EPIKH Report Summary
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Final Report Summary - EPIKH (Exchange Programme to advance e-Infrastructure Know-How)

The “knowledge triangle” (see figure attached) refers to the interaction between research & development, education and innovation, which are key drivers of a knowledge-based society. In the European Union, it also refers to an attempt to better link together these key concepts with research and innovation already highlighted by the development of the Lisbon Strategy.

The EPIKH project (www.epikh.eu - see logo attached) aims to “connect”, through the adoption and use of Grid training infrastructures, along with that of e-Infrastructures, research & development and innovation with education in order to increase the number of users and scientific applications of these platforms.

More specifically, the strategic aims of the EPIKH project are to:

• Reinforce the impact of e-Infrastructures in scientific research defining and delivering stimulating programme of educational events, including Grid Schools and High Performance Computing courses;
• Broaden the engagement in e-Science activities and collaborations both geographically and across disciplines.

These goals translate into the following specific actions:

• Spreading the knowledge about the “Grid Paradigm” to all potential users: both system administrators and application developers through an extensive training programme;
• Easing the access of the trained people to the e-Infrastructures existing in the areas of action of the project;
• Fostering the establishment of scientific collaborations among the countries/continents involved in the project.

The exchange programme has been implemented in alternating phases:

• First, a select team of young researchers visited EPIKH’s EU partners for around one month to be trained as trainers of grid technology (including site administration and application support ("gridification");
• Second, EPIKH organised and ran at least two educational events per year and per continent (Africa, Asia, and Latin America), training new users to access and apply a pilot e-Infrastructure on which applications can be deployed, developed, and then used as exemplar use cases in future events.

The EPIKH project has improved the educative mission by developing an intensive and diversified training programme in which grids are not the ‘goal’ but rather the ‘means’ by which to develop e-Science applications, gather scientific communities from four continents, and access globally distributed production quality e-Infrastructures.

EPIKH has promoted worldwide the gLite/EMI middleware developed by flagship EU co-funded project such as EGEE series, EGI-InSpire and EMI. To address the technical barriers for non-IT experts to access and use e-Infrastructures, EPIKH has worked
hard, especially in the second part of the project, to define and implement the architecture of a Science Gateway framework (www.catania-science-gateways.it) based on widely adopted standards that could actually make e-Infrastructure access transparent and ubiquitous.

The primary requirements that drove the design and implementation of the Science Gateway framework were:

- Use of standards;
- Simplicity;
- Easiness of use;
- Re-usability.

Since the very beginning, the idea was not to build a “vertical” solution but rather to create a framework made of small pieces of software that, as LEGO® bricks, could have been customized and re-arranged in many ways in order to fulfill a large variety of applications and end-users. The success of LEGO® bricks resides in the fact that the “basic element” is simple and standard and it can be easily connected to other basic elements to create huge and very complicated constructions. For the development of the basic elements of the Science Gateway framework, the JSR 286 standard (also known as “portlet 2.0”) was adopted. In this case, “our” LEGO® bricks are standard portlets that can be easily arranged to create different, even complex, portals. As portlet container, the award winning Liferay portal framework has been chosen which offers a rich, easy-to-use "web 2.0" interface. Liferay is currently the most used framework to build Science Gateways in the Grid world.

Users belonging to different organizations may have different roles in the community the Science Gateway is developed for and different privileges on the applications and related data available in the gateway. They access the Liferay-based portal and, according to their role and privileges, they are allowed to run some applications embedded in the Science Gateway and exposed through its user interface.

One of the strengths of this Science Gateway framework is the decoupling of the authentication (AuthN) phase from the authorisation (AuthZ) one. In order to access the Science Gateway, a user must be both authenticated and authorized but we treat the two steps separately and with different technologies.

User authentication relies on Identity Providers (IdPs) that are members of one or more Identity Federations. We only support federations based on the SAML 2.0 standard specifications and on its implementation done by Shibboleth and SimpleSAMLphp. We currently support several official Identity Federations established in Europe, Asia and Latin America and some of the Science Gateways developed are already registered as Service Providers of the eduGAIN inter-federation service (http://www.edugain.org) created by the GÉANT project. We also support all the Identity Providers of the Grid IDentity Pool (GrIDP - http://gridp.garr.it) a “catch-all” Identity Federation that we have expressly created to gather all the IdPs that do not already belong to any official federations and all the users of the Science Gateway who are not (already) registered in any IdPs. This is particularly important and useful in the contexts where it is necessary to authenticate the so-called “citizen scientist” and let him/her access the e-Infrastructure for dissemination and self-learning purposes. Inside the GrIDP Federation, we have also created a special IdP, the “Social Networks’ Bridge Identity Provider” (http://idpsocial.garr.it) that allows people to get authenticated with the same credentials they already have with the most known and populated social networks.

