THE EVALSO PROJECT: SOFTWARE/HARDWARE ARCHITECTURE AND REMOTE TESTS RESULTS

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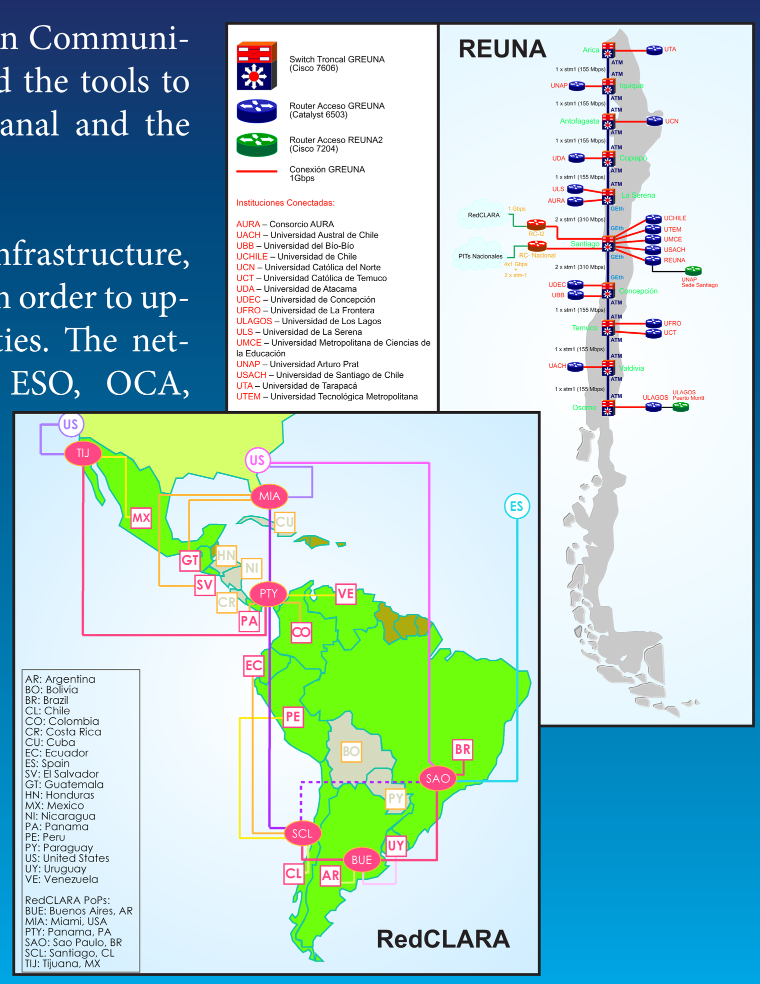
The EVALSO (Enabling Virtual Access to Latin-America Southern Observatories) project, funded by the European Community, aims to create a physical infrastructure to efficiently connect the Latin-America Southern Astronomical Observatories (European Southern Observatory – ESO and Observatorio Cerro Armazones - OCA) to Europe. This infrastructure will be complementary to the international infrastructure already created in the last years with the European Community support. A Virtual Presence system developed by the INAF - Astronomical Observatory of Trieste (AOT) will provide the astronomers with the tools to perform and control an astronomical observation from the user's site. This will be obtained re-creating selected components of the observatory environment at a remote site in order to allow the remote astronomer to interact with the on-site operators. The main objective of this activity will be to produce a low-cost, scalable, hardware and software system to be installed, without excessive efforts, in any operative situation where a suitable connectivity can be achieved. This paper will focus on the Virtual Presence sw/hw architecture and the results of the tests with remote sites.

The EVALSO project

The EVALSO project, approved by the European Community, aims to create a physical infrastructure (and the tools to exploit it) to efficiently connect the ESO Paranal and the OCA to Europe.

The main tasks of the project are:

- **Link upgrade**. Creation of the physical infrastructure, where not existent, or procurement of services in order to upgrade the connectivity to the observing facilities. The network elements currently involved are the ESO, OCA, REUNA (Red Universitaria Nacional) and RedCLARA (the network of the Cooperación Latino Americana de Redes Avanzadas) networks.
- **Fast data access**. Drastic improvement of the time needed for making the data available from the moment of the physical observation.
- **Virtual presence**. Planning and production of the tools that could be used to make possible the virtual presence of scientists, engineers, and experts at the remote facilities and, at the extreme, the possibility to perform remote observations.



