SCIENCE N**O**DE™   Home   Archive   Contribute   Sponsor
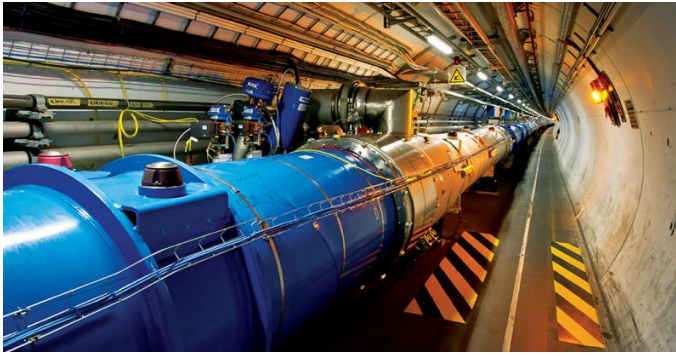
About   Give Now

Volunteer computing: 10 years of supporting CERN through LHC@home

LHC@home recently celebrated a decade since its launch in 2004. Through its SixTrack project, the LHC@home platform harnesses the power of volunteer computing to model the progress of sub-atomic particles traveling at nearly the speed of light around CERN's Large Hadron Collider. The number of projects supported by LHC@home is growing and the platform now has over 100,000 users from across the globe.

"The results of SixTrack played an essential role in the design of the LHC," says Schmidt. Image courtesy CERN.

Posted on DEC 3 2014 5:59AM

Andrew Purcell
European editor

LHC@home recently celebrated a decade since its launch in 2004. Through its SixTrack project, the LHC@home platform harnesses the power of volunteer computing to model the progress of sub-atomic particles traveling at nearly the speed of light around the Large Hadron Collider (LHC) at CERN, near Geneva, Switzerland. It typically simulates about 60 particles whizzing around the collider's 27km-long ring for ten seconds, or up to one million loops. Results from SixTrack were used to help the engineers and physicists at CERN design stable beam conditions for the LHC, so today the beams stay on track and don't cause damage by flying off course into the walls of the vacuum tube. It's now also being used to carry out simulations relevant to the design of the next phase of the LHC, known as the High-Luminosity LHC.

"The results of SixTrack played an essential role in the design of the LHC, and the high-luminosity upgrades will naturally require additional development work on SixTrack," explains Frank

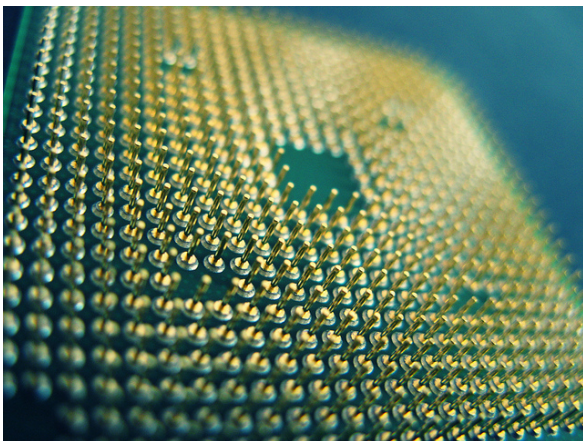## Share this story

Tags

BOINC

CERN

citizen science

LHC

LHC@Home

Particle Physics

SETI@Home

Volunteer computing

Schmidt, who works in CERN's Accelerators and Beam Physics Group of the Beams Department and is the main author of the SixTrack code. "In addition to its use in the design stage, SixTrack is also a key tool for the interpretation of data taken during the first run of the LHC," adds Massimo Giovannozzi, who also works in CERN's Accelerators and Beams Physics Group. "We use it to improve our understanding of particle dynamics, which will help us to push the LHC performance even further over the coming years of operation." He continues: "Managing a project like SixTrack within LHC@home requires resources and competencies that are not easy to find: Igor Zacharov, a senior scientist at the Particle Accelerator Physics Laboratory (LPAP) of the Swiss Federal Institute of Technology in Lausanne (EPFL), provides valuable support for SixTrack by helping with BOINC integration."

Volunteer computing is a type of distributed computing through which members of the public donate computing resources (usually processing power) to aid research projects. Image courtesy Eduardo Diez Viñuela, Flickr (CC BY-SA 2.0).

Before LHC@home was created, SixTrack was run only on desktop computers at CERN, using a platform called the Compact Physics Screen Saver (CPSS). This proved to be a useful tool for a proof of concept, but it was first with the launch of the LHC@home platform in 2004 that things really took off. "I am surprised and delighted by the support from our volunteers," says Eric McIntosh, who formerly worked in CERN's IT Department and is now an honorary member of the Beams Department. "We now have over 100,000 users all over the world and many more hosts. Every contribution is welcome, however small, as our strength lies in numbers."

Virtualization to the rescue

Building on the success of SixTrack, the Virtual LHC@home project (formerly known as Test4Theory) was launched in 2011. It enables users to run simulations of high-energy particle physics using their home computers, with the results submitted to a database used as a common resource by both experimental and theoretical scientists working on the LHC.

