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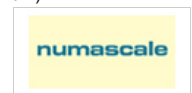
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At the OpenStack Summit in Paris, France, CERN's Infrastructure Services Manager Tim Bell gave the general session audience an overview of his institution's experiences moving to OpenStack, which he characterizes as a "cultural and technology transformation."

CERN, the European Organization for Nuclear Research, supports 11,000 physicists from around the world. These scientists use

the facilities to conduct basic research in their quest to understand what the universe is made of and how it works.

CERN was behind the famed Higgs boson confirmation in 2012, but the Higgs wasn't the only fundamental question sought by CERN scientists. Physicists remain puzzled about the nature of matter and antimatter. "When we count the planets and the stars, for example, we see that we've only got 5 percent," says Bell. There is something out there – theorized as dark matter or dark energy – which must be present to explain why the cosmos behaves as it does, he adds.

Another fundamental question concerns gravity. Scientists can describe three of the four forces very well with the standard model, which the Higgs helped confirm, but gravity is a real problem. Physicists theorize that there are particles called gravitons that move in and out of other dimensions.

"As we move the LHC further on, we hope to discover some of these particles and understand the universe further," says Bell.

Solving problems of this magnitude requires a large dedicated community and well-constructed experiments. Conceived in the 1980s, the LHC consists of a 27-kilometer ring 100 meters underground on the Franco-Swiss border. It was designed to collide beams of particles just below the speed of light.

Detectors observe and record the results of these collisions, taking 40 million pictures a second.

"That creates, amongst other things, some great pictures," says Bell, "It also creates one petabyte per second of data."

To handle this massive data stream, CERN has relied on very large computer farms, also 100 meters underground, that filter the data to levels they can record for further analysis. Still, the experiments around the ring generate up to 27PB of data each year, which is expected to be saved for 20 years. By 2014, CERN had amassed a 100PB archive, primarily stored on tape. In April 2015, the accelerator will come back online after an upgrade to double the energy of the beams. This will result in even higher data rates.

But CERN is looking further ahead. By 2023, they anticipate an annual data load of 400PB, requiring a 50-fold increase in compute power.

CERN needed an environment that would scale to handle these massive needs. Their main Geneva datacenter was equipped with one mainframe and one Cray. Using standard industry servers, they cannot fill up the empty racks that line the datacenter without going over the 6kw per square meter – the max that this environment can cool.

To expand capability, CERN established an additional datacenter in Budapest, which is now online, linked to Geneva by dual 100GbE connections. Unfortunately the current economic and political reality is such that: staff numbers are fixed; the materials budget is decreasing; and legacy tools are high maintenance and brittle. Despite the limitations, users expect fast self-service.

CERN's biggest challenge then was to bolster IT services without increasing support staff. This prompted CERN to investigate new infrastructure tools and processes. They deduced that from a computing point of view, there is no reason to be special. Regarding the staffing situation, there is no Moore's law for people; therefor automation needs APIs, not documented procedures. Culturally, they looked to open source communities and models for inspiration.

After much discussion, research and prototyping, CERN selected OpenStack to bring a flexible and agile cloud to their users.

They started with what was essentially a research project in 2011 with Cactus. Immediately, says Bell, it was clear that the rate of maturity of the software was going to exceed the rate that CERN would be reaching production on its own. After a period of training and testing, they went into production with the Grizzly release in July 2013.

Currently, CERN operates four OpenStack Icehouse clouds. The largest is currently around 75,000 cores on more than 3,000 servers. There are three other instances with 45,000 cores total located at CERN's underground compute facility to deliver additional simulation capacity. They have another 2,000 additional servers on order, and will be passing 150,000 cores in total by the first quarter of 2015. All the code that is of any interest to the community has been submitted upstream, and all CERN-specific code is publicly-available on github.

November 24, 2014

Terascala TeraOS Software Powering HPC Storage Systems at CAC  
(<http://www.hpcwire.com/off-the-wire/terascala-teraos-software-powering-hpc-storage-systems-cac/>)  
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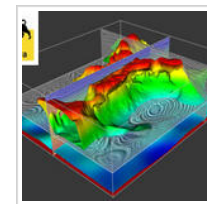
**Open Cloud Test Bed  
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(<http://www.hpcwire.com/2014/02/26/open-cloud-testbed-bolsters-big-data-innovation/>)



**How the iForge Cluster is  
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(<http://www.hpcwire.com/2014/02/26/forge-cluster-manufacturing-results-big-industry/>)



**Eni Joins Oil and Gas  
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(<http://www.hpcwire.com/2013/11/20/eni-joins-oil-gas-petaflop-club/>)



**IBM Applies Elastic  
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Challenge**

(<http://www.hpcwire.com/2014/08/25/ibm-applies-elastic-storage-big-data-challenge/>)

## HPC Tweets

Top HPC tweets (<https://twitter.com/hpcwire/lists/top-hpc-tweets>)

## Feature Articles

**Intel Etches Future Process  
for HPC Progress**  
(<http://www.hpcwire.com/2014/11/24/intel-etches-future-process-hpc-progress/>)

"This market, this industry, is poised for a fairly fundamental transformation," Raj Hazra, Vice President and General Manager of Intel's High Read more...  
(<http://www.hpcwire.com/2014/11/24/intel-etches-future-process-hpc-progress/>)

**Supercomputing Wrap: Top  
Stories from SC14**  
(<http://www.hpcwire.com/2014/11/22/supercomputing-wrap-top-stories-sc14/>)

As we noted in a few different pieces throughout the week, there has been Read more...  
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**OpenStack's New Cells** feature will enable CERN to scale to meet its needs in the near-term and in the future. The Cells approach lets them build up small units of OpenStack that can be assembled together to appear as a single homogeneous resource. It simplifies the end user experience while still scaling out the underlying environment, says Bell.



