e-Infrastructures give real boost to virtual observatories

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(PhysOrg.com) -- New tools and systems developed by European researchers are helping astronomers access data centres from anywhere in the world. From charting new stars to finding new meaning in old stellar objects, the result will be virtual observatories with very real impact.

In the past 50 years, the number of telescopes worldwide has exploded, creating at the same time vast quantities of information. This has boosted research considerably and increased knowledge of our place in the Universe.

But much more remains to be discovered, if only astronomers had access to all the possible data available on celestial objects. An astronomer may have access to images from NASA, but can he or she compare them to those acquired by the European Southern Observatory, or the European Space Agency? Do they have access to all the observations taken by every available telescope, on the ground and in space?

Virtual observatories (VOs) may provide the answer, making vast quantities of astronomical data available over the internet. The results of which could well be new stellar discoveries, but also new opportunities for researchers anywhere in the world.

“It is a question of equality, too,” explains Françoise Genova, coordinator of the Euro-VO DCA project. “Ultimately, all scientists will have equal access to all possible data on any astronomical object.”

Problem solving - making the data interoperable

Up to now, although most current and historical astronomical data is already theoretically out there to be had, much of it is stored on computers in specialised data centres, and very often these systems cannot talk to each other, or interoperate.

That was the problem the Euro-VO Data Centre Alliance sought to solve. The team wanted to coordinate data centres in Europe, to help them conform to existing standards, and where necessary refine the standards.

The project also explored problems relating to the storage of complex data, such as astronomical modelling, and looked at the best ways of integrating grid-based systems - i.e. using multiple computers to solve a single problem at the same time - with VO standards.

“There were several strands to our work,” explains Genova. “Some data centres use grid-based systems, which use their own standards. We needed to develop a way that they could connect and exchange data with the broader VO standards.”

A significant fraction of the project’s work consisted of outreach activities - through the website, seminars and several workshops - which were very well subscribed to.

Euro-VO DCA also produced, for the first time, a census of European astronomical data centres. Further success is being recorded in the project’s work on theoretical modelling and standards building with the International Virtual Observatory Alliance (IVOA), the VO international standardising body.

Euro-VO DCA completed its work at the end of 2008, which has been

taken over by the EU-funded Euro-VO AIDA (Astronomical Infrastructure for Data Access). AIDA will take the work further, seeking to unify the digital data collections of Europe's astronomy centres, integrating their access mechanisms with evolving e-technologies, and enhancing the science extracted from the data.

Pre-internet-age astronomy
The AIDA project is one more phase in the drive by the astronomical community to make data available to all. Before the DCA, the European Astrophysical Virtual Observatory project performed a valuable proof of concept, showing how this community has evolved as technology has evolved.

"Sharing data in astronomy has a long history, preceding the internet by several decades" reveals Genova. "My institute, the Strasbourg astronomical data centre (CDS), was set up to offer access to data in the early 70s, with punch card access, printouts and magnetic tape," she recalls. "They would send us letters asking for the data they wanted. Today, we receive 200,000 queries through the internet every day!"

But increasingly, scientists can access data from Genova's institute and many others, all at the push of a few keys.

VO-enabled astronomy community

The upshot is much better access to data and more interesting research. As data centres join the VO-sphere by sharing their data interoperably, it enables a diverse range of new science projects, and stimulates innovative ways of using the data.

For example, new VO services from the Institut de Mecanique Celeste et de Calcul des Ephemerides (IMCCE), in Paris, provide positions of known solar system bodies. So if an astronomer asks the question: Is that

a known asteroid streaking though my image taken in 2006? The answer is there, fast and efficient.

Other services use the core registries, or records, of the Euro-VO to request, for instance, all relevant data at a given position in the sky - a task which would take weeks to do by querying each individual website. These and many more VO services provide a new toolbox for astronomers.

The youngest astronomers are among those reaping the benefits, as evidenced by the lively participation of PhD students and postdoctoral researchers in the first Euro-VO school held in the frame of Euro-VO AIDA in April this year.

In the four-day programme, participants applied VO techniques to their own scientific projects, one of which established an efficient workflow for identifying Ultra Luminous X-ray sources and X-ray binary stars in nearby galaxies.

There is no doubt that VOs enormously boost the potential for research. And they make astronomy more economic, because they allow a greater number of researchers to benefit from all observations and to compare easily the available information.

The Euro-VO DCA project received funding from the Sixth Framework Programme for research.

More information: www.euro-vo.org/pub/dca/overview.html

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