# Welcome To The 60th HPC User Forum Meeting April 2016

# Thank You To Our Sponsors!

**GOLD:**
- HPE
- Intel

**SILVER:**
- Altair
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**BRONZE:**
- AMD
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- Ryft

**<u>Tuesday</u>**

**Breakfast – Dell**

**AM Break – AMD**

**Tuesday Lunch – IBM**

**PM Break – Ryft**

**Dinner – HPE and Intel**

**<u>Wednesday</u>**

**Breakfast – Altair**

**AM Break – Nimbix**

**Wednesday lunch – SGI**

RMCHPC USER FORUM

# Important Dates For Your Calendar

## FUTURE HPC USER FORUM MEETINGS:

**2016 Meetings:**

- September 6 to 8, Austin Texas, USA
- September 22/23, Beijing, China
- September 26/27, Bologna, Italy
- September 29/30, Oxford, United Kingdom

**2017 Meetings:**

- April 17 to 19, Santa Fe, New Mexico
- September 5 to 7, Milwaukee, Wisconsin

# Monday Dinner Vendor Updates: 8 Minutes

- Altair
- Dell
- SGI

# Welcome To The 60th HPC User Forum Meeting April 2016


Welcome to Tucson
Welcome HPC User Forum
4:33 PM 4/11/2016
Visual
Paging
Information

# Thank You To:

# Dell

# For Breakfast

SSHPC USER FORUM

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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!

**Review handouts**

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

# Welcome

**Paul Muzio**

**HPC User Forum**

**Chairman**

# The IDC HPC User Forum: 59 Meetings Worldwide Since 2000

Amsterdam, Netherlands (SARA)

Annecy, France

Bangalore, India (Indian Institute of Technology)

Beijing, China (Chinese Academy of Sciences)

Bologna, Italy (CINECA)

Bristol, UK

Bruyères-le-Châtel, France (Teratec)

Canberra, Australia

Geneva, Switzerland (CERN)

Kobe, Japan (RIKEN)

Lausanne, Switzerland (EPFL)

London, UK (Imperial College)

Manchester, UK (Manchester University)

Melbourne, Australia

Munich, Germany (LRZ)

New Delhi, India (Indian Institute of Science)

Paris, France (GENCI)

Seoul, Korea (National Institute of Supercomputing & Networking)

Stuttgart, Germany (HLRS)

Warsaw, Poland (University of Warsaw)

Yokohama, Japan (Earth Simulator Center)

Zurich, Switzerland (ETH Zurich)

United States (many locations)

# 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

- Paul Muzio, City University of New York, Chairman
- Rupak Biswas, NASA Ames, Vice Chairman
- Earl Joseph, IDC, Executive Director
- Swamy Akasapu, General Motors
- Vijay Agarwala, Virginia Tech.
- Alex Akkerman, Ford Motor Company
- Doug Ball, The Boeing Company
- Jeff Broughton. NERSC/Lawrence Berkeley National Lab
- Paul Buerger, Avetec
- Simon Burbidge, Imperial College London
- 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
- James Kasdorf, Pittsburgh Supercomputing Center
- Arno Kolster, Paypal
- Doug Kothe, Oak Ridge National Laboratory
- Jysoo Lee, National Institute of Supercomputing and Networking
- Michael Resch , HLRS, University of Stuttgart
- Vince Scarafino, Industry Expert
- Suzy Tichenor, Oak Ridge National Laboratory

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


HPC USER FORUM

# IDC HPC Market Update

SSS-HPC USER FORUM

# IDC Has Over 1,000 Analysts In 62 Countries

# About IDC: IDC HPC Activities

- Track all HPC servers sold each quarter
- 4 HPC User Forum meetings each year
- Publish 85+ research reports each year
- Visit all major supercomputer sites & write reports
- Assist governments in HPC plans, strategies and direction
- Assist buyers/users in planning and procurements
- Maintain 5 year forecasts in many areas/topics
- Developing a worldwide ROI measurement system
- HPDA program
- Quarterly tracking of GPUs/accelerators
- New: we are now doing cyber security research

