SCARIe: Enabling the grid for astronomy

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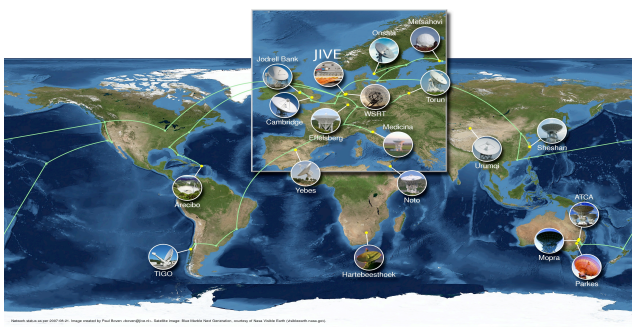
The SCARIe project is a cooperation between JIVE, SARA and the University of Amsterdam aimed at building a distributed software correlator for real-time processing of astronomical VLBI data. By delivering high quality pictures of the deep sky, VLBI is a powerful tools for astronomers. The software correlator requires fast networking connectivity for handling the high data rates in real-time. Hence, the DAS-3 grid and its user-controllable optical network, Starplane, form an ideal platform for the software correlator.

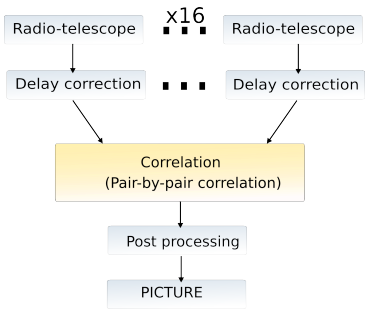
VLBI and JIVE

Very Long Baseline Interferometry (VLBI) is a technique in astronomy in which several distant radio telescopes observe the same object simultaneously. By using VLBI, astronomers can make detailed images of cosmic radio sources with unsurpassed resolution. The data is processed by correlating each pair of input signals. JIVE operates a dedicated hardware correlator specifically designed to perform this task. Currently, the recorded data are sent from the telescopes to JIVE through mail. The next step, e-VLBI, uses the Internet to stream data in real time to the correlator. Besides connecting telescopes in real-time to the correlator, these projects investigate the use of a software correlator on a Grid infrastructure to increase the flexibility and capacity of the correlation process.

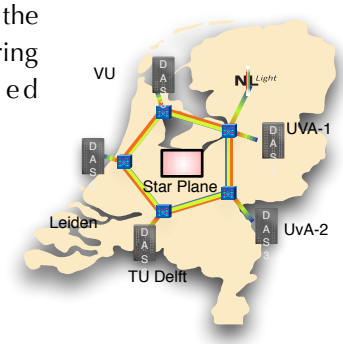


What is SCARIe ?

SCARIe aims at developing a software correlator operating on grids. A first prototype was build to track a space craft during it's descent on one of Saturn's moons and shows the flexibility of a software correlator. We estimate that 3 Tflops are needed to equal the capabilities of the hardware correlator. The challenge is not in the amount of "flops" but in the fact that correlator is supposed to operate in real-time even for large amounts of data (7.2 TB per hour).

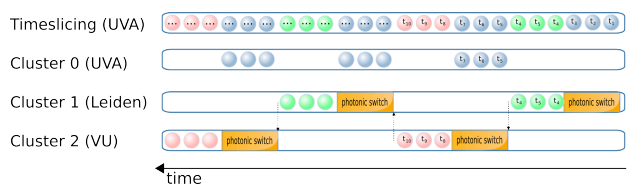


We are using the ASCII DAS-3 grid to develop and conduct our software correlation experiments. DAS-3 is composed of five cluster sites that are connected by a photonic network in which the StarPlane project is pioneering "application controlled photonic network".



Distributed software correlation consists in dividing the incoming signal into small chunks of data that are correlated independently. Starplane permits us to dynamically adapt the network topology to the amount of data we have to transmit and we are developing transmission patterns that take profit of it. For example, by switching the lightpath in a circular manner it becomes possible to send data to all clusters at high throughput (up to 80Gb/s according to the StarPlane roadmap).

Example of data distribution pattern.



Conclusion and futur plans

After one year of work we have laid the foundation for a flexible software correlator on top of distributed computing technologies. Using this software correlator we are currently working tightly with the StarPlane project in order to have a scalable software correlator working on the whole DAS-3 grid. This work will be demoed in the SuperComputing 07 demo area and will show that dynamic photonic lightpath switching is an efficient solution to distribute data for network intensive task.

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NWO Project: #643.200.504