

On the Higgs boson's track

Grid computing and EMI empower a step forward in fundamental knowledge

4 July 2012: The Large Hadron Collider (LHC) experiments presented results on the search for the Higgs boson – the particle that theorists including Peter Higgs proposed in 1964.

To investigate the fundamental constituents of matter and recreate the conditions of density and energy of the early universe, physicists need cutting-edge tools: particle accelerators, detectors and a powerful computing system. “It was a global effort and it is a global success,” said CERN Director General Rolf Heuer. “The results today are only possible because of the extraordinary performance of the accelerators, including the infrastructure, the experiments, and the Grid computing.”

Many of the tools used by the Grid computing infrastructure were developed in Europe by the European Middleware Initiative (EMI). They allow uniform access to an enormous amount of distributed computing resources and archives, and are able to support powerful, complicated and time-consuming analysis on the just-collected collision data. In order to do that, data is very rapidly distributed from CERN to more than 300 centres worldwide thanks to the Worldwide LHC Computing Grid (WLCG) and other participating infrastructures like the Open Science Grid (OSG) in the United States.

Grid computing has enabled the establishment of the new type of Distributed High Throughput Computing (DHTC) infrastructure, which allows the LHC experiments to get the results in a previously unthinkable time. Up to 30 petabytes of data, comparable to a stack of DVDs 20 times taller than the Eiffel Tower, are dealt with each year by WLCG. EMI provides the middleware used by WLCG. This set of software tools glues thousands of connected computing and storage resources in Europe into the general DHTC infrastructure called European Grid Infrastructure (EGI). “EMI is a crucial element of Grid computing that was designed with the main focus of solving the large challenges of the LHC experiments, but having in mind the needs of Life Sciences and many other scientific communities that make intensive use of distributed computational and storage resources” says Mirco Mazzucato, the Representative of the Italian Grid Initiative (IGI) in EGI and Member of the EMI Executive Coordination Board. “It includes all the services necessary to establish trust relationships and the general data and computing workload management tools, together with the distributed monitoring and accounting systems, that are necessary to allow scientists to work at the same time in an easy and transparent way on hundreds of these centres located in many different countries. Without all this, such an important result could not have been achieved in such a short time.”

“The EMI collaboration members are proud to see that all the Grid software components they had developed in the previous years, with the support of the European Commission and many European research institutions, were successfully sustaining the load of thousands of

researchers working day and night to include in their results the last collected data, to obtain sufficient statistics (trillions of high energy proton-proton collisions in 2011 and 2012) to be able to present the discovery of this new particle, consistent with the long sought Higgs boson,” confirms Alberto Di Meglio, the EMI Project Director in the CERN/IT Department.

In parallel with the LHC experiments, the EMI project supports a number of other initiatives, including the analysis of increasingly large genome samples, the search for new features of the Universe through large telescope arrays’ data, satellite scans, earth biodiversity data, and the exploration of the sea with large submarine detectors.

“Grid computing will continue to provide effective solutions for the creation of distributed computing infrastructures wherever huge computational and storage requirements arise,” concludes Mirco Mazzucato.