# The Overall IT Market: $2 Trillion in 2014

| IT Spending ($m) | | | | |
|---|---|---|---|---|
| | 2012 | 2013 | 2014 | CAGR ('12-'14) |
| **Total IT** | **1,886,686** | **1,974,550** | **2,066,120** | 5% |
| Total Hardware | 913,066 | 958,962 | 1,009,274 | 5% |
| Total Services | 614,236 | 629,363 | 648,053 | 3% |
| Total Software | 359,384 | 386,224 | 408,794 | 7% |

*Source: IDC 2015*

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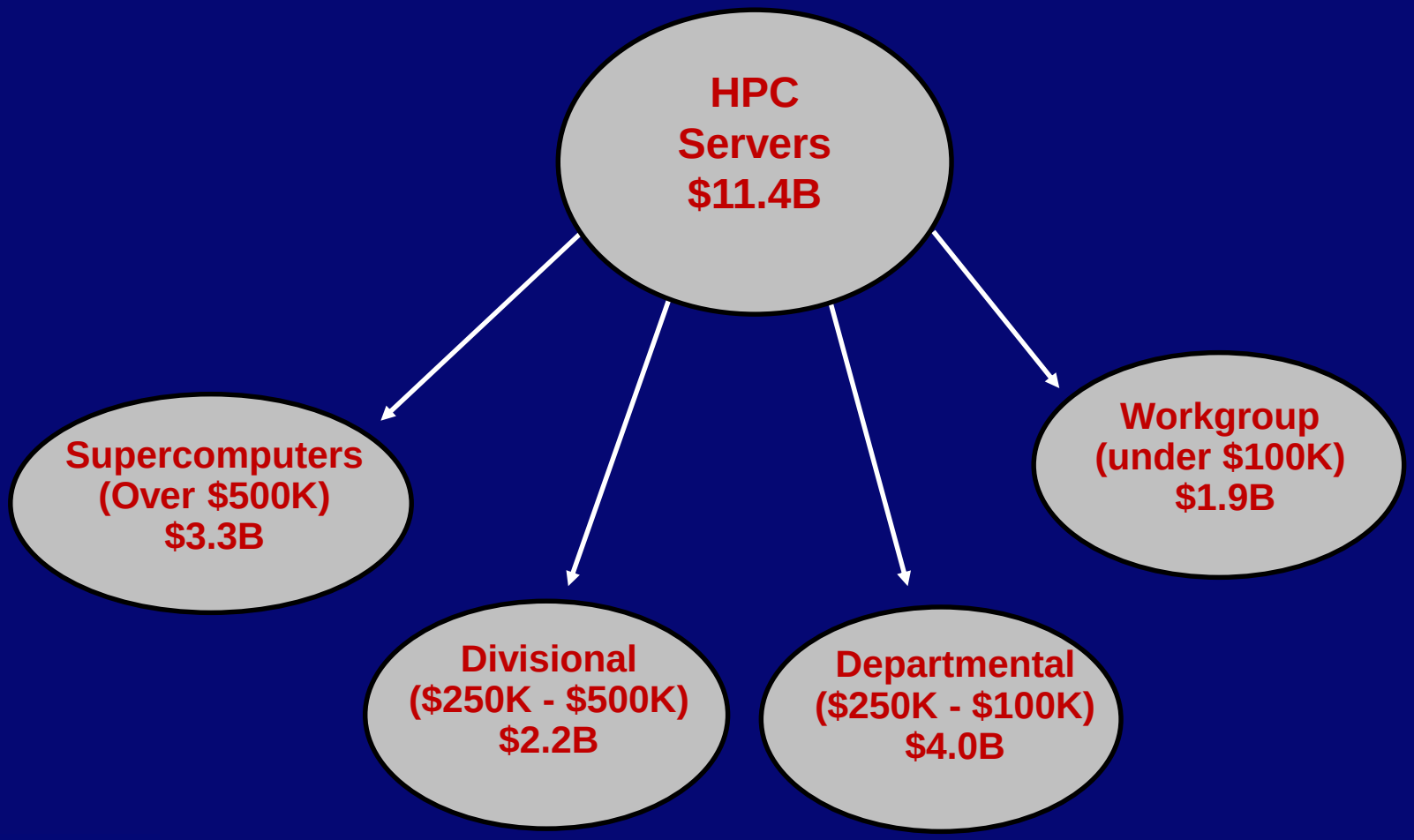
# The Overall SERVER Market: $55 Billion in 2014

