

Astronomic data over on-demand network circuits

Very Long Baseline Interferometry (VLBI) is a radio-astronomical technique used to make extremely high-resolution images of cosmic sources. In VLBI large amounts of data have to be transported between radio-telescopes to the computation center within specific quality of service constraints. To make this possible we use the GEANT2 AutoBAHN system to provide on-demand network paths across Europe, which are also extended to the United-States based on AutoBAHN's interoperability with Internet2's DCN.

VLBI and AutoBAHN

Very Long Baseline Interferometry (VLBI) is a radioastronomical technique used to make extremely high-resolution images of cosmic sources. The same technique is also used for high-precision geodetic measurements. To this end, signals from radio telescopes across the globe (Figure 1) need to be transported to a central facility, the correlator, for processing. In the past, data were recorded on magnetic tapes (more recently on disk packs) and shipped to the correlator. Over the last few years, the VLBI community has started employing networks as a transport medium transferring data over the public Internet or dedicated high-bandwidth end-to-end circuits. This method of doing VLBI (also known as e-VLBI) has some interesting benefits, like the significant reduction of the time between observation and final data product and the capability to react flexibly and rapidly to the occurrence of transient objects (such as Gamma Ray Bursts or Supernovae).

The SCARLe project aims to develop a distributed software correlator that can be used for real-time e-VLBI, integrating it with advanced networking technologies. The SCARLe software correlator is more flexible and it can be deployed in different locations. Also, the telescopes feeding the correlator with data are distributed around the world. The Internet could be used for the data transport between the telescopes and the correlator but as a publicly shared medium, it is often congested or unreliable. Alternatively, static circuits between the telescopes and the location of the correlator could be provided on a case-by-case basis but this option is not always possible and not flexible enough for a constantly changing set of locations.

The GEANT2 Automated Bandwidth Allocation across Heterogeneous Networks (AutoBAHN) system is providing a Bandwidth-On-Demand service by allowing demanding

users/applications to reserve and schedule the usage of on-demand circuits across various research networks in Europe.

1.32 m telescope dish in Cambridge, UK



Dynamic circuit provisioning by AutoBAHN presents a better solution for the SCARLe e-VLBI:

- The worldwide VLBI Network does not operate continuously, which means that the circuits are not needed permanently.
- The locations of the actual telescopes that participate in observations vary.
- In an advanced correlator setup, the software can be run on many distributed clusters, with more demanding and dynamic needs for connectivity.