Virtual Presence

The main role of the INAF - AOT within the project is to build a set of tools to implement a "Virtual Presence system" for the scientists and for any other kind of experts, obviously embedded in a "virtual environment" that reproduces the interface present at the observing site at its best. This will be obtained re-creating the observatory environment at a remote site, either the control room, or the laboratory workbench, in order to allow the needed expert to interact with the local operators. Such a system will optimize the results from actual observations, allowing the remote observer to interact with the local staff present at the observing site. The main objective of this activity is to produce a low-cost, scalable, hardware and software system to be installed, without excessive efforts, in any operative situation where a suitable connectivity can be achieved. Astronomical observing sites are natural candidates, but every situation where the remote presence of an expert is needed, is equally beneficiary of such a system.

Virtual Presence Requirements

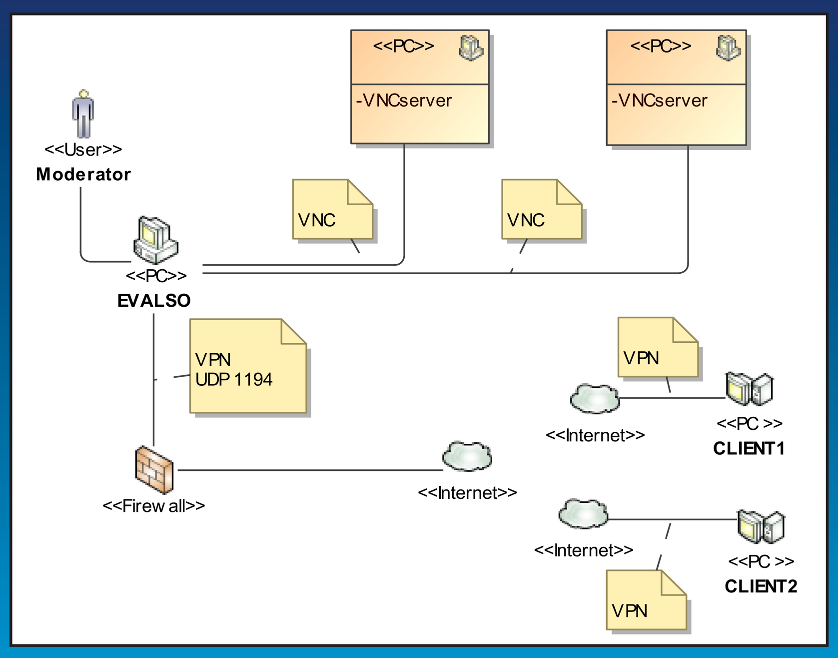
A set of requirements that the Virtual Presence system must satisfy has been defined:

- **Session management**. In order to allow the interaction through the Virtual Presence system a session has to be established between the remote observer/engineers and the observing site. A "session" can be defined as the act of establishing and starting, by the local staff, one or many simultaneous connections, then carrying out, by the remote observer(s) and engineers, the required actions, and at the end terminating them.
- **Desktop sharing**. The desktop sharing part will be in charge of replicating and sharing, between all participants to a session, a common desktop.
- **Audio and video connection**. The Virtual Presence system should allow the interaction between the remote users and the operators and assistant astronomers present at the observing site, through an audio and video connection.
- **System engineering**. The Virtual Presence system should be based on software, possibly under GPL licence, based on most common, widely used existing technologies. The session management as well as all the operations of desktop sharing must be as simple as possible. Concerning the security, the system should be based on secure connections both for desktop sharing and for audio and video connections.

Virtual Presence architecture

The current Virtual Presence software architecture is divided in two main packages: server and client. The server runs on a dedicated machine at the observing site facilities, while the client is used by the users that need to connect to the observing site. The server provides the facilities and services needed by the clients to establish and maintain a connection and perform the required actions. At the same time it provides the observing site operator (the moderator) with the tools to control and configure the session with one or more clients. A typical session is started by at least one client that connects to the server; then other clients are allowed to join the session. The client function is to provide the remote user with all the required facilities needed to establish a session with the observing site.