| IT Sever Spending ($m) | | | | |
|---|---|---|---|---|
| | 2012 | 2013 | 2014 | CAGR ('12-'14) |
| **All Types of Servers** | **53,779** | **52,520** | **54,782** | 1% |
| High End Servers | 11,433 | 9,382 | 7,892 | -17% |
| Midrange Servers | 5,921 | 4,713 | 5,260 | -6% |
| Volume Servers | 36,425 | 38,425 | 41,629 | 7% |

*Source: IDC 2015*

# The Worldwide HPC Server Market: $11.4 Billion in 2015



# Top Trends in HPC

**2015 was strong – over 11% growth in revenues!**

- And 2016 is looking fairly strong

**But the top 5 systems has slowed for over 2 years**

- The IBM/Lenovo deal also delayed many purchases

**Big data combined with HPC is creating new solutions**

- Adding many new users/buyers to the HPC space

**We have adjusted our tracking data in two areas:**

- The finance sector grew faster than what we reporting over the last two years (by ~50% higher)
- As we find new HPDA users, we add them to the HPC market space – we have created 4 new verticals in this area (see next page)

# New HPC Segments from HPDA Buyers

1. **Fraud and anomaly detection.** This "horizontal" workload segment centers around identifying harmful or potentially harmful patterns and causes using graph analysis, semantic analysis, or other high performance analytics techniques. The patterns may point to fraud, which is the deceptive exploitation or annotation of data for wrongful or illegal personal gain, or they may point to cyber security crime or insider threats, significant errors, or other anomalies that may deserve further investigation.
2. **Marketing.** This segment covers the use of HPDA to promote products or services, typically using complex algorithms to discern potential customers' demographics, buying preferences and habits.
3. **Business intelligence.** The workload segment uses HPDA to identify opportunities to advance the market position and competitiveness of businesses, by better understanding themselves, their competitors, and the evolving dynamics of the markets they participate in.
4. **Other Commercial HPDA.** This catchall segment includes all commercial HPDA workloads other than the three just described. Over time, IDC expects some of these workloads to become significant enough to split out of this "other" category and command their own segments. An example of such a high-potential workload is the use of HPDA to manage large IT infrastructures, ranging from on premise data centers to public clouds and Internet-of-Things (IoT) infrastructures.

# The ROI With HPC Is Very High

**New results <u>indicate higher ROI returns</u> related to investments in HPC, compared to the pilot study**

- On average, from the latest data:
  - $**514.7** in revenue per dollar of HPC invested
  - $**43.2** of profits/cost savings per dollar of HPC invested
  - The average HPC investment per innovation was $**3.0M**

- From the 2013 pilot study:
  - $357 in revenue per dollar of HPC invested
  - $39 of profits/cost savings per dollar of HPC invested
  - The average HPC investment per innovation was $3.1M

- **Note that an additional outcome of this research is an expansive list of HPC success stories**

# Top Trends in HPC: Growing Use of Clouds

| Do you use cloud computing today for any of your HPC workloads? | |
|---|---|
| | Percentage of Responses |
| Yes | 25.5% |
| No | 74.5% |
| Total | |
| *N = 1,269 Servers at 157 sites* | |
| *Source: IDC, 2015* | |

# Top Trends in HPC: Growing Use of Clouds

| Level of Use of Clouds for Sites that are Currently Using Clouds | |
|---|---|
| | Percent of HPC Workload in Clouds |
| Sites Currently Using Clouds | 31.2% |
| *N = 40 Sites out of 157* | |
| *Source: IDC, 2015* | |

