Developing the e-Science technologies in Armenia

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The necessity of the E-Science development in Armenia

- Armenian science was an inherent part of the soviet science having a very developed infrastructure.
- Despite of a very low-level (miserable) financing, this infrastructure is still conserved (thanks to the professionalism and enthusiasm of the scientists).
- The intensive collaboration with many world centers and labs is continuing and the new collaborations emerge. Example – YerPhI: collaboration in ALICE, ATLAS and CMS (CERN), DESY (Germany), Jefferson Lab (USA) and many other labs.
- An appropriate e-Infrastructure is necessary !

Armenian e-Science Foundation

http://www.escience.am

- Non-governmental and non-profit institution established in 2002.
- Goals - introduction and dissemination of the e-Science technologies in Armenian scientific, educational centres and other organizations.
- Root level Certification Authority. Defines the Certificate Policy and Certification Practice Statement.

ArmGrid Project of ArmeSFo

http://www.grid.am

Goals - building Grid infrastructures in Armenia.

- Manages the certification process. The subject of CA certificate issued by ArmeSFo for ArmGrid: */C=AM/O=Armenian e-Science Foundation/OU= ArmGrid/CN=ArmGrid CA.*

- Sponsored partially by the Swiss fund "Kidagan", Link Ltd software developing company (http://www.link.am), Lans Ltd computer hardware vending company (http://www.lans.am) and Web Internet Service Provider (http://www.web.am).

First Grid node in a vast geographical region

- In 2001, the ArmGrid project members from YerPhI (http://www.yerphi.am) and students from YSU (http://www.ysu.am) and SEUA (http://www.seua.am) have established in YerPhI a Grid node.
- A farm of 5 Pentium III and IV PCs
- The node is connected to the AliEn Grid infrastructure of CERN ALICE experiment (http://alien.cern.ch).
- The group is applying to enter the EDG project.

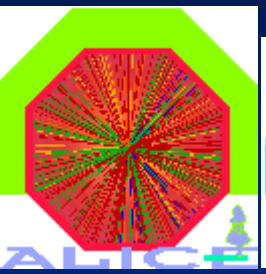
Current research WAN capacity in Armenia

- The current Armenian research WAN bandwidth is too narrow and can not provide a full-scale work in the running international Grids. For example, YerPhI has a 128/192 Kbps connection with the outer world.
- Recently NATO has launched a so-called Silk Virtual Highway project aimed at financing additional research WAN channels in South Caucasian and Middle Asian countries.
- 2 Mbps bandwidth is allocated to Armenia within that project, implemented by Armenian Research and Educational Association (ARENA).
- The bandwidth is shared by a number of research and educational Armenian organizations for their everyday needs and can not be used for the work in the Grids.

The development work can be carried out even with modest network and equipment

- The Grid is an entirely new field, and most of the work is now centred into the development of the software tools collectively known as middleware and application software.
- To participate in the development and testing of these tools, even a very modest network and computing equipment is enough.
- In some sense the simultaneous presence of different network capabilities and Quality-of-Service is an additional test of the functionality and limits of the Grid middleware.
- Small focussed groups can fully participate to an activity at the leading edge of computing science from their home location.

The work on the AliEn toolkit development (1)



The ALICE experiment -- typical next generation HEP collaboration involving ~1000 scientists from ~100 institutions (http://alice.web.cern.ch/Alice/).

- Large-scale simulations, heavily distributed processing and event storage, complex analysis of very large volume data (one event up to 2GB, 2 PB/year).
- The ALICE offline group developed a dedicated Grid architecture called AliEn. Based on the Open Source standard components (SOAP, Web services, etc), AliEn framework is a lightweight, simplified but functionally equivalent alternative to full blown Grid.
- AliEn has been successfully tested in simulation period of ALICE. It is continuously developed with aim to provide long term stable interface to Grid(s) for the ALICE users.

