Elettra Virtual Collaboratory: status and future developments

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Outline

Introduction to collaboratories The status of Elettra Virtual Collaboratory The portal application The Collaboration Tools The Architecture Usage scenarios Connection with BIOXHIT / VCS Connection with IA-SFS / JRA1 Connection with GRIDCC / MCE Connection with EUROTeV / MVL



What is a Collaboratory?

The term "collaboratory" was coined by William Wulf by merging the words collaboration and laboratory, and defined as "... Center without walls, in which researchers can perform their research without regard to geographical location - interacting with colleagues, accessing instrumentation, sharing data and computational resource, and accessing information in digital libraries".



Pros of Collaboratories

Scientific collaborations currently rely on face-to-face interactions, group meetings, individual action, and handson experimentation. The creation and introduction of effective CSCW systems aims at bringing the following main advantages:

provide remote access to expensive and hard-to-duplicate equipment (and thus reduce travel costs of research groups) increase the effectiveness of the experimental activity, since more experts can participate to experiments, give useful hints and solve problems

facilitate multi-institutional consortia collaborations on large-scale projects.



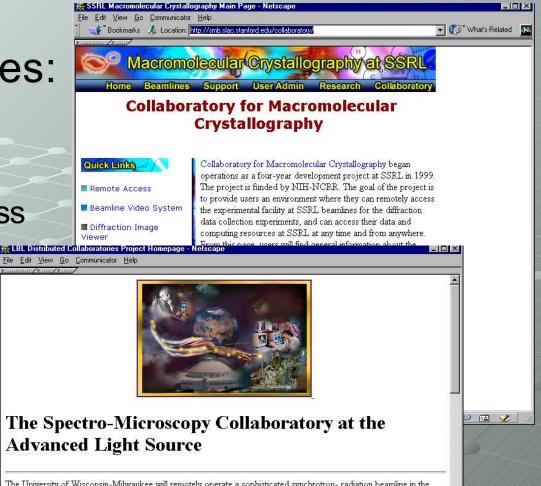
Provide Remote Access

instrumentation data (visualisation) computing power Telepresence Videoconference Notebooks

Automation

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The Spectro-Microscopy Collaboratory at the **Advanced Light Source**

The University of Wisconsin-Milwaukee will remotely operate a sophisticated synchrotron- radiation beamline in the Spectro-Microscopy Facility at the Advanced Light Source. This collaboratory will provide remote access to three analytical tools at Lawrence Berkeley Laboratory's ALS that provide spatially resolved chemical information at length scales ranging (depending on the tool and the technique) from 1 micron down to atomic scale. The collaboration that uses these instruments is fairly large and geographically distributed, with investigators from 9 institutions, so the potential for savings in time, expense of training, staffing, and travel is considerable. The ongoing growth trend of synchrotron-radiation applications will provide a large and welcoming audience for the results, in terms of both opening the SpectroMicroscopy Facility to a broader user community and applying the concepts and technologies at other facilities. One particularly interesting target audience for remote usage of this and similar facilities is the semiconductor industry, which has a critical need for sample inspection and would perform essentially identical measurements on a large number of samples.

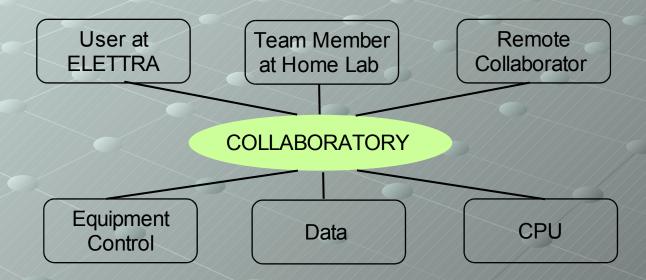
The Spectro-Microscopy Collaboratory is one of four projects funded by the U.S. Department of Energy to build Distributed, Collaboratory Experiment Environments. The project goal is to apply current network and videoconferencing technology and provide remote access to the Advanced Light Source, (ALS)

Document: Done



What is the Elettra Virtual Collaboratory (EVC)?