# HPC Revenues: By Vendor

| Mftr | 2015 Revenues | Shares |
|---|---|---|
| HPE/HP | 4,083,397 | 35.9% |
| Dell | 1,801,821 | 15.9% |
| Lenovo | 1,585,618 | 14.0% |
| Cray | 583,933 | 5.1% |
| IBM | 461,087 | 4.1% |
| SGI | 296,350 | 2.6% |
| Sugon (Dawning) | 282,230 | 2.5% |
| Fujitsu | 158,145 | 1.4% |
| NEC | 209,282 | 1.8% |
| Bull Atos | 96,475 | 0.8% |
| Other | 1,804,945 | 15.9% |
| | | |
| Total | 11,363,283 | 100.0% |

# HPC Market: By Processor Packages

| CPU Type | 2013 | 2014 | 2015 |
|---|---|---|---|
| EPIC | 3,047 | | |
| RISC | 142,251 | 139,028 | 89,431 |
| RISC-BG | 14,794 | | |
| Vector | | 7,220 | 7,680 |
| x86-64 | 3,009,880 | 3,025,692 | 3,357,239 |
| Grand Total | 3,169,972 | 3,171,940 | 3,454,350 |

# HPC
# Market Forecasts

# Why HPC Is Projected To Grow

1. **The low half of the market is finally back to a recovery mode**
2. **It has become a competitive weapon**
3. **Governments view HPC leadership as critical**
   - For national pride, but more importantly for economic prosperity
4. **There are very critical HPC issues that need to be solved**
   - Global warming, alternative energy, safe NE, financial disaster modeling, healthcare, homeland security, …
   - And 3D movies and large scale games are fun

# HPC Forecasts

- Forecasting a 7.7% yearly growth from 2015 to 2019
- 2019 should exceed $15 billion

| | 2015 | 2019 | CAGR (15-19) |
|---|---|---|---|
| Supercomputer | $3,284 | $4,829 | 10.1% |
| Divisional | $2,212 | $2,278 | 0.7% |
| Departmental | $3,994 | $5,747 | 9.5% |
| Workgroup | $1,874 | $2,616 | 8.7% |
| Total | $11,363 | $15,262 | 7.7% |

# The Broader HPC Market

| | 2015 | 2019 | CAGR (15-19) |
|---|---|---|---|
| Server | 11,363 | 15,262 | 7.7% |
| Storage | 4,729 | 6,762 | 9.4% |
| Middleware | 1,277 | 1,727 | 7.8% |
| Applications | 3,857 | 5,196 | 7.7% |
| Service | 1,895 | 2,456 | 6.7% |
| Total | 23,121 | 31,403 | 8.0% |

Source: IDC 2016

IDC Analyze the Future

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# Top Trends in HPC: HPC Storage

**Storage is the fastest-growing part of the HPC market**

**HPC storage revenue will grow to record levels**

**The HPC storage market remains fragmented**

**The big players are turning their attention to this market**

**The HPC interconnect market is in transition**

**Data movement/management is a major pain point**

- Multi-year shift away from today's extreme compute-centrism
- Many buyers still not savvy enough about purchasing storage

