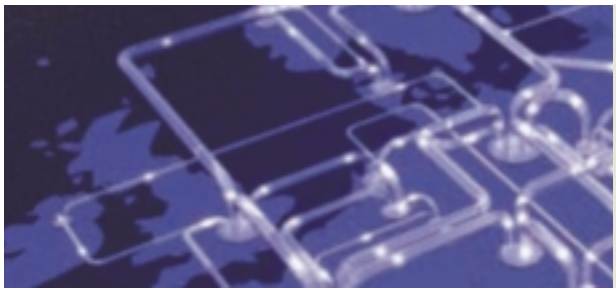
GÉANT Case Study 1: Real-Time eVLBI in Europe

One of the GÉANT network's most demanding users to date is a European (and increasingly global) association of radio telescopes. In this case study the enabling technology provided by GÉANT and its effect on the work of radio astronomers is explained...

What is VLBI?

Radio astronomy is a powerful tool in the search for answers to the Universe's most fundamental questions. It is used because some celestial objects, only dimly visible by conventional telescopes, emit radio waves far more strongly than visible light. In addition, unlike visible light, the longer wavelength radio waves can pass right through the dust and gas clouds that often surround and hide newly forming stars and galaxies.

Very Long Baseline Interferometry (VLBI) is a radio astronomy technique which harnesses the power of many radio telescopes simultaneously, generating far more detailed images than could be produced by a single observatory. In fact, the resolution (ability to pick out detail) is equivalent to a telescope of a size equal to the separation of the observatories! The further away (and hence fainter) an object is, the longer the image has taken to reach Earth. Because of this, very sensitive VLBI measurements permit astronomers to see further back in time, close to the edge of the observable Universe. Unfortunately, the wide separation of the telescopes presents the problem of transporting vast amounts of data across the globe to a single analysing supercomputer. In Europe VLBI observations are conducted by the European VLBI Network (EVN) and the data are processed by a supercomputer developed and operated by JIVE (Joint Institute for VLBI in Europe). Recently, GÉANT and various National Research Networks have successfully experimented with connecting the EVN telescopes and JIVE together in real-time, using state-of-the-art, fibre-optic network technology.



GÉANT is the pan-European multi-gigabit data communications network, reserved specifically for research and education use. It is creating the biggest interconnected community of scientists and academics in the world today, enabling them to share and distribute research data faster than ever before. It delivers exciting benefits to its users and will play an important role in shaping the future of European science.

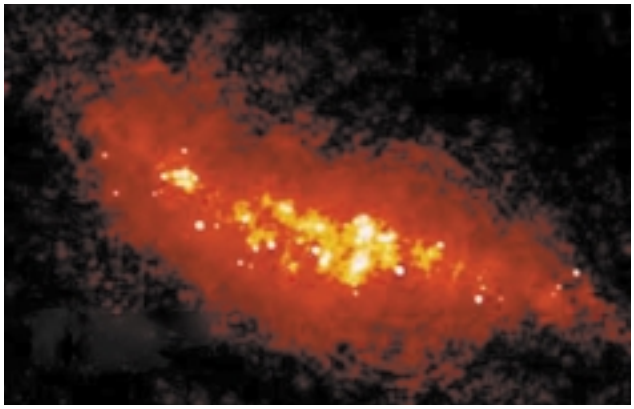
GÉANT Case Study 1: Real-Time eVLBI in Europe

GÉANT links the VLBI Partners

The capacity of GÉANT, which can transfer data at a rate of up to 10 Gigabits per second, means that bandwidth (a measure of the capacity of a network to transport data) may be allocated specifically to the EVN and the information transferred quickly and reliably from the observatories to the processing computer. This allows astronomers to generate high-quality images in near-real time. Previously, data was stored on large reels of tape at the collecting telescope and these were transported by delivery truck to the central computer. This process could take days or weeks and even then tapes might arrive damaged or incomplete. The birth of electronic VLBI (eVLBI) opens up a host of opportunities. Scientists can now assess the astronomical data as it is measured, meaning they can rapidly detect and correct errors at the telescopes, helping to optimise the value of the observation in progress. The technique also provides radio astronomers the flexibility to rapidly follow-up short-lived astronomical events such as Supernovae and Gamma Ray Bursts.

The Virtual Observatory

The users of the VLBI data work at universities and research institutes across the globe, often many thousands of kilometres from both the telescopes and the central processing super-computer. Once the data has been collected and processed, it can be distributed to these users over the GÉANT network. Thus the entire data supply chain from telescope to scientist is facilitated by GÉANT and demonstrates the versatility of the network as a fundamental tool of advanced research.



The GÉANT network has provided a flexible and powerful means for VLBI to be performed without the need for the outmoded tape technology. In doing so a new and improved method of data collection, analysis and distribution has been established and the science of astronomy is actually furthered as a result. With GÉANT the future data transfer for VLBI in Europe is assured. By the end of the decade the level of eVLBI traffic from each telescope is expected to reach several tens of gigabits per second.

Find out more

You can learn more about eVLBI and the GÉANT network at the following websites:
www.geant.net
www.evlbi.org
www.jive.nl

DANTE is the non-profit organisation that operates GÉANT on behalf of Europe's National Research and Education Networks. DANTE is also currently managing initiatives operating in Latin America, Asia, North Africa and the Middle East. Further information about DANTE and its activities can be found at **www.dante.net**

Photos provided courtesy of the EVN