Big in 2013 - find out what the experts say

Top figures from industry and academia tell iSGTW what they think 2013 has in store. Experts from CERN, The Open Science Grid, European Grid Infrastructure, The Top 500 List, and the Citizen Cyberscience Center share their predictions for the year ahead. Plus: What are you most excited about in the world of scientific computing in 2013? Why not tell us in our comments section?

Danish physicist and Nobel laureate Niels Bohr once said: "Prediction is very difficult, especially if it's about the future." So,

What does 2013 hold in store? (Image courtesy HoboElvis, Flickr)

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European editor

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when it came
to highlighting the most exciting developments that 2013 is likely to have in store for scientific computing, we decided to heed this warning and get leading figures in the field to do our prediction for us...

Greener on the other side?

The University of Tennessee's Jack Dongarra, who has been involved in the publication of the Top500 list of supercomputing sites since its launch in 1993, warns that "major challenges are ahead for extreme computing". He says that, in terms of power efficiency, supercomputers really need to reach around 50 gigaflops per watt, compared to just the two gigaflops per watt which is common today. 50 gigaflops per watt is the level of power efficiency which needs to be reached if the US Department of Energy's goal of reaching an exaflop machine at under 20MW by 2022 is to to be achieved.

Jeff Hollingsworth, general chair of this year's SC12 conference, also sees power efficiency as a major issue for high-performance computing: "In 2013, we will start to see serious developments in the areas of rethinking power and energy utilization for HPC. In particular, we will see new software models to help programmers better deal with dark silicon, true costs of data motion, and software-based resiliency." Also, with large GPU-enhanced machines, such as Blue Waters and Titan now up

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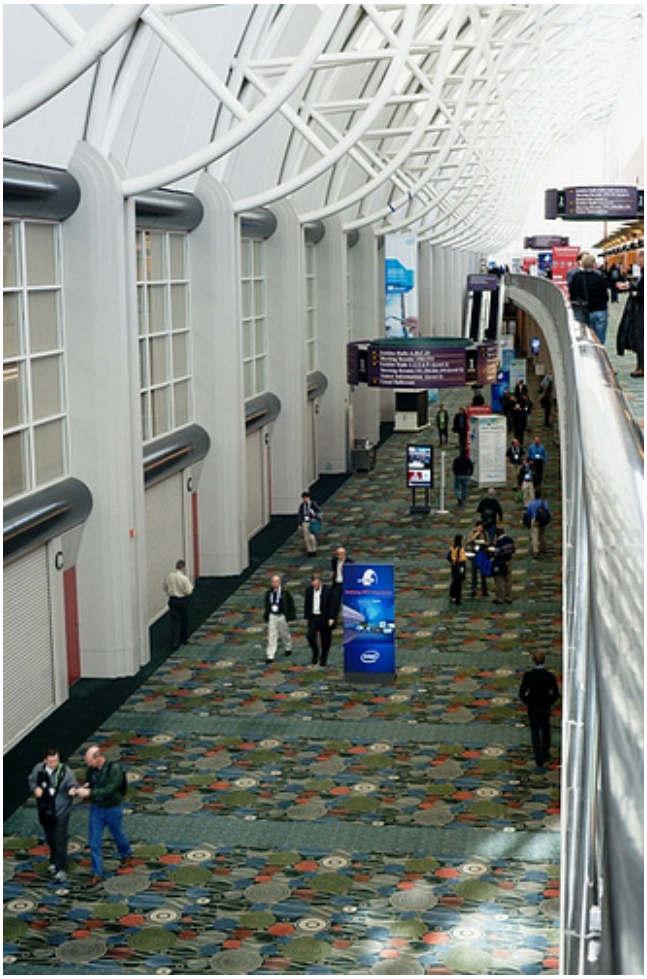
and running, 2013 could be a "critical year" for this technology too, he argues.



Jeff Hollingsworth was the general chair of this year's SC12
conference, which was held in Salt Lake City, Utah, US.
Find more of our coverage from the event here.

Bill Gropp of the University of Illinois is a co-principal investigator on the Blue Water's project. He says he is looking forward to petascale supercomputing with Blue Waters moving into full operations early next year. "After years of work to design and deploy the system (as well as a first-rate data center to house it and our other infrastructure) and to prepare science and engineering codes to take full advantage of the hundreds of thousands of

processors in the system, it will be exciting to see it enter production and enable breakthrough research."

Sticking to standards or sticking it to standards?

Gropp also says that 2013 will be a make-or-break year for OpenACC, a programming standard for parallel computing designed to simplify parallel programming of mixed CPU/GPU systems. "Will it succeed and become an important part of the HPC programming toolbox or will it become yet another failed try at providing a stable programming model for accelerators?" he asks.

And, on the subject of standards, Gropp says that he is excited about the new Message Passing Interface standard, MPI-3, released in September this year. "Implementations of MPI-3 with good performance should appear in 2013 and will become important for high-performance applications."

