Worldwide computing grid set to handle data from CERN's Large Hadron Collider

The Large Hadron Collider (LHC), the world's most powerful particle accelerator, is expected to produce roughly 15 million gigabytes of data annually once it is up and running at the end of this year. The 'worldwide LHC computing grid' (WLCG), which has the crucial role of sup...

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The LHC, based at the European Organization for Nuclear Research (CERN) in Switzerland, is a 27-km-long ring of superconducting magnets with accelerating structures along the way that can boost the energy of the particles en route; within the accelerator, two beams of particles travel at close to the speed of light with very high energies before colliding with one another. The purpose of the collider is to enable observations of fundamental particles that will help scientists answer important, unresolved questions in particle physics.

The LHC welcomes six major international experiments, including the large-scale project ATLAS ('A toroidal LHC Apparatus'). The ATLAS detector will be used to investigate a number of outstanding questions in physics, such as the existence of the Higgs boson (believed to be a particle that explains the mechanism by which particles acquire mass), and extra dimensions and particles that could make up dark matter. The researchers who will be directing the experiments and analysing the vast amounts of information generated by the detector will rely on grid computing, which

draws on the resources of thousands of different computers, for reliable access to the data.

The WLCG connects more than 140 computing centres in 34 countries in order to build and maintain the data storage and analysis infrastructure for the high-energy physicists who will use the LHC. Data collection and storage, processing, simulation and visualisation tools will be supported through the WLCG. The ATLAS experiment alone will run close to 1 million analysis jobs, sustaining 6 gigabytes per second of grid traffic over long periods. The grid's exceptional capacity is particularly important as the WLCG is expected to be used by several thousand users at any given time.

The LHC experimental data is recorded on tape at CERN before being distributed to 11 large computer centres (called 'Tier 1 centres') in Canada, France, Germany, Italy, the Netherlands, Scandinavia, Spain, Taiwan, the UK and the US. From these sites, the data is made available to more than 120 'Tier-2 centres', where specific analyses can be carried out. Individual researchers can then access the information by using local computer clusters or even their own personal computers.

'Four LHC experiments [...] have demonstrated their ability to manage their nominal data rates concurrently,' said Sergio Bertolucci, director of research and computing at CERN. 'For the first time, all aspects of the experiments' computing were exercised simultaneously: simulation, data processing and analysis. This gives them the confidence that they will be able to efficiently analyse the first data from the LHC later this year.'

Gonzalo Merino, manager of the Tier1 centre in Barcelona, said: 'It has been a very valuable exercise since many of the experiment workflows have been tested simultaneously at unprecedented scale, well above the nominal values for LHC data taking. The Tier-1 at PIC has provided a very stable and reliable service at record breaking levels: exchanging up to 80 terabytes per day with other WLCG sites and processing data at more than 2 gigabytes per second. This gives us confidence that the Spanish WLCG sites are ready for data taking.'

David Foster, head of the LHC Optical Private Network activity, added: 'New capabilities emerging in the 40 Gbps and 100 Gbps range should enable us to keep up with the anticipated data distribution needs of the LHC experiments.'

'This is another significant step towards demonstrating that shared infrastructures can be used by multiple high-throughput science communities simultaneously,' concluded Ruth Pordes, executive director of the Open Science Grid consortium.

The WLCG experimental run also included large-scale testing of end-user analysis scenarios. In addition, community-support infrastructures were examined to make

sure they were capable of adequately training the research community to be self-supporting.

Countries

Switzerland

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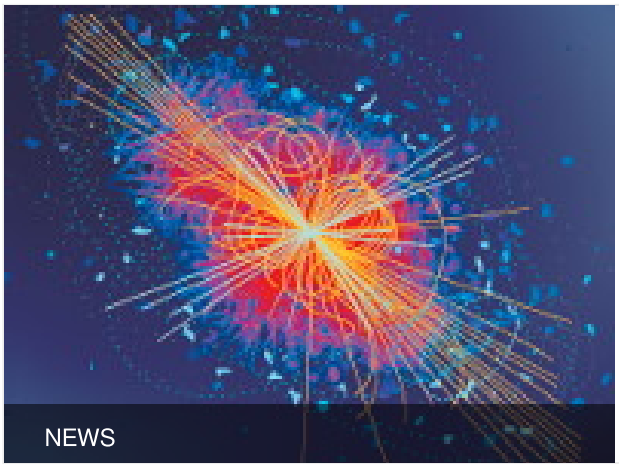

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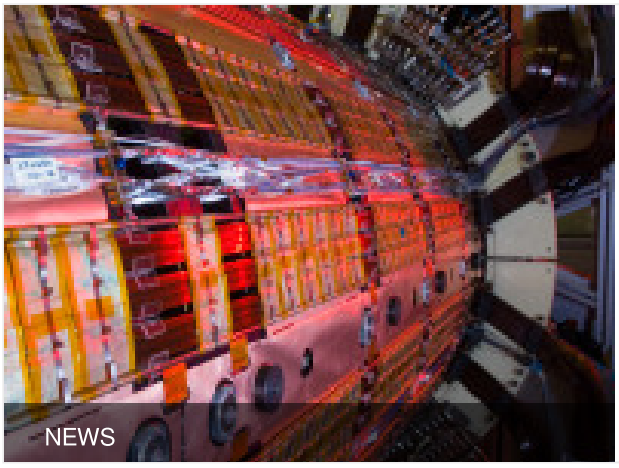

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