Update

Major Global High-Performance Computing Initiatives: HPC User Forum, September 15–17, 2014, Seattle, Washington

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IN THIS UPDATE

This IDC update captures part of the proceedings at the 54th HPC User Forum held in Seattle, Washington. With the ever-increasing demand for more powerful HPCs and a growing list of new applications and use cases for these systems, a number of government HPC centers are currently in the planning and development stages of new systems that will carry them into the next three to five years. Presenters from a number of U.S. and European government organizations conducting HPC-based R&D discussed their upcoming major public sector HPC projects. The speakers included Marek Niezgódka, ICM/University of Warsaw, on Poland's next-generation HPC plans; Jay Srinivasan, NERSC, on the recently announced Cori HPC; Michael Resch, HLRS/University of Stuttgart, on upcoming German and European Union HPC efforts; and Manuel Vigil, Los Alamos National Laboratory (LANL), on the new Trinity HPC.

Government HPC centers are facing an increasingly complex set of requirements that include increased capabilities and payoff for existing scientific applications, inclusion of new requirements for big data and analytics, and exploration of architectures that use accelerators and coprocessors. IDC notes that in order to address these requirements, government HPC centers are looking to share costs and technical resources by exploring new partnerships that include intragovernment cooperation and expanding industrial partnerships.

HPC in Poland: 2014 Update — Marek Niezgódka, ICM/University of Warsaw

Poland has an emerging rather than an established economy, and it jumped into HPCs in the 1990s. HPC is mostly in the academic domain. Funding level has been about $200 million for research, $400 million for e-infrastructure for academia, and $1.5 billion to $2.0 billion for e-infrastructures for government and administration. The 2015-2022 program is focused on operations and R&D.

Poland's HPC infrastructure consists of capacity systems at:

- Cracow
- Poznań
- Gdańsk

October 2014, IDC #251971

- Wrocław
- Świerk (energy)

And a capability system at:

- Warsaw/ICM

The current aggregate capacity (partial) is:

- Cyfronet 0.5PF (2PF+ coming)
- ICM 0.5PF (2PF+ coming)
- PSNC: 150TF
- Various others in the 100–180TF range

There's an e-infrastructure road map for 2014–2024.

OSIRIS is ICM's road map to 2022, looking at a data-driven, open science, and distributed infrastructure.

Cori: The NERSC-8 System — Jay Srinivasan, NERSC

The demand for our two Cray systems, Edison and Hopper, exceeds capacity.

Today, we have separate compute-intensive and data-intensive systems (Carver).

We surveyed users about why they like to use our data-intensive systems. Their reasons included:

- Complex workflows need high-throughput computing
- Policy flexibility
- Local disk
- Very large memory
- Massive serial jobs
- Communication with databases
- Streaming data from observational/experimental sources

DOE has big data needs that require simulation that uses big computing, memory, and storage.

Heroic computing generates big data, as does large-volume computing (screening materials, proteins, etc.). Data improves the impact of science.

DOE Science and NNSA cooperated on the NERSC-8 and Trinity procurements. Trinity will be used at LANL and Sandia.

NERSC-8 (Cori) mission needs include supporting the growing research demands for HPC, and the system will offer at least 10x the sustained performance of the Hopper system:

- The system is targeted for delivery in 2015–2016. The schedule calls for a Cray XC 9300 with Knights Landing nodes in 2016 and a separate data partition with 2,000 Haswell nodes in 2015.
- The overall system will use a Cray Aries interconnect, Knights Landing chips, and Xeon Phis to achieve more than 3TF peak and 3x single-thread performance of the first-generation Phi.
- The system will be self-hosted, with more than 60 cores, each with 4 threads, 16GBps bandwidth for on-package memory, and 64–128GB of DRAM/node.

The contract calls for five FTE years of application and optimization support.

Intel will offer remote access to early Knights Landing system, training, and an Intel FTE onsite for one week per month for four years.

NERSC goals include usable ES and data-intensive computing. The Cori plus Cori phase 1 data partition will address both these issues.

