High Performance Computing at the Universidad Autónoma de Chiapas

K. Caballero Mora, S. Estrada Jiménez, C. Franco Espinosa, J. Romo González and L. Valencia Palomo

Universidad Autónoma de Chiapas
E-mail: lizardo.valencia@unach.mx

Abstract. In these proceedings we report on the events that took place before, during and after the donation of 364 servers that will be used to develop the High Performance Computing at the Universidad Autónoma de Chiapas.

1. High Performance Computing

Nowadays the High Performance Computing (HPC) is a very important tool for the development, not only for science but also for our modern society. In the specific case of a university it becomes invaluable to provide access to the HPC to the academic, research and student community. The range of applications is quite wide, as it can vary from basic science to administrative procedures.

Chiapas, Central America and the Caribbean have necessity of HPC, unfortunately as they don’t have this infrastructure, they have to perform their scientific calculations abroad. However, depending on an institution that can be far apart is a lack of growing from the point of view of the demanding part. In this sense, requesting permission to use an external facility is subject to the availability and priorities.

For this reason the European Organization for Nuclear Research (CERN) has decided to donate an important amount of computer equipment to the Universidad Autónoma de Chiapas (UNACH). The donation consists of 364 servers with a commercial cost of, approximately, 2 million dollars.

2. European Organization for Nuclear Research

The European Organization for Nuclear Research has its origins in the mid-twentieth century. Right after World War II, the European countries noticed the importance of scientific research on Nuclear Physics. So, Pierre Auger, Louis de Broglie and Niels Bohr, together with some other colleagues pushed for the construction of a common European facility focused in this topic. The idea was to encourage the exchange of scientific knowledge but also to share the high costs of the construction and maintenance.

Along his more than 60 years of history, CERN has conducted an important amount of scientific research in the fields of Nuclear and Particle Physics. In 1965, at the same time as a laboratory in the US, they detected the first anti-nuclei conformed by an anti-proton and an anti-neutron. In 1983, by colliding proton and anti-proton beams, UA1 and UA2 experiments...
led the detection of $W$ and $Z$ bosons. One year later the leading scientists, Simon van der Meer and Carlo Rubbia were awarded with the Nobel Physics Prize. On the 4th of July of 2012, ATLAS and CMS experiments at the Large Hadron Collider (LHC) announced the discovery of the Brout - Englert - Higgs Boson. The very next year the Nobel Physics Prize was awarded to Peter Higgs and Francois Englert.

The CERN is composed of 21 "state members", most of them being europeans. There are also 6 other countries with the status of "associated members" and 5 more countries catalogued as "observers". Finally CERN has also collaboration agreements with 35 countries, among them Mexico.

With the development of the new facilities, the experiments started to become more complex and also more expensive. By the 1980’s CERN began to search for collaborators outside Europe. By the end of this decade, in order to motivate the exchange of scientific data, the physicist Tim Berners-Lee created the World Wide Web. More than 25 years after Berners-Lee’s development, due to the requirements imposed by the LHC, the informatic services have been improved. At the LHC there are around 600 million proton-proton collisions per second at energies never achieved by humankind before. These collisions are registered by 150 million sensors, resulting in an output of 700 megabytes of data per second, this is, one CD of information every second. By the end of one year of operations at the LHC, we would have approximately 30 million Gigabytes of information.

It is clear that there is no single computer nor a single data center that can store and process such amount of information. So, in order to overcome this obstacle the World Wide LHC Computing Grid was created. This is a world network of around 170 supercomputing centres from 42 countries all around the world. In Mexico only the UNAM is part of the Grid.

3. High Performance Computing Laboratory
The history of the donation of the servers can be traced back to 2014 when Dr. Luis Flores, from Hong Kong University offered to the UNACH to request a donation to CERN. The initial team of academic personnel at the UNACH working on this process was: Dr. Karen Caballero, Dr. Sendic Estrada, Dr. Carolina Franco, LIA Jorge Romo and Professor Arnulfo Zepeda. This team started some negotiations with the corresponding authorities of the UNACH, the main problematic that arose during those meetings were related to the place to store the servers once they reached the university and the transportation of all the material (around 13 tons).

Indeed, the donation consisted of equipment that was previously used at CERN Data Center. However, when the computers can no longer satisfy the extremely high requirements of CERN, they are replaced by new and more powerful computers. However, the old computers are still useful and can be safely used in universities or scientific research institutions that do not have so high computing requirements.

The 364 servers, 24 switches and 26 racks were shipped from CERN, on August 26, with Tuxtla Gutierrez as destination. Finally, the equipment arrived on October 11th to the UNACH. The arrival of computers from a top scientific research center to Chiapas was a mediatic phenomena, not only in the region but in all Mexico. Many reports and interviews were performed, local media spread the news during the following days and so the starting scientific activities in Chiapas were highlighted.

With the arrival of all this equipment it has been possible to create the High Performance Computing Laboratory (LARCAD) at the UNACH. The LARCAD is still under construction and it is expected to be finished by the end of the year. The main goals of this laboratory will be:

- Provide high efficient computing services to the academic and research staff of the UNACH.
- Obtain, as soon as possible, the category of Tier 1. In a medium term, the LARCAD should be a Tier 2 center.
• Create human resources with high specialization in the performance of the laboratory.
• Incorporate more regional universities and institutions to the development of the HPC in the south of Mexico, Central America and the Caribbean.

Finally, although the original use of the servers was exclusively in the High Energy Physics field, they can be used in any other branch of science. In particular, the main topics that are being developed at the UNACH by the academic staff are:
• Astroparticle physics: in this field there are currently a couple of professors working in international collaboration as HAWC, Pierre Auger, LAGO and JEM-EUSO.
• Optics: lasers and optic fibers.
• Complex systems: non-linear dynamics and biologic processes.
• Theoretical physics: properties of Bose-Einstein condensates, thermodynamic properties of graphene, field theories, gravitation.
• Mathematics: pure and applied mathematics, topology, differential geometry, biophysics.
• Energy: solar, eolian, hidro.
• Environment: climate change, ecology, sustainability.

4. Conlusion
In conclusion, the donation of computing servers from CERN will benefit not only to the UNACH but to all the south of Mexico. Currently the efforts are focused on the construction of the LARCAD and the first tests of the equipment. Is is expected that this data center is completed by the end of the present year.

References
[1] http://serversdonations.web.cern.ch/content/list-past-donations-servers-retired-cern-data-centre
[2] http://cds.cern.ch/record/2048937?ln=es
[3] http://dcs.unach.mx/index.php/noticia/item/3209-arriban-a-la-unach-los-servidores-inform%C3%A1ticos-donados-por-la-organizaci%C3%B3n-europea-para-la-investigaci%C3%B3n-nuclear.html
[4] J. Krige, History of CERN, Vol. 3.