Meanwhile, Wolfgang Gentzsch, general chair of this year's ISC Cloud '12 event, says that he doesn't expect any revolutionary developments over the next couple of years. "We have seen some strongly increasing trends in the last couple of years, which I think all had their origin in distributed computing, moving up to parallel computing, grids, and clouds, and big data, to the great diversity of tools and platforms we face today," says Gentzsch. "At the same time, parallel computing has stretched itself

out into the chips on one end and petascale systems on the other. Grids have also become mainstream collaboration platforms and clouds are becoming mainstream, ubiquitous computing resources for the masses and the growing volumes of data has since several years been a challenge for large scientific facilities. These trends will continue over the next couple of years, moving closer to a level similar to other utilities we are used to," Gentzsch concludes.

Wolfgang Gentzsch was the general chair of this year's ISC
Cloud '12 conference, which was held in Mannheim, Germany.
Find our round-up of this event here.

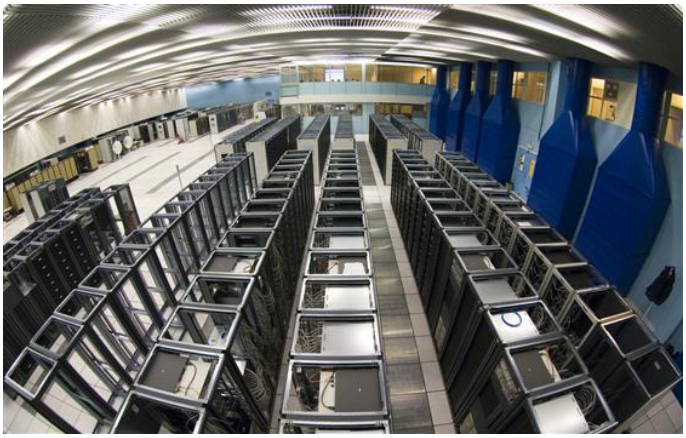
Cloud forecast

Bob Jones, the head of CERN openlab, says that the continued growth of public cloud services which Gentzsch alludes to is also likely to have an important effect on the scientific community in 2013. "There is a pricing war in the public cloud market coupled with an expansion of the scale and range of cloud services being proposed," says

Jones. "This will surely have an impact on the uptake by the research communities and public sector in general. In particular, the growth in big data services will help drive this expansion." Additionally, Jones stresses the importance of the relevant legal and policy frameworks staying on top of these developments, an issue which was likewise highlighted by Paolo Balboni at this year's ISC Cloud '12 conference.

Particle physics

Also at CERN, Frédéric Hemmer, head of the organization's IT department, shared his thoughts on the coming year. Despite the Large Hadron Collider being shut down for upgrade work from early 2013 onward, Hemmer says there will still be plenty of exciting work going on. "We expect the experiments to reprocess the 2010-2012 data, including analysis of the data taken in 2012 but 'parked', so the computing will just continue as it did the last three years, presumably at a level of 200000-250000 CPU cores in use at any point in time."



The CERN data center houses servers and data storage

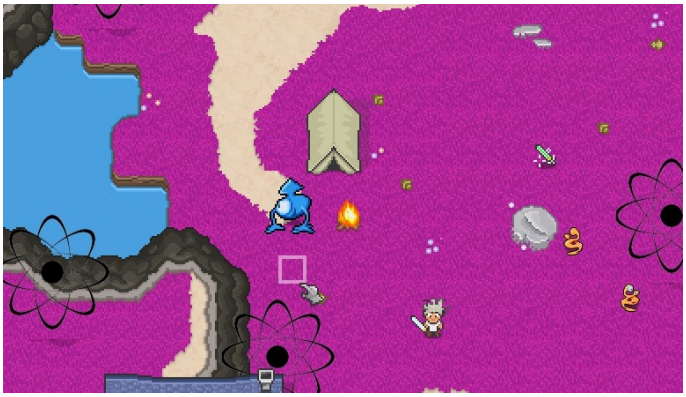
systems
not only for Tier 0 of the WLCG and for other physics analysis,
but also for systems that are critical to the daily functioning
of the laboratory. Image courtesy CERN. © 2008 CERN.

2012 also saw CERN sign an agreement with the Wigner Research Centre for Physics in Budapest, Hungary, to operate as an extension of the CERN data center in Meyrin, near Geneva, Switzerland. Under this agreement, the Wigner Research Centre will host CERN equipment and will substantially improve the capabilities of the Worldwide LHC Computing Grid Tier-0. "2013 is going to be key for our second data center in Budapest, from commissioning the first international 100-gigabit-per-second links between CERN and Wigner, shipping the first servers, and hopefully making it all run using our new agile infrastructure heavily based on virtualization," says Hemmer. The CERN Tier-0 site in Meyrin currently provides some 30 petabytes of data storage on disk, 100 petabytes on tape, and includes the majority of the 65,000 processing cores in the CERN data center. Under the new agreement, the Wigner Research Centre will extend this capacity by an extra 20,000 cores and 5.5 petabytes of disk data - this will double over three years.