EVC is an example of virtual laboratory, a system which allows a team of researchers distributed anywhere in the world to perform a complete experiment on the equipped beamlines and experimental stations of Elettra.





EVC in action: a web portal

EVC is based on the "web portal" metaphor

- All you need is a browser
- EVC supports four different user categories: Visitors Normal users
 - Project leaders Staff

lottra Virtual Collaboratory		Elettra homepage
lettra Virtual Collaboratory A collaborative virtuare	nvironment fo	or x-ray experiments
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New user	? Click here	1
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Collaborating to an EVC project

Scientists working to an EVC project can use many project related collaboration tools

EVC presents an adaptive interface changing to suite the category and expertise level of the user

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			Rahon	
the user		curri	Alessio Curri	curri@rocket
	~	kristina	kristina djinovic	djinovic@elett
		<u>write a</u>	message to	all members
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What can I do with the collaboration tools?
 Chat: chat with other members of this experiment.
 FileBrowser: browse, view and download the files of this experiment.
 DiskUsage: check the disk usage of computers on the experimental station.
 Applications: remotely connect to Elettra computing server.
 Sharp: ...
 VideoCameras: see video camera streams from the experimental station.
 BeamlineStatus: check beamline status
 DataArchiver: archive your experiment data on DDS, CD or DVD.

PDB: link to the Protein Data Base.

EOSF: After data collection is finished, compile the End Of Shift Form.

Member's list

• I would not like to see these boring explanations! Edit you user profile and set your expertise level to "Expert".

Login	Name	Mail Address	Grant	Actions
roberto	Roberto Pugliese	pugliese@elettra.trieste.it	Leader	<u>Send Msq.</u> <u>Remove</u>
vale	valentina chenda	valentina.chenda@elettra.trieste.it	Member	<u>Send Msq</u> <u>Remove</u>
ranon	Roberto Ranon	ranon@dimi.uniud.it	Member	<u>Send Msq</u> <u>Remove</u>
curri	Alessio Curri	curri@rocketmail.com	Member	<u>Send Msq.</u> <u>Remove</u>
kristina	kristina djinovic	djinovic@elettra.trieste.it	Member	<u>Send Msq</u> <u>Remove</u>

Experiment info

Experimental station: Rotating Anode Experiment status: standby

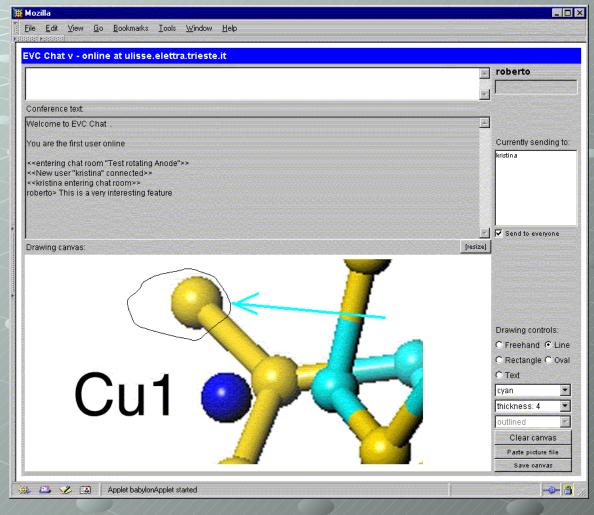
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Collaboration Tools: EVC chat

 EVC chat is "project centered": there is a different channel for each project

Usual chat feature are extended in order to allow exchange of Drawings scientific images graphical annotations





Collaboration tools: scientific visualisation

Size:

Type

type

Scientists can browse, visualise and process remotely scientific data in real-time as soon as the data is collected