The server and client packages are a collection of open-source applications. To ease the deployment of the server packages a Knoppix LiveCD Adriane 6.0-pre, based on the GNU/Linux Debian OS distribution and containing all the needed Virtual Presence system software, has been prepared. The client software packages run both on GNU/Linux and Windows operating systems.



Adopted software packages

- **Secure channel (OpenVPN)**. A secure communication channel is mandatory to guarantee an adequate security. The current adopted solution is based on OpenVPN which, in turn, is based on the SSL/TLS protocol.
- **Desktop sharing (VNC Reflector)**. The application currently best suited for this purpose is VNC (Virtual Network Computing), since its communication protocol is public and extensible. To manage the permissions mechanism based on passwords the VNC Reflector software has been adopted. VNC Reflector is a specialized VNC server which acts as a proxy sitting between a real VNC server (host) and a number of VNC clients. It supports full-control and read-only client connections.
- **Videoconference (VLVC)**. For the videoconferencing the VLC (VideoLAN Client) media player with the VLVC (Video LAN Video Conference) patch has been used.

Long distance test

In September 2009 a first long distance test was carried out between OCA (acting as a server) and AOT (acting as a client).

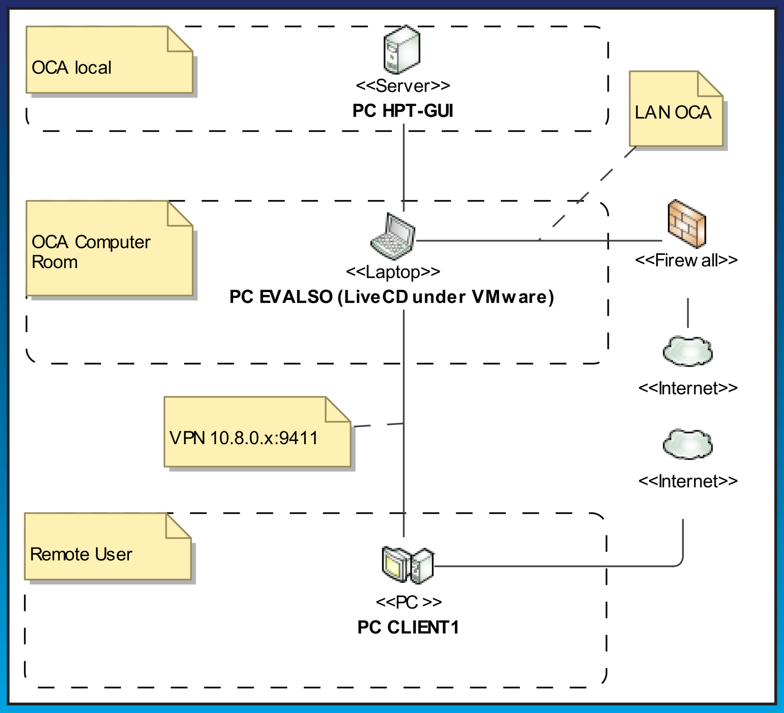
The desktop of a local workstation at OCA (PC HPT-GUI) was accessed by a remote client PC running at AOT (PC CLIENT 1) through PC EVALSO. An audio-video conference system was set up as well. The standard Virtual Presence system server and client packages were used.

The hardware setup at OCA was the following:

- PC HPT-GUI (OCA local interface via VNC)
- PC EVALSO (LiveCD under VMware running on a laptop)

At AOT the PC CLIENT 1 run the Windows XP OS.

During the test a VPN session between the PC CLIENT 1 and PC EVALSO was initiated. Since the standard VPN port on the OCA firewall was already busy, it was necessary to redirect the VPN connection to a free port. After this operation, the VPN connection was successfully established, with the VNC session and videoconferencing working properly. In the same session a bandwidth test was also carried out using the Pathload utility. The results showed that the available bandwidth range was 0.06-0.07 Mbps.



Participant organizations

- ESO - European Southern Observatory
- CLARA - Cooperación Latino Americana de Redes Avanzadas
- UniTs - Università degli studi di Trieste
- NOVA - Nederlandse Onderzoekschool voor Astronomie
- AOT - INAF - Astronomical Observatory of Trieste
- AIRUB - Astronomisches Institut Ruhr - Universität Bochum
- REUNA - Red Universitaria Nacional
- GARR - Consortium GARR
- QMUL - Queen Mary University of London

EVALSO

CAPACITIES

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