SCARIe: Enabling the grid for astronomy

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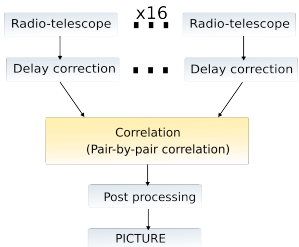
The SCARIe project is a cooperation between JIVE, SARA and the University of Amsterdam aimed at building a distributed software correlator for real-time processing of astronomical VLBI data. By delivering high quality pictures of the deep sky, VLBI is a powerful tool for astronomers. The software correlator 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, JIVE is conducting several projects (Fabrics, SCARIe) to investigate the use of a software correlator on a Grid infrastructure and to increase the flexibility and capacity of the correlation process.

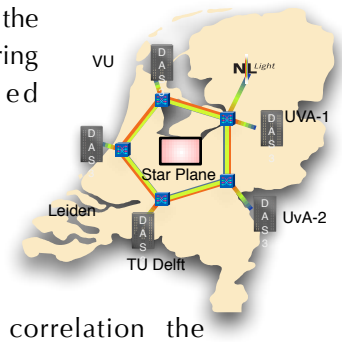
What is SCARIe ?

SCARIe aims at developing a software correlator operating on grids. A first prototype was built to track the Huygens probe during its descent on Titan, one of Saturn's moons, and convincingly demonstrated 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 this correlator is supposed to operate in real-time even for large amounts of data (7.2 TB per hour).



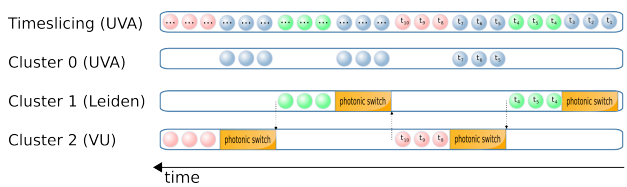
SCARIe on DAS-3/StarPlane

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 networks".



In distributed software correlation the incoming data are divided into small chunks 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 20Gb/s according to the StarPlane roadmap).

Example of data distribution pattern.



Conclusion and future plans

During the first year we have laid the foundation for a flexible software correlator based on distributed computing technologies. Using this software correlator we are currently collaborating intensively with the StarPlane project in order to implement a scaleable software correlator on the whole DAS-3 grid. This work will be demonstrated at SuperComputing 07 and will show that dynamic photonic lightpath switching is an efficient solution to distribute data for network intensive task.

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