🐺 EVC File Browser - Mozilla Bookmarks Tools Window 🔹 💉 Search 🞄 https://ulisse.elettra.trieste.it/evcts/filebrowser.do 👌 Home 🛛 🤰 Bookmarks 🥒 Google 🥒 Allthe Web. com 🥒 phone book 📩 Personal Toolbar Folder testra/ Brightnes figs
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Collaboration Tools: telepresence

The different video streams of the equipped experimental stations can be selected and viewed even through a slow connection

Movable cameras can be controlled via web by the project leader

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X-ray beam on the last Sutter Camera

[Select Detector + Beamstopper Camera] [Select X-ray beam on the last Sutter Camera] [Select Cryostream Controller Camera] [Select Crystal Camera] [Select Pan/Tilt/Zoom Camera] [Pan/Tilt/Zoom Camera to Control Room view] [Pan/Tilt/Zoom Camera to Oscilloscope view] [Pan/Tilt/Zoom Camera to Blackboard view]

Applet Camimg started



Legacy software is normally not web enabled EVC uses VNC KEVC VNC Viewer - Netscape to web enable Edit View Go Communicator legacy apps. It is small and simple, sharable and open Can be tunnelled via ssh VNC can be used as a fast integration tool

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XRD Operations **Beamline Open/Close** Last Common Photon Photon Beam 150.0 mm Shutter Stopper Beam Stopper1 Stopp 0.01 mA FrontEnd Shutters Beamline Valves **BeamlineShutters** 0.1 GeV LAUNCHER Monochromator Settings **Beamline Status** Energy (KeV) leamWatc C Experiment 7,706 Viodity C Local Marr345 Lambda (Å) 1.609 MonochromatorTuning Mirror Feedback Signal DIFF: Automatic Optimization CON -0.008 C fine @ OFF normal Signal SUM: -0.004 coarse Reload 👔 Bookmarks 🏾 🦧 Location: https://t Step (mm) Speed (mm/s) Position (mm) 🔏 Instant Message 🛛 WebMail 🖾 🕻 QUIT 0.00078125 0.15625 3.81625 File Selezioni Visualizzar Finestra Editare Opzioni oberto-[solver:~]prep PREPARE environments available for OSF1 net solver store users roberto /net/solver/store/users/roberto - type prepare alscript to prepare er pe prepare ccp4 to prepare environme repare ccp4 to prepare c. -..(livello superiore) 111111 absabat × input_files 24 Elementi 14 Nasc<u>osto/i</u> pe prepare warp type prepare warp to prepare - type prepare xds to pr erto-Isolver:~]xclock & roberto-Esolver:"]Warning: Cannot convert string "-dt-<u>interface user-medi</u> Þ Document: Done - 强 🌭 d 🖾 🏑 12/35

XRD Operations - By EES

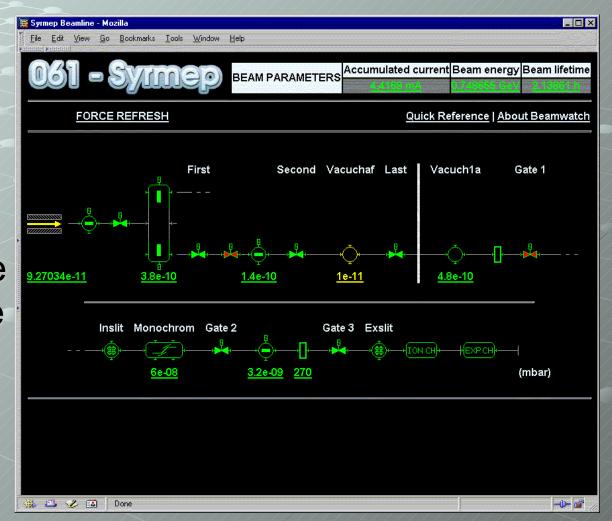
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Collaboration Tools: Remote Beamline Control and Supervision