An open, sustainable future?

Francois Grey, coordinator of the Citizen Cyberscience Centre, is also a user at CERN. He says that citizen science is fast becoming a part of

mainstream, professional science and that "2013 may well be the tipping point where funding agencies start to take this trend very seriously." He emphasizes the role that foundations and government agencies can play in this shift. "There's even an idea being floated that all Horizon 2020 research projects should have a citizen science element in them," says Grey. "This will have a big impact in turn on how seriously scientists take this trend."



Earlier this year, the Citizen Cyberscience Centre organized the
first CERN webfest, which spawned the ParticleQuest game.
You can read about this in full here.

Steven Newhouse, director of European Grid Infrastructure (EGI) is also thinking about Horizon 2020. "In 2013, we will be focusing on our sustainable future. What are the costs that the community will have to support in order to ensure the services that they need will be provided? What activities will the European Commission be willing to invest in to develop new innovation and offer new capability for the new research infrastructures that will be established during the Horizon 2020

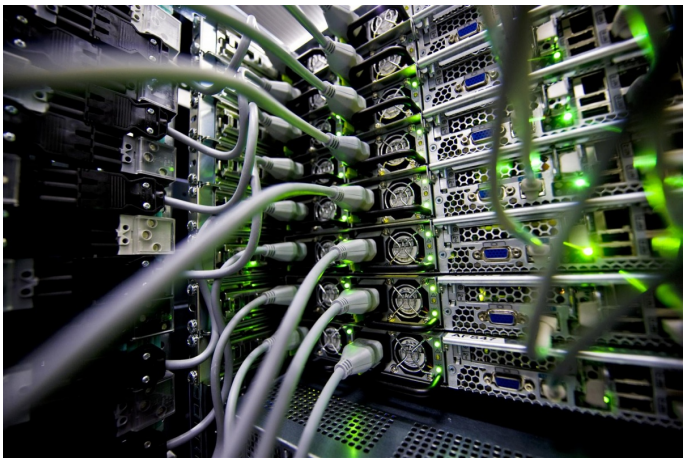
programme?", asks Newhouse. "We may not be able to have answers to all of these questions in 2013, but that is when the investment needs to be made in our sustainable future."

As far as EGI is concerned, Newhouse has this to say about the organization's plans for 2013: "We will start seeing the results of the strategy defined in spring 2012 coming into place. Our focus on community and coordination (through the recently launched EGI Champions scheme), the operational infrastructure (with the new capabilities offered by EGI's federated cloud) and the virtual research environments (supporting new user communities) will start to show results."

Returning to the theme of open science, Ruth Pordes, chair of the governing council of The Open Science Grid, also has some exciting predictions for 2013, particularly in an academic context. She says that, thanks to high throughput distributed computing growing on university campuses, Open Online Courses (OOCs) will widely grow, gaining greater reach and thus becoming Massive Open Online Courses, or 'MOOCS'. In addition to this, she believes that the normalization of distributed computing will lead to high school students increasingly thinking about computing for applications such as DNA sequencing, biofuels and climate change.

Size matters

Also, on what has certainly been one of the major



Big, bigger, biggest data. Watch this Symmetry magazine video explaining how CERN deals with the data produced by the LHC.
Image courtesy CERN. © 2008 CERN.

buzz-phrases of the last couple of years 'big data', Pordes gives this prediction for 2013: "High-throughput distributed data will similarly grow in scale from distributed sensors and robots" and "the conglomerate of data will approach 'big data'," says Pordes. This will not only be large in size, but also highly complex to store, correlate and difficult to extract meaningful information and knowledge from, she warns.

Addison Snell of Intersect360 Research has this to say on the subject of big data: "With big data, vendors of HPC technologies will find a much broader application space that they can sell into. And Hadoop is only a small part of what big data is becoming," says Snell. "As buyers from outside of HPC segments find they need new technologies in order to cope with the creation and accessibility of data related to their organizational competitiveness, areas such as higher-performing

networks or parallel file systems could see adoption in new markets."

The processor wars

Finally, in 2013, Snell predicts we'll see the culmination of what he terms "the processor wars". "With Intel's launch of its Xeon Phi coprocessor, the battle of accelerated computing architectures is now fully engaged," he says. "The primary contenders are Intel, which is pushing an x86 environment with standard Intel tools, and NVIDIA, which is claiming a higher-performance future based on GPU computing. Right now Intel has the installed base, but NVIDIA has the momentum, as CUDA [a parallel computing platform and programming model created by NVIDIA] is the fastest growing developer tool. Ultimately much of the battle will be determined by the evolution of software and programming models for accelerators and multi-core," Snell concludes.

Here at iSGTW*, we'd love to hear your predictions for the world of scientific computing in 2013. Why not share them with us in the comments section, below?*

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