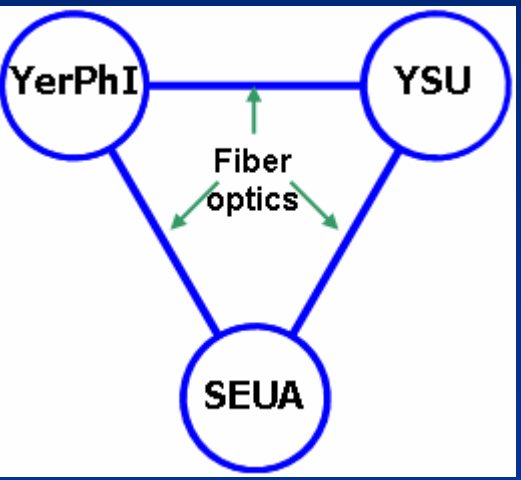
The work on the AliEn toolkit development (2)

The YerPhI group, (mainly students from YSU and SEUA), is working on the following topics:

- Authentication of the site administrators in the AliEn OpenLDAP server via SASL external authentication mechanism, using their X509 certificates.
- Perl implementation of the client-server interfunctionality.
- The AliEn toolkit porting on the Windows platform

This experience will be very useful when building national Grid infrastructures

Further steps. Building National Grids (1)



- National Foundation of Science and Advanced Technologies (http://www.nfsat.am) finances the ongoing works on the fiber optics connection (~100 Mbps) between several Armenian institutions.
- Full-value national Grids could be deployed.

Two stages.

- **The first stage**: Educational Grid between YerPhI, YSU and SEUA. Specialists and students will get first hand experience and expertise of the whole Grid architecture and functioning, will perform original developments. Regularly running testbeds will allow participants to acquire skills in the practical use of the Grid, to learn the cooperative work within the VOs.

Further steps. Building National Grids (2)

At the second stage, the acquired knowledge will be offered to other Armenian scientific institutions:

- Byurakan Astrophysical Observatory,
- Armenian Academy of Sciences,
- Earth science and Seismic centres,
- Some industrial companies.

It is foreseen to integrate into Grid infrastructures research and educational centres and enterprises located as in Yerevan as in other cites of Armenia.

Increasing the network capacity (1)

- Since Armenia and other South Caucasian republics are participating in the LHC experiments that are exploiting the Grid technology, CERN management undertakes the actions for a substantial improvement of their research WANs.

- A working group, consisting of the CERN specialists and the representatives of Armenia, Azerbaijan and Georgia, is created with the aim to elaborate a program of the Grid infrastructure deployment In South Caucasus. The corresponding documents will be presented to EU, NATO, ISTC, UNESCO and other relevant financing organizations.

Increasing the network capacity (2)

- The e-Science development in Armenia and other regional countries will create the needs and services that require the deployment of high performance network links where they do not exist yet.
- This is a very important factor in the development of high-speed connections, because the viability of the created technologies and commercial interest to them will prompt the development and not the contrary that rarely works.
- This will start a virtuous cycle were increased application pressure and business opportunities promote the development of faster networks which in turn open new business opportunities.

Socio-economic impact (1)

- Armenia possesses a remarkable intellectual potential of senior scientists trained in the former Soviet Union and numerous young specialists (PhDs, students) who studied in the national institutions during the last years.
- Due to their high professional level, they are strongly requested by entities in developed countries.
- The implementation of e-Science will allow to increase substantially the number of Armenian professionals and young specialists contributing fruitfully to the cooperative international investigations.
- e-Science will help to maintain national science and technology on the international level.

Socio-economic impact (2)

- As all the software developed in the e-Science context is Open Source and has a quite generic character, the acquired knowledge will be made available to different Armenian institutions and communities promoting the development of the e-Business, e-Banking, e-Commerce, e-Education, e-Medicine, e-Government, etc.
- This not only has the potential to improve in the medium term the quality of life but it will also help to reduce the migratory flow the countryside to the big cities and the emigration to industrialised countries with the effect to preserve the social fabric of Armenian regional communities.
- The embedding of the South Caucasian republics into a common e-Infrastructure will serve to the improvement of their relations and will promote the exchanges amongst their populations.

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