 Beamwatch presents a synoptic view of the beamlines
 Autorised people can thus operate remotely on

remotely on the beamline intrumentation

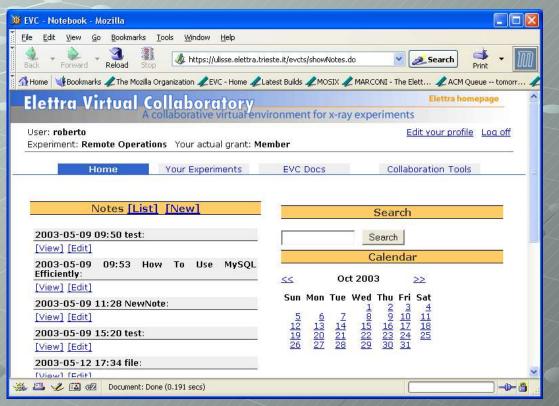




Collaboration Tools: Electronic Notebook

Web application which substitutes the Beamline LogBook registering meaningful beamline events using a wikiweblog methaphor

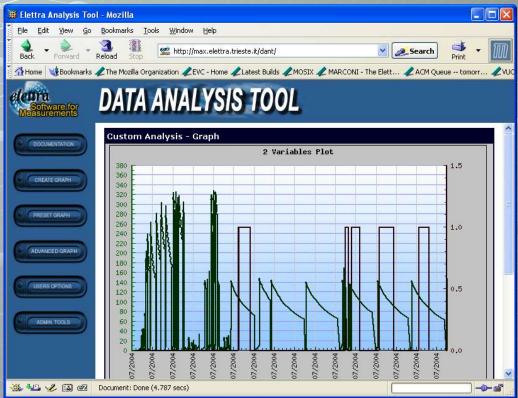
- Events can be entered manually or automatically by a program
- Texts and images are automatically indexed and hence easily searchable and browsable





Collaboration tools: Advanced LogAnalizer

Advanced LogAnalizer is a web application which allows to select variables from the logfiles produced by different control and supervision systems, and to plot them in a user specified temporal interval



Advanced LogAnalizer is technically a data webhouse, modular both considering the data loading and the data visualisation (Visual Data-Mining) NOBUGS 2004



EVC usage scenarios: Cristallography "by mail"

In a typical EVC operating scenario it is sufficient that a single person operates in the Elettra experimental hall while all the other team members collaborate operating remotely, by providing hints and suggestions, by helping to solve ordinary or accidental problems, analysing acquired data, etc.

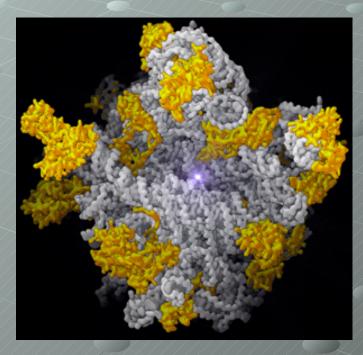
In the case of fully particulary automatized experimental stations the presence of people operating at the beamline can be even considered not necessary.



EVC usage scenarios: Cristallography "by mail"

EVC allows biologists to send by mail protein crystals which will be ananlized at the Xray Diffraction beamline by the beamline staff.

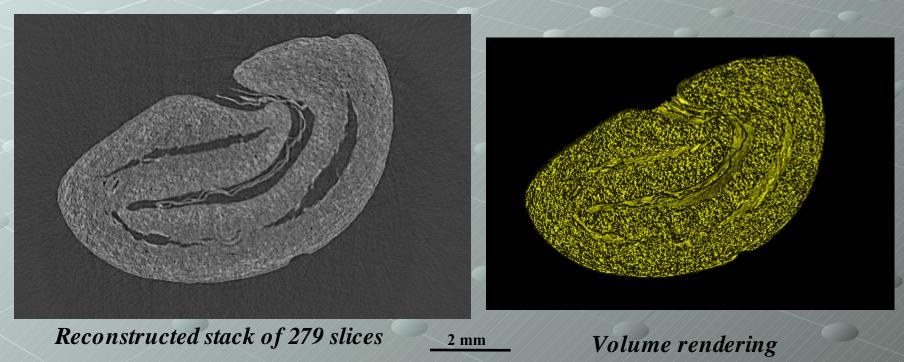
Collected data and results are accessible via EVC and results can be downloaded as soon they are available.





