storage, Gary Grider, LANL

1:30pm Disruptive Technologies Panel -- Moderator: Earl Joseph

- Bob Ewald, D-wave
- Rishi Khan, Extreme Scale Solutions, Inc.
- Bob Keller, Silicon Informatics
- Daniel Hardman, Adaptive Computing
- Bill Mannel, SGI
- Altair, Bill Nitzberg
- IBM DOME
- Leo Reiter, Nimbix
- Dale Southard, NVIDIA
- Mike Vildibill, DDN
- Inspur

3:00pm IDC HPDA Update On Big Data and HPC, Steve Conway and Chirag Dekate, IDC

3:15pm Break

3:45pm HPC Storage Challenges and Their Future Implications, Henry Newman, Instrumental

4:15pm Measuring ROI from HPC Investments, Earl Joseph, IDC

4:30pm HPC Leadership Project Overview -- CORAL: A Collaboration of Oak Ridge, Argonne, and Lawrence Livermore to Procure Their Next Generation Leadership Computing Systems, Buddy Bland, ORNL

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

Agenda: Day Two Afternoon

Disruptive Technologies Panel -- Panelists will briefly (in 5 to 6 minutes) present potentially disruptive technologies:

- Bob Ewald, D-wave
- Rishi Khan, Extreme Scale Solutions, Inc.
- Bob Keller, Silicon Informatics
- Daniel Hardman, Adaptive Computing
- Bill Mannel, SGI
- Altair, Bill Nitzberg
- Scot Schultz, Mellanox
- Leo Reiter, Nimbix
- Dale Southard, NVIDIA
- Mike Vildibill, DDN
- Inspur, SUSE, etc.

Disruptive Technologies: Question #1

Panel Discussion:

For the disruptive technologies that you presented,

what is most needed to bring it to market faster or with more certainty?

Disruptive Technologies: Question #2

Panel Discussion:

For the disruptive technologies that you presented,

what parts of the market will use it first – and will it likely become a mainstream technology?

Disruptive Technologies: Question #3

Panel Discussion:

For the disruptive technologies that you presented,

what supporting technologies are required to make it a major success?

Disruptive Technologies: Question #4 & #5

Panel Discussion:

For the disruptive technologies that you presented,

what partners (if any) would you like to help bring it to market sooner?

Can the HPC User Forum help develop these partnerships?

Agenda: Day Two Afternoon

3:00pm	IDC HPDA Update On Big Data and HPC, Steve Conway and Chirag Dekate, IDC
3:15pm	Break
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HPC USER FORUM

The IDC HPC Innovation Award Program

IDC Analyze the Future

HPC USER FORUM

HPC Award Program Goals

#1 Help to expand the use of HPC by <u>showing real ROI examples</u>:

1. Expand the "Missing Middle" – SMBs, SMEs, SMSs -- by providing examples of what can be done with HPC
2. Show mainstream and leading edge HPC success stories

#2 Create a large database of success stories across many industries/verticals/disciplines

- To help justify investments and show non-users ideas on how to adopt HPC in their environment
- Creating many examples for funding bodies and politicians to use and better understand the value of HPC → to help grow public interest in expanding HPC investments
- For OEMs to demonstrate success stories using their products

Users Have to Submit the Value of the Accomplishment

Users are required to submit the value achieved with their HPC system, in any of 3 broad categories:

a) Dollar value of the HPC usage
- e.g. made $$$ in new revenues, saved $$$ in costs, made $$$ in profits, etc.

b) Scientific or engineering accomplishment
- e.g. discovered how xyz really works, develop a new drug that does xyz, etc.

c) Value to society as a whole
- e.g. ended nuclear testing, made something safer, provided protection against xyz, etc.

… and the investment in HPC that was required (in order to calculate the ROI)

The Judgment Process -- Clear, Fair And Transparent

The ranking of the accomplishments are done by only HPC USERS, following very specific rules.

A three step process is proposed:

1. First the submission has to be complete with a clear "Value" shown
   - A number of the submissions were good, but needed a little more information – we have invited them to apply for the fall award
2. Secondly, an assessment is made to see that it is a realistic assessment of the value/returns
   - By the HPC User Forum Steering Committee
3. Then in cases where the value isn't clear, or a deeper technical depth is required -- the final evaluation is by experts in the specific area/discipline

The New Winners: At ISC'13 -- PART 1

We recognize these sites for their excellence in applying HPC to solve key business and scientific problems:

Site (Alpha Ordered)	Person	Success Area	Org Size
Alenia Aermacchi	Enrica Marentino	ROI & Eng.	Medium
High Performance GeoComputing LabUCSD	YiFeng Cui	Sci/Eng & Society	Large
DOD HPC MOD	Deborah Schwartz	ROI & Eng.	Large
DOD HPC MOD	John West	ROI & Eng.	Large
ESTECO & Airworks Eng.	Paolo Vercesi	ROI & Eng.	Medium
UCL, NAG HECTOR	HECToR dCSE	ROI Sci/Eng&Society	Medium
U. Warwick NAG HECTOR dCSE	HECToR dCSE	ROI Sci/Eng&Society	Medium

The New Winners: At ISC'13 -- PART 2

We recognize these sites for their excellence in applying HPC to solve key business and scientific problems:

Site (Alpha Ordered)	Person	Success Area	Org Size
Bottero S.P.A	Alberto Marino	ROI & Eng.	Medium
Polestar Racing	Per Blomberg	ROI & Eng.	Medium
RENCI	Phil Owen	Sci/Eng & Society	Medium
University of North Carolina/RENCI	Rick Lutteich, Brian Blanton	Sci/Eng & Society	Medium

The Trophy For Winners

HPC USER FORUM