Legion: the project that helps to turn free resources into a high computing power

Everybody connected and greater power available for all, that is the proposal of this initiative which suggests the creation of communities which optimise the free and inactive periods of the available computing equipment in order to use them in more demanding fields.

Currently most academic institutions in Latin America cannot implement high-performance computing solutions due to its high costs. However, many of them have modern computer rooms equipped with powerful computers whose power is underused most of the time. It is in these cases that the Legion project makes it possible to use the free resources of such computers, in order to gain access to a high computing power without making big investments, enabling the incorporation of researchers into new fields of research which require high-performance computing.

According to Genghis Ríos, from the Department of Academic Computing at the Pontificia Universidad Católica del Perú (PUCP) and project coordinator, this initiative aims to develop a distributed computing grid based on desktop equipment, making use of the BOINC (Berkeley Open Infrastructure for Network Computing) technology and the supercomputing project management system Legion, a web interface facilitates interaction with BOINC to researchers. "To do so, each institution belonging to RedCLARA can join the community by associating a computing laboratory to the Legion Grid, facilitating the development of a distributed supercomputing system that will be available only for community members", he states.

This way, a laboratory that wishes to join the project must have at least 20 computers with dual core and 2GB RAM and a free space of 30GB in the hard disk, and all of them connected to advanced networks. "In every grid solution the communication speed between servers and computer clusters is important; this is why RedCLARA would facilitate an ideal communication infrastructure. On the other hand, RedCLARA also represents various communities of researchers who may be interested in the use of this new service", explains Ríos.

Currently Legion has a computing power equivalent to 250 Inter Core 2 Duo processors, with an estimated maximum capacity of 1012 (10 to 12) mathematical operations per second, obtained from the potential available in 465 computers distributed in 15 laboratories run by the Department of Applied Computing (DIA) at the PUCP.
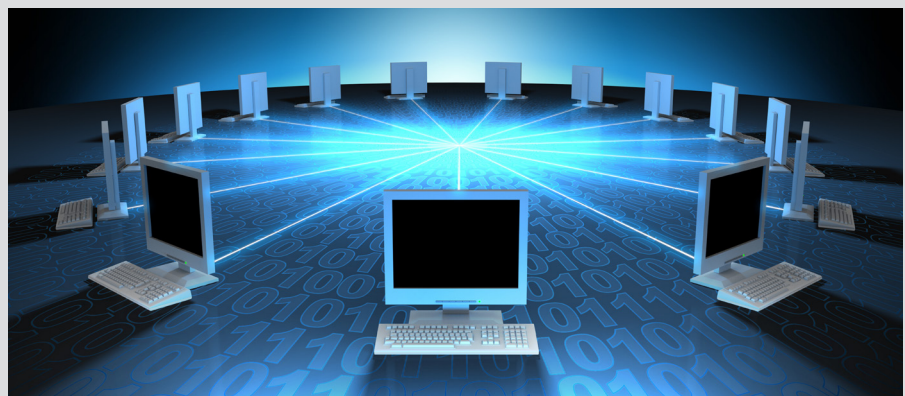
![RedCLARA logo]
Legion Projects

According to the DIA of the PUCP, high-performance computing technology will enable new possibilities for the university's researchers in areas like weather prediction, quantum chemistry, high-energy physics, oil and seismic exploration, validation of statistical models, bioinformatics, analysis of protein structures, simulations of fluids, intensive management of animations and 3D images and data mining, among others. So far the DIA has collaborated with three projects, providing the LEGION System's computing capacity:

1. Project: Validation of the binary regression model BBB Skew Probit.

   Unit: Department of Science, Mathematics Section.

2. Project: Simulation of the number of undergraduate students at the PUCP by making use of Absorbing Markov Chains.

   Unit: Department of Engineering

3. Project: Comparison of the two models for the production of high-energy neutrinos in clusters of active galaxies.

   Unit: Department of Science. Physics Section.

More information:

Project's Wiki
http://wiki.pucp.edu.pe/legion

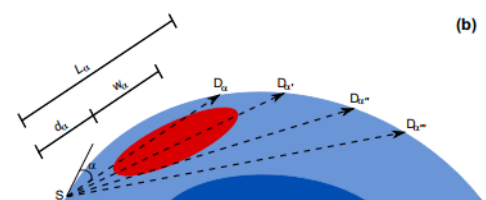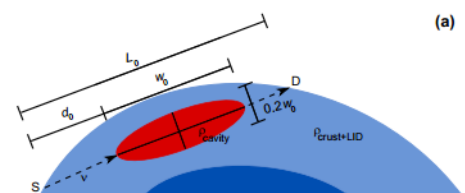**Server installed in RAAP**
http://legion.pucp.edu.pe

DIA's blog
http://blog.pucp.edu.pe/item/37409/sistema-de-super-computo-legion-desarrollado-en-la-pucp

Outstanding Application

Genghis Ríos says: "Particularly at the PUCP we have been very successful thanks to the High-Energy Physics Group (GAE, in Spanish). They researched a new method to find different densities in the Earth's crust, which can enable the detection of cavities with water, iron cavities, heavy minerals deposits and regions of accumulated load, which supposedly appear before an earthquake. To do so, the capacity of neutrinos to cross through any material would be used. The research needed a large amount of computing to perform the simulations of the mathematical models used and it took advantage of Legion's desktop computer grid infrastructure at PUCP, which features nearly 500 computers. The computing with Legion lasted about six months; however, with one computer it would have taken nearly 27 years. The resulting paper was published on the Technology Review portal of the MIT (Massachusetts Institute of Technology), where the usefulness of the method for discovering oil is highlighted (seehttp://www.technologyreview.com/view/426772/how-neutrino-beams-could-reveal-cavities-inside-earth/)"