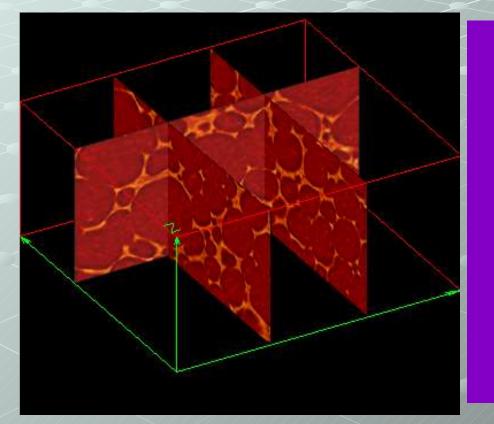
EVC usage scenarios: real time micro-tomographic reconstructions

EVC will be used to allow real-time micro-tomographic reconstructions on SYRMEP beamline, as soon as data is collected



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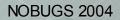
EVC usage scenario: real time micro-tomographic reconstructions





Virtual cut of the sample

(3.2 x 3.0 x 1.4) mm³





EVC Architecture

• EVC has 2 main components:

the application server and

node1

a set of nodes

The application server is running the portal application, the user and project database; the application server activates actions implemented by agents running in the nodes or requests services to external systems (e.g. VUO)

node2

nodek

application server

nodek-1

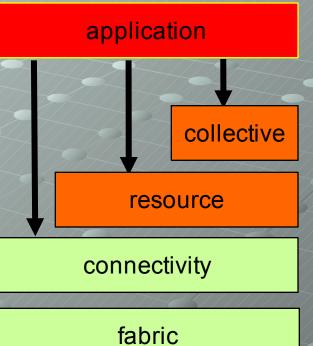


EVC Architecture (cont...)

There are many categories of nodes according to their function:

- data collection nodes,
- data storage nodes,
- computing nodes,
- data backup nodes
- new categories can be also created
- a single host can act as one or more nodes
- an experimental station is associated with a group of nodes
- Comunications between the application server and the nodes agents is via a sort of rudimentary web service (httpunit, webmin, ssh,...)

The agents in turn communicate with the application server via database NOBUGS 2004





EVC status and future developments

- EVC project started on June 2001 and finished on June 2003. The first prototype was installed on the Xray Diffraction beamline of Elettra on June 2002
- EVC is now operating on 5 beamlines and experimental stations and will be extended to all the experimental station in the first half of the year.
- EVC was presented at SMAU2002, NOBUGS2002 and SMAU2003, HCI2003
 EVC development staff is partecipating in many EU projects submitted under FP6 (BIOXHIT, IA-SFS/JRA1, GRIDCC, EuroTEV/GAN)



BIOXHIT / Virtual Collaboratory System

- ...Virtual Collaboratory System ...to allow remote control of the diffraction and fluorescence experiment by being interfaced to beamline control and data collection software
- ... VCS will be developed adopting a development technique ...eXtreme programming and ... open source web technologies
- ...attention will be paid to the maximum portability of the system, in order to allow for implementation at other facilities.
- ...VCS will be linked to the user database (Virtual User Office) and could be equally linked to the central projecttracking database, allowing easier administration both for synchrotron staff as well as for the users.



ettra VCS implementation proposal

Complex problems like "High-Throughput" Protein Crystallography involve in fact coordinating and sharing computing, application, data, storage, or network resources across dynamic and geographically dispersed organizations (Webservices/GRID?)