Whereas the code for SixTrack was ported for running on Windows, OS X, and Linux, the high-energy-physics code used by each of the LHC experiments is far too large to port in a similar way. It is also being constantly updated. "The experiments at CERN have their own libraries and they all run on Linux, while the majority of people out there have common-or-garden variety Windows

machines," explains CERN honorary staff member of the IT department and chief technology officer of the Citizen Cyberscience Centre Ben Segal. "Virtualization is the way to solve this problem."

Predrag Buncic, who is now coordinator of the offline group within the ALICE experiment, led work to create the CERN Virtual Machine in 2008. He, Artem

The birth of the LHC@home platform

In 2004, Ben Segal and François Grey , who were both members of CERN's IT department at the time, were asked to plan an outreach event for CERN's 50th anniversary that would help people around the world to get an impression of the computational challenges facing the LHC. "I had been an early volunteer for SETI@home after it was launched in 1999," explains Grey. "Volunteer computing was often used as an illustration of what distributed computing means when discussing grid technology. It seemed to me that it ought to be feasible to do something similar for LHC computing and perhaps even combine volunteer computing and grid computing this way."

"I contacted David Anderson, the person behind SETI@Home, and it turned out the timing was good, as he was working on an open-source platform called BOINC to enable many projects to use the SETI@home approach," Grey continues. BOINC

(Berkeley Open Infrastructures for Network Computing) is an open-source software platform for computing with volunteered resources. It was first developed at the University of California, Berkeley in the US to manage the SETI@Home project, and uses the unused CPU and GPU cycles on a computer to support scientific research.

"I vividly remember the day we phoned up David Anderson in Berkeley to see if we could make a SETI-like computing challenge for CERN," adds Segal. "We needed a CERN application that ran on Windows, as over 90% of BOINC volunteers used that. The SixTrack people had ported their code to Windows and had already built a small CERN-only desktop grid to run it on, as they needed lots of CPU power. So we went with that."

A runaway success

"I was worried that no one would find the LHC as interesting as SETI. Bear in mind that this was well before the whole LHC craziness started with the Angels and Demons movie, and news about possible mini black holes destroying the planet making headlines," says Grey. "We made a soft launch, without any official announcements, in 2004. To our

astonishment, the SETI@home community immediately jumped in, having heard about LHC@home by word of mouth. We had over 1,000 participants in 24 hours, and over 7,000 by the end of the week - our server's maximum capacity." He adds: "We'd planned to run the volunteer computing challenge for just three months, at the time of the 50th anniversary. But the accelerator physicists were hooked and insisted the project should go on."

Harutyunyan (former architect and lead developer of CernVM Co-Pilot), and Segal subsequently adopted this virtualization technology for use within Virtual LHC@home. This has made it significantly easier for the experiments at CERN to create their own volunteer computing applications, since it is no longer necessary for them to port their code. The long-term vision for Virtual LHC@home is to support volunteer-computing applications for each of the large LHC experiments.

Growth of the platform

The ATLAS experiment recently launched a project that simulates the creation and decay of supersymmetric bosons and fermions. "ATLAS@Home offers the chance for the wider public to participate in the massive computation required by the ATLAS experiment and to contribute to the greater understanding of our

universe," says David Cameron, a researcher at the University of Oslo in Norway. "ATLAS also gains a significant computing resource at a time when even more resources will be required for the analysis of data from the second run of the LHC."

Meanwhile, the LHCb experiment has been running a limited test prototype for over a year now, with an application running Beauty physics simulations set to be launched for the Virtual LHC@home project in the near future. The CMS and ALICE experiments also have plans to launch similar applications.

An army of volunteers

"LHC@home allows CERN to get additional computing resources for simulations that cannot easily be accommodated on regular batch or grid resources," explains Nils Høimyr, the member of the CERN IT department responsible for running the platform. "Thanks to LHC@home, thousands of CPU years of accelerator beam dynamics simulations for LHC upgrade studies have been done with SixTrack, and billions of events have been simulated with Virtual LHC@home." He continues: "Furthermore, the LHC@home platform has been an outreach channel, giving publicity to LHC and high-energy physics among the general public."

Join the conversation

Contribute ≡

Do you have story ideas or something to contribute? **Let us know!**

OUR UNDERWRITERS

Thank to you our underwriters, who have supported us since the transition from International Science Grid This Week (iSGTW) into Science Node in 2015. We are incredibly grateful.

View all underwriters

CATEGORIES

Advanced computing

Research networks

Big data

Tech trends

Community building

CONTACT

Science Node
Email: **editors@sciencenode.o**
Website: **sciencenode.org**

GIVE NOW

Copyright © 2022 Science Node ™ | **Privacy Notice** | **Sitemap**

Disclaimer: While Science Node ™ does its best to provide complete and up-to-date information, it does not warrant that the information is error-free and disclaims all liability with respect to results from the use of the information.