The ELETTRA e-Science Platform:
A Framework for Remote Operations and e-Science

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The EUROTeV Project

GAN Multipurpose Virtual Laboratory

The most likely scenario of a linear collider is that it will be built by a collaboration of existing laboratories, which will remain involved during the operation of the accelerator.

Prototypes will be developed in one institution and tested with beam in another laboratory

Equipment will be built and delivered by one partner and needs to be integrated into the accelerator complex by another partner

Whole parts of the facility will be provided by a remote partner and need to be commissioned and possibly operated with the experts at their remote home institutions

In situ trouble shooting and repairs needs to be performed with the support of off-site experts

Advanced means of communication will be necessary to support efficient collaboration.

The GANMVL project will design and build a novel collaboration tool and test it in existing accelerator collaborations.

The Multipurpose Virtual Laboratory is a tool to implement the Global Accelerator Network, a Virtual Organisation (VO) connecting international laboratories doing research in the field of accelerators

The GANMVL project will provide valuable experience of a new way in designing, building and operating large accelerator complexes, and will address the important psychological and sociological issues of the Global Accelerator Network.

Remote control of an accelerator facility has the potential of revolutionizing the mode of operation and the degree of exploitation of large experimental physics facilities.

- The tool will be a mobile communication centre which provides immersive video and audio capture and reproduction of an accelerator control room, a laboratory workplace environment or an accelerator hardware installation.
- The tool should be able to connect to standard measurement equipment (scopes, network analyzers etc.) and to elements of accelerator controls and make these connections available to a remote client.
- The remote user should be enabled to participate in accelerator studies, assembly of accelerator components, trouble shooting of hardware or analysis of on-line data as if he or she would be present on site.

GAN Architecture

Web portal interface for all types of users (remote, laboratory admin, station admin) and all usage scenarios

Fine grain control on authorization

Resource or capabilities can be associated to different levels

Awareness feature: tunnel monitoring and control, resource enable / disable

Knowledge management tab with e-log, help, download area

GANMVL tab with an integrated resource and people browser

Different kind of capabilities: High resolution cameras, file manager, chat, audio and video conference (skype, VRVS), Web tools (LabVIEW, IVI instrument integration), VNC tools (Control Room Panels), Wizards

Open source, modular distribution, plug-in architecture

Remote Experts   Operator

Modern science requires the most advanced Information and Communication technologies. Data generated by detectors and experimental stations have to be acquired, stored, processed, shared and visualized. Starting from the experience with the Elettra Virtual Collaboratory which allows a distributed team of researchers to carry out remote experiments using Elettra Beamlines and with the contribution of EU funded research projects (GRIDCC, EUROTeV, DORII) we have developed a platform for E-Science applications.

The platform is base on Grid technologies and allows the integration of sensors, instruments and other data sources to the computing and storage resources of the eInfrastructure and distance collaboration through a web portal called:

Virtual Control Room (VCR)

The platform can be used in different contexts and supports the development of both scientific and industrial applications such as on-line processing of experimental data, environmental monitoring, remote operations and supervision of geographically distributed systems.

- Virtual Collaboration Spaces
- Gridsphere 3.0
- Google Web Toolkit
- Workflow Management
- Interactive Application Support
- Https Tunneling
- DORII gLite common library
- Instrument   Element

Virtual Control Room

After their registration is approved, users may create a long-term proxy certificate on the MyProxy server via a secure servlet. After that, the VCR becomes a SSO portal to the Grid world.

VCR integrates the https tunnelling technology that allows the remote control and monitoring of legacy devices not yet integrated with the IE.

VCR allows users to search, discover, browse, control and manage Grid resources (e.g. job and workflow submission, credential management, file transfer), including remote instrumentation. VCR includes a scripting environment for creating and running simple workflows and the application manager for creating simple application-specific forms, making the grid transparent to the end users.

Background: VCR and IE both originated within the **GRIDCC** project (FP6, IST-511382) and later development continued at ELETTRA.
Present: VCR and IE are both part of the EGEE's **RESPECT** programme. VCR and IE are currently used for the **DORII** project and shall be adopted by the **CYCLOPS** project.
Future developments: interactive application support with gLogin and i2glogin (work already in progress for the DORII project.) VCR will support interactive applications and scientific visualisation.

VCR is a **collaborative environment** that offers a set of groupware tools in support of scientific team-work such as logbook, chat, wiki help, people & resource browsers.
It integrates with the third party tools like Skype…
VCR is an open source GRID portal based on Gridsphere and Web 2.0 technologies.
VCR is a front end to the Instrument Element.
VCR can be adopted both as a ready-to-use **"virtual collaboratory"**, and as an extendible framework for developing advanced, application specific collaboratories.

Instrument Element provides the traditional grid with a virtualization of real instruments and sensors, and provides the grid users with a more interactive interface to control them.

IE is an open source, pure Java, framework that runs as an Axis web service.

VCR accesses the IE using the gLite security model: Users are authenticated by their proxy certificates.

INSTRUMENT ELEMENT
middleware

INSTRUMENT MANAGER   IM

Instrument Managers are protocol adapters that link the IE to APIs of instruments and sensors. IM may be either custom developed for a single device or generic (plug-in) for self-descriptive control systems. (e.g. Tango, Epics, LabView, CIMA...) IM development requires very little effort from the framework users and is further simplified by the IM template. Instrument Managers run within the IE framework.

Device output may be stored directly to a SE, or loaded to the device from a SE, using the GridFTP.

IE: ie-grid@elettra.trieste.it   **VCR:** vcr-grid@elettra.trieste.it

TRADITIONAL GRID RESOURCES

Instrument Element provides a flexible solution for connecting a variety of devices to the grid. In particular, IE is suitable to control and monitor both large and complex facilities such as ELETTRA accelerator, as well as simple devices like environmental sensors or remotely controlled robots such as Lego Mindstorm.