University of Valencia Begins a New Chapter in the Field of Supercomputing

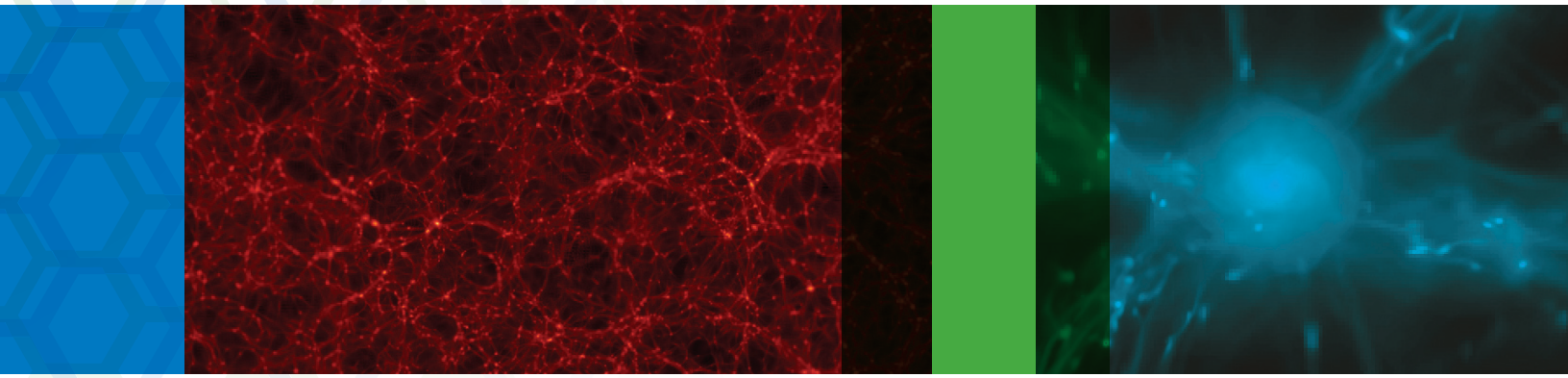
Launches New Shared Memory System Called Lluís Vives

Key Facts

Organization:
University of Valencia

Location:
Valencia, Spain

Industry:
Higher Education & Research



The University of Valencia has become a pivotal research institution in Spain, requiring a vast amount of supercomputing resources. The University's IT infrastructure has recently grown with the production launch of its new SGI® UV 1000 supercomputer, named "Lluís Vives," while also marking a new chapter in capability for the institution. The University also recently expanded its cluster system, called "Multivac."

Founded in 1499, the University of Valencia has become a prestigious institution and a benchmark for research in Spain. According to the ranking of research institutions carried out in 2010 by SCImago (www.scimagoir.com), the University is the sixth-ranked institution in Spain based on research performance, and occupies positions 79 and 266 in Western Europe and the world, respectively. On its three main campuses and various additional branches, affiliated centers and extensions, the University serves about 48,000 students in all degrees, with more than 3,500 teachers and researchers and around 1,700 employees in administration and services.

Responsible for providing IT services, the Computing Service of the University is comprised of a staff of 85 people, including 40 senior technicians, and is led by José Antonio Vázquez. The group provides computing resources for various individuals and teams needing to run scientific and teaching applications.

The University of Valencia's participation in the supercomputing race began in the 1990s with the installation of a mainframe that was later used for management tasks.

In 2003, the first SGI machine, an SGI Altix® 3700 dubbed "CESAR," was acquired. "CESAR was an Intel® Itanium® 2-based machine that was a very important investment and marked a turning point," points out Vázquez, specifying that "special public endowments for Science Parks were taken advantage of, and we had access to special grants, as the investment was not possible to do with our own resources."

In 2006, a cluster system called Multivac entered the scene, and as Vázquez highlights, "Users had access to 16GB of RAM per node." It is therefore an environment that is "oriented to sequential calculation and, in fact, is very successful as there are many users with sequential jobs or with a very low level of parallelism." Thus, Multivac was not only useful for researchers who preferred not to touch the code, but also allowed the download of other settings as "there was much sequential work in parallel computing machines," according to Vázquez.

