



GÉANT and ASTRA: Recreating ancient instruments

Computers linked across high-speed research networks were used to run a data-intensive modelling program to recreate the sounds of ancient instruments.

For centuries, the Epigonion and the Barbiton have been confined to history books, unheard since their heyday in Ancient Greece. However, these vanished musical instruments have now been brought back to life thanks to pioneering research.

The ASTRA (Ancient instruments Sound/Timbre Reconstruction Application) project aims to reconstruct the sound or timbre of ancient instruments that no longer exist. Using the high-speed GÉANT and EUMEDCONNECT* networks and advanced computer modelling technology, researchers can create models of 'lost' instruments based on archaeological data, such as fragments from excavations, written descriptions and pictures.

Computer power harnessed across research networks

To recreate sounds, ASTRA uses physical modelling synthesis, a complex digital audio rendering technique which models the time-domain physics of the instrument. The process needs extreme amounts of computing power – taking over four hours for a high powered computer to correctly reproduce a 30 second sound. In order to provide the amount of computing power needed, high capacity computers were linked using the advanced GÉANT and EUMEDCONNECT research networks. This allowed the researchers to share information across the EUMEDGRID and GILDA grid computing infrastructures.

This advanced physical modelling synthesis creates a virtual model of the instrument and reproduces the sound that the instrument might have made by simulating its behaviour as a mechanical system.

ASTRA research brings real value worldwide

Two of the first instruments that ASTRA has recreated are the harp-like Epigonion and the Barbiton, which is similar to the double bass. Knowledge of these musical instruments, dating back to Ancient Greece, is based on archaeological findings, historical pictures and literature. Using this archaeological data as an input, it was then transformed through ASTRA's audio rendering technique to model the actual sound of the instrument.

The benefits of the collaborative approach used in this project are far reaching. ASTRA not only makes it possible to recreate instruments that previously would have been either too expensive or too difficult



The Challenge

To recreate the sounds of ancient instruments using highly data-intensive physical modelling programs.

The Solution

Using GÉANT as the underlying layer, harness the power of grid computing to deliver extreme computing power, greatly accelerating the modelling process and making ASTRA's work viable.

Key Benefits

ASTRA has brought to life ancient musical instruments such as the Epigonion and Barbiton to produce a fascinating insight into the past, highlighting the vital role of research networking in collaborative research.





to manufacture by hand, but it also allows any model and its associated data to be accessed by the wider community. Research data can therefore be shared around the world, making it a truly international project of immense value to working archaeologists and historians.

Linking musicians across the world

The ASTRA project is not only resurrecting ancient instruments, but the work performed on creating a library of sounds is enabling musicians from around the world to play the instruments from

"21st Century research is very intensive from a computational point of view. We are facing a sort of technological revolution which is rapidly changing the research landscape. This intensive research, co-funded by the EU, has seen the creation of new e-Infrastructure – a term that in this context refers to the new generation of integrated ICT-based infrastructures. The success of the ASTRA project is testament to how e-Infrastructure can bring researchers and academics from across a multitude of disciplines together with artists, facilitating their creative collaboration on a global level. In addition, it provides an innovative use for research data, making this important work accessible to the general public."

Dr La Rocca
Co-ordinator of ASTRA gridification

wherever they choose. By accessing the library across research networks, and manipulating the data to create the musical notes they require, musicians are able to play the instruments – even taking part in concerts occurring thousands of miles away! For musicians who cannot afford, or who are physically unable to travel, ASTRA is providing a virtual stage where virtual instruments can be played.

The success of the ASTRA project demonstrates how high-speed networking technology can not only deliver a fascinating glimpse into the music of the past for the benefit of the students and researchers of today, but how it can enable people across the world to collaborate in real time.

"Being able to recreate the sound of the Epigonion and the Barbiton, lost for many centuries, is a major step forward in our understanding and makes the past real for researchers and academics. For the first time we can actually hear the musical sounds of the past, using modelling techniques rather than guesswork. This same approach – using the network and grids for sound modelling – is also used in the work on data sonification, which is now being used by researchers to predict volcanic eruptions." (See GÉANT Case Study: "The Mountain")

Dr Domenico Vicinanza
Engineer, DANTE

connect • communicate • collaborate

The world is criss-crossed with high-capacity data communications networks, connecting and serving research and academic institutions across the globe. The most advanced of these is GÉANT, serving Europe. GÉANT interconnects with counterparts across the world, such as EUMEDCONNECT in the Mediterranean / North Africa.

Separate from the public Internet for reasons of security and performance, many of these networks are designed, deployed and run by the networking organisation DANTE and make an enormous practical contribution to research in a wide variety of areas – saving lives, building knowledge, establishing real-time collaboration between scientists all over the world.

GÉANT and EUMEDCONNECT provided the ASTRA project with the fast and reliable connection needed for physical modelling of lost instruments. Physical modelling is an intensive computing technique since the complex models of the musical instruments are solved by integrating numerical coupled differential equations. Without access to the GÉANT network to link computing power together this would not have been possible.

* The 2nd generation of the EUMEDCONNECT network, EUMEDCONNECT2, became operational in 2008.

For more information:

GÉANT: www.geant.net
EUMEDCONNECT2: www.eumedconnect2.net
EUMEDGRID: www.eumedgrid.org
Lost Sounds Orchestra: www.lostsoundsorchestra.org

GILDA:
<https://gilda.ct.infn.it/>
ASTRA: www.astraproject.org/