The support of the SAML standard allows Science Gateways built with the framework described above to be configured as Service Providers of Identity Federations in order to extend their potential user base to all individuals enrolled in Identity Providers, owning federated credentials. In the last year of the project, EPIKH has fostered the deployment of Identity Federations in the regions addressed by the project and first Identity Providers have already successfully been established in Jordan, Mexico and South Africa thanks to specific secondments. Thanks to the presence of COMETA, the coordinator of EPIKH, in eI4Africa (www.ei4africa.eu) an EU FP7 project started on the 1st of November 2012, a Science Gateway has been implemented for Africa researchers (http://sgw.africa-grid.org) and Identity Providers have been created also in Kenya, Nigeria.
Unlike authentication, user authorization is carried out at the level of the Science Gateway: users whose request to register is approved by the managers of the portal, are stored in a LDAP-based registry together with the roles they have and the privileges they are granted.

In order to execute applications from within the Science Gateway in a middleware-independent way, the Simple API for Grid Applications (SAGA) standard specifications, defined by the Open Grid Forum, and its JSAGA implementation, have been adopted.

A software layer Grid Engine has been developed which contains a “job engine” and a “data engine” which, in turn, call the JSAGA API for job and data management.

The Science Gateway architecture described above has been used to implement more than 14 Science Gateways in the context of EPIKH and in the context of projects collaborating with EPIKH and a new training material has been created to run grid schools for Science Gateway developers and end-users (https://gilda.ct.infn.it/wikimain). As of the end of 2012, the user registries of the Science Gateways in production counted people from 219 organisations belonging to 47 countries in the world (figure 1 attached shows the geographic distribution of the organisations whose users are registered in the EPIKH Science Gateways).

During the four years of the project, about 140 researcher months have been consumed for the mobility of 114 people (just 1 less than anticipated in the Description of Work), 31 grid schools and 12 workshops have been organized and held, and 56 applications (38 the usual way using the middleware command line interface and 18 integrated in the Science Gateways) have been ported on the regional grid infrastructures in Africa, Asia and Latin America accessible through the partners of the project. Moreover, EPIKH has been presented in 22 “external” events, i.e. events organized by other organisations to which EPIKH representatives have been invited to talk about the project and its outcomes. It is worth noting that 4 of these external events were two grid schools organized by RENATA (the Colombian National Research & Education Network) that decided to adopt the EPIKH grid school as a model to learn how to deploy grid sites and develop federated services and science gateways for the virtual research communities of both the country and the rest of Latin America. All events, including agendas and presentations, can be found at the page http://agenda.epikh.eu.

EPIKH has established several Memoranda of Understanding with 8 other EU-FP7 projects (CHAIN, DC-NET, DECIDE, DEGISCO, EU-IndiaGrid2, EUMEDGRID-Support, GISELA and INDICATE) and has acted as training infrastructure for them in all the regions addressed by the project, playing a key role in the landscape of grid training and education in the world. As a consequence of this, EPIKH has been mentioned as an example to follow for monitoring and encouraging local scientific applications to fight the digital divide in the final recommendations (www.partager-le-savoir.org/template/fs/malte2011/RecommendationsSKF.pdf) made by the high-level stakeholders of the 6th Conference on “Sharing Knowledge across the Mediterranean” which was held on 6th-8th of May 2011 in Malta.

EPIKH has also been selected as the Editor’s Choice 2013 for an European Union ePractice Case Study (www.epractice.eu/cases/EPIKH).

The relevance of the EPIKH joint research programme can be summarised as follows:

- With its 23 partners from 18 countries across four continents: Africa, Asia, Europe and Latin America, the EPIKH project has been, to our knowledge, one of the largest training program on e-Infrastructures in the world;
- Groups active in strategic scientific domains were indentified early on and put in contact with colleagues in Europe and other
parts of the world widening, at a global scale, the diffusion of scientific (in)formation and best practices;

- Grid technology was used as a powerful “tool” to impart/improve education on e-Science;
- The t-Infrastructure built during the schools acted as a seed for building Grid infrastructures in regions targeted by EPIKH where e-Infrastructure sites were not present at the beginning of the project;
- At the end of the schools, many applications were ready to run on large e-Infrastructures and more users got aware of the benefits of this technology for the progress of science and society.
- EPIKH has mobilized 114 researchers for a total of about 140 researcher months, not counting of course the hundreds of people that were outreached by the project and/or attended the big number of training events.

The huge figures above witness the strong interest of the four continents of the world involved in the project in setting up an exchange programme to improve the dissemination of the know-how about Grid and e-Infrastructures.

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