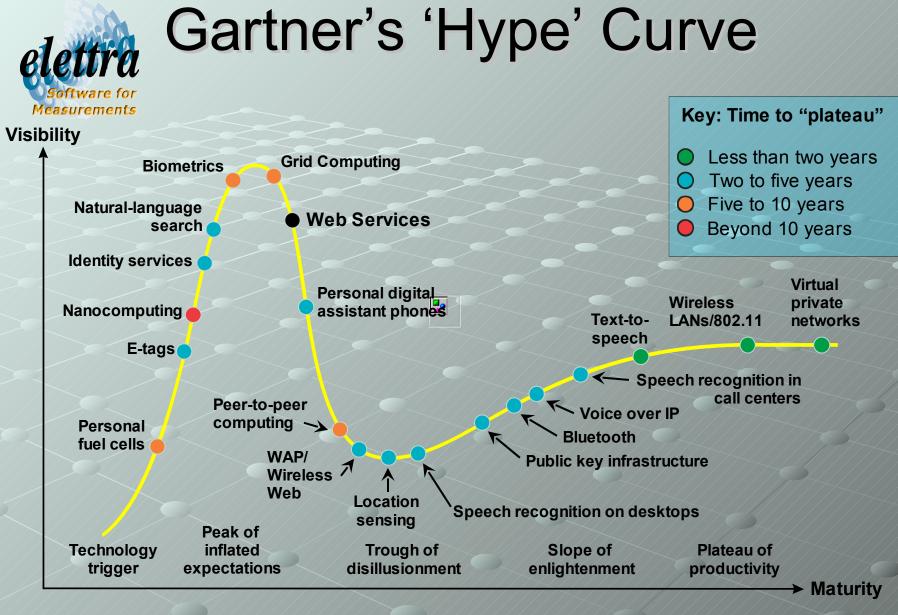
- Refactor the EVC by substituting the communication mechanism with webservices both from the application server to the agents and the way back
- Collect new requirements by the participating partners and implement the new kind of experimental stations (e.g. crystallisation station), nodes, agents, and collaboration tools involved
- A first possible application scenario is the implementation of a single application server and have only the nodes distributed among the participating facilities
- The final scenario involves the distribution of application servers (one for facility) and a communication collaboration mechanism between the application servers



Why Web Services?

"The Web can grow significantly in power and scope if it is extended to support communication between applications, from one program to another."

- From the W3C XML Protocol Working Group Charter



Source: Gartner Group June 2002



IA-SFS/JRA1-WP1 Rationale

The generic nature of the experiments performed means that users can (and do) apply to more than one site for a particular project.

This may be because specific beam-lines are more suitable to some aspects of the experiment

may simply reflect the immediacy of demand, the difficulty of the project

travel and budgetary considerations

The provision of a common application platform would enhance the efficiency of the application procedure for the users, and, if correctly implemented, might lead to a Europe-wide clearing-house for applications in this area in the mid-term (>5 years) future.



The User Perspective

 The VUO1.4 provides community services, beamtime application, beamtime calendar, access application, publication and experimental reports submission, on-line training (W3C/SLIM) ...

Big efforts were made towards usability via user centered design

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The next deadline is 31.08.2004 Click <u>here</u> if you want to view an already submitted proposal.	Here is the list of registered <u>users</u> . Calendar
Click <u>here</u> to submit an experimental report on a past proposal. This report will be used for evaluating future proposals. Click <u>here</u> if you want to fill the End of Shift	For details on Beamtime Allocation Calendar have a look to <u>Elettra Calendar</u> . Publication Search & Submittal
Summary Form.	Please note that all publications resulting from
Downloads Click <u>here</u> if you want to watch the safety videotapes and other relevant information.	measurement runs or research done at ELETTRA must be entered into the ELETTRA Publication Database. Authors are invited to complete the <u>ELETTRA</u> <u>Publication Search and Submittal Form</u> online for each contribution, i.e., journal article,



OpenUserOffice a testbed for IA-SFS/JRA1-WP1

- The VUO application which have been operating for more than 6 years has now reached his maturity.
- The VUO application will be transformed in a Open Source project taking into account any requirement from the participating partners
 - this will allow the facilities which does not have this kind of application to have one at a very low cost
 - there is a very low possibility that a facility with an already operating VUO like application will use the OpenUserOffice, which means that we have to find a way out