With CESAR and Multivac, the University offered two different computing paradigms for calculating:

1 A system applied to the running of uni-processor applications that require a large amount of memory or multiprocessor applications programmed in OpenMP and MPI.

2 A cluster of individual machines interconnected through a GigE network that provides the setting for an environment designed for running uni-processor applications of low resource consumption but which have to run a large number of times.

The Power of Lluís Vives

The University achieved a new milestone with the addition of a shared memory supercomputer, the new SGI UV 1000, to its pool of supercomputing resources. Named "Lluís Vives" in honor of the humanist and philosopher, the system replaces CESAR, the old SGI Altix 3700 computer.

The selection of the SGI UV 1000 was largely determined by its scalability. As Vázquez states, it's that "after evaluating the alternatives in the market to replace the previous SGI, all we found that was truly scalable was the SGI UV, so we held a restricted tender that was awarded following last summer (2010)."

> "For the research community, RES means a level of collaboration that has never existed."
>
> **José Antonio Vázquez**
>
> Director of the Computing Service
> University of Valencia

Facing potential growth, it is not surprising that the SGI UV 1000 enables the University to grow the system to 2,048 cores, and its architecture is ready to support up to 262,144 cores. Still, according to Vázquez, the arrival of the SGI UV "means the beginning of a new stage, mainly by simplifying the use and reducing the consumption of resources involved, especially from an energy standpoint." Compared to CESAR, Lluís Vives is double the power that was previously available at one fifth the cost, with the added ability to carry out the migration of all applications without bringing down the system.

Lluís Vives has 384 computing cores (26 hexacore Intel® Xeon® Processor X7560 at 2.66 GHz) and 2,048GB of shared memory. In terms of storage, the system has a dual controller SGI InfiniteStorage 220 with four 4Gbit Fibre Channel ports, which manages a total of 18TB on disk. The SGI UV runs a single system image (SSI) with SUSE® Linux® Enterprise Server 11 Service Pack 1 and SGI ProPack 7.

The system allows users to work with large volumes of data used in research projects without the limitations of computer cluster technologies. Says Vázquez, "Lluís Vives primarily will be used for simulations that need to be large memory arrays and array data structures, and to the extent that the more memory the system has, the bigger the array can be."

Despite having only recently entered production, a possible extension of Lluís Vives is already being considered as "we have an additional budget through the Department of Astronomy & Astrophysics, which is a very intensive user of this environment of shared memory," Vázquez explains in detail, to summarize that "the idea is to have an increase of 30-40% of cores and memory."

At the same time, the University upgraded its Multivac cluster, acquiring and integrating four new calculation servers. Each unit contains four nodes (except for a single server that only has two nodes plus GPUs), with a 4-core processor and 16GB per node, adding 56 cores and 224GB to the existing system. This results in a total of 232 CPU cores, 696GB of memory and 2 NVIDIA® Quadro® FX5800 GPUs. This breakthrough allows the University to provide the first GPU technology to the research community, further reinforcing the University of Valencia as the center of supercomputing, and further promoting research activity.

Multidisciplinary Projects

Among the major research projects carried out at the University of Valencia, the Astronomy & Space Sciences group's participation is highlighted because of the system's involvement in the construction of a telescope for solar research developed by NASA, the U.S. space agency. Also remarkable is the system's contribution to the study of human genetic diseases such as Alzheimer's, the therapeutic use of neural stem cells, and molecular biology research.

However, as stressed by José Antonio Vázquez, it must be noted that "supercomputing resources are extending beyond those of the University's own. Besides our own research groups, which make heavy use of these resources estimated at more than six million hours a year of calculation, we serve interdisciplinary research groups from other universities, especially from the Polytechnic University of Valencia, earning us recognition from the Ministry of Education as a Campus of International Excellence."

About the University of Valencia

The University of Valencia is a place where knowledge, learning and experiences are combined, offering a wide range of studies, useful infrastructures and facilities, as well as an array of human resources, in an attempt to make culture accessible to everyone. Studies include the new EHEA Bachelor's degrees, as well as a wide range of official postgraduate masters, PhDs, and other professional specialization studies.

Originally written by Lola Sánchez; translated and modified with permission.

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