**HPDA will boost storage budgets**

# Conclusions

**HPC is still expected 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

**Vendor share positions shifted greatly in 2015**

**Recognition of HPC's strategic/economic value will drive the exascale race**

**The formative HPDA market will expand opportunities for vendors** (plus machine learning, cognitive and IoT)

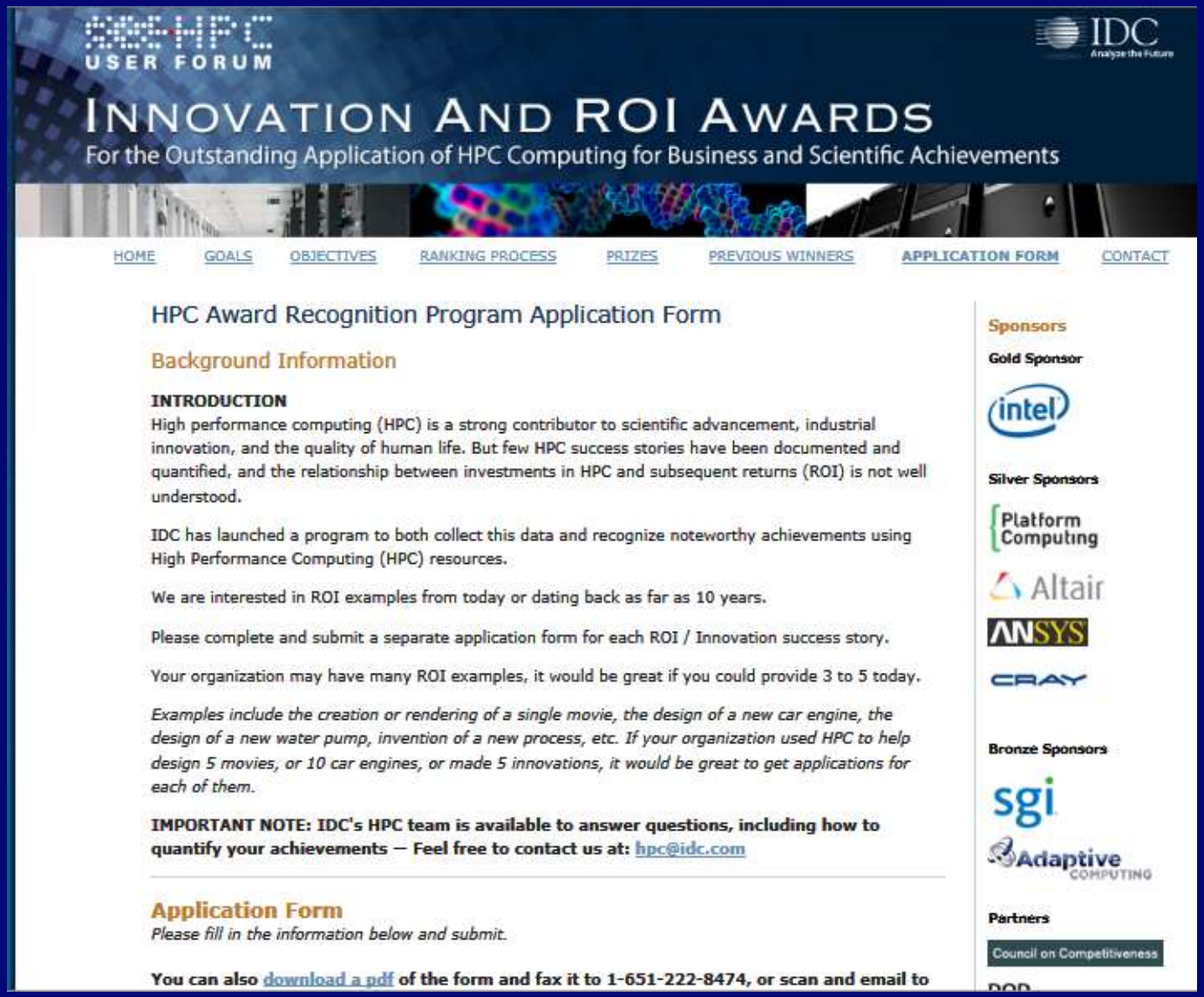
# The HPC Innovation Award

SSS-HPC USER FORUM

# The Trophy For Winners


USER FORUM

# HPC Award Program Submission Form: www.hpcuserforum.com/innovationaward



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IDC Analyze the Future

INNOVATION AND ROI AWARDS

For the Outstanding Application of HPC Computing for Business and Scientific Achievements

HOME | GOALS | OBJECTIVES | RANKING PROCESS | PRIZES | PREVIOUS WINNERS | APPLICATION FORM | CONTACT

## HPC Award Recognition Program Application Form

### Background Information

**INTRODUCTION**

High performance computing (HPC) is a strong contributor to scientific advancement, industrial innovation, and the quality of human life. But few HPC success stories have been documented and quantified, and the relationship between investments in HPC and subsequent returns (ROI) is not well understood.