Ready for Takeoff or Preparing for a Soft Landing: HPC at HLRS and in Germany — Michael Resch, HLRS/University of Stuttgart

TOP500 trends show fewer systems have less of the total performance share over the past 20 years.

There is not really an increased industry presence in the TOP500 today.

Germany may have some funding issues because the Constitution changed in 2006 to prohibit federal-state cofunding.

We have implemented a focused strategy: three national centers plus regional centers mean that HPCs are concentrated in fewer places. Universities in Germany don't have large facilities and don't spend a lot of money on HPC.

The Gauss Center for Supercomputing (GCS) operates tier 0 and tier 1 systems and coordinates with the Gauss Alliance. GCS includes three national centers, and the Gauss Alliance has 17 members.

Software activity is not as well funded as in the United States, with only 26 software projects being funded. DFG started a special ES program SPPEXA to develop software for exascale.

There are two Science Council working groups: one works on funding and one on simulation. The funding group has not issued its report yet.

The other factor is Europeanization:

- In the PRACE program, three of the six systems are in Germany.

- PRACE is very successful, and future plans for GCS funding are continuing for 2016 onward period, where there will be an additional focus on industrial use and more.
- GA funding was approved for €25 million per year for the next five years (2014–2018).
- Open issues include combining GCS and GA, coordinating activities for the funding of software development, and what to expect from the European strategy level.

At HLRS:

- HLRS is seeking closer links with industry and society.
- In 2014, HLRS is installing Cray XC30 Hornet at 3.7PF peak performance, 600TF sustained, and a 493TB memory.
- For 2015, HLRS is looking at Hazel Hen with a 7.42PF peak performance, 1PF sustained performance, and 965TB memory.
- HLRS industrial cooperation in 2013 included 92 million core hours, and HLRS will build a training center for €6 million.
- HLRS is also working on diversified cloud services with partners including T-Systems and the European Commission.
- NEC vector system will be installed at the end of 2014.

Trinity: Advanced Technology System for the ASC Program — Manuel Vigil, Los Alamos National Laboratory

It's become harder and harder to acquire large systems, especially because we've been partnering with more parts of the government. NERSC-8 and Trinity teams will continue to collaborate on the system deployments (e.g., burst buffers and Haswell activities).

Trinity contract was awarded to Cray on July 9, 2014. Target delivery date is September 2015.

ASC computing strategy is to get to two classes of systems (advanced technology and commodity technology) from the prior three.

Advanced technology is the first-of-its-kind leadership-class system to meet unique mission needs and to develop parallel programs for future system designs. Some NRE funding is allowed.

Trinity will be deployed by ACES (New Mexico Alliance for Computing at Extreme Scale = LANL and Sandia). We're also concerned about the applications code transitions to both the advanced and commodity technology systems.

Trinity will support LLNL, SNL, and LANL. There was no FLOPS requirement per se, just the ability to run certain apps 10x faster than the prior system. The system will have over 2PB of aggregate main memory. Trinity is sized to run several jobs using about 750TB of memory. It will be a classified system. Contract includes a center of excellence for application transition support with not only Cray but also Intel participation. Trinity contains Knights Landing and Haswell processors (16 cores), and

Aries interconnect with the Dragonfly network topology. This system marks the transition from multicore to many core.

Trinity is based on the mature Cray XC30 architecture with new features:

- KNL processors
- Burst buffer storage nodes
- Advanced power management system software enhancements

Our three key applications represent millions of lines of code, and it will take some time to transition them. We'll work first on the nuclear weapons stockpile simulation code.

Trinity's power consumption came in at about 9MW, which was better than we expected.

We went with KNL over GPUs because of the timing of availability plus prework done on our codes.