The OpenUserOffice will become a testbed of the WP1
 Using webservices technology, facilities with an already working application need only to implement a set of webservices for compatibility



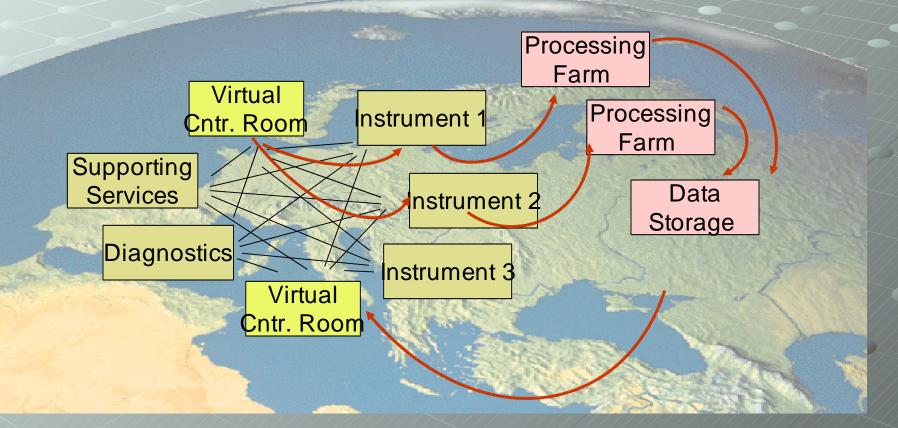
GRIDCC

- ... the GRIDCC project extends the state of the art of computing Grid technologies, by introducing the handling of real-time constraints and interactive response into the existing Grid middleware
- Our goal is to build a widely distributed system that is able to remotely control and monitor complex instrumentation ...These new applications introduce requirements for real-time and highly interactive operation of GRID resources.
- One of the main objectives of the project is to verify the feasibility of a Grid-based remote control of systems requiring real-time response with real applications running on existing Grid test beds over both national and international network infrastructures (e.g. GEANT).
- GRIDCC integrates a "grid of instrumentation" into existing Grid infrastructures that provide the computational power and storage needed for the applications ….
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.... the GRIDCC project

Use of the Grid technology, as extension of the Web Service Technologies, to develop a widley distributed control system with access to grid enabled computing and data storage facilities





AccessGRID@ELETTRA

Setup of an AccessGRID node at Elettra

- It means the implementation of a collaborative environment to support group to group interactions using AccessGRID technology
 Partners:
 - Elettra, INFN, CINECA, ICTP





EUROTeV/GANMVL Multipurpose Virtual Laboratory

If the linear collider is to be build in a collaboration between the large HEP laboratories and contributions from smaller institutions, a dense network of inter-laboratory taskforces needs to be managed and supported.

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

- The needs of the worldwide accelerator community to operate in this mode on a routine base in an efficient manner are by no means obvious. It will be a new way executing a large accelerator project. The laboratories will have to learn how to deal with it.
- The Accelerator community has started to prepare itself for the new mode of collaboration

The GANMVL project understands itself as part of the worldwide effort.
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GANMVL Project Goals

Integrate

state of the art audio- and video communications technology virtual instruments and accelerator controls into an all round communications tool implemented as a compact and transportable hardware set-up containing 3D-video screens, audio devices, video capturing devices, computer terminal, sockets for connecting network, instruments NOBUGS 2004 34/35



Conclusions

- The Elettra Virtual Collaboratory have now been operating for more than 3 years.
- We have described the results of this experience and presented the future developments relatate to EU and International initiatives and based on new emerging tecnologies like GRID and webservices.
- We are now ready to update EVC using webservices and GRID technologies in the framework of the FP6 EU projects in which our group is involved.
- These projects allows our group to participate in the grand challenging research and technological projects of this century.
- Acknoledgements: HCI Lab (UNIUD), BIOLAB (CNR, ELETTRA), ...