IDC has launched a program to both collect this data and recognize noteworthy achievements using High Performance Computing (HPC) resources.

We are interested in ROI examples from today or dating back as far as 10 years.

Please complete and submit a separate application form for each ROI / Innovation success story.

Your organization may have many ROI examples, it would be great if you could provide 3 to 5 today.

*Examples include the creation or rendering of a single movie, the design of a new car engine, the design of a new water pump, invention of a new process, etc. If your organization used HPC to help design 5 movies, or 10 car engines, or made 5 innovations, it would be great to get applications for each of them.*

**IMPORTANT NOTE: IDC's HPC team is available to answer questions, including how to quantify your achievements – Feel free to contact us at: hpc@idc.com**

### Application Form

*Please fill in the information below and submit.*

**You can also download a pdf of the form and fax it to 1-651-222-8474, or scan and email to**

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# Previous Winners: HPC Innovation Excellence Award

华大基因 BGI
BMI Corporation
Lawrence Livermore National Laboratory
DOD HPC MODERNIZATION PROGRAM
EWI We Manufacture Innovation
Shanghai Supercomputer Center
NERSC
Ohio Supercomputer Center
BSC Barcelona Supercomputing Center Centro Nacional de Supercomputación
ILLINOIS
Cornell University Center for Advanced Computing
Continuous Casting Consortium
United Technologies Research Center
NCSA
CDAC
GE
MARY BIRD PERKINS CANCER CENTER
HydrOcean
Centrale Nantes
CYCLE COMPUTING
LSU LOUISIANA STATE UNIVERSITY
AON BENFIELD
CRL
Swift Engineering Inc
TATA
SVI ST VINCENT'S INSTITUTE MEDICAL RESEARCH
WARWICK
RAMGEN POWER SYSTEMS
nag
Bottero
KiSTi
PayPal
Intelligent Light
OAK RIDGE National Laboratory
P&G
PRINCETON UNIVERSITY
polestar
facebook
Alenia Aermacchi A Finmeccanica Company
renci
Spectraseis
OLCF OAK RIDGE LEADERSHIP COMPUTING FACILITY
Ford
Imperial College London
Queen Mary University of London
SCEC an NSF + USGS center
PPPL PRINCETON PLASMA PHYSICS LABORATORY
IDC Analyze the Future
SDSC SAN DIEGO SUPERCOMPUTER CENTER
RMHPC USER FORUM

# Past Winners: HPC Innovation Excellence Awards

Alenia Aermacchi (Italy)

ALYA RED (Spain)

Aon Benfield Securities, Inc. (Canada)

Argonne National Laboratory, NRG (Netherlands), SCK-CEN (Belgium), TerraPower, and the University of Illinois at Urbana-Champaign

Argonne National Laboratory, Caterpillar, Convergent Science (U.S.).

BGI Shenzhen (China)

Bottero S.p.A. (Italy)

Center for Development of Advanced Computing (India)

Center for Pediatric Genomic Medicine at Children's Mercy Hospitals Kansas City

Central Michigan University (U..S.)

CINECA (Italy)

Cornell University Center for Advanced Computing (U.S.)

Continuous Casting Consortium & NCSA (U.S.)

Culham Centre for Fusion Energy, EPCC at the University of Edinburgh, York Plasma Institute at the University of York, and Lund University (UK)

Cycle Computing (U.S.)

Department of Defense High Performance Computing Modernization Program (U.S.)

ESTECO and Airworks Engineering (Italy)

Facebook (U.S.)

Ford Werke GmbH (Germany)

- GE Global Research (U.S.)

GIS Federal (U.S.)

High Performance GeoComputing Laboratory at the University of California at San Diego (U.S.)

HydrOcean/Ecole Centrale Nantes (France)

Imperial College London and NAG (UK)

Intelligent Light (U.S.)

Mary Bird Perkins Cancer Center and Louisiana State University (U.S.)

NASA (U.S.)

National Institute of Supercomputing and Networking, Korea Institute of Science and Technology Information (Korea)

NexIO Simulation (France)

North Carolina State University (U.S.)