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Related Research

Additional research from IDC in the technical computing hardware program includes the following documents:

- *Worldwide Broader HPC 2014-2018 Forecast: Servers, Storage, Software, Middleware, and Services* (IDC #248835, June 2014)
- *When Massive Data Never Becomes Big Data* (IDC #lcUS24922014, June 2014)
- *Worldwide Technical Computing Server 2014-2018 Forecast* (IDC #248779, May 2014)
- *Perspectives on High-Performance Data Analysis: The Life Sciences* (IDC #248348, May 2014)
- *Global HPC Market Dynamics in 2013* (IDC #248137, April 2014)
- *Industrial Partnership Programs and High-Performance Computing: HPC User Forum, April 7-9, 2014, Santa Fe, New Mexico* (IDC #248113, April 2014)
- *Disruptive Technologies in High-Performance Computing: HPC User Forum, April 7-9, 2014, Santa Fe, New Mexico* (IDC #248112, April 2014)
- *Advances in Processors, Coprocessors, and Accelerators in High-Performance Computing: HPC User Forum, April 7-9, 2014, Santa Fe, New Mexico* (IDC #248111, April 2014)
- *International Perspectives on Industrial High-Performance Computing Partnerships: HPC User Forum, April 7-9, 2014, Santa Fe, New Mexico* (IDC #248122, April 2014)
- *Worldwide HPC Public Cloud Computing 2014-2017 Forecast* (IDC #247846, April 2014)

- *Summary of IDC's 2014 Research in the Use of HPC by Oil and Gas Organizations* (IDC #247704, March 2014)
- *IBM Sale to Lenovo Opens Opportunity for Other HPC Vendors* (IDC #lcUS24694314, February 2014)
- *IDC's Worldwide High-Performance Computing Predictions 2014* (IDC #WC20140211, February 2014)
- *Seagate Looking for the X Factor in Its Acquisition of Xyratex* (IDC #lcUS24555413, December 2013)
- *Micron Demonstrates Technologies to Address Emerging Challenges in Big Data Applications* (IDC #244843, December 2013)
- *Market Analysis Perspective: Worldwide HPC, 2013 – Directions, Trends, and Customer Requirements* (IDC #244742, December 2013)
- *HPDA Pulse: 2013 Software and Consulting Market Analysis* (IDC #244513, November 2013)
- *HPDA Pulse Results: 2013 Hardware and Storage Market Analysis* (IDC #244493, November 2013)
- *HP FY13: Revenue Declines Abate on Stronger Core Business* (IDC #lcUS24466413, November 2013)
- *Catalyst Supercomputer Heralds Shift to More Balanced Architectures* (IDC #lcUS24437513, November 2013)
- *China Eyes 10,000-Fold Data Reduction for Internet of Things* (IDC #lcUS24392513, October 2013)
- *HPC User Forum, October 2013, Seoul, Korea* (IDC #243786, October 2013)
- *Tools and Techniques for Technical Computing in Life Sciences: HPC User Forum, September 2013, Boston, Massachusetts* (IDC #243778, October 2013)
- *Perspectives on Quantum Computing: HPC User Forum, September 2013, Boston, Massachusetts* (IDC #243777, October 2013)
- *National and International Initiatives: HPC User Forum, September 2013, Boston, Massachusetts* (IDC #243776, October 2013)
- *Issues in High-Performance Computing: HPC User Forum, September 2013, Boston, Massachusetts* (IDC #243775, October 2013)
- *High-Performance Data Analysis in the Life Sciences: HPC User Forum, September 2013, Boston, Massachusetts* (IDC #243774, October 2013)
- *Chinese Research in Processor Designs for High-Performance Computing and Other Uses* (IDC #243502, October 2013)
- *World's Fastest Supercomputer Set to Reach Customer in October 2013* (IDC #lcUS24300913, September 2013)
- *The Broader HPC Market 2012-2017 Forecast: Servers, Storage, Software, Middleware, and Services* (IDC #242742, August 2013)
- *IDC's Worldwide Technical Server Taxonomy, 2013* (IDC #242725, August 2013)

- *China Regains Top Supercomputer Title* (IDC #IcUS24190613, June 2013)
- *10 Things CIOs Should Know About High-Performance Computing* (IDC #241565, June 2013)
- *Worldwide High-Performance Data Analysis 2013–2017 Forecast* (IDC #241315, June 2013)
- *Top Issues for HPC Sites: HPC User Forum, April 29–May 1, 2013, Tucson, Arizona* (IDC #241463, June 2013)

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