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CERN was also able to address the problem of working across multiple clouds. With help from Rackspace, CERN developed federated identity capability on OpenStack, and the code for this is now in production release.



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"So remember," Bell tells the audience, "whenever you're helping out OpenStack, you're helping us understand how the universe works and what it's made of."



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Earlier at the OpenStack Summit, CERN was announced as the first winner of the OpenStack Superuser Awards in recognition of their accomplishments and community involvement.



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**Eurotech Hive Takes The Sting Out Of Density**  
(http://www.hpcwire.com/2014/hive-takes-sting-density/)  
Back at the International Supercomputing Conference in June, supercomputer maker Eurotech Read more...

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## Short Takes

**Weekly Twitter Roundup**  
(http://www.hpcwire.com/2014/twitter-roundup-21/)  
Here at HPCwire, we want to help keep the HPC community as up-to-date as possible on some of the most captivating news items that were Read more...  
(http://www.hpcwire.com/2014/twitter-roundup-21/)

**Big Data Compels HPC Adoption in Life Sciences**  
(http://www.hpcwire.com/2014/data-compels-hpc-adoption-life-sciences/)  
Expect a lot of the talk at SC14 this year to revolve around big data. Ari E. Berman, Ph.D., Director of Government Services and Principal Read more...  
(http://www.hpcwire.com/2014/11/04/data-compels-hpc-adoption-life-sciences/)

16  
Berman, Ph.D., Director of Government Services and Principal Read more...

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(http://www.hpcwire.com/2014/11/04/data-compels-hpc-adoption-life-sciences/)


**UK Project Tackles Bike Helmet Safety**  
(http://www.hpcwire.com/2014/11/04/uk-project-tackles-bike-helmet-safety/)  
There are certain HPC projects that stand out for their ability to help humankind in practical ways. One recent example of such a project Read more...  
(http://www.hpcwire.com/2014/11/04/uk-project-tackles-bike-helmet-safety/)

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**SpotlightON: Working Toward Workflow as a Service**  
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**11/6/14 | Nimbis Services |**  
For manufacturers, HPC cloud is primed and ready to bring to the small-to medium-sized enterprises the very tools that keep industry giants on Read more...  
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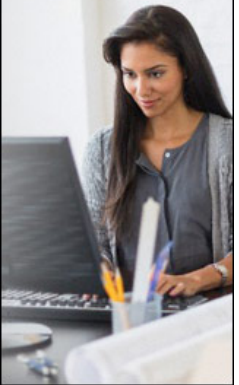
**PBS Works Suite Deployed**



**Data Management**

What you need to know - and how to use it to get ahead.

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Hardware Engineer - Mechanical Packaging - Cray  
(http://jobs.hpcwire.com/jobdetails.jid=2012)

Subsurface Support Manager- Applications Infrastructure - BHP Billiton Petroleum  
(http://jobs.hpcwire.com/jobdetails.jid=1970)

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**CHPC National Meeting 2014**  
(http://www.hpcwire.com/event/c-national-meeting-2014/)


**CHPC**  
COMPUTING

**December 1 - December 5**  
Mpumalanga  
South Africa



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3 Data Center Cooling and Power Myths Busted  
(http://www.coolitsystems.com/index.php/press/industry-news-and-research/51-industry-news/192-data-center-cooling-power-myths.html)  
Although power and cooling makes up a large part of data center costs, both are often subjects that are surrounded by many myths. Here we try to dispel a few of those misconceptions.

Bull and NVIDIA help you accelerate your applications on GPUs  
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Develop High-Performance Distributed Windows Applications  
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Introducing the Cray™ CS400™ Cluster Supercomputer – 2x performance!  
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NumaQ In-Memory Analytics Appliance  
(http://tci.taborcommunications.com/I/21812/2014-11-05/69it1)

The MapR in-Hadoop NoSQL Database is Now Available  
(http://tci.taborcommunications.com/I/21812/2014-11-05/69hbp)

Asetek to Feature Market Momentum At SC14 in New Orleans  
(http://tci.taborcommunications.com/I/21812/2014-11-04/69hbp)

Say good-bye to multiple security environments and hello to the SDA  
(http://tci.taborcommunications.com/I/21812/2014-11-05/69p93)

DataSite and Redline are teaming up to provide flexible, turn-key solutions for HPC  
(http://tci.taborcommunications.com/I/21809-09/62v43)

for Comprehensive Workload Management at The University of Nottingham  
(http://www.hpcwire.com/whitepapers/works-suite-deployed-comprehensive-workload-management-university-nottingham/)  
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ATCx Cloud UK  
(http://www.hpcwire.com/event/atc-cloud-uk/)

December 9  
Gaydon  
United Kingdom

RE.WORK Deep Learning Summit  
(http://www.hpcwire.com/event/r-work-deep-learning-summit/)

January 29, 2015 -  
January 30, 2015  
San Francisco CA  
United States

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Extending the Data Center to the Cloud  
(http://www.hpcwire.com/multimedia/webinar/extending-data-center-cloud/)

Join NetApp and Sungard Availability Services (Sungard AS) to learn how your enterprise can start building a solid foundation for hybrid cloud. Read more...  
(http://www.hpcwire.com/multimedia/webinar-extending-data-center-cloud/)

Leveraging Flash Storage to Accelerate Oracle Real Application Clusters  
(http://www.hpcwire.com/multimedia/leveraging-flash-storage-accelerate-oracle-real-application-clusters/)

Many IT organizations are looking to SSD technology to solve performance issues and improve efficiency for their business-critical applications. Read more...  
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