Oak Ridge Leadership Computing Facility, Oak Ridge National Laboratory (U.S.)

Ohio State University Cancer Comprehensive Care Center (U.S.)

PayPal (U.S.)

Pipistrel d.o.o. (Slovenia)

Polestar Racing (Sweden)

Princeton University/Princeton Plasma Physics Laboratory (U.S.)

Procter & Gamble Company (U.S.)

Queen Mary University of London and NAG (UK)

Ramgen Power Systems LLC (U.S.)

RENCI (U.S.)

Rolls-Royce, Procter and Gamble, National Center for Supercomputing Applications, Cray Inc., Livermore Software Technology Corporation (U.S.).

St. Vincent's Institute of Medical Research (AUSTRALIA.)

Southern California Earthquake Center (U.S.)

Spectraseis Inc (U.S.) and CADMOS, University of Lausanne (Switzerland)

Swift Engineering (U.S.)

Tata Consultancy Services (INDIA)

Tech-X Corporation (U.S.)

United Technologies Research Center/NERSC IPM (U.S.)

University College London and NAG HECTOR dCSE (UK)

University of Texas MD Anderson Cancer Center, Texas Advance Computing Center (TACC) and Elekta AB (U.S.)

University of Warwick and NAG HECTOR dCSE (UK)

University of Wisconsin-Madison (U.S.).

Westinghouse Electric Company LLC, ORNL (U.S.)

# Questions?

Please email:
hpc@idc.com

Or check out:
www.hpcuserforum.com

# Agenda: Day One Morning

8:15am Meeting Welcome: Paul Muzio, Rupak Biswas, Earl Joseph and Steve Conway

8:30am HPC Market Update and IDC's Top Growth Areas: Earl Joseph, Steve Conway and Bob Sorensen

**Session Chair: Arno Kolster, PayPal**

**8:45am Focus Area: Advanced Analytics/Machine Learning/Deep Learning**

- **Machine Learning, Prabhat (NERSC)**
- Computing and Networking for Big Data: Mosharaf Chowdhury (University of Michigan)
- Data Analytics for Multi-Scale Biology: Arvind Ramanathan (Oak Ridge National Laboratory)

10:15am Break

10:45am Challenges Deploying Advanced Analytics Using SPARK in a Shared Infrastructure: Nick Werstiuk (IBM)

11:15am ORIGAMI: Advanced Data and Workflow: Rangan Sukumar (ORNL)

11:45am Intel Technology Update: R&D Plans for HPC Going Forward

12:00pm Networking Lunch

# Lunch Thanks to:
# IBM

***Please Return Promptly at 1:00pm***

# Agenda: Day One Afternoon

**Session Chair: Paul Muzio, City University of New York**

**1:00pm Focus Area: HPC in the Cloud**

- **Jetstream: Adding Cloud-based Computing to the National** Cyberinfrastructure: Matt Vaughn (TACC)
- Use Cases and Best Practices for Cloud-based Enterprise HPC: David Pellerin (Amazon Web Services)
- Trends in HPC Cloud Computing: Tejas Karmarkar (Microsoft Azure)
- Managing Large Production Cloud Deployments: Jason Stowe (Cycle Computing)

3:00pm Update on HPC and AMD and FirePro: Greg Stoner (AMD)

3:15pm Break

3:45pm OpenHPC: Community Building Blocks for HPC Software, Karl Schulz, Intel

4:00pm Focus Area: HPC in the Cloud

- Status of the "Missing Middle": Clouds and Classes of Service: Leo Reiter (Nimbix)
- Performing simulation based, live decision making with Cloud HPC: Zack Smocha (Rescale)
- Risk Analytics in the Cloud: Jeffrey Smart (SunAmerica)

5:15pm Networking Break

6:30pm Special Dinner Event: Southwestern Food and Live Music; Astronomers and Telescopes

# Thank You To:

# Ryft

# For The Break

# Dinner Logistics

- Special Dinner Event:
  - 6:30pm -- Reception
  - 7:00pm -- Dinner
- Sponsored by Intel and HPE!

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

**Dinner**
**Thanks to:**
**Intel and HPE**

**Breakfast**
**Thanks to:**
**AMD**

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SGI HPC USER FORUM

# Agenda: Day Two Morning

8:10am Welcome: Paul Muzio, Rupak Biswas, Earl Joseph and Steve Conway

8:15am IDC Research Update on Cyber Security Issues: Bob Sorensen

Session Chair: Michael Resch, High Performance Computing Center Stuttgart

8:30am HPC in Europe

- Europe's Fastest Supercomputer and the World Around It: Michael Resch (HLRS)
- HPC at Imperial College London: Simon Burbidge
- HPC and SMEs: The Fortissimo Initiative: Bastien Koller (HLRS)

10:00am Break

10:30am DOE's HPC4mfg Initiative: Peg Folta (Lawrence Livermore National Lab)

11:00am Disruptive Technologies: Brief vendor overviews of new/emerging technologies that may have a disruptive impact on the HPC market

11:45am HPE Vendor Update: Bill Mannell

12:00pm Networking Lunch

# Thank You To:

# Bright Computing

# For The Nimbix

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# Disruptive Technologies Panel: Process

Panel members are asked to present in under 10 minutes a disruptive technology that could change the HPC industry.

Each presenter is asked to use 3 slides:

a) What is the disruptive technology
b) Why it is disruptive – What does it do for the end user?
c) What do you expect it will do in the market place?

Then three of the HPC User Forum steering Committee members will probe:

1) Is this really a disruptive technology?
2) 2) Who will likely be able to use it?
3) 3) What can be done to bring it to market sooner?

# Disruptive Technologies Panel: Presenters

- All and none of the above, Paul Muzio, CUNY
- 3D Xpoint technology, Ken Gibson, Intel
- Processing 1 EB per Day for the SKA Radio Telescope, Peter Braam, Cambridge University
- Accelerating Content Distribution and Enabling Collaboration, Chris Myhill, Data Direct Networks
- The D-Wave 2X Quantum Computer: 1,000 Qubits, Bo Ewald, D-Wave
- Challenging Data Analytics Architectures, Joseph George, Hewlett Packard
- ExaNest technology: Targeting Exascale in 2018, Peter Hopton, Iceotope
- Leveraging Containers in Elastic Environments, Nick Ihli, Adaptive Computing
- Breaking the Disk IO Bottleneck in CFD by Eliminating It, Steve Legensky, Intelligent Light
- NVLink Interconnect for GPUs, Stan Posey, Nvidia
- Heterogeneous On-Demand Storage for HPC Workflows in the Cloud, Leo Reiter, Nimbix
- Optimizing Cloud and HPC Technologies through a Disruptive Business Model for Advanced Simulation, Robert Walsh, Altair Engineering
- Optical Processing in HPC, Optalysys, Nicholas New

Needs updating

# Lunch Thanks to:
# SGI

***Please Return Promptly at 1:00pm***

# Agenda: Day Two Afternoon

| | |
|---|---|
| 1:00pm | Coupled Models for Water Resources Research, Ruth Cheng (ERDC) |
| 1:30pm | Fostering Innovation at AFRL: Lloyd Slonaker |
| 2:00pm | Simulating the Global Climate and Carbon Cycle: Joellen Russell (University of Arizona) |
| 2:30pm | The National Supercomputing Center for Energy and the Environment: Joseph Lombardo |
| 3:00pm | Break |
| 3:30pm | Graph Analysis Using GPUs, with Real-World Examples at the British Museum: Brad Bebee (Blazegraph) |
| 4:00pm | Keynote: Update on the NSCI Initiative: Saul Gonzalez Martirena (White House Office of Science and Technology Policy)<br>• Followed by a discussion of ideas to help make the NSCI initiative succeed (led by Bob Sorensen) |
| 5:00pm | Meeting Wrap-Up, Paul Muzio, Rupak Biswas, Earl Joseph and Steve Conway |

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# HPC User Forum
# Meeting

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# Questions?

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